



FUTURE AND CURRENT PROSPECTS OF HYDROPONICS MARKET IN INDIA

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Abstract: Hydroponics is an innovative and sustainable technique for growing plants in a soil-less medium using nutrient-rich water solutions. The current state and potential growth of the Indian hydroponics market are examined in this research Article. Hydroponic systems give plants a regulated environment to grow in, resulting in crops of greater quality that are unaffected by pests, the environment, or illnesses carried by the soil. As a result, hydroponics is expanding in popularity in India since it provides a more dependable and effective method of growing crops. Also, compared to conventional farming techniques, hydroponics utilizes substantially less water and land, making it an effective use of resources. The sector is anticipated to continue expanding quickly due to several causes, including the increasing demand for high-value crops, the scarcity of farming land, and the requirement for sustainable agricultural practices. The hydroponics market size and trends in India are examined. About 70% of the hydroponics market is dominated by the vegetable segment, with hydroponically grown vegetables being in high demand because of their superior nutritional value, consistent quality, and accessibility. In the following years, it is anticipated that demand for flowers, herbs, and vegetables cultivated hydroponically will rise dramatically. Only a few monopolistic large companies make up most of the hydroponics industry in India, which is dominated by small and medium-sized businesses. The hydroponics sector does, however, confront several difficulties, including the high cost of setting up hydroponic farms, farmers' ignorance of the technology, and limited government assistance. Despite these obstacles, it is anticipated that government initiatives to support vertical farming and the creation of effective technologies will hasten the growth of the hydroponics market in India. The goal of this paper is to raise people's knowledge of the hydroponics market's size and potential while also enticing them to develop hydroponic gardens, even on their balconies or terraces. Overall, this study emphasizes the rise in hydroponics demand in India and the necessity of sustainable farming methods to counteract risks to people's lives from food and pollution.

KEY WORD: India Hydroponics Market, Positives, Demand Controlled requirements, lack of agricultural land, Sustainability, High setup costs for industrial players, Challenges

INTRODUCTION

The global agriculture industry is confronted with a slew of issues that jeopardize food security and the environment. Land degradation, water shortage, and the rising food demand brought on by population increase are just a few of the problems that make new agricultural methods necessary. Hydroponic farming has become a practical substitute for conventional agricultural methods in recent years.

Farmers may grow plants without using soil using the hydroponic systems, where nutrients are supplied through mineral fertilizer solutions in a water solvent. Hydroponics is viewed as a viable answer to the above problems in India, where the agricultural industry employs more than 50% of the workers but only contributes 15% to the GDP. Despite being one of the biggest producers and consumers of fruits and vegetables in the world, a sizeable amount of the crop is still untapped because of weak supply chain infrastructure and post-harvest losses from rotting or pests.

According to recent research on the Indian horticulture industry, there has been a lot of interest from business people in establishing large-scale hydroponic farms around the nation. Hydroponic agriculture may be used to target niche markets with localized needs/preferences-based consumer base types, such as health-conscious people looking for organic products. Currently, 400 hectares of India's land are used for controlled environment agriculture using more modern techniques, such as hydroponic systems, on about 5000 hectares of protected cultivation.

Advantages of Hydroponics: Comparing hydroponic systems to conventional agricultural techniques, there are several advantages. First, because the water is recirculated and can be reused several times, it provides far effective water utilization, consuming 70–90% less water than conventional systems. Second, it allows for year-round production, which enables farmers to harvest throughout various seasons while more successfully adapting to quickly shifting customer trends/preferences. Thirdly, it lessens the need for hazardous chemical pesticides that would otherwise damage groundwater supplies and endanger people, animals, and pollinators by reducing pesticide consumption and soil-borne illnesses.

Challenges: Despite its promise, hydroponics in India suffers several difficulties. Adoption is hampered significantly by the high cost of infrastructure and equipment as well as the shortage of technical expertise and qualified labour. Additionally, investors and farmers may experience uncertainty because to the unclear regulatory framework around hydroponics.

Opportunities: India offers enormous hydroponics potential as well. The system has several benefits over conventional agricultural techniques, including larger yields, quicker growth cycles, and less water consumption. These advantages may be especially

significant in areas with limited water supplies or available land. The growth of hydroponics in India is also being fueled by the rising demand for locally grown, fresh products and the growing interest in sustainable agriculture.

Market Scenario: As government policies and private sector investments support sustainable agriculture initiatives aimed at enhancing food security while mitigating the effects of climate change, the future market for hydroponics in India appears to be promising. The use of cutting-edge technology in agriculture is being promoted by government initiatives including the National Horticulture Mission, National Agricultural Development Programme (Rastriya Krishi Vikas Yojana), and the Indian Council of Agricultural Research (ICAR). From 2021 to 2030, the global hydroponics market is anticipated to expand at a compound annual growth rate (CAGR) of 14.5%, reaching \$6.31 billion.

Due to several factors, including rapid urbanization, a declining supply of arable land, rising disposable incomes, a shift in consumption habits in favor of healthier diets, rising environmental consciousness, and effective climate change mitigation measures, among others, the Indian hydroponics market has enormous potential for growth. Additionally, research organizations like ICAR, working closely with industry participants, facilitate technology dissemination through skill-development programs and training workshops aimed at farmers and youth who might wish to explore new agricultural entrepreneurship avenues to achieve better livelihood outcomes sustainably in the long run, thereby contributing to national goals achievement/milestones set forth by various international agreements/commitments like the UN's Sustainable Development Goals.

NEED OF THE STUDY.

India's hydroponics industry is anticipated to increase significantly over the next several years as a result of rising consumer demand for high-value crops, organic food, and sustainable agriculture. Although there are several issues that need to be resolved, such as the high cost of infrastructure and equipment and the lack of legislative clarity, the potential advantages of hydroponics cannot be overlooked. Hydroponics has the potential to alter Indian agriculture and provide food security for the country's expanding population with the help of governmental organizations, private sector investment, and research organizations.

RESEARCH METHODOLOGY

This research study's objective is to examine the potential for the Indian hydroponics business both now and in the future. We have chosen a mixed-methods technique that comprises a literature review, expert interviews, market analysis, and a consumer impression survey in order to accomplish this goal.

Literature Review: We have gone through five different research article publications on the issue in order to comprehend the present situation of the hydroponics sector in India. The literature research will shed light on the hydroponics industry's development factors, obstacles, and potential in India.

Probable Customer Survey: To understand the potential demand for hydroponics among Indian consumers, we conducted a customer perception survey of 100 individuals from varied backgrounds. The survey has collected data on consumer awareness, attitudes, and preferences towards hydroponics.

Overall, the literature review and customer perception survey highlight the potential of hydroponics in India, but also identify several challenges that need to be addressed for the industry to grow. Increased awareness, government support, and addressing cost barriers are some of the key factors that could help promote the growth of hydroponics in India.

Population and Sample

We took a Sample Size of exactly 100 Individuals from varied field. They were asked a total of 9 Question's out of which 2 were open ended and rest seven were all close ended Question's. The Sample Size includes, Students', Working Professional's, Home-makers, Retired Individual's and Gardeners'. They all gave varied responses according to the Question's. We have used Google Forms to collect these 100 responses. We majorly used Social Media Platforms to share the Questionnaire in Google Form. Wherever required, we interacted with Customers' or eve respondent via Call or message to give best possible answer to the Respondent to any Question they are having.

Data and Sources of Data

1. **Type of Data:** This includes the type of data that we have collected for our study. For this Research we collected both primary Data and Secondary Data, the Primary Data are being Collected as form of Questionnaire. In the Questionnaire, we collected both Qualitative and Quantitative Data from the Respondent's. We revied Articles – Research Articles, Newspaper Articles, and Blogs as part of Secondary Data.

2. **Data Collection Methods:** We collected the Primary Data by using a Questionnaire shared among 100 different Individual's by Google Forms. We reviewed different Articles available from the Internet.

3. **Sampling Technique:** We used Random Sampling Technique to analyze the data received from the Questionnaire Survey.

4. **Sample Size:** The sample size is taken of 100.

5. **Data Analysis Methods:** We are using JMP Statistical Software to analyze the Data received from Google Forms.

6. **Sources of Data:** The Sources of our Secondary Data are -

Statistical tools

JMP, a division of SAS Institute, is the company that created the JMP statistical analysis software package, which is pronounced "jump". It was introduced in 1989. We have used the latest version of 17.1/March 2023 (Licensed Version). We used the Tool to find some basic Interpretation of Data. We also interpreted the mean, median and mode from the data and also tried to understand some relations of each of the Datasets.

Research Review:

The review of Articles Suggest us the following:

- a. **Hydroponic farming** is a modern agricultural technique that has the potential to revolutionize farming in India. It uses nutrient-rich water instead of soil, increasing yield, quality, and profitability while using less space and water than traditional farming methods. It is more sustainable, reducing the need for harmful pesticides and fertilizers, and produces healthier and more nutritious food with a longer shelf life. It is climate-controlled, allowing for optimal crop production and quality throughout the year, and can help solve the problem of food security and sustainability. Technology such as artificial intelligence and data analytics software can help farmers maximize their yield while lowering costs.

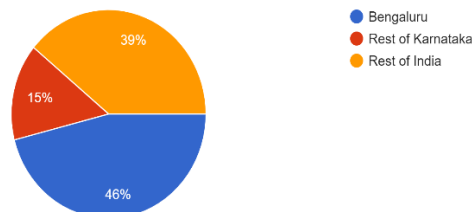
- b. How an Ahmedabad based Aggrotech Start-up, who is providing an end-to-end solution for Hydroponics and doing good in the Business; emphasizing more that Hydroponics has a good future in India and how currently this Startup performing in India: Rise Hydroponics is an aggrotech startup based in Ahmedabad, India that provides end-to-end soilless and hydroponics farming solutions. It works with businesspersons and corporations on a joint venture basis to set up hydroponics projects and retails hydroponically grown vegetables through their brand called 'Rise Freshz - Direct from Farms.' The startup has grown more than 50 types of crops and has trained more than 35,000 people in soil-less farming. It has completed more than 40 commercial large projects in 27 cities and developed more than 25 lakh square feet of hydroponics and soil-less farm.
- c. Strategic Insights of Hydroponics Market in India: Hydroponic farming is growing due to sustainable and protected farming practices and higher crop yields. However, lack of awareness and high initial investment and maintenance costs are hindering market growth. The India hydroponics market is segmented by technology, with nutrient film technique being the most popular due to its low cost and high productivity. Fruits and vegetables dominate the market, catering to retail and hotels, fast food chains, railway catering, foreign food service companies, defense establishments, and NGOs. The India Hydroponics market is segmented into nutrient film technique, drip system, ebb & flow/flood drain system, and others. The nutrient film technique segment is estimated to reach a market valuation of USD XX thousand by 2027 from an initial market value of USD 1286.64 thousand in 2018. Products suited for production under nutrient film techniques include lettuce, herbs, and baby greens. The average cost per installation of Nutrient Film Technique gully's in 1 acre varies between 23,000 and 30,000. Commercial growers across the region are currently deploying Nutrient Film Technique systems due to their low-cost, high productivity nature and increasing investment in this technology. The India Hydroponics market is segmented into fruits & vegetables, and flowers. The fruits & vegetable segment is estimated to reach a USD XX thousand market value by 2027 from an initial market value of USD 2544.15 thousand in 2018. The fruits & vegetable segments are further segmented into tomatoes, strawberries, cucumber, leafy vegetables, bell pepper, and others. These products are produced through nutrient film technique, deep water culture, and Dutch bucket technique.
- d. Growth of Hydroponics Market in India: A compound annual growth rate (CAGR) is a measure of the annual growth rate of an investment over a specified period. In this case, the hydroponics market in India is expected to grow at a CAGR of 13.53% during the period of 2020-2027. This growth rate suggests that the market is expected to experience significant expansion in the coming years. The growth of the hydroponics market in India can be attributed to several factors, such as the increasing demand for fresh and healthy food, the need for efficient use of resources, and the growing interest in sustainable agricultural practices. Additionally, the Indian government has been promoting hydroponics as a viable alternative to traditional agriculture, which has further spurred growth in the market.
- e. India's untapped potential in hydroponics: The article discusses how hydroponics can be an ideal solution for the insufficiencies of conventional farming in India. Despite agriculture being the main occupation of people in India, the contribution of the agricultural sector to India's GDP has been declining. Hydroponics, a modern form of horticulture or plant cultivation, does not use soil and involves growing crops on water that is rich in essential macronutrients and micronutrients. It controls the balance of nutrition, humidity, and temperature, uses less water, and increases yield without chemicals or pesticides. Hydroponics is suitable for regions with water and land scarcity, urban agriculture, and regions that require resource conservation. The article mentions that the global population is projected to reach approximately 15 billion people by 2050, with 66% of them living in urban areas. Hydroponics is considered an important production system in such regions. Although hydroponics is gaining popularity globally, India has a lot of catching up to do. However, the India hydroponics market is expected to grow at a compound annual growth rate of 13.53% during the period (2020–2027). Hydroponics farming is financially viable and acts as a motivator for established farmers and aspiring entrepreneurs. The approach is more profitable in the age of organic farming and a fitness-conscious generation. The article mentions that hydroponics farming requires a significant initial cost compared to conventional farming, including a building-like structure, food-grade plastic trays, and tubes.

RESULTS AND DISCUSSION

The Results of the Questionnaire as Follows (100 Respondent's):

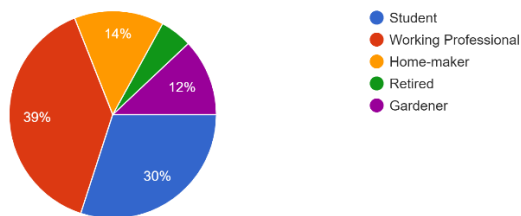
- They are majorly from the Location of Bengaluru, Karnataka.

Location
100 responses



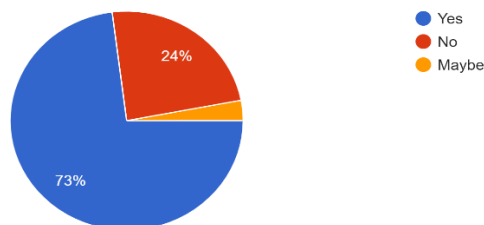
2. The following could be said about their Occupation:

Occupation
100 responses



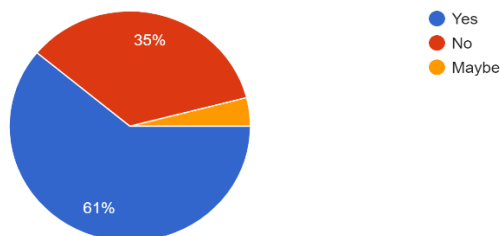
3. Majority of them know about Hydroponics:

Do you know what is Hydroponics
100 responses



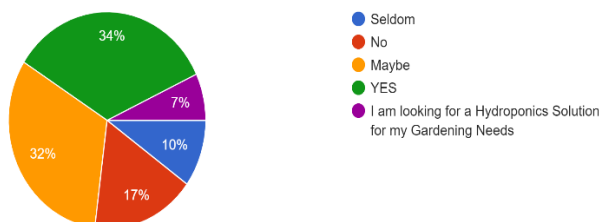
4. When asked If they know about Someone doing Hydroponics it was strange to see that they know people who are doing Hydroponics in a small/big manner in their said space.

By the way, Do you know anyone using Hydroponics?
100 responses



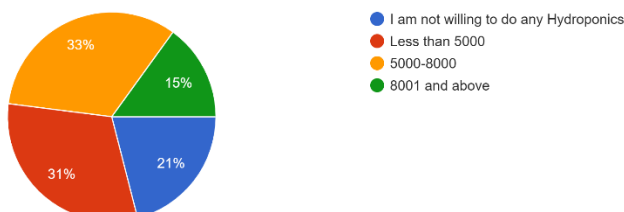
5. When asked If they would like to do Hydroponics If given all materials and learning, the answer received is not what was expected:

Would you like to do or have a Hydroponics Garden If you get to know about it ?
100 responses



6. When asked how much they are ready to spend for any Hydroponics Solution, the answers are as follows:

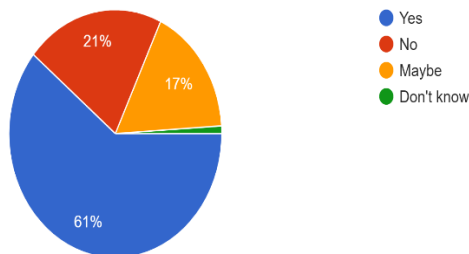
Amount you would like to invest in Hydroponics ?
100 responses



7. When asked about the potential of Hydroponics Market with the Context of Indian Market Scenario, the answers are as follows:

With the Context of Indian Market Scenario, do you think moving Forward, Hydroponics is going to be best Suitable Option for growing plants & Crops?

100 responses

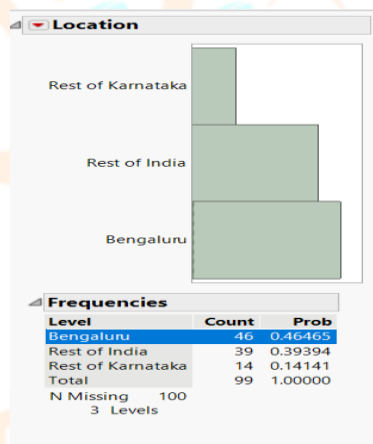


8. When asked about their Thought's on Hydroponics being a Common Culture/ Practice for Growing Plants or for Agricultural Practices in near Future; a few answers are as follows:

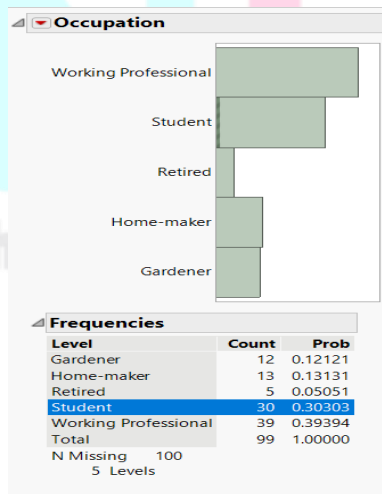
- The practice of cultivating plants without soil utilizing nutrient-rich water is already well-liked in several agricultural areas and has gained popularity recently as a more effective and sustainable substitute for conventional farming techniques.
- There are several benefits to using this technique, including increased yields, quicker growth rates, and the capacity to grow plants in locations with poor soil or constrained space. Hydroponics is emerging as a promising alternative for agricultural practices considering the growing world population and the need for sustainable food supply. Using less water and fewer resources, it enables farmers to grow crops more effectively and sustainably.
- There are still certain obstacles to be addressed, such the high cost of initial setup and the requirement for specialized skills and tools.

Analysis of the Data:

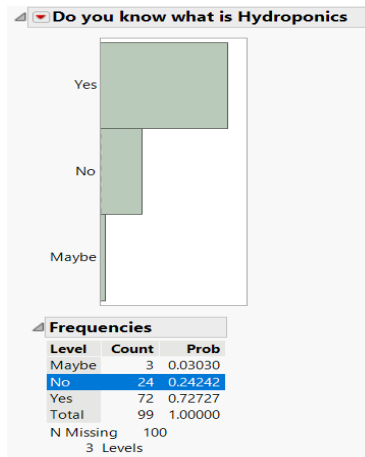
i. Location of the Respondent's: By Count the maximum Respondents are from Bengaluru. With the maximum probability of more than 46%.



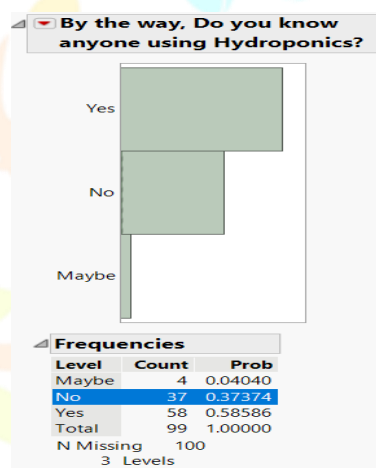
ii. Occupation of the Respondents: The maximum Respondents by count are from Student Fraternity which is comprising the probability of more than 30% of the Data.



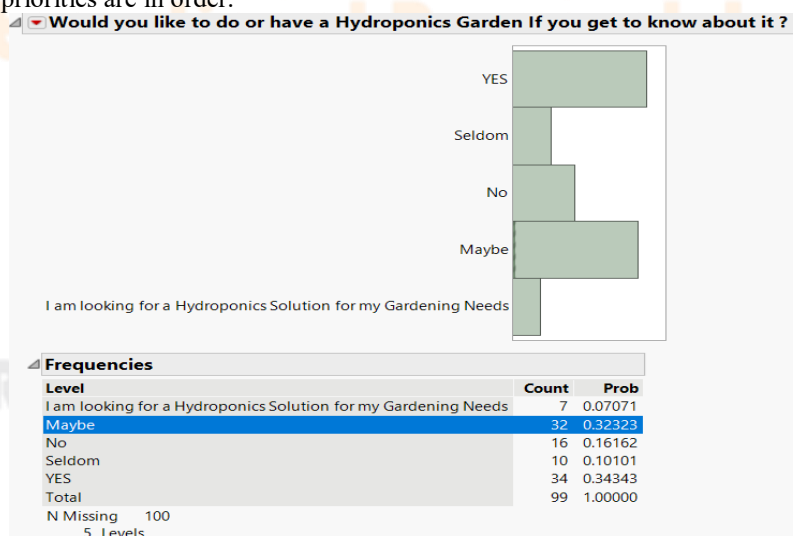
- iii. Knowledge about Hydroponics: Maximum people who have taken part in the survey are having knowledge about Hydroponics or at least by paper know what is Hydroponics with having more 72% probability.



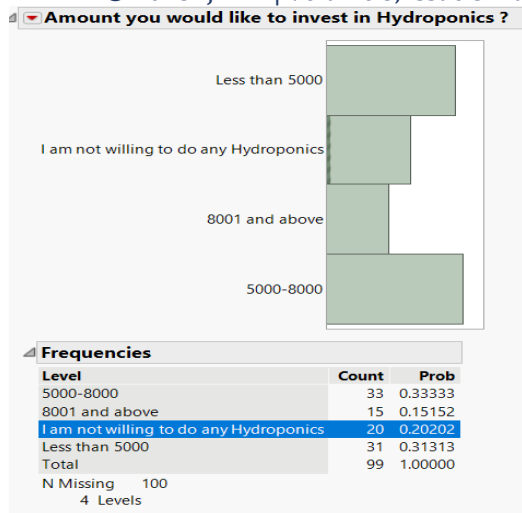
- iv. On asking if they know anyone who is using or practicing Hydroponics in their Home Environment or at any way associated with Hydroponics: The majority of the respondents with more than 58% know someone who is associated with Hydroponics in one way or another.



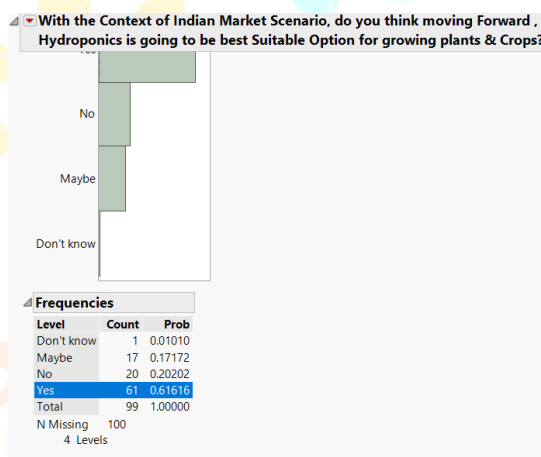
- v. On asking if they would like to do Hydroponics If they are given an opportunity to do so: They response is overwhelmed with more than 34% are interested to do so and more than 32% may do so provided all other commitment's/priorities are in order.



- vi. On asking about the Investment, they would like to do so for Hydroponics: More than 33% people are interested to invested in range of 5000-8000 INR. About a wholesome 31% people are interested to invest below the sum of 5000 INR. From the Survey it is also being found that there are about 20% people who are not Interested to do any Hydroponics.

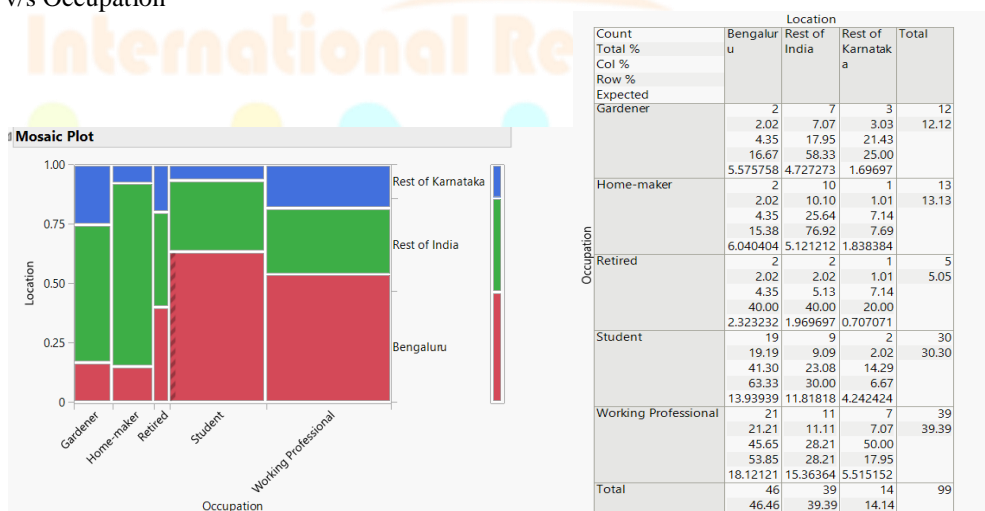


vii. When asked about the Hydroponics Market in India: The Respondents are positive with more than 61% think that there is Scope of Hydroponics in context of Indian Market. About 17% people are optimistic about the Hydroponics Market in India.

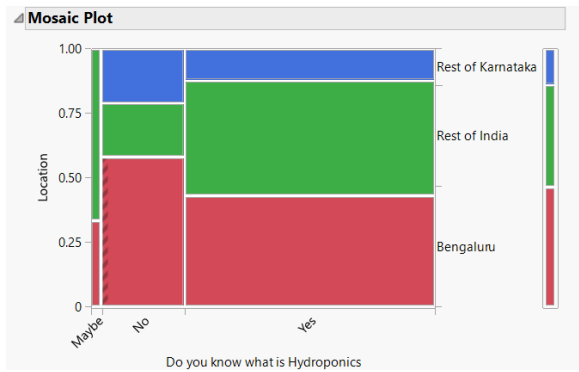


To understand more about the Data in Clarity we do some Chi-Square Test among the following:

- Location v/s Occupation

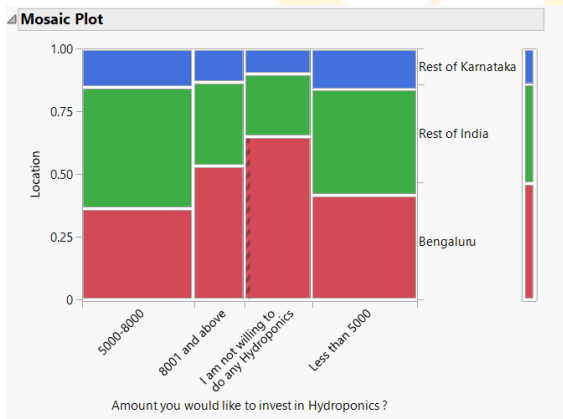


- Location v/s knowledge about Hydroponics



		Location			Total
		Bengaluru	Rest of India	Rest of Karnataka	
Do you know what is Hydroponics	Expected				
	Maybe	1	2	0	3
		1.01	2.02	0.00	3.03
		2.17	5.13	0.00	
	33.33	66.67	0.00		
	1.393939	1.181818	0.424242		
No		14	5	5	24
		14.14	5.05	5.05	24.24
		30.43	12.82	35.71	
		58.33	20.83	20.83	
		11.15152	9.454545	3.393939	
Yes		31	32	9	72
		31.31	32.32	9.09	72.73
		67.39	82.05	64.29	
		43.06	44.44	12.50	
		33.45455	28.36364	10.18182	
		46	39	14	99
Total	46.46	39.39	14.14		

- Location v/s Investment:



		Location			Total
		Bengaluru	Rest of India	Rest of Karnataka	
Amount you would like to invest in Hydroponics ?	Expected				
	5000-8000	12	16	5	33
		12.12	16.16	5.05	33.33
		26.09	41.03	35.71	
	36.36	48.48	15.15		
	15.33333	13	4.666667		
8001 and above		8	5	2	15
		8.08	5.05	2.02	15.15
		17.39	12.82	14.29	
		53.33	33.33	13.33	
		6.969697	5.909091	2.121212	
I am not willing to do any Hydroponics		13	5	2	20
		13.13	5.05	2.02	20.20
		28.26	12.82	14.29	
		65.00	25.00	10.00	
	9.292929	7.878788	2.828283		
Less than 5000		13	13	5	31
		13.13	13.13	5.05	31.31
		28.26	33.33	35.71	
		41.94	41.94	16.13	
		14.40404	12.21212	4.383838	
Total	46	39	14	99	
	46.46	39.39	14.14		

Discussions:

Hydroponic farming is a cutting-edge agricultural practice that has the potential to revolutionize the Indian agriculture business. Compared to conventional farming practices, it has a number of benefits, including enhanced crop yields, profitability, and sustainability. Technology like artificial intelligence and data analytics software may be used to increase hydroponic farming's production even further. The Ahmedabad-based Rise Hydroponics enterprise is a shining example of a business that is effectively introducing hydroponic gardening in India. But there are barriers to the expansion of the hydroponics industry in India, including a lack of knowledge and costly startup and maintenance expenses. Despite this, the India hydroponics market is anticipated to expand at a noteworthy compound yearly growth rate of 13.53% between 2020 and 2027, suggesting that hydroponics farming in India has a promising future. Hydroponic farming is the perfect answer for the deficiencies of conventional farming in India since it has the capacity to address issues with food security and sustainability.

Our survey's findings show that the respondents had a high degree of knowledge of and interest in hydroponics. The vast majority of responders were Bengalureans, and a majority of them were students. The majority of respondents were familiar with hydroponics and knew someone who worked there. This shows that hydroponics is becoming more well-liked as a more environmentally friendly agricultural technique than conventional ones. The majority of respondents said there was room for expansion and were overwhelmingly enthusiastic about the prospects of hydroponics in the Indian market. There were still certain issues that needed to be resolved, such as the high cost of initial setup and the requirement for specialized knowledge and equipment. Our chi-square tests' findings indicate a strong association between location and investment, location and understanding of hydroponics, and location and profession. Future studies and choices on hydroponics policy in India can be informed by these findings. Overall, our research shows the necessity for ongoing initiatives to support and promote hydroponics as a viable and effective method of plant cultivation in India.

CONCLUSION:

The global agriculture industry is facing several challenges that threaten food security and the environment, and hydroponic farming has emerged as a viable solution to address some of these issues. In India, where agriculture employs over 50% of the workforce but only contributes 15% to GDP, hydroponics presents a significant opportunity for growth and development. Despite facing challenges such as high infrastructure costs, technical expertise shortages, and regulatory uncertainty, the advantages of hydroponics, such as effective water utilization, year-round production, and reduced pesticide consumption, make it an attractive option for farmers and investors. The study aims to explore the potential of the hydroponics industry in India through a mixed-methods approach. The study used a literature review and customer perception survey to identify the potential benefits of hydroponics, such as providing high-value crops, organic food, and sustainable agriculture, but also highlighted the challenges that need to be addressed.

The study recommends increased awareness, government support, and addressing cost barriers as key factors to promote the growth of the hydroponics industry in India. Rise Hydroponics is a successful agrotech startup in India that provides end-to-end solutions for the India hydroponics market is expected to grow at a CAGR of 13.53% during the period 2020-2027 due to increasing demand for fresh and healthy food, the need for efficient use of resources, and the growing interest in sustainable agricultural practices. A questionnaire was conducted to assess the level of awareness about hydroponics among respondents, with a majority having knowledge about the concept and some having experience with it. The data also suggests that the location of the respondents, with a majority being from Bengaluru, plays a significant role in their level of knowledge and interest in hydroponics. Overall, the results suggest that there is potential for the growth and development of hydroponics in India, but certain challenges such as the initial setup cost and specialized skills and tools need to be addressed.

ACKNOWLEDGMENT:

We would like to Acknowledge Google LLC for letting me use their Product Google Forms and have given me access to their linked Google Sheets for a Comfortable Collection and Interpretation of the Data received by the Questionnaire Survey.

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