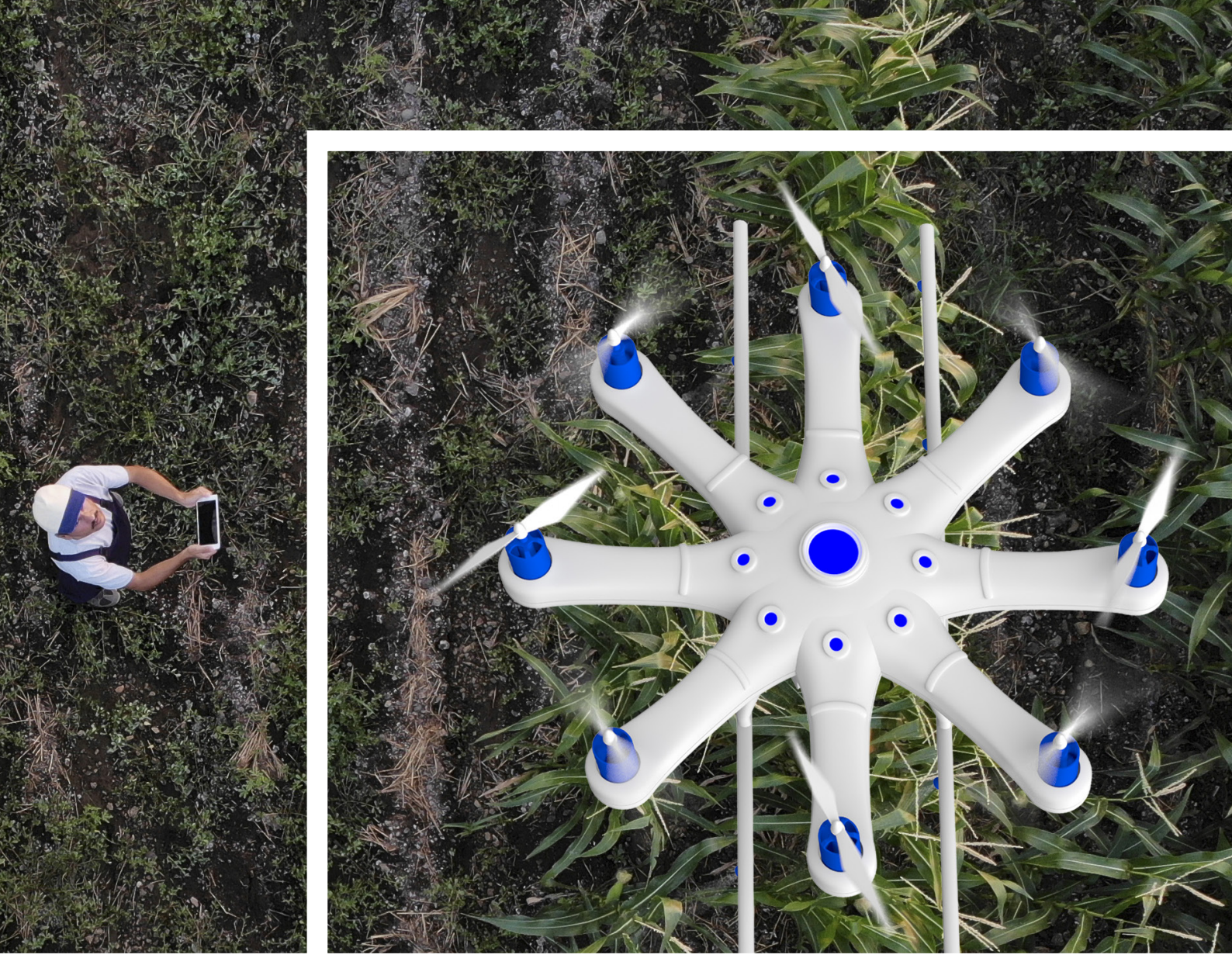


Agri start-ups: Fostering collaboration to bring paradigm shifts in Indian agriculture

January 2022

pwc

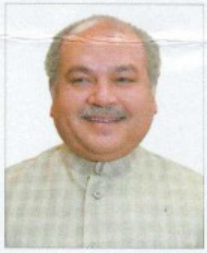
Azadi Ka Amrit Mahotsav

FICCI

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सत्यमेव जयते

कृषि एवं किसान कल्याण मंत्री
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MINISTER OF AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI



MESSAGE

Over last 7 years of governance under the leadership of Hon'ble Prime Minister of India, Government of India (GoI) has undertaken various initiatives to boost the development of agriculture and allied sector. India has approximately more than 700 Agritech startups that are providing customized solutions and products to make the agriculture value chain more profitable and remunerative. Growth and expansion of new age Agritech Startups in India is being driven by numerous promising technologies, while addressing key challenges in the agriculture value chain.

In the last few years, the Government of India (GoI) has made considerable efforts to augment the overall ecosystem for the startups in the country. The growth of Agri startups also has a direct bearing on socioeconomic conditions of rural population through employment generation and bringing farm prosperity. It's an opportune time to seek the right partnerships among key agri startup nations as well, that will add value through innovations and achieve shared goals through their combined efforts. **An efficient exchange of technology, market interests and investments amongst the countries would be highly useful in terms of addressing mutual interests and building efficiencies in the sector.**

I congratulate FICCI team for taking a step to facilitate the deserving and innovative agri startups in the country. Also, I compliment the FICCI-PwC team for taking significant efforts in developing the knowledge report. As proposed in the FICCI-PwC report, agri startups must look-out for market ready solutions with full proof scalability plan while garnering support from ecosystem players and building requisite partnerships.

I feel this report is very timely and ready reckoner for taking informative decisions for enabling Agri startups ecosystem ready for serving the country's need.

(Narendra Singh Tomar)

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MESSAGE

I am happy to know that FICCI is organizing a summit for Agri Startups on January 7, 2022. It is a pleasure to see that FICCI is recognizing potential agri-startups to promote agri business ecosystem in the country. This will certainly help to boost the agricultural productivity as well as create employment opportunities in the country. The startups with innovative technologies and processes are solving the problems of agri-value chain. India requires more startups and investments in this area for higher agricultural growth.

Indian Council of Agriculture Research is promoting startups through 50 Agri-Business Incubation (ABI) Centres in different parts of the country. ICAR incubators provide wide range of services including research support, business planning, office space, access to information, communication technologies and advice on IPR management, marketing, technical, legal and financial issues. AgrInnovate India Limited is promoting development and dissemination of Research and Development outcomes in national and international arena.

I appreciate FICCI for the initiative and convey my best wishes for the success of the event.

(T. MOHAPATRA)

Dated the 3rd January, 2022
New Delhi

Message from FICCI



T R Kesavan

Chairman, FICCI National Agriculture Committee, and
Group President, TAFE Ltd

It is a herculean task to provide adequate food and nutrition security to ten billion people. This certainly calls for transforming Indian agriculture by boosting agri innovations. While we aim to transform agriculture by improving farmers' incomes, it would be most appropriate to include the growing number of agri entrepreneurs as an important part on this journey. Farmers need sustainable solutions and technologies which are customised to their specific requirements. In the last few years, we have seen young entrepreneurs come up with ideas, innovations and business models to support farmers and help them achieve scale and sustainability.

Future interventions in the agriculture sector should certainly focus on the two aspects of reducing production costs for farmers and decreasing losses in the agri and food supply chain. Innovations and new-age technologies in this regard will certainly bring about major changes. Aspiring entrepreneurs have made a significant impact across all the segments of the agriculture sector. With so much potential, these agri start-ups need to be suitably supported and guided. At FICCI, we have made considerable efforts in the last few years to drive industry-start-up partnerships and enable policy initiatives for the development of a strong agri start-up ecosystem in the country.

FICCI and PwC have undertaken a comprehensive survey to understand the 'people-process-technology' aspects of the Indian AgriTech ecosystem and identified 'collaboration' as the stimulus required to strengthen this framework. This report analyses the findings of the survey in detail, and I believe it will of great interest to readers.

Message from FICCI



Vivek Chandra

CEO, Global Branded Business, LT Foods, and Member,
FICCI National Agriculture Committee

The agriculture sector, considered to be the backbone of the Indian economy, has been significantly robust and resilient during the COVID-19 pandemic and innovations by agri start-ups have contributed enormously. The AgriTech sector has gained momentum in the last four years, driven by the entry of highly talented entrepreneurs. Today, India has more than 700 AgriTech start-ups that are providing customised solutions. It is a matter of pride for us that the country has built a strong name for itself in the global AgriTech start-up ecosystem.

The demand for foodgrains would increase from 192 million tonnes in 2000 to 345 million tonnes in 2030 despite no increase in land and natural resources.[I] In such a scenario, we certainly need entrepreneurs who can develop business solutions that enhance crop productivity and build a robust agri supply chain by leveraging new-age technologies. Going forward, building a conducive agri start-up ecosystem is very crucial for the country and this can be done by strengthening collaboration between key stakeholders and developing friendly policies. Strong alliances with potential agri start-ups will lead to innovation-led growth in the sector. Collaboration and alliances will also ensure that AgriTech start-ups scale up and achieve the desired high-level impact that will be crucial not only for their sustainability but also for enhancing the productivity and output of the sector.

I congratulate the FICCI Task Force on Agriculture Start-ups and the PwC team for providing a very conducive platform to agri start-ups to showcase their technologies. I am sure that this knowledge report will provide interesting insights to readers and help build a robust agri start-up ecosystem in the country.

I https://icar.org.in/files/ICAR-Vision-2030.pdf

Message from FICCI



Hemendra Mathur

Chairman, FICCI Task Force on Agriculture Start-ups and Technology

The year 2021 has been a fantastic one for Indian AgriTechs. Indian agri start-ups raised investments to the tune of almost USD 1 billion. The investments gathered momentum despite the pandemic, with the participation of many new investors from the seed stage to late stage. I see the momentum continuing in 2022 and beyond.

The Indian AgriTech sector, which took root in the last decade, has evolved into a space that offers innovative solutions to the problems faced by Indian farmers. I am hopeful that India will have more than 10,000 sustainable start-ups in the next 8–10 years. I am also delighted that many such start-ups have been founded by the sons and daughters of farmers, making the ecosystem more inclusive.

Indian AgriTech is entering its third phase, which will be driven by increasing farmer adoption of new-age innovations and a significant degree of consolidation in the start-up space. For a change, we are also witnessing significant participation from agri corporates, who are trying to partner with start-ups or building their own platforms. The intersection of agribusinesses and AgriTech will further drive the scale and innovation agenda in the sector.

As we enter into the next phase of AgriTech, I see two big opportunities ahead – innovations for solving climate risk issues and integration of unique financing models for farmers and value chain members, including processors, warehouses, distributors and retailers. Both these themes are likely to reach inflection points in 2022–23. We need to create an enabling ecosystem for these two themes to foster participation from governments, multilaterals and financial institutions.

The participation of women in Indian agriculture is increasing, and I would like to see more women entrepreneurs in the sector in order to bring in more diversity and build more women farmer centric solutions. A few such women are already engaged in some path-breaking work, and I am hopeful that they will inspire other women entrepreneurs to join the ecosystem. Lack of talent is another challenge faced by the sector. It's high time that we reorient the curriculum in our agricultural universities to make it multidisciplinary, especially by including data science, digital tech, biotech, nutrition tech and behavioural sciences. We need to build capacity to cater to the emerging talent needs of the start-up ecosystem.

The scale of Indian AgriTech start-ups depends on the partnerships that they are able to develop with ecosystem players, including farmers, farmer producer organisations (FPOs), cooperatives, common service centres (CSCs), research institutions, agricultural universities, incubators, investors, central/state governments and district administrations. This is precisely the reason we have chosen 'partnership and collaboration' as the core theme of this report. At FICCI, we are facilitating partnerships between agri start-ups and the industry and policymakers to accelerate the adoption of AgriTech solutions. In order to achieve this, we organise events, publish reports, undertake research and arrange for meetings to drive interactions on a continuous basis. This report aims to update our readers on the latest and best developments in Indian AgriTech.

I acknowledge and appreciate the significant efforts of my colleagues at FICCI and the members of the PwC team in bringing out this report.

Message from PwC



Ashok Varma

Partner and Leader, Agriculture and Social Sector

PwC India

The agriculture sector not only contributes towards securing the livelihoods of large populations in developing economies but also helps in sustaining economic growth in developed countries. By 2050, the global population is **forecasted to reach 10 billion**, which makes it critical to find disruptive solutions to fulfil the future requirements of food, feed, fuel and factory,[II] and sustain the livelihoods of smallholder farmers (SHFs). In this context, AgriTech start-ups have been playing an important role in harnessing the potential of such disruptive technologies to support farmers in achieving better scale, systems and sustainability.

India is a prominent agricultural economy among emerging markets. It is the largest producer of **spices, pulses and milk, and the second-largest producer of wheat, rice, tea, fruits and vegetables, sugarcane, farmed fish, cotton and oilseeds.**[III] Currently, India is the world's fourth-largest producer of agrochemicals and accounts for nearly one-third of the global tractor production. While the country's production, productivity and exports have been impressive in the last decade, it is also imperative to keep pace with the global trends in the agriculture and food sector through rapid adoption of evolving technologies, innovations and research and development. The vibrant ecosystem of AgriTechs has played a critical role in the last few years.

India is next only to the US and China in terms of AgriTech funding and has secured cumulative investments worth over **USD 1.5 billion in the last ten years, exhibiting 14 times growth from USD 45 million in 2011.**[IV] At present, there are **more than 700 AgriTech start-ups** in India that are developing customised solutions and products to make the agricultural value chain more profitable and remunerative. With an impressive inflow of funding, more than 48% of AgriTech CEOs in the country believe that they will have the next AgriTech unicorn within a three-year time frame.[V] Hence, the future potential for AgriTech start-ups in India is immense while they navigate the **'USD 10 billion and beyond' journey.**

The Government of India (GoI) has shown its deep commitment to bring policy reforms in the agriculture and allied sector to further strengthen the AgriTech ecosystem.[VI]

This knowledge report discusses the results of a dipstick survey on the **people, process and technology** aspects of the Indian AgriTech ecosystem. According to the survey, '**collaboration**' will drive this burgeoning framework. This collaboration can be in the form of thematic partnerships, institutional partnerships to augment innovations, scalability and value chain profitability, corporate-AgriTech collaborations, geographical collaboration to exchange best practices, among others. Understanding the capabilities and areas of expertise of agri start-ups and how the solutions developed can be made affordable and scalable can pave the way for applying these solutions at scale to address the unique challenges faced by Indian farmers.

II https://www.fao.org/3/i6583e/i6583e.pdf

III https://ficci.in/study-page.asp?spid=23437&sectorid=11

IV https://assets-global.website-files.com/5f1ff8f1f7870a765db9d2f2/5fd376f3834460551277252d_Post%20Covid%20Agritech%20Landscape%20in%20India-compressed.pdf and PwC analysis

V https://aspirecircle.org/impact-event/food-agri-agritech/

VI https://agricoop.nic.in/sites/default/files/NITI%20Aayog%20Policy%20Paper.pdf

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Executive summary

Global food systems employ **29%[1] of the world's workforce and utilise 38%[2] of the total available** land for the cultivation of crops. A total of **570 million farms** are available worldwide, out of which **500 million[3] are smallholders which account for 80% of the world's agricultural produce**. By 2050, the global population is **forecasted to reach 10 billion**, which makes it crucial to find disruptive solutions to fulfil future requirements of food, feed, fuel and factory,[4] and sustain the livelihoods of smallholder farmers (SHFs).

Indian farmers are predominantly SHFs, and there are **more than 40** critical farming activities that need attention and informed decision making to ensure a good yield and appropriate return on investment. New and emerging technologies such as the internet of things **(IoT), drones, mobility, cloud computing, big data, remote sensing, artificial intelligence (AI), machine learning (ML), image analytics and processing, blockchain, and agribots** are poised to transform traditional agriculture into data-driven precision farming to generate sustainable profits.

AgriTech start-ups harness the potential of these emerging technologies to support farmers in reaching better scale, systems and sustainability. Some of the potential solutions offered by AgriTech start-ups are the use of mobile app based crop advisory, crop and livestock sensors, rental services in farm machinery, drones, Agri-FinTech and others. Global investment in AgriTech start-ups stood at **USD 91.55 billion till Q1 2021**, and the last two years accounted for 51% of the investments. **More than 3,000 AgriTech deals have been finalised to boost innovation and address the complex challenges across the agriculture and allied value chain**. Globally, AgriTechs have attracted investments worth over **USD 26 billion** in 2020. Downstream AgriTechs have **received approximately 60% of these investments, i.e. USD 15.8 billion**. India is next only to the US and China in terms of AgriTech funding.

AgriTechs in India have secured cumulative investments worth over **USD 1.5 billion in the last ten years, exhibiting 14 times growth starting from USD 45 million in 2011**. The country has **more than 700 AgriTech start-ups** that are providing customised solutions and products to make the agricultural value chain more profitable and remunerative. Interestingly, every **ninth agri start-up in the world is from India**, wherein less than five global AgriTech companies have ventured in India compared to over 25 Indian AgriTech companies with a global presence. Currently, the market size of AgriTech start-ups in India is valued at **USD 204 million**, which is estimated to be **1%** of the current addressable market opportunity of **USD 24 billion**. Hence, the future potential for such start-ups is immense while navigating the **'USD 10 billion and beyond' journey**.

A few such **promising AgriTech developments** in the agriculture and allied value chain include future-ready farm mechanisation (FM), tech-based cold chain and logistics in agriculture, plant-based proteins, fortification in the food value chain and using technology in the dairy sector. PwC and FICCI have conducted a dipstick survey to understand the **people, process and technology** aspects of the Indian AgriTech ecosystem and identified **collaboration** as the driver for growth in this ecosystem.

While Indian AgriTechs embark upon their journey of prominence and profitability, it is important to learn from a few of the best AgriTech practices from leading AgriTech countries like Israel, Netherlands and China. Public-private partnership (PPP) and the development of a composite **innovation-investment-interdependence** ecosystem emerge as key observations from the best practices in by these countries. The current status of Indian AgriTechs makes it incumbent on them to pursue the **collaboration and partnership** agenda and consolidate themselves for long-term sustainability. They may collaborate based on thematic areas, institutional or regional priorities, and complementary capabilities. Such collaboration would support the evolution of Indian AgriTech start-ups from their current state of dynamic change to one of greater stability.

1 https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS

2 https://www.fao.org/3/i6583e/i6583e.pdf

3 https://www.fao.org/family-farming/themes/small-family-farmers/en/

4 https://www.fao.org/3/i6583e/i6583e.pdf

5 https://finistere.com/wp-content/uploads/2021/04/Finistere-Ventures-2020-AgriFood-Tech-Investment-Review.pdf and PwC analysis









Journey of agri start-ups worldwide

Understanding the global relevance of agriculture

The agriculture sector not only contributes towards securing the livelihoods of large populations in developing countries but also helps in sustaining economic growth in developed economies. Employees of global food systems account for **29%[6] of the world's employed and utilise 38%[7] of the total available** land to produce food. Out of the total **570 million farms** available worldwide, **500 million[8] are smallholders which produce 80% of the world's food crops**. The global population is **forecasted to reach 10 billion by 2050**, which makes it crucial to find solutions to fulfil future requirements of food, feed, fuel and industry.[9]

Global food demand is expected to increase by **59–98% by 2050.[10]** Agricultural produce needs to increase by 50% by 2050 compared to 2012 production levels if this demand is to be met. Most of the additional food demand in the near future is expected to arise from the regions experiencing high population growth, particularly India, the Middle East, North Africa and Sub-Saharan Africa. India is also expected to become the most populous country, overtaking China by 2027.[11]

In future, we would need to feed **10 billion[12] people** worldwide, provide them with adequate nutritional security and ensure sustainable agriculture despite the shrinking land and natural resources. To develop strategies which will address the problems of global hunger effectively and efficiently while boosting innovations, it is imperative to understand the region-wise relevance of agriculture based on some important parameters presented in the figure below.

Relevance of agriculture worldwide

Parameter	Americas	South Asia and Southeast Asia	Europe	Sub-Saharan Africa	Australia and New Zealand	India
Total population (in million)	368	4,641	747	1,340	42	1,330
Share of agriculture in GDP (%)	4.5%	14.5%	1.3%	14.9%	1.9%	~20%
Share of small landholders (<2 ha) in total (2013)	>10%	<60%	60%	~80%	>10%	~70%
Share of agriculture employment in total employment (%)	10.3%	47.4%	4.2%	54%	3%	~60%
Access to network (4G)	80%	88%	80%	60%	83%	~74%
Food preference relevancy (simple and low in sugar, fats, lactose, etc.)	High	Medium	Medium to high	Low	Medium to high	Medium
Share of food wastage due to supply chain issues	11.6%	20.7%	15.7%	14%	5.8%	~30%

Source: PwC analysis

- The above figure clearly suggests that Europe, the Americas and Australia focus majorly on reducing food losses and providing more nutritious food to consumers.
- With agricultural employment accounting for a significantly high share in total employment, increased smartphone and 4G penetration, and the growing demand for farm-to-fork visibility/traceability in agri supply chains in South and Southeast Asia, adoption of digital solutions is growing rapidly across the agricultural value chain.

6 *https://www.weforum.org/reports/the-global-risks-report-2020*

7 *https://www.oav.de/fileadmin/user_upload/5_Publikationen/5_Studien/170118_Study_Water_Agriculture_India.pdf*

8 *National Compilation on Dynamic Groundwater Resources in India, 2019, Central Ground Water Board*

9 *https://www.fao.org/3/i6583e/i6583e.pdf*

10 *https://www.fao.org/3/ca9229en/ca9229en.pdf*

11 *https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html*

12 *https://www.weforum.org/reports/innovation-with-a-purpose-the-role-of-technology-innovation-in-accelerating-food-systems-transformation*

The above trends indicate that new-age start-ups worldwide are working proactively to solve the sector's impeding problems as a whole and transform it into a **billion-dollar opportunity area.**

The increased role of digital interventions in the agricultural and allied value chain, and emergence of AgriTechs

The need for sustainable and robust agricultural value chains has never been felt so strongly before as issues like a growing global population, shrinking arable land, shortage of labour, increase in per capita consumption, diet pattern changes and rise in greenhouse gas (GHG) emissions are becoming prominent. While agricultural domain-specific advancements have addressed the value chain concerns to some extent, digital technologies hold immense global promise for the future.

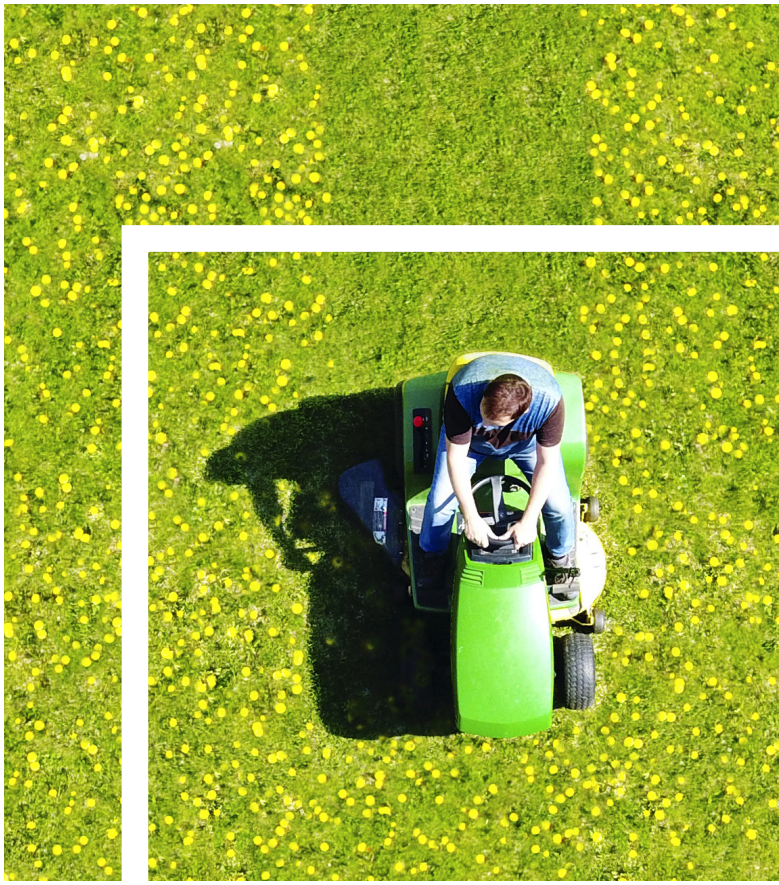
More than 40 critical farming activities need attention and informed decision making to ensure good yield and appropriate return on investment. Farmers are challenged by the insufficient quality of agri inputs, poor decision making during critical crop-growth stages, produce marketing, weather unpredictability, role of different intermediaries such as commission agents, and shortage of labour, loans, and insurance facilities, etc. Easier and quicker access to real-time data related to weather forecasts, crop characteristics, soil health, diseases or pests, and telemetry is a significant development. New and emerging technologies such as **IoT, drones, mobility, cloud computing, big data, remote sensing, AI, ML, image analytics and processing, blockchain, and agri bots** are transforming traditional agriculture into data-driven precision farming for generating sustainable profits. The COVID-19 pandemic has further accelerated the adoption of such relevant technological interventions to manage multiple aspects across the agricultural value chain.

There has been a significant inflow of entrepreneurial ideas and sizeable investments over the last decade, with the emergence of multiple digital and tech-based opportunities across the agricultural and allied value chain. These AgriTech start-ups are providing customised solutions and products to transform the agricultural value chain into a more profitable and remunerative one. The global growth and expansion of new-age AgriTechs are being driven by numerous promising technologies while addressing key challenges. Both the Government and the private sector are continuously emphasising the integration of scientific data and technology in the farming system. Some of the potential solutions offered by AgriTech start-ups are the use of **mobile app based crop advisory, crop and livestock sensors, rental services in farm machinery, drones, Agri-FinTech and others.** Apart from providing these services, the growth of AgriTech start-ups also has a direct impact on the socioeconomic conditions of the rural population through employment generation and bringing farm prosperity, especially in developing nations.

The global AgriTech investment scenario: A USD 100 billion journey

Global investment in AgriTech start-ups stood at **USD 91.5[13] billion up to Q1 2021**, out of which 51% investments were recorded only in 2019–2020. **More than 3,000 AgriTech deals[14] were closed in 2021 globally to boost innovations, address complex challenges across the agricultural and allied value chain, and ensure food and nutritional safety while adhering to ESG compliances.**

The examples below show how global AgriTechs are addressing certain deficiencies in the upstream[15] and downstream[16] segment of the agricultural value chain.



13 *https://finistere.com/wp-content/uploads/2021/04/Finistere-Ventures-2020-AgriFood-Tech-Investment-Review.pdf and PwC analysis*

14 *https://agfunder.com/research/2021-AgFunder-agrifoodtech-investment-report and PwC analysis*

15 *Industries around farm inputs, biotechnology, farm management, commodities and trading, food safety and traceability, indoor farms, aquaculture, cultured meat, etc.*

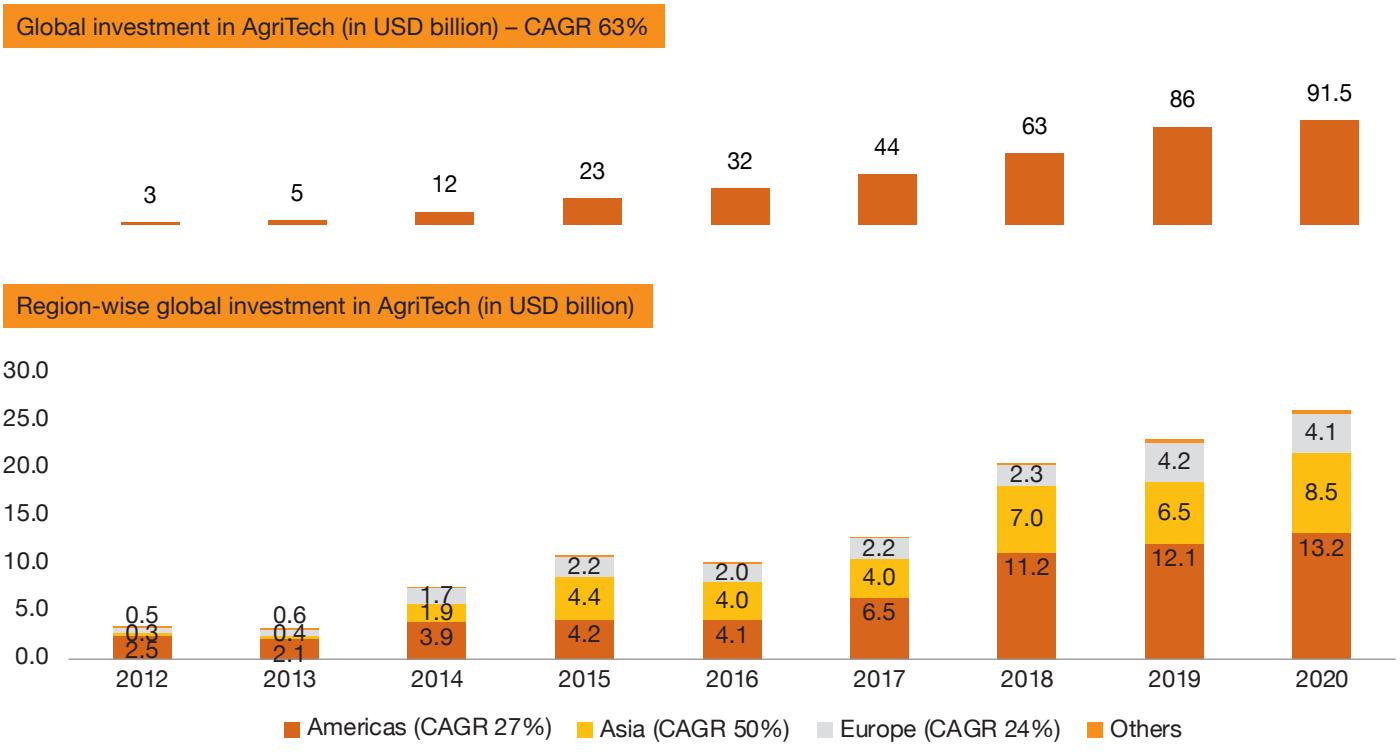
16 *Industries around retail tech, online restaurant marketplace, e-grocery, etc.*

- **A total of 500 million SHFs produce food for 80% of the population from developing countries**. Farmer landholdings in developing nations are majorly fragmented, resulting in significantly low yields. In **Europe and the US, the average sizes of landholdings are 30 times and 150 times more** respectively, compared to India. Increased population and continuous subdivision of agricultural land in India's joint family system have further reduced the average operational landholding size.
- **Nearly 1.3 billion tonnes of food is wasted** due to an inefficient supply chain.
- **Approximately 155 million children suffer stunted growth while two billion people** are overweight.
- The existing global food system is responsible for **approximately 30% GHG emissions, 70% freshwater withdrawals and 70% biodiversity loss.**[17]
- Production advantages are huge on the supply side but the level of processing for perishables in **developing nations** continues to be **very miniscule at around 10% and even lower for fruits and vegetables (F&V) at approximately 2%.** Additionally, the level of agricultural produce wastage is very high due to the dilapidated supply chain network.

Although these challenges demand concerted efforts from all ecosystem players, innovation-led agri start-ups have emerged as important catalysts, making the entire global agri-food system more efficient, effective and sustainable across both developing and developed nations.

AgriTechs worldwide have attracted investments worth over **USD 26[18] billion** in 2020. Downstream AgriTechs have **received approximately 60% of the investments, i.e. USD 15.8 billion,** compared to upstream AgriTechs. The key trends and highlights of this **USD 100 billion journey of investments in the global AgriTech space are shown below.**

Global investment in AgriTech (in USD billion)[19]



Source: AgFunder AgriFoodTech Investment and PwC analysis

17 *https://www3.weforum.org/docs/WEF_Innovation_with_a_Purpose_VF-reduced.pdf*

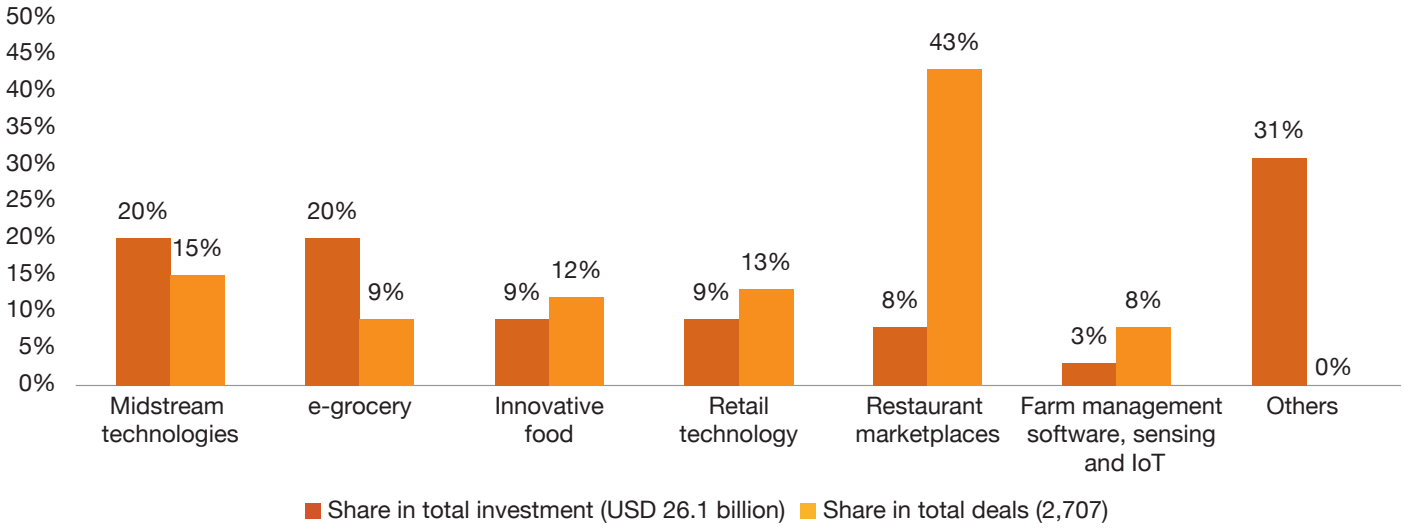
18 *https://agfunder.com/research/2021-AgFunder-agrifoodtech-investment-report and PwC analysis*

19 *https://agfunder.com/research/2021-AgFunder-agrifoodtech-investment-report and PwC analysis*

Globally, the **US** holds the **leading position** in attracting the maximum number of deals and a majority of the investments across the agricultural and allied value chain with an annual investment portfolio of **USD 15.4 billion**. Investments in the US primarily focus on the matured bets (AgriTechs which have received multi-round funding) in midstream categories (mix of upstream and downstream). China has exhibited slow growth in acquiring deals, but focuses primarily on **downstream categories with large ticket sizes** such as e-grocery, online restaurants and home and cooking tech. On the other hand, investments in Europe increased at a year-on-year (YoY) growth rate of **5% compared to 7% in Asia.**

It is evident from the figure below that the restaurant and consumption category (platforms which aggregate vendors to deliver food) attracted the majority of deals, followed by midstream categories (food safety, logistics and processing) and innovative foods (plant-based meat, proteins, etc.).

Overall global investment and deals in AgriTech in 2020 (by sector)



Source: AgFunder AgriFoodTech Investment and PwC analysis

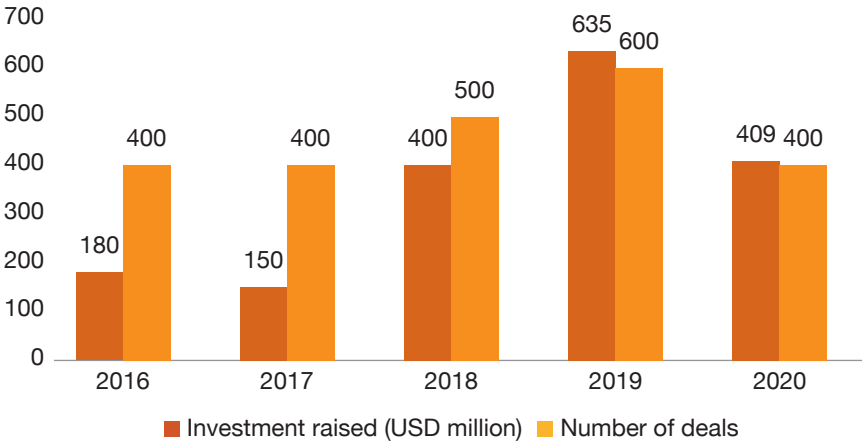
AgriTech investments in India: A USD 10 billion opportunity

India is next to the US and China in terms of the amount of AgriTech funding it attracts. AgriTechs in India have received cumulative investments worth over **USD 1.5 billion in the last ten years, exhibiting a 14 times growth starting from USD 45 million in 2011.**[20]

There are approximately **more than 700 AgriTech start-ups** in India that are providing customised solutions and products to transform the agricultural value chain into a more profitable and remunerative one. Growth and expansion of new-age AgriTechs in India are being driven by numerous promising technologies while addressing key challenges in the value chain. Both the Government and the private sector are continuously emphasising the integration of scientific data and technology in the farming system. Some of the potential solutions offered by AgriTech start-ups are the use of mobile app based crop advisory, crop and livestock sensors, rental services in farm machinery, drones, Agri-Fintech and others. Apart from these services, the growth of AgriTech start-ups directly impacts the socioeconomic conditions of India's rural population through employment generation and bringing farm prosperity.

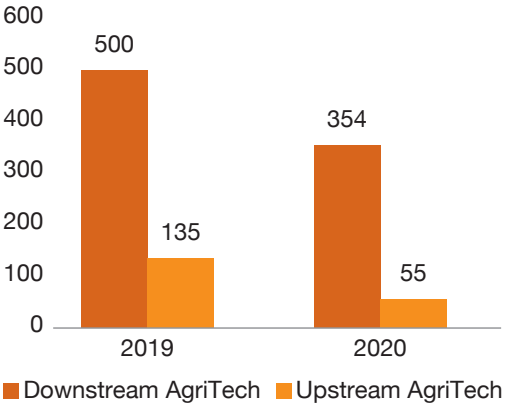
20 *https://assets-global.website-files.com/5f1ff8f1f7870a765db9d2f2/5fd376f38344605512772252d_Post%20Covid%20Agritech%20Landscape%20in%20India-compressed.pdf and PwC analysis*

Domestic investments and deals in Indian AgriTechs (2016–2020)



- In 2020, the total value of annual investment declined by 35% compared to 2019 and reached USD 409 million.
- Altogether, 45 AgriTechs have raised funds in 2020 compared to 58 in 2019.

Domestic investments in AgriTech by streams in 2019–2020 (USD million)



In contrast to the global trends, Indian investors are investing more in downstream opportunities compared to the upstream segment. It has also been observed that most of the mature AgriTechs are present in both the segments.

Source: World Bank

Investments worth USD 1 billion were recorded between 2010–2020, out of which **approximately USD 600 million** came in between 2019–2020. It is estimated that investments worth USD 10 billion will be recorded **in this space over the next decade**. A platform approach in AgriTech (input, credit, data, advisory, market linkage, processing and value addition) is critical to solving the most complex value chain challenges and optimise profitability in agriculture.

Industry perspectives on India's AgriTech journey

The Indian AgriTech sector came into prominence in 2010 and is being driven by increasing investor interest and the entry of prominent entrepreneurs, thereby gaining momentum in the last few years. Interestingly, every **ninth AgriTech start-up in the world is from India,** though less than five global AgriTech companies have ventured in India compared to over 25 Indian AgriTech companies with a global presence.

AgriTech start-ups in India are endeavouring to solve multiple challenges prevalent in the agricultural value chain. These include suboptimal productivity, low efficiency in the supply chain, lack of access to markets and institutional credit, low penetration of crop insurance, poor-quality inputs and lack of market linkages. Currently, the market size of AgriTech start-ups in India is valued at **USD 204 million**[21] which is estimated to be 1% of the current addressable market opportunity of **USD 24 billion.** Hence, there is immense future potential for such start-ups as they navigate the **USD 10 billion and beyond journey.** At present, supply chain and output market linkages are the major investment areas in the Indian agri start-ups space, followed by Agri-FinTechs, precision agriculture and traceability start-ups.

Start-ups which have successfully overcome the pandemic-induced challenges and other related uncertainties have a long way to go in their business journey. The pandemic has provided start-ups with new business opportunities in the agricultural value chain. A few such promising AgriTech themes operating in the agricultural and allied value chain have been identified based on industry interactions and are analysed below.

1. Future-ready farm mechanisation (FM)

The Indian farm equipment market is worth **USD 13 billion. It accounts for 7% of the global market and is forecasted to grow at a compound annual growth rate (CAGR) of 6% from FY19–25.** Currently, the mechanisation level in India stands at **40–45%,** which is very low compared to developed economies where it has reached beyond **90%,**[22] ultimately offering huge opportunities in the sector. The adoption rates of farm equipment have been increasing and the **increased sales of tractors and rise of farm power availability (FPA)** in last several years are a clear indicator of this.

21 https://ficci.in/spdocument/23437/Agri-start-ups.pdf

22 https://ficci.in/spdocument/23154/Online_Farm-mechanization-ficci.pdf

Promising AgriTech investment areas under future-ready FM include promotion of specialised equipment for small and marginal farmers, promotion of shared utility or IT-enabled aggregation, promotion of climate-smart and gender-neutral mechanisation, promotion of mechanisation around farming as a service (FaaS), IoT and AI, etc.

2. Tech-based cold chain and logistics in agriculture

As per a study conducted by the Central Institute of Post Harvest Engineering and Technology **(CIPHET), Ludhiana, the total harvest and post-harvest losses in India amounted to USD 14 billion in 2018.**[23] The crop wastage levels in India vary across categories, with F&V and the marine sector accounting for the highest. There is a huge opportunity in technology-based cold chain and integrated logistics in the country. Based on the previous trends, the cold chain market is expected to grow at a CAGR of 20% till FY26.[24]

Potential AgriTech investment areas under tech-based cold chain and logistics in agriculture include farm gate micro cool chambers, doorstep scientific storage solutions, flexible and mobile cold storage solutions, adoption of clean energy based technology solutions instead of grid electricity, passive cooling system to service the last mile with reduced risks and dependency on connected powers, affordable instant milk chillers, etc.

3. Plant-based proteins

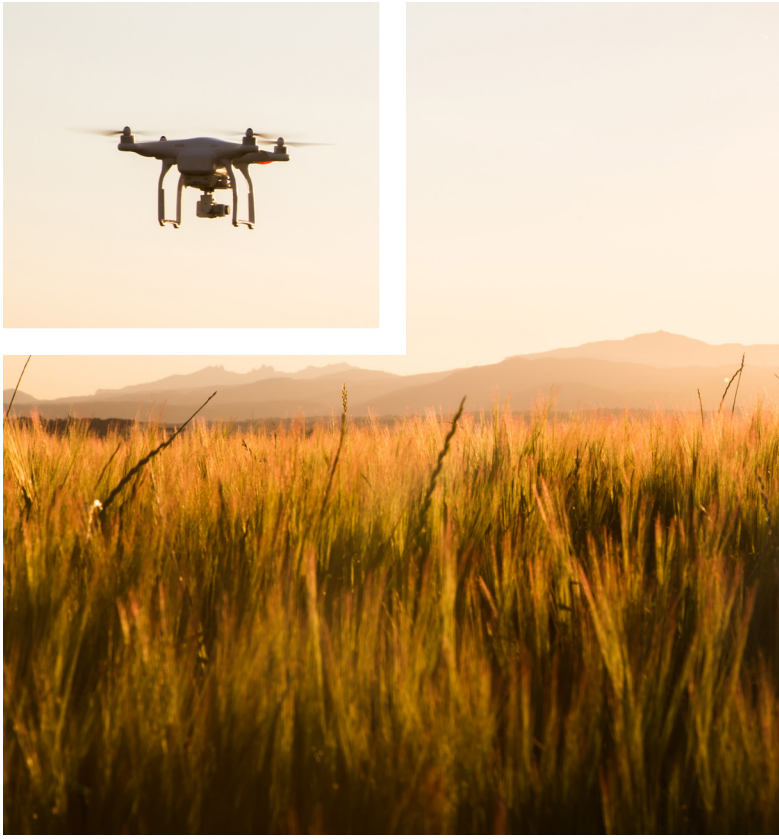
The plant protein market size in India was valued at USD 427 million in FY19 and is expected to grow at a CAGR of 14.5% between FY19–24. Soy dominates the Indian plant protein market.[25] The growth of plant proteins is being majorly driven by India's growing population (especially the middle-income group), crop diversity, greater awareness about fitness and nutrition (the sports nutrition market is expected to grow at a CAGR of **23% by 2023), and** the demand for vegan products surging by 40–60% during the pandemic.

Key AgriTech investment areas in plant-based **proteins include protein supplements (powders/ shakes/bars) from new sources** such as pea, rice, quinoa and almond, **product innovations** in plant-based dairy – ice-cream, yoghurt and cheese – and plant-based meat, eggs and seafood, exploring research and development (R&D) and innovation opportunities (taste, texture and nutritional profile of soy-based meat), etc.

4. Fortification

As per a Global Alliance for Improved Nutrition (GAIN) report, approximately **26% of India's population (268 million) is considered to be food insecure, consuming less than 80% of the minimum energy requirement.**[26] India accounts for one-third of the world's total number of stunted children under the age of five.[27] In this context, agriculture through fortification has an important role to play in not only improving farmers' income but also leveraging it for the country's larger nutritional and health outcomes. Fortification is a proven and cost-effective **(<0.1% of the maximum retail price)** approach to mitigate malnutrition and related challenges. India's food fortification premix market attained a volume of nearly 925 metric tonnes in 2020 and is expected to grow at a CAGR of 23.2%.[28]

The potential AgriTech investment areas under this space include the promotion of biofortified seeds (vitamin Z, zinc and iron), fortified ready-to-eat (RTE) products, meeting global standards in fortification methods and processes, and enhancing R&D opportunities in **food and seed fortification.**



23 *https://www.ciphet.in/upload/files/CIPHET%20AR%202018-19.pdf and PwC analysis*

24 *https://www.yesbank.in/pdf/cold_chain_opportunities_in_india.pdf*

25 *https://www.agroberichtenbuitenland.nl/binaries/agroberichtenbuitenland/documenten/publicaties/2020/10/15/emi--quest-for-plant-protein-india-2020/EMI_Embassy+of+Netherlands_Plant+Protein+In+India_15.10.2020.pdf*

26 *https://www.pfndai.org/Document/Association_News/Delhi%20Activity/Food_Fortification_In_India_Enriching_Food_Lives_-_Ms_Deepti_Gulati_.pdf*

27 *https://www.who.int/nutrition/globalnutritionreport/2018_Global_Nutrition_Report.pdf*

28 *https://www.expertmarketresearch.com/reports/india-food-fortification-premix-market*

5. Dairy

India is the largest milk producing country with an aggregate production of **198 million metric tonnes (MT) in 2019–20.**[29] The overall output value of the agricultural and allied sector in the country is estimated to be at around INR 28 lakh crore and milk accounts for **more than 25% of the total output value.**[30] With an increasing population, urbanisation and an enabling policy environment for the dairy sector, it is estimated that India would require around 600 million MT of milk per year to fulfil the demand for milk and milk products in 2060 and beyond.[31] India's milk production has to grow at a CAGR of around 3.2% for the next 40 years to meet future requirements.

AgriTech investment areas for the dairy sector include product innovations and increased processing efficiency, **traceability,** technology innovations in niche dairy products such as **flavoured camel milk powder, camel milk based skincare products or goat milk ghee,** tech-enabled **milk and milk-product delivery platforms, genetic breed improvement, forage management, artificial insemination and disease management.**

PwC and FICCI understand the promising areas of exploration for AgriTech in India and have jointly conducted a detailed ground survey to gather insights on the Indian agri start-up ecosystem, related challenges and the way forward in terms of people, processes and technology adoption.



29 *https://www.nddb.coop/information/stats/milkprodindia*

30 *https://ficci.in/spdocument/23304/Development-Dairy-Sector.pdf*

31 *Ramsinbhai P Parmar, Chairman, GCMMF, at the 45th Annual General Body Meeting, 29 May 2019*

A closer look at AgriTechs and insights

PwC, in collaboration with FICCI, conducted a detailed virtual survey of agri start-ups in India in September 2021. The key insights from the survey, presented in this section, could help investors, industry players, the government, farmer producer organisations (FPOs) and other ecosystem players to better strategise in the Indian AgriTech space. The survey covered a sample of 43 start-ups across the industry in various areas of operations.

Understanding the ecosystem

People: To understand the 'people' aspect of the AgriTech ecosystem, information was collected on team structure, their involvement in business, operations and how team skills are supporting and helping to grow the business. In addition, challenges and future plans have also been presented.

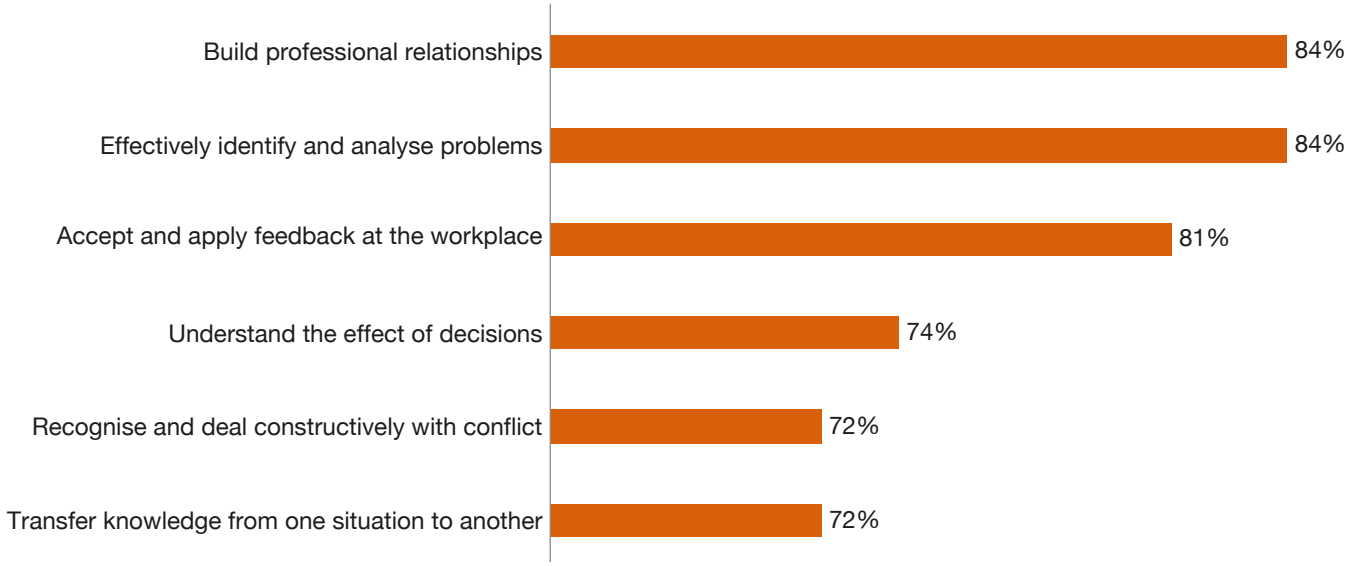
Assessment of the people parameter

1. Strength of start-ups

Parameter	Core team members	Total strength	Share of female
Average	3	31	21%
Highest	11	202	67%
Lowest	0	2	0%

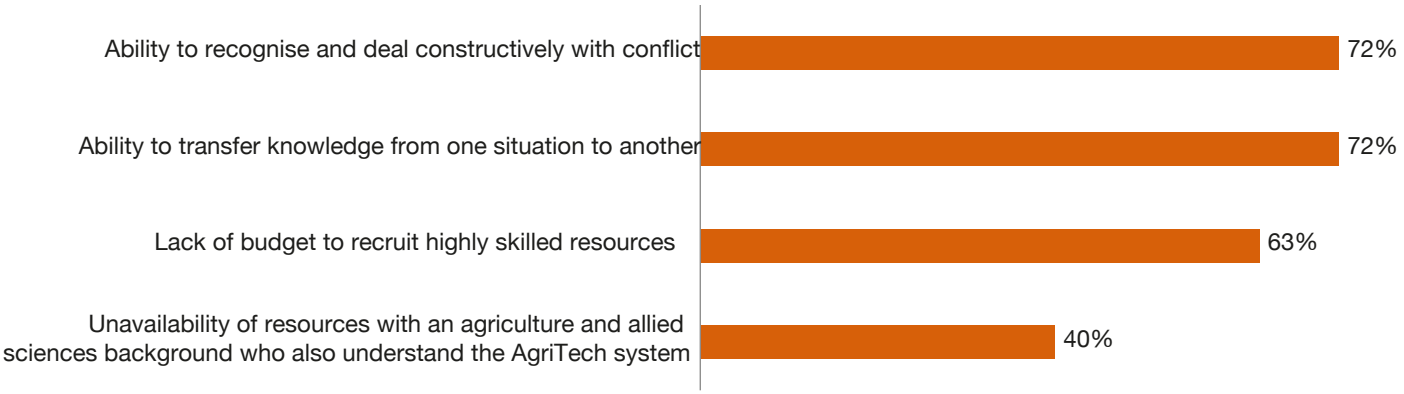
2. Skills available in the existing team

Respondents rated the skills on a scale of 1 (highly unlikely) to 5 (highly likely). The chart below shows only the skills that received a score of 4 (likely) and 5.

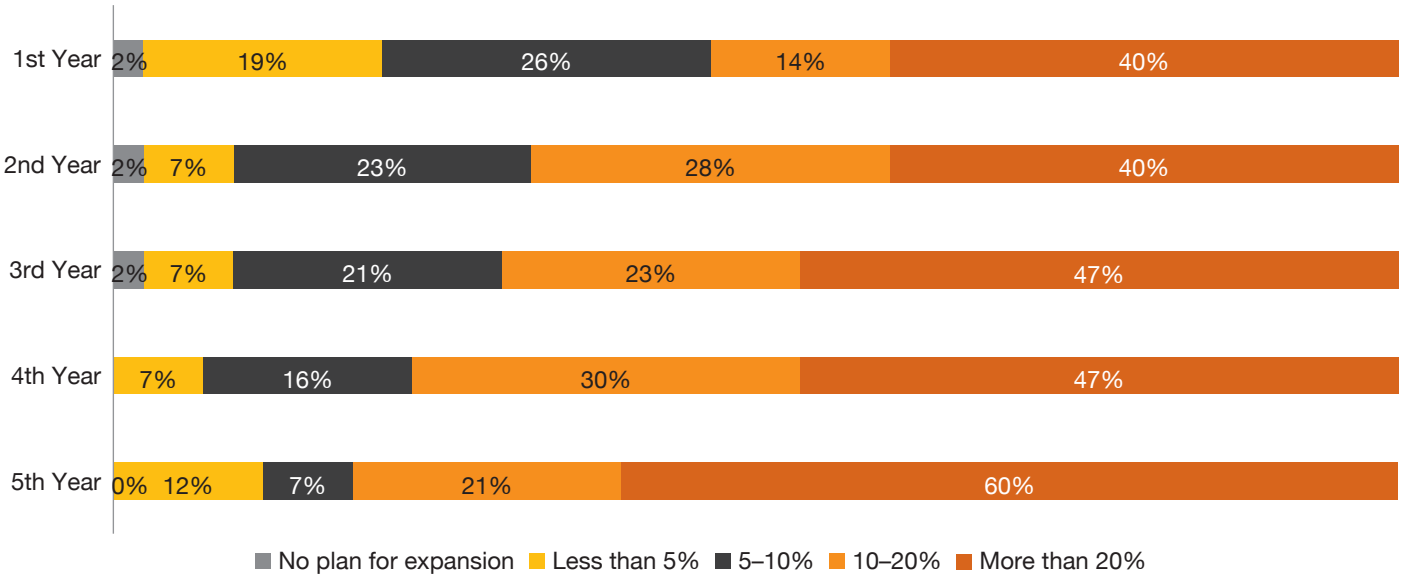


3. Challenges faced

As with the previous category, we used a rating scale of 1 to 5. The chart below shows only those challenges that respondents rated 4 and 5.

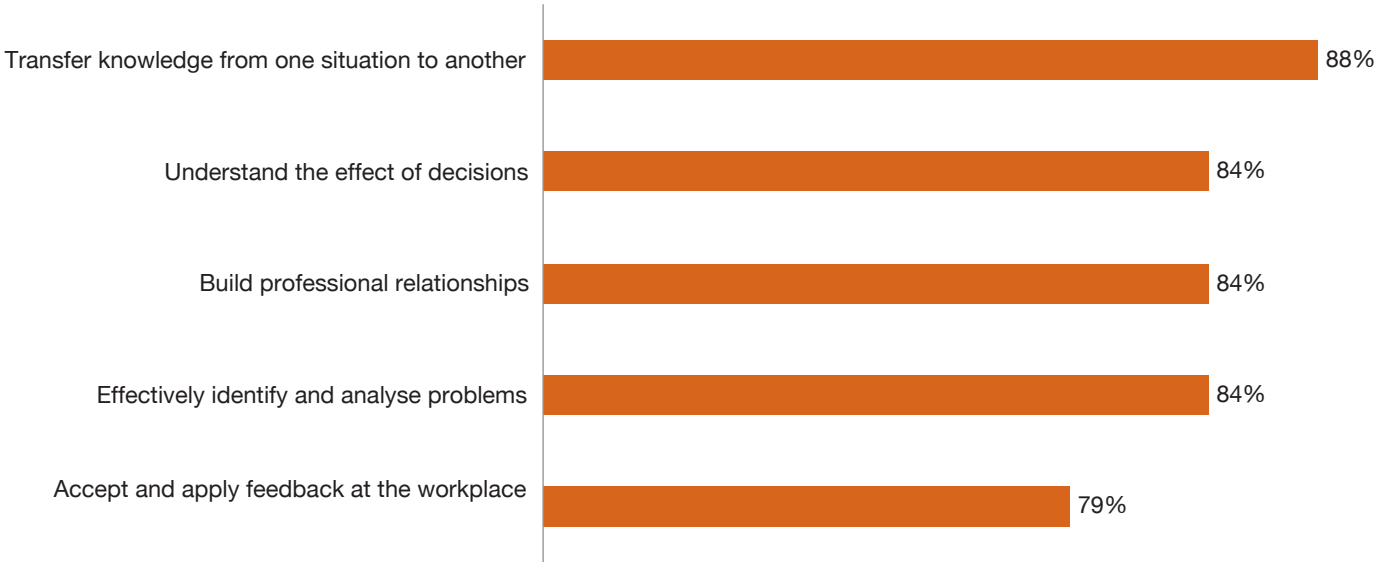


4. Plans to expand your team in the next five years



5. Skill sets identified for future development of the start-up

The chart below shows only those skill sets that were rated 4 (likely) and 5 (highly likely) on a scale of 1–5.

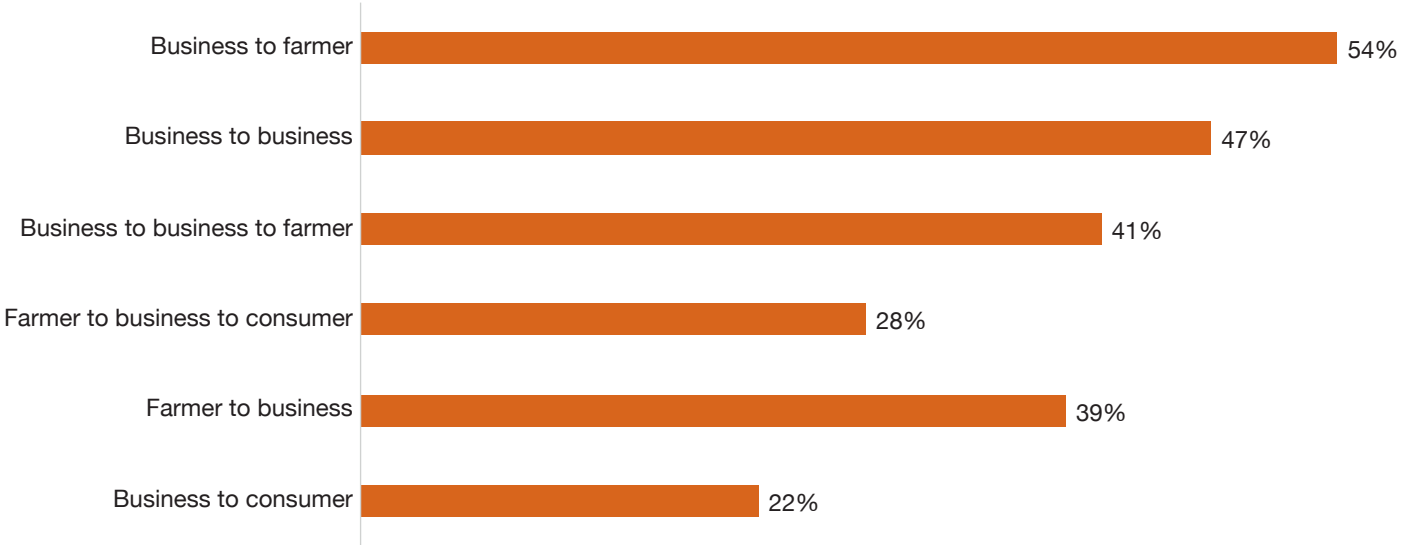


Based on the findings of our survey, it appears that **Indian AgriTechs anticipate an increase in resource requirements for the next five years.** The skill sets that will be in demand among AgriTechs include agility, ability to build professional relationships, networking skills, and problem identification skills.

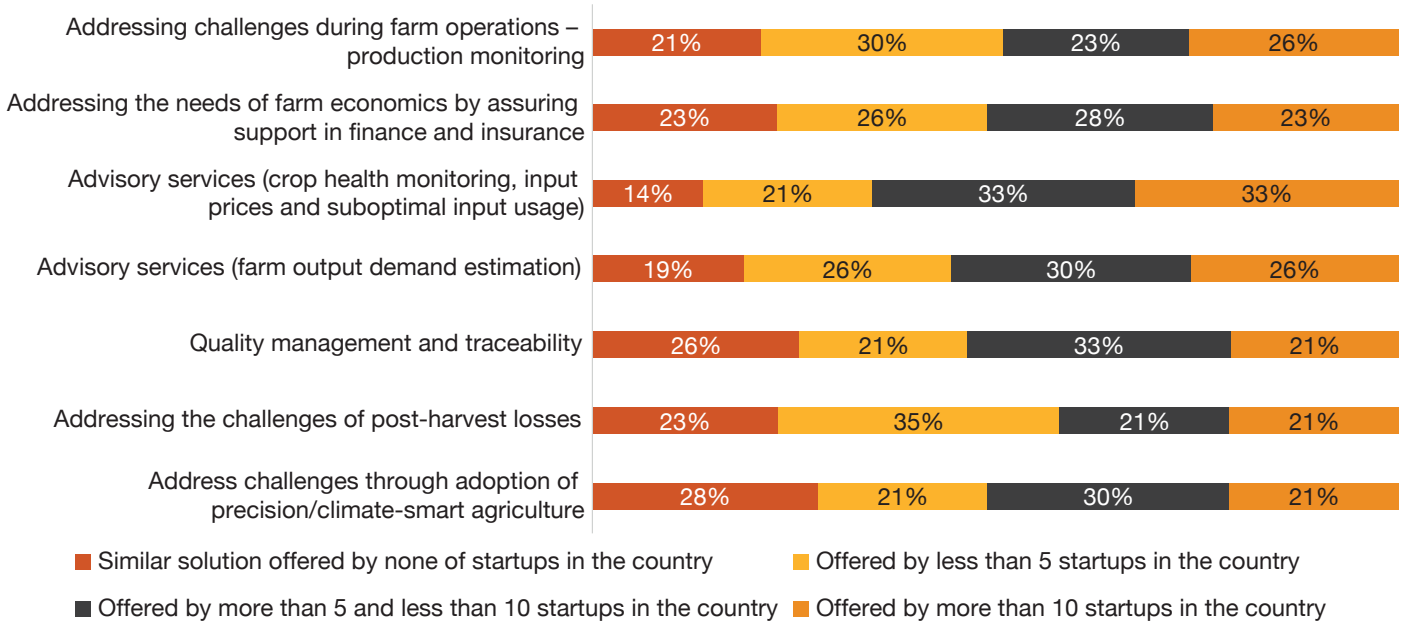
Process: Our survey also evaluated the 'process' parameter, which encompasses the business models adopted by start-ups, uniqueness of their business propositions, problem statement addressed and business outreach.

Assessment of the process parameter

1. Status of the business – type of business model adopted

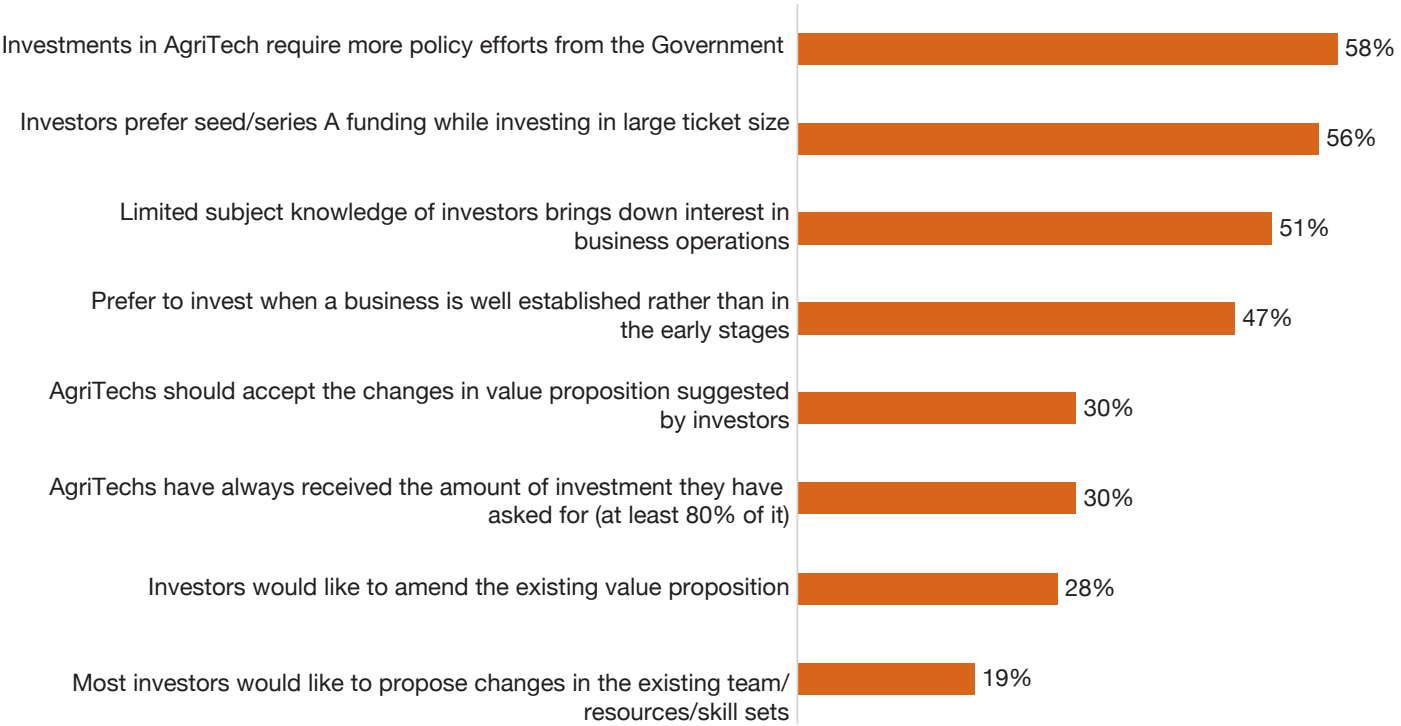


2. Uniqueness of the business proposition

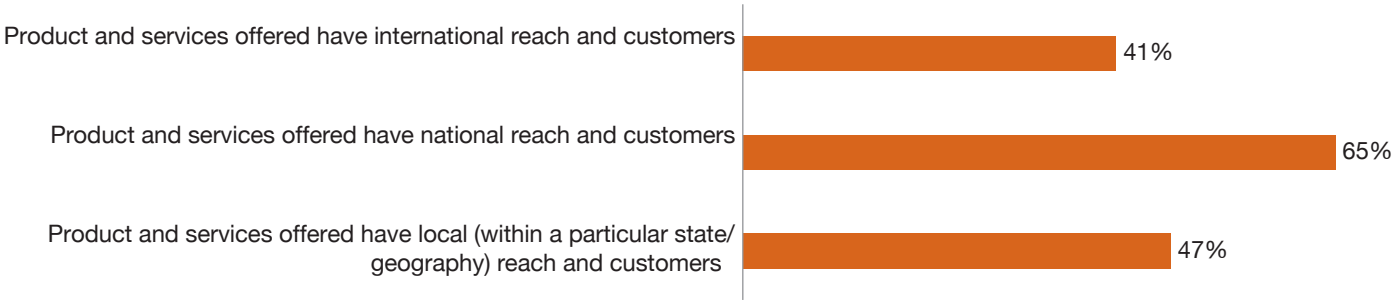


3. Challenges/requirements of investors

The challenges and requirements were rated on a scale of 1 to 5, where 5 is highly likely and 1 is highly unlikely. The chart below shows the responses that received a score of 4 and above.

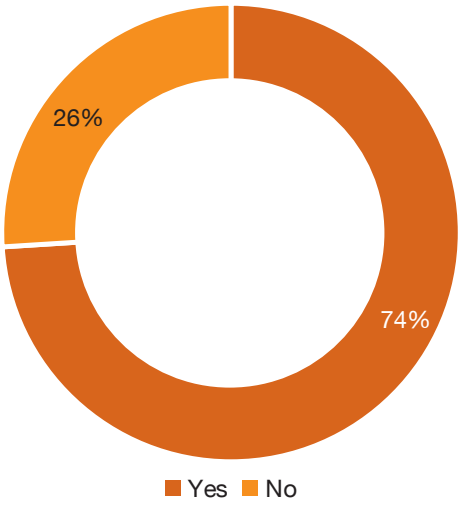


4. Existing business outreach/scale of business



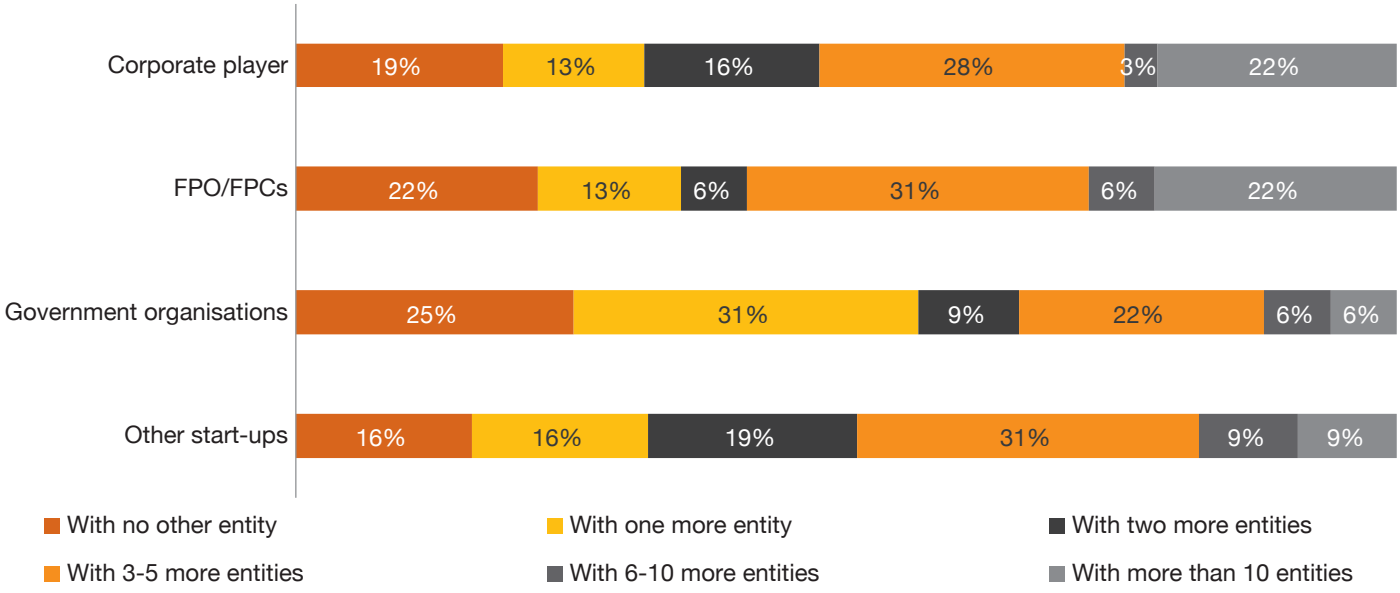
5. Existing relationship with other market entities/stakeholders?

5.1 Are you involved with other types of enterprises such as corporate players, (FPOs)/farmer producing companies (FPCs), government organisations or other start-ups?



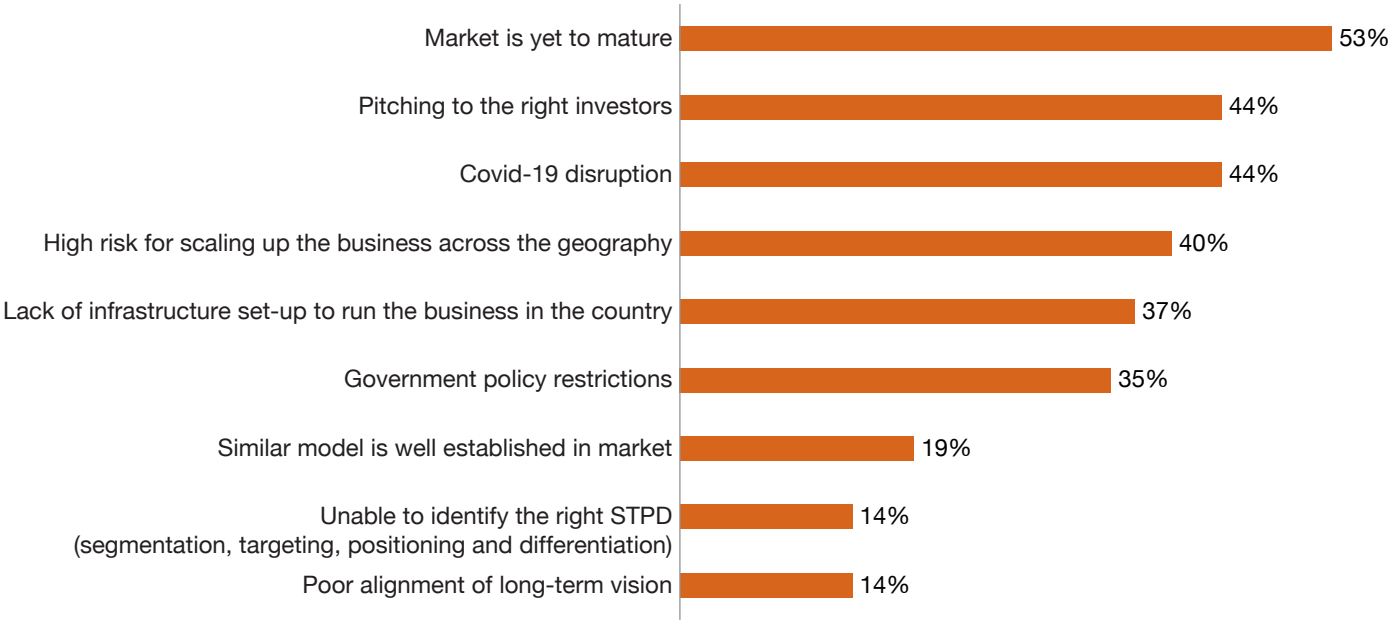
5.2 Number of entities involved/partnered with under each category

Out of the 43 respondents, 74% (or around 32 of the start-ups surveyed) have established linkages with other entities. Here is the status of their partnership by category of entity.

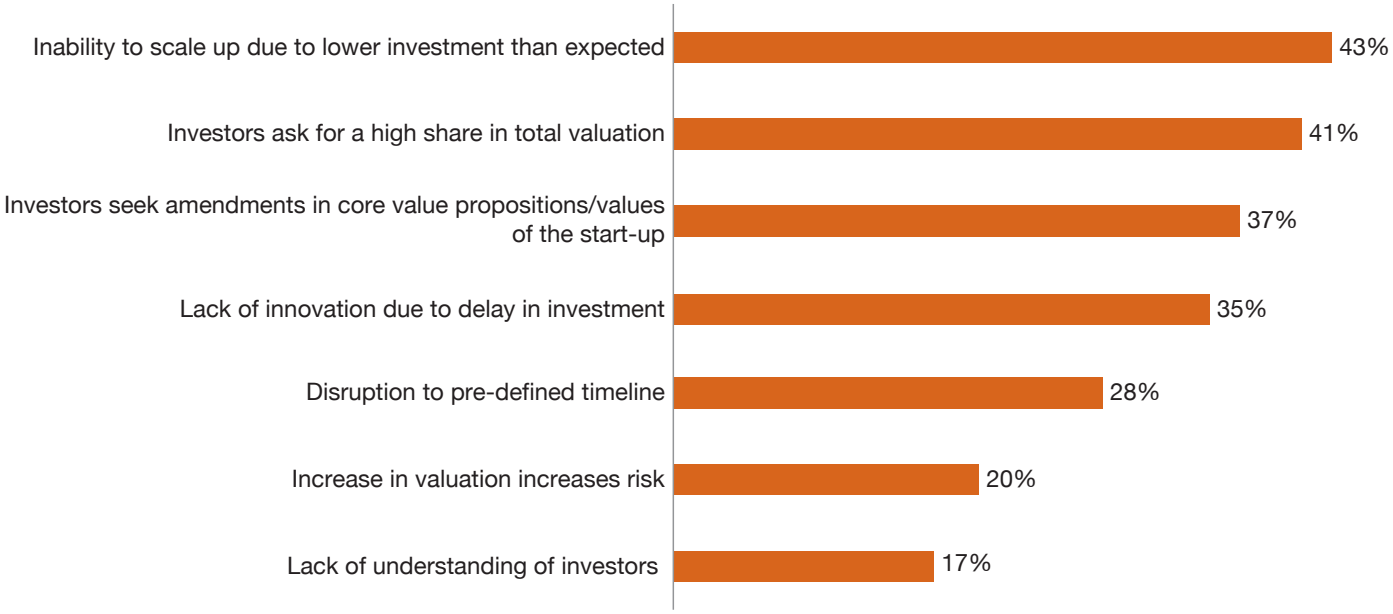


6. Challenges faced in operations

The chart below shows the responses that were rated 4 and above on a scale of 1 (highly unlikely) to 5 (highly likely).



7. Challenges faced after receiving funding



With regard to process, business proposition turned out to be ‘ordinary’ than ‘unique’ as 80% of the responses offer similar recommendations/solutions like other 5–10 start-ups in the market.

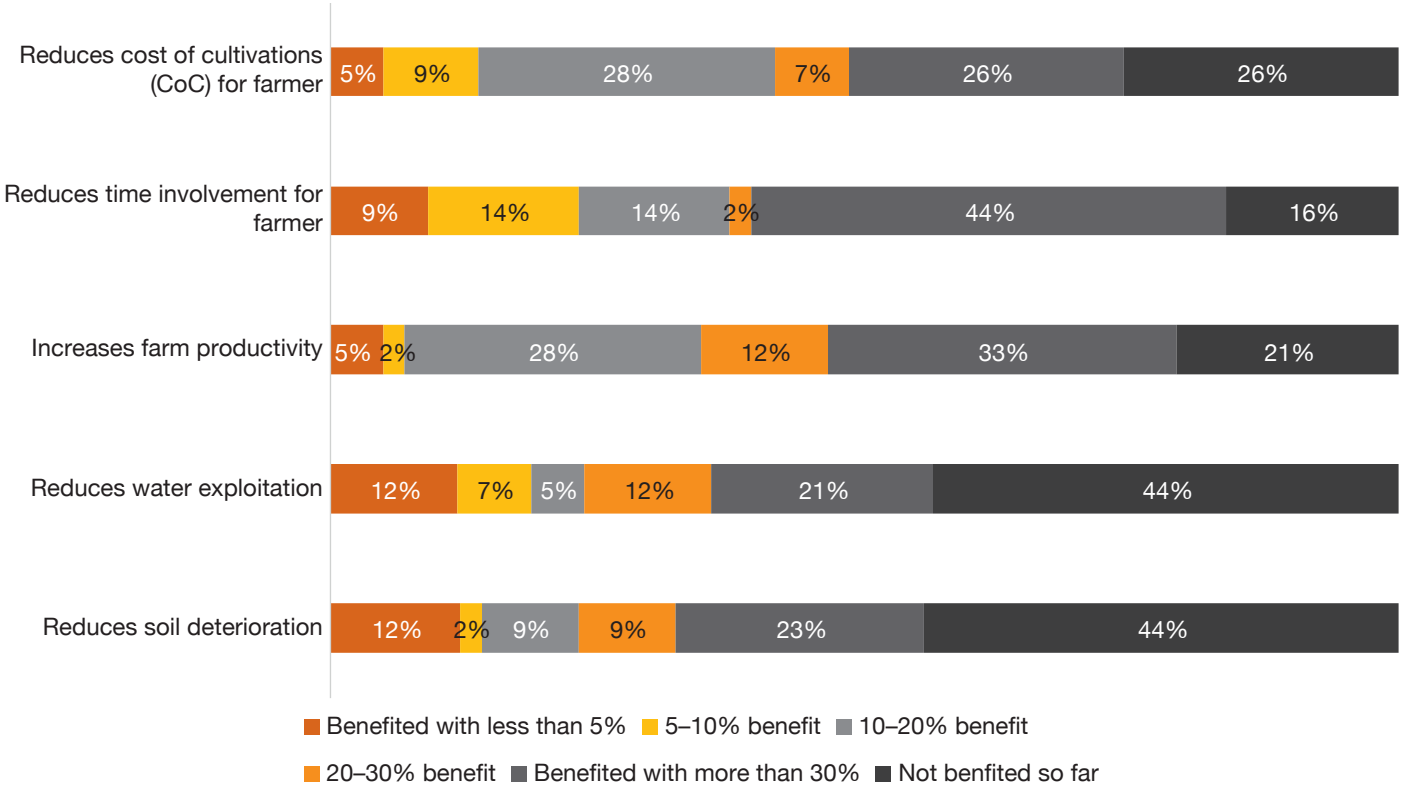
Technology: Our survey also gathered information on the **technology** aspect in terms of dependency, benefits and way ahead.

Assessment on technology parameter

1. Technology interventions by start-ups

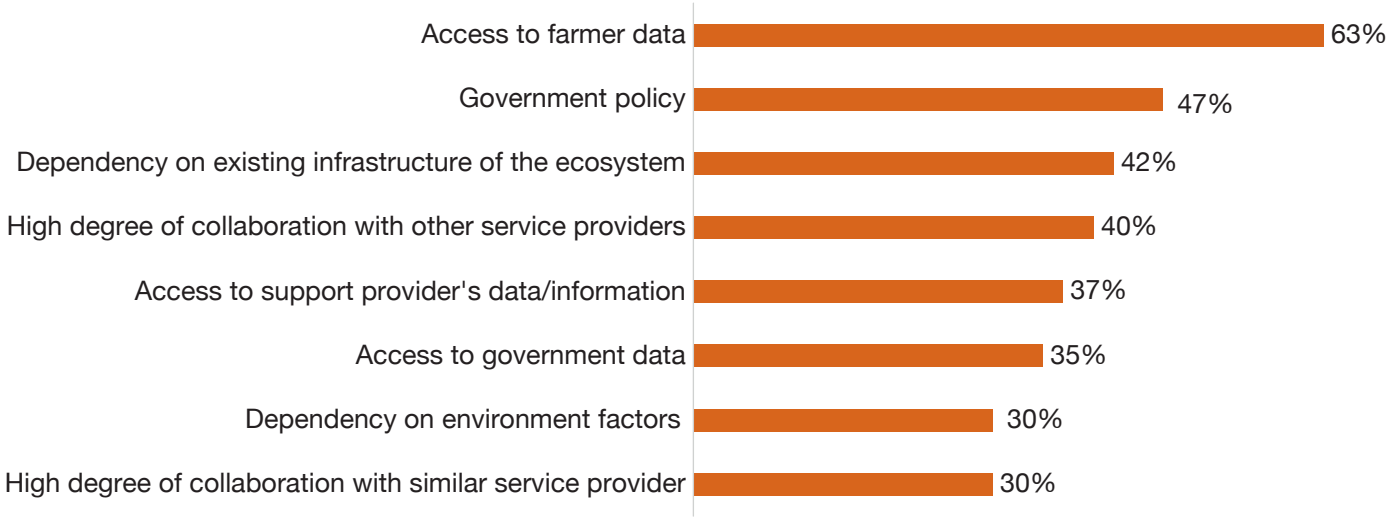
Parameter	Number of technologies developed at your own	Number of technologies procured from developer	Number of technologies available
Average	3	1	4
Highest	12	5	12
Lowest	0	0	0

2. Benefits of existing technology interventions

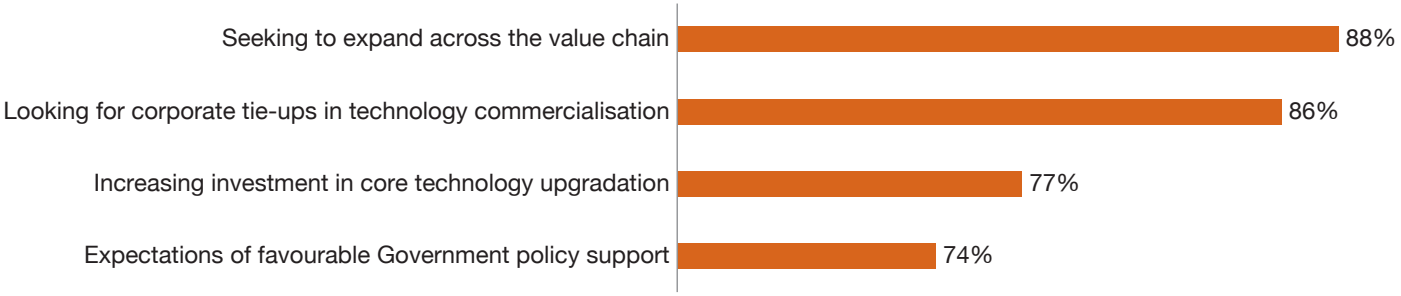


3. Dependency on technologies invested in or developed by start-ups

The chart below shows the responses that were rated 4 and above on a scale of 1 (highly unlikely) to 5 (highly likely).



4. Future plan



On the technology front, our survey indicates that AgriTechs are looking to expand across the value chain.

A closer look at our survey findings reveals that AgriTechs will see considerable traction in the area of technology adoption in the next five to ten years. With regard to process, business proposition turns out to be 'ordinary' than 'unique' as 80% of the responses offer similar recommendations/solutions like other 5–10 start-ups in the market. AgriTechs say they expect enabling Government initiatives and collaboration for commercialisation of technologies.

To scale up AgriTechs in a more sustainable way, domestic start-ups would need better access to people, processes and technology. Collaboration and learnings from other AgriTechs, including global ones, could be very useful to domestic start-ups.

Learnings from global agri start-ups

What learnings can Indian AgriTechs draw from their counterparts in leading nations such as **Israel and the Netherlands?** Understanding the capabilities and areas of expertise of agri start-ups in these countries can pave the way for collaboration and partnerships in the post-COVID world and beyond, helping to build a globally competitive and a robust agri start-up ecosystem.

Israel

Despite limited natural resources, Israel's agriculture sector contributes around **1.15%[32] of its GDP.** Interestingly, Israeli agri start-ups saw investments worth around **USD 800 million** until 2019.[33] Currently, **700 agri start-ups** in Israel are addressing the various challenges of the country's agri and allied sector. A global R&D hub based in Israel spends **approximately** 4% of country's GDP[34] in order to solve global challenges in innovation and hence attracts a sizeable amount of foreign investment too. In Israel, agri start-ups are largely innovating and investing in the upstream segment of the supply chain. This segment accounted for **72%** of the overall funding value received and **80%** of the number of deals locked in 2014–2018. Among these, farm management, sensing and IoT accounted for investments worth **USD 208 million.**

AgriTech in Israel: An overview[35]

Sectoral challenges	Drivers	Expertise areas
• Only 20% of the land in Israel is arable • Shrinking water resources – only 90 cubic metres available per capita compared to 1,069 in India, 1,927 in China and 8,615 in the USA • Soil structure unsuitable for farming	• Comparatively higher investments in R&D and innovations at ~4% of GDP compared to the EU (1.9%) and USA (2.7%) • Significant global investments in Israeli AgriTechs • Enabling government initiatives like Yozma (programme based primarily on developing funds that combine public and private money to invest in Israeli start-ups), Israel Innovation Authority (IIA), and innovation programmes	• Plant genetics and breeding technology • Technology solutions to increase efficiency and reduce losses in the harvesting of farm production • Platform for automating agricultural applications • ML-based data-driven solutions for analysing plant/tree health • Smart irrigation solutions • Crop/beehive monitoring solutions • Seed breeding using DNA sequencing data sets and genomic code • AI-powered harvesting solutions

32 *https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=IL*

33 *http://mlp.startupnationcentral.org/rs/663-SRH-472/images/Israel%20AgFunder%20Startup%20Nation%20Report%202018.pdf*

34 *https://www.oecd.org/israel/sti-scoreboard-2017-israel.pdf*

35 *https://institute.global/sites/default/files/2020-01/Israel%20Case%20Study%20Web%20reduced.pdf*

Netherlands

As the second largest exporter of agricultural produce in the world, the Netherlands has focused has been on producing food in more sustainable ways. To stimulate innovation, the **Dutch government offers competitive research incentives** to fuel scientific entrepreneurship in agri and food systems. The Netherlands also encourages unique public-private partnerships like the **Dairy Campus**, which has been established by one of the country's premier universities to aggregate farmers, suppliers and processors on one platform.

AgriTech in the Netherlands: An overview

Sectoral challenges	Drivers	Expertise areas
• Limited land resources for agriculture – ~1.3 million ha of grassland and 1.0 million ha of arable land[36]	• Second highest exporter of agri produce in the world • Home to one of the world's pioneering agricultural research institutes • Leadership position in dairy and innovative foods	• Smart dairy management (integrated cattle health-tracking platform for dairy farmers) • Insect-based edible protein • Risk management and liquidity solutions for agribusinesses • Indoor farming solutions • Web and sensor-based diversified farm management solutions • B2B marketplace for fresh products • Innovative glasshouses for horticultural crops

China

With over one-fifth of the world's population and less than one-tenth of the agricultural land, China is leveraging its technology leadership in 5G, artificial intelligence (AI), advanced drones and digital trading platforms to move away from traditional farming practices.

AgriTech in China: An overview

Sectoral challenges	Drivers	Expertise areas
• Increasing population • Small farmland holdings • Focus on traditional farming techniques	• Focus of youth on farming (~4.5 million returned to farms recently)[37] • Investments worth USD 6 billion across ~300 deals, with 33% YoY growth[38] • Increasing number of agribusiness firms, which promotes sustainable agriculture	• Focus on upstream • Investments focused on farm mechanisation, robotics, and agri-biotechnology • E-groceries • Fresh food and ingredient supply through digital interventions

It's an opportune time to seek the right partnerships with nations that are leading in the AgriTech domain. Such collaboration will add value through innovation and help in achieving shared goals. The efficient exchange of technology, market interests and investments amongst countries would be highly useful in addressing mutual interests and building efficiencies in the sector.

36 *https://data.worldbank.org/indicator/AG.LND.ARBL.HA?locations=NL and https://globallandusechange.org/wp-content/uploads/2020/11/201029_WWF_Grasslands_IKI_Final_Web.pdf*

37 *http://en.people.cn/n3/2020/0519/c90000-9691709.html*

38 *https://agfunder.com/research/china-2021-agrifood-startup-investment-report/*

Realising AgriTech potential through collaboration and partnerships

The Government of India has introduced many policy reforms to bolster the agriculture and allied sector. Various government-led interventions, including formation of policies on agri-produce marketing, agri-input subsidies, credit facilities as well as technical know-how, are aimed at the larger goal of doubling farmers' income by 2022.[39]

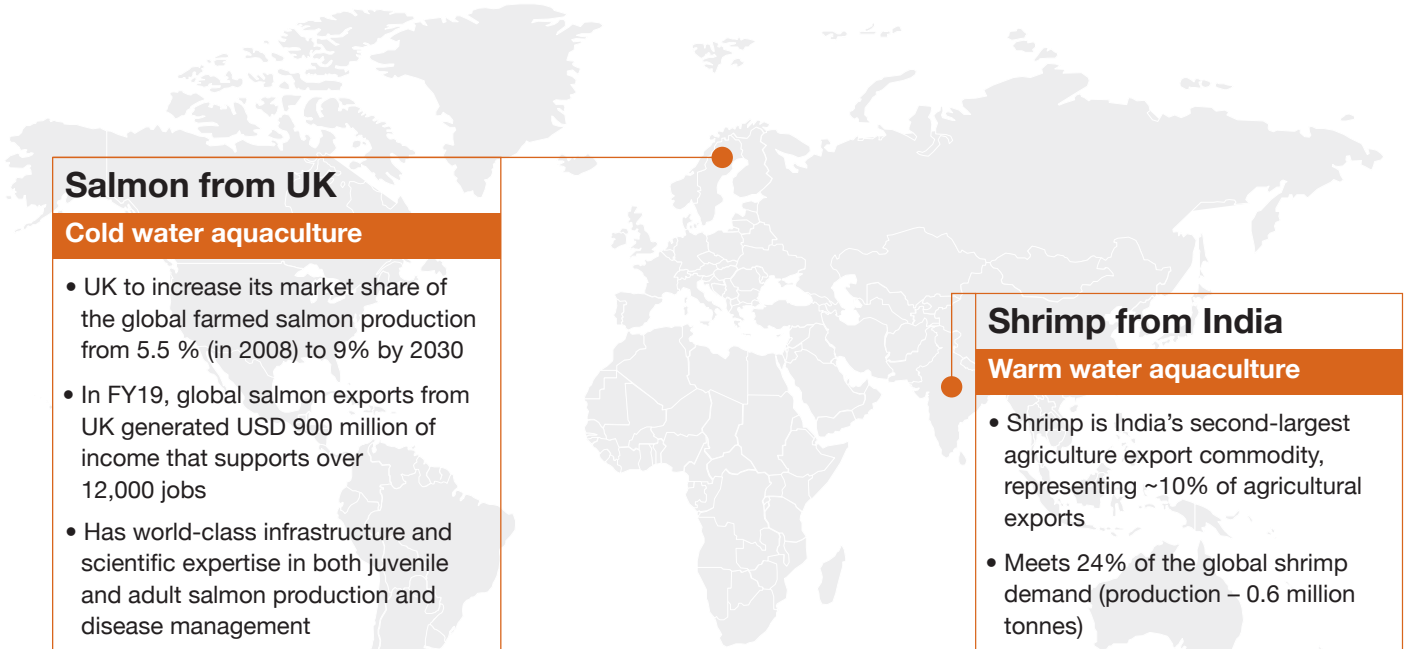
While India leads in the production of agricultural products globally,[40] there is vast scope for technology integration through collaboration and partnerships among various start-up ecosystem players, to bring efficiencies in the value chain. The following are the key types of collaboration that may be explored.

1. Thematic collaboration among partner countries

For a win-win proposition, AgriTechs of partner countries can collaborate and complement each other's sectoral strengths and opportunities. Such collaboration and innovation based on shared goals can add considerable value through the combined efforts of partner countries.

For instance, a thematic collaboration framework for UK-India FishTech has been presented below.

A win-win proposition for UK-India through collaboration



Salmon from UK

Cold water aquaculture

- UK to increase its market share of the global farmed salmon production from 5.5 % (in 2008) to 9% by 2030
- In FY19, global salmon exports from UK generated USD 900 million of income that supports over 12,000 jobs
- Has world-class infrastructure and scientific expertise in both juvenile and adult salmon production and disease management
- World's fifth-largest shrimp consumption market, imported shrimp worth USD 875 million in FY17
- UK relies on exports to the EU for 12% of its GDP, whereas the EU relies on exports to the UK for 3% of its GDP

Shrimp from India

Warm water aquaculture

- Shrimp is India's second-largest agriculture export commodity, representing ~10% of agricultural exports
- Meets 24% of the global shrimp demand (production – 0.6 million tonnes)
- An estimated USD 2.6 billion opportunity in incremental exports
- Production has grown at a CAGR of 30%
- The dollar value of salmon import in 2019–20 stood at USD 6.8 million
- YoY import of salmon in India grew by 300% during 2014–2018 from 2016– 2018

39 *https://agricoop.nic.in/sites/default/files/NITI%20Aayog%20Policy%20Paper.pdf*

40 *https://ficci.in/spdocument/23437/Agri-start-ups.pdf*

We understand that India and the UK have a complementary aquaculture ecosystem, as India has a significant presence in **warm water aquaculture**, whereas the UK has in-depth expertise in **cold water aquaculture**. There are multiple avenues for collaboration around these capabilities:

Areas for collaboration around this theme:

Technology partnering: Species diversification, introduction of new genetics and breeding management, aquatic health management system, specific pathogen-free (SPF) seeds and hatcheries, veterinary consultancy, vaccination, IoT-enabled FishTech solutions, AI-driven smart fishing and disease management, blockchain/radio frequency identification (RFID)-enabled fish traceability system, robotic cages, sensor-based smart aquaculture

Acceleration partnering: Collaboration between Indian FishTech companies with sustainable aqua-culture accelerators in the UK to find technology partners, incubate and scale up

Thematic partnerships could be further facilitated by identifying the right stakeholders through business-to-business (B2B) and business-to-government (B2G) connections, **fine-tuning areas of collaboration areas, identifying suitable intent statements and then grounding the opportunities.**

2. Institutional partnerships to augment innovations, scalability and value chain profitability

There is a need to foster a win-win collaborative partnership among domestic and global institutions, including agri start-ups, academia and research institutions, farmer institutions, accelerators and incubators, industry players and funding agencies, to augment innovation and scalability, and to optimise profitability across the value chain.

Institutional partnerships (AgriTech and academia) to augment innovation in plant-based proteins

- **Knowledge sharing on extraction techniques** for legumes is an attractive opportunity as mung beans and chickpeas are being explored as protein-rich substitutes for eggs, meat and flour
- **Research and technology-driven collaboration** to grow the market for processed products (e.g. burgers, ready-to-cook food) that are adapted to suit the Indian palate

Institutional partnerships (AgriTech–academia–government) to scale up vertical farming in India

In India, urban farming is still in its infancy and has to be given much more importance by both the Government and private agencies to increase profitability. Collaboration among start-ups, both national and global, engaged in vertical farming, local governments (especially the urban planning division) and research and tech institutions is necessary. A few successful examples of cities where such partnerships have been established are New York, Portland and Los Angeles in the USA; Abu Dhabi and Dubai in the UAE; and Shanghai and Beijing in China. The Illinois Institute of Technology, in collaboration with the local government and private players, has developed a detailed plan for implementing vertical farming in Chicago.

Institutional partnerships (AgriTech–FPO–MSME) to optimise value chain (VC) profitability

Establishing the desired micro-processing infrastructure, distributed cold storage facilities, micro cool chambers, etc., near the farm gate could act as game changer in Indian agriculture while reducing substantial losses at the production end. While agri start-ups in India are collaborating with rural entrepreneurs to establish such enabling infrastructure at the farm gate, the major challenge is marketing the processed produce and maintaining profitability over the long term. In this context, there is a need for greater collaboration between start-ups, FPOs and MSMEs in the post-harvest (PH) segment to optimise profitability across the value chain and ensure improved price realisation for small and marginal farmers.

3. Forging corporate–AgriTech collaboration

For innovations to become popular and accepted into the mainstream, they need to achieve economies of scale and become financially viable for farmers. This also ensures that only the best solutions are widely adopted. The pilots must start growing into large projects and then into market offerings. This cycle would eventually become an inherent aspect of the agricultural ecosystem in the country.

To achieve the same, it is important that large corporates collaborate with agri start-ups to support and conduct large-scale projects which leverage technology solutions such as AI, machine learning, drones and IoTs that focus on bringing down the cost and increasing produce for farmers. The following are the possible collaboration modalities between corporates and AgriTechs:

- **Build–invest–buy (BIB):** Corporates come forward and offer the requisite handholding to budding AgriTechs while giving access to corporate leadership, coaching, data platforms, customer base and other resources. In return, agri start-ups offer complementary innovation capabilities or technology to corporates.

- **Commercial or scale-up collaboration:** This model would be more appropriate for mature AgriTechs which have a proven market offering that can be taken to customers. In this type of partnership, corporates act as a commercialisation engine to help the AgriTech grow bigger at a faster pace.

4. Geographical collaboration to exchange best practices

The overall strategy would be to generate more and/or larger businesses through the creation of partnerships for progress. This may be achieved by establishing managed regional spaces (regional innovation platforms) where those involved can meet directly and indirectly to pursue the development of business interests. Additionally, the more proactive environment of an incubation/agri start-up park may be provided to support and mentor emerging AgriTechs.

One example of regional/geographical partnerships is business clubs in the UK, which bring together players with mutually beneficial skills and resources. Such regional business clubs serve as conduits for AgriTech start-ups to access support as well as forums where ideas are shared, innovations are unveiled, businesses are launched, and skills are nurtured. Participation may be membership based, with sustainability being ensured through payment of subscriptions.

Such collaboration and partnerships would not only help Indian agri start-ups harness their true potential on the journey towards USD 10 billion and beyond but also bring greater prosperity to the entire global AgriTech community.



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