Innovation in Plant-based Protein in India

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The Good Food Institute India

Accelerating the shift to a sustainable, healthy, and just food system through three key areas of work:

Science & Technology

Analyzing, advancing, and funding the foundational science of alternative proteins

Corporate Engagement

Consulting with the world's biggest food companies to help them capitalize on opportunities in the alternative protein market

Policy

Advocating for fair regulation of plant-based and cultivated meat and lobbying for government investment in alternative protein R&D

We work as a force multiplier, bringing the expertise of our departments to the rest of the world.

United States
Brazil
India
Europe
Asia Pacific
Israel

100+ staff in 6 regions

Feeding 10 billion: Implications for the Global South

Climate change and environmental degradation

Industrialized animal agriculture is in the top **2-3 most significant contributors** to the world's most pressing environmental issues such as water use, air pollution, and loss of biodiversity.

Developing countries are disproportionately affected by the impacts of climate change; India is currently the fifth most vulnerable country to climate change.

Source: United Nations, Livestock's Long Shadow (report)

Global food insecurity and nutritional deficits

Animal-based protein is often unaffordable and difficult to access, resulting in severe repercussions on nutrition and food security.

It takes **nine calories** of food fed to a chicken to produce **one calorie** of meat.

Sources: World Resources Institute (calorie formula); UN FAO (land use)

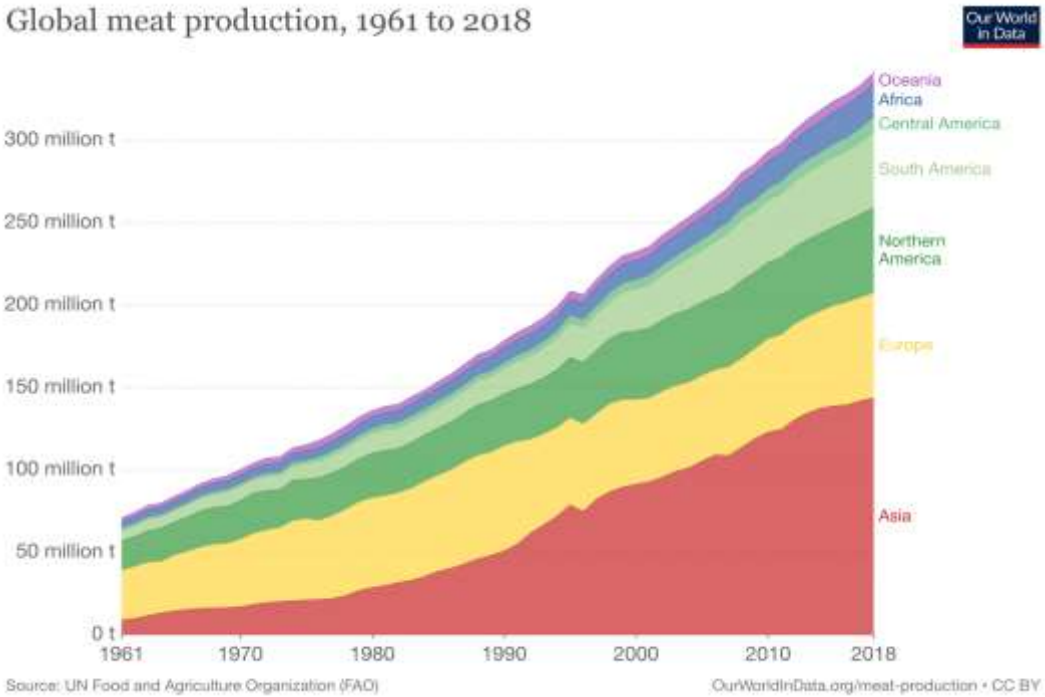
Threats to public health and food safety

Foodborne illnesses from animal-derived food products disproportionately affects individual wellbeing and community health in low-to-middle-income communities.

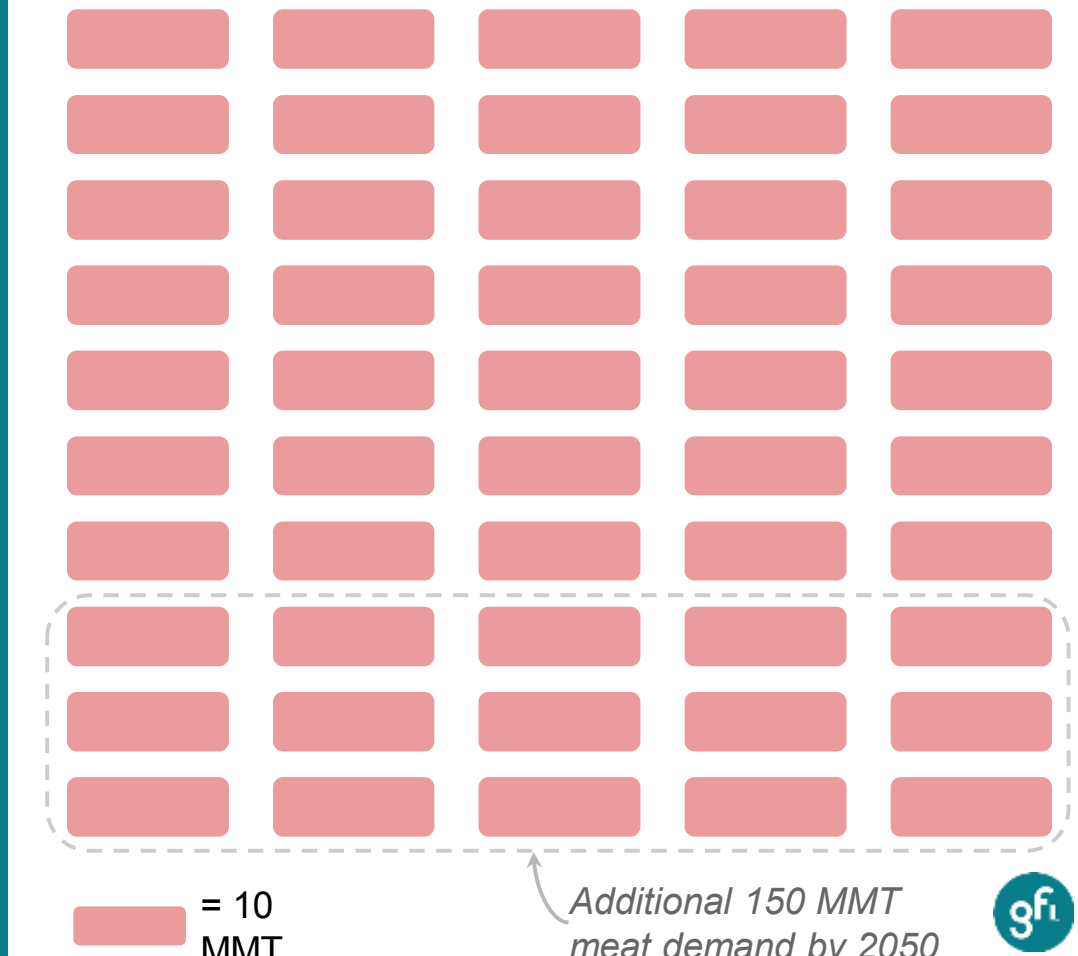
Medical experts expect **10 million annual deaths** from antimicrobial resistance (AMR) in 2050

Sources: FDA (animal-consumed antibiotics); IMS Health (human-consumed antibiotics); United Nations IAGC (AMR)

Global meat production growth 1961-2018

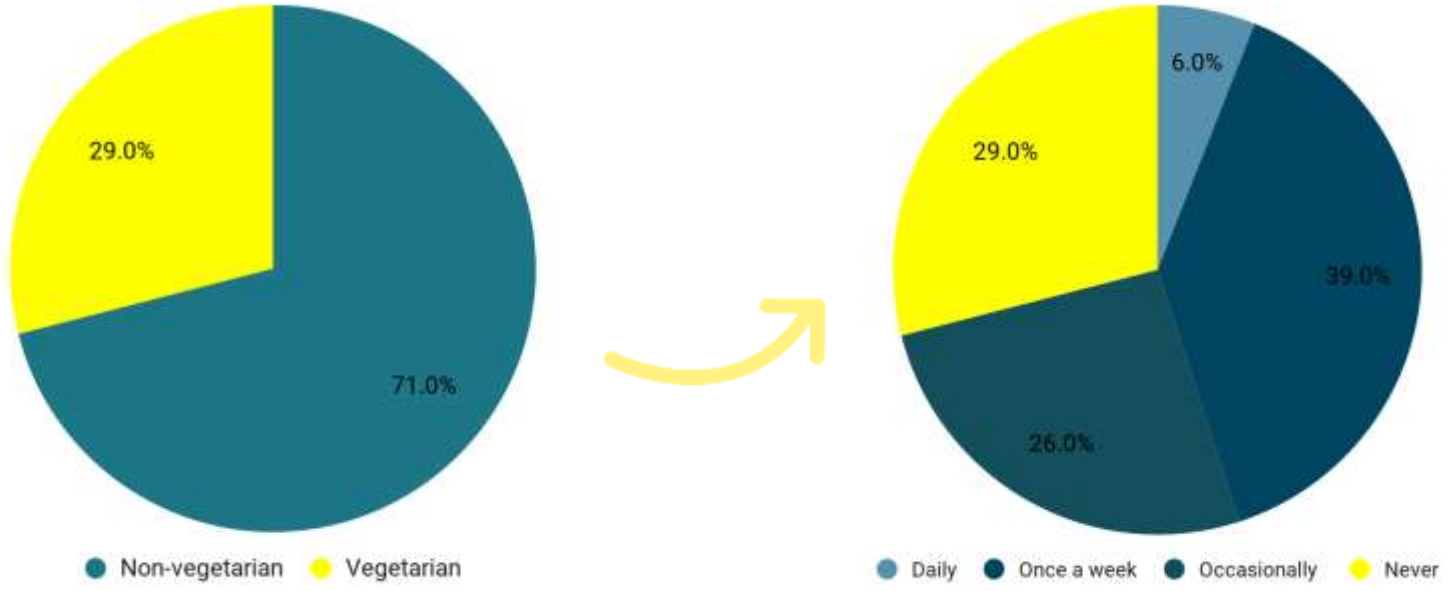


Total meat 350MMT



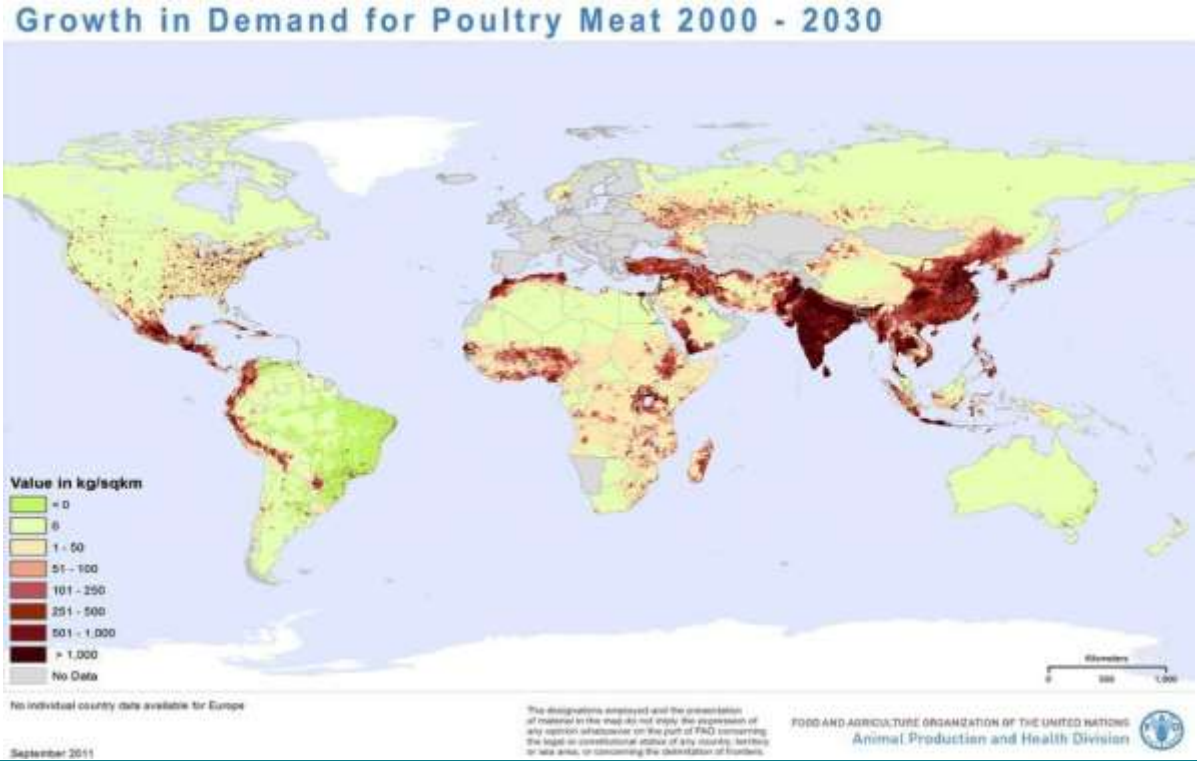
Contrary to the popular misconception, 71% of India's 1.3 billion people self-identify as non-vegetarian

Approximately 200Mn households eating ‘non-vegetarian’ food



Source: Census-level Sample Registration Survey, 2014, NFHS-4

50-70% rise in protein demand driven by incomes in emerging markets – India, China, SE Asia



Protein diversification has implications across different issues in India

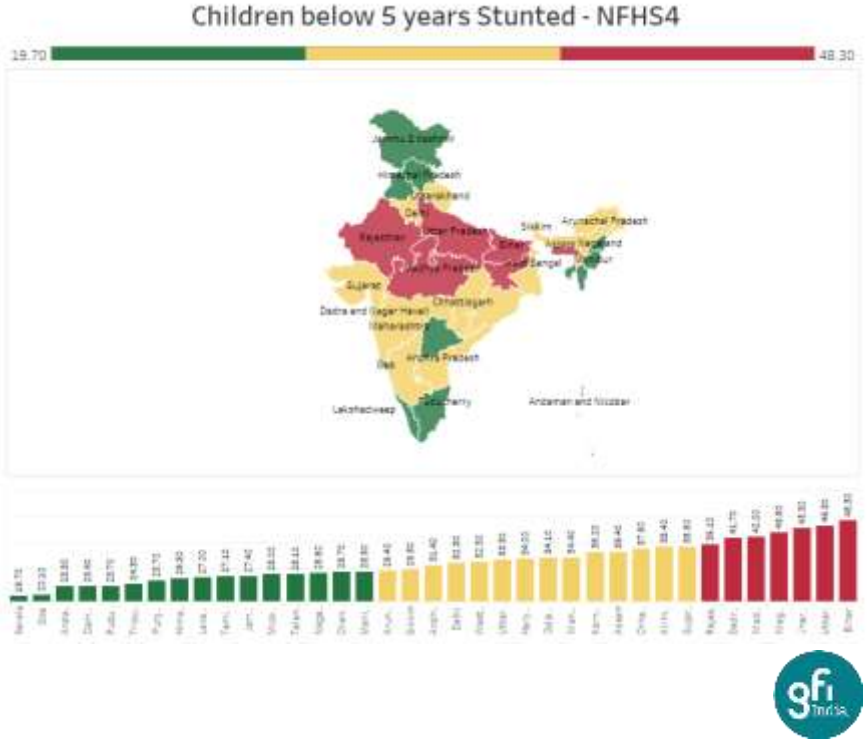
SOUTH ASIA

"Due to drastic fall in the demand of poultry, meat and eggs, chicken prices have sharply dropped at the farmgate to 60% below cost of production, milk demand has reduced by 20-25%..."

Impact of COVID-19 and associated lockdown on livestock and poultry sectors in India

Jyotsnarani Biswal, Kennady Vijayalakshmy and Habibar Rahman

"As per the estimate, COVID 19 impacted 10 lakh broiler poultry farmers and 2 lakh layer farmers, losses were estimated at Rs. 27,000 crores. When the country was battling COVID-19 outbreak, the State of Assam was gripped under the threat of African Swine Fever. The deadly virus reported to have killed 14,000 pigs within 15 days of the outbreak."



Sources: IFPRI 2020; Veterinary World, EISSN: 2231-0916 2020

GFI India's approach

GFI's Solution: Accelerating 'smart proteins'

We can create meat, eggs, and dairy more sustainably and efficiently by making them from plants, cultivating them directly from cells, or producing them by fermentation.

Instead of asking consumers to give up the foods they love, GFI is accelerating the transition to alternative or smart proteins by helping companies make products that are **delicious**, **affordable** and **accessible**.

Smart proteins fit into three categories from a production, cost, and infrastructure perspective

PLANT-BASED

FERMENTATION

CULTIVATED

Plant-based foods

Plant-based meat, eggs, and dairy are produced directly from plants.

Like animal products, they are composed of protein, fat, vitamins, minerals, and water. Next-gen plant-based options look, taste, and cook like conventional meat, and offer complex carbs and fiber.

What is plant-based meat?

Plant-based meat is produced directly from plants.Like animal-based meat, plant-based meat is composed of protein, fat, vitamins, minerals, and water. Next-generation plant-based meat looks, cooks, and tastes like conventional meat.

Impossible Foods' burger patty which is a plant-based beef patty

Beyond Meat's Beyond Sausage which is a plant-based sausage

Ojah's plant-based meat

Plant-based eggs

JUST Egg:
Made from mung
- 98% less water
- 83% less land
- 93% less CO2

Plant-based dairy

Pea protein based milk

Coconut cream , almonds based creamer

Almond milk based yogurt

Tapioca flour, pea protein based cheese

Plant-based 1.0 started with ingredients like soya nuggets or jackfruit as a mimic of meat-like texture:

A chain serving popular indian dish ‘biryani’ recently debuted a jackfruit based biryani to appeal to religious sentiments

Popular QSR chains like Subway are offering ‘veg protein’ options made from soy

But now, plant-based 2.0 is going mainstream with an expanding landscape.

While Americans consume 3 burgers a week and have ONE hero category….

India has multiple ‘national dishes’ leaving space for diverse innovation across dayparts

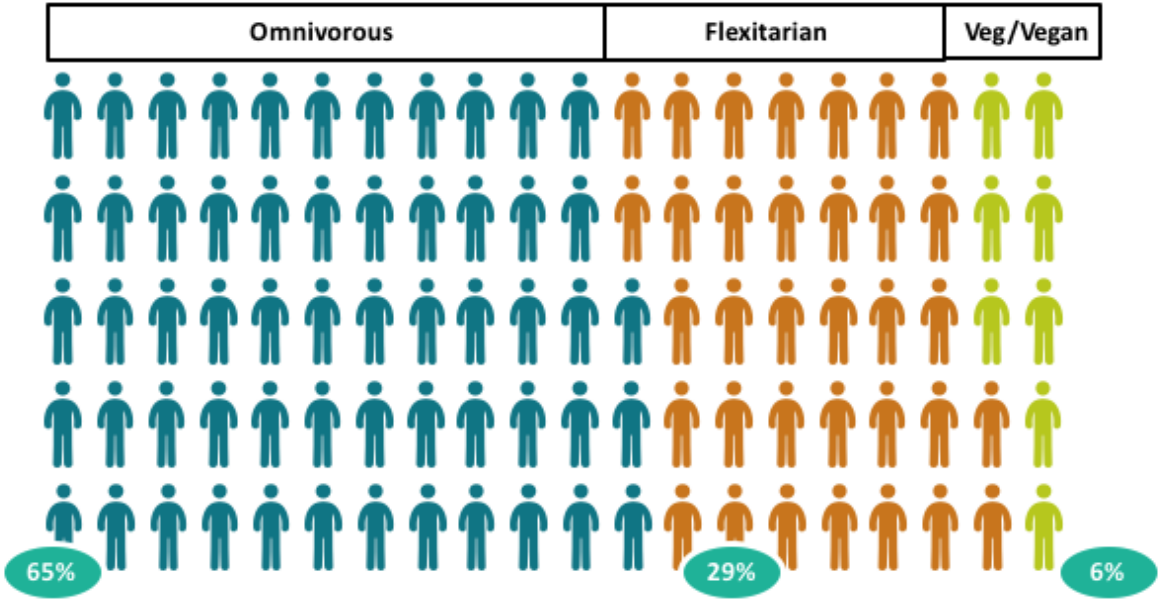
Products getting launched across formats - from main meals to snacking items, in the formats and flavours that resonate well with the consumers

The plant-based meat competitive landscape expands

The landscape of early stage companies continues to grow

Plant-based meat	Plant-based dairy	Plant-based eggs

The consumer market is no longer just vegans and vegetarians

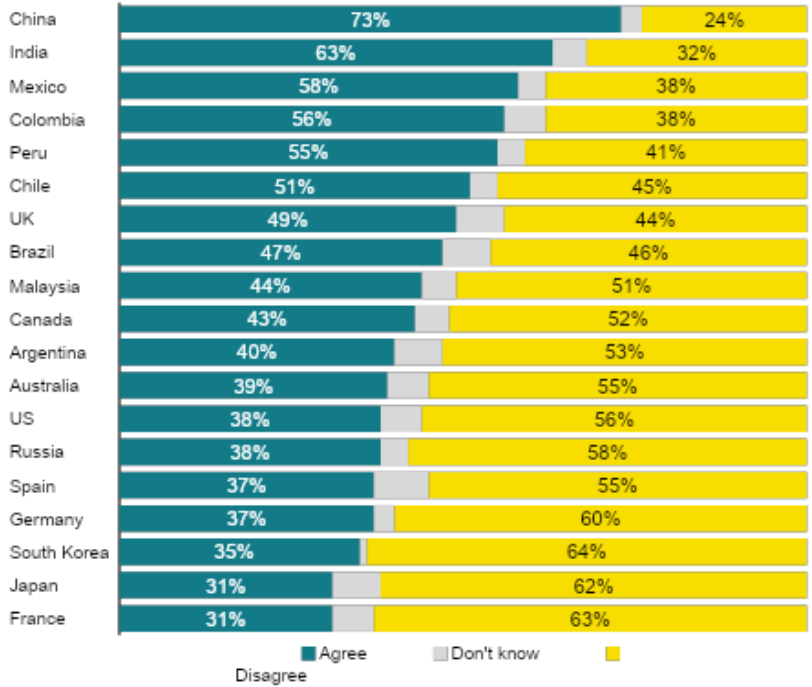


16% of consumers regularly use plant-based alternatives such as almond milk, tofu, and veggie burgers

89% of these consumers do not consider themselves vegan or vegetarian

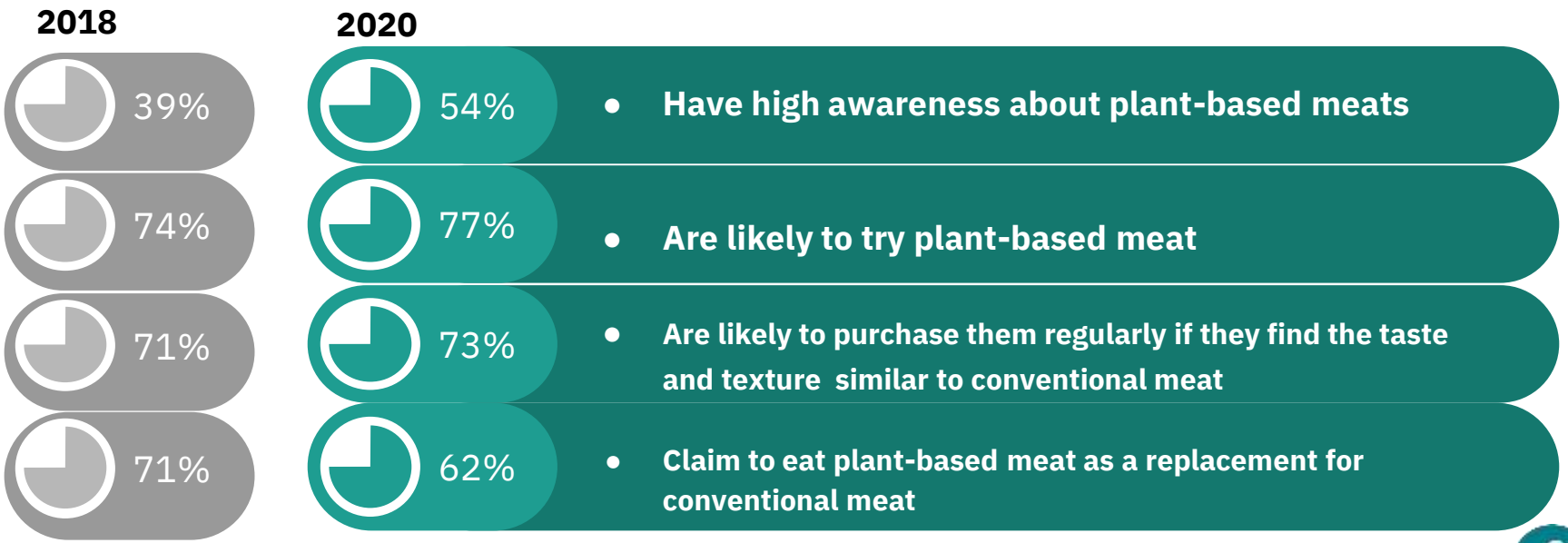
More consumer interest in plant-based meat in China, India, LATAM, and UK

Consumer agreement with "I would eat a plant-based meat substitute," by country
2018



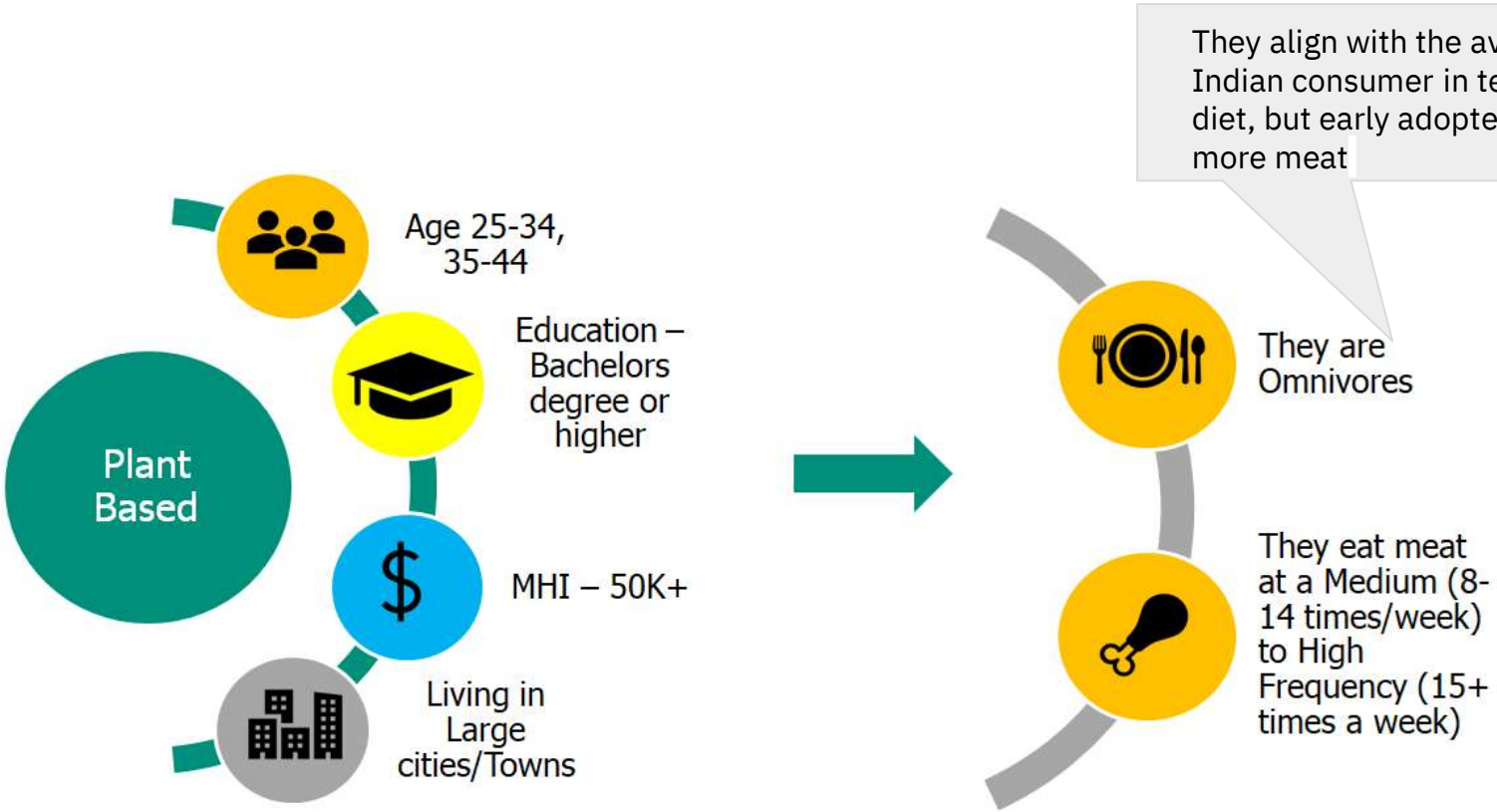
Source: Ipsos, "Global Views on Food" (2018)

High positive disposition seen towards the category in India with 54% early adopters familiar with plant-based meats and 77% willing to try them



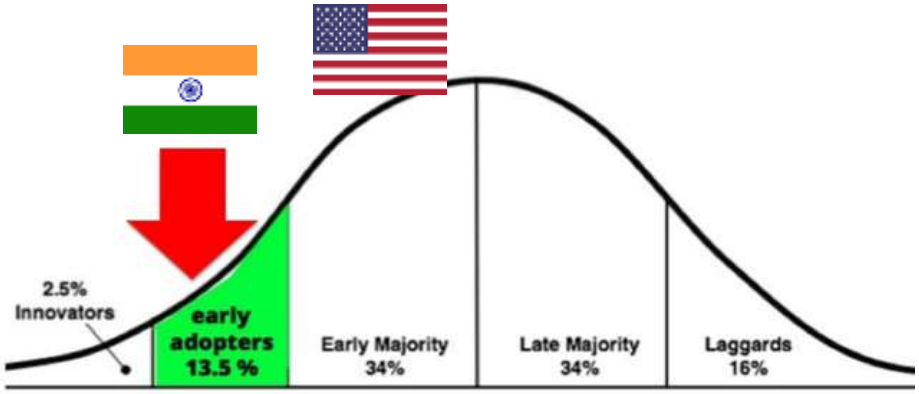
Source : GFI India consumer research, All scores are top 2 box (very/extremely)

Who are the early-adopters of plant-based meat in India?



Source : Study by GFI , India– Indian Early adopter profile

Though the category is in its early stages in India, high positive disposition seen towards the category by early adopters - driven not only by health, but also by animal cruelty and impact on planet



Diffusion of innovation theory

2018	2020	
39%	54%	Awareness about plant-based meat
74%	77%	Are likely to try plant-based meat
71%	73%	Are likely to purchase them regularly
53%	53%	Willing to pay a price premium

Profile of early adopters

25-34, 35-44 years of age

Bachelor's degree or higher

Monthly Household Income – 50K+

Living in large cities/towns

Meat eaters

Source : GFI India consumer research

Plant-based as a category is targeting the early adopters in India currently

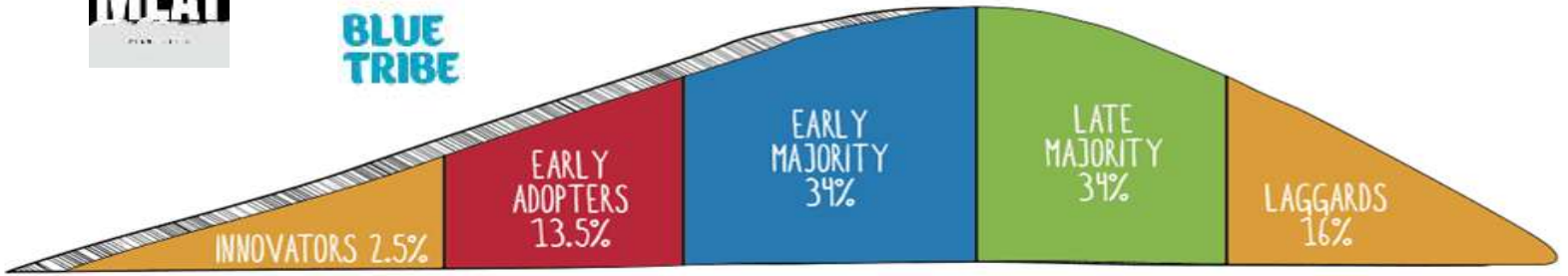
IMAGINE MEAT WITHOUT MEAT

greenest.

good dot

BLUE TRIBE

Identifying the profile of the early adopters and understanding their usage and attitudes towards animal meat can help manufacturers or entrepreneurs in the plant-based meat industry to tailor their marketing and product development efforts



Diffusion of innovation theory

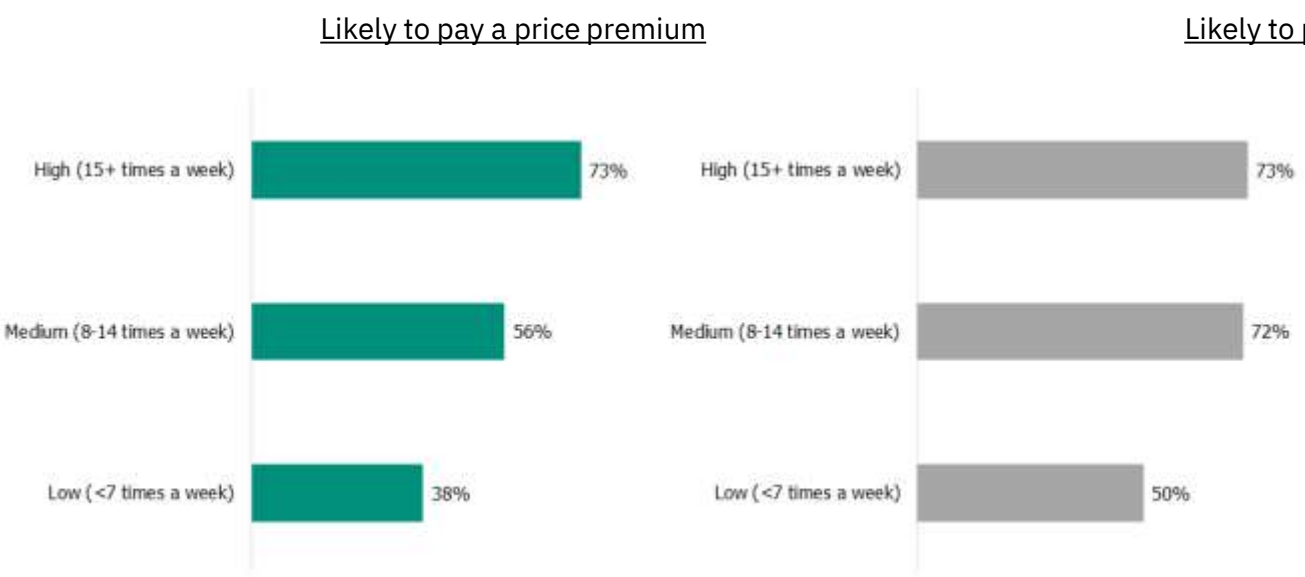
Profile of the early adopter segment

Profile of the early adopter is identified using 2 parameters

- Respondents who reported being “very or extremely likely” to **pay more** for plant-based meat than they would for conventional meat, and
- Respondents who reported being “very or extremely likely” to **regularly purchase** plant-based meat

Since initial market prices are generally higher than their conventional meat counterparts, those who are more likely to pay more for plant-based meat and those who are interested in regularly purchasing plant-based meat can be truly labelled as early adopters

Early adopters have medium to high meat eating frequency.. This category is not for vegans or vegetarians



2020 - Alternative Protein Investment overview
(Despite COVID 2019)

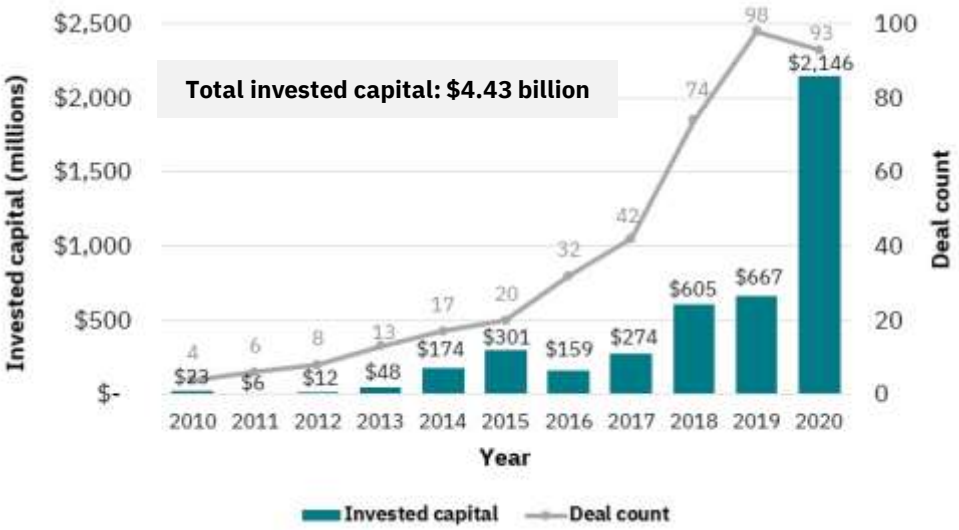
	Plant-based		Fermentation		Cultivated	
	Total	2020	Total	2020	Total	2020
Invested capital	$4.4 bn	$2.1 bn +222% from 2019	$1.0 bn	587 mm +109% from 2019	$505 mm	$366 mm +515% from 2019
Deals	419	93 22% of all deals	102	28 27% of all deals	125	49 39% of all deals
Unique investors	645	196 new	259	80 new	245	94 new

Source: GFI analysis of PitchBook Data, Inc. Invested capital includes accelerator and incubator funding, angel funding, seed funding, equity and product crowdfunding, early-stage venture capital, late-stage venture capital, private equity growth/expansion, capitalization, corporate venture, joint venture, convertible debt, and general debt completed deals.
Note: Data has not been reviewed by PitchBook analysts.

Plant-based investments near $4.5 billion

Annual investment in plant-based companies

2010-2020



Source: GFI analysis of PitchBook Data, Inc. Invested capital includes accelerator and incubator funding, angel funding, seed funding, equity and product crowdfunding, early-stage venture capital, late-stage venture capital, private equity growth/expansion, capitalization, corporate venture, joint venture, convertible debt, and general debt completed deals.

Note: Data has not been reviewed by PitchBook analysts.

The global alternative meat market is projected to reach at least $100b if not $370b by 2035

Global plant-based meat market projections			
Source	**Projected market size**	**By year**	**Projected share of global meat market**
Markets and Markets	$28b	2025	2%
J.P. Morgan	$100b	2035	7%
Barclays	$140b	2029	10%
A.T. Kearney	$370b	2035	23%

Source: Nasdaq (May 2019); Business Times (May 2019); J.P. Morgan (May 2019); CNBC (May 2019); A.T. Kearney (May 2019); Grizzle (May 2019)

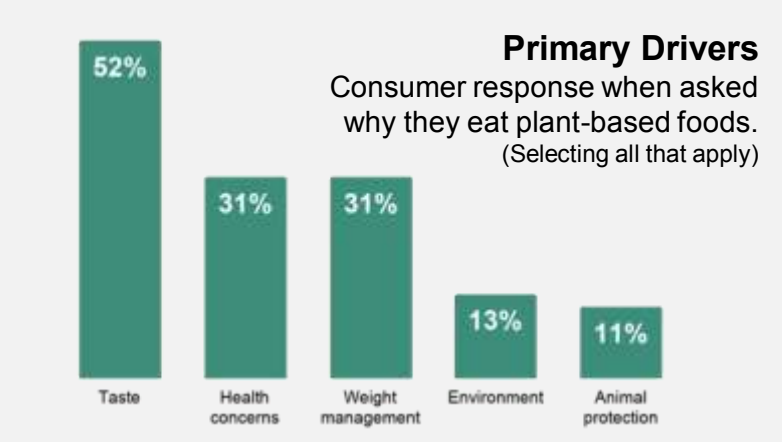
Global cultivated meat market projections			
Source	Projected market size	By year	Projected share of global meat market
Jefferies	$ 187 b	2040	7%

Source: Jefferies - The great protein shakeup, Sep'2019, base scenario

Industry is making progress on critical drivers of taste, price, and convenience

TASTE IS #1

Studies have shown that **taste** is the most important attribute of plant-based foods. And the **belief** that plant-based foods **don't taste good** is the primary **barrier** to consumer adoption.



PRICE MATTERS

Consumers say price is #2 in importance after taste.

- Most consumers said they would pay **less** or the **same** for plant-based products compared to animal-based products.
- Only 27% said they would consider paying **more**.

CONVENIENCE APPEALS TO ALL

Increasing access to plant-based food in mainstream grocery stores and restaurants is resulting in adoption from the largest group of consumers—omnivores.

- 76% of consumers want to find plant-based meat in the **meat aisle** and frozen area where they already shop.
- **Millennials** rank convenience more highly than other groups do, and care about the **ease of cooking & preparation**.

Sources: Mintel. (2018). *Plant-based proteins—U.S.* London, UK: Mintel; Parry, J., & Szejda, K. (2019). How to drive plant-based food purchasing: Key findings from a Mindlab study into implicit perceptions of the plant-based category. Washington: The Good Food Institute; The Food Industry Association & The Foundation for Meat & Poultry Education & Research. (2019). Power of meat. Arlington, VA: The Food Industry Association

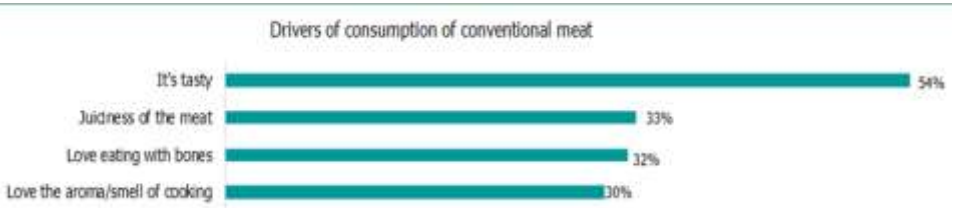
The biggest open opportunities are to win on taste and price

INNOVATE ON TASTE

There is room for growth in products and flavors on offer.

- Dairy products eggs, poultry and fish have the highest penetration followed by mutton and shellfish
- Replicate the entire sensorial journey, i.e. aroma, juiciness, bones, etc.

India consumers: drivers for consumption of animal meat products



CLOSE THE PRICE GAP

Plant-based products are priced at a premium compared to animal-based products.

Product	*PB Price*	*Animal Meat Price*
Mutton	INR 800 for 1 Kg (Shelf-stable)	INR 1050 for 1 KG
Pizza	INR 459 for medium	INR 395 for medium
Chicken mince	INR 1300 for 1kg (Frozen)	INR 555 for 1 KG

Multiple areas of improvement for plant-based meat & seafood products

Composition

- Textured base protein, fat, binder, flavor, salt, preservative, color.

Expectation

- Characteristic flavor, texture & appearance
- Provides protein, fat, iron

Consumption

- Center of plate
- **Comminuted**: burgers, sausage, nuggets
- **Intact muscle:** steaks, slices, breasts, wings

Areas of Opportunity

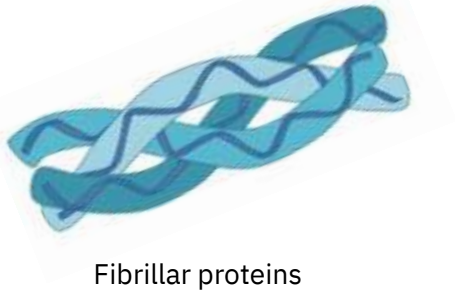
Texture	Intact muscle, fat retention, seafood
Flavor	Base off-flavor, exact matches, subtle flavors (e.g., fish), precursor ingredients
Variety	Goat, lamb, organ meats
Experience	Raw feel, recipe resilience, color change on cooking
Cost	Scale, automation
Health	Alt. proteins, clean label, salt & saturated fat reduction
Authenticity	Shifting from “fake meat” to real food

Source: GFI Plant Protein Primer

Technological insight: the core goal of plant-based meat is utilizing plant proteins to act like animal proteins

Storage

Globular proteins



Fibrillar proteins

Function & mobility

Plant-based meat production

CROP OPTIMIZATION

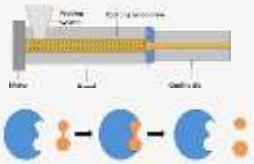
The best source material for the end product is selected

OPTIMIZE

The source material is optimized via breeding or engineering

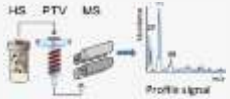
RAW MATERIAL OPTIMIZATION

Raw materials are isolated and functionalized by mechanical and chemical processes to create optimal ingredients for the end product



END PRODUCT COMPOSITION AND PROCESS OPTIMIZATION

The correct mix of ingredients and processes are established to create the desired taste, texture, smell, and structure



Final Product

Plant proteins with growth potential

Protein	Protein Concentration	PDCAAS	Allergen Risk	Commercial Stage	Flavor	Functionality	Cost (/kg protein)	Global Crop Volume (MMT)
Sunflower								
Potential to be cost effective (byproduct of 3rd biggest oilseed). Needs scale-up & commercial development.								
Mung Bean								
Scale-up needed for cost improvement. Excellent properties & starch byproduct used for noodles & other foods.								
Potato								
Rice								
Attractive attributes. Volume can expand until available precursor from starch processing is consumed.								
Duck Weed								
Sustainable, excellent properties. Needs scaling and commercial development to increase volume & decrease cost.								
Chickpea								
Navy Bean								
Oat								
Great potential if byproduct utilization (starch) is improved.								

Alternative plant proteins need a competitive value proposition to bring about growth.
To compete directly with wheat and soy a major question is how well they texturize.

Opportunity highlight: Algae, seaweed, and aquatic plants

Algae, seaweed, and aquatic plants offer a particular portfolio of opportunities as plant protein sources:

- High in protein (e.g. 9-25%)
- Omega-3 fatty acid content
- Scalable (can be grown very efficiently and inexpensively)
- Whole-plant harvesting
- Minimal land use
- Coloration (red seaweeds like dulse turn brown when cooked)

Examples:

Spirulina

Duck Weed

Dulse

Agronomic yield improvement
(both overall crop yields and protein content)

Shared supply chain
(multiscale co-manufacturing, transport, pooled procurement)

Process & facility scaling
(production, extraction, fit-to-purpose design)

Low-cost extraction
(lower inputs, higher throughput & yield)

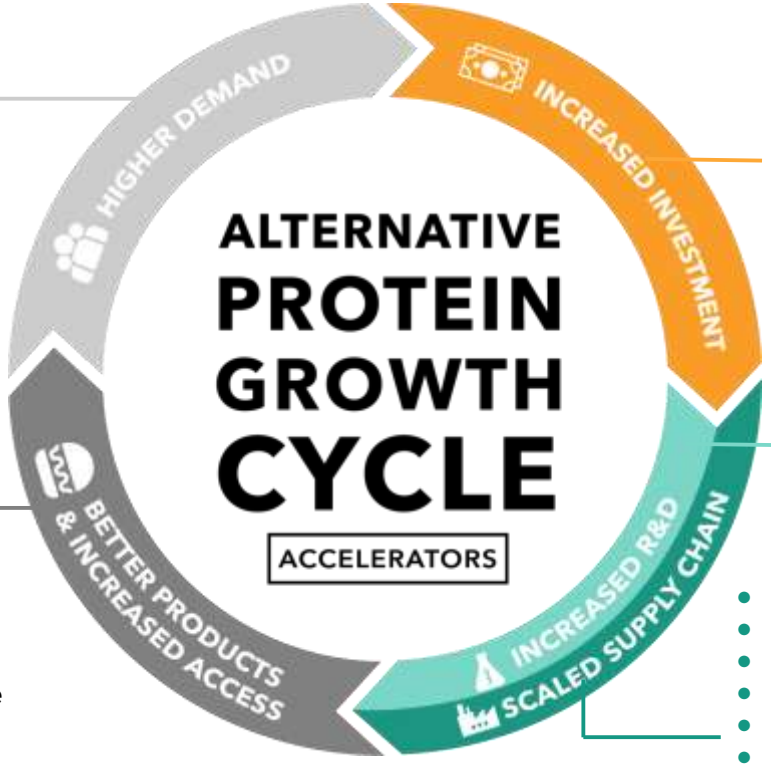
By-product valorization
(oil, starch, fiber, extracts)

Localized production
(farm, processing, food manufacturing)

Scaling novel protein supply chains
(like duckweed, seaweed, and pea)

De-risking crop production
(market data, insurance, price guarantees, technical assistance)

Innovation expected to fuel continued growth



- Positive perception
- Accurate information
- Effective promotion
- Cultural integration
- Societal support
- Food industry support

- Abundant, inexpensive capital to meet existing and future demand
- Diverse pool of investment sources to meet variety of industry needs
- Investors bring strategic value

- Scientific advancement
- Research ecosystem
- Innovation pipeline
- Funding
- Shared knowledge
- Talent & workforce development

- Quality & Functionality
- Affordability
- Availability
- Health & Safety
- Ecologically Sustainable
- Variety

- Fair & effective regulation
- Adequate capacity
- Resilient
- Supportive enabling industries
- Funding
- Shared knowledge
- Talent & workforce development

High impact priorities for India

Open access R&D and infrastructure building

- Establishing Centres of Excellence
- Launching open access research grant programmes in smart protein
- Cross country programmes for tech and knowledge transfer

Policy incentives and a conducive regulatory landscape

- Establishing regulatory frameworks for emerging categories such as cultivated meat
- Subsidy and policy support at the business and farm level

Building talent pools and skills across the value chain

- Launching Smart Protein curriculum in universities
- Incubation and accelerator programmes focused on smart protein

‘Atmanirbhar Bharat’ in Smart Protein via a dual market opportunity | India, as a consumer and a supplier

Large crop biodiversity

Lucrative, sustainable value addition in pulses, millets, and other indigenous crops

Globally competitive talent pool

Entrepreneurship and engineering & scientific skill sets

Major industrial opportunity

Rapidly growing biotech and food processing industries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