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STPI

STPINEXT
INITIATIVES

INNOVATIONS THROUGH AGRITECH

A study on the adoption and impact of technology on Agri and Agri-allied sectors

STPI KnowledgeUp Series

June, 2023

Key message

Shri Alkesh Kumar Sharma
Secretary
Ministry of Electronics and
Information Technology

Agriculture contributes nearly 17% to the country's GDP which is significantly high as compared to global average of 4.4%. Agri & Agri-allied sector has great potential for development, as it is key to meeting half of the 17 Sustainable Development Goal (SDG) targets which includes eliminating poverty & hunger and reducing inequalities

The aim is to address the growing food demand and becoming self sustainable in food supply through innovation and application of technology. Agritech has been able to address issues like productivity, labor efficiency & cost, climatic uncertainties, market connect etc. through precision farming, digital platforms, farm mechanization and biotechnology.

Government has been supporting the sector through various technology led initiatives in solving problems at both local and global levels. Initiatives like e-NAM (National Agriculture Market), e-Krishi Samvad, e-Pashuhaat, Agricultural Marketing portal (AGMARKNET), HORTNET project, Kisan Suvidha mobile application have been launched to facilitate online trading of agricultural produce, provide advisory services, and create digital marketplaces for agri produce & livestock. Remote sensing, satellite imagery, and drones are used for ensuring transparent & efficient implementation of Pradhan Mantri Fasal Bima Yojana. The India Digital Ecosystem of Agriculture (IDEA) provides framework and National e-Governance Plan in Agriculture (NeGP-A) provides funds for development of agri-focused solutions leveraging emerging technologies

With channelized focus on market linkage, farming advisory, data analytics for desired quality and quantity of yield, government is trying to ensure overall development of the agricultural value chain.

"Innovations through Agritech: *A Study on the Adoption and Impact of Technology on Agri and Agri-allied sectors"*, exhibits the current state of Indian Agritech sector, highlighting challenges, upcoming technologies, and preferred solutions. It provides valuable insights for start-ups, investors, policymakers, and other stakeholders. This report will be particularly helpful to start-ups and budding entrepreneurs, providing them with a landscape of the sector and the opportunities and challenges it presents.

I extend my congratulations to the STPI for bringing out this report. This report will be a valuable source of information for start-ups, academia, industry, investors, and government departments and agencies working in the start-up ecosystem.

With Best Wishes

Message

Shri Arvind Kumar
Director General
Software Technology
Parks of India

Innovation and technology have been the driving force behind growth in various industries. New ideas and technologies are developed and applied, generating greater output with the same input. In manufacturing sector more goods are produced, stimulating wages and business profitability. Similarly agriculture sector has also witnessed technical revolution through multiple agricultural technology (agritech) innovations. It has led to efficient mapping, monitoring and managing farming decision preciously. The value of agricultural output export was Rs 3.4T in FY 22 and in FY 23 the value is estimated to rise to ~ Rs 3.7T.

With the aim to optimize resource utilization and maximize yields, inclusion of technology in agriculture has been in rise. The agritech sector of India has witnessed consistently high registration averaging ~8.5K start-ups per year. Emergence of these numerous startups focuses on offering farm management and advisory services with personalized recommendations on crop selection, planting techniques, fertilizer application, pest management, and weather forecasts. The fintech solutions in the agritech sector have also gained prominence, providing farmers with access to credit, insurance, and financial services. Digital lending platforms have emerged, offering loans based on real-time data and crop insurance schemes tailored to the needs of farmers. The advancements in agricultural technology have empowered farmers to effectively compete in and cater to the global market. By meeting the growing demand for international cuisines, locally sourced exotic produce, traceable food sources, and fresh organic produce, these innovations have revolutionized the farming industry.

The agritech sector has witnessed a substantial influx of investments from various investors and corporate entities, amounting to an impressive sum of approximately USD 958 million in the CY 2022. Furthermore, the value of these investments has displayed remarkable growth, with a CAGR of approximately 51% from the CY 2017 to 2022.

The penetration of technology in agriculture sector is still at a relatively low level, estimated to be ~1%. In light of this, the report titled "Innovations through Agritech: *A Study on the Adoption and Impact of Technology on Agri and Agri-allied sectors"* emerges as an invaluable source of inspiration for individuals and organizations alike. It serves as a comprehensive resource that highlights the transformative potential of agritech and encourages stakeholders to drive innovation and create a positive impact in this field. It showcases the immense potential and opportunities that lie within this sector, motivating stakeholders to explore new horizons, challenge the status quo, and develop groundbreaking solutions.

I would like to express my heartfelt gratitude to the esteemed industry leaders, experts, investors, and entrepreneurs who generously contributed their valuable insights and expertise during the preparation of this report. Together, we can foster a culture of innovation, collaboration, and sustainable growth in the agritech sector, driving positive change and creating a better future for all.

Message

Dr. Devesh Tyagi
Senior Director
Software Technology
Parks of India

Given India's large agricultural sector, the significance of agritech cannot be overstated. By leveraging technology, agritech solutions have the potential to transform Indian agriculture, address challenges faced by farmers, and drive sustainable and inclusive growth in the sector.

India has a large and growing population, making food security a top priority. Agritech solutions contribute to ensuring food security by increasing agricultural output, improving crop quality, and reducing wastage. By enabling farmers to adopt modern farming techniques and access real-time information, agritech solutions help in meeting the rising demand for food and reducing the dependence on imports.

Government has been taking multiple steps to promote innovators and innovation in agritech. It has established incubation centers, innovation labs, and funds to support agritech startups and encourage the development of technology-based solutions. These initiatives provide startups with mentorship, funding, and a supportive ecosystem to foster innovation and entrepreneurship in the agriculture sector.

Under the same objective Sofware Technology Parks of India (STPI) has setup 22 domain/technology focused Center of Entrepreneurship (CoE) that dedicatedly works to nurture start-ups working in the domain/technology. These CoEs are spread across the country to drive innovation and support start-ups from all geographies. Out of these, 3 CoEs viz. Fasal at Akola, OctaNE at Guwahati, OctaNE at Gangtok having focus of IoT in Agriculture and IT application in Healthcare & Agritech are working comprehensively to bringing forward the innovation in Agritech space. They are designed to handhold the agritech start-ups in their journey, through mentoring, access to lab, business & market access support and funding etc. With the inputs from CoEs, this report *"*Innovations through Agritech: *A Study on the Adoption and Impact of Technology on Agri and Agri-allied sectors"* has been developed.

The report provides an overview of the overall agritech industry, including key players, funding trends, regulatory landscape, and emerging technologies. The report highlights untapped opportunities and unmet needs within the agritech sector. Startups can leverage this information to develop innovative solutions that address specific pain points and cater to the demands of farmers, consumers, or other stakeholders. It can also assist in identifying gaps in the market that can be filled with new products or services.

I would like to congratulate team STPI/STPINEXT for their concerted effort in bringing this report together for individuals, start-ups, industry, academia and policy makers.

Foreword

Shri Subodh Sachan
Director
Software Technology
Parks of India

Agriculture has been the backbone of the Indian economy since time immemorial. It has played a pivotal role in the development and growth of the country, providing livelihoods to millions of people and contributing significantly to the GDP. With the increasing population, changing dietary patterns, and the need for sustainable farming practices, there is a pressing need for innovation in agriculture. The rise of Agritech startups in India is a testament to the fact that technology can play a crucial role in transforming the agricultural landscape.

This knowledge report focuses on Indian Agritech, an emerging sector that has seen a surge in investment and interest in recent years. The report aims to provide insights into the current state of Agritech in India, the challenges faced by the sector, and the opportunities for growth and innovation.

The report "Innovations through Agritech: *A Study on the Adoption and Impact of Technology on Agri and Agri-allied sectors"* delves into various aspects of Indian Agritech and allied sectors (dairy & fishery), including precision agriculture, farm mechanization, crop monitoring, market linkages, and financing. It highlights the role of emerging technologies such as artificial intelligence, IoT and blockchain in transforming Indian agriculture. It also discusses the challenges faced by the sector, such as inadequate supply chain infrastructure, limited access to finance, and the need for knowledge.

The knowledge report is a valuable resource for innovators, entrepreneurs, policymakers, investors, and anyone interested in the Agritech sector in India. It provides a comprehensive understanding of the opportunities and challenges in the sector and outlines strategies for growth and development.

I hope this report will stimulate discussion, inspire innovation, and contribute to the growth of Agritech in India, ultimately helping to achieve the goal of sustainable and inclusive agriculture.

Key highlights

- Agriculture contributes **9.5% to India's total GVA**; agriculture **exports** stood at **~US$ 43B** in FY23 (Apr'22 – Jan'23)
- Owing to changing consumer behaviour, exotic fruits & vegetable imports to India are observing an upward movement

- **Investments** in **Agritech** start-ups grew at a CAGR of **~51%** from **CY17-22**
- Output market linkage platforms have received **~20%** of the **total agritech investments** due to the **higher profit margin for the stakeholders**

- **~87% of farmers are marginal farmers** with land holding **<2.5 acre**
- **Marginal land holding is a vital reason for under-utilization of technology** and developments of agriculture

- **Emerging agritechs** are solving **critical problems** like farm inputs, financing, labour shortage, etc.
- Core **agricultural supply chain** is fragmented, creating **opportunities** for disruption and innovations by **Agritech** players

- Government initiatives like Micro irrigation fund (**INR 5,000Cr**), eNAM have started to improve the **market linkage**, **technology,** and **infrastructure** facilities to help optimize farmers' operations and trade

Executive summary (1/3)

Overview of core agricultural sector

- Agriculture has contributed to **~9.5%** in Gross Value Added (GVA) in FY23 for India; with **INR 2.2T of net exports** and forms backbone of Indian economy with 55% population still dependent on it
- The traditional way of farming with **excess reliance on local mandis and ration shops has been increasing costs** for the end consumer without adding value to farmers
- With multiple government initiatives, there is **focus on improved farm and produce quality along with efficient marketplace and infrastructure** for Agriculture sector
- The evolution and rapid growth for Agricultural sector needs to be a **combined effort for private sector along with government initiatives**
- Core agricultural **supply chain is fragmented**, creating opportunities for disruption and innovations by Agritech players

Challenges to agriculture sector

- Agricultural value chain is riddled with a **lack of awareness of best practices & technology**, causing inefficiencies and leading to financial and production losses
- India's **agricultural output trading market** is large, aided by co-operatives & FPOs, but **growing with low technology penetration** results in output wastage
- Core agricultural processes continue to face challenges due to a **lack of data analytics support and market awareness**, leading to low yields and sales
- With fewer alternatives of financing, **agriculture value chain gets disrupted** due to multiple obstacles like
  - **High costs** of supply chain and transportation
  - On **lower working capital** during the credit periods
  - Exploitation by local lenders

Source(s): Secondary research, Primary interviews (N = 18); Inclusive of investors, startup ecosystem, farmers, intermediaries / MEs), Praxis analysis

Executive summary (2/3)

Emerging trends

- Lot of new-age, cutting edge technologies like **indoor farming techniques** of hydroponics, aeroponics, etc., **data analytics, robots and drones** have come up in the past decade to address the challenges
- Since **~87% of the farmers** in India are marginal farmers, indoor farming is a vital technology as it **optimizes space through vertically stacked cropping**
- There has been a **paradigm shift in consumers' eating habits** due to growing exposure to foreign cuisines, and awareness towards health resulting in increased demand for organic and exotic produce
- India's **growing population**, coupled with **rapid urbanization and improving incomes** along with technology intervention and conducive government policies is spurring demand for milk and milk products as well
- **Conducive government policies** infusing capital in the sector along with **technology intervention** is **accelerating the demand for Indian fishery products** in domestic and international market

Evolving agritech landscape

- Agritech in India is poised for accelerated growth driven by **improving participation of modern marketplaces, digital penetration, and impetus from government**
- Private corporate sector has paved way for extensive **inclusion of technology in agriculture**, in the form of emerging agritechs that are solving critical problems in the ecosystem like farm inputs, financing, labour shortage, disease prone crops, low yield etc.
- Investment value in Agritech startups saw a **~51% CAGR from CY17-22**, benefitted by the digitalization push due to COVID-19 through improved use of technology and mobile internet penetration in the sector
- While the private sector has been accelerating productivity and reach through technology, government has been shaping and governing the blended framework of agriculture with technology
- Initiatives like Micro irrigation fund (**INR 5,000Cr**), eNAM (Platform of platforms) have started to improve the **market linkage**, **technology,** and **infrastructure** facilities to help optimize farmers' operations and trade

Source(s): Secondary research, Primary interviews (N = 18); Inclusive of investors, startup ecosystem, farmers, intermediaries / MEs), Praxis analysis

Executive summary (3/3)

Future Outlook

- Though **ground-breaking technologies have been introduced** to accelerate agriculture yet there are factors restraining the adoption of technology by a large section of farmers. Some of these factors
  - Marginal land holding is a vital reason for under-utilization of technology and developments of agriculture
  - **Scattered land holding of a single farmer** & heterogeneity of cropping system hinders the capability of the farmer to adopt the technology
  - **Lack of trust and technical know-how** act as barrier to penetration of technology & development for majority of farmers
- In order **to facilitate awareness and mass adoption of emerging technologies**, a collective effort of farmers, industry stakeholders & the government would be required to push forward the agriculture sector
  - Though difficult to implement, **restructuring the land by unifying and aggregating the scattered land** of small farmers would help in making a collective adoption of technology
  - FPOs can play a crucial role by working in the designated geographical area and adjoining maximum farmers for collective implementation of technology

Source(s): Secondary research, Primary interviews (N = 18); Inclusive of investors, startup ecosystem, farmers, intermediaries / MEs), Praxis analysis

Agenda

- **Overview of agriculture and allied sector in India**
- Technology interventions in the system
- Trends in agricultural sector
- Agritech sector current landscape
- Benchmarking with International markets

Agriculture remains primary source of livelihood for 55% of Indians with expected contribution of ~9.5% to total GVA in FY23P

Key statistics as of FY23

Indian agricultural industry comes as a major contributor in terms of GVA with a large population relying on it for livelihood

- **9.5%* (~INR 24T)** expected contribution by core agriculture output to total GVA (~**INR 247T**) in FY23P
- **55% (~812M)** of total population **dependent on agriculture** as their primary source of livelihood
- Government has sanctioned **INR 13,681Cr** for agricultural infrastructure in India for more than **18,133 projects** in CY22
- **22** Mega food parks with additional **17** in pipeline to provide a mechanism for linking agricultural production to market
- **~US$ 43B** worth agriculture exports in **FY23 (Apr'22–Jan'23)**, registering increase of 6.04% over previous year

Agricultural sector of India is backed by the presence of a sizable amount of arable land and a large livestock population

- **87% (~73M)** farmers are marginal farmers, owning less than 2.5 acres of land as per latest agricultural census
- Out of the total agricultural output** **(~909.6 M MT)** in India in FY23, **54%** is driven by **sugarcane**
- Foodgrains production in India **increased to 330.5 M MT in FY23 from 315.7 M MT in FY22** with rice being the highest contributor
- Horticulture boasts record of **342.3M metric ton** production in **FY22**, increased **by ~2.3%** from **FY21**
- India produces **~11M tons** of spices, making it the world's largest exporter and consumer

Note(s): * Current basic price, GVA – Gross Value Added; ** Agricultural output includes foodgrains, oilseeds and commercial crops production; Exchange rate US$ 1 = ~INR 80 as of September 2022; According to RBI, marginal farmers are ones cultivating <2.5 acres of land, small farmers are ones cultivating >2.5 acres of land but <5 acres of land
Source(s): Secondary research, Praxis analysis

Agricultural output contributed 9.5% to the total GVA in FY23P; exports and imports stood at ~INR 3.7T and ~INR 1.5T in FY23P

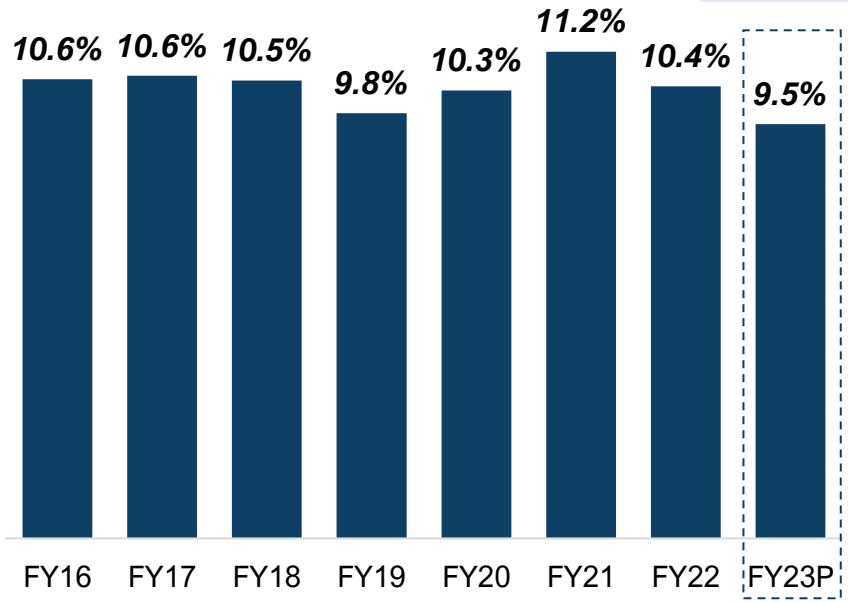
Agricultural output (only) contributed roughly ~10% to the country's total GVA in FY23P

India is expected to remain a net agricultural exporter, with ~INR 1.5T & ~INR 3.7T worth of imports & exports in FY23P respectively

% contribution by agriculture to GVA

(FY16-23P)

GDP from Agriculture in India reached an all-time high of ~INR 6.6T in the fourth quarter of 2021

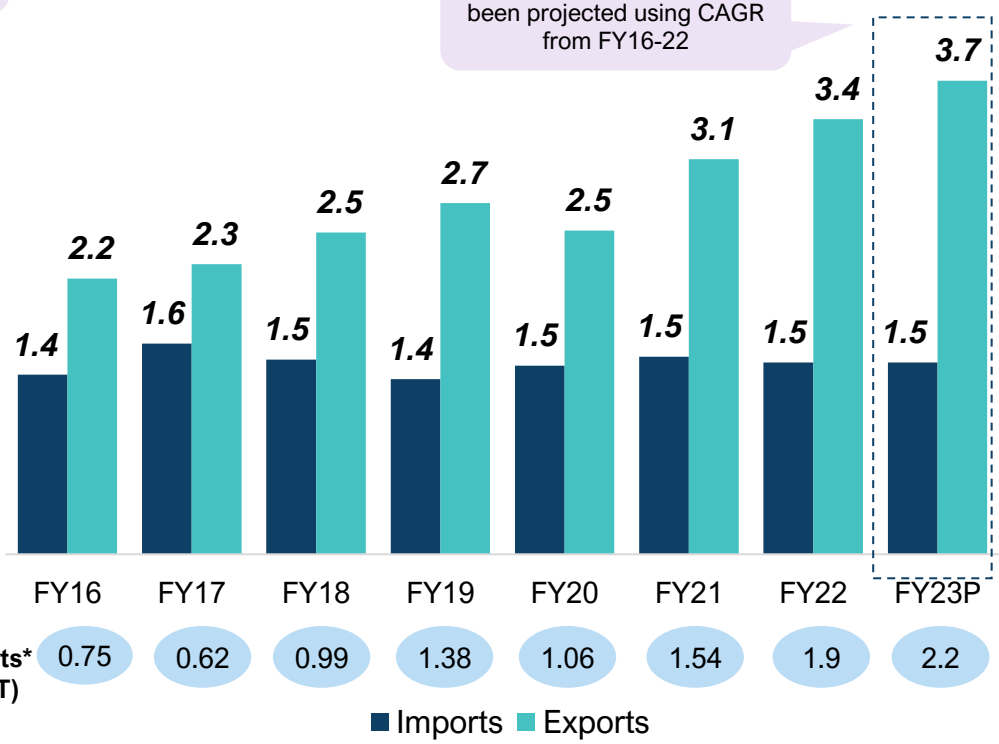


	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23P
Agriculture GVA (INR T)	13.3	14.9	16.3	16.8	18.9	20.0	21.7	23.6

Agricultural imports and exports

(INR T, FY16-23P)

Import and export data has been projected using CAGR from FY16-22



	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23P
Net exports* (INR T)	0.75	0.62	0.99	1.38	1.06	1.54	1.9	2.2

Note(s): *Net exports = Exports – Imports, FY23 is financial year from April'22 to March'23, P: Projected
Source(s): Agriculture statistics report, Directorate General of Commercial Intelligence & Statistics, Department of Commerce, Praxis analysis

India is the largest milk producer in the world; Dairy output is expected to contribute ~3.9% to the total GVA in FY23P

Uttar Pradesh is the top milk producing state in India followed by Rajasthan, MP, Gujarat and Andhra Pradesh

India's Export of Dairy products is projected to be 1,32,301.5 MT to the world **worth US$ 480.1M** during FY23

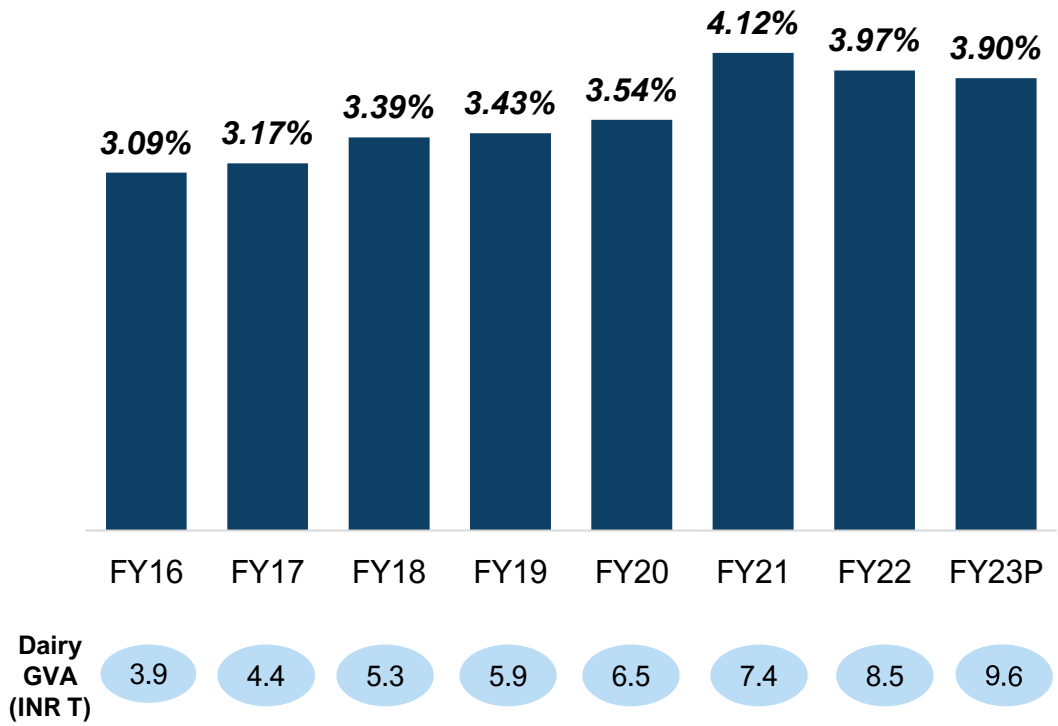
The top 5 milk-producing states are: Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat Andhra Pradesh

The dairy market in India size reached **INR 14,899.8B in FY22.** Expected market to reach INR 31,185.7B by FY28 at a **CAGR of 13.2% during 2023-28**

Milk production in the country has grown at a CAGR of ~6.1% to **reach 221.1M tonnes in FY22**

Dairy output contributed roughly ~4% to the country's total GVA in FY22 and is projected to contribute 3.9% in FY23P

% contribution by dairy sector to GVA
(FY16-23P)



Note(s): P: Projected
Source(s): Agriculture statistics report, Directorate General of Commercial Intelligence & Statistics, Department of Commerce, Secondary research, Praxis analysis

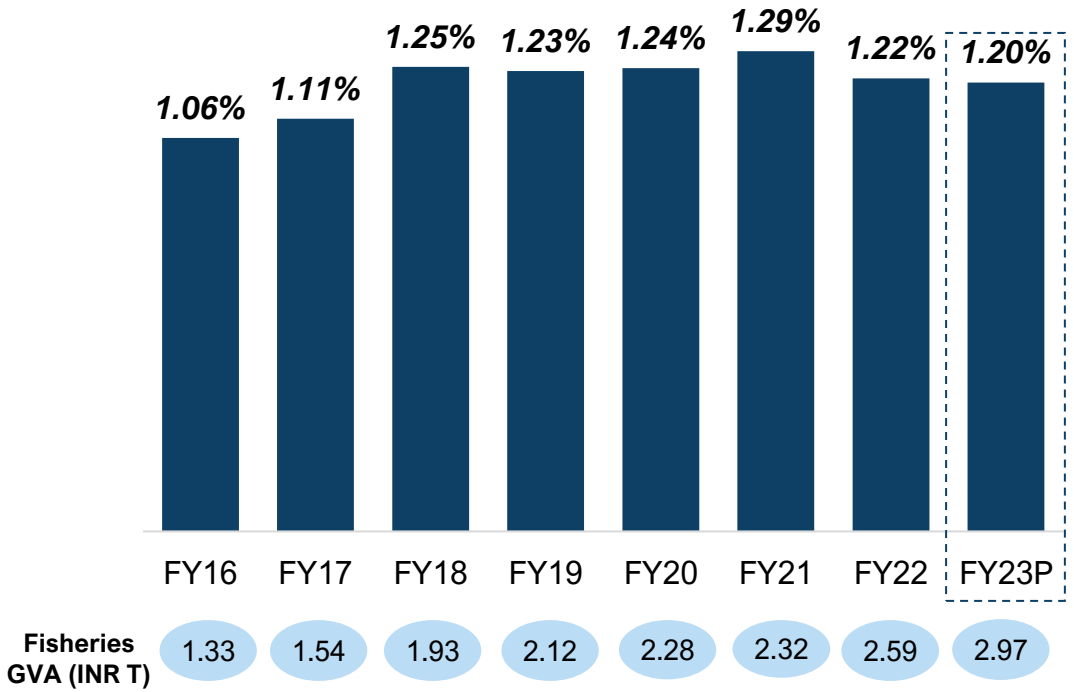
Fisheries remain the primary source of livelihood for the 28M Indian population; with the GVA contribution of ~1.20% in the FY23P

Indian fisheries industry ranks 3rd in fish production with average annual growth in fish production ~10.87%

- India ranks **3rd in fish production** and is the **4th largest exporter of fish** and **fisheries products as of Sep 2022**
- Indian fish market is expected to grow at a **CAGR of 18%** from **INR 650B** in **FY23** to **INR 1,950B** in **FY27**
- Total **marine exports** in **FY23 is expected to grow to US$ 8.5B from US$ 7.8B in FY22.**
- **Andhra Pradesh** is the largest fish producer in India in **CY22**
- The sector supports the **livelihood of over 28M** in India as on **CY22**
- On an average fisheries production exhibit a **growth** of **8%** per year, with fish production of **16.25M tons** in **FY 22**

Fisheries output contributed ~1.20% to the country's total GVA in FY23P

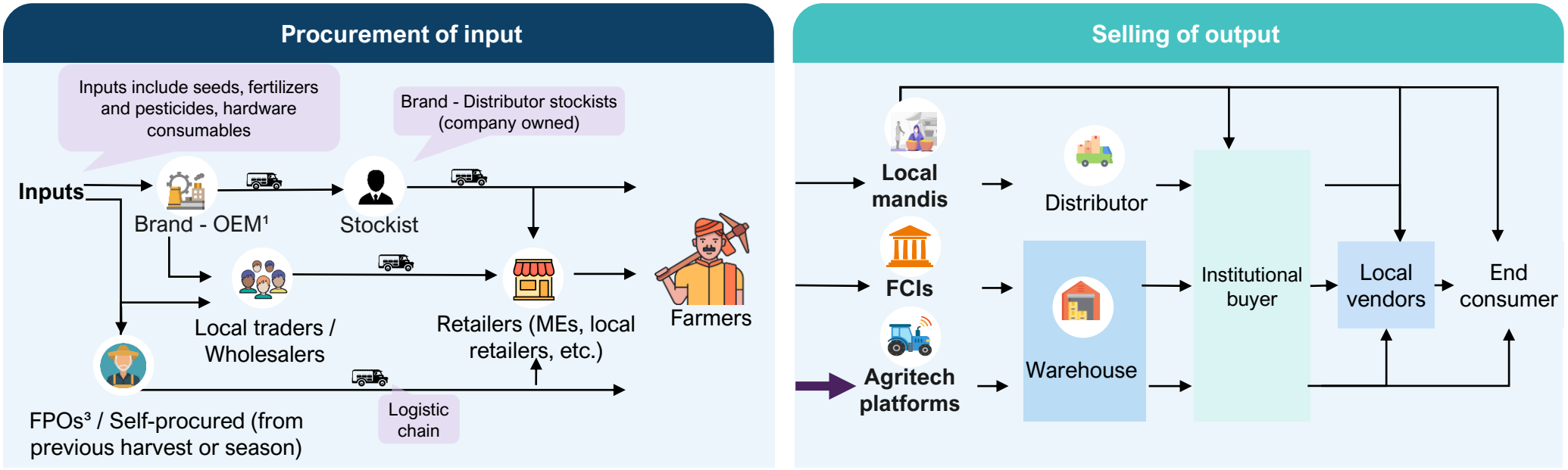
% contribution by fisheries to GVA
(FY16-23P)



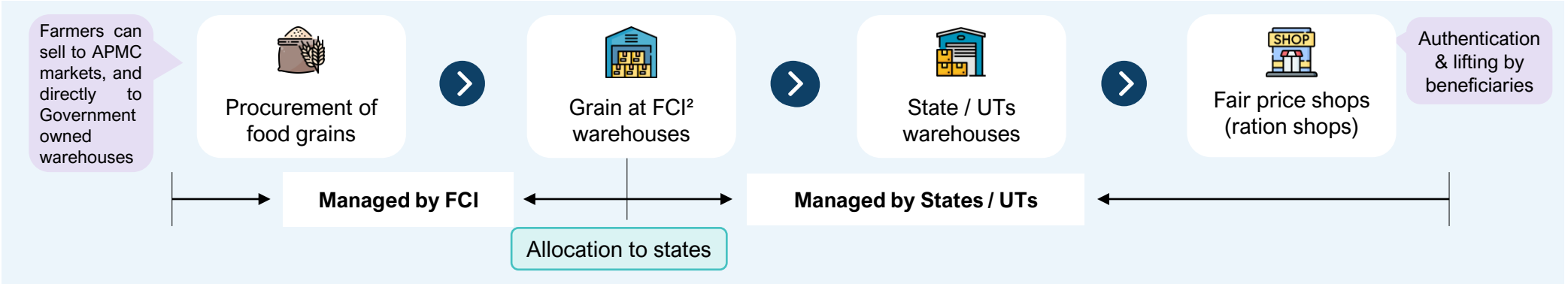
Note(s): P: Projected
Source(s): MPEDA report, secondary research, Praxis analysis

Farmers rely on distributors and brand OEMs for input procurement, selling the output is largely reliant on local mandis and ration shops (1/3)

Farmer's operational model



Government's procurement model from farmers

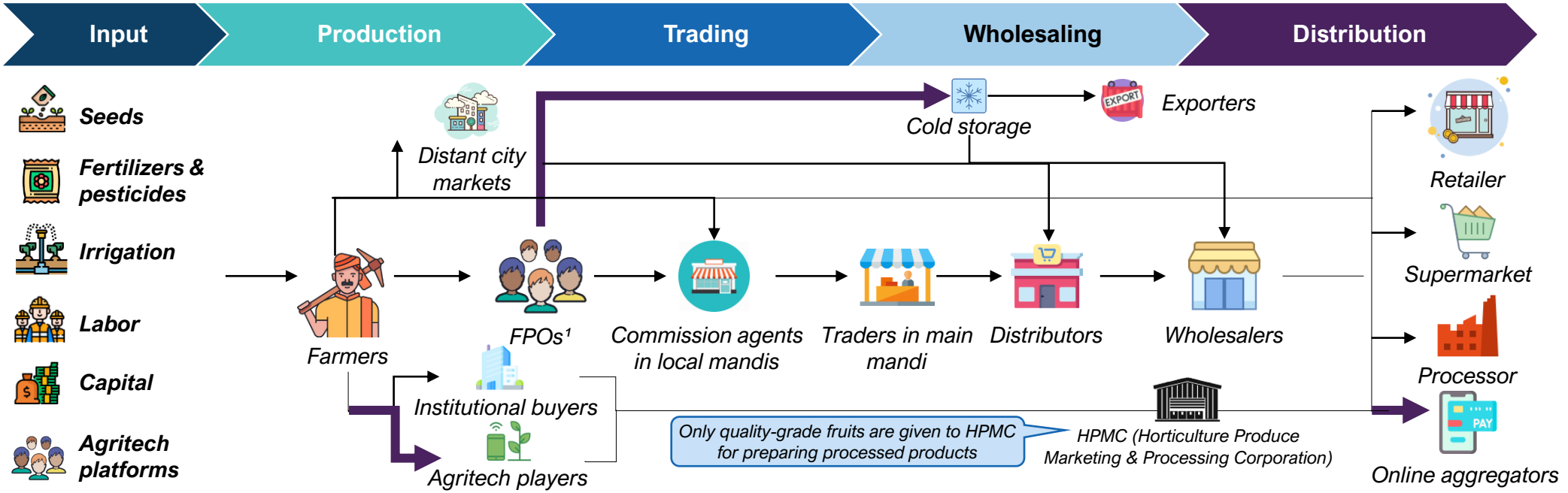


Note(s): 1: OEMs: Original Equipment Manufacturers; 2: FCI: Food Corporation of India; 3. FPOs: Farmer Producer Organizations
Source(s): Industry reports, Secondary research, Praxis analysis

Technological approach

Horticulture input chain is like core agricultural input linkages; however, the output chain relies on storage and FPOs due to perishable nature of some goods (2/3)

Horticulture output chain linkages



Logistics / Distribution:
- Distributors offer allied services like warehouse, cold storage, farm dispatch and delivery
- Logistic providers offer distribution and supply chain management, and transportation at competitive costs

Government:
- Under the Public Distribution System, Central Government procures commodities from farmers at MSP[2], to be distributed at Fair Price shops
- Government policies and initiatives help boost the agricultural ecosystem

Retailers / wholesalers:
- Retailers / wholesalers procure items from various channels to be sold to the end consumer
- Local mandis (APMC markets) buy products from farmers at wholesale prices and further sell to retail outlets

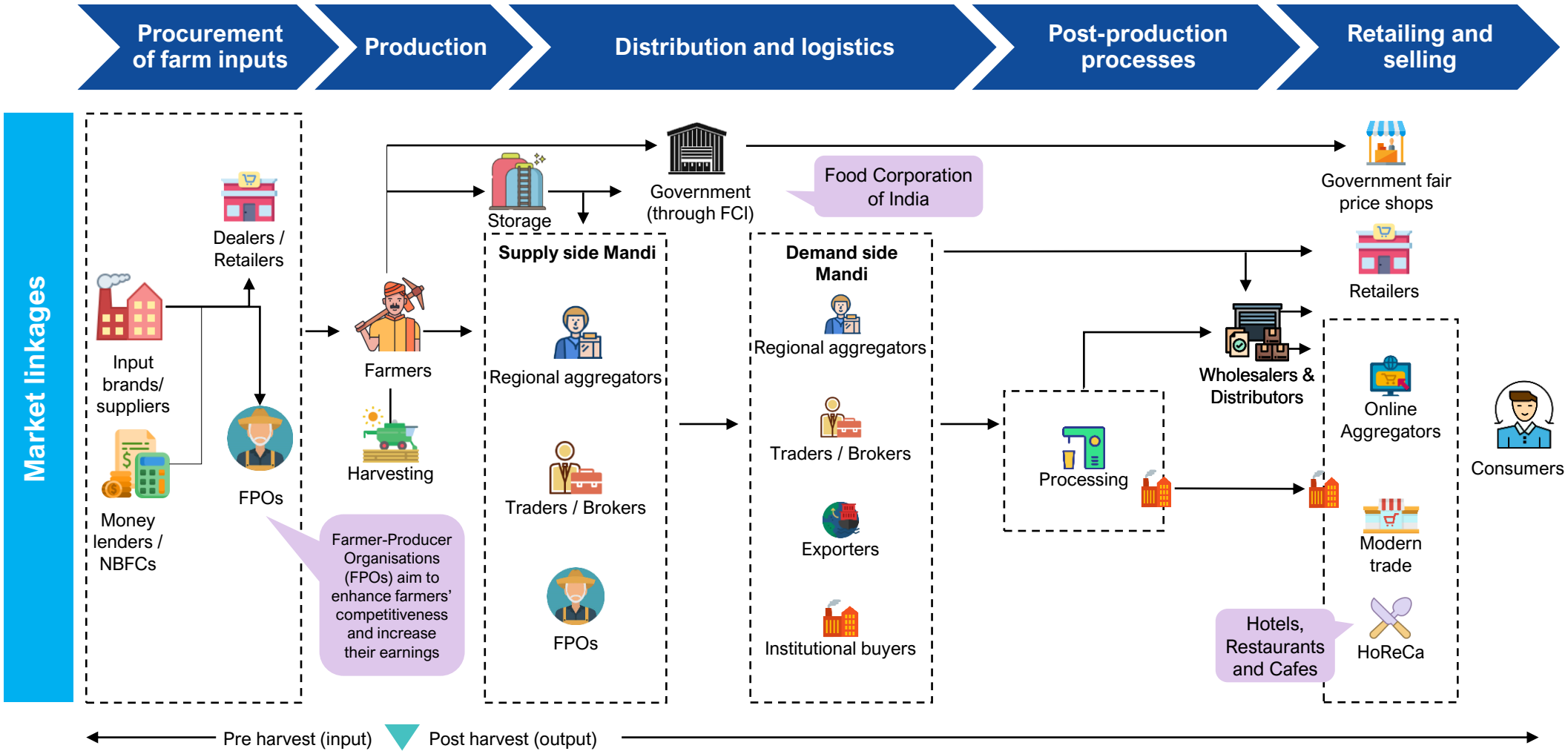
Agritech platforms:
- Enable farmers to get higher margins
- Assistance in crop grading and packaging
- Exposure to market and brands
- Provide platform to access better-quality inputs
- Scientific guidance in terms of usage

B2B procurement:
- Large farmers and FPOs can procure seeds, fertilizers, hardware, etc., from Original Equipment Manufacturers (OEMs)
- Institutional buyers purchase products from farmers (through distributors) for further processing, distribution, or retail

Note(s): 1. FPOs: Farmer Producer Organizations, 2. MSP: Minimum Support Price
Source(s): Industry reports, Secondary research, Praxis analysis

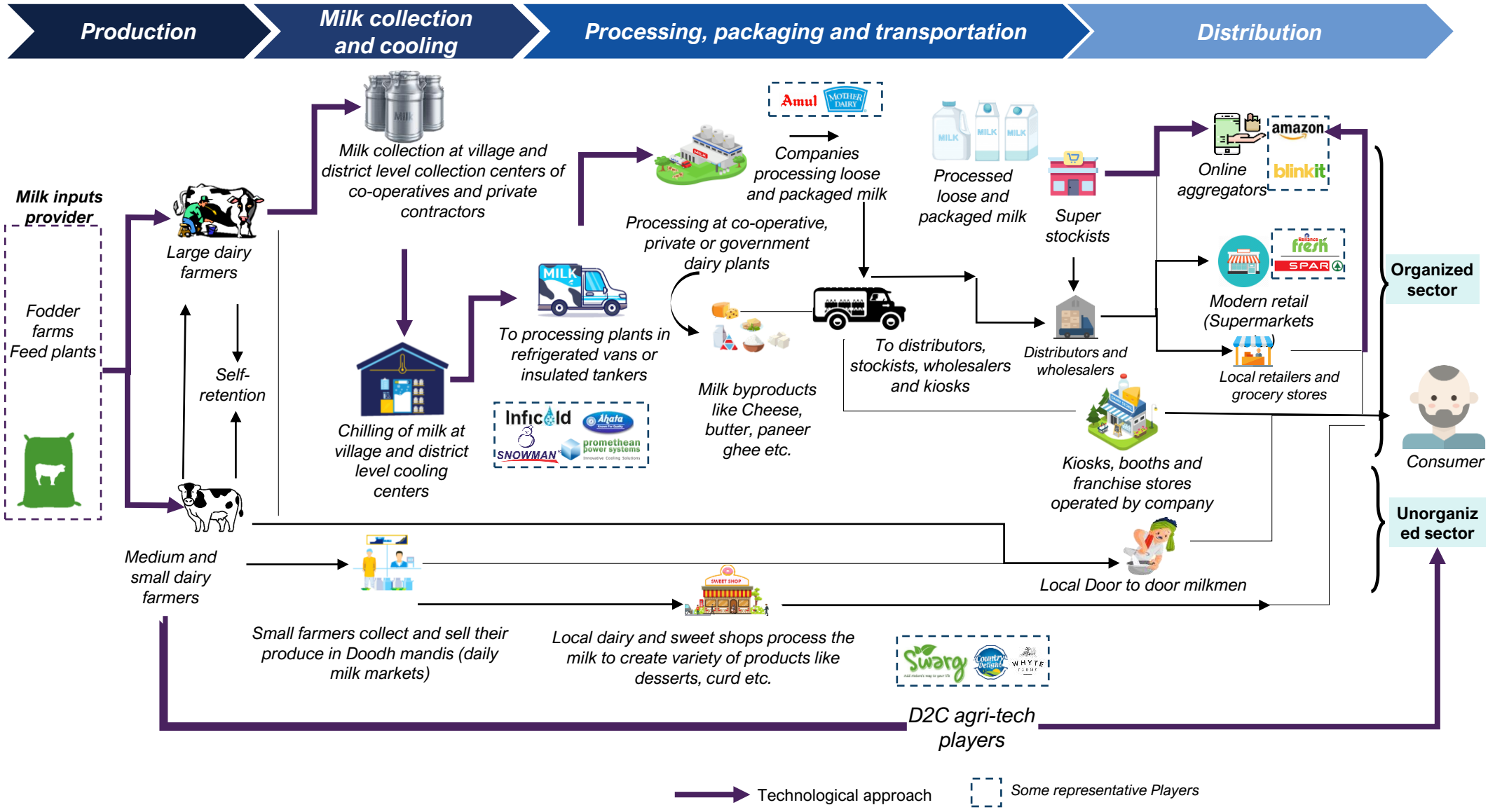
Technological approach

Core agricultural supply chain is fragmented, creating opportunities for disruption and innovations by Agritech players (3/3)



Note(s): 1. FPOs: Farmer Producer Organizations
Source(s): Industry reports, Secondary research, Praxis analysis

The supply chain for milk is quick & agile as fresh produce is processed and delivered daily



Note(s): Self-retention means retaining some quantity of the produce for local supply and self-consumption
Sources(s): Praxis analysis

The end-to-end process of the fisheries supply chain model needs to be quick due to the perishable nature of the product

Production & Procurement | **Handling, processing & trading** | **Consumption**

Domestic consumption

Fishing

Local Fishermen

Marine fishing

Inland fishing

Fish farming

Fish farmer

- *Discard and bycatch*
- *Preserving*
- *Transferred to shore*

Broker

- *Auction at the shore*
- *Buys from fisherman or farmer*

Wholesaler

Sorting and processing

Dry fish – sun dried, salted and smoked

Raw fish– grading and icing

Door to door sellers / local mandis

- *Weighing, icing, cutting and gutting*

Final consumers

Restraunts

Brokers/agents buys fish from fish farmer

Fishes are canned to increase shelf life

Raw fish– grading, icing and packing

Online retailers for canned fish

Online retailers for fresh fish

amazon.in | Flipkart | Licious | Fresh to home

Exports

Fish farming

Large scale business tie up with fish farmers and

Procure fish from farmers or owned harvesting reservoirs

- *Chemical and mechanical process operations to preserve the fish.*
- *Entrails is removed to extend the shelf life of fish*
- *Adopted sophisticated measures for processing*

Export products

- *Canned fish for export*
- *Export quality frozen fish*
- *Dried first for export*

Avanti Feeds Limited | KINGS | APEX

Products exported to various international countries USA, China & UAE, are the major importers of Indian seafood

Distributors and wholesalers

End consumer

Retailers | **Restraunts** | **Large scale businesses** | **Final consumers**

Some representative Players → Technological approach

Source(s): Secondary research, Praxis analysis

Government schemes, incentives & initiatives

Variety of programs were launched by government to improve farm and produce quality along with efficient market place and infrastructure for Agriculture sector

February 2016 — PMFBY

Pradhan Mantri Fasal Bima Yojna

- **Stabilizing farmers'** income during losses and damages due to unforeseen issues
- Enables **continued farming activities** by **flowing credit** into Indian Agriculture
- Enhances **food security and growth** along with **diversification and competitiveness**

March 2018 — Jaivik Kheti

Jaivik Kheti — Rasayan Mukt Bharat

- Aims to **facilitate and promote organic farming** through a knowledge base and e-commerce platform
- Maintains **repository** of videos, case studies, and best practices
- E-commerce platform that **interlinks buyers and sellers** for Indian Agriculture
- **Organic products** like grains, pulses, fruits, and vegetables

July 2020 — Soil Health Card Scheme

सॉयल हेल्थ कार्ड — स्वस्थ धरा, खेत हरा

- Objective is to **improve soil health, quality and its fertility**
- **Issues soil health card to farmers** every 2 years
- **Educates farmers** and **addresses** any nutritional **deficiency** in fertilization process
- Provides **information to farmers on** appropriate **dosage of nutrients**

February 2019 — Agriculture Infrastructure Fund

- **Aims to create** post-harvest infrastructure and **community farming assets**
- Provides **medium to long term debt** financing till 2025-26
- **Credit available** to farmers **at 3% interest subvention**
- **Provision of credit guarantee support** to farmers, on the loans

July 2022 — eNAM (PoP)

eNAM portal was launched in April'16 whereas eNAM PoP started in July'22

E-National Agriculture Market (Platform of Platforms-PoP)

- Farmers sell produce directly via **National Agriculture Market** started in 2016
- Promotes uniformity with **real time price discovery**, and **remove information asymmetry**
- Connects buyers and **farmers**, **sellers** for local aggregators and **commission agents**

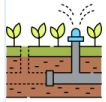
Source(s): Government reports, Secondary research, Ministry of Agriculture & Farmers' Welfare website, Praxis analysis

Government policies aim at increasing sales, distribution, protect farmers and environment with use of renewable energy, to maximize Agricultural output & growth

Schemes/regulations	Date		Description	Focus area
New Farm Laws (WIP)	**2021**		• **These laws were passed to** – Establish a framework for **contract farming** – Facilitate **barrier free trade** of farmers' produce outside the states under APMC laws – **Regulate supply** of certain food items under extraordinary / uncertain circumstances	**Sales and distribution**
Amendments to Farmer Producer Organization Act	**2020**		• **Legal entity formed by farmers** who **share profits** among its members and provides other facilities which is aimed at **protecting farmers' interests** • **Facilities like** credit, assistance for production, processing, marketing, storage, export & import of agricultural produce are **provided to the farmers** • **Better income** for producers and higher **bargaining power** to farmers	**FPOs**
Contract farming act	**2020**		• Allows large agribusiness corporates to sign deals with farmers • **Offers assurance & security to farmers** that output will be purchased • **Offers flexibility to Agri business corporates** as they can now ask farmers to grow their desirable crops as per the contract	**Growth and Privatization**
Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance	**2020**		• Ends the monopoly that state-authorized mandis have on buying produce from farmers and selling it downstream • **Removes barriers for interstate trading** of agricultural produce • Aims to achieve **higher growth** and **unrestrictive buying and selling** of agricultural produce	**Sales and distribution**
Pradhan Mantri Kisan Maan-Dhan Yojana (PM-KMY)	**2019**		• This scheme is for farmers who are **aged 18-40 years** and have **registered under pension fund** • It aims to provide a minimum **monthly income of INR 3K** to farmers **above 60 years of age** • **Farmers' cooperation and welfare department of agriculture** started this for welfare of farmers	**Farmers' retirement benefits**
PM Kusum	**2019**		• **Subsidizes farmers** across India to install solar pumps, grid connected solar and other renewable energy power plants (REPP), reducing their dependence on **diesel and kerosene** • **Enhance farmers' income** and implement **eco-friendly irrigation** to generate **safe energy**	**Renewable energy**

Source(s): Government reports, Secondary research, Praxis analysis

Since India has varied climate & geography across states, focus of government has gradually moved to cater nationwide agricultural requirements through laws & regulations

Schemes/ regulations	Date		Description	Focus area
Micro Irrigation Fund	**2019**		• Aims to **boost agriculture production** and **farmers income** via a dedicated **INR 5000 Cr fund** • **Objective is to** bring more land area **under micro-irrigation** with **potential of 70 million hectares** as against **current coverage** of only **10 million hectares** • Fund is **set up under NABARD** which will lend amount to states at **concessional rates of interests**	**Micro-irrigation**
PM – AASHA	**2018**		• Protect the income of the farmers through PM-AASHA which is aimed at ensuring that **farmers get remunerative prices for their produce** thereby stabilizing their income	**Farmers income protection**
PM Kisan Samman Nidhi Yojana (PM-KISAN)	**2018**		• Intended to support small farmers by making them strong to be able to **sustain farming activities** • **Provides income support** to all land-holding farmers to help them buy various farm implements • It's objective is to **transfer an annual amount of INR 6K** into marginal farmers' account	**Farmers' sustainability**
JOHAR	**2017**		• Launched a program "**JOHAR**" which **helps Jharkhand** develop climate-resilient agriculture • **Helps 2L rural** targeted households to **enhance and diversify their income** via **year-round cultivation** of vegetables and **diversifying** into pulses, oilseeds, livestock, fisheries, and more	**Enhancing rural income**
Paramparagat Krishi Vikas Yojana (PKVY)	**2015**		• Aims to promote organic farming and bring **5 lakh acres of agricultural land** under organic farming • Each farmer that enrolls for this scheme is entitled to get **INR 20K per acre** of agricultural land • Focuses on establishing **10000 clusters** over coming years with **each cluster having 50 farmers**	**Organic farming**
Neem Coated Urea (NCU)	**2015**		• Reduces cost of cultivation, improves soil health, and increases yield of **sugarcane**, **red gram** • Govt made mandatory for all indigenous producers of urea to **produce 75%** of total subsidized urea as **Neem Coated Urea**; **MRP** for farmers hiked by **5%** charged by fertilizer manufacturers	**Neem Coated Urea (NCU)**
Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)	**2015**		• Scheme for **development of commercial organic farming** in Northeastern Region aimed at transforming farmer **clusters into FPOs** and providing **support from farm to fork** • FPOs **supplies output to B2C companies** like Big Basket, Big Bazaar and many more • Roped in ~83K farmers, ~170 FPOs, covered ~75K ha area with per year area **target** of **1L ha** • Started with **average annual allocation** of INR 134 Cr; Now increased to **INR 200 Cr per year**	**Commercial organic farming**

Source(s): Government reports, Secondary research, Praxis analysis

Government introduced various subsidies focused towards farm inputs, farm infrastructure, financing, and sales and distribution of farm produce

Type of subsidy		Important government subsidies	Focus area
Seed subsidy		• Provision of **high yielding seeds** with **future payment** alternatives, at **reasonable prices** • **Research and development activities** are undertaken by the government to generate prolific seeds	**Raw materials**
Fertilizer subsidy		• Government ensures **cheap inputs to farmers and stability in fertilizer prices** via this subsidy • **Reasonable returns** to manufacturers are provided along with availability of **needed fertilizers** to farmers	**Raw materials**
Irrigation subsidy		• Provision of **irrigation services at lower cost** than the market rate with **minimal fees** from farmers • Includes provision and construction of **irrigation infrastructure** like canals, dams, tube wells, pumps	**Infrastructure**
Power subsidy		• Government provides **electricity at a cheaper rates** to farmers than their cost or market price • Under MNRE, farmers to get 75% subsidy on solar pumps which consume 3-10 horse-power • Farmers have started using proper irrigation tools; **increasing agricultural productivity,** both in terms of yields per hectare and cultivated hectare	**Infrastructure**
Export subsidy		• **Financial incentives** provided to **increase exports** • Provided to farmers to **help them compete on a global scale** and **promote agricultural exports**	**Sales**
Credit subsidy		• Difference between **interest charged** to farmers and **actual rates**, with other expenses like bad loans • **Due to absence of funds and collateral,** farmers cannot purchase agriculture **equipment or get loans** • Local money lenders charge **higher interest rates** whereas not all banks cater to **agricultural financing**	**Finance**
Agriculture Equipment subsidy		• **Sub-Mission on Agricultural Mechanization** (SMAM), **Rashtriya Krishi Vikas Yojana** (RKVY), **National Food Security Mission** (NFSM), etc. are various schemes for farmers • These subsidies are provided to farmers **through State Governments** under different types of schemes	**Infrastructure**

Notes: MNRE: Ministry of New and Renewable Energy
Source(s): Government reports, Secondary research, Praxis analysis

Government introduced various schemes focusing on development of FPOs which are vital to growth in farming

Body	Type of scheme	Launch date	Important government schemes
Banks and Financial Institution	Special Liquidity Facility	2020	• It's objective is to ensure continuous flow of credit from banks to farmers to carry out their agricultural operations, amidst COVID-19 pandemic • Provides front end monetary aid to Regional Rural Banks, Cooperative banks and Monetary Financial Institutions
Small Farmers Agribusiness Consortium (SFAC)	Venture Capital Assistance Scheme	2014	• Support entrepreneurs by **promoting and training** them to **set-up agribusiness projects** approved by RBI and banks • **Assist backward linkages** of Agribusinesses with producers and provide assured markets to the producers
Centrally Sponsored Schemes	eNAM – National Agriculture Market Scheme	2022	• Pan-India **electronic trading portal** that connects existing APMCs and other markets to a **unified national market** • Market for **agricultural commodities** that enables **interstate trading via an online portal** of physical mandis
	Re-vamped National Food Security Mission	2018	• **Enhancing soil fertility, productivity and farm level economy / profits,** to restore farmers' confidence • **Area expansion and productivity enhancement** in a sustainable manner to increasing production of variety of foods
	Operation Greens	2018	• Centrally sponsored scheme for **development of Tomato, Onion and Potato** value chain with allocation of INR 500 Cr • Aims to build capacity to **stabilize** prices, reduce post-harvest losses, provide logistics, prevent **distress sale**, and more
State Government Schemes		NA	• Formation of FPOs on a **large scale** through state financed programs and provision of easy issue of **licenses to FPOs** • **Maharashtra, Odisha, Punjab, Kerala, Karnataka, Madhya Pradesh, Andhra Pradesh and Karnataka** are a part of it

eNAM portal was launched in April'16 whereas eNAM PoP started in July'22

Source(s): Secondary research, NABARD report, Praxis analysis

Government policies aims at increasing quality milk production, developing infra and strengthening supply chain to maximize milk output and growth

Schemes/ regulations	Launch Date	Description	Focus area
National Programme for Dairy Development (NPDD)	**2021** 	• Aims to enhance quality of milk and milk products and **increase share of organized milk procurement** • The scheme has **two components:** – Component 'A' focuses towards **creating/strengthening of infrastructure for quality milk** testing equipment as well as primary chilling facilities for State Cooperative Dairy Federations – Component 'B' provides financial assistance from Japan International Cooperation Agency (JICA) as per project agreement already signed with them	**Quality milk procurement**
Animal Husbandry Infrastructure Development Fund (AHIDF)	**2020** 	• To help **increase milk and meat processing capacity** and product diversification • To make **available increased price realization** for the producer • Develop **entrepreneurship and generate employment** • **Promote exports** and increase the export contribution	**Infrastructure development**
Supporting Dairy Cooperatives & Farmer Producer Organizations	**2020** 	• To assist the State Dairy Cooperative Federations by **providing soft working capital loan** to tide over the crisis on account severely adverse market conditions or natural calamities • To provide **stable market access** to the dairy farmers • Enable state Cooperative Dairy Federations to continue to **make timely payments of dues** to the farmers • Enable the cooperatives to **procure milk at a remunerative price from the farmers**, even during the flush season	**Sales and distribution**
Dairy processing & Infrastructure Development Fund	**2017** 	• Aims at **modernizing the milk processing plants** and machinery and create additional infrastructure for processing more milk • Provide **subsidized loan @6.5%** to capital stressed milk cooperatives for primarily replacing their decades old chilling and processing plants and addition of value-added product plants	**Growth and Infrastructure**
Rashtriya Gokul Mission (RGM)	**2014** 	• Implemented for **development and conservation of indigenous bovine breeds** • Aims at : – Enhancing **productivity of bovines** and increasing milk production in a sustainable manner – Propagating **use of high genetic** merit bulls for breeding purposes – Enhance **Artificial insemination coverage** through strengthening breeding network and delivery of Artificial insemination services at farmers doorstep	**Production**

Source(s): Department of animal husbandry and dairying, Secondary research, Praxis analysis

Government schemes aim to boost the fisheries sector's growth, create employment opportunities, and improve the living standards of fishermen

Schemes/ regulations	Launch Date	Description	Focus area
National Fisheries Development Board (NFDB) Scheme	**2021**	• Scheme aims to **promote the development of the fisheries sector** by providing financial assistance to fish farmers, entrepreneurs, and other stakeholders	**Infrastructure**
Pradhan Mantri Matsya Sampada Yojana (PMMSY)	**2020**	• Aims to **enhance fish production by an additional 70 lakh tonne** by 2024-25 and create employment opportunities • Scheme has a total outlay of Rs. 20,050 crore and is implemented over a period of 5 years	**Production**
Fishery and Aquaculture Infrastructure Development Fund	**2018**	• Provides **financial assistance to the fisheries sector** for the development of infrastructure, including fishing harbours, cold storages, fish processing units, and fish markets	**Financial assistance**
Sagarmala Scheme	**2015**	• Scheme aims to promote **port-led development** and enhance the fisheries sector's contribution to the country's economic growth • Scheme has a total outlay of INR 8,000Cr	**Infrastructure**
Blue Revolution	**2015**	• Scheme focuses on **increasing the productivity** of aquaculture and fisheries, enhancing the livelihood of fishers • Creating **employment opportunities** • Scheme has a total outlay of Rs. 3,000 crore	**Production**
National Scheme for Welfare of Fishermen	**NA**	• Scheme provides **financial assistance to fishermen** for their welfare and development • Facilities include **insurance coverage, assistance during natural calamities, and provision of houses and community halls**	**Financial assistance**
Development of Inland Fisheries and Aquaculture	**NA**	• Scheme aims to **increase the productivity of inland fisheries and aquaculture** and provide **training and capacity building to stakeholders**	**Production**

Source(s): Department of animal husbandry and dairying, Secondary research, Praxis analysis

Agricultural value chain is riddled with a lack of awareness of best practices & technology, causing inefficiencies and leading to financial and production losses

Challenges faced in the agricultural sector

Input

1. **Credit-dependent business** with high gestation period
2. **High dependence** on traditional channels which increases costs
3. **Legal complexity in storage and sales** of certain input material
4. **Few large farmers & FPOs have access** to all types of buyers

Advisory

1. **Lack of knowledge** about modern practices to improve yields because of poor tech and internet penetration
2. **Soil testing programs are time consuming**, and private labs are located far from the village
3. **Limited awareness and high consulting costs** for the range of input materials available in the market

Storage & handling

1. **Lack of good quality** or affordable warehouses
2. **Limited availability of warehouses** that are closer to mandi during peak season
3. **Mishandling of farm produce during logistics & storage** causes higher wastage of the produce
4. Competitive primary buying due to the **involvement of multiple buyers' stakeholders**

Output

1. **Long / disjointed supply chain**, too many non-value adding players / layers
2. No controls over **quality of raw material** sourced in the absence of adherence to grading by the producer / intermediary
3. **Fragmented supply leads** to multiple touch points for procurement
4. **Distantly located mandis** with poor infrastructure

Financing

1. **Fragmented market** with high involvement of informal lenders who exploit farmers
2. **Limited data** to understand the risk profile
3. Lack of **banking facilities** in rural areas
4. **Harvest and post-harvest losses** of major agricultural production, leading to financial losses

Source(s): Secondary research, Praxis analysis

Challenges

India's agricultural output market is large, aided by co-operatives & FPOs but growing with low technology penetration results in output wastage

~910 M MT

Agricultural output* in FY23

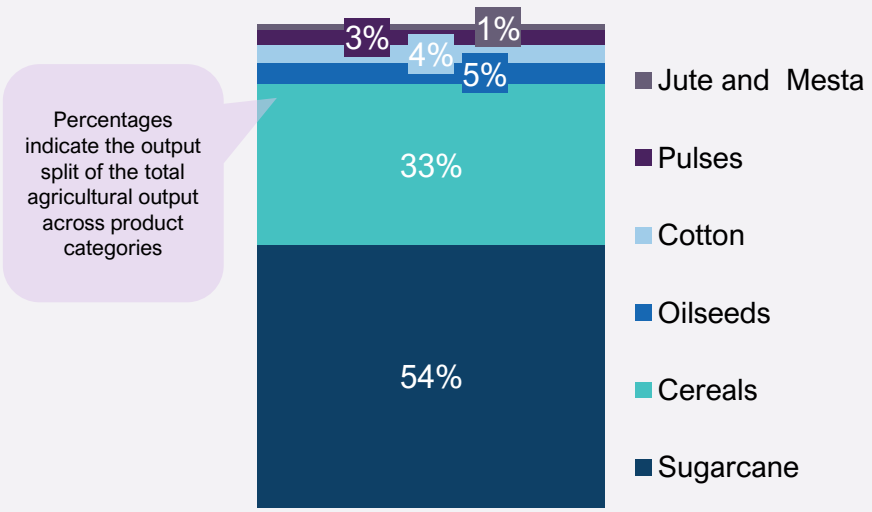
7%

Consumer spending on agricultural produce

~1%

Tech penetration in agricultural sector

Total agricultural output and production split (M MT, FY23)



Efficiencies in the ecosystem driving output growth

- **Technological interventions** that help increase output
- **Innovations in packaging** had a considerable impact on the ecosystem, **mitigating loss in the value chain** and driving profits
- **Co-operative societies** across different industries played a significant role in **creating market linkages**, ensuring farmers' participation **in price discovery and gradually expanding exports**
- **FPOs** ensure that farmers have **access to technology** related to production and provide the required support to make the value chains competitive and inclusive, **enabling a larger market reach**

Inefficiencies in Agricultural output

- Production **loss** (estimated at US$ ~11B annually), caused by inefficient transportation, warehousing & storage, etc.
- Various **intermediaries** in the value chain at every stage, drive up the costs
- Lack of **transportation** & **warehousing facilities** during peak season
- **Mandis** located in **remote, distant** areas
- **Fragmented** and **complicated** value chain

Note(s): * Agricultural output includes foodgrains, oilseeds and commercial crops production; FY23 is financial year from April'22 to March'23
Source(s): Industry reports, Secondary research, Praxis analysis

Challenges

Core agricultural processes continue to face challenges due to lack of data analytics support and market awareness, leading to low yields and sales

Value chain stakeholders that get affected by the challenges faced	Production challenges				Technological challenges		
	Quality of seeds and produce	Grading, threshing & other processing	Loss in yields	Financing/ monetary & training	Data analytics & forecasting	Market research & information	Advanced machinery
 Input suppliers, Brand OEMs, Farmers	✓			✓	✓	✓	✓
 Distributors, Storage broker		✓	✓	✓	✓		✓
 NBFCs, financing agents, FPOs			✓		✓	✓	
 Retailers, Wholesalers	✓	✓	✓	✓	✓	✓	
 Institutional buyers, Exporters	✓		✓	✓	✓	✓	
 Hotels, Restaurants, Cafes	✓		✓	✓	✓	✓	

A disruption in production, in quality or quantity, affects the entire value chain

✓ = challenge affects the corresponding stakeholder in the value chain

> *"Digitization can help, especially if there are no land records, which can create a huge problem for farmers in case of getting credit, insurance, claiming insurance. It is not that long a process, and it just requires tagging the farm, but it is difficult on a larger geographical level."*
>
> ***- Project Manager, leading Agritech player***
>
> *"Lack of trust and technical know-how act as primary barriers to adoption of Agritech players. Small farm size is a vital reason for the under-utilization of technology and developments."*
>
> ***-Project Manager, leading Agritech player***
>
> *"If some new technology is introduced in the market, there are going to be some innovative farmers who are going to opt for it, but a majority would not. Agritech is relatively new. There is difficulty while adapting to any new technology among small-scale farmers."*
>
> ***-Consultant & Founder, leading Agritech player***

Source(s): Secondary research, Praxis analysis

Dairy and fisheries sector face a lot of challenges with delivery delays, leading to financial and production losses

Challenges in Dairy sector

Value chain stakeholders that get affected	Key challenges
Dairy farmers 	• **Consistency** and quality **across the batches** is an issue • **Shortages** in supply and **credit** facilities • **Delay** in deliveries • **Low genetic potential of Indian bovines**, limited nutritious and balanced feed rations • **Inadequate veterinary care** leads to low milk productivity • **Lack of remunerative prices** due to low market prices (No MSP) and lack of elasticity in prices of milk
Logistics 	• Proper packaging solution • **Lack of chilling capacities** • **Break in cold chain** because of rise in temperatures beyond those prescribed during transportation • **Lack of trained and skilled workers** who can handle the milk processing operations hygienically and safely
Super stockist, distributors and retailers 	• **Pressure on profit margins** due to transportation cost • **Non-availability** of **required quantity** of milk • **No credit facility** given by the processors • Dealing with **consumers complaints** if they receive spoiled products **due to delays** in the supply chain which usually occur at the distributors end • **Cumbersome return process** as product might get damaged in the transit which has to be returned directly to the processor and not the distributor • **Delay** in delivery at times

Challenges in Fisheries sector

Value chain stakeholders that get affected	Key challenges
Fish farmers 	• **Lack of water bodies** to harvest fish • **Contamination** of existing water bodies with **pesticides** • **Lack of knowledge** on **technologies** related to fishing decreases the farm production and increases the cost • **Reduction in profit** due to **high wastage** of fish feeds • **Poor quality of output** in fish farming due to improper water management
Wholesalers 	• **Reduction in profit** due to **lack of product quality** tracing • **Lack** of **proper storage** facilities • **Delays in transportation** of product leading to **rotting of product** due to its perishable nature
Retailers 	• **Delays in transportation** of product leading to **rotting of product** due to its perishable nature • **Lack** of **proper storage** facilities • **Declining revenue** due to improper packaging and distribution • **Shortage** of **credit** facilities

Source(s): Secondary research, Praxis analysis

Impact of government schemes on challenges

While policies on farming advisory & resolving credit issues for farmers are in place, adoption & usage of new-age technologies are the emerging areas of focus

Paradigm shift in policies

- **Earlier**, for a long time, Indian policies related to agriculture industry **focused on production alone**
- The **focus** now has shifted to forming **policies that incorporate technology** and **help farmers in resolving credit issues** and **generating sustainable income**
- Policies are also being formed to **encourage and build start-up ecosystem around agriculture** with their technological interventions
- With **channelized focus on market linkage, farming advisory, data analytics for desired quality and quantity of yield**, government is trying to ensure **overall development** of the agricultural value chain

Impact on agricultural value chain through government initiatives

- Policies like Soil Health Card Scheme, Agri Infrastructure Fund, e-NAM platform, PM KISAN, RKVY etc. have positively impacted the agricultural value chain, thus **facilitating growth** in the agricultural sector
- There has been **improvement in soil health** with ease of soil testing, **increase in good quality warehouses and cold storages** for storage and handling, **better connectivity with markets** through online market linkages and **availability of easy credit** for farmers
  - Government has sanctioned **INR 13,681Cr for agricultural infrastructure** in India for **more than 18133 projects**
  - Nearly 1,260 mandis of 22 states and 3 UTs have been integrated on e-NAM, with **trading worth INR 2.22 Lakh Cr** recorded, **by Oct 2022**
  - PM-KISAN beneficiaries have been provided concessional institutional credit through Kisan Credit Cards (KCC) with sanction of **~377 Lakh new KCC applications** with a **credit limit of INR 4.3 Lakh Cr as on Nov 22**
- Government is also **investing in agri-tech start-ups** thus providing a **boost to the technological advancements** in the sector
  - **INR ~6.3Cr worth grants-in-aids** have been released to **nearly 1,055 startups** by different Knowledge Partners (KP) and RKVY RAFTAAR Agri Business Incubators of DA&FW

Areas to be focused for future growth

- There has been **yield of positive results** in the agriculture sector with the **implementation of various schemes** and polices by government
- However, it is still saddled with **issues**, acting as a **barrier to the overall development of agriculture** in India
  - Despite **sharp increase** in **use of micro-irrigation** with the **inception of PM Krishi Sinchayee Yojana**, there is presence of **wholly unirrigated area of 38.6%** in comparison to **34.4% wholly irrigated area** in India
- **Adoption and usage of new-age technologies across marginal landholdings** and improving **low-income levels of population solely dependent on agriculture** for their livelihood are the **key areas to be focused** on, to ensure sustainable growth of agriculture sector in future

Note(s): DA&FW stands for Department of Agriculture and Farmer Welfare
Source(s): Secondary research, Praxis analysis

Agenda

- Overview of agriculture and allied sector in India
- **Technology interventions in the system**
- Trends in agricultural sector
- Agritech sector current landscape
- Benchmarking with International markets

Technological advancements across various value chain segments are leading to the holistic growth of the agriculture sector and providing value to farmers





Value chain	Procurement of farm inputs	Production	Distribution	Post production processes	Retailing
Technological intervention	**Input market aggregation** Digital platform for unified market linkage services to connect farmers with farm inputs **Biotechnology** Technology to produce quality and hybrid seeds for better yield and nutritious food produce	**Precision agriculture through data analytics** Improving productivity through extensive use of sensors, soil mapping, weather forecasting, robotics, AI and ML **Farm automation** Automation technologies like drones, robotics and industrial machines are used for procedures like crop scanning, irrigation, seeding and weed removal for precise farming **Farm infrastructures and techniques** Indoor farming systems like hydroponics, aeroponics and aquaponics within controlled environment for production of unseasonal, nutrient rich, organic and exotic produce	**Supply chain technology** Digital infrastructure to handle entire supply chain and maintain the quality of output **Produce Traceability** Tracking the produce from farm to retailer to maintain the connectivity and supply of adequate produce **Output quality assurance** Output produce quality check analysis and monitoring to maintain the grade quality for industrial manufacturing **Output market aggregation** Digitalized marketplace for sale of output produce to respective buyers (mandis, food production companies, retailers etc.)		
Extensive technological intervention	**Financial services** Financial service help farmers with credit facilities for working capital, procurement of inputs, equipment etc along with insurance facility		**Marketplace information platforms** Online services to provide information to the farmers about technical know-how of farm equipment, mandi prices etc.		

Source(s): Secondary research, Praxis analysis

Input market linkage platforms have helped farmers with attaining favourable pricing for their high-quality seeds, fertilizers, pesticides etc.

Procurement of farm inputs

Input market aggregation

Access to high-quality seeds

- Ability to acquire high-quality seeds with better access to open input material markets
- Enhancement in the quality and quantity of the crop produce of farmers

Price transparency

- Improved access to the markets to the farmers
- Attribution of high bargaining power to the farmers in obtaining desired quality farm inputs

Marketplace information

- Provision of information to the farmers based on the best market practices
- Creation of awareness about the seeds, crops, fertilizers, pesticides, etc. for ideal crop production

Discussion forums

- Nodal point for different farmers, industry experts, and agri-entrepreneurs
- Discussion to understand and resolve various techniques and issues in farming

Challenges addressed

- **Unavailability of hybrid seeds** for high yield
- **Lack of access to the proper markets** to sell the crop produce
- **Inability to manage the quality of output** post harvesting
- **Lower yield price** offered by local buyers and mandis

Barriers to adoption

- Lack of technical know-how in the rural area
- Reluctancy of the farmers to use such platforms
- Inability of the ecosystem to remove the middlemen and the traders of agricultural commodities and products

Agritech players

NUZIVEEDU SEEDS, FARMGO, Isankarts.com, agribazaar, AgroStar, BigHaat.com, OneAgri, DeHaat, unnati

> *"Input market platforms have been providing farmers with relevant information and awareness towards procuring higher quality of seeds, fertilizers, pesticides etc in order to help them with producing a crop with higher yield. Usage of higher quality of seeds and consumption-friendly fertilizers helps farmers to produce organic and healthy crops for the end consumers"*
>
> ***- Growth partner, Leading Agritech***

Source(s): Secondary research, Praxis analysis

Players providing both input and output services

Biotechnology techniques have increased crop resistance against diseases, alongside boosting chemical tolerance and nutritional value

Procurement of farm inputs

Biotechnology

Genetic engineering

- Combination and modification of multiple genes
- Intentional altercation of the framework or characteristics of an organism to get desired quality output

Somatic hybridization

- Combination of multiple genes of plant species to produce a plant with desired qualities to yield disease resistant crop

Embryo rescue

- Nurture of an unmature plant embryo in a controlled environment for its survival
- Usage of this technique to preserve the nearly extinct seeds

Micropropagation

- Production and conservation of plasma of medically vital plants on large-scale
- Production of multiple clones of a single species of plants

Challenges addressed

- **Unavailability of hybrid seeds** for high yield
- **Lower resistance of the crops against diseases**
- **Lower nutritional value** of the crop produce
- **Lower chemical tolerance** of the yield

Barriers to adoption

- Lack of technical know-how in the rural area
- Unawareness towards usage of proper seeds
- Reluctancy of the farmers to use new-age technology
- Uncertainty among farmers about the performance

Agritech players

NUZIVEEDU SEEDS, mahyco, InnoTech AgroFertilizers, ARANYA PARIDHI, nu-genes, Agret, TELLURIS BIOTECH

> *"With intervention of technology in the past few years, high yielding variety of seeds are coming up, along with tractors, drones, and robots for specific tasks that leads to efficiency and ease of operations."*
>
> *-Founder, Agritech platform*

Source(s): Secondary research, Praxis analysis

Data analytics and precision agriculture has paved way for higher yield and better quality produce

Production

Data analytics and Precision Agriculture

Digital Crop Mapping

- Advice for a specific crop to be produced for precise yield for the season
- Advice based on the quality of soil, climate and region,

Fertilizers Recommendation

- Estimation of deficiency and abundance of the soil nutrients based on examination of the soil
- Recommendation for a suitable fertilizer

Weather Prediction

- Continuous weather prediction carried out for the region
- Safeguarding the farmer against any crop damage due to unseasonal-rain

Disease Detection

- Disease detection done on the crop yield through analysis of soil and yield
- Recommendation of any pesticide against the disease

Auto Irrigation System

- Auto irrigation system devised through analysis of rain in the region and crop yield
- Certainty of sufficient water irrigation in the soil to flourish the crop yield

Challenges addressed

- Crop destructions due to **unseasonal rainfall**
- Yield reduction due to **nutrient deficient soil**
- **Unavailability of Data & insights** to guide use of resources, such as water and labour
- **Early detection of diseases** for taking necessary measures

Barriers to adoption

- Culture & Perceptions of the Users
- Small Farm Size
- Heterogeneity of Cropping Systems & Market Imperfections
- Lack of Local Technical Expertise
- Data Availability, Quality & Costs

Agritech players

AgroEdge, DeHaat, Dirghadhi Technology Pvt. Ltd., FarmERP, BharatAgri, Knotebook Networks, BlackEye, Fasal, farmagain, Cropin, EkoSight, InventoHack, Survis, Alphaev Technologies Pvt. Ltd.

> *"Precision farming is acting as a catalyst to ensure quality output by using machine learning by mapping the coordinates for plantation , spraying pesticides with upto 2-3 cm precision and irrigation. This would help farmer in a long way though 90% of farmers continue to spray excess pesticides and over irrigation leading to reduced crop quality."*
>
> ***- Growth partner, Leading Agritech***

Source(s): Secondary research, Praxis analysis

Farm mechanization has aided to the shortage of labour in peak season as well as reduced the deferred cost of labour

Production

Farm automation

Harvesting machines

- High quality harvesting machines that help the farmers in cropping the produce and stacking them away from the waste

Drone farm scan and seeding

- Scanning and viewing of entire farm through drones
- Help in seeding for precise crop growth in the farm region

Farming Robots

- Help of farming robots in harvesting, threshing and stacking the yield in a homogeneous way

Drone and robot weeding

- Identification of weeds through drones
- Removed of weeds by robots from the high yield produce in farm to keep up with the produce

Automated Drone irrigation

- Use of various machines in automated drone irrigation to irrigate the produce with the precise quantity of water requirements

Challenges addressed

- **Labour shortage in peak season**
- **Labour cost and productivity issues**
- **Uneven seeding** during peak season
- **Scarce / over-irrigation / untimely irrigation** to crop yield

Barriers to adoption

- Lack of technical skills & training mechanism
- Economic viability of solution considering small farm size
- Uncertainty among farmers about the performance
- Lack of financial assistance to encourage adoption

Agritech players

OURANOS, SOILSENS, Intech Harness Pvt. Ltd., Kastur automation, grene ROBOTICS, TARTAN SENSE, GRoboMac, NIYO AGROTECH, JAYA Infotech LLP, RproARVE, Sand Bird Research And Development Pvt. Ltd., AI-GENIX INTERNATIONAL PVT. LTD., Krishigati, AEDAA, TerraCroft

> *"Farm automation would definitely reduce the disguised employment on the fields and would also help farmers with precise handling of the crop produce on a very large scale. The adoption for farm automation is still very low due to small farm holdings of majority of the farmers"*
>
> ***- Revenue Manager, Leading Agritech***

Source(s): Secondary research, Praxis analysis

In a well-managed indoor farming facility, production can increase 3 to 10 times as compared to conventional agriculture in the same arable land

Production

Indoor farming (Farm infrastructures)

Growing of crop in a controlled environment with precision farming practice and artificial light to yield a high-quality crop

Vertical farming

- It is a controlled - environment agriculture process which aims to optimize plant growth, and soilless farming techniques in vertical stacks

Hydroponics

- Hydroponics is a technique of indoor farming wherein the plants are grown in a controlled environment in tubed filled with water

Aeroponics

- Plants are grown in a controlled environment in air. Under this technique, nutrients are supplied to the plants through mist spray

Aquaponics

- Under aquaponics, plants and fishes are grown together in a culture. The plants rely on fishes for their nutrition

Challenges addressed

- Lack of **arable land** in certain regions
- **Farming with limited resources**
- Lack of **technology-driven** farming techniques
- **Lower control over input-output efficiency** during the crop cycle

Barriers to adoption

- Lack of local technical expertise
- High opportunity cost
- Lack of institutional support to guide during the total cropping period
- Lack of financing and insurance mechanism

> *"With indoor farming, Production increases 3 to 10 times in the same amount of space. Many crops can be produced twice as fast in a well-managed hydroponic system. Indoor farming in a climate-controlled environment means farms can exist in places where weather and soil conditions are not favorable for traditional food production."*
>
> ***- Product Manager, Leading Agritech org***

Source(s): Secondary research, Praxis analysis

Hydroponics helps in producing disease-free and organic crops to meet the changing consumer demands

Production

Farming Techniques

Hydroponics

Nutrient Film Technique

- With this technique, plants are grown in a grow tray that it slightly angled and positioned above a reservoir filled with the water-nutrient mix
- There are two different types of NFT system:
  - Horizontal NFT System
  - Vertical NFT System

Ebb and Flow Technique

In this technique, plants are flooded with the nutrient-rich water, once the plant roots up take nutrients, water is drained to a reservoir to be reused later

Wick system

In this technique, plants are grown in an inert growing medium such as rock, wool or clay balls that help anchor the plant roots while nutrients are passively supplied to the plant from a wick or piece of string

Challenges addressed

- Disease-prone crops and plants
- Farming with limited resources
- Lack of technology-driven farming techniques
- Lower control over input-output efficiency during the crop cycle

Barriers to adoption

- Expensive setup
- Dependency on power
- High opportunity cost
- Lack of institutional support to guide during the total cropping period
- Lack of financing and insurance mechanism

Agritech players

BRIO™ | RISE | nutrifresh | urban kisaan | SHIVATV | Omdatt | JUNGA

> *"Hydroponics is a groundbreaking technology for indoor farming. For a country like India, where there resources are very limited and the arable land is scarce, such technology is a boon for the farmers. Though the affordability of the solution is on higher end, yet the solution can bring about improvements to the yield"*
>
> ***-Founder, Leading Agritech organisation***

> *"In pharma industry, hydroponics is being used to cultivate nutraceutical compounds & botanical extracts for Indian traditional medicine systems. Dabur, Himalaya and Patanjali have been major consumers for such products for their raw material"*
>
> ***-Growth manager, Leading Agritech organisation***

Source(s): Secondary research, Praxis analysis

Aeroponics resolves irrigation issues by facilitating the growth of crops in air and providing nutrients through nutrient mist sprays

Production

Farming Techniques

Aeroponics

High pressure Aeroponics (HPA)

- In the high-pressure aeroponics system, the plant roots are entirely suspended in air
- The only nutrient source they get is a high-pressure nutrient mist of 20-30 micrometers through a reverse osmosis pump, which is discharged to the roots for a few seconds every few moments

Low pressure Aeroponics (LPA)

- Low-pressure aeroponics (LPA) is also referred to as the soakponics system due to the appearance of the roots.
- The roots are always wet and drip excess nutrient mix back into the water reservoir

Ultrasonics fogger system

- Under this technique, farmers use an ultrasonic fogger to spray water into small water beads that are very miniscule in size.
- This aeroponic system is used for high-end commercial cultivation.

Challenges addressed

- Lack of water for irrigation
- Lack of arable land in certain regions
- Farming with limited resources
- Lack of technical farming techniques

Barriers to adoption

- Maintenance of mist sprays for long term
- Maintenance of nozzle for adequate nutrient mist
- Lack of readily available inputs for infrastructure

Agritech players

SV AGRI | MACRO GARDENS | Eat Neat Project

"Indoor farming as a cumulative of vertical farming, hydroponics, aquaponics and aeroponics has been growing at the CAGR of 12%"

-Founder, Leading Agritech organisation

"The consumer markets for aeroponically produced fruits and vegetables include retail and hotels, fast food chains, railway catering, foreign food service companies, defense establishments, and NGOs"

-Founder, Leading Agritech organisation

Source(s): Secondary research, Praxis analysis

Aquaponics is a dual-output farm technique as it facilitates the cultivation of crops and fishes simultaneously in a controlled ecosystem

Production

Farming Techniques

Aquaponics

Raft System

- In a raft system, plants are grown on polystyrene rafts that float on top of water in a tank separate from the fish tank
- Water flows continuously from the fish tank, through the raft tank where the plants are grown to absorb nutrients

Media filled beds

This system uses a tank that is filled with gravel, perlite or other media for the plant bed This bed is periodically flooded with water from the fish tank along with all the waste, including the solids, is broken down within the plant bed

Nutrient aqua film technique

- This technique is an extension of hydroponics, here, plants are grown in a fish beaker that it slightly angled and positioned above a reservoir filled with the water-nutrient mix

Challenges addressed

- Ability to grow crops and fishes in same culture
- Farming with limited resources
- Lack of technology-driven farming techniques

Barriers to adoption

- High cost of setting up
- Difficulty in maintaining fish and crop culture
- Continuous recycling and sterilizing water
- High opportunity cost

Agritech players

RED OTTER FARMS | LANDCRAFT AGRO | AQUAHYD

> *"By product type, the India Hydroponics market is segmented into fruits, vegetables and flowers grown primarily in Karnataka, Telangana, Maharashtra and Punjab"*
> ***-Growth manager, Leading Agritech organisation***

> *"Prominent players in the Indian indoor farming market are establishing new commercial plants in metro and tier 1 cities in collaboration between regional farmers and global technology providers to meet the growing demand for exotic and organic foods"*
> ***-Founder, Leading Agritech organisation***

> *"In a situation where farmers are dependent on soil fertility and thus, cannot produce crops throughout the year, the aquaponic technique offers a way to ensure all-year-round cultivation, enabling higher farm incomes. Because water is recirculated in this method, plants produced aquaponically can also use 10 per cent less water than plants grown in the field. This is to state that the technique does not exploit the environment for higher economic gains but uses scientific methods to create a win-win situation."*
> ***-Project Manager, Leading Agritech***

Source(s): Secondary research, Praxis analysis

Investment in Hydroponic oriented startups is high as it caters to the demand of organic and exotic produce with lower setup time

Production

Parameters	Hydroponics	Aquaponics	Aeroponics
Capital Intensity			
Setup Time			
Required Technical Awareness			
Technical awareness with Indian Farmers			
Attractiveness to Agri-Entrepreneur			
Attractiveness to Investors			
Investment deals in India			

Very low → Very High

Investment in Hydroponic oriented startups is high as it is an attractive sector for agri-entrepreneurs **due to quicker setup time, lower technical requirements** compared to aeroponics

Aquaponics requires cultivation of fishes in the plant base. Hence, **the setup time and required technical awareness is high** in comparison to hydroponics and aeroponics

Hydroponics and aeroponics require **nutrient supplements for plants in water and mist which is lower for aquaponics as there is aquaculture growing along the roots of the plant**. This helps with fresh and sufficient nutrients for the organic growth of produce in aquaponics.

> *"Hydroponics is very well accepted among farmers as it is relatively easy to maintain. In Aquaponics, we use fish excreta as a nutrient source for the crops and then recycle it. This recycling and sterilizing is a challenge compared to Hydroponics. Also maintaining fish and crop together is a challenge. In Aeroponics, the water and nutrients are sprayed in minute droplets through nozzles. The maintenance of spray, spray size, spray nozzle and nutrient composition make this technology more challenging for the farmers."*
>
> ***- Principal Scientist, ICAR - IARI***

Source(s): Primary interviews (N = 18); Inclusive of investors, startup ecosystem, farmers, intermediaries / MEs), Secondary research, Praxis analysis

Digitization of farm gate and cold chain processes has helped in resolving challenges like food wastage and low shelf life for all stakeholders

Distribution and logistics

Farm gate process

- Presence of **farmgate process** for **direct selling** of farm produce **by farmers to end consumers** like retailers, kirana stores, etc.
- Access to e-market platforms to enhance market linkages
- Presence of limited intermediaries between farmer and consumer

Cold chain process and linkages

- Availability of **cold chains for distribution within city or district**
- Cold storages, cold hubs, pack-houses available near farm gates and distribution centres to ensure food preservation

Challenges addressed

- Reduction in wastage during transmit, due to presence of warehouses near farm gates
- Removal of inedible portions with quick mechanized detection
- Improved quality of produce
- Increase in shelf life of food produced

Barriers to adoption

- Lack of technical and compliance know-how among farmers, leading to difficulty in handling
- Inability of the ecosystem to remove the middlemen and the traders of agricultural commodities and products

Agritech players

waycool | Quantrello Digital Pvt. Ltd. | Cropin | Gloverse Labs | Froots | TESSOL Viable. Reliable. Sustainable | Gramco Infratech The Rural Company

*'There are various start-ups that are aiming at minimizing the post harvest losses in the form of wastages. They are not just looking at **traceability** but also **storage** and **transportation** as these are the areas where a maximum amount of Agri output is wasted."*

-Project manager, Agritech platform

*"To improve the post processing / harvesting infrastructure, government has started doling out subsidies for stakeholders that are building **cold storage warehouses** to cater to **perishable agricultural produce**."*

-Investor

*"Some Agritech start-ups are focusing on **block-chain enabled warehousing** that enables efficient and reasonable solutions to farmers."*

-Project manager, Agritech platform

Source(s): Secondary research, Praxis analysis

E-marketplaces are making farmgate distribution systems easily accessible to consumers and B2B players, enabling direct purchasing from farmers

Farm gate processing

A total of **1,260 mandis** are utilizing the **e-NAM platform across 22 States & 3 UTs, as of 30th Nov' 22**; the platform was launched by the government to reduce the supply chain by increasing access to farmgate centers

Domestic distribution

Farmers directly selling to consumers is possible through farm gate processes

- **Processing industries**
- **Retail chains**
- **HoReCa***
- **Kirana stores**
- **Consumers**

Logistics infrastructure

- Farmgate nearby affordable warehouses
- Integrated post-harvest management
- Collection or transportation of crop
- Warehouse receipt system
- Efficient logistics from farmgate to warehouses and end-customer storage supply chain management

Digital infrastructure

- E-market platforms to enhance market linkages
- Crop quality testing through AI and image analytics
- Access to varied types of buyers - local mandi players, etc., in e-marketplaces
- Improved crop packaging to maximize net realization for farmer

> *"To solve logistical problems, farmers can start using Agritech platforms that are **providing logistics solutions**, or they can also join Farmer producer organizations that are helping small and marginal farmers with efficient faming solutions."*
>
> ***-Managing director, Agritech platform***

> *"Many start-ups are coming up in logistics space. **Storage is important** until the demand is created. Post which the logistics part must be **efficient** to reduce wastages, during transit."*
>
> ***-Founder, Agritech platform***

Note(s): *HoReCa; Hotel, restaurant and cafe
Source(s): Industry reports, Secondary research, Praxis analysis

Cold storage and supply chain processes can utilize data-driven and IoT-based approaches to maximize profits and reduce loss at appropriate costs

Cold storage process chain and linkages

Modern pack-house at farmgate

Modern Pack-house - source point at farm-gate (for fresh produce preconditioning), near a farmgate

Transport from pack-house to next stage

Long Haul Transport - from source to a wholesale buyer (stage-by-stage in the supply chain)

Cold storage (hub)

Cold Storage Hubs - Close to consumption / distribution centres, in proximity to the market

Cold storage when storing

Cold Storage Bulk – When storing at food processing premises

Ripening units (as required for products)

Ripening Chamber - Close to consumption / distribution centre, in case of select produce

Last mile retail units

Retail / Front end - Last mile merchandising and transport (distribution within city / district)

Logistics infrastructure

- Data and information captured at all the points to help decide the right logistics to deliver things rightly packed at the assured time at an appropriate cost
- Intelligent leveraging of data into actionable information
- Blockchain technology to add trust, transparency, and traceability
- Assistance in tracing complex, multi-tiered supply chains, involving many parties and operating in regulated environments

Digital infrastructure

- Use of IoT[1] to get more efficiency in the supply chain saving a ton of cost and identifying trends before they evolve into problems
- Automated data capturing to achieve clean and intelligent data
- Smart sensing of consumer behaviour and mindset through tools such as Social Media Analytics (SMA)
- Building alternative supply chain models and evaluation of risks & rewards through simulations

Note(s): 1: IoT: Internet of Things; 2. MT: Metric Tonnes
Source(s): Industry reports, Secondary research, Praxis analysis

Automated solutions for repetitive applications and risk monitoring and mitigation have facilitated reduction in human imprecision and mass customization of output

Post production processes

Biotechnology

Automation for repetitive application

- Repetitive tasks like **sorting, piling, pick and place, packaging, loading/ unloading, assembly, and spacing** done at very high speeds with precision
- Provision of **enhanced food safety and hygiene** along with **simplification of maintenance & increased human safety**

Simulation software for food-processing plant

- **Leverage of real-time data & modulation of physical system virtually** including materials, process, processing line in the ecosystem
- Performance of **testing, analyzing & optimization in the virtual world** before any physical changeover is conducted at the actual factory

Risk monitoring and mitigation

- Use of **non-thermal technologies like pulsed light and high-pressure processing** for pasteurization of liquid foods and disinfection of food package surface
- Predictive analytics to receive information on inventory refills, maintenance of food processing equipment

Challenges addressed

- Reduction in food wastage
- Overcoming human imprecision and errors
- Mass customization of output
- Conservation of produce for later consumption or sale, along with fetching a better price
- Reduction in cost for manufacturing due to automated inventory track

Barriers to adoption

- High default rates from farmers and long over-dues hindering work cycle for companies
- Inability of the ecosystem to remove the middlemen and the traders of agricultural commodities and products

Agritech players

Sohan Lal Commodity | NBHC Adding Value to Commodities | Nebulaa | Farmer by Nature | 3 Stake Labs | agricX | Intello Labs | Skyware Automation

> *"People have gradually started to realize that they can segregate and harvest **different quality of produce** into different buckets and later find the right market to sell the varied quality of produce."*
>
> ***-Growth partner, Agritech platform***

Source(s): Secondary research, Praxis analysis

High-tech robots, facilitated with smart cameras and image processing systems, have improved access to high quality produce for end consumers

Post production processes

Produce Traceability

- Enhancement in the ability **to track the movement of a produce** through specific stages of production, processing and distribution
- Help in tracking of produce
- **Enactment as a catalyst to growth & implementation of farm to form model**

Robots for quality inspection

- Robots with **high-resolution smart cameras & integrated with high-tech image processing systems**
- Precise inspection of the produce
- **Helpful to monitor the quality of food, colours, shape, volume, and labelling accuracy**

Challenges addressed

- Improved industrial raw material, fit for consumption by human beings
- Removal of inedible portions with quick mechanized detection
- Improved quality of produce
- Increase in shelf life of food produced
- End-to-end traceability and product recall in case of defection

Barriers to adoption

- High default rates from farmers and long over-dues hindering work cycle for companies
- Inability of the ecosystem to remove the middlemen and the traders of agricultural commodities and products

Agritech players

Sohan Lal Commodity | NBHC Adding Value to Commodities | Nebulaa | 3 Stake Labs | agricX | Intello Labs | Skyware Automation

> *"People have gradually started to realize that they can segregate and harvest **different quality of produce** into different buckets and later find the right market to sell the varied quality of produce."*
> ***-Growth partner, Agritech platform***

> *"Pre harvesting sector has not seen much growth. However, in post **harvesting sector**, the **return on capital is good**, thereby attracting investors."*
> ***-Founder, Agritech platform***

> *"Various Agritech start-ups have appointed agents at village level, who helps in collecting the produce from the farmers. They act as a touch point between the farmers and the Agritech players who source goods from them. This helps to **reduce wastage and increase efficiency** in the Agri value chain."*
> ***-Investor***

Source(s): Secondary research, Praxis analysis

Output market linkage platforms have helped farmers with better access to markets and favourable pricing for their farm produce

Retailing

Output market aggregation

Access to retail market

- Better access to open output material markets for sale of output produce to respective buyers like mandis, food production companies, retailers etc.

Price transparency

- Improved access to the markets for output sale
- Attribution of high bargaining power to the farmers to obtain appropriate value for their produce

Marketplace information

- Provision of information to the farmers based on the best market practices
- Awareness about the market prices, marketplaces for output sale, etc. for ease in sale

Discussion forums

- Nodal point for different farmers, industry experts, and agri-entrepreneurs
- Discussion to understand and resolve various issues related to farm output marketing and sale

Challenges addressed

- **Lack of access to proper marketplaces** for output sale
- Lower infrastructure in agricultural markets and low share of farmers' price realization
- **Lower yield price** offered by local buyers and mandis

Barriers to adoption

- Lack of technical know-how in the rural area
- Reluctancy of the farmers to use such platforms
- Inability of the ecosystem to remove the middlemen and the traders of agricultural commodities and products

Agritech players

Vyazhan technologies, BIJAK, REAL FOODS, Integrity Exports Pvt. Ltd., waycool, ninjacart, ALO AGRI, agribazaar, DeHaat, unnati

> *"The output market linkage has contributed the most. Now the farmers have more bargaining power because the output sector has become more organized as they help farmers get better prices, without many middlemen involved."*
>
> *-Consultant, World Bank*

Players providing both input and output services

Source(s): Secondary research, Praxis analysis

Technological intervention

Agri-financing has contributed to overall growth of agriculture by providing loans and advances at every segment of value chain

Financial services

Agri financing

Crop Loan

- Provision of crop loan to meet all expenses involved in raising a particular crop including various agronomic practices

Supply Chain Financing

- Aim to lower financing costs for buyers & sellers linked in a sales transaction
- Automation of transactions & tracking of invoice approval and settlement processes

Receivables Financing

- Provision of receivables financing to cover the period between the completion of sales & the actual payment
- Used to out-weigh the working capital shortage during the credit period

Farmer Credit Score

- Tool to assure the credibility of a farmer in order to provide credit, loan , insurance etc.

Agri Insurance

- Protection of agriculturists against financial losses
- Occurrence of losses due to uncertainties that may arise from crop failures/losses arising from foreseen or unforeseen perils, beyond their control

Challenges addressed

- **Unavailability of credit/ loans** on easy access
- **High costs of supply chain** and transportation for farmers/MSMEs
- Exhaustion of farmers to survive on **lower working capital** during the credit periods
- **Exploitation of farmers by local lenders**

Barriers to adoption

- Knowledge & Technical Gaps
- Dominance of local lenders in rural areas
- Issues of over-dues and default rate
- Land Ownership, infrastructure & Institutional Constraints

Agritech players

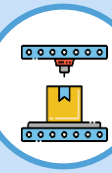
Cropin, aryaag, Samunnati, agribazaar, GRAMePAY, agriwise, Jai Kisan

> *"Only 8% of farmers in India get agricultural credit when he really needs it. The major reason behind this is the hectic onboarding process . Though new-age agritech players are getting directly in touch with the farmers but are limited to their respective geographies only."*
>
> ***-Growth partner, Leading Agritech***

Source(s): Secondary research, Praxis analysis

Technological intervention

Automated repetitive tasks using robotics acts as a catalyst to overcome human imprecision and improve output with mass customization

Stakeholders	Concerns of agricultural sector	Affects of digitalization
 **Farm Level**	• Primitive methods of farming • No control on the quality of inputs • Unavailability of reliable handling	• Precision Farming ensures fine yield • Input Market Linkages for high quality inputs • Farmgate Processing to ensure expert handling
 **Processing Level**	• Inferior quality of input raw material • Irregularities in raw material inspection • Variability of repetitive tasks like sorting, packaging etc. • Wastage of raw input and output • Input/output untraceability	• Usage of Data analytics and Farm infrastructure • Industrial robots for quality inspection • Usage of robotics for repetitive tasks & quick execution • Automation for accurate input processing • Produce tracing from farm to fork
 **Distributor Level**	• Lack of modern transportation facilities • Inadequate warehousing/cold storage • Unavailability of reliable handling of output	• Latest supply chain tech and produce traceability • Farmgate processing and cold supply chain facilities • Use of IoT and data analytics for output handling
 **Consumer Level**	• Continued dependency on seasonal products • Lack of variety of food products • Poor/unhealthy quality of products	• With high quality management, product life increases • Variety of products available through emulsification & processing • Quality products with precision agriculture & processing

Source(s): Industry reports, Secondary research, Praxis analysis

Techniques like robotic milking machines, health tracking device and digital feed management can help in optimizing the milk production

Themes	Techniques used	Challenges addressed	Description	Key Players
Standardized production quality	• Milking parlour • Robotic milking machines	• Cows have always been milked manually by hands • It is a **time-consuming activity and has labour cost associated** with it, thereby increasing the price of milk	• Mechanization and optimization of the milking process • Milking frequency **can increase by 3X per day**. • **Helped in increasing** efficiency for milk production, gets much more milk output than traditional method, consistency in product quality across batches	GEA, miRobot, DeLaval, Bhairaj Organics Pvt. Ltd., Fullwood Packo
Inadequate veterinary care and imbalance feed	• Health tracking device • TMR* feeding machine • Digital feed monitoring solution	• Access to better feeds and fodders • India **faces a net deficit of 11.2% green fodder**, 23.4% dry crop residues, and 28.9% concentrate feed ingredients in FY22	• Farmers **can track, monitor and manage cattle's health**, nutrition, behavior, pregnancy, milking frequency, milk production in real-time • Milk **yield can be increased by 20%** • **Cattle health expenses can be reduced up to 50%** through this solution, • Tracking devices also provide the complete data of their cattle	SmaXtec, Moocall, Agrosonic, COWLAR, SMARTBOW
Low genetic potential of Indian bovines	• Flow-Cytometry • Genomic selection • Gender-sorted semen technology • Embryo transfer technology	• Reducing the equal chance of getting male and female foetus and **increasing chances of female foetus**	• In **FY22, >2.5L sex-sorted semen doses, transferred around 1,085 embryos** by AMUL • Sex sorting lab with its severe quality control, focusses on removal of dead, male sperm cells to ensure **production of over 90% females** • The technology also helps in building a disease-free closed herd and improving desirable traits in a faster way • Amul has **launched a sex-sorted semen project** in 2020 under a subsidized rate for dairy farmers	STgenetics India, Amul
Milk freshness	• Pasteurization • Haelen technology • Sensor kits	• Milk is a **highly perishable product** with low shelf life • Despite treating it with pasteurization, freezing and preservation processes, it tends to go stale • **Millions of tons of milk turns stale** before timely consumption and goes waste	• Haelen technology can keep natural milk fresh in the **refrigerator for at least 60 days without using any additives or preservatives** • US scientists have pioneered a new pasteurization technique which increases shelf life of fresh **milk from 13 days to 40 days** without changing its taste or nutritional value. • IIT Guwahati scientists have **developed a smartphone-app aided paper sensor kit that can test the freshness of milk** and inform how well it has been pasteurized	
Packaging and transportation	• Charcoal cooler • Refrigerated immersion cooler or cooling rings • Plate-heat exchanger	• Storage temperature, cold chains availability, weather, perishability/shelf life, first and last-mile distance, packaging	• Most **vapour compression refrigeration systems** use compacted polyurethane foam or expanded polystyrene which **keeps the milk cool for at least 12 hours with a temperature rise of not more than 1°C** at an ambient room temperature of 30°C • **PHE technique cools milk in seconds**. The process also destroys bacteria immediately and is essential in maintaining milk quality & taste	Tapway, TESSOL, Mr. Milkman, Warehouses India

Note(s): *TMR stands for total mixed ration
Source(s): Secondary research, Praxis analysis

Fishing industries need to adopt various technological solutions that can lead to proper management and development of the sector

Themes	Challenges addressed	Technology Description	Key Players

Improper water management	• Scum in the water leads to death and poor quality of fish production in the fish farming	• **Biofloc technology**
		  • **2,766 biofloc units approved** under PMMSY till date
		  • With the usage of biofloc technology which removes waste and provides nutrition to the aquatic animals
			OCEAN GLOBAL
			Autofloc Aquaculture Pvt. Ltd

High wastage of fish feeds	• The cost of fish feed is very high
	• No proper management for feeding the fish
		• **Digital feeding**
		  • **Reduce feeding cost** by **20%**, reducing over feeding
		  • Monitor fish behaviour and health, which helps in understanding the feeding pattern
		  • Help farmers **reduce their input cost by 30%** and **increase their production by 20%**
			AQUA CONNECT
			xpertSea ecto

Poor product quality	• The quality of product cannot be traced, which can lead to buying of rotten fish
	• Reduces profitability of the wholesaler and distributor
		• **Product traceability**
		  • Increase in transparency to determine the quality of fish and **reduces wastage by 30%**
		  • Enables **tracking of fish** from harvesting to consumption
			OPTEL

Logistics and transportation	• Industry faced huge loss when it comes to transport of the fishery product
	• Unavailability of proper transport facility and improper road condition delays the product resulting to increased losses
		• **Tech-enable logistic solution**
		  • **30% increase in revenue** due to **fastest tech enabled** solution provided **to retailers for logistics and supply chain**
		  • Increased efficiency in product quality and order management
			Licious
			captain fresh Fresh to home

Improper management of resources	• Developing economies do not have tools to monitor their EEZ which leads to improper management of the marine resources	• **Smart vessel identification**
		  • Monitors EEZs, beneficial to marine resources
		  • It aims to achieve the **30% protection and conservation** of **marine resources**
			CNS Systems BigOceanData
			ORBCOMM WÄRTSILÄ

Source(s): Secondary research, Praxis analysis

Agenda

- Overview of agriculture and allied sector in India
- Technology interventions in the system
- **Trends in agricultural sector**
- Agritech sector current landscape
- Benchmarking with International markets

Since ~87% of the farmers in India are marginal farmers, indoor farming is a vital technology as it optimizes space through vertically stacked cropping

Emerging trends of the Indian agriculture sector

Buoyancy of agriculture sector

- Foodgrains production in India **touched a record of 330.5 M MT** in **FY23 with YoY growth of ~2.5% over FY22 (315.7M MT)**
- India's **agriculture exports reached ~US$ 43B in FY23 (Apr'22 – Jan'23) with growth of 6.04% over corresponding period in FY22 (US$ 40B)**. The highest-ever exports were achieved for staples like rice, wheat, sugar, other cereals and meat
- The buoyancy of crop production is attributed to modern techniques of agriculture, including:
  - DNA-modified varieties of food grains
  - Diversification in cropping pattern to maintain soil fertility and quality
  - Development of machinery and fertilizer management

Inclination towards horticulture and indoor farming

- Agriculture has expanded its horizons from food grains to extensive cultivation of fruits, vegetables, spices, dry fruits, as well as flowers, dairy, and animal husbandry
- The production of horticulture has increased from **280.9M MT to 342.3M MT** from **FY15 to FY22** while the area under horticulture has increased only 4.7M Ha **from 23.4 M Ha in FY15 to 28.1 M Ha in FY22**
  - The increase in production without significant change in cropping area is attributed to indoor farming technique
- Since **~87% of the farmers in India are marginal farmers** (with less than 2.5 acre of land), indoor farming is forming a vital technology as it allows a **stellar usage of space through vertically stacked cropping**
  - New age farming infrastructure constitutes a technology-based approach to provide **holistic protection to the crops** and **maintain an optimum growing environment throughout the crop cycle**
  - As the farmers have the flexibility to optimize everything about a plant's growing cycle, it **helps them to grow healthier and more abundant crops**. This would also help the consumers with healthy and pesticide-free food
- Though indoor farming is energy-intensive, requiring excess electricity to run various lights, pumps, sensors, cameras etc; **it is now being offset by usage of renewable energy**

Note(s): M MT= Million metric tonnes, M Ha= Million Hectare
Source(s): Secondary research, Praxis analysis

Owing to changing consumer behaviour, exotic fruits & vegetable imports to India are observing an upward movement

Emerging trends of the Indian agriculture sector

Emerging role of government and private sector

- Increased integration of the agricultural with the private sector has created a paradigm shift for both sectors. Private corporate sector has paved way for the extensive inclusion of technology in agriculture
- While the private sector has been accelerating productivity and reach through technology, government has been shaping and governing the blended framework of agriculture with technology
  - Government is facilitating **FPOs to accelerate the adoption of modern technology**
  - Development of technology platforms like “farm mech app”, e-NAM, “Krishi yantra app” etc. to spread awareness
- Increased **adoption of contract farming** along with application of quality inputs like seeds, fertilizers, pesticides, etc. for higher yield and sustainable incomes

Technological shift

- The growth of agriculture and technology has been attributed to multiple factors but improvements in **output market linkage has helped in creating a paradigm shift for the agriculture sector**
  - It has **been easier to attract farmers to the output market linkage** segment as it does not involve any additional cost to them and helps in directing their produce to get a higher price
  - Now the farmers have **higher bargaining power**. There has been a **shift towards an organized marketplace to help farmers get better prices**, without the involvement of many middlemen
- Agri-finance has also exhibited a significant impact on the growth of farmers by helping them with working capital requirements during the off-season, crop insurance, etc.

Changing consumer preferences

- There has been a paradigm shift in consumers’ eating habits. The growing exposure to foreign cuisines, and awareness towards health are influencing the eating habits of consumers
- Factors like **global warming, awareness towards zero waste, sustainability, and healthy eating habits** play a crucial role in inspiring the change
- Changing **consumer demands have influenced farmers and agri-entrepreneurs to grow organic and exotic produce**. These crops are usually grown in a controlled environment through indoor farming
- Owing to changing consumer behaviour, **exotic fruits & vegetable imports** to India are **observing an upward movement** with at **19% CAGR from FY20 to FY22**

Source(s): Secondary research, Praxis analysis

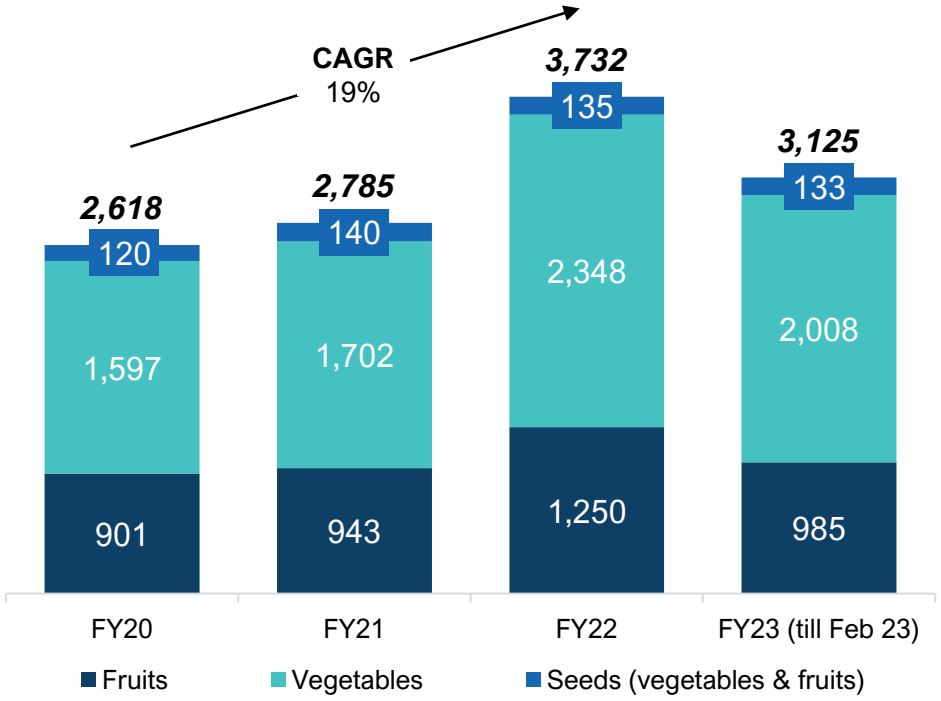
Exotic product imports by India are increasing at 19% CAGR, with Afghanistan (~16%) for fruits and Myanmar (~30%) for vegetables, being the top exporters to India

Exotic fruits and vegetables in India

- Exotic products (~US$ 3,732M) were **imported from outside of the country in FY22** and sold at a higher price in the local market
- Grown at a **low temperature**, during the winter seasons; the seeds are sown between September to November, cultivated in **poly houses**[1]
- Some of the **freshly grown organic produce** also is classified under the exotic produce category and **has growing demand**
- E.g.- Broccoli, purple broccoli, asparagus, baby corn, cherry tomato, rosemary, thyme, red cabbage, colored bell pepper, etc.

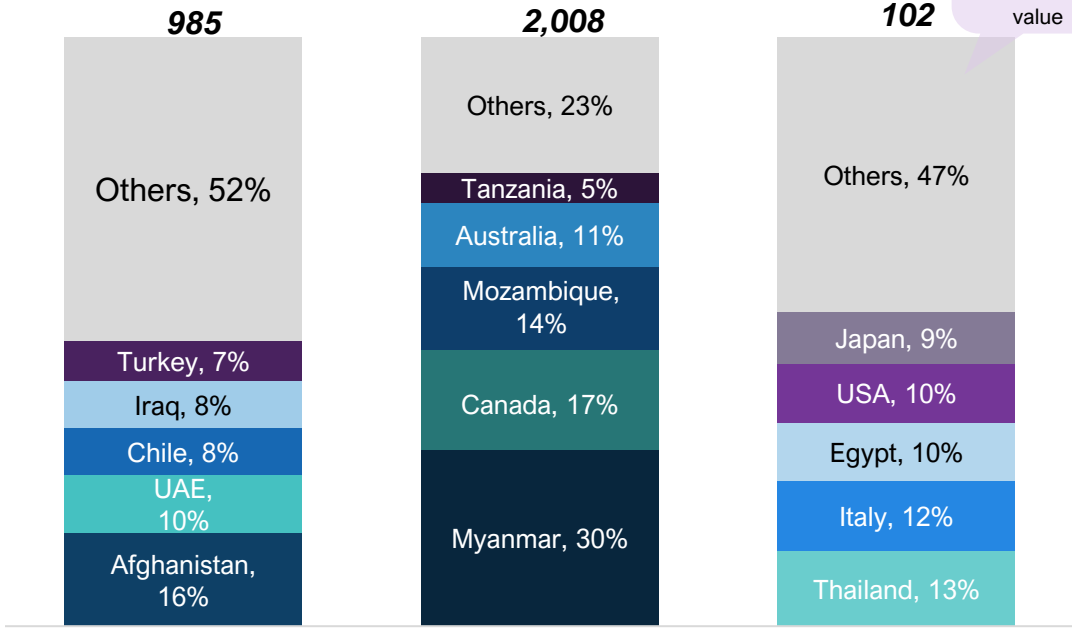
Total import (value) of exotic fruits & vegetables

(US$ M, FY20-FY23 (till Feb 23))



Top 5 exporters for major exotic products to India

(US$ M, FY23 (till Feb 23))



The top 5 exporters add up to more than ~50% of the total trade value

Note(s): 1: Poly houses are specialized structures with controlled climate conditions, FY23 is financial year from April'22 to March'23
Source(s): DGCIS annual data, Secondary research, Praxis analysis

Farmers and producers have started growing exotic products locally under controlled conditions owing to the increased demand and profitability in the sector

View of the market for Exotic products

Changing trends in consumer behaviour

- Increase in demand from **health-conscious consumers**
- Restaurant and hotel chains have now started **sourcing exotic products locally**
- The industry is also aided by the **shifting trend to fresh organic produce**
- **Farmers are starting to grow these products** in controlled conditions in India, being drawn to them because of their profitability and increased demand
- These crops are being grown between **traditional grain cultivation cycles** to **quadruple the income** generated
- **Growing retail interest** due to increased spending on exotic products

Demand drivers

- **Rapidly growing** organized food-service sector
- **Higher consumer demand** through increased awareness
- **Innovation in the supply chain** including the flourishing of modern retail and commerce, delivery platforms, and digital payments
- Increase in demand for **international cuisines**
- Various state governments have **launched incentive schemes** to motivate farmers for cultivating the exotic produce
- **Rapid increase** in the exotic vegetable demand has attracted corporate houses to **boost their investments** in the industry

Areas of improvement

- Growing exotic F&V need extensive care due to **high susceptibility to pests and diseases**
- Need controlled environment for cultivation
- **Large investments are needed** to help develop the infrastructure and technology, from importing seeds to developing post-harvest infrastructure like cold chain facilities
- There is room for development for **pan-India mapping of individual crops**, and increased access to research and advisory services for marginal farmers
- With better onboarding process and geographical reach, farmers in India to get **agricultural credit**

Note(s): According to RBI, marginal farmers are ones cultivating <2.5 acres of land, F&V: Fruits and vegetables
Source(s): Secondary research, Praxis analysis

Increased demand especially from the food service industry with some companies focused on exotic fruits and vegetables delivery

Some notable players

Liable Essential Oil Products Pvt. Ltd., trikaya, Q Mart, McDonald's, Continental The Future in Motion, Frugivore, Foodhall – for the love of food –, Kodai Fresh, iris, Coconut HUB, SOI, SM Foods, Earthy Tales, The Big Chill Café, Fresh India Organics, EF, Abhinandan agro, tC, SUBWAY, Nature's Basket, bigbasket

"Farmers of new generation have started cultivating and leveraging the increased demand for exotic food produce. The production of exotic produce is also concentrated in certain regions as it requires creating an artificial environment for growth"

-Investor, Social Business Fund

"Due to unfavorable natural conditions in India, exotic produces are commercially cultivated in greenhouses and poly-houses and retailed at higher prices than the native vegetables and fruits. Moreover, the shifting consumer preference toward international cuisines is providing a thrust to the market growth"

-CXO, Black Eye Technologies

"The proliferation of ecommerce and social media platforms has widened the consumer base to favour the growth of the exotic produce market. Farm to fork model has helped in taking the fresh exotic produce from farm to the plate of consumer"

-Product Manager, one of the leading agri-tech companies

Source(s): Primary conversations, Secondary research, Praxis analysis

Agenda

- Overview of agriculture and allied sector in India
- Technology interventions in the system
- Trends in agricultural sector
- **Agritech sector current landscape**
- Benchmarking with International markets

Overview of Indian Agritech Industry

Agritech players across value chain

Farm inputs

Commerce websites supplying inputs*

FARMC, AgriBegri, Kisankarts.com, AgroStar, BigHaat.com, Vaishali Organic, OneAgri, Gramophone

Not a market place model

Hybrid seeds and biopesticides

NUZIVEEDU SEEDS, ARANYA PARIDHI, nu-genes, Agret, mahyco

Farming, cultivation and harvesting

Farmer advisory

Jai Kisan, FarmBee, फसल सलाह, FARMRISE, IFFCO KISAN, RML, RISK, NIRUTHI

Hydroponics

Growing plants without soil

JUNGA, TRITON FOODWORKS, LIVING FOOD CO., absolute foods, woolly, Simply fresh, Fresco

IoT + Drones

Using IoT / Sensors for agriculture

CR EDIBLE, AGRONXT, Kastur automation, bitmantis, Fasa, SOILSENS, ZENTRON LABS, ARVE

Precision agriculture and farm management (SaaS)

Hummingbird, stellapps, SatSure, FarmGuide, EkoSight, Kisan Hub, Cropin, eXabit Systems, AGNEXT, INVENTOHACK, FarmERP, Notebook Networks, AIBONO, Survis, BharatAgri, frontalrain, farmagain, FarmNXT, Ackcezione

Equipment, storage and handling

Equipment leasing*

EM3, Gold Farm, AGRI BOLO, KhetiGaadi, TRINGO, Oxen, Tractor Bazar, JFarm Services

Smart farm equipment

Automated irrigation and smart farming

SOILSENS, Navaniti Innovation, drip TECH, Vikon.in, NETAFIM, CULTYVATE, ARVE

Post harvest management

SSL, arya.ag, NBHC, NCML, DeHaat, StarAgri

Crop quality assessment

AI / Image powered food analysing solutions

Nebulaa, 3 STAKE LABS, agricX, INWEON, INTELLO LABS, Skyware Automation

Output

Farm output*

ninjacart, BIJAK, agribazaar, FarmLink, MOBIFARM, Country Delight, Kamatan, Farmley, waycool, OUR FOOD, farmizen, VnF, FarmCon, KISAN NETWORK Smart Deals in Your Hand, Jumbotail, bigbasket, ALO AGRI, REAL FOODS, Farmtaaza

Meat delivery*

Licious, pescafresh, Zappfresh.com, fresh to Home, TENDER CUTS, fipola

Novel / alternative food*

good dot, MISTER VEG, Vezlay, Quality Vegetarian Foods, evo

Input and Output both*

KHETHINEXT, NeML, DeHaat, unnati, agribazaar, Safal Fasal, eKUTIR, FK

Finance, Insurance & Knowledge sharing

Loan/ finance/ pre-payment enablers

arya.ag, Aggois, DeHaat, NBHC, Samunnati, ORIGO FINANCE, VAYANA, agribazaar, agriwise, BIJAK, GRAMePAY

Knowledge sharing and network building platform

ThinkAg, ArthAgri, KRISHIFY किसानों का नेटवर्किंग ऐप

Insurance

NIRATHI, WEATHER RISK, NIRATHI, bharti AXA, suraksha ka naya nazariya, Aggois

Traditional insurance companies

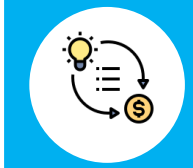
BAJAJ Allianz General Insurance Co. Ltd., HDFC ERGO, RELIANCE General Insurance, SBI general, FUTURE GENERALI TOTAL INSURANCE SOLUTIONS, IFFCO-TOKIO GENERAL INSURANCE, ICICI Lombard

Input | Output

Note(s): * – These categories and players are marketplace model
Source(s): Tracxn, Secondary research, Praxis analysis

Competitive landscape

A range of Agritech landscapes have emerged in the country, with each of them focusing on increasing scalability, efficiency, ease, and income derived via farming

Parameters	Farm inputs	Farm outputs	Allied farming services	Agri Financing
Business model 	• Omni channel model that connects with farmers via mandis apps, calls for selling inputs • Operates retail stores from where farmers can purchase inputs • Aggregators that enables trading with use of efficient technology	• Distribution of farm sourced fruits, vegetables, staples, dairy products, and more • Connect farmers with consumers via app without middleman • Commodity trading with efficient logistics and better prices	• Hub & spoke model MEs / stores acts as a link between farmers • Improve farm efficiency with technological advancements • Transforming Agri value and supply chain using technology	• Open network that caters to entire Agri value chain financing • Works with multiple parties on supply and demand side, both • Credit and neo banking platform for farming and allied services
Value proposition 	• Market linkage facility along with logistics and warehousing solution • Easing farmers' operations by providing multiple support services	• Tech-enabled supply chain creating a phy-gital model • Enables seller to find a credible buyer and settlement of trade	• Enhancing farm yields and efficiency with advanced tech • Focusing on soil health management to improve produce	• Focuses on Agri Commerce, Agri Finance and other services • Provision of easy and quick access to financing for entire Agri value chain
Offerings 	• Farm inputs such as pesticides, fertilizers, seeds, hardware • Advice on soil health, weather forecasting, pesticide dosage, etc	• Fruits, vegetables, staples and more, sourced directly from farmers for end consumers • Accounting, payment and rating facility to bring accountability	• Provision of various SKUs under input and output • IoT based farm management, crop quality assessment, trade settlement and surety	• Multiple loan offerings like working capital, term loan, receivables financing • Credit and BNPL services for entire Agri supply chain

Source(s):Secondary research, Praxis analysis

Factors for adoption

Farmers deal with Agritech players to get better quality farm inputs, advisory services and higher margins on output sales all in one place

Buying input from Agritech player	Selling output to Agritech player	Taking advisory services from Agritech player
Key reasons to purchase input: • **Better-quality input** as compared to local market • **Price is similar** to a local market • **Trust factor between farmers & Agritech player MEs** facilitates query resolution	**Key reasons to sell output:** • Provides **marginally higher prices** to farmers as compared to a local market • After harvesting, all cost is taken care of (quality checking, packing, transport to node) by the Agritech player	**Key reasons to use advisory services:** • MEs help farmers with variety of instructions like **usage of fertilizers, pesticides, crop rotation, disease treatment** etc. • Advisory services are **provided free of cost**
Key advantages: • Farmers buy inputs from the ME[1] shop rather than ordering on the app / over call. Farmers **prefer this close interaction** • **Easy return or exchange of their produce**	**Key advantages:** • ME is the **primary contact point** for the farmer which serves as an easy selling stop • ME connects with the respective Agritech player node, which looks after the distribution	**Key advantages:** • ME is easily reachable & guides the farmers and shares knowledge with them • Improvement in quality & quantity of produce
Key pain points: • **Shortage of supply** at ME / on the app Agritech players would ideally want all MEs to have all facilities. However, few MEs have not been in this business traditionally therefore it might take time to train them.	**Key pain points:** • Many farmers don't know about the facility • Small # of MEs are entitled to procure output • Agritech player only procures grade 1 quality produce, which may not always be the case • In-adept infrastructure	**Key pain points:** • The ME advisory / suggestions on the quality & quantity of produce are sometimes not useful

> *"The Agritech companies have come up with hybrid seeds or improved seeds, they have a proven method to demonstrate the quality of their product. FPOs are trusted by the farmers & can be utilized to market the products."*
>
> ***-Project Manager, leading Agritech player***

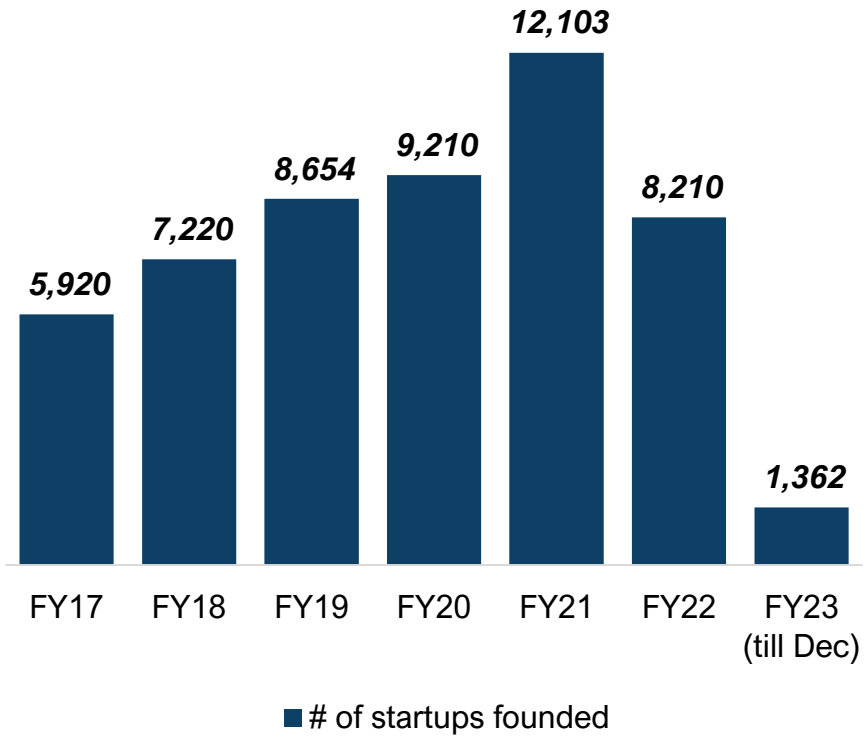
> *"The biggest lag is that there is no single platform where the farmers can sell and the customer can buy it, some of the platforms have been created but it has not been executed properly. Most investments also go into post-harvest products, leaving pre-harvest neglected."*
>
> ***-Chairman & MD, leading Agri-IoT devices player***

Note(s): 1. ME: Micro Enterprise
Source(s): Primary conversations, Secondary research, Praxis analysis

New startups registered under the Agritech sector have been consistently high averaging ~8.5K/year, with the # of funding deals averaging ~945/year

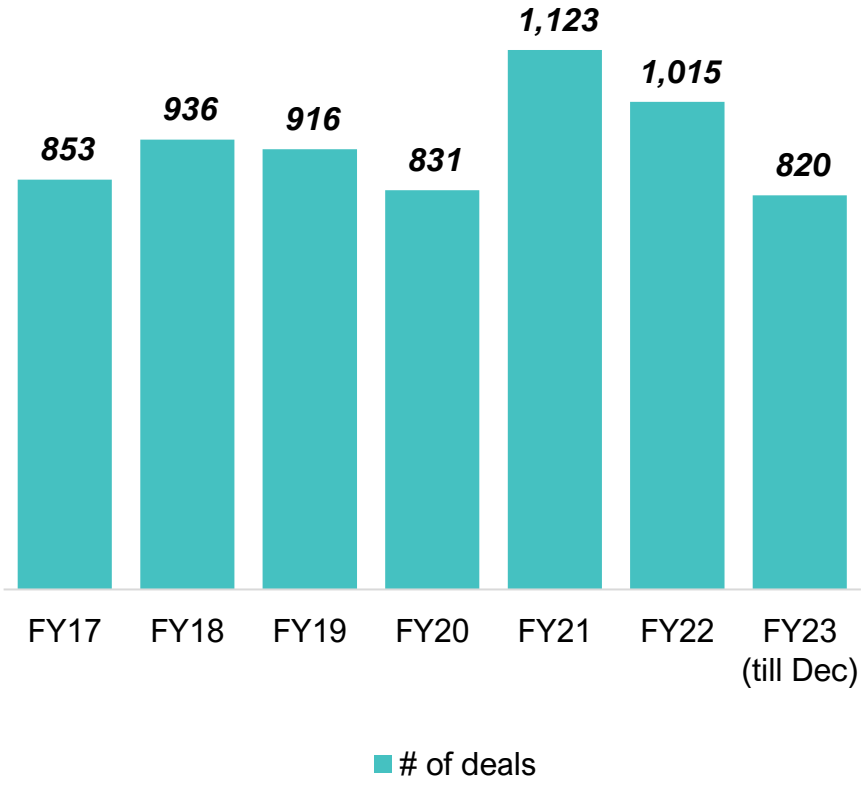
Cumulative # of Agritech startups founded in India

(#, FY17-23 (till Dec)



Indian Agritech funding # of deals

(#, FY17-23 (till Dec)

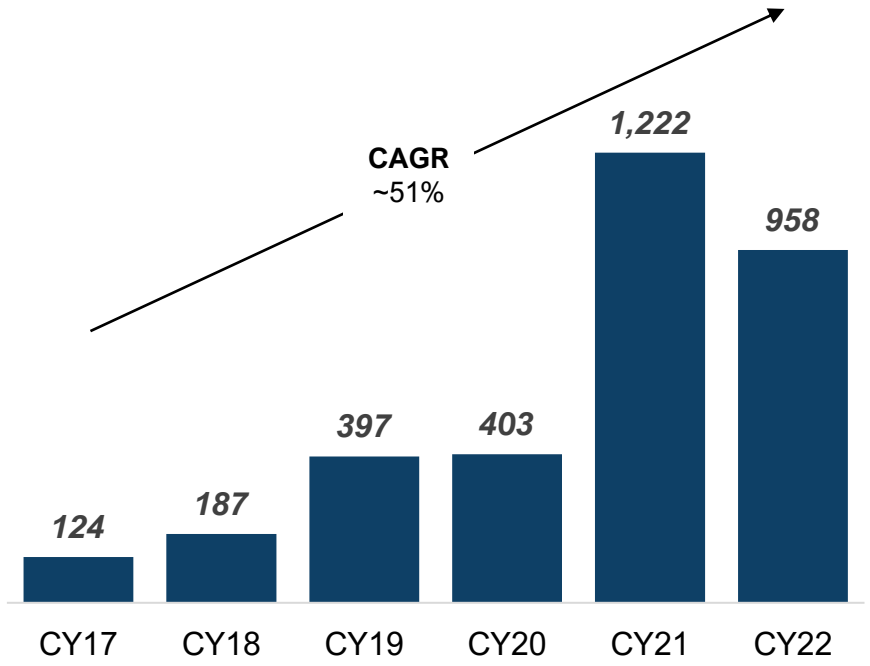


Note(s): 1: PE / VC: Private equity / Venture firms; Conversion rate: US$ = ~INR 80 as of September 2022,*Data last updated in Dec'22, FY23 is financial year from April'22 to March'23
Source(s): Tracxn, Praxis Deals database, Second research, Praxis analysis

Investment value in Agritech startups saw a ~51% CAGR from CY17-22, benefitted by the improved use of technology and mobile internet penetration in the sector

Agritech startups saw increased funding from last 5 years, growing with ~51% CAGR

Indian Agritech funding amount
(US$ M, CY17-22*)



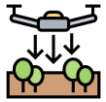
Increased PE / VC interest, increased digital adoption amongst farming communities are a few growth drivers

Growth drivers

1. Improving mobile internet penetration
2. Increased use of technology solutions
3. Innovative founders and the adoption of newer supply chains
4. Reforms and government initiatives supporting the Agritech Sector
5. Digitalization pushed by the COVID-19 pandemic
6. Venture capital firms helping Agritech startups
7. Accelerators and incubators supporting Agritech startups
8. Technology disruptions initiated by Agritech companies

Note(s): 1: PE / VC: Private equity / Venture firms; Conversion rate: US$ = ~INR 80 as of September 2022, *Data last updated in December'22, CY22 is financial year from January'22 to December'22
Source(s): Tracxn, Praxis Deals database, Second research, Praxis analysis

Since the start of 21st century, government has focused on bringing laws related to sales, distribution, technology, data protection, to enhance Indian Agriculture

Steps taken	Date		Relevant government laws applicable to the Agritech sector	Focus area
The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance	**2020**		• This ordinance **overrides multiple state APMC acts** and enables competitive trading channels that **helps** to facilitate reasonable prices • Provides efficient and **barrier free transport system** across and beyond the markets / states notified by the prior legislations and sets framework for **electronic trading**	**Sales and distribution**
The Essential Commodities (Amendment) Ordinance and Act	**Implemented in 1955 Amended in 2020**		• Enhance farmers' **income** and **increases** the competitiveness in the agriculture sector • Helps to **liberalize the regulatory system** and **protect consumers' interests** • Provides **authority** to the **government** to **control production, supply, distribution, trade and commerce** for certain commodities	**All areas**
National Drone Policy	**2018**		• Guidelines deals with **requirements for use and operation of drones in India** • It also deals with requirements for operation of **civil remotely piloted aircraft system**	**Technology**
Intellectual Property Laws	**NA**		• With development of **innovative Agritech tools** it is essential for players to make sure that their **IP products are registered** • Agritech also involves **provision of services through negotiated contracts** • Players need to ensure appropriate **IP protections and licensing clauses** are mentioned in the contract	**IP**

Source(s): Government reports, Secondary research, Praxis analysis

Agritech players are supported by investments and various government initiatives & programs, aiming at increasing efficiency of value in supply chain

Steps taken	Date	Key regulatory initiatives by Government	Focus area
Digital infrastructure	**2022**	• **INR 600 million** will be allocated for upgrading the digital infrastructure for Agritech • **Digital and hi-tech services** will be delivered to farmers developed in association with private sector companies	**Technology and infrastructure**
Key initiatives in Budget 2022 – 23	**2022**	• Hopes to **launch a blended capital fund under a co-investment model** facilitated through NABARD for investments in **Agritech start-ups and rural enterprises** • Focus on **integration of** public sector research with private Agritech players	**Agri Finance**
Investments by Ministry of Agriculture	**2020**	Rashtriya Krishi Vikas Yojana • **Plans to invest INR ~36 Cr into ~350 Agritech start-ups via RKVY** • Believes that these startups will **generate employment** and contribute towards **enhancing and stabilizing the income of the farmers**	**Agri Finance**
Launch of financing facility under AIF	**2020**	• Launch of financing facility under **Agri-infra fund (AIF) of INR 1,00,000 Cr** in partnership with multiple lending institutions as loans to primary Agri credit societies, farmer groups, FPOs & Agritech players	**Infrastructure**
Organization of food & Agri business accelerator program	**2015**	• Organized **food and Agri business accelerator program** providing mentoring, industry network and investor pitching guidance to agri-business startups	**Development**

Source(s): Government reports, Secondary research, Praxis analysis

STPI, founded in 1991, offers a number of value-added services for startups, including incubators, infrastructure, mentorship, funding, investment, etc. (1/4)

Founded 1991 Under MeitY[1]	**Software Technology Parks of India (STPI)**	• Promote the **development and export of software and software services** including IT Enabled Services/Bio-IT • Provide statutory and other **promotional services** to the exporters **by implementing Software Technology Park**/Electronics and Hardware Technology Park Schemes • Provide **data communication services** including value-added services to IT/IT enabled services related industries • Promote **micro, small and medium entrepreneurs** by creating a conducive environment for entrepreneurship

Infrastructure

- **Ready to work** 'Plug and Play' space
- Health Informatics Lab/IoT Lab, Fab Lab, AI/Data Analytics Lab
- **Year-around operational** workspace
- Testing and validation facility

Facilities include fully air-conditioned incubation spaces, uninterrupted power supply, 24x7 security, workstations, cubicles, conference halls, internet bandwidth etc.

Monitoring

- **Monitoring and guiding** through dedicated portfolio managers and startup support executives
- **Reviewing and monitoring** the progress and performance periodically
- Taking necessary actions as and when required

Marketing

- Support in **end-to-end marketing plans** to attract visibility
- Technical & business knowledge sessions, road shows, networking events, social media outreach
- **Partnerships** with key international promotional agencies for cross-border collaboration

Mentorship

- Needs-based **mentoring sessions** on legal, compliance, branding, cybersecurity, tech
- Transformation from idea level to prototype level, prototype level to MVP (Minimum Viable Product) level, MVP level to GTM (Go-To Market) level, and **graduating the startups** into full-fledged company status
- **Networking with other players** in the ecosystem

Intellectual Property Rights

- MoU with NRDC for filing Intellectual Property Rights
- **Patenting** (drafting & filing), **Trademark**, **Copyright** and other related legal or statutory support

Funding & Investment

- **Support in raising funds** by leveraging connections with potential customers
- **Networking** with HNI (High Net Income) individuals, VCs (Venture Capitalists), corporates as per the size of startups
- Grants, equity, debt

Note(s): 1. MeitY: Ministry of Electronics and Information Technology
Source(s): Secondary research, Praxis analysis

NGIS[1] scheme, launched by STPI, is a comprehensive incubation scheme that has provided seed investment of INR ~18.3Cr to 82 startups to date (3/4)

NGIS Next Generation Incubation Scheme

- Launched by **STPI** under **MeitY**
- A **futuristic and comprehensive** incubation scheme
- Focusing on **12 Tier 2 locations**
  - Locations include Agartala, Bhilai, Bhopal, Bhubaneswar, Dehradun, Guwahati, Jaipur, Lucknow, Prayagraj, Mohali, Patna & Vijayawada
- Aim to support **300 startups** in the field of IT/ITeS/ESDM
- Budgetary outlay of **INR 95Cr** for 3 years

Incentives	Description
Physical incentives	• Ready to work **P&P[2] incubation** within the constraint of lockdown & thereafter • Full-fledged **security & vulnerability testing** of software products through Software Product Security Testing (SPST) facility • **Additional facilities and services** of the pan-India domain-specific CoEs[3] of STPI may be leveraged
Soft support	• **Mentoring** support • **Access to VCs** for funding support • Networking opportunities/Industry connect and **go-to market** support for exhibiting/showcasing products/solutions through various National / International events/workshops/exhibitions • **Facilitation support** for IRP/Patent filling
Financial incentives	• **Cloud Credits** from leading third-party service providers • **Pre-incubation programs** and mentoring for up to six months with **stipend support** of upto **INR 30K per month** • **Seed funding of up to INR 25L** available to beneficiary/supported startups based on innovativeness of idea, novelty of solutions, strength of team & soundness of business proposal
CHUNAUTI	• **Challenge Hunt Under NGIS for Advanced Uninhibited Technology Intervention** is a series of online challenges under NGIS for the selection of startups working towards **developing of products/solutions in Emerging Tech** • **14 challenge programs** have been **conducted** and currently, the 15th challenge program is underway

Outcomes

1. Created a startup support ecosystem comprising of **128 mentors and 48 knowledge partners**
2. Total **352** beneficiary startups have generated **3,200+ jobs**
3. About **45%** of the beneficiary startups are **women-led entrepreneurs**
4. Beneficiary startups have contributed significantly to **IP generation and product creation**
5. **82** startups have received **seed investments** of **INR ~18.3Cr**

Note(s): 1. Next Generation Incubation Scheme; 2. Plug and Play; 3. Centre of Entrepreneurship *Number of beneficiary
Source(s): STPI, Secondary research, Praxis analysis

Centers of Entrepreneurship (CoEs) are technology incubators set up for building India's startups leadership (2/4)

Centre of Entrepreneurship (CoE)	• **Centers of Entrepreneurship** (CoEs) **are technology incubators** which have been established by STPI for building India's startups leadership • A CoE is a facility where **the highest standards and best practices** are made available for specific focus areas

CoE	Location	Technology area	Startups Incubated (#)
Electropreneur Park	New Delhi	Electronics Systems Design and Manufacturing	57
IoT OPENLAB	Bengaluru	Internet of Things	50
STPI NEXT INITIATIVES		IoT in Health & Pharmaceuticals	30
Electropreneur Park	Bhubaneswar	Electronics Systems Design and Manufacturing	27
VARCoE		Virtual & Augmented Reality	9
mTek		Analytics, Machine learning and AI	Selection underway
FinBlue	Chennai	Financial Technology	36
NEURON A Startup Punjab Hub @ STPI	Mohali	AI/Data analytics, Internet of Things	42
MOTICON	Pune	Autonomous Connected Electric & Shared Mobility	31
IMAGE	Hyderabad	Gaming, Animation, VFX, Computer Vision, AI	28
apiary	Gurugram	Blockchain	26

CoE	Location	Technology area	Startups Incubated (#)
MedTech	Lucknow	Medical Technology	22
OCTANE	Guwahati	Internet of Things in Agriculture	22
	Shillong	Animation	
	Imphal	Emerging technology (Augmented/Virtual Reality)	
	Itanagar	Geographic Information System	
	Aizwal	Gaming Technology	
	Kohima	Graphic Designing	
	Gangtok	IT application in Healthcare & Agritech Technology	
	Agartala	Data Analytics	
asal	Akola	Internet of Things in Agriculture	18
KALPATARU	Visakhapatnam	Industry 4.0	Selection underway

Source(s): STPI, Secondary research, Praxis analysis

Insights from Chief Mentor of FASAL

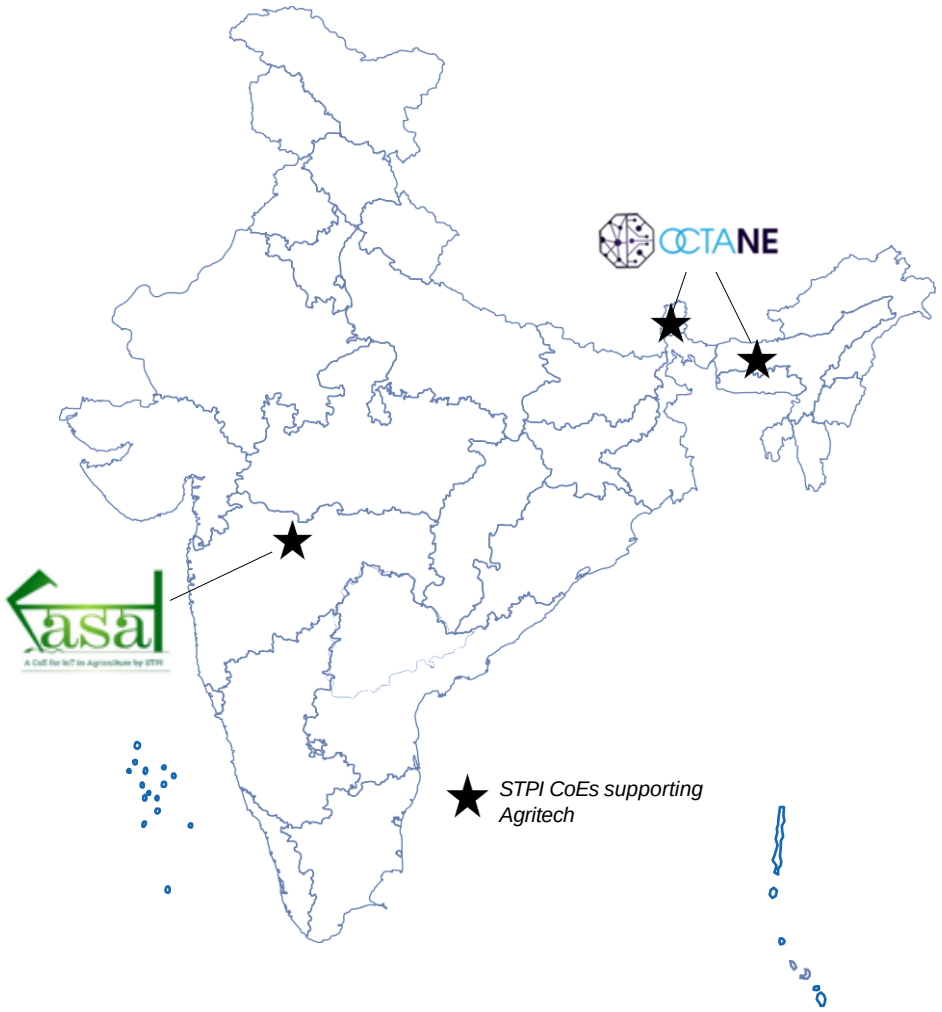
Dr. Anand Deshpande

Founder, Chairman, and Managing Director of Persistent systems

Technology innovation in agriculture is crucial for India's future development due to its potential to address several challenges the sector faces, such as low productivity, climate change, and food security. With a growing population and limited arable land, the need for sustainable and efficient agricultural practices is more pressing than ever. Farmers can improve crop yields, reduce input costs, and conserve natural resources by adopting precision farming techniques and using sensors, drones, and robotics. Additionally, technology can enable farmers to access real-time information on weather patterns, market prices, and demand, allowing them to make informed decisions and increase their profitability.

Software Technology Parks India has taken an important step to address the problem by establishing FASAL, the Centre of Excellence for the Internet of Things in Agriculture, in collaboration with Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Several start-ups have come forward to set up their units in the facility. I am confident that innovations from these start-ups will scale and provide the solutions necessary for our country

3 STPI CoEs are supporting Agritech start-ups from all over India; some of those being incubated have been mapped below (illustrative) (4/4)



Qualifying Categories for Incubation for Start-ups at these 3 CoEs

- Digital Farming
- Predictive Analytics
- Agritech
- Internet-of-Things

STPI Agritech start-ups

AI-GENIX INTERNATIONAL PVT. LTD. Redefining Crop Protection
Birghadhi Technology Pvt. Ltd.
AGROTECH Stepping Towards Agri-Automation
Tapway
Sand Bird Research And Developement Pvt.Ltd.
EkoSight
Dr Pashu
ArthAgri Green Wins
AEDAA
Intech Harness Pvt. Ltd.
MLIT
Gloverse Labs
Aranya Paridhi
Froots
ALO AGRI
3 Stake Labs
Krishigati™
Knotebook Networks
SHIVATV
Omdatt
Aigret
Farmer by Nature
Agrosonic Solutions Private Limited
Groedge
GRAMePAY A Smarter way to Pay
ouranos robotics
Kisankarts.com
INVENTOHACK
OneAgri Innovations
Kastur automation Ideas for today & tomorrow !

Note(s): 1. Next Generation Incubation Scheme; 2. Plug and Play; 3. Centre of Entrepreneurship *Number of beneficiary
Source(s): STPI, Secondary research, Praxis analysis

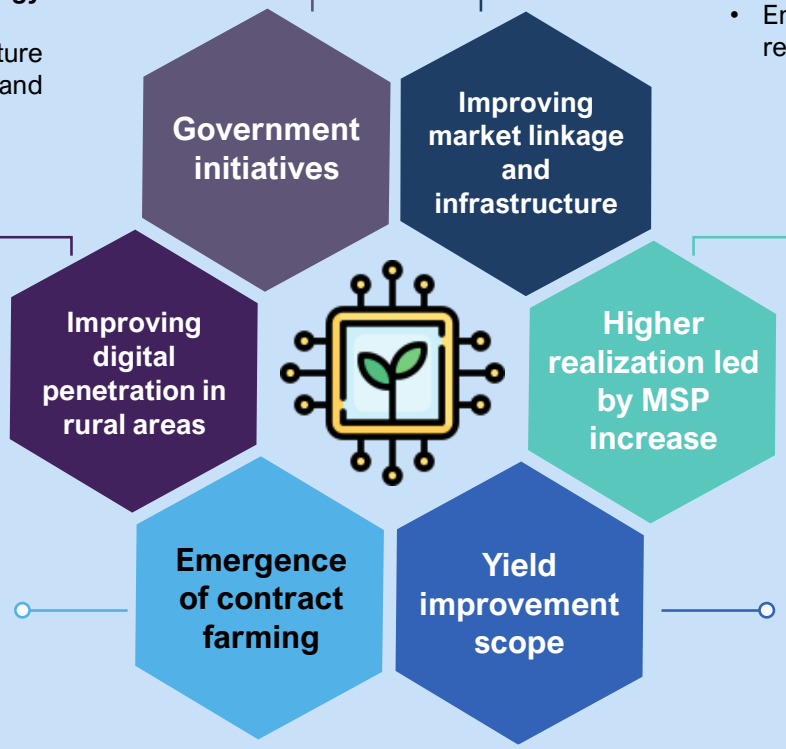
Agritech in India is poised for accelerated growth driven by improving participation of modern marketplaces, digital penetration, and impetus from government

Drivers for Agritech growth in India

- Effort to **double farmers income** by increasing productivity, **technology usage, and barrier free trading**
- **1 lakh crore** agriculture infrastructure fund to facilitate loans at **3% pa** and credit guarantee coverage

- **Internet penetration** is expected to grow at **20+% CAGR** to add **328M** users in rural India alone
- **Lowest data rate** in the world at **US$ 0.09 per GB** is increasing digital adoption among lower income groups

- Contract farming can consolidate farms & improve earnings
- **Transfer of knowledge** with regards to technology and scientific methods will **increase adoption of Agritech**



- **Market linkage & rural logistics** have improved
- Enabling farmers to make better realization on the crop

- Government announced **6% average increase** in MSP 2022-23 Kharif Marketing season
- **Technology to improve yield** thereby fuelling farmers income

- India's **yield in rice** is lower by **~16% (World)** and **~46% (China)**
- Yield in **wheat** is nearly half of that **China and ~8% below BRICS's** average

> *"Government has introduced schemes and policies related to insurance, etc. and the mega food parks who rely only on farmers' produce for their raw materials. These policies bundled with the advent of Agritech players are making a big impact on all these as the farmers to get a fair price and get catered properly which helps the ecosystem grow*
>
> ***-Product Manager, one of the leading Agritech organization***

Source(s): Government of India, Ministry of Agriculture, Secondary research, Praxis analysis

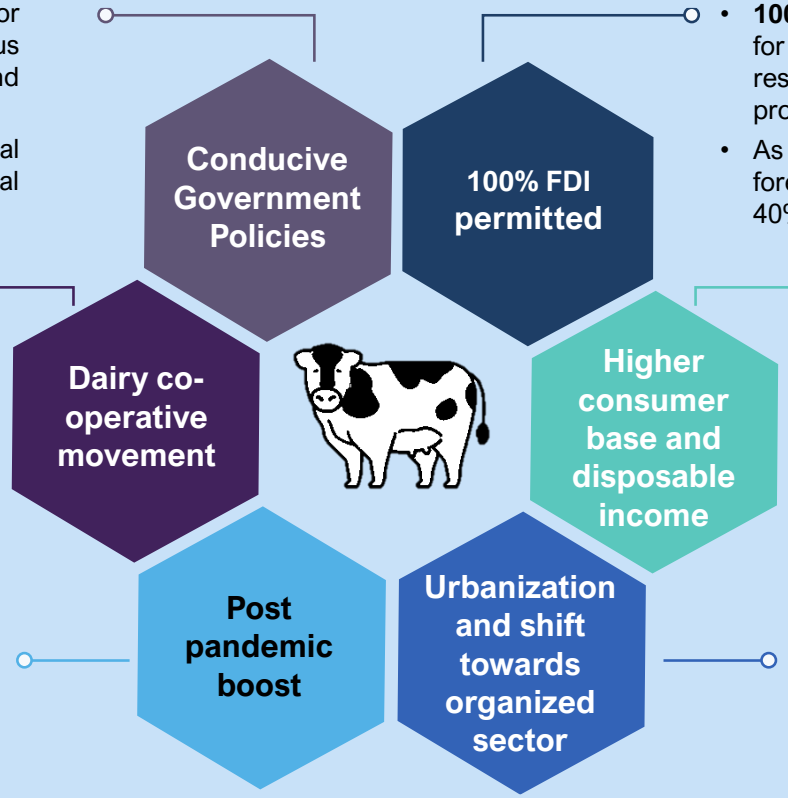
India's growing population, coupled with rapid urbanization and improving incomes, is boosting the demand for milk and milk products

Drivers for Dairy growth in India

- **Rashtriya Gokul Mission (RGM)** aims for development and conservation of indigenous breeds, enhancing milk production and productivity of bovine population
- **Kisan credit card scheme** announced by central government aims at providing working capital requirements of farmers

- **100% FDI under government approval route** for trading, including through e-commerce, in respect of food products manufactured and/or produced in India
- As a result, the Dairy sector has seen substantial foreign direct investment (FDI) constituting about 40% of FDIs Indian food sector

- Dairy co-operative movement transformed India from a **milk deficit country to largest milk producing nation**
- India has **~2L primary village level dairy cooperative** societies with 1.5Cr members engaged in procurement of milk as of FY23
- **228 district level cooperative unions** are present in India which take care of processing and manufacturing value-added products



- About **a third of the national population is under age 14**, a group **inclined to consume higher quantities of milk and milk products**.
- India's growing population, coupled with rapid urbanization and improving incomes, is boosting the demand for milk and milk products.
- Increase in per capita disposable income- INR 141K in CY18 to INR 193K in CY22 at a CAGR of 8% has increased demand.

- Dairy industry to **achieve 12-14% growth in revenue on a Y-o-Y basis in FY23** due to revival of Hotel, Restaurant and catering segment and increased retail prices

- Rate of urbanization increased from 34% to 37% by 2025.
- As per NAP on Dairy Development Vision 2022 report, it is envisioned to **increase milk procurement and processing through setting up of village-level dairy infrastructure**.
- Under this plan, **Organized milk handling is to be increased to 50% by FY24**.
- Milk procurement by the private sector to increase from 10 per cent to 30 per cent in the same period.

Source(s): Secondary research, Praxis analysis

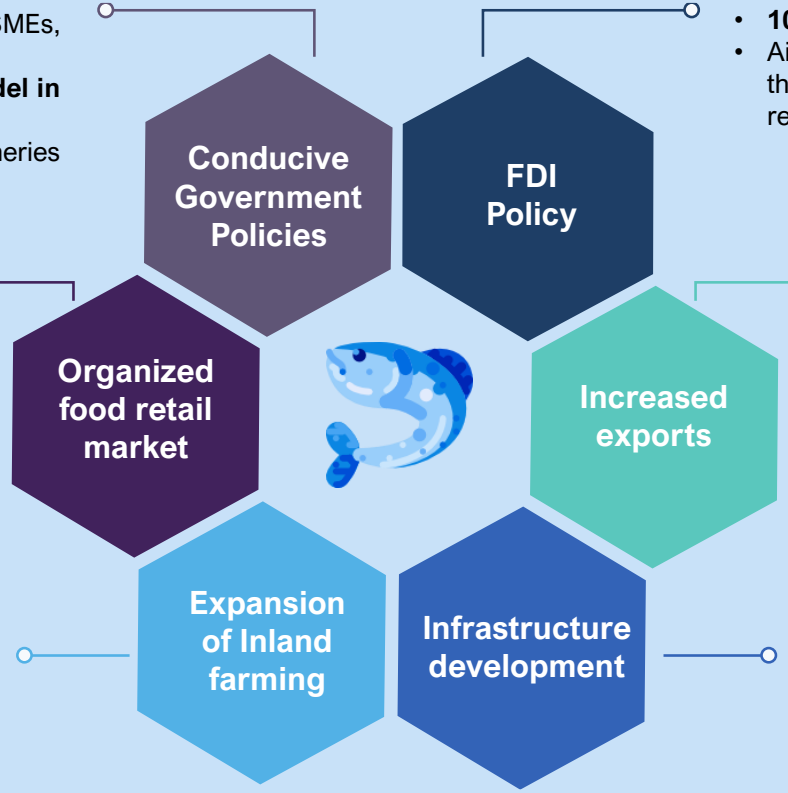
Various government initiatives, growth in organized market and expansion of Inland farming are drivers leading to growth in fisheries sector

Drivers for Fisheries sector growth in India

- **INR 6000 Cr** investment in **FY23** for MSMEs, fishermen and fish vendors
- **Fund** of **INR 100 Cr** under **entrepreneur model in fishing sector**
- **60% subsidies to women** working in the fisheries sector including women entrepreneurs

- **100% FDI is allowed** in through mechanized route
- Aims to carry out **technological development** in the sector which will reduce the **production cost** related to aquaculture

- Increase in accessibility of processed fish due to **growth in organized food chain** market
- **Expected growth of processed fish market** from **US$ 16.3B** in **CY22** at a **CAGR of ~10%** till the year **CY27,** reasons being increase in consumption and cost-effective substitute to meat and other protein rich products



- **Marine exports** in **FY23 is expected to grow to US$ 8.5B from US$ 7.8B in FY22**
- **Huge demand** of **Indian seafood** in **international market** and increase in productivity
- MPEDA targeted export of **INR 1 Lakh Cr** till **FY25**

- **~76% expansion of aquaculture** in the year CY22
- Vast **under-utilized freshwater** resources in the form of 191K km of rivers and canals and 2.36M Ha of ponds and tanks

- **Improvement in the infrastructure** of **fishing harbors** and **landing centers** by the government
- 69 harbors and landing centers of **INR 7299 Cr** have been developed till **CY22**

Note(s): FIDF - Fisheries and Aquaculture Infrastructure Development Fund, PMMSY - Pradhan Mantri Matsya Sampada Yojana, GOI – Government of India
Source(s): Secondary research, Praxis analysis

While Agritech sector is instrumental in addressing existing challenges and bridging gaps in agriculture sector, there are few limitations that the sector faces

Barriers of Agritech growth in India

- Agri-financing is still dominated by **local money lenders in remote areas**.
- Agritech players face plethora of issues like **huge default rates from the farmers and long over-dues** etc., hindering their work cycle

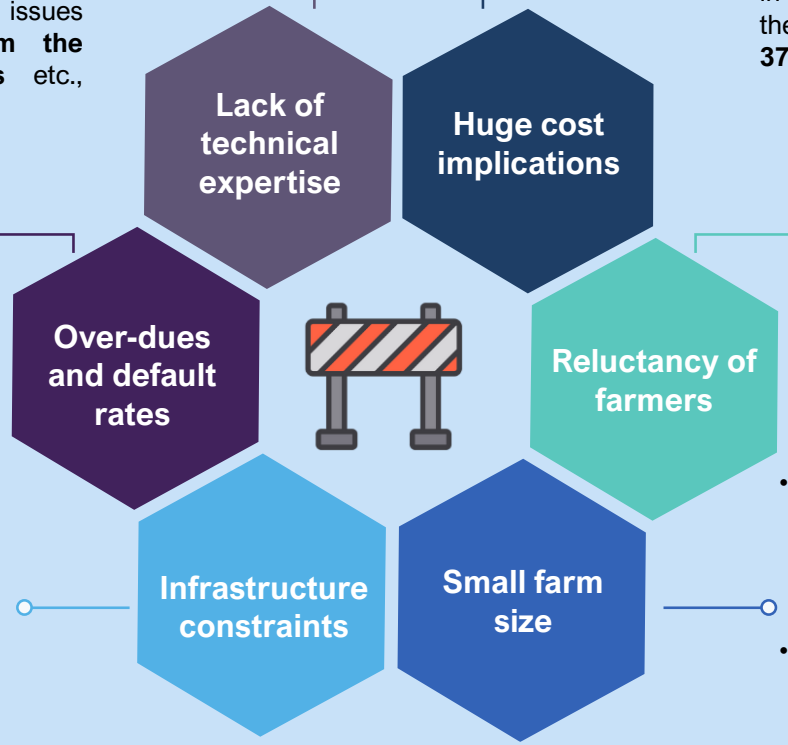
- There is lack of technical expertise in the rural and remote region as the **digital penetration stands at 37% of the rural population**

- The farming infrastructure in India is yet to catch up with the international standards **for farm irrigation, soil tilling etc.**

- Due to farmers' financial condition, they may not be able to bear **huge cost to implement the new age technologies of precision farming**
- Economic feasibility of **automation and robotics is also restricted by pocket heavy** technologies for farmers

- Small farm sizes make it difficult and costly for the farmers to implement the latest technologies
- **~ 87% of Indian farmers** cultivate the farm of **<2.5 acre in size**

- Farmers often fear that they could make the wrong tech-choice for their farm and **end up with an expensive system that becomes outdated quickly**
- Many farmers refrain from using the latest technologies **and rely on age old practices**



> *"Very few farmers in India get agricultural credit when they really need it. The limitations are the hectic onboarding processes and ambiguous regulations for the farmers. Many Agritech players directly get in touch with the farmers but are limited to certain extent geographically."*
>
> ***- Product Manager, one of the leading Agritech organization***

Source(s): Government of India, Ministry of Agriculture, Secondary research, Praxis analysis

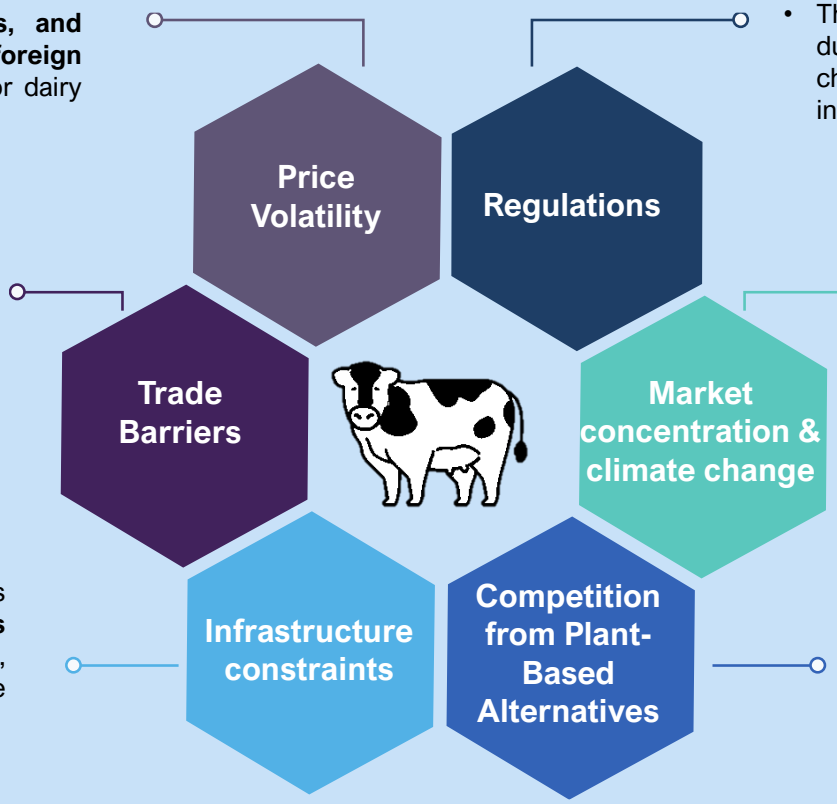
Dairy sector in India faces hindrance to growth in the form of price volatility, infrastructure constraints and stringent regulations

Barriers of Dairy sector growth in India

- Trade barriers such as **tariffs, quotas, and regulations can limit access to foreign markets**, reducing export opportunities for dairy products

- Dairy industry requires **access to reliable transportation, storage, and processing facilities** to get its products to market
- In some regions, limited infrastructure can be a barrier to growth and profitability

- Rise of plant-based alternatives such as **soy, almond, and coconut milk has increased competition** for dairy industry, especially among consumers who are lactose intolerant



- The dairy industry is **prone to price volatility** due to factors such as weather conditions, changes in consumer demand, and fluctuations in input costs

- Dairy farmers and processors are subject to **numerous regulations regarding food safety, environmental protection, and animal welfare**
- Compliance with these regulations can be **costly and time-consuming**

- The industry is **dominated by a few large companies**, which can make it difficult for smaller producers to compete in terms of price and market access
- Climate change has significant impact on the dairy industry, **affecting factors** such as feed availability, water availability, and heat stress on animals

Source(s): Government of India, Ministry of Agriculture, Secondary research, Praxis analysis

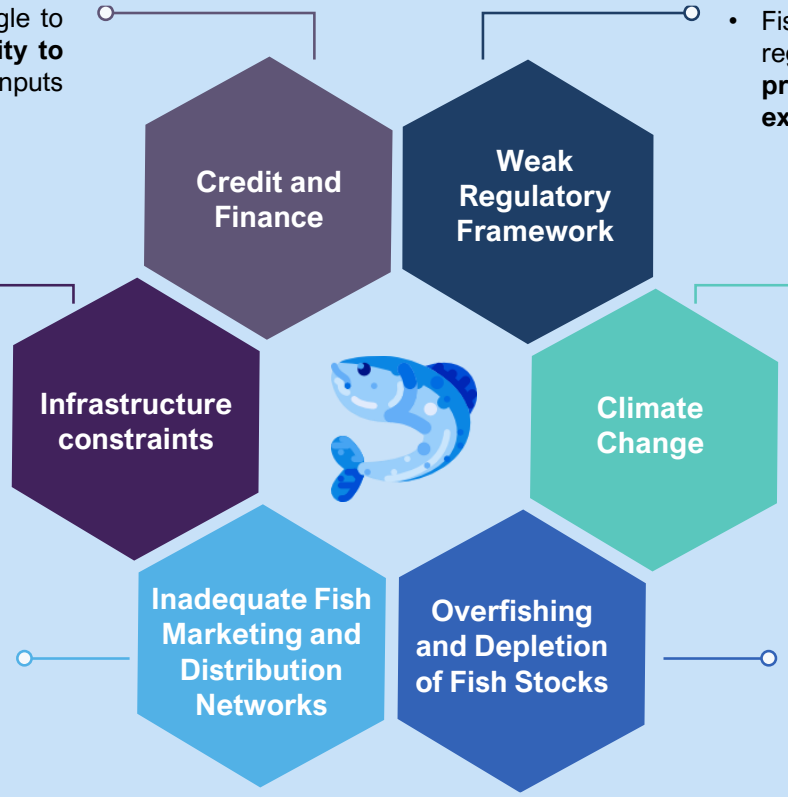
Fisheries sector in India faces hindrance to growth in the form of weak regulatory framework, climate change limiting the availability of fish

Barriers of Fisheries sector growth in India

- Fishermen and fish farmers in India often struggle to **access credit and finance, limiting their ability to invest in equipment, technology**, and other inputs necessary for fishery production

- Fishery sector in India is subject to weak regulation, which allows for **illegal fishing practices, overfishing, and unsustainable exploitation of fish resources**

- India's fishery sector **lacks adequate infrastructure such as cold storage, transportation, and processing facilities**
- This can result in **post-harvest losses and reduced product quality**, limiting the sector's profitability and competitiveness



- Climate change has led to changes in ocean temperature, currents, and weather patterns, **impacting fishery resources and livelihoods**
- It has also led to increased occurrences of natural disasters such as storms and floods, which can cause significant **damage to fishery infrastructure and production**

- Fishermen and fish farmers often **lack access to markets and are unable to obtain fair prices** for their products due to the absence of proper marketing and distribution networks

- Overfishing, illegal fishing, and destructive fishing practices have led to the **depletion of fish stocks in some regions, reducing the availability of fish** for commercial and subsistence purposes

Source(s): Secondary research, Praxis analysis

VOCs

Better internet penetration via high usage of mobile phone in rural areas acts as a boon, but fragmented land holdings and frauds acts as barriers

	Drivers for Agritech sector	Barriers for Agritech sector
Awareness among farmers	*"**Usage of mobile phone** has increased in rural areas that has increased flow of information to farmers **creating awareness** and are growing their produce keeping in mind the customers' demands."* ***-Investor***	*"The reach of advanced technological assistance to the farmers at the right time poses as a challenge. **Awareness** about them is **very limited** amongst the farmers. This leads to their lower adoption in farming activities."* ***-Founder, Agritech platform***
Digitization of agriculture	*"With intervention of technology, tractors, drones, and robots are being used for specific tasks to ease operations. Inclusion of farm management using **data analytics and IoT** driven technologies are increasing farm productivity thereby helping the Agri ecosystem."* ***-Project manager, Agritech platform***	*"Fragmented landholding patterns for farmers in India is the biggest barrier for Agriculture and Agritech sector. Also, the **agricultural land in India is not digitized** which makes it more difficult to keep track of them. Digital records for land must be kept."* ***-Project manager, Agritech platform***
Use of technological equipment	*"The new central government is working with farmers by providing them money, importance and awareness. Farmers are now aware of latest technologies like **precision agriculture** and other technological equipment to increase their farm quality, produce and productivity."* ***-Founder, Agritech platform***	*"4/5th of the farmers in India have small land holdings, i.e., less than 2 acre of farming land. In such cases it is **difficult to use technological equipment** as it does not create value for the farmers."* ***-Consultant and Founder, Agritech platform***
Government schemes and initiatives	*"There are many government schemes available currently. Even in the State Agriculture Universities and Institutes, the **business development programs** take **very nominal fees** from the farmers to help them with the new age technologies."* ***-Principal Scientist, ICAR - IARI***	*"There are a lot of **frauds** that are committed by the **middlemen who mobilize the government's schemes** to farmers at ground / village level. This has created fear within farmers to actively look and enroll for any government provided assistance schemes."* ***-Consultant and Founder, Agritech platform***

Source(s): Primary interviews (N = 18); Inclusive of investors, startup ecosystem, farmers, intermediaries / MEs), Praxis analysis

Agritech simplifies and enhances the operations of farmers via wide range of market linkage and credit services, enabling the adoption of technology

	Traditional value chain player		Role in value chain	New intervention possibility	Enablers for Agritech players to replace traditional players
Market linkage	**Retailers for Agri inputs**		Providing Agri inputs to farmers on cash or credit	Easy shift towards Agritech	• Aggregate demand from buyers to **negotiate better prices with input sellers** • Sell directly to FPOs/farmers at attractive prices with financing
	Traders (Arthiyas)		Buying Agri output from farmers with provision of credit	Connecting farmers with assured buyers	• Quality assessment and **transparent pricing** along with **diversified** products • **Higher net realization for farmers** with collection at farmgate
	Local Mandis (APMCs)		Market place for farmers to buy variety of inputs and sell output	Farmers assured of selling output at reasonable price; On-spot cash on sale	• Market linkages and access **to wider range of buyers** • **Better price discovery and financial solutions** for immediate payment
	Government Minimum support price shops		Buy commodities from farmers such as wheat, paddy	Secured and assured channels to sell output	• Price and buyer discovery for higher **net price realization** from farm-gate • **Real-time price information** to incentivize farmers to sell outside MSP shops
Credit	**Banks / Co-op societies**		Financial institutions for availing short-term and long-term credit	Hassle-free and better process via Agritechs	• **Alternative risk assessment tools** to underwrite loans, profiling for borrowers, and limited paperwork and interest rate as compared to counterparts • **Customized solutions** based on scale of business/produce as against collateral
	Informal lenders		Informal source of credit for farmers	Lower interest rates and less TAT via Agritechs	• **Faster loans at lower prices and better flexibility** based on agricultural practices and produces

Very low ○ → ● Very high

Possibility of new intervention

Source(s): Secondary research, Praxis analysis

Agenda

- Overview of agriculture and allied sector in India
- Technology interventions in the system
- Trends in agricultural sector
- Agritech sector current landscape
- **Benchmarking with International markets**


Agriculture
Farmers
Crop Yield
Crop Damage
Farm Map
Soil Erosion
Water Stress
Last Sync 3 min ago

The global Agritech market, is expected to grow at a CAGR of 13.1% (CY22-32) and reach ~US$ 76B by CY32

Global scenario

Global Agritech market was valued at **US$ 22.14B** in 2022 and is projected to reach **US$ 75.87B** by 2032, growing at **13.1% CAGR** (CY22-32)

After the US, India recorded the **2nd highest** number of deals in Agritech. The country witnessed an increase in total deal value **from US$ 124M in 2017** to **US$ 958M in 2022** growing at a **CAGR** of **~51% (CY17-22)**

70% more food will be needed **by 2050** to feed a growing population and **80% of food** for the developing world is **produced by marginal farmers***

In **2022**, the **United States soybeans export** stood at **US$ 34.4B**, with China being the top destination for export

Funding for Asia-Pacific **farm management software, sensing and IoT startups** increased by **13%** to **US$ 300M** in **2022** from **US$ 261M** in **2021**

Ranking based on total funding amount invested within the country

Global Funding Ranking	Country	Funding amount (2016-2020, US$ B)
1	USA	10
2	Germany	4
3	India	1.12
4	China	1

Ranking based on total no. of investments within the country

Global Funding Ranking	Country (# of investments, descending)
1	USA
2	UK
3	India
4	China

Ranking based on total exports with top commodity exported

Global Exports Ranking	Country	Top commodity exported
1	Indonesia	Palm oil
2	USA	Soybeans
3	China	Garlic
4	India	Rice

Rankings are in descending order of agricultural exports as of 2022

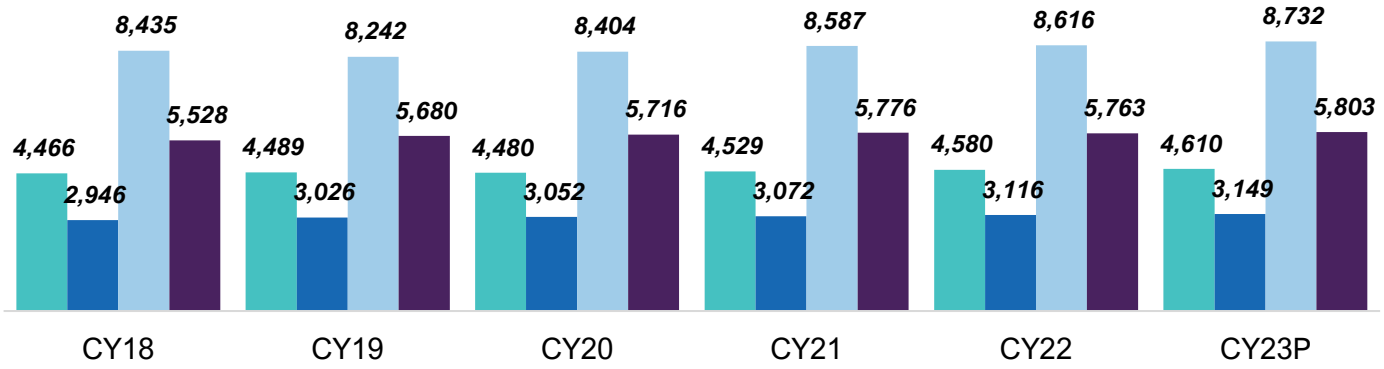
Basmati rice export grew by ~40% from US$ 2.4B (Apr-Dec 2021) to US$ 3.3B (Apr-Dec 2022)

Source(s): Industry reports, Secondary research, Praxis analysis

Global cereal yield is expected to reach 4,610 kg per hectare in 2023; US has consistently had the highest cereal yield in kg per ha

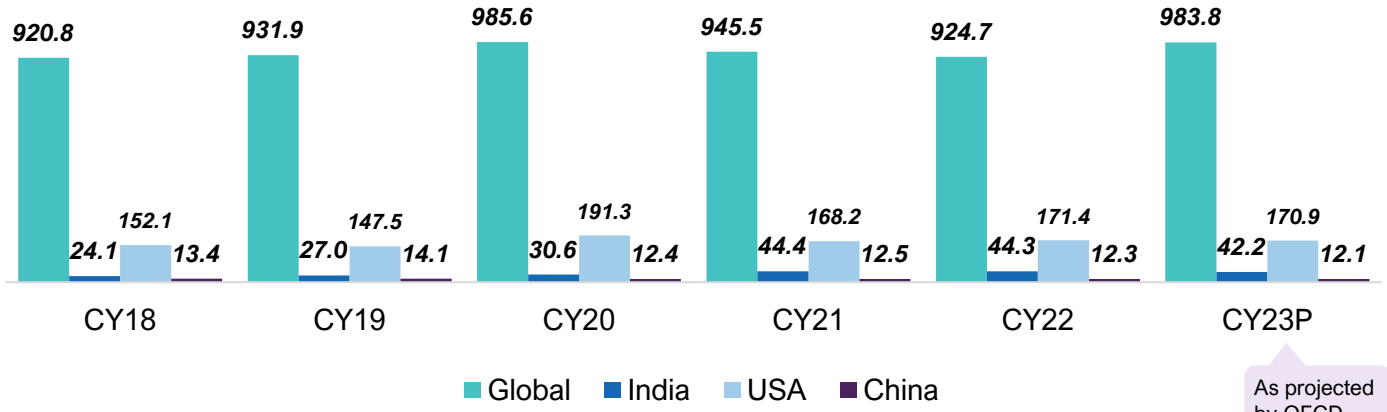
Cereal yield
(Yield in kg per hectare, CY18-23P)

Cereal yield has been calculated considering only wheat, maize and rice production



As projected by OECD

Agriculture and allied sector exports
(M Tonnes, CY18-23P)



As projected by OECD

Insights on global trends:

- In **2023**, global cereal yield is expected to touch **4,610 kg per hectare** as per OECD
- India's contribution to global **agriculture & allied sector exports** is expected to reach **4.3% by 2023** as per OECD

Some key learnings on farm productivity from around the Globe:

- Drawing up **accurate weather maps** & forecasts, landscape maps
- Application of **automatic fertilization** and insecticide
- Use of **drones for monitoring fields** and spraying fertilizers
- Introduction of **automation** of agricultural machinery for harvesting & field processing

Note(s): P: Projected, * is the projected value of USA, Allied sector includes exports of dairy products and fisheries
Source(s): Industry reports, OECD Data, World Bank, Secondary research, Praxis analysis

Overall view of Indian Agritech for various segments

Input

Marketplace: Farm inputs

Commerce websites supplying inputs

AgroStar, Gramophone, AgriBegri, BigHaat, FARMGT

Equipment leasing

EM3 Agri Services, Oxen, AGRI BOLO, Gold Farm, KhetiGaadi, Tractor Bazaar, Farm Services, TRRINGO

Smart farm equipment

Automated Irrigation and smart farming

drip TECH, CULTYVATE, NETAFIM, Vikon.in, SOILSENS, Navariti Innovation, RproARVE

Hybrid Seeds

NUZIVEEDU SEEDS, nu-genes, Agret, ARANYA PARIDHI, mahyco

IoT powered agriculture + Drones

CREDIBLE, bitmantis, AGRONXT, Fasa, SOILSENS, RproARVE, ZENTRON LABS

Output

Marketplace: Farm output

ninjacart, BIJAK, FarmLink, agribazaar, KISAN NETWORK Smart Deals in Your Hand, Farmley, MOBIFARM, VnF, Kamatan, waycool, FarmCon, farmzen, Country Delight, OUR FOOD, big basket, Farmtaaza, Jumbotail

Meat delivery

Licious, pescafresh, Zappfresh.com, fresh to Home

Novel / alternative food

good dot, MISTER VEG, Vezlay, evo

Crop quality assessment

AI / Image powered food analyzing solutions

INWEON, Nebulaa, agricX, INTELLO LABS

Input & output

Marketplace: Input & output

DeHaat Seeds To Market, unnati, FK, KHETHINEXT, Safal Fasal, EKUTIR

Only advisory

Farmer advisory

FARMRISE, IFFCO KISAN, FarmBee, WEATHER RISK, RML, फसल सलाह, bharti AXA, NIRTHI, Jai Kisan

Finance

Input

Jai Kisan, DeHaat Seeds To Market, Samunnati Invested in Your Growth

Output

Jai Kisan, BIJAK, Aggois, Samunnati Invested in Your Growth

SAAS

Precision agriculture & farm management

Provide analytical support for farm / allied activities management

Hummingbird Compass of AgriEconomy, stellapps, AIBONO, eXabit Systems, BharatAgri, Kisan Hub, FarmNXT, farmagain, SatSure, AGNEXT, Cropin, FarmGuide, TARTAN SENSE, frontalrain, Ackcezione Technology for Life, FarmERP, EkoSight, Survis On Demand, INVENTOHACK

Hydroponics

Hydroponics

Growing plants without soil

JUNGA Fresh n Green, woolly, Simply fresh, Fresco, absolute FOODS, LIVING FOOD CO., TRITON FOODWORKS

Insurance

कृषक बल रक्षणम्, NIRTHI, WEATHER RISK securing smiles, bharti AXA suraksha ka naya nazariya, Aggois

Marketplace

Source(s): Secondary research, Praxis analysis

Agritech landscape in USA

Crop inputs & Ag biotech

Ag biotech

CIBUS, INSCRIPTA, Verinomics, pairwise, Apeel Sciences, KULTEVAT, GenCanna, REV GENOMICS, EPICROP TECHNOLOGIES INC.

Hybrid Seeds

INARI, EMERALD SEED COMPANY, KUSSMAUL SEEDS, Sostena, VOLOAGRI, DIXON seed, Kineo's Genetics, dpseeds

Crop protection

agrimetis, AGBIOME, cultiva, PROVIVI, indigo, PEBBLELABS, PIVOT BIO, BOOST BIOMES, BORAGEN

Aquaculture / animal tech

openblue, AAD Advanced Animal Diagnostics, ASCUS BIOSCIENCES, recombinetics, VeroBlue Farms, NATURALSHRIMP, ASTOR FARMS

Farm management and analytics

Precision agriculture & farm management

VISAG SOLUTIONS, CIBO, FARMOBILE, FarmLogs, conservis, SMART FARM, AgShift, Agworld, ARABLE, farmQA, Farm with control, Barn2Door, ecoation, AERIAL INTELLIGENCE, agxio, REALM, Dynamax, grojo, mesur.io, PLANT • MESUR • GROW, teralytic, AGDOC, iFood Decision Sciences

Indoor agriculture & hydroponics

AeroFarms, BOWERY, BRIGHT FARMS, eden green TECHNOLOGY, GOTHAM GREENS, Square Roots, gogreen AGRICULTURE, IRON OX, plenty, farmone, Tortuga AgTech, AppHarvest

Smart farm equipment + imagery

AR AMERICAN ROBOTICS, pyka, VERDANT ROBOTICS, HYLIION, HORTAU, SOFT ROBOTICS, FarmWise, sentera, GrowLife, RESSON, DroneDeploy, ceres

Marketplace & distributors

Market place & e-distributor

ZERO LINK MARKETS, PLOVGH, GrubMarket, POD FOODS, Food Roots, WhatsGood, BÖN HARVEST, Cheetah, Harvestable, FULL HARVEST, DENVER MICROGREENS, LocalHarvest, AGROMOVIL, FoodMaven, simple, BlueCart, Spoiler Alert, AZOTI, Aggrigator, Our Harvest, FARMERS WEB, INTELAGE

Meat delivery

TENDER BELLY, BUCK WILD BISON, CROWD COW, CERTIFIED PIEDMONTESE, Porter Road, GREENSBURY, HONEST

Finance and insurance

Finance & insurance

FARM PLUS FINANCIAL, AGAMERICA LENDING, AG CREDIT, ALABAMA, American Farm Mortgage & Financial Services, Rabo AgriFinance, CHUBB

Equipment / land leasing

TILLABLE, IronSearch, TractorHouse.com, Farmers Implement & Irrigation, FarmExchange, Shared Earth, FarmlandFinder

Novel / alternative foods

IMPOSSIBLE, MEMPHIS MEATS, BEYOND MEAT, alpha FOODS, motif FOODWORKS, GOOD CATCH, IMPROVED nature

Source(s): Secondary research, Praxis analysis

Agritech landscape in China

Crop inputs and Ag biotech

Ag biotech

DBN 大北农集团 | 生物技术 Biotech

科瑞种业 KEHUI SEED

奥瑞金

水中銀 VITARGENT Smarter Testing · Safer Choices · Better World

安徽荃银高科种业股份有限公司 WIN-ALL HI-TECH SEED CO., LTD.

Farm inputs

大丰收 农资商城 DFS168.COM

云农场 ync365.com

Suntoda

农淘网

Farm management and analytics

Precision agriculture & farm management

数溪科技 Shuxi.ai

中农普惠金服

农芯智能

AIRAG

上海飞未 SHANGHAI FEIWEI

珈和科技 JiaHe Info

NB-INNOVATIONS

MCFLY

绿度股份 GREEN MARKS

芝麻地

优农帮 Yoonop

Indoor farming systems

alesca life

aspara

优鲜共享 zuzi

SCATIL

Smart farm equipment + imagery

慧云信息 TALENTCLOUD

Waobot 瓦屋科技

博田机器人 Agribot

科百科技 Kebai Science Inc.Beijing

FJ DYNAMICS

农業航空 Agricultural aviation

WVZ

Marketplace & distributors

Marketplace & e-distributor

宋小菜 SONGXIAOCAI.COM

买点菜

一亩田 YIMUTIAN

找食材

冻师傅 DONGSHIFU

望家欢

美菜 meicai.cn

Nxin 农信互联

LEHE 乐禾食品 LEHE FOOD

海上鲜

Finance and insurance

Finance & insurance

四季为农 SI JI WEI NONG

阳光农业相互保险公司

农发贷 nongfadai.com

中国农业银行 AGRICULTURAL BANK OF CHINA

安华农保 安而上，信而本！

国元农业保险股份有限公司 GUOYUAN AGRICULTURAL INSURANCE CO.,LTD.

安华农业保险 ANHUA AGRICULTURAL INSURANCE

可溯·金融 www.kesucorp.com

Equipment / land leasing

51找地 51ZHAODI.COM

农田管家

Novel / alternative foods

珍肉

avant

STARFIELD 星期零 Food Science & Technology

EIYOKA ALGAE FOODS

OMNIPORK

Source(s): Secondary research, Praxis analysis

Agritech landscape in SEA(1)

Farm management and analytics

Precision agriculture & farm management

HABIBI, mimosatek, TERRAVIEW, CloudFarm Innovations, Inc., msmb, AGRHUB, AGROMEQ, GENEKU, 睿畜科技, REMOTE GRID, MERTANI

Indoor agriculture & hydroponics

POPTANI, EVERGROW AUTO FARM, EdenFarm, SINGROW, SUSTENIR agriculture, HACHI

Smart farm equipment + imagery

REMOTE GRID, ADATOS.AI, garuda robotics, Poladrone

Marketplace & distributors

Marketplace & e-distributor

chilibeli, Fresh at Heart, NUSA BERDAYA, KROPS, 100rai.com, Tagani, Sikumis.com, TaniHub, supply bunny.com, aruna

Farmer advisory

AgriMedia Weather & Agriculture Solutions, GREENcoffee, 8villages, Peragano

Finance and insurance

Finance & insurance

CROWDE, ANGON, iGrow, CROPITAL, Lenddo, VASHAM, ricult, GroWpd, TaniFund, iAPPS

Farm equipment / land leasing

TUNGYAT

Supply chain tech

Supply chain tech

Eachmile, KOLTIVA

Aquaculture

Aquaculture

UMITRON, JALA, eFishery

Novel / alternative foods

Novel / alternative foods

Entobel, NutritionTechnologies, bugsolutely

Note(s): (1): SEA: South-East Asia
Source(s): Secondary research, Praxis analysis

Agritech landscape in GCC(1)

Farm management and analytics

Indoor agriculture & hydroponics

مـزارع مـدار madar farms

عالم الزراعة المائية Hydroponics World

RED SEA FARMS

SIXTY SECONDS SOLUTION
Wifi indoor farming & Grocery Delivery Marketplace

ivris

VERTICROFT

Aero Fresh Farm

Pure HARVEST SMART FARMS

badia FARMS

Oæsis Lighting System Company

Smart farm equipment + imagery

POROSPONIC

Greenponics
Sustainability through Hi-Tech Urban Farming

Moistube
Revolutionising Sustainable Irrigation

Precision agriculture and farm management

FARMIN

ORBITCROPS

AbuErdan.com

Nakheel COGNITIVE PALM

THE PLATFORM CONNECT SMART THINGS

Marketplace & distributors

Marketplace & e-distributor

crops eat smart

Hezmah | حزمة

Uns Fresh. Urban. Local.

farmbox

NABATIK

كيو فريش أنلين QFresh Online

FISH.ME

Grown locally in the U.A.E Nutritious Little Leaf Microgreens

BUTCHERSHOPAE aramtec

bio box

ثمرات farms.sa

EVERY DAY FRESH NRTC Fresh

Hadag

Tajitabe

Supply chain tech

Supply chain tech

agriprocity

Aquaculture

Aquaculture

أكواپونيكا aquaponica

DIBBA BAY

Novel / alternative foods

Novel / alternative foods

Next FOOD

Note(s): (1): GCC: Gulf Cooperation Council
Source(s): Secondary research, Praxis analysis

Food and Agritech: Landscape in different geos (1/2)

Theme	India	US	China	SEA[1]	Israel	GCC[2] + Egypt	CEE[3]
Agri biotech	NUZIVEEDU SEEDS, mahyco, nu-genes	CIBUS, INSCRIPTA, KULTEVAT, EMERALD SEED COMPANY, pairwise, VOLOAGRI, EPICROP TECHNOLOGIES INC.	DBN 大北农集团, 生物技术 Biotech, VITARGENT, 安徽荃银高科种业股份有限公司 WIN-ALL HI-TECH SEED CO., LTD.	×	×	×	×
Agri information and communications technologies (ICT)	FarmBee, IFFCO KISAN, RML, फसल सलाह	AgriSync, WeGrow, Hemp.com, Windowfarms	云种养, AGRIBUDDY	AgriMedia, GREENCoffee, Peragano	×	×	×
Irrigation solutions	drip TECH, FLYBIRD, Intech Harness Pvt. Ltd.	HORTAU, PureSense, FloraPulse, WaterBit, spiio	FENGBA 丰霸, PKYDRIP, Galcon	×	AutoAgronom Ltd., Viridix, NETAFIM, NDrip, SoliDrip	×	×
Smart farm equipment	Cropin, stellapps, AGNEXT, SOILSENS, Fasal	AR, HYLIION, SOFT ROBOTICS, sentera	科百科技 Kebai Science Inc.Beijing, Waobot 瓦屋科技, FJ DYNAMICS	ADATOS.AI, garuda robotics, Poladrone, REMOTE GRID	cropx, See Tree, prospera, FieldIn	POROSPONIC, Moistube, GreenPonics	DATAMARS, QualySense, Quantis
Precision agriculture	eXabit Systems, KnoxiaTechnologies, Eruvaka	CiBO, mesur.io, PLANT • MESUR • GROW, teralytic, INNERPLANT	神农说, 数溪科技 Shuxi.ai	×	BeeHero, FruitSpec, agrematch	×	XTAL FIELDS
Farm management	BharatAgri, Hummingbird, farmagain, FarmERP	CLIMATE FIELDVIEW, CropTrak, conservis, TARANIS	数溪科技 Shuxi.ai, N3-INNOVATIONS, 农芯智能, 上海飞未 SHANGHAI FEIWEI, 珈和科技 JiaHe Info	HABIBI, AGROMEQ, mimosatek, AGRHUB, TERRAVIEW	FARM DOG, agrint, Saturas	FARMIN, THE PLATFORM, ORBITCROPS	eAgronom, FARMDOK
Hydroponics / Indoor agriculture	Fresco, TRITON FOODWORKS, absolute codes	AeroFarms, BRIGHT FARMS, BOWERY, gogreen AGRICULTURE, Square Roots	alesca life, aspara, 优鲜共享	SINGROW, EdenFarm, SUSTENIR, EVERGROW	×	Oæsis, VERTICROFT, madar farms	CombaGroup, NATUFIA, Caulys

Note(s): (1): SEA: South-East Asia, (2): GCC: Gulf Cooperation Council, (3): CEE: Central and Eastern Europe
Source(s): Secondary research, Praxis analysis

Food and Agritech: Landscape in different geos (2/2)

Theme	India	US	China	SEA[1]	Israel	GCC[2] + Egypt	CEE[3]
Post harvest management	ZENTRON LABS, CLOVER, Occipital Tech, Nebulaa	APEEL SCIENCES, purfresh, metrc, FoodLogiQ, hazel technologies inc.	×	×	Pimi Agro, CLARIFRUIT, Valentis nanotech	×	×
Marketplaces & e-commerce	Farmley, ninjacart, FarmLink, bigbasket, Jumbotail, BigHaat, AgroStar, Country Delight	Harvestable, FoodMaven, Food Roots, simple, GrubMarket, TENDER BELLY	宋小菜 SONGXIAOCAI.COM, 一亩田 YIMUTIAN, 冻师傅 DONGSHIFU, Nxin, 海上鲜	chilibeli, 100rai, supply bunny.com, TaniHub, Fresh Heart	×	crops eat smart, Uns, farmbox, NABATIK	×
Agri fintech	Aggois, DeHaat, Jai Kisan	FARM PLUS FINANCIAL, AGAMERICA LENDING, AG CREDIT, American Farm Mortgage & Financial Services	四季为农 SI JI WEI NONG, 农发贷 nongfadai.com, 中国农业银行 AGRICULTURAL BANK OF CHINA, 阳光农业相互保险公司, 国元农业保险股份有限公司 GUOYUAN AGRICULTURAL INSURANCE CO.,LTD.	CROWDE, VASHAM, Lenddo, iGrow, GroWpd, CROPITAL	×	×	×
Farming as a service	EM3 agri services, xen, AGRI BOLO, Tractor Bazar, KhetGaadi	TILLABLE, IronSearch, TractorHouse.com, Farmers Implement & Irrigation, FarmExchange, Shared Earth	51zhaodi.com, 农田管家	×	×	×	×
Animal tech	Odaku, AQUA CONNECT, SEACRASS TECH	openblue, AAD Advanced Animal Diagnostics, Alltech, ASCUS BIOSCIENCES, VeroBlue Farms, NATURALSHRIMP, Agrivida	好当家 HOMEY, 東方海洋 ORIENTAL OCEAN, 大湖股份 DAHU AQUACULTURE COMPANY LIMITED	UMITRON JALA, eFishery	AQUINOVO, BioFishency	aquaponica	×
Novel / alternative foods	good dot, Vezlay, VEG, evo	IMPOSSIBLE, MEMPHIS MEATS, BEYOND MEAT, alpha FOODS, nature, GOOD CATCH	avant, STARFIELD 星期零, EIYOKA ALGAE FOODS, OMNIPORK	Entobel, bugsolutely	DouxMatok, INNOVOPRO, FUTURE MEAT, ALEPH FARMS	Next FOOD	×
Nutrition and supplements	VITALIC MEDICAL, innovcare LIFESCIENCES, OmniActive HEALTH TECHNOLOGIES, Bayir, ORGANIC INDIA, Yoga Bar	Prolacta BIOSCIENCE, JOINT Juice, suja ORGANIC, MUSCLE MARKETING USA, BODYARMOR	金达威集团 KINGDOMWAY, 保龄宝生物 BAOLINGBAO BIOLOGY, layn Natural Ingredients	cerecin, youvit, Eu Yan Sang, MEGA We care	Enzymotec Delivering Lipids, YOFIX	×	×

Note(s): (1): SEA: South-East Asia , (2): GCC: Gulf Cooperation Council, (3): CEE: Central and Eastern Europe
Source(s): Secondary research, Praxis analysis

Global landscape

Universal list of Food and Agritech themes identified (1/2)

Themes	Sub-themes	Description	US	China	India	Israel	GCC[1]+ Egypt	SEA[2]	CEE[3]
Novel / alternative foods	• **Plant based proteins** • **Cultured meat** • **Novel ingredients**	• **Innovative food alternatives** to replace or complement existing food products • Protein-rich ingredients sourced from **plants, insects, fungi, or through tissue culture** to replace conventional animal-based sources	IMPOSSIBLE, mnature, BEYOND MEAT, alpha FOODS, MEMPHIS MEATS	OMNIPORK, STARFIELD 星期零	good catch, evo, VEG, Vezlay	DouxMatok, FUTURE MEAT, ALEPH FARMS	Next FOOD	Entobel, NutritionTechnologies, bugsolutely	×
Smart farm equipment	• **Automation in agriculture** • **Drones** • **Robotics** • **IoT devices**	• **Smart on-farm** machinery, automation, drones and farm equipment including sensors, imagery • **Robots** for agriculture • Use of **IoT devices in farming**	HYLIION, SOFT ROBOTICS, sentera	科百科技, Waobot 瓦屋科技, FJ DYNAMICS	Cropin, stellapps, SOILSENS, AGNEXT, Fasal	cropX, See Tree, prospera	POROSPONIC, Moistube, GreenPonics	ADATOS.AI, REMOTE GRID, Poladrone, goruda robotics	DATAMARS, QualySense, Quantis
Nutrition and supplements	• **Nutraceuticals** • **Dietary supplements** • **Meal replacements**	• Products derived from food sources with **extra health benefits** in addition to the basic nutritional value found in foods • Non-specific biological therapies used to promote general **well-being, control symptoms and prevent malignant processes**	suja, JOINT Juice, healthy energy	金达威集团 KINGDOMWAY, layn Natural Ingredients	VITALIC MEDICAL, ORGANIC INDIA, Yoga Bar, Bayir	Enzymotec Delivering Lipids, Granalix, YOFIX	×	cerecin, youvit, MEGA We care, biotropics MALAYSIA	×
Marketplaces & e-commerce	• **Market linkage platforms** • **Direct to consumers** • **Farm input platforms** • **Direct to farmer**	• Digital platforms which connect farm output with the customers directly, **eliminating middlemen** and streamlining the supply chain • Platforms through which **farmers can buy agricultural inputs** like – seeds, fertilizers, pesticides, etc.	Harvestable, FoodMaven, simple, GrubMarket, TENDER BELLY	宋小菜, Nxin, 海上鲜	ninjacart, Jumbotail, AgroStar, bigbasket, Country Delights	×	crops eat smart, Uns, farmbox, NABATIK	chilibeli, supply bunny.com, TaniHub, 100rai	×
Hydroponics / Indoor agriculture	• **Hydroponics** • **Indoor agriculture** • **Vertical farming**	• Method of **growing plants** in water based, nutrient rich medium, **without the use of soil** • It also includes **indoor agriculture and vertical farming**	AeroFarms, BOWERY, Square Roots	alesca life, aspara	Fresco, TRITON FOODWORKS	×	VERTICROFT, Oæsis, madar farms, Pure	SINGROW, EdenFarm, EVERGROW	CombaGroup, Caulys, NATUFIA
Farm management	• **Farm analytics** • **Farm management**	• Farm management software provides **analytical and decision support** for farm management • Aims to increase **yields**, **fuel** and work efficiency • Allows farmers to **be precise and saves time**	FIELDVIEW, CropTrak, TARANIS	NB-INNOVATIONS, 上海飞未 SHANGHAI FEIWEI, 瑞和科技 JiaHe Info	Hummingbird, BharatAgri, FarmERP	FARM DOG, agrint, Saturas	FARMIN, THE PLATFORM	AGROMEO, TERRAVIEW	VITAL FIELDS, FARMDOK

Note(s): (1): GCC: Gulf Cooperation Council, (2): SEA: South-East Asia, (3): CEE: Central and Eastern Europe
Source(s): Secondary research, Praxis analysis

Global landscape

Universal list of Food and Agritech themes identified (2/2)

Themes	Sub-themes	Description	US	China	India	Israel	GCC[1]+ Egypt	SEA[2]	CEE[3]
Precision agriculture	• **Crop productivity** • **Farm process efficiency**	• Innovative technology solutions for **increasing crop productivity** and **farm process efficiency**	CiBO teralytic	数溪科技 Shuxi.ai 神农说	eXabit Systems Eruvaka KnoxiaTechnologies	BeeHero agrematch	✕	✕	✕
Animal tech	• **Tech in aquaculture** • **Livestock tech** • **Animal feed**	• **Breeding, rearing, and harvesting** of fish, shellfish, algae, and other organisms in all types of water environments • **Tech innovations** for animal farms, livestock breeding tech, farm security	openblue ASCUS 好当家 HOMEY 大湖股份	Odaku AQUA CONNECT SEACRASS TECH	G.F.A BioFishency AQUINOVO	aquaponica OMDA DAY	UMITRON eFishery JALA	✕
Post harvest management	• **Produce preservation** • **Food source traceability** • **Quality testing**	• Companies that develop **technology solutions** for **post-harvest produce handling** • Provide the option of **traceability of produce**, **quality check and preservation**	APEEL SCIENCES metrc FoodLogiQ hazel technologies inc.	ZENTRON LABS CLOVER Nebulaa Occipital Tech	Pimi Agro CLARIFRUIT Valentis nanotech	✕	✕	✕
Agri biotech	• **Hybrid seeds** • **Farm genetics research**	• On-farm inputs for crop including **genetics, microbiome, hybrid seeds**, etc. • Produce plants that are more **nutritious and resilient**, and regulate **farm health** more efficiently	CIBUS INSCRIPTA KULTEVAT	DBN 生物技术 Biotech VITARGENT	NUZIVEEDU SEEDS mahyco nu-genes	✕	✕	✕	✕
Agri fintech	• **Credit providers** • **Agri insurance**	• Innovative financial services using technology to promote **greater access to credit, related services and agriculture insurance**	FARM PLUS FINANCIAL AGAMERICA LENDING	四季为农 SI JI WEI NONG 农发贷 nongfadai.com	DeHaat Jai Kisan	✕	✕	VASHAM CROWDE	✕
Agri information and communications technologies (ICT)	• **Information platforms** • **Advisory services**	• Facilitating access to information such as market pricing, **weather information**, **farming tips** and other information • Helps farmers in understanding the **best input products to increase yields**	AgriSync WeGrow Hemp.com	云种养 AGRIBUDDY	FarmBee PML फसल सलाह IFFCO KISAN	✕	✕	AgriMedia	✕
Farming as a service	• **Equipment leasing** • **Farm services**	• Affordable **technology solutions** to farmers for efficient farming by converting fixed cost to variable cost. It includes **equipment leasing, farm services**, etc.	TILLABLE Farmers TractorHouse.com	51找地 SIZHAODI.COM 农田管家	oxen AGRI BOLO KhetiGaadi	✕	✕	✕	✕

Note(s): (1): GCC: Gulf Cooperation Council, (2): SEA: South-East Asia, (3): CEE: Central and Eastern Europe
Source(s): Secondary research, Praxis analysis

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