Agri start-ups: Heralding the next level of agricultural transformation

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सत्यमेव जयते

कृषि एवं किसान कल्याण,
ग्रामीण विकास और पंचायती राज मंत्री
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KRISHI BHAWAN, NEW DELHI

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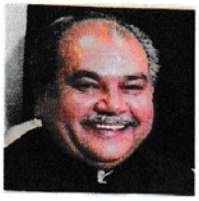

संदेश

मुझे यह जानकर अत्यंत हर्ष का अनुभव हो रहा है कि फेडरेशन ऑफ़ इंडियन चैंबर्स ऑफ़ कामर्स एंड इंडस्ट्री (फिक्की) द्वारा **तीसरे फिक्की समिट एवं एग्री स्टार्टअप अवार्ड** का आयोजन 9-10 फरवरी 2021 को किया जा रहा है। इस अवसर पर फिक्की एवं पीडब्ल्यूसी द्वारा **'एग्री स्टार्टअप्स: भारतीय कृषि में परिवर्तन के नए आयाम का ऐलान'** विषय पर एक रिपोर्ट का प्रकाशन भी किया जा रहा है।

कृषि क्षेत्र में सुधार के साथ ही खेती को लाभकारी बनाना एवं किसानों के जीवन स्तर में सुधार लाना माननीय प्रधानमंत्री श्री नरेन्द्र मोदी जी के नेतृत्व में भारत सरकार की पहली प्राथमिकता है। विगत साढ़े 6 वर्ष में इस दिशा में कई महत्वपूर्ण कदम उठाए गए हैं।

आज किसी भी क्षेत्र में स्टार्टअप्स की भूमिका अत्यंत महत्वपूर्ण है। नई सोच-नई उर्जा के साथ स्टार्टअप्स हर क्षेत्र में सफलता प्राप्त कर रहे हैं। माननीय प्रधानमंत्री जी के नेतृत्व में सरकार ने स्टार्टअप्स को बढ़ावा देने के लिए कई महत्वपूर्ण कदम उठाए हैं। कि कोविड-19 की महामारी के संकटकाल में भी एग्री स्टार्टअप्स ने सराहनीय कार्य किया है।

भारतीय कृषि अनुसंधान संस्थान (ICAR) द्वारा देशभर में 27 बिजनस इन्क्युबेशन सेंटर स्थापित किये हैं जो कि 556 स्टार्टअप्स को अपेक्षित सहयोग प्रदान कर रहे हैं। राष्ट्रीय कृषि विकास योजना (RKVY) के अंतर्गत लगभग 350 स्टार्टअप्स को वित्तीय सहयोग के साथ ही अन्य अपेक्षित सहायता भी प्रदान की जा रही है।

मैं फिक्की की टीम को बधाई देता हूं कि उन्होंने उत्कृष्ट कार्य करने वाले एग्री स्टार्टअप्स को सम्मानित करने का कदम उठाया है। एग्री स्टार्टअप्स के कार्य पर आधारित यह रिपोर्ट भी प्रशंसनीय एवं सराहनीय है। मुझे उम्मीद है कि यह रिपोर्ट कृषि एवं स्टार्टअप्स से जुड़े सभी लोगों के लिए उपयोगी एवं तथ्यपरक सामग्री साबित होगी।

(नरेन्द्र सिंह तोमर)

Message from FICCI

Uday Shankar
President, FICCI

The COVID-19 pandemic caused a once-in-a-century global crisis in 2020, resulting in the contraction of per capita GDP of 90% countries. India's GDP contracted by **23.9%** in the first quarter of FY20 and by **7.5%** in the second quarter.[1] India is expected to witness a V-shaped recovery across all its key economic indicators.

The agriculture sector, considered to be the backbone of the economy, has displayed significant robustness and resilience during the pandemic, and digital and technological innovations have contributed enormously to the sector's recent performance. In the last few years, the sector has been witnessing the rapid rise in technological innovations and mushrooming of AgriTech start-ups due to a massive influx of investments, thereby enhancing the overall efficiencies across the value chain.

India has approximately **more than 600 AgriTech start-ups** that are providing customised solutions and products to make the agricultural value chain more profitable and remunerative. Growth and expansion of new-age AgriTechs in India are being driven by numerous promising technologies while addressing key challenges in the agricultural value chain. Both the Government and the private sector are continuously emphasising on the integration of scientific data and technology into farming. Some of the potential solutions offered by agri 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 agri start-ups also has a direct bearing on the socioeconomic conditions of India's rural population through employment generation and farm prosperity.

In the last few years, the Government of India has made considerable efforts to augment the overall ecosystem for start-ups in the country. The extension of the tax holiday for one more year and incentivisation of the incorporation of one-person companies in Union Budget 2021–22 are welcome steps for the start-up ecosystem in India.

Going forward, apart from innovations and collaborations, building an AgriStack – a single unified digital agri database infrastructure – is required. It will act as a public ecosystem of data repositories by collating existing data and addressing data availability related challenges for all key stakeholders in the agri start-up ecosystem. It will also allow agri start-ups to enhance their focus on data modelling rather than spend disproportionate time and efforts on data collection. AgriStack will certainly invigorate the agri start-up arena and inject a new wave of transformation in the agricultural value chain.

1 Economic Survey of India 2021

Message from FICCI

T R Kesavan
Chairman, FICCI National Agriculture Committee and
Group President, Tractors and Farm Equipment (TAFE) Ltd

Agri start-ups are using innovative technologies to solve critical gaps in the agriculture sector. This would give farmers access to appropriate technologies, thereby increasing productivity and growth. Agri start-ups have an important role to play in years to come. Young agri entrepreneurs can be major drivers of change in Indian agriculture and support the sector by preparing farmers for the future. However, focus on efficiency and sustainability is a prime requisite. Indian agriculture needs solutions that not only make the value chain competitive but also sustainable in the long run. This focus should remain at the centre of all innovations. Technological advancement itself is not sufficient to bring positive transformation in Indian agriculture. It should be customised according to the needs of farmers and should be able to create long-term impact. One area which needs conscious attention is technology-infused and data-driven decision making for smart agriculture. Efforts and collaborations in this regard are crucial and deserve attention by agri start-ups.

When the food and agriculture supply chain was disrupted during the pandemic, agri start-ups played a pivotal role in providing immediate solutions. They built their capabilities and adapted to the situation rapidly to get through the pandemic and beyond. The new normal will certainly help agri start-ups in bringing out the best in themselves.

The Government of India has strongly focused on developing an agri start-up ecosystem in the country and is providing opportunities to young entrepreneurs so that they remain receptive to new ideas.

FICCI's Summit and Awards for Agri Start-ups has emerged as the leading platform for agri start-ups to showcase their innovative interventions that can enable a change in agriculture. This report indicates our endeavour to foster the development of an agri start-up ecosystem. I am confident that this report will address some of the key interventions necessary to take the Indian agri start-up ecosystem to the next level.

Message from FICCI

Hemendra Mathur
Chairman, FICCI Task Force on Agri Start-ups and Venture Partner,
Bharat Innovation Fund

The Indian agriculture sector faces multiple challenges, including climate change, water stress, poor soil health, price volatility and lack of motivation among farmers to continue farming. Farmers need to adopt innovations for agriculture to become sustainable and profitable as we enter into a new decade following the COVID-19 pandemic.

The Indian AgriTech sector took root in the last decade and can solve every problem faced by Indian agriculture. The sector gained further momentum in the last four years, driven by the entry of highly talented entrepreneurs who have developed innovative business models. Investors have put in close to USD 1 billion in upstream AgriTech over last decade, out of which over nearly USD 600 million was invested in the last two years, clearly indicating an inflection point for the sector.

Indian AgriTech start-ups are trying to solve multidimensional problems, including low productivity, suboptimal efficiency in the supply chain, lack of access to markets, institutional credit, crop insurance, quality inputs and market linkages.

As demonstrated by about 600 AgriTech start-ups in recent times, innovations can go a long way in improving farm economics with improved yield, reduced cost of inputs and de-risking farmers against commodity price fluctuations, monsoon failures, etc. Agri entrepreneurs are working towards improving farmer access to markets, quality inputs, institutional credit and insurance. Consumers also benefit with improved access to safe, nutritious and affordable food. Both the industry and the Government gain as they can access reliable, timely and accurate data for decision making and designing policies for farmer welfare.

It is also time for the Government to parallelly drive the innovation agenda in agriculture to ensure that the impact of agri reforms is more productive. At FICCI, we are committed to taking Indian AgriTech to the next stage by helping start-ups connect with industry stakeholders and policymakers, with the objective of taking these solutions to farmers. We have held a series of events, published many reports, organised meetups and tried our best to help agri start-ups during the pandemic. This report is another step towards updating our readers on the latest and the best of Indian AgriTech.

I acknowledge the significant efforts put in by colleagues at FICCI and the team from PwC in bringing out this report.

Message from Husqvarna India

Rajesh Raghavan
Managing Director and Country Head
Husqvarna India

The growth in India's AgriTech start-up space has primarily been fuelled by the wide range of technologies and innovations that cater to the end-to-end production cycle in agriculture, right from land preparation to consumption.

The COVID-19 pandemic also has played a part in redirecting innovative and technology-based ideas towards strengthening agriculture by utilising smart farming, AI, robotics and IoT. India is expected to play a key role in the worldwide adoption and usage of AgriTech, and will be a key destination for investors.

Husqvarna has strengthened and supported various technological developments across sectors in the past three centuries, with a passion for customer-centric innovation. We are glad to be associated with FICCI and congratulate them on recognising and acknowledging the upcoming AgriTech leaders at the Summit and Awards for Agri Start-ups, 2020.

Message from FICCI

Dilip Chenoy
Secretary General
FICCI

AgriTech innovation models have the potential to upscale various farming operations being practiced in India, enhance the overall efficiencies across the agricultural value chain and improve farm prosperity through positive agronomic and socioeconomic impact.

Fortunately, access to a wide range of digital technologies has been facilitated in the last decade by numerous AgriTech start-ups. The technologies deployed by such start-ups help track multiple data points along the value chain from pre harvest to post harvest and all the way to the retail and export markets. The data is captured through a combination of multiple devices such as sensors, IoT devices, smartphones, spectrometers, drones and satellite images. With a significant increase in investment activity and considering the huge market potential of AgriTech in India, industry experts estimate that there will be investments worth over USD 10 billion in the next ten years, at an average of USD 1 billion per year.

To achieve the desired scale and commercial viability for emerging agri start-up innovations, there is a need to foster a win-win collaborative partnership between start-ups, Farmer Producer Organizations (FPOs) and MSMEs. The Government of India's focus on the formation and promotion of 10,000 FPOs will further augment the consolidation of the agricultural value chain by collectivising farming activities. Such a partnership model will not only bring AgriTechs and MSMEs – the two vibrant value-chain actors – closer through the creation of a recognised interface but will also optimise profitability across the value chain, while ensuring better price realisation for small and marginal farmers. A rural entrepreneurial drive would provide an ecosystem-level support in the form of agri incubation centres with right mentorship and a mix of technological and managerial support, ultimately adding to the inclusive and equitable growth of the Indian economy.

Message from PwC

Ashok Varma
Partner and Head, Social Sector Advisory Practice, PwC India

The COVID-19 crisis resulted in the world going through one of the toughest times history has witnessed. The pandemic has significantly impacted all countries on health and socioeconomic fronts. Though there were temporary setbacks for the Indian agriculture sector that affected certain elements of the food system, the crisis accelerated the adoption of a number of emerging technologies, allowing the sector to manage multiple aspects across the agricultural value chain.

Agri start-ups are playing a pivotal role to provide customised solutions and products to make the agriculture value chain more remunerative. Currently, India has approximately 600 proof-of-concept (PoC) AgriTech start-ups that are attempting to solve multitudes of challenges encompassing suboptimal productivity, low efficiency in the supply chain, lack of access to markets, institutional credit, crop insurance, quality inputs and market linkages.

This transition can be attributed to the significant opportunity for digitisation that exists within the Indian agriculture landscape, with **only 1% of the addressable market being currently tapped**.[2] Despite the pandemic, AgriTech deals worth USD 500 million were recorded in 2020, compared to USD 248 million in 2019. With a significant rise in investment activity and looking at the huge market potential, industry experts estimate that there will be investments worth over **USD 10 billion in the AgriTech sector in the next ten years**. The Government as well as private players are continuously undertaking measures to support innovation-led tech farming and reach out to small and marginal farmers.

The Government of India (GoI) has been deeply committed to bring policy reforms in the agriculture and allied sector to further boost the agri start-up ecosystem.[3]

This knowledge report identifies the current status of Indian agriculture and its sectoral drivers and policy enablers, and the resilience of start-ups during COVID-19 and beyond. It also recommends strategies to build a globally competitive and robust agri start-up ecosystem through infrastructural enablement, product innovations, collaborations, entrepreneurial drive and incubation, and institutionalisation of a dedicated start-up cell at state and district levels. The creation of a dedicated **agri start-up cell** at a decentralised level will not only help in meeting the requisite regulatory as well as **Ease of Doing Business (EODB)** requirements, but also bring catalytic funding and incubation support for agricultural entrepreneurs.

2 Industry estimates and PwC analysis
3 https://niti.gov.in/writereaddata/files/document_publication/DOUBLING%20FARMERS%20INCOME.pdf

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01 Executive summary

With an aggregate sectoral value of USD 414 billion in 2019–20, agriculture continues to be the mainstay of the Indian economy, and accounts for 16.5% of the Indian GDP. **In 2019, India exported agricultural products worth USD 37.4 billion, securing the ninth position globally among agricultural export countries. Agricultural exports account for approximately 12.6%** of the country's total merchandise exports and have grown at a **compound annual growth rate (CAGR) of 19% between FY10–18 to reach USD 38.21 billion in FY18**.[4]

While agricultural production, productivity and exports have been impressive in the last decade, it's also imperative to keep pace with global trends in the sector by adopting evolving technologies and innovations, investing in research and development (R&D), and encouraging the growth of more agri start-ups. An enabling start-up ecosystem equipped with innovation strategies would be instrumental in developing new and more efficient business models and making food systems more productive, sustainable, efficient, transparent and resilient. Such innovative start-ups can alleviate the systemic challenges such as small landholdings of farmers (more than 70% have less than 1 hectare [ha]),[5] lower level of food processing and a dilapidated supply chain network.

The agribusiness ecosystem in India has received considerable support from schemes like the PM-Kisan Samman Nidhi that provides required economic support to small and marginal farmers, and the Kisan Credit Card (KCC) that ensures timely access to credit. Under the Aatmanirbhar Bharat (self-reliant India) Yojana, the Government of India (GoI) recently announced a number of agri marketing reforms. Furthermore, the Government's focus on the formation and promotion of **10,000 Farmer Producer Organizations (FPOs)** will also enable faster consolidation of the agricultural value chain by collectivising farming activities.

The Indian agriculture sector has recently witnessed speedier adoption of digital tools and techniques. Both the Government and the private sector are continuously emphasising further integration of scientific data and technology into the farming system. Some technologies currently being used are mobile app based crop advisory, crop and livestock sensors, rental services in farm machinery, agricultural drones, agri FinTech.

India has approximately **600 proof-of-concept (PoC) AgriTech start-ups**[6] that are providing customised solutions and products to make the agricultural value chain more lucrative. Interestingly, every ninth agri start-up in the world has its roots in India and more than 25 Indian AgriTech companies have established their presence in the global arena. Growth and expansion of new-age AgriTechs in India are being driven by numerous promising technologies, while addressing key challenges in the agricultural value chain.

The market size of AgriTech start-ups in India is currently valued at **USD 204 million**, which is estimated to be **1%** of the current potential market opportunity worth **USD 24 billion**. Interestingly, out of the **USD 1 billion** invested between 2010–2020, approximately USD 600 million has been invested in 2019–2020, thereby defying the COVID-19 pandemic's effect on the economy. **In FY20, 133 deals worth USD 1.05 billion were recorded, which is approximately a year-on-year (YoY) growth of 6.4 %.**[7] It is estimated that there would be investments worth USD 10 billion in the AgriTech start-up space over the next ten years.[8]

4 http://ficci.in/spdocument/23154/Online_Farm-mechanization-ficci.pdf
5 https://www.theindiaforum.in/article/india-s-biggest-challenge-future-farming
6 http://blog.ficci.com/archives/8679 1
7 https://agfunder.com/research/india-2020-agrifood-startup-investment-report/
8 "http://blog.ficci.com/archives/8679

Interestingly, many agri start-ups in India took a proactive approach in exhibiting resilience by rapidly adopting artificial intelligence (AI) and digital technologies and turned the COVID-19 crisis into an opportunity.

It is anticipated that reforms in the agriculture sector will help in stabilising the regulatory environment in the agricultural value chain and AgriTech start-ups will be better equipped than large agribusinesses in building farm-sourcing systems and related infrastructure. Small and marginal farmers require supply chain efficiencies — from better supply-demand matchmaking to lower volatility on pricing and superior cold storage facilities.

Reforms in the agriculture sector are expected to open up such avenues and let farmers interact directly with new-age agri start-ups that have built their foundations on technology.

Start-ups that have outlived the challenges and uncertainties brought upon by the pandemic are more focused and confident ones, and have a longer business journey to sustain. Also, the challenges emanating from the pandemic have allowed start-ups to consider entering into new businesses in the agricultural value chain. Currently, Indian agri start-ups are positioned at the beginning of finding avenues to usher in a robust development outlook while focusing on the five strategic areas of **infrastructural enablement, product innovation, collaboration, entrepreneurship and incubational and institutional support**.

As far as infrastructural enablement for agri start-ups is concerned, there is an immediate requirement to create an AgriStack – a single unified digital agri database – for India. An AgriStack could act as a **one-stop-solution** for data requirements of key stakeholders in the start-up ecosystem. It will also help start-ups to develop new apps with better optimisation and put efforts into data modelling rather than disproportionate efforts on data collection.

It is very important to enhance data availability till the last mile and strengthen digital literacy, apart from putting efforts into fast-tracking publicly available data through an AgriStack. While the rate of mobile penetration and data availability in rural areas has been laudable, operational digital literacy to utilise AgriTech applications needs concerted efforts. Availability of high-speed internet in rural areas for seamless technology transition is a prerequisite for bridging the existing technology gap. While mobile phones have become handy these days, repairing them requires users in rural areas to visit nearby towns or cities. A chain of mobile service centres may result in enhanced adoption of mobile technologies by farmers.

Using technology applications, agri start-ups are in the process of addressing some of the critical need gaps of farmers, ranging from accessibility to timely credit requirement. These start-ups are working to improve the efficacy of financial instruments related to farming and would further collaborate and engage with banking and insurance companies to develop **crop- and region-based credit and insurance products (Agri-FinTech solutions)** that will encourage small and marginal farmers to readily adopt resilient solutions.

Ecosystem-level support in the form of agribusiness incubation centres, right mentorship and a mix of technological and managerial assistance would be the key methods for AgriTech start-ups to leapfrog hurdles in their business. Agribusiness incubation centres are playing a crucial role in nurturing entrepreneurship and innovation in the area of agribusiness. These centres provide technical know-how to start-ups and support them in handling various challenges and mitigating risks while scaling up.

While a few state agricultural universities (SAUs) and Indian Council of Agricultural Research (ICAR) institutes have established agribusiness incubation centres, right mentorship and a mix of technological and managerial support would be critical for the progress of AgriTech start-ups.

For wider industry collaboration and mainstreaming of agri-industry/micro, small and medium enterprises (MSMEs), AgriTech platforms can aid in creating synergy in two vibrant subsets for driving holistic growth in agri and allied sectors. Transformation of the agriculture sector would be strengthened if start-ups are provided institutional support in the form of **dedicated agri start-up cells** in states and district levels. Such cells will encourage aspiring entrepreneurs and help agri start-ups operating at the grassroots levels to hold a continuous dialogue with the respective state governments.

02 Emerging trends in Indian agriculture

Agriculture in India – status and outlook

India's agriculture sector plays a crucial role in fostering livelihood and employment, and ensuring food and nutritional security. Many other critical businesses in secondary and tertiary sectors, such as consumer packaged goods, retail, textile and e-commerce, majorly rely on agricultural output, thereby enhancing its impact on the country's economy.

India is the largest producer of milk, pulses and spices, and is the second-largest producer of rice, wheat, cotton, sugarcane, farmed fish, sheep and goat meat, fruits, vegetables and tea.[9] The key enabling features of the Indian agri ecosystem are presented in the figure below:

Key enabling features of the Indian agri ecosystem

Prominent position at the global level	**First largest** • Pulses, spices, milk, cashew and jute production	**Second largest** • Wheat, rice, tea, fruits and vegetables, sugarcane and cotton production	**Third largest** • Fisheries production
	• Largest livestock population **~535.8 million** (31% of the global population)		
Favourable agroclimatic conditions	• 20 agroclimatic regions • 46 out of 60 soil types in the world • Tenth-largest available arable land in the world		
Growing consumption expenditure	• Growing at a **CAGR of 14%** from 2015		
Accelerating farm mechanisation	• Largest manufacturers of farm equipment like tractors, harvesters and tillers (contributes **one-third** of world's tractor production)		
Record foodgrain production	• Recorded **291.95 million tonnes of foodgrain** production in 2019–20		
Surge in agri export	• India is the **ninth-largest exporter of agricultural products in the world and the export value of agricultural goods stood at USD 37.4 billion, accounting for ~12.6%** of the total merchandise exports from India		
Robust AgriTech ecosystem	• Every **ninth AgriTech startup** in the world is from India • **<5 global AgriTech companies** ventured in India, as compared to >25 Indian AgriTech companies with a global presence		

Source: PwC analysis of data from FICCI's 'Agri start-ups: Innovation for boosting the future of agriculture in India' report

9 https://www.worldbank.org/en/news/feature/2012/05/17/india-agriculture-issues-priorities#

Although agricultural production levels have increased considerably owing to increased agricultural investments and technological innovations, there are considerable opportunities to enhance crop yields in India. The table below compares the crop yields for some of the major crops produced in India with their global averages.

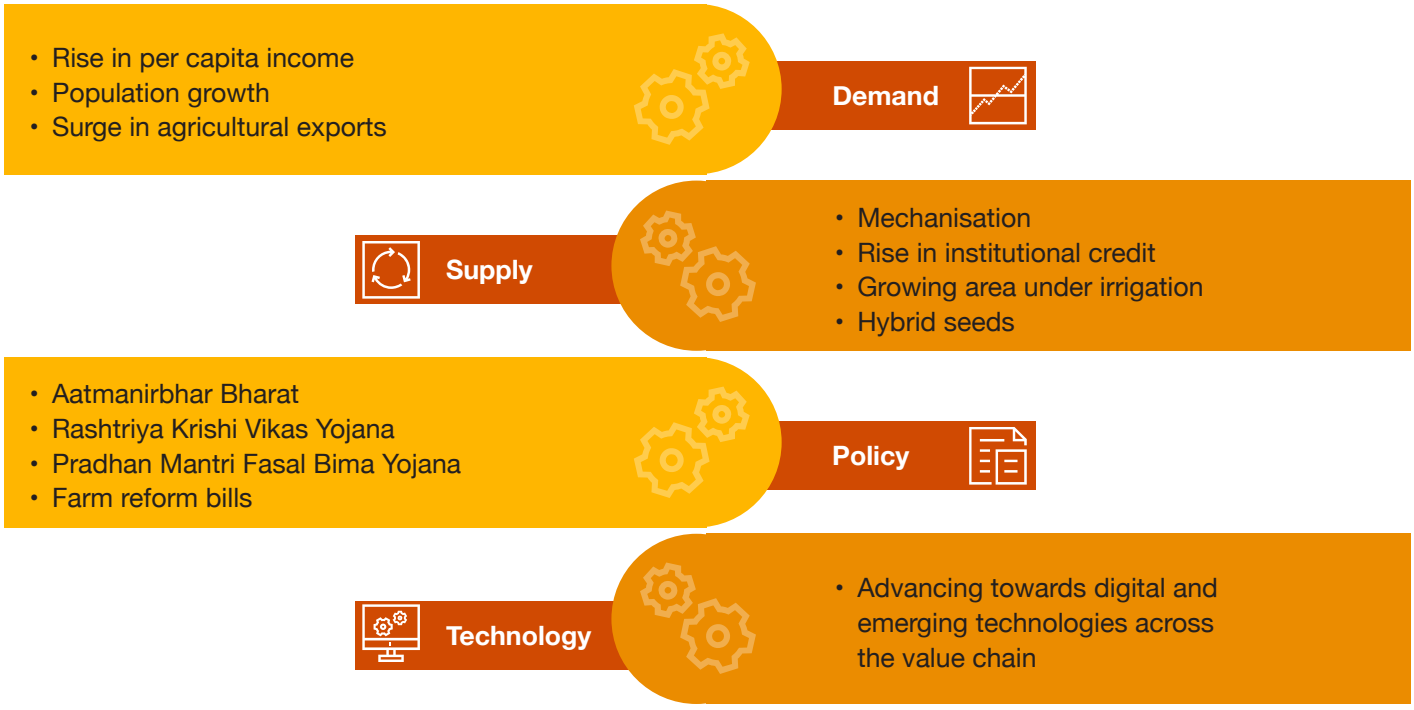
Crop yield in metric tonne per hectare (MT/ha)[10]	Global average	India	Gap (%)
Cotton	1.34	0.96	**28**
Soybean	2.4	1.1	**54**
Rice	5.0	3.0	**40**
Sugarcane	70.6	70.4	0.3
Maize	5.6	2.6	**54**
Tomato	28.0	19.6	**30**
Groundnut	1.4	0.9	**31**
Onion	19.4	16.1	17
Pulses	9.9	6.6	**33**

While yield maximisation is considered to be one of the top agendas for the next level of transformation in agriculture, farm prosperity and food security remain the critical components of the sector. Also, it is important that the Indian agriculture sector keeps pace with global food and agriculture trends such as inclusion of emerging technologies, R&D and innovations through start-ups. A vibrant agri start-up ecosystem equipped with emerging technologies and innovations would be the right platform for developing new and more efficient business models, and making food systems more productive, sustainable, efficient, transparent and resilient.

Key drivers of agricultural transformation in India

The sectoral growth of agriculture in India has been driven by four key factors – demand pull, supply push, policy measures and technology drive.

Key drivers of agricultural transformation



Source: PwC analysis of data from industry insights

10 https://www.indiachem.in/brochure/Presentation%20by%20Mr.%20Harsh%20Dhanuka-%20Dhanuka%20Agritech.pdf

Exploring the demand pull

The overall demand in India's agriculture sector is being driven by rising population, rapid urbanisation, increasing per capita income and surging demand for the export of the agricultural commodities.

The demand for higher quantity and better quality of food, fibre and biofuel is increasing with rising global population. India is forecasted to overcome China as the world's most populous country by 2027.[11] While India's population is estimated to grow at a CAGR of about 2%, the demand for key food grains will see a corresponding rise at a CAGR of 3%.[12] Additionally, a robust growth in per capita income has added to the greater demand for agri output which is expected to reach USD 2,762 in 2021,[13] and also impacted the food basket with a shift in preferences for other food items in place of cereals.[14]

India aspires to be among the top five agricultural exporters in the coming decade with a higher focus on marketing, alliances and traceability. In the last one decade or so, India has become the ninth-largest exporter of agricultural products and the total value of exported agricultural products in 2019 **stood at USD 37.4 billion, accounting for approximately 12.6%**[15] of the total merchandise exports from India. Agricultural exports from India have grown at a CAGR of 19% over FY10–18 to reach USD 38.21 billion in FY18.[16] There has also been an increase in the export of meat, fruits, milk and high-value food items in the last decade.

Measuring the supply push

Enhanced usage of improved agri inputs from seed to credit have contributed remarkably in pushing supply and matching demand . Higher adoption of quality seeds, increased rate of mechanisation, growing area under irrigation and access to institutional credit are the key supply-side drivers. Institutional credit to agriculture and allied activities has increased at a notable CAGR of 13% from FY12–18.[17] There has been consistent support from the Government to push KCCs. Moreover, agricultural loans have been categorised as priority sector lending and all banks are to mandatorily lend to farmers and agricultural organisations operational in the sector. The farm mechanisation market in India has been growing at a CAGR of 7.54% during FY16–18 due proactive Government policies.[18]

In recent years, the GoI has made significant efforts in bringing efficacy to the supply-side delivery mechanism through multiple interventions revolving around **Jan-Dhan, Aadhar and Mobile (JAM) trinity and the Pradhan Mantri Kisan Samman Nidhi Yojana (PM-Kisan)**, aided ably by the Direct Benefit Transfer (DBT) system. The entire supply ecosystem is further revolutionised by emerging FPO-promotion initiatives, transforming the input and output value chain. Rapid digitisation and emerging technologies are playing pivotal roles in reducing the overall costs for all the key value chain actors involved, as well as helping the Government to achieve its aim of doubling farmers' income by 2022.

Enabling policy measures

The enabling policy measures taken to strengthen the agriculture sector can be well understood by the Government's aim of doubling farmers' income by 2022. In recent years, the GoI has focused on increasing minimum support prices (MSPs) for agricultural produce and launched a number of flagship schemes to significantly push for overall sectoral growth.

While schemes like the PM-Kisan Nidhi are intended to provide required economic support to small and marginal farmers, KCCs ensure that they have timely access to credit. The recently announced agri marketing reforms under the Aatmanirbhar Bharat Yojana, i.e. The Essential Commodities (Amendment) Ordinance 2020, The Farming Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020, and The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance, 2020, are also expected to transform the agricultural marketing scenario in the country.

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11 UN's Department of Economic and Social Affairs (DESA), 2018
12 https://icar.org.in/files/ICAR-Vision-2030.pdf
13 http://ficci.in/spdocument/23049/Agri-start-ups-Knowledge-report-ficci.pdf
14 https://www.thebetterindia.com/98604/india-eating-habits-food-50-years-culture/
15 http://ficci.in/spdocument/23343/Ushering-in-a-new-growth-wave_Online1.pdf
16 http://ficci.in/spdocument/23154/Online_Farm-mechanization-ficci.pdf
17 http://ficci.in/spdocument/23049/Agri-start-ups-Knowledge-report-ficci.pdf
18 https://economictimes.indiatimes.com/news/economy/agriculture/indias-agricultural-export-grows-economic-survey/articleshow/80585995.cms?from=mdr

Furthermore, the GoI's focus on formation and promotion of **10,000 FPOs** will also enable faster consolidation of the agricultural value chain by collectivising farming activities at an FPO level. FPOs will play a pivotal role in the dissemination of future agri services by acting as a bridge between small and marginal farmers whose digital literacy skills are below par but are ready to adopt newer technologies, and AgriTech companies. The measures taken by the GoI envision to enhance farmers' income by strengthening farm gate infrastructure, disintermediation through aggregation and capacity building.

Technology drive – digital agriculture

There is an urgent need to drive efficiencies across the agricultural value chain, along with structural changes in habitats, employment, food consumption patterns, climate changes, etc. Adequate focus is required in the areas of input supply and usage, crop production, harvesting, grading, sorting, assaying, warehousing, cold storage and logistics, as well as processing and retailing. **Technologies**, especially digital technologies, can play a critical role across the agricultural value chain to increase per-unit returns.

In order to understand the potential capabilities of digital applications and related technologies across key stages of the agricultural value chain, a digital capability framework for the Indian agri ecosystem addressing the value chain vulnerabilities has been developed and presented below.

Digital capability framework for the Indian agri ecosystem

	Value chain vulnerabilities	Technology-driven solutions	Impact
Agricultural inputs	• Unsustainable use of fertilisers and pesticides leading to lower productivity • Poor access to institutional credit	• Soil monitoring based cropping decision • Interaction history-based e-extension services • FinTech-led credit and insurance services	• Agri-input optimisation • Robust agri extension • Increased access to credit and insurance
Farming practices	• Unscientific practices leading to increasing cost of cultivation • Rising labour cost • Climate change	• Predictive pest management • Drone-led agrochemical spraying • Precision farming – IoT and remote sensing • Smart tractors and agribots	• Robust incident management resulting in decreased crop loss • Decreased cost of cultivation • Increased productivity
Harvest and aggregation	• Increased level of intermediation by a network of aggregators, traders and commission agents • Lack of primary processing at farm gates	• AI-based insurance claim settlement • Real-time yield estimation • Commodity testing solution • Commodity grading/sorting solution • Transaction discovery • Procurement optimisation	• Increased price realisation • Increased rate of claim settlement
Storage	• Poor access to storage capacity at farm gates • Bulk arrival during harvest leading to price volatility	• Smart warehousing and cold storage solution • Linked to electronic markets • E-WRF	• Ability to convert warehouses into markets • Decrease wastage and losses
Marketing and trading	• Lack of price discovery and intelligence mechanism • Disaggregated and disconnected supply chain	• Price information and intelligence mechanism • Agristack • Transport optimisation • Traceability	• Capturing premium value through traceability • Ease of trading • Informed decision making for marketing

Source: PwC analysis of data from industry insights

Advanced sensors and imaging tools augmented with improved communication technologies are driving efficiencies and decision accuracies in farm operations by monitoring and analysing critical parameters such as soil, water, temperature, humidity, crop growth, storage, transportation and marketing. These technology enablers are certainly helping to meet the goal of sustainably increasing **smallholder farmers' income as well as enhancing per-unit productivity through data-driven decision making**.

Key vulnerabilities in the agricultural value chain

Indian agriculture suffers from low crop yields as well as labour productivity. In order to understand these concerns, it is imperative to understand the entire value chain and the inherent challenges in each component.

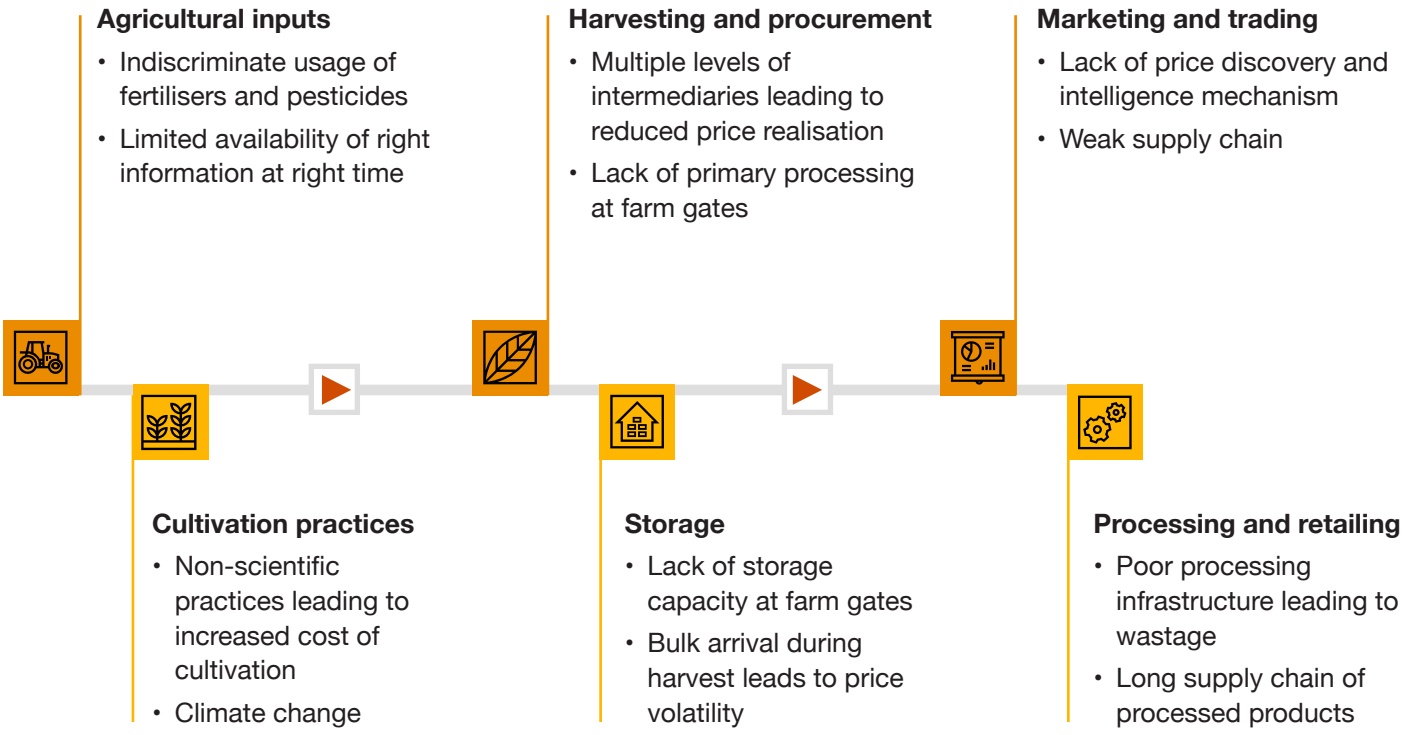
Key components of India's agricultural value chain

Farmer landholdings in India are highly fragmented and small. Nationally, more than 70% landholdings are less than one ha, resulting in significantly low farm yields. Compared to India, the average sizes of landholdings in Europe and the US are 30 times and 150 times bigger respectively. Continuous population growth and subdivision of agricultural land in joint families have further added to the reduction of average operational landholding size in India.

Production advantages are significant to the supply side, but the level of processing for agri produce continues to be miniscule at around 10% and even lower for fruits and vegetables at approximately 2%.[19] Approximately 15 billion tonnes of agri produce is wasted every year due to the run down supply chain network.

Key vulnerabilities that have been mapped to individual components of the agricultural value chain are presented in the figure below.

Key vulnerabilities across the agricultural value chain in India



Source: PwC analysis of data from industry insights

19 http://face-cii.in/sites/default/files/food_processing_report_2019.pdf

We observe that promising sectoral drivers and enablers beckon the growth for Indian agriculture but inherent challenges are restricting the sector's true potential. In such a scenario, there is a need for a catalytic agri start-up ecosystem with disruptive technology solutions to aid sustained increase in productivity, efficiency and farmers' income.

Emerging trends in the Indian agribusiness ecosystem

Agriculture in India is gradually evolving, with the focus shifting from basic food grain production **(productivity driven)** to a profitable and export-oriented economic activity **(market driven)**. Since the last few years, there is a gradual transition in adoption of technology, information and knowledge management systems, integrated value chains and favourable policymaking.

The changing dynamics and the top four emerging trends in India's agriculture and food systems are presented in the figure below.

Transition of the Indian agribusiness landscape

Then	Future
Productivity driven Focus on enhancing production	**Market driven** Market linkage: Contract farming, e-platforms, FPOs, etc.
Input retail shop Dealers' agri-input shops in the marketplace	**Online one-stop solution** Online input shops and custom hiring of equipment
Outmoded Traditional agriculture equipment	**Automated agri infrastructure** Automated tractors, agribots, drones, sensors, etc.
Traditional supply chain Physical and paper-based transaction of commodities	**Digital supply chain** Automated logistics and supply chain processes
Traditional credit system Dependency on local moneylenders/agents	**Agri-FinTech revolution** Digital credit scoring and easy access to finance
Physical markets Mandi, rural haats	**Digital markets** Online platforms as e-NAM and others

The top four emerging trends in the Indian agribusiness landscape

Consumer preference

Healthy consumption pattern
Increased inclination towards millets, dairy and horticulture products and declining preference for cereals. Per capita increase in consumption of milk and milk-based products from 200 gm to 400 gm per day in the last 20 years

Prospering direct-to-consumer models
Farm to fork and enhanced efficacy of tech-enabled supply chains to respond and fulfil demands

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Modernisation of value chain

Tech-enabled supply chain
Integration of precise and timely data on agri operations to enhance efficacy of decision making

Increasing value-chain financing
Use of crop monitoring dashboards by financial institutions for crop loans

Institutionalisation of climate finance
Technology to monitor climate-related data and promote adoption of climate-resilient practices

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Advancement in stakeholder setups

Use of digital aids by farmers
Increasing awareness and ease for online e-platforms, increased viewership of social media platforms and mobile applications

Budding rural entrepreneurship
Business-oriented farmers collectives
Farmers as input dealers, drone pilots, artificial insemination workers, etc.

Involvement of corporates, FPOs and start-ups
Acting as a catalyst for AgriTech innovations
Integrative approach to come out with optimised and effective solutions

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Market and investment stimulus

Convergence of food and agri markets
Tech-enabled farm value additions
Collaborative model driving more lucrative gross margin for the sector

Burgeoning the investment ecosystem for agri start-ups
More than USD 10 billion investment scenario in AgriTech over the next decade

Investment of USD 900 million between 2010 and 2020, out of which about USD 600 million came in 2019 and 2020

Despite the COVID-19 pandemic, 133 deals were recorded in 2020

Source: PwC analysis of data from industry insights

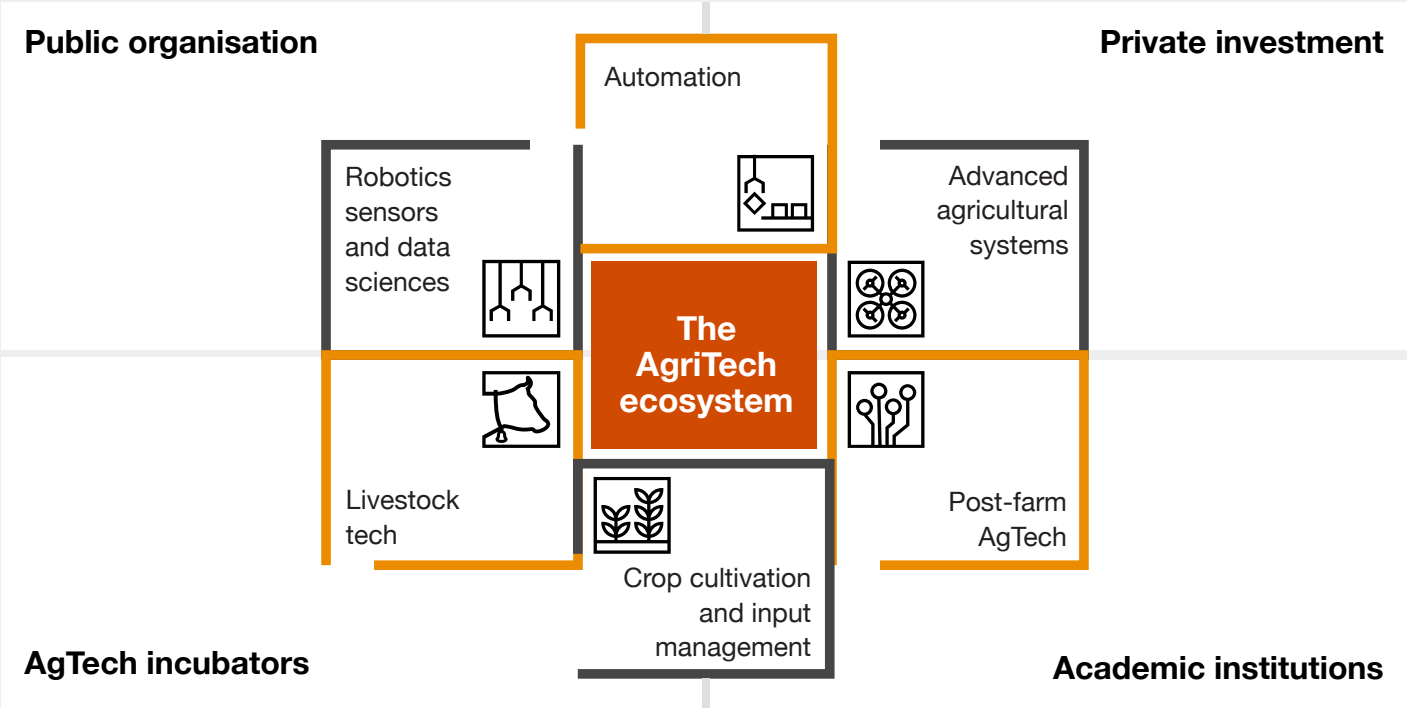
It is evident that these trends indicate the substantial opportunities that exist for technology integrations across the agricultural value chain. Fortunately, numerous AgriTech start-ups have facilitated access to a wide range of digital technologies in the last few years. These technology solutions aid in tracking multiple data points across the value chain from preharvest (input application, area under production, farm boundaries, farmer profile, soil health, hyperlocal weather, crop health, etc.) to post harvest (quality, grades, traceability and losses, etc.) and all the way to retail and export markets.

03 Agri start-ups in India – realising the true potential of agriculture

The AgriTech ecosystem in India

India has approximately 600 PoC AgriTech start-ups[20] that are providing customised solutions and products to make the agricultural value chain more remunerative. AgriTech in India started growing from 2010 onwards and has gained momentum in the last few years due to increasing investor interest and the entry of high-quality entrepreneurs. Interestingly, every ninth agri start-up in the world is from India, wherein less than five global AgriTech companies have ventured in India as compared to more than 25 Indian AgriTech companies with a global presence. AgriTech start-ups in India are attempting to solve multitude of challenges prevalent in the agricultural value chain encompassing suboptimal productivity, low efficiency in the supply chain, lack of access to markets, institutional credit, crop insurance, quality inputs and market linkages. The overall AgriTech ecosystem in India is presented in the figure below.

The AgriTech ecosystem in India



The AgriTech ecosystem in India not only includes agricultural technology start-ups, but also encompasses various financial institutions, think tanks, academia, industries, FPOs, farmers' bodies, investors and policymakers to drive the adoption of innovations in all agricultural aspects.

20 http://blog.ficci.com/archives/8679 1

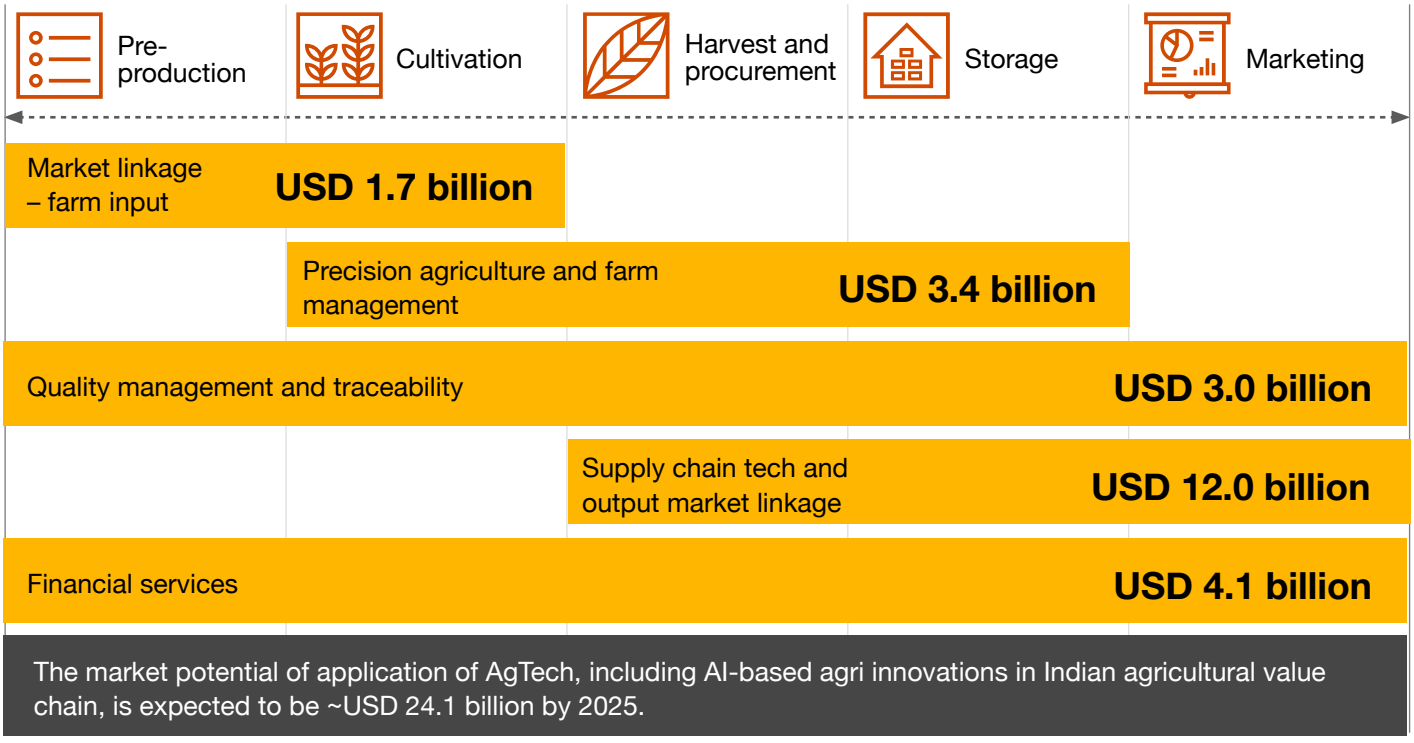
The growth and expansion of new-age AgriTechs in India are being driven by numerous promising technologies while addressing key challenges in the agricultural value chain. A few such challenges addressed are described below:

AgriTech segment	Description	Challenges addressed in the value chain
Predictive analytics and machine learning (ML)	• Precision agriculture and farm management	• Improved productivity through insights into weather and soil health • Data and insights into using resources such as water and labour • Risk models to predict farmers' credit profiles
Data and platforms for price transparency	• Market linkage – farm inputs • Supply chain and output market linkage	• Better returns for farmers through higher transparency • Online platforms for price discovery of inputs and outputs
Imaging and AI to monitor crop quality	• Quality management traceability	• Imaging for monitoring crop quality and improvement of AI automation for output grading and yield classification
Traceability	• Supply chain and output market linkage	• Increased visibility and transparency in the supply chain • Data availability for product recalls
AgBots and drones for cultivation/ harvesting	• Farm mechanisation and automation	• Help overcome labour shortage • Improve time to market for produce

Market potential of AgriTechs in India

The market size of AgriTech start-ups in India is currently valued at **USD 204 million**, which is estimated to be 1% of the current addressable market opportunity worth **USD 24 billion**. The market potential for AgriTechs across the value chain is given below:[21]

Market potential of the AgriTech space in India



Source: PwC analysis of data from The Economic Times

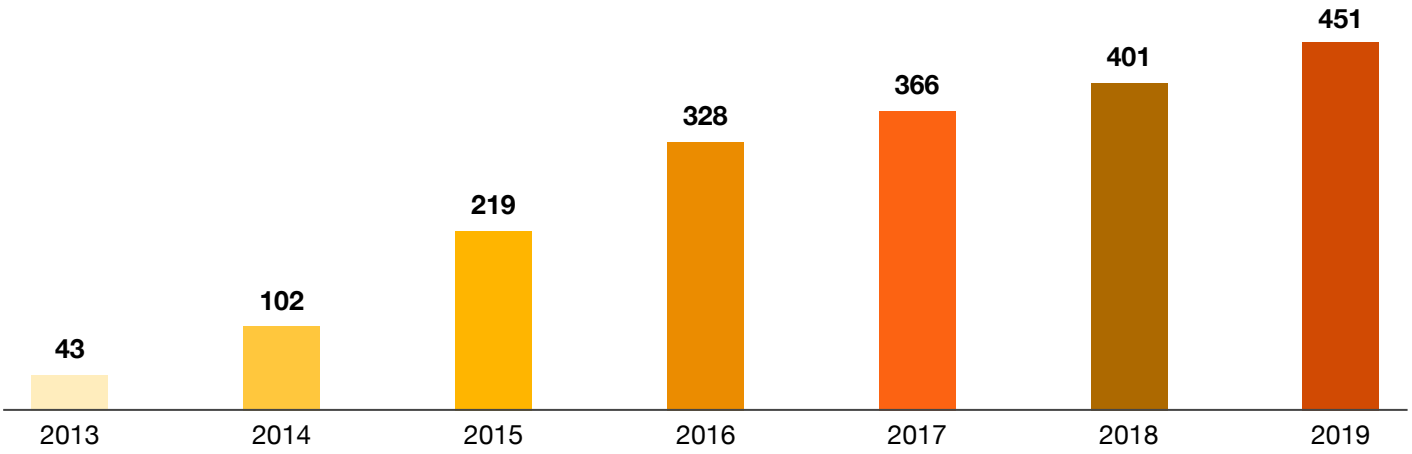
21 https://economictimes.indiatimes.com/news/economy/agriculture/indian-agri-tech-can-grow-to-24-1b-in-5-years-report/articleshow/77966010.cms

A number of upcoming start-ups in the Indian AgriTech segment are disrupting the traditional methods of farming. These start-ups are using methods such as precision farming, equipment rentals, supply chain aggregation and cloud-based analytics for decision making. AI, big data, internet of things (IoT), drones and ML are being harnessed for multiple applications such as farmer decision support systems, precision farming and insurance claims assessment tools. Supply chain and output market linkage dominate majority of the investment activity in the Indian AgriTech start-up sector.

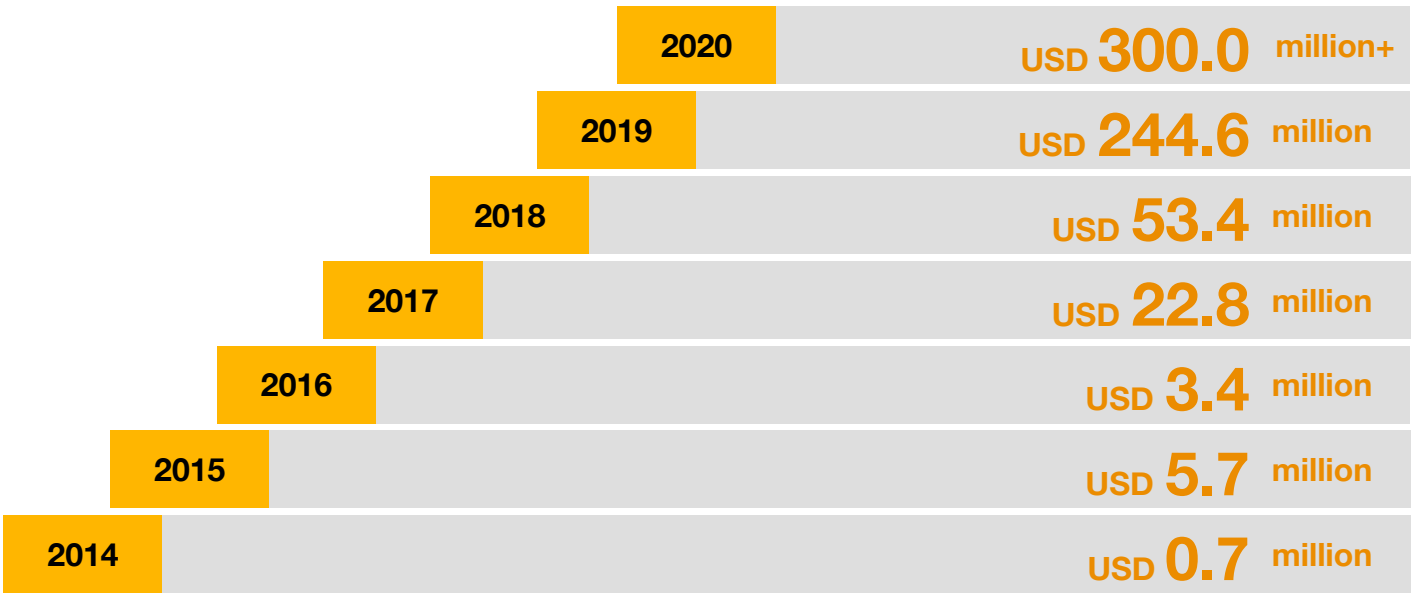
Investment scenario in the Indian AgriTech space

Investments worth USD 1 billion were recorded in the Indian AgriTech space between 2010–20, out of which 2019–20 accounted for **approximately USD 600 million**.[22] **In FY20, Indian Agri-FoodTech start-ups raised USD 1.05 billion through 133 deals, registering a YoY growth of 6.4%**.[23] It is estimated that the sector will attract investments worth USD 10 billion over the next decade.

Trend and sector-wise presence of agri start-ups in India



Source: PwC analysis of data from NASSCOM



Source: PwC analysis of from NASSCOM

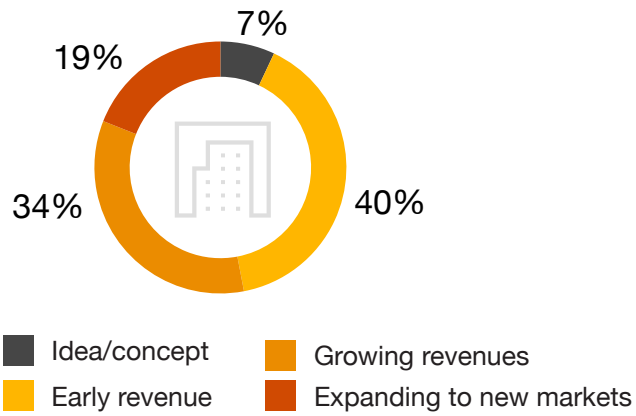
- A total of 451 agri-based start-ups were founded between 2013 and 2019.
- Investments worth approximately USD 600 million were recorded in 2019–2020.

22 https://economictimes.indiatimes.com/news/economy/agriculture/focus-on-farm-mechanization-to-cope-up-with-increasing-food-demand/articleshow/73814116.cms?from=mdr

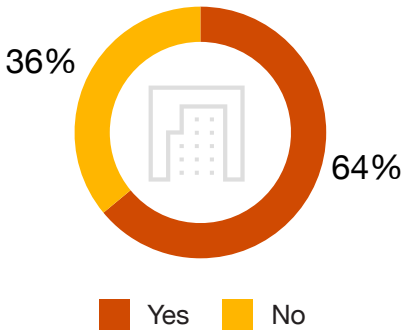
23 https://agfunder.com/research/india-2020-agrifood-startup-investment-report/

While interacting with AgriTech start-ups in India, FICCI and PwC teams observed the following key top-of-the-mind recalls:

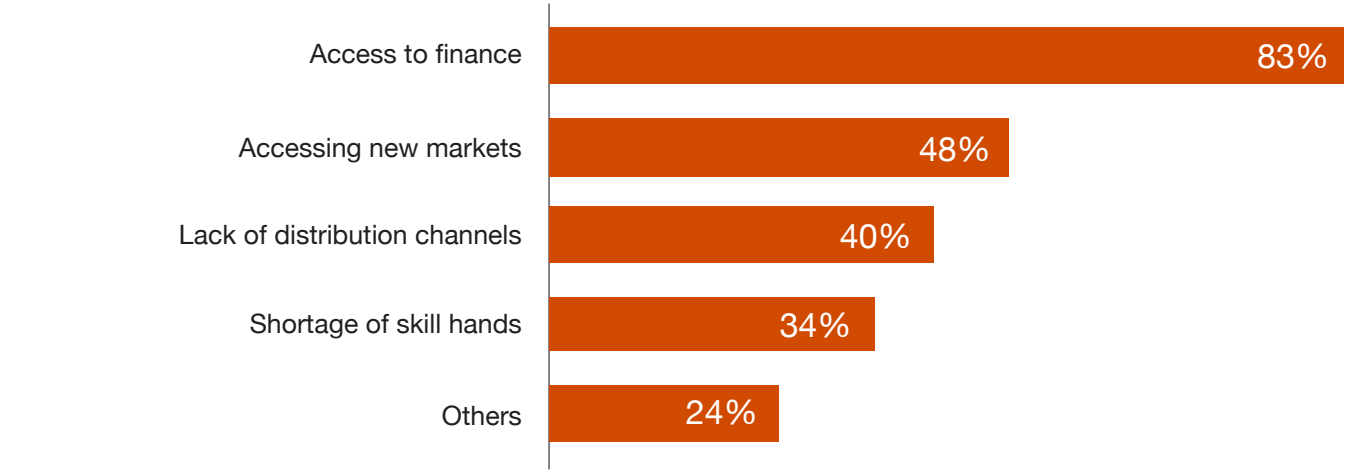
Stage of the start-up



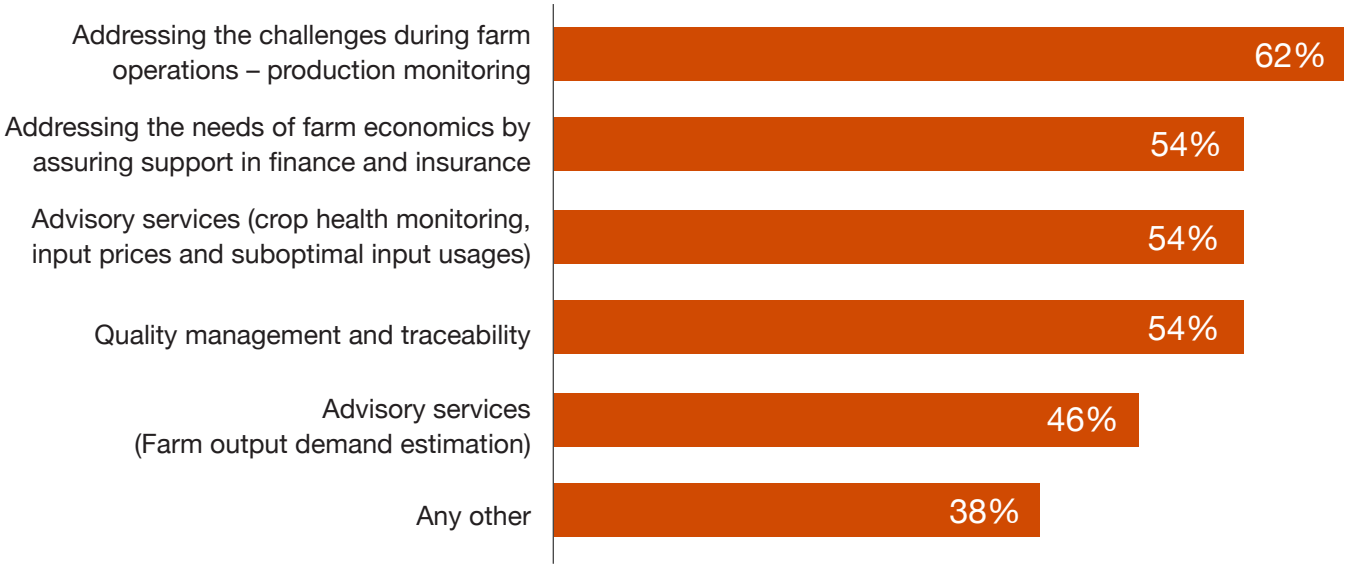
Affiliation with a start-up incubator



Challenges faced in scaling up businesses



Need for speedier adoption of digital technologies



Source: Excerpts from interactions with select agri start-ups in India in December 2020

With the significant increase in investment activity and considering the huge market potential of AgriTech, industry experts estimate that there will be investments worth over **USD 10 billion in the next ten years, with an average of USD 1 billion** per year. A platform approach in AgriTech (input, credit, data, advisory, market linkage, processing and value addition) is critical to solve the most complex value chain challenges and optimise profitability.

04 The agri start-up ecosystem in the new normal

The COVID-19 crisis has put the world, including India, to the severest test people have had to face for a very long time. It has created widespread uncertainty on the health, social and economic fronts, and shockwaves are still being experienced across the world . According to World Bank forecasts, global recession will be the deepest in eight decades, caused by **the global GDP contracting by 5.2% in 2020**.[24]

Challenges posed to the agriculture sector during the COVID-19 pandemic and the resilience of agri start-ups

While the pandemic has adversely affected many sectors such as manufacturing and services. The agriculture sector has however remained resilient and buoyant, and has performed comparatively better than several other sectors despite the difficulties it has faced during this crisis. Moreover, while the sector has been subjected to temporary shockwaves, certain elements of the food system have remained unaffected, such as primary supply, processing, trade, national and international logistics systems, and intermediate and final demand, but has witnessed creation of opportunities for rapid adaptation of technology and adoption of improved and resilient business models.

Key challenges in the agriculture sector during COVID-19

Pre-production

- **Delay in supply of agri inputs** to farmers for Kharif crops
- **Limited access to farm implements** during crop operations
- **Demand – supply strain** in timely availability of agrochemicals/fertilisers/ MIS
- **Liquidity constraints** for channel partners due to inventory built up, storage, interest, salaries, etc.

Production

- **Minimal traceability** in value chain and farm operations increasing chances of infections
- **Increased exposure** to routine farm activities and less social distancing
- **Reverse migration** to impact labour-intensive operations like sowing, harvesting, IC operations

Procurement and logistics

- **Lack of clarity on MSP** access for farmers
- Significant **reduction in arrivals and price realisations** in crops
- Labour and transportation **hurdles at procurement centres**
- **Subdued** domestic and export **demand**

Storage, processing and retail

- **Underutilisation of storage and processing capacity**
- **Delay in electricity payments** from cold chain units
- Bulk **demand reduction from** the closure of hotels, airlines and restaurants
- **Supply chain challenges** for supermarkets and online grocery platforms

24 https://openknowledge.worldbank.org/handle/10986/33748

Many agri start-ups in India have demonstrated their proactive approach, been resilient, and by their rapid adoption of digital and AI technologies turned the crisis into an opportunity. Given below are some emerging innovations in the agri start-up space. These may have been initiated in pre or post-COVID, but have a great potential for accelerated adoption in the near future.

1. Increase in the spread of the Farming-as-a-Service (FaaS) concept with improved farm advisory and data- driven Smart farming techniques
2. Optimisation of need-based usage of agri input based on crop diagnostics
3. Implementation of tech-enabled and demand-driven supply chain with digitised aggregation and distribution of agricultural commodities from the farm gate to consumption points
4. Upgrading of quality assessments, e.g., image processing, and improved price discovery and traceability of farm produce
5. Development of warehouses and processing units in proximity to farm gates with improved access to post-harvest finance and market linkages through e-platforms
6. Increase in focus on environment-controlled agriculture (ECA), e.g., hydroponics, vertical farming and aquaponics

Enablement of policy measures: Boosting the agri start-up ecosystem

In response to the impact of COVID-19 on the agriculture sector, the GoI has been promulgating a series of policy measures and reforms to encourage private investments in the sector and support farmers under its **Aatmanirbhar Bharat Yojana**.

Key fiscal measures announced for the agriculture sector under Aatmanirbhar Bharat

- The economic package of USD 263 billion under the Aatmanirbhar Bharat – Agriculture component has led to significant fiscal measures being adopted by the GoI to strengthen credit supplies to farmers and agricultural processors, and provide them additional funds for infrastructure development, logistics and capacity building in the field crop, horticultural and livestock segments.
- Along with fiscal support, the GoI has also announced three agri reform bills to promote barrier-free trade, increase the efficiency of supply chains and reform agricultural marketing systems in order to augment farmers' income.

Source: The GoI's Aatmanirbhar Bharat announcements

The GoI's fiscal measures have given an impetus to the agri start-up ecosystem in the country and also provided attractive opportunities to entrepreneurs and agri start-ups to support their growth and expansion initiatives. The Government's focus is on infrastructure development, expansion of micro food enterprises and enhancement of the efficiency of supply chains. It is inviting start-ups to explore niche areas such as be-keeping and herbal cultivation, and is also promoting their interest in the fisheries and animal husbandry segments.

Understanding agri reform laws and emerging opportunities for agri start-ups

Recently, the GoI has announced three agri marketing reforms under its Aatmanirbhar Bharat Yojana scheme, **The Essential Commodities (Amendment) Bill 2020, The Farming Produce Trade and Commerce (Promotion and Facilitation) Bill, 2020 and The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020**. These reforms aim to transform agricultural marketing, enable contract farming and remove the stock limits of essential commodities.

Details of these reforms are presented in the table below:

Farm reform laws and their key features

The Farmers' Produce Trade and Commerce Bill	• Adequate flexibility to farmers to sell agri produce outside the notified agricultural produce market committee (APMC) market yards • Barrier-free interstate and intratrade ecosystem and framework for e-commerce outside the physical premises of markets • Price and quality assurance framework for transparently engaging with processors, aggregators, retailers and exporters • Risk mitigation, assured returns and quality standardisation are integral parts of the framework
The Essential Commodities Act (Amendment) Bill	• Deregulation of food commodities, including cereals, edible oils, oilseeds, pulses, onion and potato • Stock limit to be imposed under very exceptional circumstances like national calamities, famine, war and extraordinary price rise • No such stock limit shall apply to processors or value chain participants, subject to their installed capacity or to any exporter, subject to the demand • Attracting investments for building supply chains and enhancing competitiveness in the agriculture sector
The Farmers Agreement of Price Assurance and Farm Services Act	• The process of price determination to be predefined by an agreement between a farmer and a buyer • Pricing of farming produce to be determined in the agreement for a period of maximum five years • Agreement to be done for a minimum period of one crop season or one production cycle • Guaranteed price for the produce, plus any additional amount specified

Source: Data from PwC's 'Unlocking growth opportunities in agricultural supply chains' report

It is envisaged that the agri reform laws, when implemented, will have a possible impact on AgriTech start-ups and will connect farmers to agribusinesses, agri processors and exporters, agri warehouses and cold storage providers, supply chain and logistics operators to ensure transparency and timeliness, put in place online agri trading marketplaces and other stakeholders directly operating in the agricultural value chain, and work towards reducing inefficiencies in farm-to-fork activities. The following table includes the key probable impact of agri reform laws on agri start-ups in India:

Probable impact areas of farm reform laws on agri start-ups

Better demand visibility, improved transparency and traceability in supply chains

Better market access and opportunities (procurement and infra) near farm gates

Direct buying from farmers across regions without any licensing and intermediary bottlenecks

Derisking of relationship-based business through contract proofing

Reduction in gestation period and improved scalability

Popularisation of AgTech models post farm reform laws

Online agri market places

Cold chain and storage solution near farm gates

Farm advisory/ consulting

Legalities and agri contracts

Predictive analysis for pricing and produce

Farm-to-fork supply

Tech-enabled logistics

Supply chain optimisers

Source: PwC analysis of data from industry insights

It is anticipated that agri reforms will stabilise the regulatory environment in the agricultural value chain, and AgriTech start-ups will be better equipped than even large agribusinesses in building farm-sourcing systems and related infrastructure. Small and marginal farmers, particularly, require supply chain efficiencies — from enhanced supply-demand matchmaking to reduced volatility in pricing and superior cold storage facilities. Agri reforms are expected to open up such avenues and let farmers interact directly with new-age agri start-ups that have built their foundations on technology. In addition to supply chain innovations and related investments, these farm laws will bring in trust and quality assurance, and enable drawing up of legal frameworks and contracts between farmers and agri start-ups.

05 Avenues for next level start-ups in agriculture and allied sectors in India

Start-ups which have lived through the challenges inflicted by the pandemic and other related uncertainties have a longer way to cover in their business journey, as they are also more focused and determined. Also, the challenging times have led to ponder on newer avenues for start-ups and their interplay in the agricultural value chain. A few such probable business models for start-ups operating in the agriculture, fisheries and livestock space, along with the potential impacts, have been listed below:

Probable business models for AgriTech start-ups

	Agri start-up business model	Potential impact
	• Farm-to-fork model – e distribution of agricultural commodities • Direct supply of fresh produce to hotels, restaurants, retailers and wholesalers	• Price optimisation for farmers • Post-harvest loss management
	• B2B marketplace to trade commodities • Aggregated logistics services • Digitised transaction and bookkeeping	• Producers get real-time prices from buyers • Reduces post-harvest wastage • Transparent payment and records
	• Phone call based order of agri inputs • Home delivery of inputs	• Timely availability of inputs • Ease of accessing inputs • Affordable and transparent rates
	• One-stop solution/end-to-end services to farmers • Crop selection, technical support, input availability and value addition, as well as marketing	• Optimisation of resources • Post-harvest crop management • Better market price for the produce
	• Smart farm – complete data-driven farm management • Forecasting, crop management, warehouses, traceability, etc.	• Risk mitigation • Enhanced efficacy of production • Better market accessibility
	• Digitised business payment • Cashless payment • Building financial credibility	• Ease in access to finance • Credit scoring • Transparent payment system

FishTech start-ups

	FishTech start-up business model	Potential impact
	• AI-based farm advisory solution through mobile apps • Real-time production data • Linkage to data-driven marketplace for shrimp and fish farmers	• Reduces disease occurrence • Optimises farm input usage • Improves farm revenues
	• Online business-to-business hybrid (inventory led and marketplace) e-commerce platform for seafood • Integrated shipping • Payment protection • Quality assurance services	• Increased efficacy of dealers in material and order management • Reduction in gaps between demand and supply • Dynamic route planning and optimisation facilitating real-time orders • Effective inventory management

Livestock technology start-ups

	Livestock technology start-up business model	Potential impact
	• Online platform for delivery of meat and seafood • Vacuum sealed, fresh, marinated cold cut • Fast delivery with zero inventory model	• Reduces wastage • Optimum price for the produce
	• IoT and data analytics based supply chain • Digital platform, data via sensors embedded in milking systems, animal wearables, milk chilling equipment and milk procurement peripherals	• Provides optimisation and monitoring support • Effective management of cattle, dairy farm and logistics management • Provides animal profile
	• Manufacturing of radio-frequency identification (RFID) tags for animal identification and tagging • Low frequency, high frequency and ultra-high frequency passive tags • RFID tag readers	• Animal database management • Animal behaviour monitoring • Easy access to medical history

Source: PwC analysis of data from industry insights

06 Way forward

While looking to achieve full potential[25] post the pandemic period, tech-enabled start-ups are gaining traction in the agriculture sector due to positive growth and expansion capabilities in the space. However, it should be noted that agri start-ups could only account for **1% of the current addressable potential market opportunity of the USD 24 billion** in India.[26] This clearly indicates that there is significant future potential for agri-start-ups in the country.

This accelerated growth potential is evident from the investment inflow into India, with investors **pumping in more than USD 500 million** in AgriTech deals in 2020, compared to USD 248 million in 2019. The GoI, as well as private players, are also making a focused effort to support innovation-led tech farming so that small and marginal farmers can benefit.

Key interventions to build a robust AgriTech ecosystem

The GoI is committed to bringing in policy reforms in the agriculture and allied sectors to bolster these. Various Government-led interventions, including formation of policies on agri-produce marketing, agri-input subsidies, credit facilities and technical know-how, are aimed at meeting the Government's goal to double farmers' income by 2022.[27] Today, while India leads in production of agricultural products globally, there is still vast scope for integration of technology to bring efficiencies in the country's value chain.

India stands at a critical juncture and is looking for ways to enable a robust AgriTech ecosystem in the country while focusing on five intervention areas – **infrastructural enablement, product innovations, collaborations, entrepreneurship and incubational and institutional support**.

25 https://www.manage.gov.in/publications/discussion%20papers/MANAGE-Discussion%20Paper-10.pdf
26 https://www.psmarketresearch.com/market-analysis/artificial-intelligence-in-agriculture-market, PwC analysis and industry estimates
27 https://niti.gov.in/writereaddata/files/document_publication/DOUBLING%20FARMERS%20INCOME.pdf

Infrastructural enablement

The success of a robust and accurate decision-making system mainly depends on underlying data. In agriculture ecosystems, most datasets required by agri start-ups are not available publicly and the ones that are available need a thorough review in terms of their size, diversity and authenticity. Traditionally, various public agencies have maintained such data pools. However, manually and unscientifically collected data on farm output is often undependable for important decision making, e.g., financing for small and marginal farmers. Consequently, there is an immediate requirement for the creation of a single unified digital agri database infrastructure, an **AgriStack**, in India. This could be a one-stop-solution for data collection for all key stakeholders in the agri start-up ecosystem. It would help them develop new and improved apps, and enable them to concentrate on data modelling rather than on making disproportionate efforts to collect data. Unlike IndiaStack, AgriStack will cover multiple crop cycles and fluctuations in farms over a period of time.

AgriStack will fast-track the availability of easily accessible data and help achieve last-mile digital literacy. Over the years, while the mobile penetration and data availability rates have been laudable, concerted efforts to increase and update operational digital literacy to utilise the application of AgriTech is the need of the hour in India. Taking high-speed internet to rural areas to enable seamless tech transition is a prerequisite for bridging the tech gap in the country. And while mobiles are handy, their repair and the need for spares and replacements drive people outside their locations. In this scenario, a chain of mobile service centres would enable farmers to adopt m-technology.

Product innovation

India has all the **15 prominent climates** that exist across the globe. It has **20 agroclimatic regions** and the tenth-largest arable land area in the world.[28] In recent times, climate change poses a major threat to agriculture across the world, including in India, and adversely affects resources, livelihoods and production. During the last few years, AgriTech start-ups have been trying to address climate change related risks by building climate-predictive data-enabled models, resource conservation solutions and models to reduce carbon footprints in the country. Many of them have been able to decode technology, but decoding the farmer's psychology and behaviour will be the key to get closer to adoption of such technology. The adoption curve for AgTech can be steep. Fast product customisation of the latent and emerging needs of the farming community and innovation in product types is of prime importance here.

Going forward, agri start-ups will need to collaborate closely, engage actively with banking and insurance companies and innovate crop and region-based credit and insurance products (Agri-FinTech solutions) in such a manner that small and marginal farmers will be encouraged to readily adopt climate-resilient solutions. For instance, food and agricultural products exported from India amount to approximately USD 30–35 billion per annum. Within this amount, export of marine products accounted for 1.4 million metric tonnes (MT) and was valued at USD 6.7 billion in FY19.[29] This indicates that agri start-ups can innovate and customise tech solutions for quality assaying, traceability and food safety. This will ultimately lead to reduced sanitary and phytosanitary (SPS) violations and rejections at borders.

Such product innovation strategies can be executed successfully through continuous engagement between start-ups and the Government, and other facilitators in the ecosystem. For example, an agency such as the Agricultural and Processed Food Products Export Development Authority (**APEDA**) can take the lead in enabling stakeholder interactions, fostering B2G dialogues and pilot interventions for export-linked product innovation.

Ushering in entrepreneurship and incubation in the agri sector

Incorporating entrepreneurship training in data analytics courses and ML in agricultural education can equip agri start-ups with the requisite skills and quality, and help them efficiently execute and expand their business models. The Government can complement such novel initiatives by establishing agribusiness incubation centres in SAUs, Krishi Vigyan Kendras (KVKs) or any other institutions engaged in nurturing agri entrepreneurs and motivating rural youth to undertake into their own entrepreneurial ventures. Scaling up of such incubation centres will help to meet the requisite knowledge and capacity- building requirements of rural entrepreneurs.

28 https://www.ibef.org/download/Agriculture-and-Allied-Industries-August-2019.pdf
29 http://nfdb.gov.in/PDF/National_Fisheries_Policy_2020.pdf

Some SAUs and ICAR institutes have already established agri incubation centres with the required mentorship and a mix of technological and managerial support, e.g., the Association for Innovation Development of Entrepreneurship in Agriculture (a-IDEA) is a technology business incubator (TBI) and is being promoted by the National Academy of Agricultural Research Management (ICAR-NAARM) in Hyderabad. a-IDEA has been supporting start-ups across 14 agriculture and allied segments.[30] It has helped agri entrepreneurs sensitise, ideate, incubate and accelerate their innovative early-stage start-ups that are ready to become competitive food and agri-business ventures through capacity building, mentoring, networking, provisioning business support services and providing investment and advisory support.

Another interesting example is the innovation-based Zonal Technology Management – Agribusiness Incubation (ZTM-ABI) Centre established at the ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) at Kochi in Kerala. This industry-specific incubator enables agribusiness enterprises to access local knowledge and business networks that are already established. Through this centre, the institute has reached out to more than 150 small and medium technology- and technology-enabled enterprises, and has helped them create an ample number of employment opportunities.[31]

Promotion of entrepreneurship in agricultural education under National Agricultural Higher Education Project, an ICAR- and World Bank-funded initiative[32]

Along with the educational, research and training activities, the Indian Council of Agricultural Research (ICAR) and the GoI, with the assistance of the World Bank (WB), implemented their National Agricultural Higher Education Project (NAHEP) in November 2017, with the objective of supporting participation in agricultural universities (AUs) and ICAR institutes, and providing relevant and high-quality education to students.

Since its inception, NAHEP has given high importance to inculcating entrepreneurship capabilities in students by conducting international and in-plant training, organising 'industry exposure' visits, establishing an industry-institution-interaction cell, developing an industry-oriented course curriculum, organising entrepreneurship development programmes, supporting adoption of digital initiatives and emerging technologies, etc., to create a ripple effect and provide enhanced employment opportunities.

NAHEP has been encouraging the students and faculties of partner AUs to visit international higher-education institutions (HEIs), learn about emerging areas of science and technology in agriculture and share the rich experiences gained during their training for the betterment of India's agricultural ecosystem. The key subject areas where students have received training are detailed below:

Subjects

- Agriculture entrepreneurship – sustainable agriculture
- Skills for entrepreneurship and management in agricultural engineering
- Entrepreneurship and leadership training
- Veterinary clinical practice
- Precision agriculture and recent advances in agriculture technology
- Management of pig husbandry
- Aquaculture and aquatic resource management
- Innovation in food production systems
- Remote sensing and GIS application
- Unbundling engineering to achieve Sustainable Development Goal 6
- Food processing, food safety and food microbiology
- Sensory evaluation and consumer behaviour analysis

The key outcome envisaged through such initiatives, including international training, is to instil an entrepreneurial spirit in students to adopt innovative and cutting-edge technologies in agriculture.

30 https://aidea.naarm.org.in/

31 Development in Fisheries Sector through Agribusiness Incubation. Razia Mohamed A, Manoj P Samuel, George Ninan and Ravishankar C N. Indian Farming (January 2020)

32 https://nahep.icar.gov.in/pdf/NAHEPAnnualReport2019-20.pdf

Co-creating through collaborations

More than 7,000 FPOs in India are trying to bridge the value chain gaps in the sector through farmer aggregation programmes and adoption of multiple market-linkage models. Such endeavours are aligned with the efforts made by agri start-ups through their tailormade solutions in this space and ensure that both the entities reach the desired scale and commercial viability through collaboration and synergies.

It is worth mentioning that two important elements in the value chain, i.e. agri input and post-harvest supply chains, are dominated by MSMEs. Unfortunately, there is barely any significant interface between MSMEs and start-ups to optimise the cost of sourcing and improve value addition through collaboration. Therefore, there is a need to foster a win-win collaborative partnership between start-ups, FPOs and MSMEs to optimise profitability across value chains and ensure improved price realisation for small and marginal farmers. Such MSME-AgTech platforms can bring in super synergy in two vibrant subsets and drive holistic growth in agri and allied sectors.

Institutional support at initiation

Institutional support can be provided to start-ups in the form of a dedicated agri start-up cell at state and district levels. Such cells will facilitate continuous dialogues between the Government and agri start-ups at local execution levels and will help start-ups to meet all requisite regulatory and ease of doing business (EODB) norms. It will also help to bring in catalytic funding and incubation-related support for entrepreneurs at a decentralised level.

While agri start-ups have been making significant efforts to transform the agriculture sector, it is equally important for them to incorporate structural changes, including enabling infrastructure, product customisation, institutional support from the Government and incubators, to help them sustain this change. These structural changes, with much-required ecosystem-related collaborations, will help agri start-ups bring about the much-needed transformation in Indian agriculture.

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PwC India has a dedicated team and highly experienced team working in the agriculture and natural resources sector which provides advisory services related to agriculture and agribusiness management, long-term transformational project implementation, food processing, agricultural credit, agri policy, impact assessment, performance improvement, commodity trading, integrated resource management, farm inputs and agri infrastructure. The group consists of graduates and postgraduates in agriculture, agribusiness management and natural resources with extensive experience in various aspects of agriculture, including advisory in the agriculture and food domain, supply chain management, public private partnerships, policy advocacy, agri economics, agri retail, agri marketing, farm inputs and banking.

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