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Vegan first

The Rising Plant Based Sector in India Insights and Opportunities

February 2023

The Associated Chambers of Commerce and Industry of India

Message

The world of Food Processing is transitioning at a fast pace globally. In India, we are seeing the development of a vibrant infrastructure in this sector along with faster dissemination of knowledge and technologies. Traditionally, we were provisioned to spectate a limited variety of food products, but presently the food plate is diversified with exquisite assortments. This is an indication of the growth and proliferation of the Indian Agri-Food Industry with the involvement of multiple stakeholders co-creating a newer Food Sphere.

Plant-based food and its presence in India is not novel, as millions of Indians live on a proper plant-based diet, including dairy. But when we compare the present scenario in India to the West, the emergence of Plant-based foods in the recent past has revolutionized the Indian food processing industry. We are now seeing the presence of 'mock meat', which almost tastes like its counterpart, plant-based dairy alternatives, which are taste-neutral and sometimes filled with intrinsic flavours as per consumers' liking. Innovations in Food Processing Technologies have allowed us to create plant-based alternatives that taste much like regular dairy/meat products. Plant-based foods are more sustainable, healthier and cruelty-free and are more closely rooted in the values of Indian culture.

Consumers are becoming more conscious about their food consumption and the perilous impact of conventional agricultural practices on animals and the environment, intensifying the demand for plant-based food options. The plant-based food industry has the potential to be poised as an effective alternative for supermarket chains and restaurants alike. It will galvanize the food processing industry and bring together a range of customers to enjoy such products.

Given the necessity and significance of plant-based foods for encouraging more sustainable and healthy consumption habits, ASSOCHAM, jointly with Vegan First, has come out with this report which highlights the significance of the plant-based food industry and the importance of the sector. We acknowledge the efforts made by the experts in preparing this report which will be released at the National Conference on Plant-based Food: Capturing Avenues to Intensify the Food Processing Industry. We hope the report will provide helpful information and insights to the policymakers, industry constituents and other stakeholders and will aid in strengthening the Indian food processing industry while moving towards an Aatmanirbhar Bharat.

Mr. Deepak Sood
Secretary General
ASSOCHAM

Forward

The opportunity before the Indian plant-based movement is enormous, and there has never been a better time for it. Rising demand for plant-based foods and conscious consumers have resulted in unprecedented innovations in the sector around the world. From innovations like plant-based meats, dairy, poultry, and seafood to alternative materials like plant-based leather, wool, and fur, the shift and inclusivity of a vegan diet and lifestyle is obvious.

It is expected that within the next decade, 20% of meat, eggs, and dairy consumed globally will be plant-based. This is just the start.

It's a dream come true for Vegan First to see the recent growth of the plant-based sector. Since we launched Vegan First in 2016, we've seen a sharp rise in vegan and ethical consumption in the country, and around the world in all sectors - food, fashion, and cosmetics.

India is one of the biggest growing economies in the world - that combined with our culture being rooted in values of non-violence and harmonious coexistence - makes India the promised land for a successful plant-based economy. Rising middle-class consumers want to make healthier, more environmentally friendly choices and are eager to try new and more sustainable and cruelty-free foods.

This report delves deeply into the plant-based food industry. It highlights the growing opportunity. Through this report, we will not only shed light on the global and Indian plant-based food and beverage growth opportunities and investments, but we will also look at consumer trends, positioning and the go-to market these innovations.

Plant-based foods are attracting a lot of investment, scientific attention, and media attention in India as big food companies, celebrities, cricketers, have started to support this sustainable food system. Even though veganism is not a new concept in India, consumer choices and awareness related to the variety of alternatives and their potential usage remains limited. Retailers show an increased interest in sustainable plant-based and healthy brands.

I'm pleased to be sharing this report with the industry because it clearly elucidates how market players can use this opportunity presented by the plant-based sector through investments and innovations. Our team of journalists, data analysts, and editors have put together actionable insights for the plant-based processed foods sector, highlighting promising avenues and expected outcomes in an easy format.

Lastly, I would like to thank all the individuals, scientists, non-profits, and alternative foods businesses that have strived for years to create a nurturing ecosystem for plant-based foods. I'm positive about the possibilities for a fair, environmentally responsible, and wholesome future.

Palak Mehta
Founder & CEO, Vegan First
Member of Task Force for Vegan Foods by FSSAI

Vegan First (www.veganfirst.com) is India's leading media events company for all things plant-based. Started in 2016, Vegan First works actively to enable the plant based ecosystem in India bringing together conscious consumers, vegan-friendly users, businesses, services and institutions through festivals, community meet-ups, online webinars and flagship events such as the **Vegan India Conference.** Today, VeganFirst.com reaches out to millions of Indians with the latest news, recipes, events and nutrition plans digitally.

Founded by Palak Mehta, Vegan First was inspired by humanitarian Mohanji's teachings of non-violence. Palak represents the Indian chapter of the World Vegan Organisation. She is also a part of the task force on vegan foods by FSSAI (Food Safety and Standards Authority of India) which is responsible for creating guidelines and a regulatory framework for vegan foods in India.

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Executive Summary

Although the term may have gained relevance recently, plant-based has never been a foreign concept in India. The nation, which had always been a land of ahimsa, vegetarianism and vegan cuisines by default since time immemorial, has been witnessing a swift growth in the plant-based food market over the last few years. It has become a sunrise sector with tremendous opportunities. India's market for plant-based meat is forecasted to increase dramatically, from a current estimate of $30-40 million to $500 million. Meanwhile, the plant-based dairy sector is expected to see a rise from $21 million to $63.9 million by 2024, with a compound annual growth rate of 20.7%. The overall vegan food market is expected to have a compound annual growth rate of 11.32% between 2022 and 2027.

Going by the consumer preference trends, sales volume, and private and public investment, the plant-based industry has gained acceptance and interest, even among consumers who do not identify as vegetarians or vegans, which is crucial for its growth. The volume of questions received by Vegan First from young health conscious non vegans, flexitarians and transitioning vegans is testament to the growing curiosity and interest in the plant-based movement.

As the alternative protein industry takes off in India and taps into the mainstream consumer market, it is predicted that local companies will be far more price competitive than industry giants in the West, with lower per unit products costs. This is already underway in India, where plant-based leader GoodDot has achieved local price parity with meat, and OneGod (previously Good Mylk) has introduced plant milk at a lower price than dairy. This is likely to be an important goal amongst a host of emerging startups across the region.

The export market for India's plant-based sector is projected to be significant by 2030. The plant-based meat market is projected to range from $283 million to $880 million (Rs. 2194 crore to 6824 crore), whereas the plant-based milk market is projected to range from $59 million to $244 million (Rs. 459 crore to 1889 crore).

India, the second largest populated country in the world, also faces the greatest threat in terms of food insecurity and its associated challenges. 70% of people in India consume meat. The production of animal-derived products such as meat, dairy, and eggs has significant environmental consequences. The demand for animal meat also leads to land conversion for feed crops and grazing, using up a lot of water and resources. This negatively impacts local communities and ecosystems.

Thus, it's crucial to have a sustainable food system and consumption. Our food systems rely heavily on animal agriculture, which leads to climatic pressure. To reduce this, we need to diversify. A plant-based diet is a solution that addresses various problems in today's agricultural system, such as unethical farming practices, mistreatment of animals, and unsustainability. Adopting a vegan or more plant-based diet can improve both human and planetary health.

There are multiple approaches to decreasing the environmental effects of animal agriculture that don't require giving up animal products entirely. One approach is to select animal products produced with sustainable and ethical methods, such as grass-fed beef or free-range chicken. These production methods can use fewer resources and have less negative impact on the environment and local communities. Another way is to decrease the consumption of animal products by either eating them less often or choosing more environmentally friendly alternatives.

Additionally, given that resource consumption, population growth, climate change and the looming disease epidemics will only continue to escalate, the region is in urgent need of innovation in sustainable mass protein production as a means to combat these issues. In India, the current talent pool needs to acquire essential skills and technical knowledge for more advanced products in the sustainable food space. Supporting the acquisition of technical and professional skills through education and training will help close the widely recognized skill gap and contribute to the overall development of the nation.

A solid foundation needs to be built for the relatively new industry by substantially stronger research and development investment for both product attributes and manufacturing methods. Plant-based food innovation, particularly one that capitalizes on the strong points of Indian crop production and biodiversity of our millets, will necessitate government-led evaluation and approval of novel ingredients.

Given the industry's multifaceted benefits, including significant economic opportunity, the Government of India must ensure that this process is efficient while also safeguarding consumer safety. The Central Government needs to prioritize funding to support the Food Safety and Standards Authority of India's critical work on plant-based foods. Efficiency in this aspect will reduce the time between R&D and return on investment, allowing for faster and more robust sector growth.

Strategic support is being given to the plant-based industry by the Ministry of Food Processing Industry, and this work should be kept up and expanded. The Pradhan Mantri Kisan Sampada Yojana (PMKSY) provides a good framework for upcoming work. The success of the market for plant-based products, both now and in the future, depends on all of these initiatives, better investments and food technologies combined.

The future looks promising for the sunrise sector, as a large fraction of consumers are looking to make healthier, planet-friendly choices and are open to new and more sustainable proteins. Expansion of the plant-based market is certain, though its course is still being determined. We predict that homegrown alternative protein companies will overtake US and European brands due to growing demand and innovations in the coming years.

CHAPTER 1
Introduction

I. What is Veganism?

Vegetarianism and the principles of ahimsa have been a part of India's heritage and culture since ancient times. From our saints to the commoners, a majority of the country's population has thrived on a diet devoid of meat for centuries, owing to spiritual and ethical beliefs. The concept of veganism emerged in India more recently, as awareness of health, the environment and animal welfare manifolded. With the rising trend, a large section of the non-vegan community also grew curious about the lifestyle and began to embrace it occasionally.

The term 'vegan' was first coined by UK-based Donald Watson, who along with Elsie Shrigley and three other friends, created a society in London in 1944 to advocate a non-dairy vegetarian diet.[1] Later, it came to be known as 'The Vegan Society'. Backed by strong ethical reasons and to end animal suffering, the vegan movement spread far and wide, without taking much time to reach India. A person who has adopted veganism neither consumes nor uses any animal products as part of their lifestyle. In terms of food habits, animal products like dairy products, eggs, honey, meat and gelatin are avoided. Animal-derived materials like leather, wool, fur, silk and personal care products tested on animals are also not used as part of veganism. This has taken the vegan market beyond food and led to several fashion and beauty brands offering vegan solutions.

Be it vegan skin care from The Body Shop, makeup essentials by Plum Cosmetics, accessories by Baggit or even vegan silks and leather by various brands like Taneira by Tata and Zouk, the market is fast expanding. Many designers across the world have also supported the vegan lifestyle by producing plant-based apparels, including home-grown names like Anita Dongre and JJ Valaya.

[1] World Vegan Organization. History of Veganism. https://worldveganorganisation.org/History/WorldVeganism

II. What are plant-based foods?

Traditionally, a lot of regional Indian cuisines and everyday meals have predominantly been plant-based by default - from the humble idli, dosa, appam and idiyappam to fruits, vegetables, dal chawal, rotis and poha. There are many types of naturally plant-based foods that have been a part of India's rich and diverse cuisines. Some of the most common plant-based foods in India include:

1. Lentils and legumes: Lentils and legumes such as moong dal, chana dal, and kidney beans are staple ingredients in many Indian dishes.
2. Rice and grains: Rice, wheat, jowar, bajra and other grains are staple foods in India and are often served with curries.
3. Vegetables: A variety of vegetables such as potatoes, tomatoes, okra, and eggplant are used in common Indian dishes everyday.
4. Spices and herbs: A variety of spices and herbs such as turmeric, cumin, coriander, and garam masala are commonly used in Indian cooking to add flavor and aroma to dishes.
5. Street food: Street food in India often features plant-based options, such as Pani Puri, Vada Pav, and Bhel Puri.
6. Sweets and desserts: Many traditional Indian sweets and desserts such as Mysore Pak, Kaju Barfi and Jalebi are made using nuts, lentils, and wheat flours.

However, food preferences have also been evolving, leading to the need of aping a good chicken-based dish or dairy. Thus, new plant-based meat, poultry, seafood, dairy and honey substitutes entered the food business, some of which can be categorized as ultra-processed plant-based foods.

Processed plant-based Foods

Processed plant-based foods include vegan chicken nuggets, vegan mutton kebabs, plant-based cheese, plant-based ghee alternatives, etc. These readily available foods have been made possible with new advancements in food technology, machinery and manufacturing processes, which help mimic the textures and colors of non-vegan foods.

Though health conscious consumers raise concerns around certain processed plant-based foods, they can be made healthier and delicious with the use of cleaner ingredients and less saturated fats with minimal to no cholesterol.

Brazil was the first nation in the world to publish dietary recommendations based on the degree of food processing, and it created the Nova classification in 2014.[2] In this approach, which is known as NOVA (Portuguese for 'new'), minimally processed foods were divided from processed foods and ultra-processed foods.

Whole Foods plant-based

A whole-food plant-based (WFPB) diet is one that primarily consists of unprocessed or minimally processed vegan foods. The goal of a WFPB diet is to consume as many nutrient-dense plant foods as possible, which includes a lot of vegetables, fruits, beans, peas, lentils, soybeans, seeds, nuts and whole grains like wheat.

Due to the WFPB diet's low fat and high fiber content, several studies have emphasized the advantages of utilizing it in the diagnosis and treatment of lifestyle disorders like high blood pressure, weight gain, diabetes (type 2), etc. The World Health Organization's 2015 report 'Cancer: Carcinogenicity of the consumption of red meat and processed meat' has classified meat as carcinogenic. The report's working group considered more than 800 different studies on cancer in humans (some studies provided data on both types of meat; in total more than 700 epidemiological studies provided data on red meat and more than 400 epidemiological studies provided data on processed meat).[3] [4]

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[2] Food and Agriculture Organization of the United Nations. Ultra-processed foods, diet quality, and health using the NOVA classification system. https://www.fao.org/3/ca5644en/ca5644en.pdf

[3] Taylor & Francis Online. The whole-food plant-based diet: what does it entail and what lessons can it offer South African dietitians? https://www.tandfonline.com/doi/full/10.1080/16070658.2021.1943165

[4] World Health Organization. 'Cancer: Carcinogenicity of the consumption of red meat and processed meat https://www.who.int/news-room/questions-and-answers/item/cancer-carcinogenicity-of-the-consumption-of-red-meat-and-processed-meat

Nutritional requirements of a plant-based diet

A plant-based diet should provide sufficient nutrients to meet an individual's daily nutritional needs if it is well-planned and varied. Key nutrients to pay attention to in a plant-based diet include protein, iron, calcium, vitamin B12, vitamin D, omega-3 fatty acids, and iodine. Whole grains, legumes, nuts, seeds, and fortified foods can provide most of these essential nutrients. Additionally, a plant-based diet should be high in fiber, antioxidants, and other beneficial phytochemicals.[5]

Some of the key nutritional requirements of a plant-based diet include:

1. Protein: Beans, lentils, soy products, nuts, and seeds are all good sources of plant-based protein.
2. Iron: Leafy greens, tofu, tempeh, and legumes are rich in iron.
3. Calcium: Leafy greens, tofu, almonds, and fortified plant milks are good sources of calcium.
4. Vitamin B12: Fortified plant milks, breakfast cereals, and nutritional yeast are sources of Vitamin B12.
5. Vitamin D: Fortified plant milks and orange juice, as well as exposure to sunlight, can provide adequate Vitamin D.
6. Omega-3 fatty acids: Chia seeds, flaxseeds, walnuts, and algae-based supplements are sources of Omega-3 fatty acids.

It is important to note that a poorly planned plant-based diet can lead to nutrient deficiencies, so it is crucial to educate yourself and consult with a registered dietitian to ensure adequate nutrient intake. If you are found to be low on any of the crucial nutrients, consumption of supplements is ideal. There are several sports legends and mountaineers like Serena Williams and Kuntal Joisher who have achieved great success by following a healthy and nutrient-rich plant-based diet.

III. Consumer Insights and Behaviour

Plant-based foods are the fastest-growing category in many grocery shops, and the industry is celebrating a record-breaking year. According to Google Trends statistics, searches for vegan-related topics have reached an all-time high this year due to growing global interest in the topic. Additionally, consumers worldwide are beginning to become more interested in the health advantages of plant-based diets, particularly after the pandemic. Indian consumers have also started to embrace western concepts like salamis, hot dogs, cold cuts as well as native concepts like jackfruit meat and coconut milk.

According to a recent GFI survey, 77% of Indian consumers are open to trying plant-based meat products, with the early adopter market showing a particularly high level of positive attitude.[6] Since the initial products debuted in 2015, this shows a positive progression.

Opportunities to optimize the manufacturing chain are abundant, because the plant-based industry is still in its infancy, especially in places like India. Developing nations like India need to start realizing their potential in this sector.

Catalyzing events that impact consumer behavior

Respondents might have gone through certain particular catalytic experiences that would have encouraged a complete shift of lifestyle. A catalytic experience is the encounter that exposes the person to some aspect of cruelty to animals and leads to repression or becoming oriented (the desire to understand more, make a choice or do both). Additionally, this has caused varied social networks to reconsider eating meat.

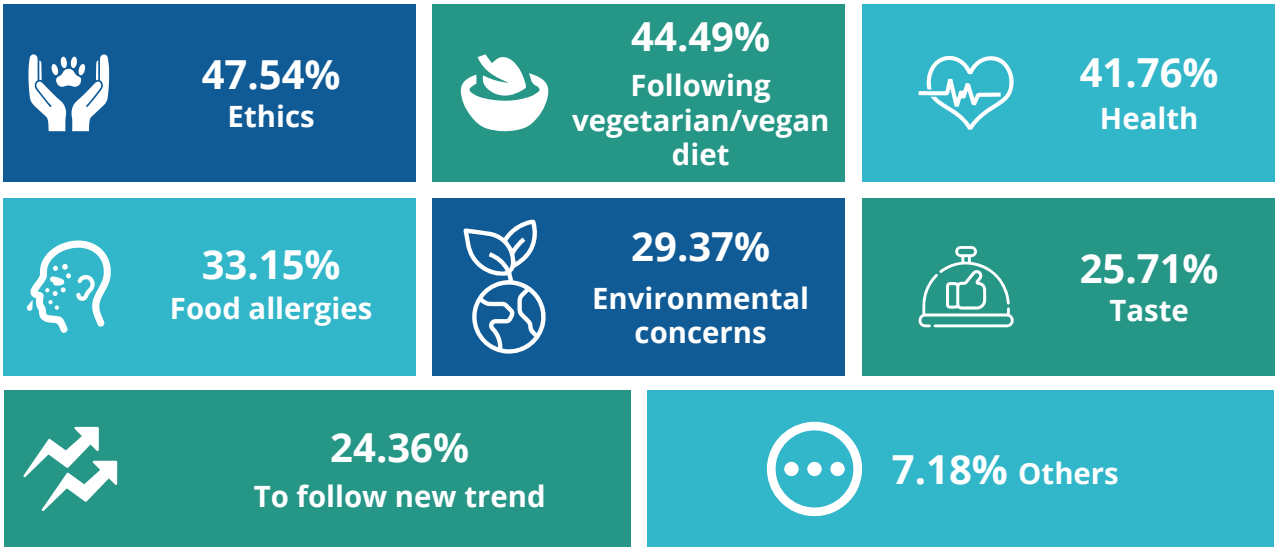
We anticipate the emergence of plant-based substitutes for almost all food categories as the business develops further. The drive towards plant-based foods is here to stay as a result of consumer demand.

[5] National Library of Medicine. Nutritional update for plant-based diets. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3662288/

[6] Fi Global Insights. Poised for takeoff: The alternative protein landscape in India https://insights.figlobal.com/india/poised-takeoff-alternative-protein-landscape-india

A survey conducted by Rakuten Insight late last year stated that 47.54% of the participants in India ate plant-based food owing to animal welfare concerns, while 44.49% were in it to follow a vegan or vegetarian diet.[7] Here's a detailed result of the survey:

TOP REASONS FOR CHOOSING PLANT-BASED FOOD



Categories of plant-based consumers and their motivations

There are multiple categories of plant-based consumers who follow the diet for various reasons. Some of them are as listed below:

1) Flexitarians - This group makes a vast majority of consumers, who follow a predominantly plant-based diet but occasionally consume animal products. They include pescatarians, who follow a plant-based diet but include fish and seafood, pollotarians, who eat plant-based foods but include chicken and other poultry products, as well as reductarians. These are individuals who are committed to reducing the amount of animal products they consume by gradually reducing meat, dairy, eggs, and other animal products in their diet and choosing plant-based alternatives instead.

2) Whole food plant-based - This diet is followed by consumers mainly for health reasons or by people who have food allergies. Their diet primarily consists of whole, unrefined, or minimally processed foods. It emphasizes a variety of fruits, vegetables, whole grains, legumes, nuts, and seeds and minimizes or eliminates the consumption of animal products, processed foods, and added oils. Their focus is on eating a variety of foods in their natural state, rather than relying on processed or packaged options, in order to maximize nutrient intake and overall health benefits.

3) Curious non-vegans - These are individuals who are not following a vegan diet, but are interested in learning more about it and exploring the potential benefits of incorporating more plant-based foods into their diet. They may be motivated by concerns for their health, the environment, or animal welfare, and may be considering transitioning to a fully vegan diet, or just incorporating more plant-based foods into their meals.

4) Vegans - They do not consume or use animal products in any form. This includes meat, dairy, eggs, honey, and other animal-derived ingredients. They adhere to a plant-based diet and lifestyle, and often do so for ethical, environmental, or health reasons. Vegans also typically avoid products that have been tested on animals, and may choose to

[7] Statista. Reasons for choosing to consume plant-based food products in India as of November 2021 https://www.statista.com/statistics/1071736/india-plant-based-food-consumption-reasons/

wear clothing and use personal care products that are free of animal products.

All the above categories of plant-based consumers are motivated by different reasons such as animal rights, sustainability, etc. While some of them follow a vegan lifestyle for ethical reasons and to avoid any form of animal exploitation, there are others who desire to contribute to the environment, lessen their impact on deforestation and minimize greenhouse emissions caused by the animal agricultural industry, which is the second largest contributor of environmental pollution.[8]

Many plant-based consumers also follow the diet to improve their health. "Health is now the second largest motivator for so many people adopting veganism," Veganuary CEO Simon Winch said. These consumers understand that excess red meat consumption may pose health risks. Those with lactose sensitivity may also decide to follow a vegan diet. In India and parts of Asia, there are also spiritual vegans who choose their dietary preferences based on their spiritual convictions and principles of non violence. For instance, many Jains strictly adhere to a vegan diet in order to avoid participating in violence of any form.

[8] Climate Nexus. Animal Agriculture's impact on climate change. https://climatenexus.org/climate-issues/food/animal-agricultures-impact-on-climate-change/

CHAPTER 2

The importance and necessity of plant-based foods

I. Key reasons for the crucial need of plant-based products

There is a crucial need for reducing our dependency on animal based products and switching to more plant based alternatives. In India, plant-based foods play an essential role for a number of key reasons:

1. Environmental sustainability: Plant-based foods require less water, land, and other resources to produce compared to animal-based foods, making them a more sustainable option for the environment. Animal agriculture is resource intensive and is also a significant contributor to greenhouse gas emissions, deforestation, and other environmental problems.
2. Health benefits: A Whole Food Plant-based food diet is rich in nutrients, fiber, and antioxidants, and if planned right, could even help prevent several lifestyle disorders such as diabetes (type 2), hyperthyroidism, blood pressure and PCOS.
3. Addresses food security: India has a large and growing population, and traditional animal-based food sources are becoming increasingly unsustainable to meet the demand for food. By prioritizing plant-based foods, India can help to ensure that everyone has access to nutritious and sustainable food sources, contributing to food security for its growing population.
4. Cultural and spiritual traditions: Many communities in India have beliefs that promote vegetarianism and non-violence, making plant-based foods an integral part of their diet.
5. Ethics: Some people choose plant-based products for ethical reasons, such as avoiding animal cruelty or reducing their impact on wildlife habitats.

6. Affordability: Naturally occurring plant-based foods are often less expensive than animal-based foods, making them more accessible to people with limited incomes.

7. Preserve biodiversity and reduce species extinction: Every year more than 80 billion animals are killed for food and lifestyle products.[9] This is unsustainable. By reducing demand for animal-based foods, there is less pressure on these habitats and the species that rely on them.

8. Prevent pandemics: As per a United Nations report, 60% of infectious diseases known to affect humans and 75% of newly emerging infectious diseases that pose a threat to humans have an animal origin.[10] More consumption of plant-based foods can limit the outbreak of pandemics.

9. Create export opportunities: By leveraging its strong tradition of plant-based foods, cost-effective production, unique ingredients, and investment in the industry, India has the potential to create export opportunities in the growing global market for plant-based foods.

Alternative proteins, also known as smart proteins, are food items that can predictably replace the consumption of meat, eggs, and dairy products derived from animals. These next-generation foods aim to give consumers and producers a viable alternative to foods derived from animals by flawlessly recreating the sensory experience. It goes well beyond the soy-based nuggets and fake meats that have been around for a while.

According to a report from the Food and Agriculture Organization of the United Nations that recommends severe reductions in meat consumption to slow climate change, livestock are responsible for 14.5% of the world's human-induced greenhouse gas emissions. Additionally, cattle consume around 15% of the planet's land—primarily grasslands and rangelands—for grazing and about 40% of it for growing their feed.[11] Alternative proteins help reduce such emissions.

II. Need for sustainability & food security in the next decade

Globally, there are a rising number of people who are severely food insecure and who require immediate assistance with their diets, livelihoods, and other necessities. Without the dangers associated with conventional meat, eggs, and dairy, plant-based diets offer a sustainable and moral way to address these severe nutritional shortages.

Thus, several non-vegan brands have transitioned to introduce a vegan range or completely switch to being 100% vegan, in response to market demand and ethical concerns. Ben & Jerry's is a well-known ice cream brand that has introduced a range of vegan ice cream flavors. Unilever, a multinational consumer goods company, has introduced vegan mayonnaise. The company has also made a commitment to increase the availability of plant-based products and reduce its carbon footprint. Similarly, Nestlé is a multinational food and beverage company that has introduced a range of plant-based products, including vegan burgers and plant-based milk alternatives.

The market for plant-based foods in India has already attracted hundreds of SMEs and FMCGs, who are producing vegan alternatives to dairy, meat, eggs, seafood, and pet food.[12] Growing demand for plant-based meals offers farmers a tremendous opportunity to boost their income while addressing issues like food insecurity, hunger, climate change, and public health risks.

[9] The Guardian. Humanity has wiped out 60% of animal populations since 1970, report finds https://www.theguardian.com/environment/2018/oct/30/humanity-wiped-out-animals-since-1970-major-report-finds

[10] United Nations Environment Programme. Preventing the next pandemic. https://unsdg.un.org/sites/default/files/2020-07/UNEP-Preventing-the-next-pandemic.pdf

[11] LA Times. Prepare yourself for an avalanche of fake meat https://www.latimes.com/food/story/2021-10-21/fake-meat-cultured-meat-plant-based-protein

[12] PBFIA. The dawn of a plant based age. https://pbfia.org/wp-content/uploads/2022/07/The-Dawn-of-a-Plant-Based-Age.pdf

India has the ability to play a significant role on a global stage by growing and processing plant-based products, and by developing its natural, social, and economic advantages. One of the top five nations in the world for producing chickpeas, lentils, millet, peas, rice, soybeans, and wheat is India. Additionally, early indications suggest that the nation's market for plant-based foods has a substantial opportunity for expansion. Consumer demand is high, private sector businesses are entering the market quickly, and the agricultural sector's strength offers a solid platform for expansion.

India can produce an abundance of nutrient-dense plant-based foods both domestically and abroad without compromising the wellbeing and future of its ecosystem. Optimism breaks through in the face of the existential risks posed by climate change and the difficulty of feeding a growing global population. This industry's power and influence has the ability to change the food system while offering solutions that reduce our global warming impact and improve food security for the entire world's population.

CHAPTER 3

From fringe to mainstream

I. Growth of the market globally

The global market has been burgeoning constantly over the last few years, with several plant-based businesses flourishing. According to a report by Bloomberg Intelligence, the vegan food market could take up 7.7% of the world protein market by 2030, valued at $162 billion. Moreover, the global animal and dairy protein demand is estimated to reach $1.2 by 2030.[13]

Major global brands like Beyond Meat, Oatly and Impossible Foods have been partnering with restaurants, which is resulting in a significant increase in the availability of vegan food options for consumers. The industry also received a sweeping boost in 2019 when Beyond Meat went public with an IPO of $25 per share. A much older Turkey alternative brand Tofurky, present since 1995, has been witnessing an all-time high sales during Thanksgiving since 2020. It's interesting to note that most of these brands were once subjected to mockery among the masses.

Other legacy brands like Nestle and Kellogg have also started offering plant-based products, driving further market boom and an increase in options. Especially in North America, Europe, and China, investor and consumer interest in plant-based foods has skyrocketed.

[13] Bloomberg. Plant-based Foods Market to Hit $162 Billion in Next Decade, Projects Bloomberg Intelligence. https://www.bloomberg.com/company/press/plant-based-foods-market-to-hit-162-billion-in-next-decade-projects-bloomberg-intelligence/

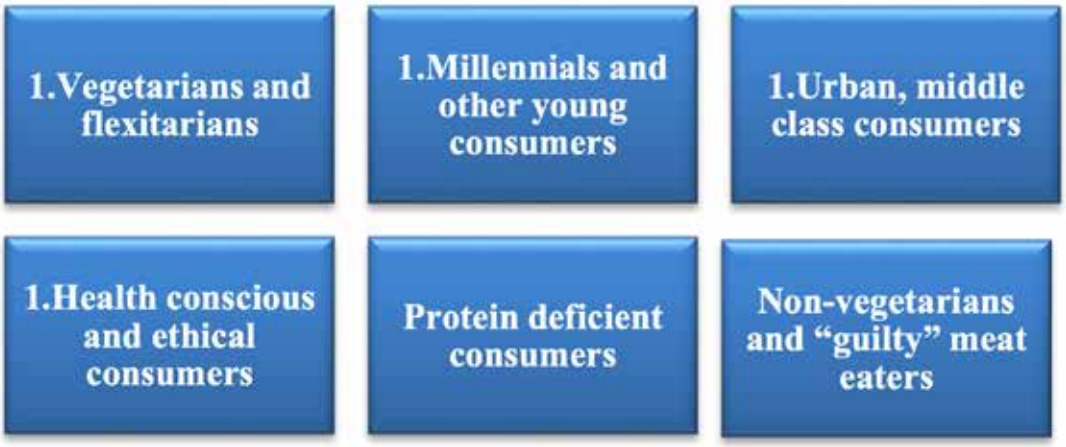
BLOOMBERG'S REGION-WISE PLANT-BASED PROTEIN MARKET PROJECTIONS BY 2030

$64.8 billion Asia-Pacific	**$40 billion** Europe	**$40 billion** North America
$8-9 billion Africa	**$8-9 billion** Middle East	**$8-9 billion** Latin America

II. Humble Beginnings to Exponential Growth in India

In a country where a majority of the population had never heard of veganism until a few years ago, market activity in the plant-based category has significantly picked up steam over the past 18 months. Indian consumer cohorts' familiarity and engagement in these products have also increased. Young urban Indian consumers have been displaying interest in consuming processed plant-based meats to fulfill their protein requirements and enjoy the taste of animal meat guilt free.[14]

Figure 1. Target Consumer Groups for Plant-Based Meat Substitutes



**Source: USFDA*

Countless numbers of SMEs and FMCGs have now entered India's plant-based food market, offering plant-based alternatives to meat, poultry, sea food, dairy and vegan meals for dogs and cats.[15] The growth of the plant-based foods industry offers farmers significant opportunities to increase their income while addressing food insecurity, climate change obstacles, hunger, and public health risks. Furthermore, given India's diverse crop output, advanced F&B sector, research institutes,

[14] United States Department of Agriculture. India Emerges as a Burgeoning Market for Plant-based Meat Substitutes https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=India%20Emerges%20as%20a%20Burgeoning%20Market%20for%20Plant-based%20Meat%20Substitutes_Mumbai_India_05-03-2021

[15] plant-based Foods Association: The dawn of a plant-based age- India to lead the way to world food security and nutrition. https://pbfia.org/category/insights/

significant R&D successes, and expanding private equity sector, there is an opportunity for growth.

In January 2022, Indian delivery giant Swiggy, the largest ordering and delivery platform in the country, announced a partnership with GoodDot to make animal-free foods easier to source. A study by Kerry, released in December 2021, revealed that India is a high-growth location for plant-based nutrition, with poll results demonstrating a generally open mind to plant-based options, plus a willingness to buy them regularly. The study highlighted that 41% of people already eat a minimum of six types of plant protein, with a willingness to add more, including plant-based meats.[16]

Industry projections point to a much bigger market in the next few years. India's plant-based meat market is estimated to jump from $30-40 million to $500 million. The plant-based dairy market is expected to grow from $21 million to $63.9 million at a CAGR of 20.7%. The rising demand for vegan snacks and confectionery is further boosting the growth of India's vegan market. Overall, the vegan food market will showcase a CAGR of 11.32% during 2023-2027 as per industry reports.[17]

Looking at the exponential growth of veganism in India, celebrities have also played a significant role in drawing attention to the movement by raising their voices in defense of the environment, animals, and the planet's future. They have also joined global campaigns in their effort to support the cause.[18]

- More recently, The Plant-Based Treaty received support from Bollywood actors and Imagine Meats' founders Genelia D'souza and Riteish Deshmukh. They started their own business to manufacture sustainable and wholesome plant-based meat.
- Cricketer Virat Kohli and actor-wife Anushka Sharma invested in the popular alternate vegan meat brand Blue Tribe.
- Sadaa Sayed, a Telugu actor and campaigner has been advocating veganism on her social media accounts over the years. She started the Earthlings Cafe in Mumbai to help more people adopt a plant-based diet.[19]
- Svetlana Tulasi, an Indian classical Kathak and Bollywood dancer and choreographer, Meher Malik, a belly dancer and animal rights activist, and Anand Mahendroo, an Indian film producer, are a few of the other supporters of a plant-based lifestyle, who have all indicated a desire to go vegan.
- Mountaineer Kuntal Joisher and Tennis Player Vishwajeet Sangle have openly spoken about the health possibilities of this diet even for athletes.
- The mayors of roughly 12 Indian cities have signed The Plant-Based Treaty along with a number of other politicians and corporations. The treaty is a proposed international agreement aimed at promoting the adoption of plant-based diets to address the environmental and ethical impacts of animal agriculture. It aims to encourage governments, organizations, and individuals to shift towards more sustainable and ethical food systems that rely on plant-based sources of protein.

Veganuary, an international organization that influences and guides people to try veganism throughout the month of January, received a tremendous response when it was launched in India in 2022. The country had the third highest number of participants in the world, with around 60,000 people joining the campaign.[20]

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[16] Green Queen Media. The APAC Alternative Industry Report 2022 GQ-APAC-REPORT-2022-V3.pdf (greenqueen.com.hk)

[17] Trade Promotion Council of India. Vegan products: A sunrise segment for India's F&B industry https://www.tpci.in/indiabusinesstrade/blogs/vegan-food-products-a-sunrise-segment-for-indias-fb-industry/

[18,19] Mid-day. Several indian celebrities endorse the plant-based treaty- a global campaign to resolve the climate crisis. https://www.mid-day.com/brand-media/article/several-indian-celebrities-endorse-the-plant-based-treaty-a-global-campaign-to-resolve-the-climate-23231769

[20] Veganuary. Veganuary 2022 campaign in review. https://veganuary.com/wp-content/uploads/2022/03/US-Veganuary-2022-EoC-Report-Final.pdf

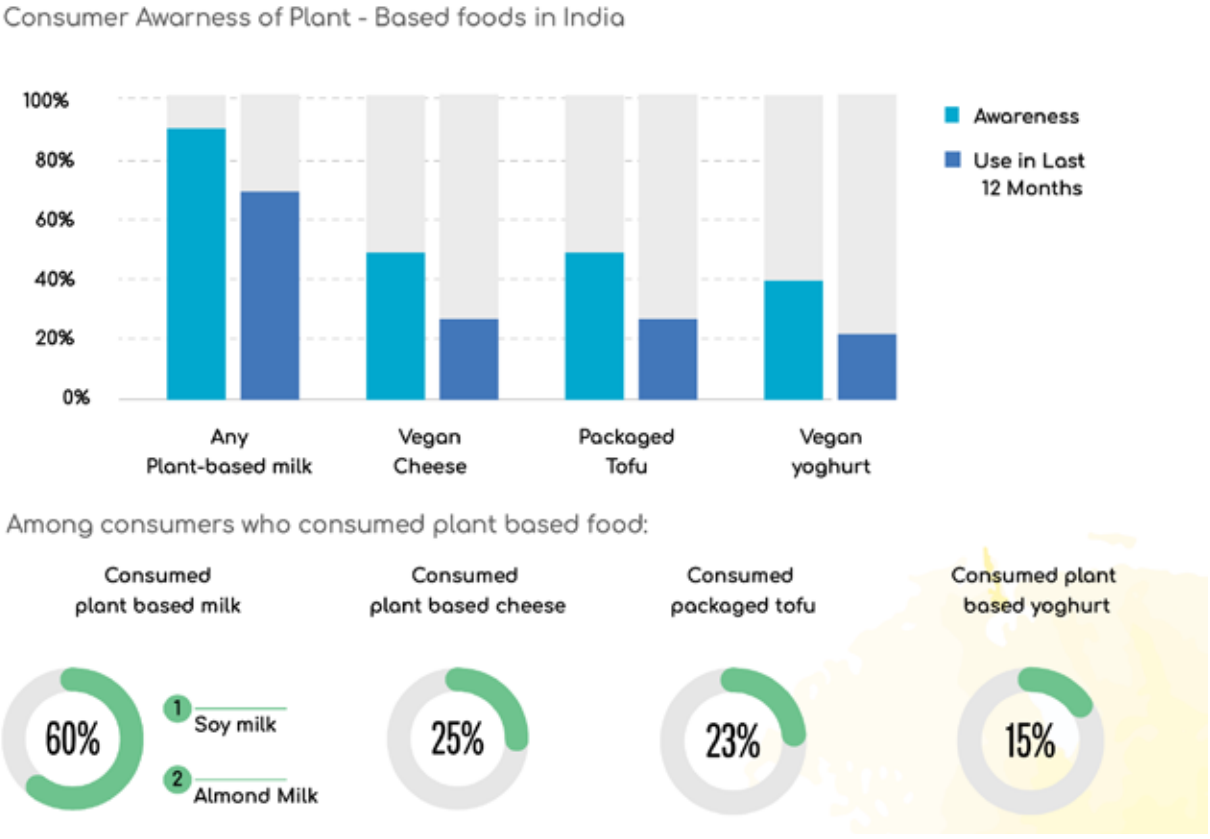
III. New entrants to the plant-based foods market in India

In the last 1-2 years, Indian consumers found a whole new range of plant-based alternative brands, which offered everything ranging from nut milks to coconut cheese and vegan chicken patties to plant-based eggs. Across the socioeconomic pyramid, vegan protein products are now found that are sustainable and delectable, thanks to bio-based revolutionary foods like cultivated beef and proteins obtained from fermentation, such as tempeh. Besides a sizable population of vegans and vegetarians, huge FMCG businesses are targeting non-vegetarian consumers who are looking for alternatives to animal proteins. The segment, which just opened two years ago, is predicted to reach about USD one billion by 2030.[21]

Several firms such as the Blue Tribe, funded by cricketer Virat Kohli and actor Anushka Sharma, have joined the market for this plant-based meat substitute. Products in the plant-derived meat category are already available at e-commerce platforms and major chains in metropolitan areas. Under the new brand 'Tata Simply Better', Tata Consumer Product Ltd (TCPL) announced its foray into the plant-based meat products industry and unveiled four variants: nuggets, burger patties, Awadhi seekh kebabs, and spicy fingers.

Businesses in the HoReCa (hotel, restaurant, and catering) sector are focusing on institutional clients, and a number of Quick Service Restaurant (QSR) chains, including Domino's and Starbucks in India, have added plant-based meat options to their menus. The Tata group FMCG arm claims that plant-based meats are at the forefront of the larger plant protein landscape and are intended to mimic the sensory and cultural resonance of meat obtained from animals without the negative impacts.

Under its ITC Master Chef IncrEdible brand, ITC has introduced ecological plant-based protein products for consumers in two varieties - Incredible Burger Patties and Incredible Nuggets. As of now, the product has been distributed through significant retail chains and e-commerce platforms in eight cities.



Source: USFDA

[21] Business Standard. Big FMCG companies enter plant-based meat segment, target non-veg consumers. https://www.business-standard.com/article/companies/big-fmcg-companies-enter-plant-based-meat-segment-target-non-veg-consumers-122072400548_1.html

CHAPTER 4

New technology for plant-based food production

In India, alternatives to milk (such as almond milk and coconut milk) and meat (such as jackfruit and soy) have been around for decades. Soya chaap has become popular amongst 'guilty non-vegetarians' or newly turned vegetarians. Globally, tofu, tempeh, and soy milk have been used as replacers for animal-based products. More recently, plant-based milk alternatives have started gaining acceptance and are being embraced by flexitarians, vegetarians, vegans, and non-vegetarians alike. But until recently, the market for plant-based meat has remained small and stagnant.

On the contrary, the market for plant-based meat worldwide has grown considerably over the past 5 years as businesses such as Beyond Meat created plant-based meats that are indistinguishable from traditional meat. With the 2016 launch of the Impossible Burger and the Beyond Burger, both of which were successful in major fast-food outlets, this "biomimicry" approach has become increasingly popular. Fast forward to 2023, plant-based meat alternatives have not only started to mimic the texture, but also the flavor, cultural references, and fragrance.

Plant-based alternatives could use single-hero ingredients or take a hybrid approach while developing their products. Some brands like Only Earth and Alt Co. have taken a purist approach in their offerings as they stick to pure almond-based or oat-based ingredients. However, there are other brands like One Good that use hybrid ingredients by combining oats, cashews, and emulsifiers to mimic the taste and texture of dairy milk.

India's first plant-based egg brand Plant Made follows a proprietary approach as they use proteins from indigenous grains to make their liquid egg. Companies such as Katharos and Break of Dawn have fermented almond feta cheese alternatives, which do not mimic dairy-based cheeses or butters. On the other hand, the White Cub dairy-free butter

range closely mimics the texture and flavor of dairy-based butter.

I. Types of alternatives

Plant based alternatives can be derived from 3 methods:

- **Plant-based food processing**

Plant-based meat is artificial meat produced by using ingredients derived from plants. The taste, texture, and physical properties of animal-derived meat can be replicated to a large extent by processing plant-derived (in some cases - fungi) ingredients. Plant-based meats take significantly less resources and produce less emissions as compared to animal-based meat. It also drastically reduces the land and water pollution caused by animal agriculture as there are no animals involved in the production. The applications of plant-based meat are the same as animal-based meat - in salads, curries, burgers, finger food, and gourmet dishes.

Plant based dairy comprises plant-based replacements for dairy milk as well as dairy products such as curd, yogurt, cheese, butter, cream, and ghee. Each segment faces the challenge of direct comparison of taste and physical properties of dairy products with plant-based ones. Despite that, plant-based chefs on wide reaching platforms are introducing new and innovative methods to replace dairy based ingredients. For eg. Aquafaba is the leftover water from boiling chickpeas and can be successfully used as a creamer for desserts.

- **Fermentation**

Microorganisms such as yeast and bacteria are used to ferment plant-based ingredients to create plant-based cheeses and meat alternatives. Micro-organisms such as algae or fungi are a very promising source of alternative meat products. While cheese and tempeh are classic examples of fermented plant-based foods, a number of startups are working on perfecting the sensory aspects of plant-based protein. Fermented plant-based alternatives can be usually consumed directly and are as delicious, sustainable and nutritious. They are also used as 'host systems' to produce other ingredients of interest - like egg or milk proteins.

A growing field of fermentation derived foods delivering next-generation meat and dairy alternatives is biomass fermentation. It uses fast-growing, high protein microorganisms to produce large quantities of protein in bioreactors, which can be further used in the final product.[22]

- **Cultivated or cell-based**

This technology involves culturing animal cells in a lab to create meat alternatives, without the need for animal slaughter. The 'meat' is artificially produced by cultivating a small sample of animal cells taken via non-invasive methods. By farming the cells directly instead of raising and slaughtering animals, a highly wasteful process involving cruelty, antibiotics, and fecal contamination is replaced by engineering a product which exactly mimics the properties of flesh. Cultivated meat is also called 'cultured', 'cell-based', or 'clean' meat.

It must be noted that cell-based meats are neither vegan nor vegetarian. However, these meats might be a good substitute for consumers who focus on lessening the total impact of animal suffering but would still like to enjoy the same sensory pleasure of eating meat.

II. Common technologies in use today -

There are several time-tested and traditional as well as new and advanced technologies that are being used for plant-based food production.

Homogenization or blending is commonly used to make plant-based milk alternatives. The base ingredients such as nuts and seeds are soaked, ground, and mixed with water to create a homogenous mixture. This mixture is then filtered to remove solids and create a smooth, consistent liquid. This process is commonly used by home chefs who prefer to make their plant milk from scratch. Some plant-based milk beverages may also undergo additional processing steps such as heating, sterilization, and fortification - to improve

[22] Fi Global. How fermentation is fuelling next-generation plant-based alternatives
How fermentation is fuelling next-generation plant-based alternatives (figlobal.com)

their texture, taste, and nutrient profile. High Pressure Processing (HPP) may also be used to extend the shelf life of some plant-based milk alternatives.

Plant-based butters are typically made using a process similar to that of plant-based milks, with some additional steps. The ingredients, such as nuts, seeds, or oils, are ground into a paste, then mixed and emulsified to create a spreadable consistency similar to dairy butter. The mixture may also be flavored, sweetened, or fortified with vitamins and minerals, depending on the desired end product. Some plant-based butters may also undergo additional processing steps, such as heating or cooling, to improve their physical properties such as spreadability and boiling point.

Plant-based meats are typically made using a combination of food processing techniques, including extrusion, high-pressure homogenization, and heating/cooling. The ingredients, such as soy, pea protein, wheat gluten, or legumes, are first ground and mixed to create a dough-like mixture. This mixture is then processed using extrusion technology to create the desired texture and shape of the final product. Existing technologies are being adapted and new technologies are being introduced to advance protein alternatives.

High-pressure homogenization is used to create a meat-like texture, and heating and cooling may be used to further improve the texture and mimic the behavior of animal-based meats when cooked. Additional ingredients, such as oils, flavorings, and colorings, may also be added to improve the taste and appearance of the final product. The resulting plant-based meat can be used as a substitute for traditional meat in a variety of dishes.

The latest extrusion technology for both wet and dry textured vegetable protein (TVP) continues to evolve and improve as the demand for plant-based meat alternatives increases. Some of the latest advancements in extrusion technology for TVP production include:

- Dual-screw extrusion: This technology uses two interlocking screws to more efficiently mix and homogenize the ingredients, resulting in improved texture and consistency.
- Co-rotating twin-screw extrusion: This technology uses two interlocking screws that rotate in the same direction, producing a more uniform and consistent product compared to single-screw extrusion.
- High-temperature short-time (HTST) extrusion: This technology combines high temperature and short processing times to produce a more tender and flavorful product.
- Membrane extrusion: This technology uses a porous membrane to separate the extruded product from the screw and barrel, reducing wear and tear on the extruder and improving efficiency.

It's important to note that the specific extrusion technology used may vary depending on the product requirements and the desired end result, and the most appropriate technology may also depend on the type and form of the starting ingredients.

Frequently, High Pressure Processing (HPP) is also used to preserve the taste and texture of plant-based foods. High Pressure Processing (HPP) is a food preservation method that uses high hydrostatic pressure to inactivate pathogens, extend the shelf life and maintain the quality of food products.[23]

These technologies are helping to improve the taste and texture of plant-based foods, making them more appealing to a wider range of consumers and driving the growth of the plant-based food industry.

Future alternate meat consumption will likely include a variety of meats, including plant-based, microbial fermentation-based, and cell-cultured meat - with newer and kinder meats as advancements further in food technologies. Some of them could include cultivated fat to mimic the succulence of animal-based meat.

[23] Food Industry Executive. How New Technologies Are Advancing the Plant-Based Meat Business. https://foodindustryexecutive.com/2022/04/how-new-technologies-are-advancing-the-plant-based-meat-business/#:~:text=Bioprinting%3A%20Similar%20to%203D%20printing,%2Dgrown

III. Creating a successful plant-based meat alternative

Creating a successful plant-based meat alternative requires:

1. Ingredient selection: The choice of ingredients is crucial in creating a plant-based meat alternative that closely mimics the taste, texture, and mouthfeel of animal-based meat. The right combination of plant-based proteins, starches, and oils can help create a product that is similar to traditional meat in terms of taste, texture, and appearance.

2. Processing technology: The choice of processing technology is also crucial in creating a successful plant-based meat alternative. Techniques such as extrusion, high-pressure homogenization, and heating/cooling are often used to create the desired texture and mouthfeel of the product.

3. Flavor and seasoning: Creating a delicious and appealing flavor profile is essential for a successful plant-based meat alternative. The use of natural flavorings and seasonings, such as spices and herbs, can help create a product that is appealing to a wide range of consumers.

4. Nutritional value: Plant-based meat alternatives should provide a similar or improved nutritional profile compared to traditional meat, and be free from harmful additives and preservatives.

5. Marketing and branding: Effective marketing and branding can help create consumer awareness and demand for the product. The product must be presented in a way that appeals to the target audience and effectively communicates the benefits and qualities of the plant-based meat alternative.

6. Packaging and distribution: The product must be packaged and distributed in a way that is convenient for consumers and extends the shelf life of the product.

In summary, creating a successful plant-based meat alternative requires a combination of careful ingredient selection, advanced processing technology, and effective marketing and branding strategies.

IV. How to introduce new innovations to the consumer

The consumer group and category for plant based milks is more evolved and accepted than other alternatives such as meats, poultry and seafood. This is due to several reasons such as the quality of innovations, price parity and product benefits.

Creating mass awareness about a new category of products like plant based meats would require significant efforts towards creating brand awareness. In some cases, for D2C brands, Indian celebrities and cricketers have been promoting the idea of cruelty free, sustainable and kinder innovations.

Another approach which has proved to be successful is B2B partnerships. Working with an established QSR chain or mainstream aggregators that customers are familiar with and love is one of the quickest methods to get a brand in front of them.

In order to make it simpler to make cruelty-free delicacies accessible to everyone, the largest ordering and delivery platform in India, Swiggy, announced a partnership with GoodDot in January 2022.[24] BVeg Foods announced a strategic alliance with the market-leading manufacturer of industrial equipment in Switzerland, Bühler, in April of last year, making it one of the first major facilities in the nation to offer high moisture extrusion technology. Additionally, Starbucks India announced in June 2022 that it will collaborate with Imagine Meats to create a variety of vegan menu dishes to be provided at its cafes in ten key cities.

Plant-based products and their retail availability

Nowadays, stores in a number of Tier-I and Tier-II cities, including Foodhall, Nature's Basket, and D Mart stock vegan dairy and meat alternatives. With the expansion of shelf-stable plant-based food products on the market and improvement in packaging technology, it is projected that consumer

[24] Green Queen.https://www.greenqueen.com.hk/swiggy-gooddot-partnership-india/

access will improve dramatically. At present, startups are struggling to survive on the retail shelves as a result of the hefty listing charge. Plant-based food items can be made more widely available to customers with the help of the government, retail forums, product breakthroughs, and the creation of retailer rules.

According to a recent YouGov poll, more than 65% of Indians want to eat more vegan meals this year. This shift in viewpoint is driven by environmental concerns and health benefits. Industry giants in the FMCG sector like ITC and Tata Consumer Products have launched products to take advantage of the opportunity and drive industry transformation.

	SEITAN	TOFU	TEMPEH	TVP	QUORN	INSECT	FAKE MEAT	FISH PROTEIN
Protein Content (per 100g)	50-80%	5-12%	15-30%	40-90%	40-50%	20-70%	20-30%	15-40%
Stage of Development	Emerging	Developed	Emerging	Developed	Emerging	Emerging	Testing	Emerging
Market Penetration	Emerging	Mainstream	Emerging	Mainstream	Emerging	Future	Future	Emerging
Cost of Production	Low	Low	Medium	Low	Medium	Medium	High	High
Innovation/ Technology	Medium	High	Medium	High	Medium	Medium	Medium	Medium

Source: Future Market Insights

**Source: PBFIA*

V. Addressing the nutritional concerns of plant-based alternatives via fortification

Plant-based foods are fortified by adding vitamins D3 and B12, macronutrients such as calcium, iron, and protein. This is typically done by mixing the nutrients into the food during the production process, or by coating the food with a nutrient-rich powder. Common examples of fortified plant-based foods include plant milks, breakfast cereals, and meat alternatives. Due to absence of guidelines on having a balanced diet and achieving a complete nutrition profile, most people suffer from nutritional deficiencies.

While it is possible to obtain these nutrients from other plant-based sources, fortified foods can help ensure adequate intake. However, not all plant-based foods need to be fortified and it depends on an individual's diet and their specific nutrient needs. It is always a good idea to consult a healthcare professional to determine the best approach for meeting your nutritional needs.

VI. Innovation in the Indian plant-based sector

The entrance of new innovations and technologies is certainly helping the segment grow. This aspect of the industry is paving the way for its expansion and increasing the accessibility of plant-based products. It can tackle the major factors determining the acceptability of plant-based foods by the average Indian consumer – taste and texture, affordability and convenience.

BioDimension Technology

BioDimension Technology, a tissue engineering business co-founded by Ranjith Kumar Velusamy, creates artificial tissues to replace animal-based research for evaluating cosmetic chemicals by cosmetic corporations.[25] Their innovation does away with the use of animals in the drug discovery process. With the help of their makeshift artificial tissue models, they hope to reframe science in a more compassionate manner. The group stated, "We are currently concentrating on generating 4D printed tissue that replicates human skin and eyes."

[25] Your Story. Bio Dimension technology. https://yourstory.com/companies/biodimension-technology

Gooddot

Gooddot is a pioneer in the plant based meat sector in India. This Udaipur-based company is an early mover, which has achieved price parity with their products. They offer plant-based meat alternatives made from soy, pea protein, and other ingredients.

One Good

One Good (or Good Mylk) is one of the first Indian plant-based dairy companies that offers a range of vegan dairy products, including milk, cheese, cream, and yogurt alternatives made from nuts and seeds. They have received positive reviews from customers for the taste of the products as well as the competitive pricing they offer. The brand recently achieved another feat by introducing their fresh plant-based milk at Rs.59 per liter, which is the same price as cow milk.

Sofit

Sofit, which was founded more than a decade ago, was aquired by Hersheys India. It has long been a front-runner in the market for plant-based milk. Its flavours range from naturally sweetened to sugar-free and have been marketed as healthy options. With celebrity endorsements like John Abraham, it has gained widespread recognition among vegans, flexitarians, and lactose intolerants. It is also one of the most affordablle plant based milks in India.

Greenest

India's pioneering plant protein food brand, Greenest is backed by investors like Better Bite Ventures (a New Zealand based dedicated Alt Protein VC fund), Magnetic, and Sachid Madan (the former Chief Executive of ITC's frozen snacks business). It shipped India's first plant-based meat export consignment to the USA from Gujarat, India in September 2022.

Blue Tribe

This is one of the most loved vegan meat brands for their close resemblance in taste and texture to chicken and mutton. The company had first gained popularity for its plant-based chicken nuggets and later went on to receive appreciation for their flavourful Darjeeling chicken momos. Virat Kohli and Anushka Sharma are now investors in this brand.

WhiteCub

WhiteCub is a widely accepted 100% vegan ice cream brand. Their ice creams are made with a coconut, soy and almond milk base. They have also launched other plant-based alternatives like salted butter, soy-coconut curd and lassi, which tastes and feels very similar to the animal-derived counterparts.

Imagine Meats

Imagine Meats was the first brand in India that introduced delicious alternatives to Indian meat dishes like Chicken Biryani and Seekh Kebabs, besides the usual patties and nuggets. They impressed consumers by mimicking the exact taste, texture and even the fragrance of a meat biryani.

Phyx44

Bharath Bakaraju founded Phyx44, which is focused on developing naturally occurring, microbe-produced proteins and fats for human consumption, with the goal of producing cow or bovine milk and milk derivatives. By using cutting-edge technology, this procedure enables bacteria to produce the proteins and fats needed to produce complete cow milk. By 2024, they hope to begin selling their precisely fermented milk components. Their present objective is to sell in Singapore, India, the US, and Europe. They noted that the APAC area offers a market worth $15 billion.

Vezlay Foods

Vezlay Foods is a plant-based food company that offers a range of meat alternatives, including burgers, sausages, and nuggets, made from ingredients like soy and pea protein.

ProMeat

ProMeat, a company founded by Pranjuli Garg, Debabrata Das, and Sugriv Gupta, produces excellent plant-based meat products that are high in protein, have a beautiful texture, and are made from local crops. Their mission is to act as a catalyst for the transition to sustainable proteins. In the established Indian market for plant-based meat substitutes, Debabrata stated, "We are looking to aggressively sell ourselves as a price competitive nutritionally sound product that can stand out."

Naya M!lk

Naya M!lk is a plant-based dairy business founded by Jai Khandelwal and Aditya Shah with a focus on creating substitutes for value-added dairy products. These are made using innovative native crops. The team's current research focuses on plant-based paneer that has comparable sensory and practical characteristics to paneer made from dairy. Restaurant owners and chefs have given them positive comments. 'They prefer our products' taste, texture, and sensory profile above those of competing paneer substitutes," said the founders.

Plantish Foods

Plantish is a food-tech business founded by Sushil Kumar Gehlot and Ishu Bindal that aims to address the issue of food insecurity brought on by a horribly ineffective animal-based food system. They are creating ethically produced plant-based eggs that can be utilized to make a variety of egg meals without sacrificing flavor, cost, or nutrition. "We have a big competitive edge because our product cooks and tastes like an egg while still having a high nutritional profile," according to Ishu.

Nutrela

Nutrela offers a range of soy-based products, including whole soybeans, granules, and flour, as well as ready-to-eat food items such as soy nuggets and soy chunks. The brand is well-established in India and has a reputation for producing high-quality soy-based food products.

3D printed food - appealing because of the usefulness or novelty?

The production of lab-grown cultured 3D meat uses bovine stem cells taken from a cow or chicken egg. These are isolated and cultured in a bioreactor to create a significant amount of biomass; they are also known as beginning cells. The cells are then differentiated into edible muscle and fat cells that form the familiar and delicious meat. Consumers can relax knowing that this method is completely safe and harmless. This procedure is further divided into steps, each of which may be different depending on the technology and firm developing it. Although some vegans may still believe that taking a single cell from a sentient being is against their principles.

Alternative foods that resemble meat are becoming immensely popular as more individuals adopt vegan, flexitarian, or vegetarian eating habits and as animal welfare concerns rise. Food that can be manufactured using 3D technology includes pasta, chocolate, and even meat. Although there is opposition to 3D-printed beef, the technique will continue. Grown or created meat called 3D meat, sometimes known as 3D printed meat, is produced utilizing 3D printers and additive manufacturing processes, as well as artificial intelligence and material science.[26]

One method entails feeding the printer with animal cells that have been grown and "printed" into meat-like forms. Imagine a standard printer that you feed with a viscous consumable material in place of ink, and the output is something you can eat. However, one must be aware that 3D printing merely creates the meat; it still needs to be cooked before it can be eaten. The only step in the 3D printing process is printing or projecting the material in the desired shape onto a surface.

Any ingredient can be utilized to create 3D food as long as it complies with the printing method. Some of these methods consist of printing based on extrusion, chosen laser sintering, extrusion at ambient temperature and from hot melt, inkjet printer, inkjet binding and printing using several printheads and materials.

Certain elements are found in most 3D foods such as puree, potato mash, jelly, cheese, frosting, chocolate, sugar, cocoa powder, powdered protein and sauces (ketchup, pizza, hot sauce, mustard, etc.) in addition to food dye. This list of components for 3D-printed meat may comprise cultivated animal cells or plant-based components like peas, chickpeas, beets, etc.[27]

[26, 27] Savor Eat. What is 3D Meat, How is it Made, and What are its Benefits? https://savoreat.com/what-is-3d-meat-how-is-it-made-and-what-are-its-benefits/#:~:text=3D%20meat%20or%203D%20printed,'%20into%20meat%2Dlike%20forms

CHAPTER 5
Regulatory framework for vegan foods

I. Policy and Vegan Logo by FSSAI

According to the FSSAI Regulations, Food Business Operators (FBO) are required to make sure that the proper precautions have been taken in accordance with Good Manufacturing Practices at all stages of production, processing, and distribution in order to avoid the unintended presence of any non-vegan substance. Before producing vegan products, a thorough cleaning or comparable steps in compliance with manufacturing practices must be taken if a production line is shared with non-vegan products or ingredients.

In order to maintain the integrity of vegan meals, food ingredients, or food products on a timely basis, the FBO must obediently adhere to any additional standards outlined by the food authority. Since the format provided by the authority is accepted, no vegan food products are imported unless accompanied by a certificate issued by the recognised authorities of the exporting nations.

As per the requirements of the Food Safety and Standards (Vegan Foods) Regulations, 2022, the Food Safety and Standards Authority of India, or FSSAI, recently released instructions for the submission of a proposal for the endorsement of the vegan emblem.[28] In September 2021, the FSSAI unveiled a new logo to make it simpler for customers to recognise and distinguish vegan meals from other types of food. It is a square box with a green "V" in the center, a little plant on top, and the words vegan written at the bottom. It is similar to the contemporary vegetarian and non-vegetarian food and product emblem, which is a dot in the center of a square.

[28] FSSAI. Guidelines for submission of applications for endorsement of vegan logo and formats https://www.fssai.gov.in/upload/advisories/2022/07/62df709761476Guidelines_Vegan_Food_26_07_2022.pdf

Comparable to the kosher mark for food, the FSSAI Vegan Logo is a registered trademark that is recognised worldwide. This makes vegan items and foods readily apparent to customers interested in them and makes it easier for vegans to shop without having to look through ingredient lists. It aids businesses in recognising a burgeoning vegan market and the popular lifestyle it represents.

No food may be produced, packaged, sold, offered for sale, marketed, distributed, or imported as vegan food unless it complies with the FSSAI regulations. The provisions of the packaging regulations must be followed by every packaging material used for vegan goods. According to the FSSAI regulations, the seller of vegan food must store and display such food in a way that is identifiable from any non-vegan food, whether they are selling it separately or as part of retail items. Additionally, after receiving clearance, every package of vegan food must bear a particular FSSAI mark.[29]

Items Qualifying for the FSSAI Vegan Logo

According to the FSSAI Regulations on Vegan Foods, a food or food ingredient is considered vegan if it does not contain any animal-derived ingredients, including additives, flavorings, enzymes, carriers, or processing aids. These ingredients must also not have been used at any point during the production or processing of the food. Additionally, vegan food products must not have undergone animal testing for any reason, including safety evaluation, unless specified by a regulatory authority.

II.Understanding of Labels & novel Ingredients

A deeper insight into reading the labels on vegan food

Consumers must first start by scanning the food package for a vegan label. Shopping has never been easier, and they may save time by not having to read through a long list of ingredients because many supermarkets and home food companies now choose to designate their products as being vegan. However, a word of caution - "vegan" doesn't always mean "dairy-free," "lactose-free," or "free from." All of the following substances—glycerin(e)/glycerol, lactic acid, mono or diglycerides, and stearic acid—may be derived from animal fat, but can also be vegan.[30] If they are plant-derived, the label ought to state as much.

Animal products included on food labeling

It's crucial to read the food label and look for substances made from animals. This is a list of animal products that can be added to food and that we should be aware of:

- Milk protein called casein
- Lactose (a milk sugar)
- Whey (a by-product of milk)
- Collagen (found in connective tissues, bones, and skin of animals like cows, chickens, pigs, and fish)[31]
- Elastin (a protein present in the ligaments of the bovine aorta and neck).
- Keratin (often made with the skin, bones, and connective tissues of animals like cows, chickens, pigs, and fish)
- Gelatine/gelatin (derived from cows or pigs and made by boiling skin, tendons, ligaments, and/or bones)
- Aspic (another commercially used gelatine substitute that is created from clarified animal, fish, or vegetable stocks and gelatin)
- Lard/tallow (animals fat often derived from the abdomen of animals like pigs)
- Shellac (obtained from the bodies of the female scale insect tachardia lacca)
- Honey and Propolis (used by bees in the construction of their hives)
- Royal Jelly (secretion of the throat gland of the honeybee)
- Vitamin D3 (from fish-liver oil or sheep's wool)
- Albumen/albumin (comes from egg)

[29] Corpbiz. Overview of FSSAI Vegan Logo. https://corpbiz.io/fssai-vegan-logo

[30, 31] Vegan Food and Living. A vegan's guide to reading food labels.https://www.veganfoodandliving.com/features/a-vegans-guide-to-reading-food-labels/

- Isinglass (a substance obtained from the dried swim bladders of fish and is used mainly for the clarification fining of wine and beer)
- Cod liver oil (used in lubricating creams and lotions, vitamins and supplements)
- Pepsin (from the stomachs of pigs, a clotting agent used in vitamins)

While that may seem like a long list, there are plenty of products that are made without any of the above ingredients. Awareness of these ingredients makes it easier for the consumer to spot non-vegan foods.

III. Support required from the government for plant-based food startups in India

The Indian government may make strategic investments and policy changes to ensure that it leads the world in plant-based food production. The main objective of such measures is to promote industry innovation and growth, allowing it to not only be a significant economic driver, employer, and provider of nutrition on a national level, but also to become a strong regional and international exporter as other countries increasingly look for foods that are both nutrient-dense and environmentally friendly.

The need to take a lead in the global discussion on changing the food system

India has the chance to take the lead globally in the expansion of the market for plant-based foods and, consequently, the overall future of the food system. Although China, North America, and Europe were early pioneers in the plant-based food industry, India's government is actively working to change national legislation, which could spur this industry's growth. The future must be based on a food system that provides healthy diets and effective, low-waste food production, according to a fervent demand from intergovernmental, academic, and civil society leaders around the world. The change is referred to as the "Great Food Transformation" in the much-publicized EAT-Lancet Commission report, which also emphasizes the value of diversity of plant-based foods as opposed to low levels of animal source foods.

Supporting the agri-food processing business, utilizing public procurement and subsidies, believing that consumers understand labels, and prioritizing effective examination and approval of innovative ingredients are the areas that should be focused in the Indian market for plant-based food startups.

Encouraging the agri-food processing sector

India is in a good position to be a global leader in the processing of plant-based foods because it has the third-largest food processing industry in the world. The agri-food processing business and the market for plant-based foods are mutually beneficial. The sector's performance depends heavily on the industry, and the expansion of plant-based foods will create a large number of excellent new job possibilities.[32]

The Government of India can make supportive investments to ensure that India's processing industry can benefit as the demand for protein isolates, concentrates, flours, and finished products increases on a national and international level. The government can also assist in identifying the infrastructural, processing capacity, transportation, and research gaps that need to be filled for India's agricultural production to change. The best way to increase infrastructure capacity is to give priority to processing techniques that are less expensive, allow for the use of a wider range of components, and have the least negative effects on the economy, the environment, and society.

As new facilities are constructed, expenditures in the repurposing of existing infrastructure may be part of capacity expansion. Transit is a key element of the sector, and increasing funding for rail cargo transport would guarantee that plant-based foods are accessible outside of major cities and across the nation. In order to ensure that people from the formal and informal sectors may engage in the plant-based foods sector, the government of India should also invest in skill development programmes. If there is a labor disruption, this will be especially crucial in the long run.

[32] Plant-based Foods Association: The dawn of a plant-based age- India to lead the way to world food security and nutrition. https://pbfia.org/category/insights/

Aim to promote the development of novel plant-based goods and services

Innovative services assist attract joint venture investment and boost competitiveness while the majority of competitors are frequently focused primarily on innovative manufacturing. Such projects can keep offering startup mentoring through its many programmes, such as an incubator for fresh startups and an accelerator mentorship that aids startup growth by enhancing an already-existing business.

A boost for entrepreneurs in the plant-based food industry

The next generation of entrepreneurs and those considering entering the industry must close gaps in product formats, packaging, nutrition, pricing, and accessibility if they are to reach the actual mass market. End-to-end value chains that are localized, capital investment, expanded manufacturing and processing facilities, and last but not least, ongoing government assistance, can make all of this possible.

The Indian government is aware of the potential of smart proteins and has previously provided public funding support to a number of businesspeople and research organizations. On the strength of a collaborative study proposal co-written by GFI India, the Department of Biotechnology (DBT) awarded the Centre for Cellular and Molecular Biology (CCMB) and the National Research Centre on Meat (NRC Meat) a Rs 4.6 crore grant in 2019.[33] Similar to this, the Department of Science & Technology (DST) awarded the Sanjay Gandhi Post-Graduate Institute of Medical Sciences (SGPGI), Lucknow, a grant of Rs 50 lakh to study cultivated meat in 2019. Additionally, in 2021, a Rs 66 lakh grant was given to researchers at the Central Institute of Fisheries Education (CIFE), Mumbai, to support their study of cultivated seafood.

Taking up the role of a torchbearer for plant-based foods will be hailed by a global chorus of agriculture professionals and could spark more prospects for foreign technical and financial support for India's developing plant-based startups.

IV. Policy recommendations to boost production of vegan products

Here are a few policy recommendations that could boost the production of vegan products:

1. Financial incentives: Governments could provide financial incentives to companies that produce and market vegan products, such as tax breaks, grants, and loans.
2. Research and Development: Governments could fund research and development programs aimed at improving the taste, texture, and nutritional profile of vegan products.
3. Education and Awareness: Governments could launch educational campaigns to increase awareness of the benefits of a vegan diet and the availability of vegan products. This could include public service announcements, school programs, and partnerships with food companies.
4. Regulatory Support: Governments could implement policies that make it easier for vegan products to be marketed and sold. For example, they could ensure that vegan products are accurately labeled and that there are no barriers to their sale.
5. Infrastructure Investment: Governments could invest in the infrastructure needed to support the production and distribution of vegan products, such as cold storage facilities, transportation networks, and processing plants.

These are a few examples of how government policies could support the growth of the vegan food industry.

[33] Nuf Foods Spectrum. Smart protein sector is poised to create 4 lakh jobs in India by 2030 https://nuffoodsspectrum.in/2023/01/01/smart-protein-sector-is-poised-to-create-4-lakh-jobs-in-india-by-2030.html

CHAPTER 6

The big global picture for India's plant-based food sector

I. India's strengths that work in the favor of our plant-based sector

1. India's agrarian culture and crop biodiversity

India is a top producer of protein-rich crops and is well-positioned to supply to the domestic and global plant-based food industries. It is home to 45,000 plant species. For each of the following essential plant proteins: chickpeas, lentils, millet, peas, rice, soybeans, and wheat, the nation is among the top five producers in the world. India, which accounts for 24% of worldwide production when looking at pulses as a whole, is by far the greatest producer.

India also produces 41% of the world's millet.[34] Millets are tough plants that require much less water to grow than rice. They can be rain-fed even in arid regions with nutrient-poor soils. They are high in fiber, extremely nutritive, and simple to digest. Sorghum, pearl millet, maize, barley, finger millet, and small millets including barnyard millet, foxtail millet, kodo millet, and proso millet are just a few of the diverse millets grown in India. 35 India can take advantage of the distinctive features of its local crops.

2. India's capabilities of biopharmaceutical production and biotech industry

The biopharmaceutical and biotech industries in India have a strong research and development base that can be leveraged to develop new plant-based ingredients and products. The industries have the experience and expertise to develop and scale up processing and manufacturing technologies for plant-based products. They also have a strong focus on quality control, which is critical for ensuring the safety and efficacy of plant-based products.

[34, 35] Plant-based Foods Association: The dawn of a plant-based age- India to lead the way to world food security and nutrition. https://pbfia.org/category/insights/

The alternatives industry may benefit from India's current strengths in biopharmaceutical production and fermentation. Because of its affordability, size, and adaptability to a variety of feedstocks, including waste and sidestreams, fermentation may be especially appealing for low and middle-income situations. By enhancing both supply chain resilience and environmental sustainability, innovation in sidestream valorisation will play a significant part in de-risking the alternative protein industry at scale. One such example is using microbial fermentation to transform agricultural waste into nutrient-rich protein at the farm level.

3. Young population a valuable resource for the plant-based industry

India's young population is more health-conscious and environmentally aware, and they are increasingly interested in plant-based food options. This growing consumer demand is driving the growth of the plant-based industry.

They are also entrepreneurial and tech savvy, which is driving them to create new businesses and startups focused on plant-based food production and distribution. This entrepreneurial energy is helping to drive innovation and growth in the industry. The young labor force is also critical for scaling up production and meeting the growing demand for plant-based foods.

4. Favorable climatic conditions key to success of India's plant-based food industry

India's favorable climatic conditions, including abundant sunshine and rainfall, provide an ideal environment for growing a wide range of crops, including those used for plant-based food production, year-round. It reduces the need for artificial heating and cooling systems, minimizing the cost of production and increasing the efficiency of the plant-based food industry.

The favorable climatic conditions allow for high-quality crops with optimal nutritional content, contributing to the safety and quality of the final plant-based food products. It also reduces the need for pesticides, improving the sustainability of the plant-based food industry and reducing its impact on the environment.

5. India's economic advantage over other markets

India has a large and growing workforce, low wages, and abundant raw materials, which together help to keep the cost of plant-based food production low compared to other countries. The Indian government's financial and policy support for the development of the plant-based food industry, including tax incentives and subsidies for new businesses, research, and development, also helps the industry.

6. Research capabilities driving innovation in this sector

India has a large pool of highly skilled scientists, researchers, and engineers, who are being used to develop new and innovative plant-based food products that meet the evolving needs of consumers. Research is also being conducted to improve the quality, safety, and nutritional content of plant-based food products, contributing to their competitiveness in the global market.

The research community in India is working closely with SMEs in the plant-based food industry to provide them with the technical and scientific support they need to grow and succeed. India's research community is also collaborating with international partners to share knowledge, expertise, and technology, further contributing to the development of the plant-based food industry.

II. Current limitations of the plant-based industry

India is one of South Asia's most developed commercial economies. The demand for plant-based meat alone in this region is expected to increase 200% during the following five years. 36 Although there are many opportunities for the plant-based business in India, there are several common issues that need to be resolved if this industry is to grow.

[36] Dupont Nutrition & Biosciences. Plant-based Meat Alternatives Set to Thrive in the Next Five Years.https://www.dupontnutritionandbiosciences.com/news/nutrition-biosciences/2020/plant-based-meat-alternatives-set-to-thrive-in-the-next-five-years.html

"Historically, most APAC funding has been going to countries like Singapore, China, Australia and Korea. But dozens of talented founders are building promising startups in India, Indonesia and other large Southeast Asian markets. These startups, along with bodies like GFI, are helping the mass population in these markets understand the benefits of plant-based products for animals, health, and the planet. As consumer education and interest levels grow, startups creating local flavors and affordable options will succeed in attracting investment and scaling," opines Siddhart Kothari, VC, Ahimsa.

The lack of cold chain logistics

The lack of cold chain logistics in the nation is one of the most significant obstacles impeding the expansion of this sector. Indian retailers in general are still warming up to varied products, which need temperature controlled environments. Alternative dairy products, especially plant-based ice creams, do not have access to low cost temperature-controlled transportation. This often hinders companies from expanding across states and in smaller retail stores.

"Most of the products are temperature-controlled in this segment. Infrastructure in terms of logistics really needs to be built in the country right now. And this is what hampers the growth rate of these companies as well because scalability becomes an issue," says Shivnayan Aggarwal, Lead at The Plant Factor, where they aim to bring together businesses, investors, and industry experts, to better understand what these barriers are and how entrepreneurs are overcoming them.[37]

Lack of access to capital

Another issue is a lack of access to capital. The plant-based industry is currently an underfunded sector in India, and insufficient capital is a major obstacle in reaching price parity by most brands. Since Indian consumers are price-sensitive, this is a major obstacle for growth.

Being data dark

Data darkness is limiting the ability of companies and organizations in the industry to make informed decisions and optimize their operations. Having access to more research and statistics can help the industry better understand consumer preferences, market trends, and opportunities for growth. It can also help companies identify areas for improvement and make more informed decisions about product development, marketing, and distribution.

However, the use of data and analytics is growing in the plant-based industry in India, and many companies are investing in the development of their data and technology capabilities. This is expected to improve the competitiveness of the industry and support its growth and development in the future.

Higher regulatory hassles

Apart from that, the industry faces higher regulatory hassles than other food tech industries. The plant-based market has more entry barriers, and brands often struggle on how to position themselves in a market which is still warming up to plant-based products. For instance, dairy milk is an easily understood concept for the customer due to its prevalence in the market. Plant-based milks, on the other hand, have restrictions on how they are marketed, labeled, and categorized, which tends to affect sales.

In India, the plant-based food industry has seen the emergence of more than 200 companies in recent years. According to a survey by PBFIA and The Insight Partner, the market is currently worth $0.27 billion but will reach $5 billion in the following ten years. Indian customers are prepared to spend more on diets, natural foods, health supplements, and exercise after the pandemic.

Challenges in terms of accessibility

The key concern that hampers accessibility of plant-based products is that many issues that the plant-based industry faces are common to other sectors as well. For example, the issue of

[37] Vegan First. Lesser Known Struggles And Opportunities Of The Indian Plant-Based Industry https://www.veganfirst.com/article/lesser-known-struggles-and-opportunities-of-the-indian-plant-based-industry

temperature-controlled transportation is present in the ice-cream industry at large, as well as the pharmaceutical sector. The higher price point of plant-based alternatives is another hindrance that negatively impacts accessibility of these products for consumers. For instance, plant-based meals are subject to a higher rate (on average 18%) than their animal-based counterparts, which have an average GST rate of 5%.[38]

The sector will attain parity with the support of more accessible production, local ingredient procurement, and democratized technologies. Moreover, the reality is that dairy is a highly subsidized sector in India. In Feb 2020, an allocation of Rs 4460 crores was made towards dairy farming, which was further boosted with another Rs 15,000 crores in June 2020 towards animal husbandry. These issues can also be solved through collaboration between incumbents of different industries.

While some companies focus on manufacturing, some take up logistics and solving market issues, connecting companies with investors, technologies and experts. The corporate sector and the distribution and logistics sector can come together to tackle different obstacles. The plant-based industry will be one of the beneficiaries from this collaboration.

Fighting the Price Imparity

Prices for Traditional Products (USD per 100 gms)	Product Type	Prices for Plant-based products (USD per 100 gms)
0.63-0.88	Sausages	1.37-1.60
0.88-1.33	Burger Patties	1.4-1.6
0.88-1.33	Ground Crumbles	1.1-1.4
1.00-1.5	Slices	1.7-2.0
0.49-0.82	Nuggets & Popcorn	1.4-1.7
0.07-0.1	Milk	0.14–0.31
0.16-0.29	Ice Cream	1-1.5
0.28-0.52	Yogurt	0.9-1.1
0.66-1.5	Cheese	1.7-2.6

Source: PBFIA

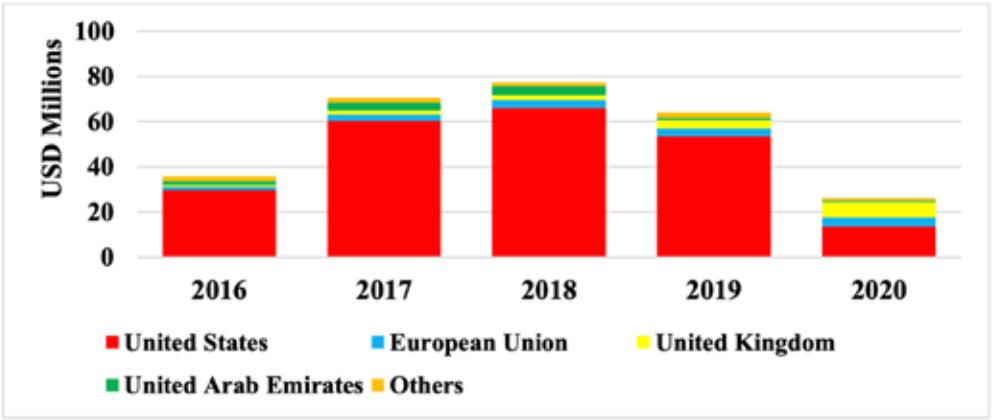
38 Business World. Next On Your Platter Is – Plant-Based Foods. https://www.businessworld.in/article/Next-On-Your-Platter-Is-Plant-Based-Foods/29-09-2022-448586/

III. Emerging opportunities for plant-based foods in India

In the Indian market, there are presently more than 56 brands, 300 SKUs, and 30+ formats operating across all 3 technology categories (plant-based, fermentation-derived, and grown).[39] More than 56 companies have launched and tested their plant-based foods in India during the past five years, marking an expansion that was unheard of. Entrepreneurs are increasingly experimenting with innovative protein sources, such as indigenous crops like millets and pulses, as well as microalgae and seaweed, by utilizing India's agricultural diversification and its extensive coastline. Additionally, at least ten businesses are currently operating in India and developing deep-tech innovations, including cultured meat and precision fermentation.

Not only is India expected to be a significant market for smart protein, but it also has the potential to be a significant exporter of goods and ingredients made from plants. The export potential for plant-based meat in 2030 ranges from Rs 2,194 crore to Rs 6,824 crore, according to a report by GFI India and Deloitte India. The number range for plant-based dairy is similar, falling between Rs 459 crore and Rs 1,889 crore. The export potential for plant-based eggs in 2030 is between Rs 266 crore to Rs 631 crore.[40]

Graph 1. Indian Imports of Protein Concentrates and Textured Protein Substances



*Source: USFDA

India has a growing market for plant-based food products, and there are several flourishing opportunities in this industry:

1. **Increasing health awareness:** The rise of plant-based diets in India is driven by growing health concerns, as consumers look for more sustainable and nutritious food options.
2. **Growing vegetarian population:** India has a large and growing vegetarian population, which presents a significant opportunity for the plant-based food industry.
3. **Government support:** The Indian government has shown increasing support for the development of the plant-based food industry, recognizing the potential for growth and job creation.
4. **Export potential:** India has a large and growing export market for plant-based products, particularly in countries with large vegetarian populations.

[39, 40] Nuf Foods Spectrum. Smart protein sector is poised to create 4 lakh jobs in India by 2030 https://nuffoodsspectrum.in/2023/01/01/smart-protein-sector-is-poised-to-create-4-lakh-jobs-in-india-by-2030.html

5. **Growing demand from food service sector:** The growth of the plant-based food industry is also driven by the increasing demand for vegetarian and vegan options in restaurants and other food service outlets.
6. **Investment opportunities:** With the increasing demand for plant-based products, there are growing investment opportunities in this industry, from production and processing to distribution and retail.

Overall, the plant-based food industry in India presents a range of opportunities for entrepreneurs, investors, and consumers alike, as the demand for healthier and more sustainable food options continues to rise.

Plant-based food production at the national level can benefit from and encourage an expanding global market for plant protein crops, processed protein ingredients, and manufactured goods. The demand for plant-based meals is surging in North America, Europe, and Asia, which will create chances to bridge supply gaps and benefit from technology that is rapidly updating in the near future. India will benefit greatly if it can establish a global market for its domestic agricultural products.

IV. Key growth drivers for plant-based alternatives in India

Alternative proteins industry needs significant funding from a variety of participants, ranging from venture capitalists to development finance institutions. They also need favorable industrial policy to promote the expansion of the industry, in order to scale smart protein solutions. The main barriers for the industry in India include a lack of well-established production processes, long-lasting value chains, and a distinct path to market.

When it comes to manufacturing capacity, hundreds of startups and established businesses already have off-take capabilities; but there are still no facilities for small-scale experimentation, pilot-scale production, or industrial-scale production. Therefore, entrepreneurs and businesses are now unable to satisfy the market's desire for highly inventive and more sustainably manufactured smart protein goods.

To support the application of specialized technologies that help construct an end-to-end vertical value chain proof of concept and a promise of self-sustainability and scaling, we also need patient and wise capital, particularly on the deep-tech side. Finally, a supportive regulatory framework is and will remain essential for fostering investor trust in the industry and facilitating capital inflow.

India, a major agrarian economy and one of the largest farm producers in the world, provides tremendous opportunities for investors and entrepreneurs in the country and abroad for the following reasons:

1. We are the 5th largest producer of soya in the world.
2. Cost of production in India is relatively economical, compared to other countries.
3. We have the geographical advantage as we are in close proximity to the Middle East, South East Asia and other demand-heavy regions.
4. India has the government's support through its 'Make in India, for the world' initiative.
5. We have world class agriculture and food technology research institutes

V. Current funding scenario for plant-based startups in India

Recently, India got its first venture focused fund Ahimsa VC focused on reducing the harm to the planet, animals and human health.[41] While the worldwide alternative protein market attracted $5 billion in investment capital in 2021, with only $10.35 million going to India, 2022 saw a challenging economic and market climate overall. A minor decline from the rapid rate of investment growth saw in 2021, alternative protein companies collected a total of $2.2 billion in investment capital. However, the industry entered a crucial period of market activity, with numerous businesses announcing the launching of new products and brand alliances.[42]

[41] Ahimsa VC. Investing in building a sustainable, humane and healthy world https://www.ahimsa.vc

[42,43] Nuf Foods Spectrum. Smart protein sector is poised to create 4 lakh jobs in India by 2030 https://nuffoodsspectrum.in/2023/01/01/smart-protein-sector-is-poised-to-create-4-lakh-jobs-in-india-by-2030.html

Infrastructure investments, advantageous financial and credit schemes, foreign direct investment policy, and centralized procurement schemes have propelled the sector's growth. Federal examples of such support are reflected in Pradhan Mantri Kisan Sampada Yojana (PMKSY), the National Bank for Agriculture and Rural Development (NABARD), the Production Linked Incentive Scheme for Food Processing Industry (PLISFPI), and specific support for smaller enterprises such as 'Make in India'. With an outlay of $1.5 billion (Rs.10,900 crore), PLISFPI supports the creation of global food manufacturing champions commensurating with India's natural resource endowment and will help Indian brands achieve success in international markets.

At NABARD, the government has set up a special Food Processing Fund of approximately $265 million to extend affordable credit to designated food parks and the individual food processing units in the designated food parks. In 2020, Finance Minister Smt. Nirmala Sitharaman announced a scheme worth $1.3 billion (Rs. 10,000 crore) to help micro food enterprises.

It seems like a level playing field among the several alternative protein sub-segments, but only time will determine which ones will win over the general public. India's alternative protein industry needs crucial backing from regulators and policymakers if it is to compete globally with economies like China, Canada, or Israel. [43]

An interest in cell-based foods is also being encouraged. The Chief Minister's Office of the Government of Maharashtra approved a partnership between GFI India and the Institute of Chemical Technology (ICT), Mumbai, to establish a Center of Excellence in Cellular Agriculture, which will also serve as an incubator for entrepreneurs. Through their current Biotechnology Ignition Grant (BIG) programme, where grantees are granted Rs 50 lakh apiece, organizations like the Biotechnology Industry Research Assistance Council (BIRAC) and the DBT have been sponsoring a number of smart protein firms. [44]

[42,43] Nuf Foods Spectrum. Smart protein sector is poised to create 4 lakh jobs in India by 2030 https://nuffoodsspectrum.in/2023/01/01/smart-protein-sector-is-poised-to-create-4-lakh-jobs-in-india-by-2030.html

[44] Birac. Biotechnology Ignition Grant Scheme. https://birac.nic.in/big.php

CHAPTER 7

Market innovations and new category of products

India's sector for plant-based foods is expanding rapidly as a result of improved access and availability of products. The country's vegan milk and plant-based meat markets are worth $20 million and $30–40 million respectively.[45] Beyond big cities, accessibility to plant-based foods is expanding regionally. Plant-based foods are becoming more popular and readily available in Andhra Pradesh, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal. They are already comparatively well-established in Delhi, Telangana, Maharashtra, Haryana, and Karnataka.

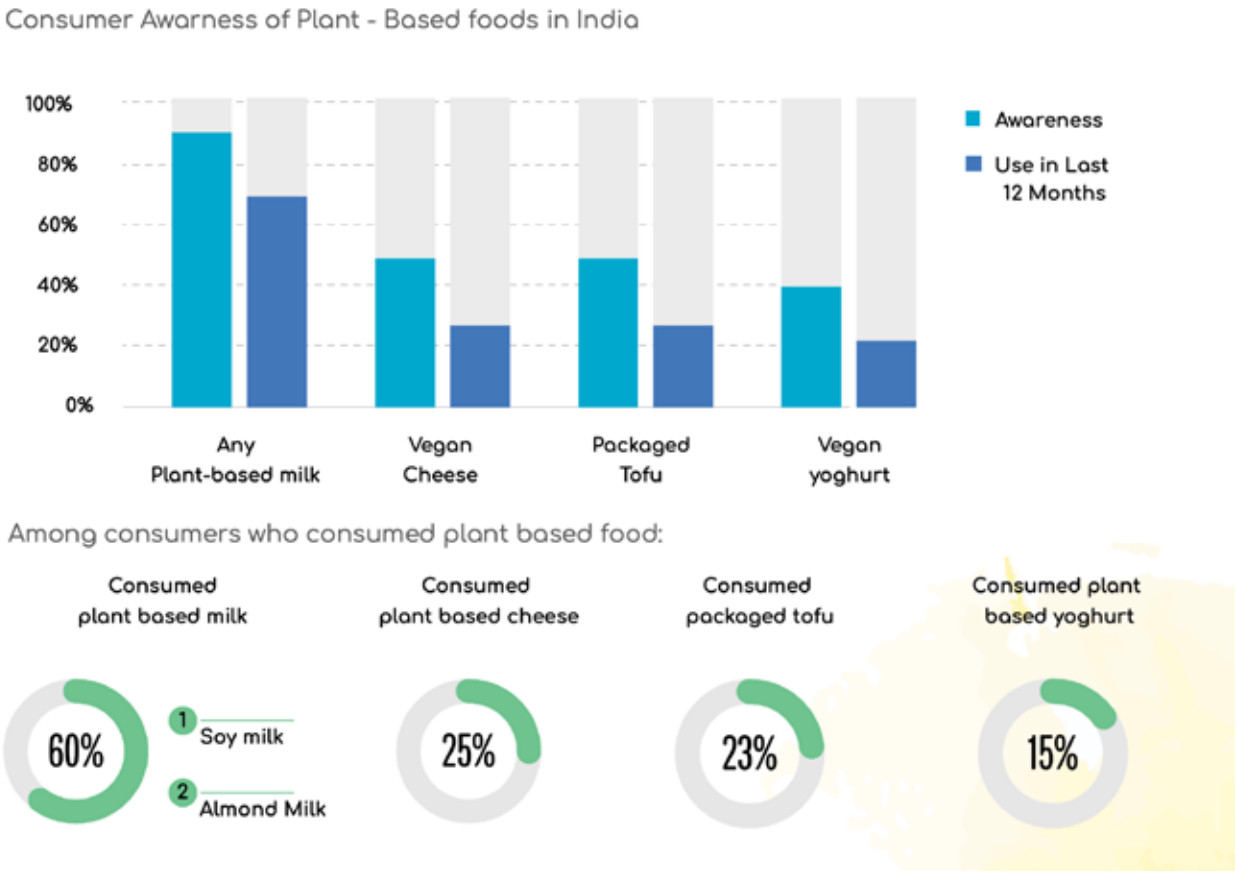
Plant-based foods can be of diverse nature. Below are few examples:

1. Meat alternatives: Plant-based burgers, sausages, hot dogs, and other meat alternatives made from soy, peas, mushrooms, and other ingredients.
2. Dairy alternatives: Plant-based milk, cheese, yogurt, and ice cream made from almonds, oats, soy, and other ingredients.
3. Whole food plant-based diets: Diets based on whole foods like fruits, vegetables, legumes, grains, and nuts, without any animal products.
4. Snack foods: Plant-based snack foods such as chips, crackers, and cookies made from ingredients like potatoes, corn, and legumes.
5. Plant-based drinks: Plant-based drinks such as smoothies, juices, cold coffee, flavoured drinks, and nut milks made from ingredients like fruits, vegetables, and nuts.
6. Plant-based desserts: Plant-based desserts such as ice cream, cakes, and cookies made from ingredients like soy, almond, and coconut.
7. Plant-based condiments: Plant-based condiments such as dressings, sauces, and spreads made from ingredients like nuts, seeds, and avocado.

These different types of plant-based foods offer a wide range of options for people following a vegetarian or vegan diet, or for those who are looking for more sustainable, ethical, or health-conscious food options.

For the foreseeable future, the market will continue to change swiftly. There are both international and Indian businesses operating and both business-to-business and business-to-consumer sales of plant-based goods have recently increased. Examples of firms that produce plant-based milk include Borges (Spain), Life Health Food (New Zealand), Hershey's (United States), Raw Pressery, Drums Food International, NatureVit, and Urban Platter in India.

Eateries and coffee shops are increasingly stocking plant-based goods. Restaurant brands like McDonald's, Subway, and KFC already offer a greater selection of plant-based items than what they do in the United States. While Starbucks, the biggest coffee chain in the world with over 250 stores in India, provides its patrons with soy, almond, and oat milks, Café Coffee Day, India's largest coffee chain with over 900 outlets, offers a variety of plant-based beverages.[46]



*Source: PBFIA

[45, 46] Plant-based Foods Association: The dawn of a plant-based age- India to lead the way to world food security and nutrition. https://pbfia.org/category/insights/

I. Plant-Based Meat

India has seen a growing interest in plant-based meat products in recent years. Some of the latest innovations in India's plant-based meat industry include introduction of new plant-based meat products, such as sausages, burgers, and kebabs, made from ingredients like soy, pea protein, and mushrooms. Traditional Indian spices are also being used to create unique plant-based meat products that cater to local tastes and preferences, such as the Mutton Biryani by Imagine Meats. Meat enthusiasts are avoiding meat because plant-based meat provides a meat-like feel. Both in restaurants and in retail, plant-based meat is growing in popularity. [47]

India's plant-based meat industry is introducing a variety of new types of plant-based meats, including:

1. Soy-based meat alternatives: This includes products like tofu, tempeh, kebabs, chaaps and textured vegetable protein, made from soybeans.
2. Pea protein-based products: This includes burgers, sausages, and other meat alternatives made from pea protein.
3. Mushroom-based products: This includes burgers and sausages made from mushrooms, which are a popular alternative for their meat-like texture and taste.
4. Legume-based products: This includes meat alternatives made from legumes like lentils, chickpeas, and black beans.
5. Jackfruit-based products: Jackfruit is a popular alternative meat source in India and is being used in products like burgers, biryanis and tacos.

II. Plant-Based Seafood

Although alternatives to beef and chicken are expected to have the largest sales, there is still a sizable market for plant-based seafood, with a projected CAGR of 31.3% from 2022 to 2032.[48] In December 2021, CULT Food Science Corp. completed a strategic investment in Singapore-based startup Umami Meats, which produces cultured seafood.[49] The collaboration intends to lower production costs for farmed seafood, making it easier for businesses to sell it. Japanese Eel, Yellowfin Tuna, and Red Snapper cultivation will be Umami's first areas of attention. The business also plans to work on projects involving halibut, grouper, and mahi-mahi in the future.

In India, SeaSpire creates and manufactures the first whole-cut fish filet made from plants. Shantanu Dhangar and Varun Gadodia founded Seaspire, which creates plant-based seafood substitutes using cutting-edge technology, digital tools, and nutrient-rich plant-based ingredients. The company is developing an operational base in India to serve the APAC region and claims to be the first of its type to make bioprinted whole-cut whitefish goods in that area.[50] According to SeaSpire, it focuses on technology that can replace inefficiencies in the production of seafood and is looking at the possibility of repurposing horticultural side streams to create feedstock for alternative seafood wholecuts.

The company is confident that in the future years, the Indian subcontinent will see a similar increase in demand for the alternative seafood sector as plant-based meat consumption there continues to develop. In New Zealand, they have their R&D headquarters. Beginning with plant-based whole-cut snapper filets, the company will pilot-launch its first batch of plant-based seafood products in India and New Zealand over the coming months. It

[47] USFDA. India Emerges as a Burgeoning Market for Plant-based Meat Substitutes <https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=India%20Emerges%20as%20a%20Burgeoning%20Market%20for%20Plant-based%20Meat%20Substitutes_Mumbai_India_05-03-2021.pdf>

[48] PBFIA. The plant-based Revolution. https://pbfia.org/wp-content/uploads/2022/07/The-Plant-Based-Revolution.pdf

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will also concentrate on developing an alternative seafood brand in the developing APAC markets, such as Singapore and Australia.

According to the State of the Industry Report by the Good Foods Institute (GFI), global investments in alternative seafood increased by over two times in 2021 compared to 2020. The APAC area, where the majority of the world's fish consumption occurs, saw by far the biggest concentration of investment and research effort. Nearly 30% of all investments in plant-based products were made in the alternative seafood sector in 2021.

III. Plant-based Poultry

It is widely known that chickens can carry Salmonella bacteria, which can be transmitted to eggs even before the shells have formed. Salmonella causes an estimated 1 million cases of foodborne illness in the U.S. annually. Moreover, antibiotic treatment of egg laying hens has been linked with the 5 development of antibiotic-resistant strains of Salmonella.[51] Liquid egg products are typically pasteurized to kill pathogens before they are sold, but they pose a risk nonetheless due to their high potential for bacterial contamination and because they exhibit a moisture level and nutrient profile that support bacterial growth. Moreover, for each ton of chicken eggs, layer hens produce multiple tons of manure. Ammonia emissions from this waste is a health and safety concern on farms, and water pollution from waste used as fertilizer is a major contributor to biodiversity loss in streams and ocean dead zones across the United States.

Consumers may seek egg-free options in particular to avoid cholesterol and egg allergies and also to support a sustainable and animal-friendly product, brand, or company. However, while plant-based poultry products exhibit an excellent solution in terms of food safety, they do lag behind in terms of versatility. For instance, consumers will often use animal proteins such as chicken in dozens of different ways, while plant-based products are often formulated for highly-specific applications, such as nuggets.[52] Plant-based products that are convenient to purchase, transport, store, prepare, cook, and seamlessly integrate into common recipes and cuisines are needed.

IV. Plant-based Dairy Products

The plant-based milk category is the most developed plant-based category, worth $2.6 billion. Plant-based milk alone accounts for 36 percent of the total plant-based food market in the world.[53] Plant-based milk can often be produced using equipment and a process similar to fruit juice production, creating an opportunity for plant-based companies to repurpose old or underperforming juice plants.[54]

Plant-based milk users in India claim that they will continue using both animal-derived and plant-based milk in the future. In fact, 90% of them (plant-based milk users) have also consumed animal-derived dairy milk in the past 12 months.[55] This clearly shows the potential for plant-based dairy to grow alongside animal-derived dairy consumption and not instead of it.

Consumers rate plant-based milks high on unique propositions like sustainability and for lactose intolerance while they rate animal-derived milk better on taste, price and versatility - proving both categories to be distinctly desirable.

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CHAPTER 8

Predictions and Plant-based trends to watch in 2023

In recent years, the plant-based food business in the US has experienced unprecedented growth, and in 2021, it is expected to generate retail sales of over $7.4 billion USD.

Below are some plant-based food industry trends to look out for in 2023

1. Clean label products will be a priority

For a majority of plant based food innovators, the next step would not just be to create an alternative with the new technology and ingredients but to match nutritional profiles or ensure the ingredients are healthier, whole and minimally processed. As the novelty of plant-based alternatives wears off and people consider whether they are healthier options — especially in this inflationary period, given that these alternatives can sometimes cost more than conventional products. The young Gen Z consumer is a conscious and smart consumer that reads the ingredient deck and wants to understand what is going into their body. They want food products that are both delicious and healthy.

2. Plant-based seafood will be making waves in the year ahead.

In 2021, plant-based seafood was just 1% of all plant-based meat dollar sales, but demand is growing, highlighting the whitespace opportunity for these products. The number of plant-based seafood products sold in U.S. retail increased 25% in 2021.[56]

By 2031, the plant-based seafood market is expected to be worth $1.3 billion.[57]

[56] The Beet. These 7 food trends are going to be huge in 2023.
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This expansion can be attributed to the influx of new companies focusing on perfect seafood alternatives, such as Good Catch, which was recently acquired by Wicked Kitchen to expand its product distribution

3. Advancements and perfection of plant based Meats

Specialty products and diverse offerings will be introduced as more companies perfect their offerings. This will benefit the still-growing plant-based meat industry, which will benefit from a clear, compelling message and products that are priced competitively while tasting just as good as traditional meat. More culinary diversity in alternatives will take place. Alternatives will be introduced for traditional recipes of butter milk, keemas, butter chicken, tikkas, and specialty foods such as whole cut meats. According to Datassential's 2023 Food Trends, 40% of consumers plan to purchase plant-based meat products in 2023.

"Any new industry is dynamic in the initial years. Innovations that solve real problems are often permanent and can't be considered as a passing trend. plant-based meat is an innovation which is here to stay as more and more people realize the need for it. Will all plant-based meat companies make the cut? Perhaps not. As the initial hype around the innovation dies down, it will be a play of survival of the fittest. Companies with great products, quality taste, better texture, transparent ingredients, clear go to market strategy, competitive pricing will thrive. Mediocre products might not," says Palak Mehta, founder of Vegan First.

4. More HoreCa partnerships for plant based foods

As the category expands in India, more plant-based meat and milk companies will introduce their products only through B2B channels. This will be especially true for plant-based meats. In the past, this approach has proven to be effective in creating a vegan-curious audience for this new category of foods. This allows companies to reach a wider audience and generate interest among consumers who may be curious about these products but may not have tried them yet. By targeting food service providers, companies can also benefit from the expertise and resources of these businesses, who can help promote and market the products to their customers. Additionally, the B2B format can provide a steady revenue stream and help build brand recognition, which can be crucial for the success of a new product or category.

5. More legacy brands will introduce plant-based choices

Many food companies are introducing new plant-based products that cater to these needs, offering a range of flavors and textures, and working to create plant-based products that are indulgent and satisfying. Additionally, the prediction that 42% of consumers think most people will be eating plant-based foods instead of meat in the next decade highlights the growing demand for these products and the potential for growth in this industry. 58 Food companies that are able to innovate and offer a variety of high-quality, tasty, and satisfying plant-based options are likely to be well positioned for success in this growing market.

Plant and non-plant options launching in tandem. "In the past, if we were launching a dairy and non-dairy variant of an ice cream, the team would create a separate campaign for each. Now it feels natural to launch them together," says Fatma. "The launch of Ben & Jerry's campaign for its new sundaes in Europe and the products launched in partnership with Tony Chocolonely used this approach. Increasingly, consumers expect to be to be offered dairy and non-dairy options as a given, so their focus is on what they have always loved and looked for in our ice creams – flavours, product experience and indulgence."

6. Projected Growth of Domestic and Export Market

India's market for plant-based foods is expected to grow dramatically over the next ten years as a result of rising consumer interest in and access to these foods, product innovation, and hundreds of millions of dollars in domestic and foreign private sector investment.

[58] Veg News. 42% of consumers think plant based food will replace meat by 2023. https://vegnews.com/2022/11/plant-based-food-replace-meat-2032

Some domestic brands, like GoodDot and Greenest, are already well-known abroad. The latter has won praise for its kebabs, samosas, and keema there. Others, like the creators of plant-based eggs Evo Foods, are well-known on a global scale as a result of their ingenuity. For the time being, India's primary concerns may be domestic production and food security, but the country's entry into new markets could bring in some much-needed funding for the industry.

An analysis conducted by Deloitte and the Good Food Institute India forecasts the domestic and export markets for plant-based foods in India through 2030. The research provides a variety of scenarios based on various customer uptake assumptions. The research for the domestic market takes into account the categories of plant-based dairy, plant-based meat, and plant-based eggs. The largest industry, with an estimated value of $623 million to $1.4 billion (Rs 4827 to 10625 crore), will be plant-based dairy.[59]

The market for plant-based meat is anticipated to be worth between $233 million and $759 million (1803 crore to 5884 crore in Indian rupees). The market for plant-based eggs will be the lowest, with estimates ranging from $68 million to $183 million (about 527 crore to 1416 crore in Indian rupees). Although the plant-based meat market is anticipated to be higher than that of milk, the export market for India's plant-based sector is also anticipated to be considerable by 2030.

7. A surge in cellular agriculture will grow more curiosity about alternatives

According to the co-founder of Aleph Farms, cellular agriculture will experience a spike in M&A activity in 2023, although partnerships will still be the most popular type of business arrangement.57 By the end of the decade, the market will be worth $25 billion and will be priced similarly to meat from farms. Early-stage and mature businesses will want to grow quickly, and mergers and acquisitions (M&A) are a quick way to do it when mega funding rounds ($100M+) are less realistic.[60, 61]

8. Rise of the budget conscious flexitarian

Food shoppers are more concerned with their budgets than ever before. They are looking for value, which means brands must be creative with their pricing. With the increase in demand for plant-based products, there has been a rise in competition, leading to more affordable options. Brands will find new ways to reduce production costs to make their products more accessible to a wider range of consumers.

9. A surge in demand for low-impact and climate friendly foods and packing

There is no denying the effects of climate change. Consumer demand for brands and products that are produced responsibly or that considerably reduce their carbon footprints by doing away with or lowering the need for packaging is predicted to thrive in 2023. Brands will need to prioritize sustainability and reduce their carbon footprint to appeal to the conscious consumer of today.

Overall. We can predict that global growth of the plant-based industry is going to be both accelerated and sustained because of the great innovation, soaring consumer demand, and expanding multi-stakeholder support. Consumer interest in plant-based diets will continue to increase due to several reasons such as health, environmental, and ethical reasons. As a result, more and more food companies will continue to invest in the development of plant-based alternatives to meat, dairy, and other animal-based products.

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[61] Vegconomist. Industry Leaders Reveal Their 2023 Food Trend Predictions, Part 1. https://vegconomist-com.webpkgcache.com/doc/-/s/vegconomist.com/market-and-trends/industry-leaders-predictions-2023-1/

Additionally, advancements in food technology are making it possible to create plant-based products that closely resemble the taste, texture, and nutritional profile of animal-based foods. This is likely to drive further growth in the industry, as it will make plant-based products more accessible and appealing to a wider range of consumers.

In India, plant-based food items have a promising future, and the market will grow quickly.

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NOTES

About ASSOCHAM

The Knowledge Architect of Corporate India

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations, and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities – Sustainability, Empowerment, Entrepreneurship and Digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators, and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences. In line with its focus on being future-ready, the Chamber is building a strong network of knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology driven 'Knowledge-Based Economy. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills, sustainability, to name a few.

The Associated Chambers of Commerce and Industry of India

4th Floor, YMCA Cultural Centre and Library Building, 01, Jai Singh Road, New Delhi-110001
Tel: 011-46550500 (Hunting Line) | Fax: 011-23017008, 23017009
Web: www.assocham.org