POLICY PAPER 108

# Agri-startups in India: Opportunities, Challenges and Way Forward

NATIONAL ACADEMY OF AGRICULTURAL SCIENCES NEW DELHI
July 2022

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**CONVENER** : Dr Ch. Srinivasa Rao, Director, ICAR-National Academy of Agricultural Research Management (NAARM), Hyderabad 500030, Telangana

**CO-CONVENER** : Dr Ranjit Kumar, Head, Agri-Business Management, ICAR- NAARM, Hyderabad 500030, Telangana

**REVIEWER** : Dr K. Srinivas, ADG (IPTM), ICAR, New Delhi

**EDITORS** : Dr Pratap Singh Birthal and Dr Malavika Dadlani

**CITATION** : NAAS 2022. Agri-startups in India: Opportunities, Challenges and Way Forward, Policy Paper No. 108, National Academy of Agricultural Sciences, New Delhi: pp. 16



Published by Executive Director on behalf of
**NATIONAL ACADEMY OF AGRICULTURAL SCIENCES**
NASC, Dev Prakash Shastry Marg, New Delhi-110012, India
Tel.: 011-25846051-52; Fax: 011-25846054
Email: naas-mail@naas.org.in; Website: www.naas.org.in

# Preface

Over the past five decades, Indian agriculture has made tremendous progress, resulting in a multi-fold increase in food grains, horticultural and animal products. Nevertheless, farmers face several challenges, including low farm incomes, fragmented supply chains, post-harvest losses and climate change. To manage these challenges, many educated youths have developed innovative ideas leading to agri-startups. Currently, there are more than 2500 agri-startups registered with Startup India. The National Agricultural Research and Education System (NARES) has also geared up to create an ecosystem for the handholding of these startups. There are seven Technology Business Incubators (TBI) supported under the National Initiative of Development and Harnessing Innovations (NIDHI) scheme of the Department of Science and Technology, 50 Agribusiness Incubators (ABIs) in the Indian Council of Agricultural Research, and 29 ABIs in the State Agricultural Universities. Incubation is a critical driving factor in the success of startups.

Recognizing the importance of the agri-startups in energizing agriculture, the National Academy of Agricultural Sciences (NAAS) organized a brainstorming session (in online & offline modes) on “Agri-startups in India: Opportunities, Challenges and Way Forward” on November 5, 2021. The purpose of this brainstorming session was to know the gaps in startup ecosystem and develop strategies for creating an enabling environment in the NARES for scaling up the successful agri-startups.

On behalf of the Academy, I express my sincere thanks to Dr Ch Srinivasa Rao and Dr Ranjit Kumar for organizing the brainstorming session and synthesizing the ideas and experiences of the participants in the form of this document. I thank all the participants for their contribution, especially Dr P.K. Joshi, for initiating the discussion and anchoring the workshop. I also thank Drs P.S.Birthal and Malavika Dadlani for their editorial support.

**(Trilochan Mohapatra)**
President, NAAS

July 2022
New Delhi

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## 1. INTRODUCTION

Globally, the entrepreneurship culture has been gaining considerable importance in recent years. The transition from controlled and license-regulated public company-oriented economies to knowledge-based ones has encouraged individuals to start businesses. The term startup denotes the early stage of an enterprise integrating the science-based innovations that can scale it up. In short, all startup founders are entrepreneurs, but not all entrepreneurs are startup founders. Startups are emerging as a vehicle for realizing social purposes, a means of actualising technological prowess, the wings of creative imagination that transports the purposeful dreamers to a land of their creation, and preferred routes to riches. Startups are considered to be the next growth engines to take the Indian economy to the size of US$5 trillion and to realize the dream of *Atmanirbhar Bharat.*

India has the second-largest cultivated area, with a large number of cultivators (146 million), mostly (86%) smallholders. The sector is facing several complex problems and challenges. The tiny landholdings increase transaction costs, making it challenging to adopt several modern technologies essential for efficient resources. Even a lack of information about soil, weather, market, etc., hinders crop planning and diversification. It also leads to a smaller scale of production.

Consequently, a small marketed surplus makes it unremunerative for producers and buyers to engage inefficient price discovery and trade. These hold for the livestock production system as well. The climate change scenario further aggravates these challenges. The cumulative effect of these is the lower household income. The latest Situation Assessment Survey (SAS) conducted by the NSSO in 2019 shows that the income from crops for rural households is even less than wage earnings. On average, the agricultural families earn Rs 816.5 per person per month from farming.

On the other hand, the urban consumers, whose absolute number and average per capita income have been rising, are demanding foods of better quality in different forms (variety of the products-fresh and processed) and at reasonable prices. Apart from domestic demand, there is a massive upsurge in the export market for quality agricultural products, including organic food products. It is evident that during the Covid pandemic period, when all other sectors of the economy languished, the farm sector has sustained its growth momentum. The share of agriculture in the gross domestic product (GDP) reached almost 20%in 2020-21, for the first time in the past 17 years (Economic Survey 2020-21). The sheer size of the agricultural sector offers umpteen opportunities for evolving an efficient market based agrarian ecosystem.

Several new ventures are registered with Startup India. As of November 10, 2021, more than 1.73 lakh ventures had registered, of which the Department for Promotion of Industry and Internal Trade (DPIIT), Government of India has recognized 58,650 startups. Considering the problems and challenges in agricultural development, several startups have filled the gap in agri-food value chains. Currently, there are 7241 agri-startups, of which the DPIIT recognizes only 2605. There are also 2594 startups in the food & beverage industry. However, compared to the importance of agriculture, the number of agri-startup looks much less in number. During the last ten years, a total of 80+ startups reached the valuation of more than $1 billion, commonly known as “Unicorns”.

Further, a whopping 38 startups have already made it to the list within 11 months of 2021. But agri-startups somehow remained in the shadow. More surprisingly, most high-growth agri-startups have been founded by young professionals with engineering and management backgrounds. On the other hand, about 45,000+ students graduate (under-graduation and post-graduation) every year from 75 agricultural universities (ICAR, 2017). This raises a few critical concerns:

- How to make agricultural education and research organizations hubs for developing and nurturing scalable business ideas? Should the course curriculum of agricultural universities be rejigged to trigger students' interest to take up entrepreneurship as a career?
- What kind of policies and infrastructures in the National Agricultural Education & Research System (NARES) would promote agri-startups in India?
- What capabilities and resources are needed for Agribusiness Incubators to identify and nurture high quality and scalable agri-startups?
- Are there any policy hurdles in setting up startups and their scaling up?

Against this backdrop, the National Academy of Agricultural Sciences (NAAS) organized a brainstorming session (in hybrid mode- online and offline) on 5th November 2021. The experts shared their views and experiences on enabling an environment for scaling up agri-startups.

## 2. STARTUPS FOR SOLVING COMPLEX PROBLEMS

Startups usually compete through either of the three distinct innovation strategies: radical innovation, incremental innovation and imitation. A startup can compete by developing a hitherto unknown good (product or service), usually based on a radically new technology/ innovation. Alternatively, they can build products or services that are already known. In this case, the products need to be either better (in quality) or cheaper than the competitors'. An improved product is often based on an incrementally new technology that the firm achieves by improving existing technology or process innovation. Third, ventures typically do not engage in any technological development to develop cheaper products or services but reproduce existing goods at the lowest possible cost, thereby competing through imitation (Herrmann, 2019). In some cases, these startups offer different types of customers' experiences, which may be convenience, variety of products/services, etc. However, the playbook for all these startups remain the same:


**Fig 1. A general framework of typical startups**

The startups evolve through several stages before reaching the stage of a full-fledged scalable business. The first stage is the ideation stage, where a startup founder comes with an idea for a product or service that the startup is supposed to deal with. The idea is mainly to solve some complex problems in the value chain. The startups with ideas then move to the validation stage, where a minimum value product (MVP) is developed to solve the identified problem. After validation,

the product starts gaining traction, and the startups acquire customers and generate revenue. It may enter the scaling stage once it gets stabilized and starts generating profit.

Every stage has its challenges. Not all startups reach the stage of scaling, and many remain at early stages and eventually perish and disappear. The early stage of minimum value product (MVP) is considered the riskiest as the founder may not have a complete idea about the market and customers. The failure rate of startups is estimated to be around 90% (Startup Genome, 2020). Out of many factors considered for failure, premature scaling (KPMG, 2018) and running out of cash (Cantamessa *etal*., 2018; Rovenpor, 2003) are identified as more important.

A 19-point "Startup India Action Plan" was launched in January 2016, which led to the introduction of several policy initiatives to build a robust ecosystem for nurturing innovation and startups (GoI, 2016). This led to a tremendous surge in incorporating new companies with innovative ideas in almost every sector- agriculture, healthcare, biotechnology, engineering, fintech, transport, fashion, environmental science, legal services, logistics, IT services, marketplace, etc. The technology-led startups, alias tech startups, are also growing. It has been found that around 3-4 tech startups are born each day in India (Indian Startup Ecosystem, 2020).

Scalability remains the lynchpin of the new entity termed startup. However, the focus on radically innovative entrepreneurship may be problematic sometimes as established firms also generate high employment growth. Secondly, even in the developed countries with the matured ecosystem, radically creative ventures occur less frequently than their incrementally innovative counterparts.

**Box 1: Criteria for Startups Recognition**

The Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce & Industry, Government of India recognizes any entity/venture as startup based on the following criteria:

- it should not be in operation or existence exceeding 10 years from the date of incorporation,
- It should be incorporated as a Private Ltd/ Partnership Firm/ Limited Liability Partnership
- Its annual turnover should not exceed ₹100 crore for any of the financial years since its incorporation
- It should be an original entity, and not be formed by splitting or restructuring of existing business
- It should have scalable business model with high potential for creation of wealth & employment generation

Source: https://www.startupindia.gov.in/, The Gazette of India No. 111, February 19, 2019

## 3. CURRENT STATUS OF AGRI-STARTUPS IN INDIA

The agricultural sector, including crops, livestock, and fisheries, has witnessed several startups, commonly named "agri-startups". These agri-startups are further classified based on their focus like agri-tech, animal husbandry, dairy farming, fisheries, food processing, organic agriculture, etc. Similarly, these are also categorized according to their growth stage: Ideation, Validation, Early traction, and Scaling. Among all the recognized agri-startups, currently, there are 1485 agritech startups— 474 for organic agriculture, 1774 for food processing, 48 for horticulture, 130 for animal husbandry and dairying, 22 for fisheries, and 74 have a combination of such activities (Startup India, 2021).

In terms of geographical spread, about 60% of the agri-startups are located mainly in Tier I & II cities in a few states. Karnataka and Maharashtra accounted for half of the total agritech start-ups in the past five years. From an analysis of the Indian Startup Ecosystem, it is evident that

Bengaluru (Karnataka) is one of India's established startup ecosystem hubs, followed by Mumbai and Delhi NCR.

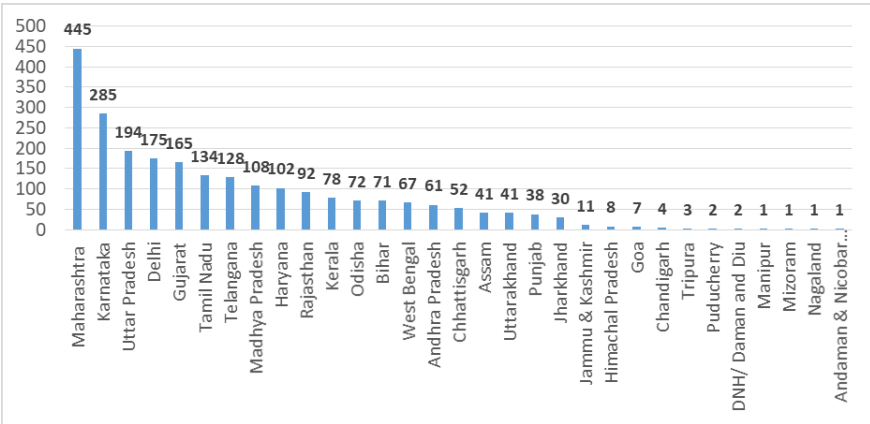


**Fig 1. State-wise number of DPIIT-recognized agri-startups in India (as of Nov 10, 2021)**

Agri-startups usually operate at one or more stages of the agricultural value chain. Chandra *et al.* (2020) have classified these startups into seven broad categories: a) providing output market linkages; b) facilitating input supply; c) enabling mechanization and irrigation; c) offering a financial solution (credit and insurance); d) helping quality maintenance through monitoring and traceability; e) post-harvest management; f) logistic services (warehousing & cold chains), and g) supporting animal husbandry activities. They provide solutions to farmers through different business models like:

**Supply chain-** E-distributor, Marketplace, Logistics, and Warehousing

**Growing system and components-** Aquaponics, Hydroponics, Vertical farming, Drip irrigation

**Financial solution-** Payments, Revenue sharing, Lending, Insurance

**Farm data and analytics-** Integrated Platform, Remote sensing software platforms, Farm mapping, Farm management solution, Advisory

**Field operations**- Farm mechanization, Bulk handling

These startups use different types of innovations and technologies.They develop products and/or services to improve efficiency at various stages of the value chain in terms of infrastructure (storage & warehousing), farm automation (digital farming, advisory services), precision agriculture, input delivery and advisory, market linkages, agri-finance and insurance, agri-biotech (new inputs, post-harvest methods), etc. The technology can radically improve agriculture advisory to support farmers and bring objectivity and transparency in the post-harvest value chain. Various business models have emerged in India in the agricultural space, including downstream 'farm-to-fork supply chain model, IoT or big data-led innovation model and the upstream marketplace model. These agri-startups are leveraging technology, for instance, data digitization, SaaS (software as a service), machine learning, data analytics, artificial intelligence (AI), Internet-of-Things (IoT), satellite data, drone, and blockchain, to make agriculture and agri-industry more efficient (Mikhailov et al., 2019). The list of major agri-startups and new agripreneurial opportunities are given in Annexure I& II.

Some of the agri-startups which have adopted AI and IoT systems, like Intello Labs (for product quality testing), Tartansese (for guiding field robots), Eruvka (embedded in aquaculture), Fasal

and Stellaps (for predictive algorithms), are getting market traction after initial struggles. Ninja Cart is another example of a hyper-local market linkage platform that intermediates transactions between farmers and small and mid-tier green-grocers in cities and is expanding its in-house data science capabilities (Anita and Deepthi, 2019).Tartan Sense has built a small agricultural robot that can move around on farmlands and identify weeds and spray pesticides. Its flagship product viz. Brijbot, an automatic robot powered by artificial intelligence (AI), traverses the farm, examines the crops through cameras mounted on its computer and sprays the pesticides on identifying the weeds. The spray precision is around 3 cm, reducing the use of chemicals by 50 to 70%. In other words, the development of farm-specific, data-driven diagnostics to determine soil and crop health, leveraging drones or tractor-based solutions to get data (both on weather and agricultural) on the field to assess risk, is an ample opportunity. According to an estimate, there would be 900 million active internet users by 2025. Growing smartphone penetration also enables precise farming decision-making and helps farmers increase productivity and revenue while reducing costs.

## 4. ECOSYSTEM SUPPORTING AGRI-STARTUPS

A startup ecosystem is formed by entrepreneurs, startups at various stages and various types of organizations like universities, funding organizations, support organizations(like incubators, accelerators, co-working spaces etc.), research organizations, service provider organizations (like legal, financial services etc.) and large corporations in a location (physical and/or virtual), interacting as a system to create a new startup. National institutions also need to stimulate varieties of entrepreneurship through research to facilitate the development of types of entrepreneurs. Firms often engage in R&D collaborations with other organizations, including research labs, universities and industries, to jointly develop new products or services.

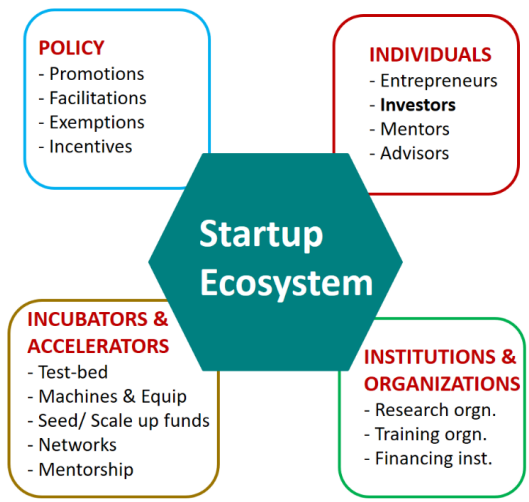


**Fig 2. Components of Startup Ecosystem**

The ecosystem towards agri-startups started witnessing significant activities in 2015-16 when the Agribusiness Incubator centres (ABIs)were set up in different parts of the country. These ABIs started nurturing innovative ideas to solve farm-level problems and have a high potential for growth by adding value and linking farm producers. Agribusiness incubators identify and mobilize small cohorts of emerging entrepreneurs and facilitate their growth through a combination of services, such as shared facilities and equipment, business development, technology, finance, mentoring and networking. At the end of the incubation process, which could last from 6 to 36 months, incubates are expected to validate their business models and start generating significant growth in revenues, customers, and staff.

There are more than 100 agri-focused incubators in India, mostly in academic and research organizations, mainly at the ICAR institutes and agricultural universities. These incubators are supported by schemes like Startup India, Atal Innovation Mission, NSTEDB, RKVY-RAFTAAR, and ICAR. There are 36 agriculture-based incubation centres in India supported and promoted under the NIDHI scheme of the Department of Science & Technology (DST). Only seven TBIs are located in NARES, mainly at ICAR-IARI, New Delhi; ICAR-NDRI, Karnal; ICAR-NAARM, Hyderabad;

ICAR-IIHR, Bangalore; TNAU, Coimbatore and ICRISAT, Patancheru. Similarly, there are about 45 NIDHI PRAYAS centres in India, but only one (at NAARM) in the NARES. The ICAR has set up 50 Agribusiness Incubators (ABIs) in different research institutes with an annual budget of Rs10 crores (Rs 20 lakhs each ABI). Similarly, 29 ABIs have been set up at various state agricultural universities (SAUs) under the RKVY-RAFTAAR scheme of the Ministry of Agriculture & Farmers' Welfare with a Rs 2-3 crores grant to each R-ABI. These ABIs are currently supporting over 750 agriculture-based startups and agri-entrepreneurs, including farmer-entrepreneurs and producers' companies (FPOs).

## 5. INVESTMENT IN AGRI-STARTUPS IN INDIA

India witnessed 46 unicorns (new companies with $1 billion valuations) in 2021 alone, making India the third-largest unicorn hub (with total 90 unicorns) behind the US and China. Indian startups raised $42 billion in 2021, up from $11.5 billion in the previous year. Financing agri-startups is one of the significant challenges in India, although there is a lack of unified information on investment in these startups. Apart from grants from different incubation and acceleration schemes through incubation centres by the government, the agricultural sector has witnessed external (foreign) investment in Agritech startups. The investment comes at different stages, say angel funding (friends, relatives, individuals), early-stage (by incubators and venture capitalists), growth stage (venture and private equity) or late-stage (private equity). In 2016, the global agritech investment was US$ 3.23 billion, of which Indian agritech startups accounted for around 9%(US$ 313 million) raised by 53 startups. According to ThinkAg, the sector has received more than US$656 million in funding in 2018-19, a massive growth of 300% as compared to the previous year. However, in 2020-21 during the pandemic period, when other sectors like health, education and retail witnessed a surge of several tech startups, agritech startups faced a significant drop in investment to $409 million. According to a joint report by PwC and FICCI, the Indian agri-tech and agro-food startups raised $1.05 billion through 133 deals in 2019-20, while the actual market potential is estimated at $24 billion (Akshatha, 2021).

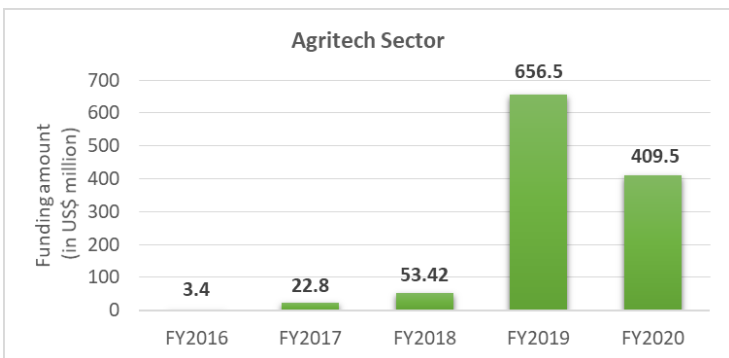


**Fig3. Funding in agritech startups in India**

Source: https://inc42.com/; ThinkAg (2020)

1 National Initiative for Developing and Harnessing Innovations (NIDHI) is a scheme launched by National Science & Technology Entrepreneurship Development Board (NSTEDB) under DST. Under NIDHI, there are different programmes through which start-ups and entrepreneurships are being promoted. These are: Setting up of Technology Business Incubator (TBI), Seed Support System, Accelerator program Centres, Centres of Excellence, Promoting & Accelerating Young & Aspiring Innovators & Startups (PRAYAS) Centres, Entrepreneur-in-Residence (EIR) Centres, and Inclusive TBI (iTBI).

In 2020, 42 ag-tech startups raised investments compared to 58 in previous years. Further, the median investment almost doubled to $2.15 million in 2020 instead of $ 1.42 million in 2019 (ThinkAg, 2021).This indicates that agri-startups with enormous scale-up opportunities attracted a large chunk of investment. According to AgFunder, the agri-food-tech startups in India have attracted investment of over $2.0 billion in 2021 (Jan – Jun). Although, there is no information about the funding to the non-tech agri-startups in India, which are also quite large.

## 6. INDIAN AGRICULTURE ON THE CUSP OF (R)EVOLUTION

IBM Institute for Business Value and Oxford Economics found that 90%of Indian startups fail within the initial five years of their set-up. The lack of innovation is the main reason. However, in 2021, India has moved to 46$^{th}$ in the Global Innovation Index. However, several startups in the agri-sector are finding it difficult to scale up the operation at the pan-India level. Different stakeholders attribute different factors to the lackluster growth and performance of agri-startups in India.

**Challenges faced by the Agri-startups**

**Business model:** Most of the agri-startups are mainly oriented towards production and marketing of agricultural produce on their own. They are unable to connect to the real problems of large number of stakeholders in the value chain to expand their businesses. Therefore, after initial success at small scale, they find great difficulty in scaling up the business.

**Lack of seed fund:** Agri-startups coming from humble background need funding support at initial stage to validate their ideas and develop minimum viable product (MVP). Small and fixed ticket-size grant opportunities are of very limited use for many of the agri-startups.

**Lack of mentorship:** The budding entrepreneurs in agriculture sector also face problems of right mentors, who can support them in networking, finding resources and developing proper business plan.

**Incubators' competence:** The agribusiness incubators located with agricultural universities and other research organizations are also in early learning stage of learning curve. To provide needed support to startups, the incubators need to have network of professionals with different domain knowledge. The incubators are also expected to provide test bed facilities for some of the startups. Overall professional competence with agribusiness incubators need to be boost up.

**Limited knowledge of available technology:** In agriculture sector, several commercially viable technologies (including digital technologies) are available with different research organizations, however the budding entrepreneurs either not aware of these technologies or they are not able to connect these technologies with the problems.

The agri-food system will continue to remain a pivot of the economy for obvious reasons, like the growing demand for food due to population growth, demand for quality and variety of foods due to demographic changes and urbanization, challenges of climate change, digital and internet penetration, and evolution of new-age technologies. Although smallholding and slow technological development have kept precision farming a distant dream so far, Indian agriculture seems to be ready for its next digital agriculture revolution. Agriculture 4.0[1] would enable 'the Internet of Farming'- the intelligent use and analysis of data applied to the whole value chain, resulting in reduced costs, boosting farm income, and improving quality with end-to-end traceability. According to estimates,

1 Agriculture and allied sector in India have progressed over the years in different phases. Agriculture 1.0 may be referred for pre-Green Revolution period characterized by radical land reforms; Agriculture 2.0 was the Green Revolution phase during which intensive farming increased the farm productivity along with development of parastatal agencies; Agriculture 3.0 may be referred to post-liberalization period (1995- 2015) which has witnessed significant diversified growth in sub-sectors like horticulture, poultry, fisheries, and livestock. Post-2015 period is viewed as period of disruptive innovations with application of digital technologies in agriculture, entrepreneurial environment and promotion of farmers producers' organizations (FPOs). Current period may be termed as Agriculture 4.0.

there are 600-700 agritech startups in the country that use AI, machine learning, the internet of things, etc., to provide services to farmers. Digitally literate next-generation Indian farmers will simultaneously navigate the different farm and non-farm activities to augment their income.

In the backdrop of Agriculture 4.0, some of the challenges need to be addressed to create a culture for startups and enable an environment for new-age startups in the agriculture sector. Currently, the sector needs transformation focusing on digitalization, talent, sustainability, and business model. To accomplish this, a robust startup ecosystem has to play a vital role by

- creating the right mindsets and cultures in the agricultural research and educational institutes/universities to promote agri-startups,
- dynamic course curriculum of agricultural universities to give exposure to startups at an early stage and give adequate support to the interested students and faculty,
- encouraging inter-disciplinary and multi-disciplinary approach in agricultural education and research for making affordable innovative and efficient technologies for farmers and other stakeholders,
- building of common data platform as public good infrastructure about the research products, geospatial information, market, production, etc.,
- setting up a robust incubation system with needed infrastructure and competent workforce to provide handholding support to the startups,
- involving corporates in the startup ecosystem,
- financing for working capital at the early stage of agri-startups.

## 7. RECOMMENDATIONS

Several important recommendations emerged from the discussion, which the concerned agencies may take up for promoting and creating sustainable agri-startups in India. The flux of entrepreneurial ideas to solve major problems of the languishing agriculture sector should come from young minds. Currently, too few agri-graduates decide to found companies. There are mainly two reasons for that: the lack of a clear entrepreneurial mindset and obstacles in the founding process, like the fear of financial insecurity, the lack of entrepreneurial knowledge, or complicated procedures. The following approaches should be considered for better outcome in this regard:

### 1 Creating ecosystem for startups sustainability

a. **Startup India Initiative:** To overcome many pain points of startups, Government of India has launched Startup India Initiative wherein it tries to bring in most of the startups on one platform as well as identifying and enrolling them for benefits of different schemes like tax exemption, government procurements, financial access (seed fund) etc. Mentors, incubators and accelerators need to educate the startups for boarding the platform to reduce the risk. This ecosystem is sector agnostic. This ecosystem development partially fulfils the need of the startups.

b. **Provision of market access to agri-startups:** The major hurdle in growth of startup is market access. Innovation needs to be matched with proper markets. Collaborative work in Startups in emerging economies is determined by awareness of the role of the

environment, the size of the market and the context where the market is developing. For effective decision-making, the government should stimulate these companies in joint effort to continue exploring different interactions among all stakeholders, which allow a market for mutual benefit between company and farmers.

c. **Provision of growth capital for agri-startups:** Agriculture is known as a slow-growing and long-gestation sector; hence attracts less attention of the private investors, who are primarily interested in multiplying their investment quickly. Therefore, a dedicated fund for the growth of agri-startups has been earmarked in budget 2022-23. However, its access to startups should be ensured.

d. **Creating the digital infrastructure for rural information:** Data related to geo-referenced land/soil details, crop production, market transaction information, etc., should be kept in the public domain so that startups need not spend time and resources on collecting already available information. It will significantly reduce the product development cycle for the startups. The concept of India Digital Ecosystem of Agriculture (IDEA, 2021) seems to be in a similar direction, which may be expedited.

e. **Pool of mentors and investors:** State-wise common pool of mentors with expertise may be created who can support the activities of incubation centres in mentoring the startups. Similarly, a pool of investors will make the whole startup ecosystem more amenable for young minds throughout the country.

f. **Website on Agri-startups:** A website may be developed to provide all information about startups at one place. It may include state-wise government programs, policies, and incentives for startups. It may also contain the state-wise list of incubation centres, registration procedures, all types of application forms, funding/financing sources, along with the interest rates. A section on 'frequently asked questions (FAQ)' is to be included. Such a website will benefit agri-startup aspirants to know the processes under one umbrella.

## 2. Research for innovation and entrepreneurship

a. **Incentives to researchers and faculty to become entrepreneurs:** A policy for researchers/faculty should be in place to encourage them towards entrepreneurship. The students and young professionals will find role models in such faculty, and will raise their confidence in creating startups of their own. The IIT, Delhi has a similar model under the FIRE (Faculty Innovation and Research-driven Entrepreneurship) scheme. Such a scheme needs to be replicated and implemented in other research and educational institutions.

b. **Favourable terms of trade for sourcing agricultural technologies:** Technologies developed by different research organizations should be made available on a shared public platform in an easily discoverable well-categorized format. Besides, validation of the technologies should also be within reasonable terms and conditions.

## 3. Strengthening of Incubation Centre

The tools and actions offered by the business incubation centers have a direct and positive impact on the survival of startups. These centers are expected to provide end-to-end handholding support to

the startups- refining in ideation, incubation, acceleration, market linkage, regulatory compliances, mentorship, and scale-up funding assistance. Therefore, each research and education organisation should set up a Business Incubation Centre. There may be a centralized monitoring cell for agri-incubators to bring synergies. This will also help the cross-pollination of ideas and share critical resources across incubators. For example, the ICAR has 100+ research institutes spread across the country. Special care may be taken in setting up high-capacity incubation centres at these institutes. Besides the following measures would be essentially required to create robust incubation centres:

a. **Motivated and professional staff:** Agri-bussines incubation activities require professional inputs and a very different set of skills from those, which the scientists in R&D organizations are generally expected to possess. It is essential that the incubation centre(s) are managed by highly motivated personnel who understand the requirement of the entrepreneurs and their business. These high-capacity team members would be able to filter out high-quality startup ideas that can be further supported.

b. **Adequate funding support:** In agriculture based innovative enterprises risk is large and financial returns are not easily foreseeable. The reasons for failure may not be limited to technical robustness of technology but may include dynamics of national and international markets, poor marketing or management issues, regulatory issues etc. Some technologies need a certain level of 'de-risking' to be done, proof-of-concept demonstrated, prototype built and tested before an enterprise can be built on them. This 'de-risking' of the technology might take 2–3 years. The Incubation Centre(s) should, therefore, be provided access to 'high-velocity catalytic funding' that will avoid the death of 'promising business ideas before their birth as an agri-startup'. At the same time, the incubation centre(s) should help the startups to raise external funding during incubation.

c. **Transparent governance system:** The incubation centre(s) should have a governance system which can make high velocity and high-quality decision-making. A team of professionals with varied entrepreneurial experiences may be entrusted for strategic decisions.

## 4. Transforming Agricultural Education System for Innovation Ecosystem

a. **In agricultural universities:** Innovation hubs need to be set up to provide a platform for startups/entrepreneurs to find the needed skills, and develop partnerships in a structured manner. Universities can set-up an innovative and entrepreneurial mindset in their curricula. The students should also be encouraged to take short-term internship with successful startups during semester breaks.

b. **Introduction of elective courses related to innovations and entrepreneurship:** The new-age startup ventures need to plan right from the beginning to connect their clients (farmers/consumers/vendors) in different ways reducing the transaction time and cost, and speed up the business for higher revenues. Customized elective on entrepreneurship for each student entrepreneur could be a good option, where in the student can mix different subjets/topics as per requirement for development of her innovation to next level.

c. **Entrepreneurial break/exit option and fellowship:** Students should be allowed to take a break after 3rd years to try their hands on innovations and entrepreneurial ideas. They may be provided handholding support and fellowship during this period to meet their living expenses. This endeavour can be considered as a credit electives for graduation. The entrepreneurial break[2] in the degree should be given weightage in the system for the risk-taking attitude of the students.

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[2] Following National Education Policy (NEP) 2020, Jawaharlal Nehru Technological University, Hyderabad (JNTUH) has introduced 1-year entrepreneurial break for the students at the end of second and third year to pursue their startup aspirations. Students are also allowed a maximum of 10% attendance exemption in all years to participate in bootcamps, conferences, etc.

## Annexure I. List of important Agri-startups in India

| |
|---|
| **Agri-Startups enabling the supply of quality inputs and farm solutions to the farmers in the upstream** |
| Agrostar, DeHaat, Khetinext, Gramophone, LeanAgri, BharatAgri, BigHaat, A-One Seed, Terra Agro, AgriApp, SmartFarms, FarmGuru, Unnati, etc. |
| **Agri-startups helping precision farming through farm mechanization/ irrigation and digital technology** |
| CropIn, EM3Agri Services,Fasal, Hummingbird,Trringo, FlyBird Innovation, Kritsnam Technologies, JaiKisan, Gramcover, Niruthi technology, Kheyti, Ecozen, SatSure, Farmguide, TartanSense, etc. |
| **Agri-Startups offering finance and insurance in the agriculture sector** |
| PSamunnati, Jai Kisan, GramCover, Samaaru, PayAgri |
| **Advisory, quality maintenance and traceability** |
| CropIn, Intello Labs, FarmERP, Jivabhumi, Agricx, qZense Lab, AgNext, Amnex, RML Agtech, Farm-Bee, Nebulaa's Matt, TartanSense, Yuktix, Fasal, etc. |
| **Providing output market linkage (Downstream)** |
| Animall, BigBasket, Ninjacart, WayCool, DeHaat, Bijak, Captain Fresh,JumboTail, Otipy, Kisan Network, Crofarm, Clover Ventures, Teabox, Tokri, Milkbasket, Farmpal, MeraKisan, VnF, FarmTaza, Green N Good, Organo fresh, Farmcon, Kamatan, Farm Fresh, etc. |
| **Startups for warehousing and logistics** |
| Arya Collateral, Origo Commodities, Ergos, NCML, StarAgri, etc. |
| **Vertical farming/ hydroponics startups** |
| LetcetraAgritech, Urban Kisaan, Future Farm, Bitmantis Innovation, Ela Sustainable Solutions, Acqua Farms, JungaFreshnGreen, etc. |
| **Startups in the livestock sector** |
| Licious, TenderCut, Fresh to Home, ZappFresh, Caprabook, Eggoz, Aquaconnect, Stellapps, Country Delight, Eruvaka, Aquaconnect, etc. |

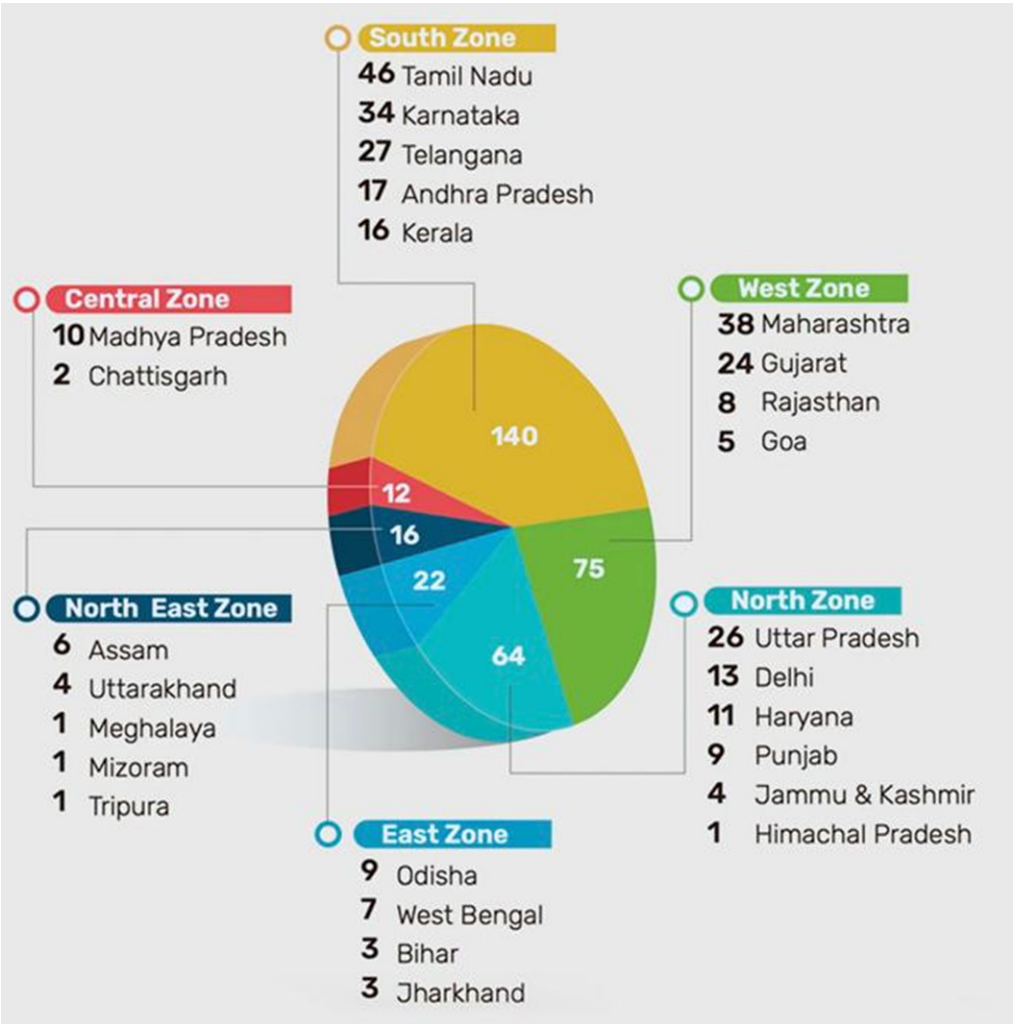
Source: Rao et al. (2020), ThinkAg (2021)

## Annexure-II. Modern technologies and data-driven agri-startups opportunities

| Sl No | Segment of Agriculture Value Chain | Value-added Services | Indicative Value Proposition | Technologies to be used |
|---|---|---|---|---|
| 1. | **Crop Planning** | Macro Crop Planning | • Planning the extents, locations, and varieties of the crop to be grown in different agro-climatic zones<br>• Focus on nutrition, export revenues, etc. | • AI<br>• ML<br>• Statistical models<br>• Big Data |
| | | Micro Crop Planning | • Advisories to the farmers 4-6 weeks ahead of each season on what crops/ varieties to sow<br>• Advisories on optimal sowing windows | • AI<br>• Soil data<br>• Satellite/ Remote Sensing data |
| 2. | **Cultivation** | Smart F-a-a-S (Smart Farming-as-a-Service) | • Providing a range of digital services to the farmer in respect of crop management<br>• Aggregation of innovative services provided by multiple service providers<br>• The portfolio of services could include<br>- Rapid soil testing<br>- Integrated Nutrient Management<br>- Uberized farm machinery services<br>- Hyper-local weather advisories<br>- Pest prediction and management advisories<br>- Credit services<br>- Insurance services | • Aggregation platform<br>• ML<br>• IoT<br>• Drones<br>• Satellite data<br>• PoS devices |
| 3. | **Supply Chain** | Logistics | • Logistics services for transportation of inputs and produce<br>• Storage<br>- Warehousing<br>- cold chain<br>- eNWR | • IoT<br>• Blockchain |
| 4. | **Market** | Market Connect | • Market Intelligence<br>- Demand & Price prediction<br>• Produce Aggregation Services<br>• Hyper-local connect (F2C)<br>• Online Retail | • AI<br>• Satellite data<br>• IoT |
| 5. | **Quality** | Quality Testing | • Rapid quality testing &certification @<br>- Public Procurement<br>- Market Yards<br>- Exports | • AI<br>• IoT |
| | | Traceability | • Exports<br>• High-value produce<br>• Organic produce | • Blockchain<br>• IoT |

Source: Consultation Paper on IDEA (June 2021), Government of India

## Annexure III. State-wise number of incubation centres in India




Source: Bloomberg | Quint (2021)

## List of Participants (online & offline)

1. Dr T. Mohapatra, President, NAAS
2. Dr A.K. Singh, Vice President, NAAS
3. Dr P.K. Joshi, Secretary, NAAS (in-person)
4. Dr Malavika Dadlani, Editor, NAAS
5. Dr Sanjeev Saxena, Executive Director, NAAS (in-person)
6. Dr Ch. Srinivasa Rao, Director, ICAR-NAARM, Hyderabad (in-person)
7. Dr Ranjit Kumar, Head, Agri-Business Management, ICAR-NAARM, Hyderabad
8. Prof V. Ramgopal Rao, Director, Indian Institute of Technology, Delhi
9. Dr R.C. Aggarwal, DDG (Education), ICAR, New Delhi
10. Dr Manish Diwan, Head-SPED, BIRAC, New Delhi
11. Sh Ram Kaundinya, Management Consultant & Investor, Hyderabad
12. Mr Hemendra Mathur, Venture Partner, Bharat Innovation Fund
13. Mr Tauseef Khan, Co-founder & CEO, Gramophone Pvt. Ltd.
14. Mr Nikhil Toshniwal, Vice President, Digital & Network Initiatives, DeHaat
15. Dr Renuka Karandikar, Founder & CEO, BioprimeAgrisolutions Pvt. Ltd.
16. Mr Lovlesh Nagori, Founder, Sampkal Business Solutions Pvt. Ltd.
17. Mr Babbar Singh, Founder & CEO, Delmos Research Pvt. Ltd.
18. Dr K. Srinivas, ADG (IPTM), ICAR, New Delhi
19. Dr G. Vekateshwarlu, Joint Director, ICAR-NAARM, Hyderabad
20. Dr Mathala Gupta, Senior Scientist, ICAR-CCARI, Old Goa
21. Mr Philroy Jonathan, ABI, ICRISAT, Patancheru
22. Dr Prabhat Kant, Principal Scientist & Head, ICAR-IGFRI, Jhansi
23. Dr P. Krishnan, Principal Scientist, ICAR-NAARM, Hyderabad
24. Dr Bablu Kumar, Principal Scientist, ICAR-IVRI, Bareilly
25. Dr Sanjiv Kumar, Scientist, ICAR-NAARM, Hyderabad
26. Dr Shalander Kumar, Principal Scientist, ICRISAT, Patancheru
27. Dr V.V. Sumanth Kumar, Senior Scientist, ICAR-NAARM, Hyderabad
28. Dr Girija Nandini, Associate Professor, Centurion Univ. of Techno. & Management, Bhubaneswar
29. Dr Ashutosh Patel, Principal Scientist, ICAR-CAZRI, Jodhpur
30. Dr Amit Patil, Scientist, ICAR-IGFRI, Jhansi
31. Ms Rajul Patkar, CEO, Proximal Soilsens Tech. Pvt. Ltd., Pune

32. Dr K.V.R. Rao, ICAR-CIAE, Bhopal
33. Dr S.V. Ramana Rao, Principal Scientist, ICAR-IIOR, Hyderabad
34. Dr Sathish B, Principal Scientist & CEO, NaaViC, ICAR-NIVEDI, Bangalore
35. Dr Ajay Sharma, Principal Scientist, ICAR- NRC Grapes, Pune
36. Dr Purushottam Sharma, Principal Scientist & Head, ICAR-IGFRI, Jhansi
37. Dr Romen Sharma, Scientist, ICAR-IIMR, Ludhiana
38. Dr Tejveer Singh, Scientist, ICAR-IGFRI, Jhansi
39. Dr N. Sivaramane, Principal Scientist & CEO, a-IDEA, ICAR-NAARM, Hyderabad
40. Dr Gaurav Gupta, Senior BDM, a-IDEA, ICAR-NAARM, Hyderabad
41. Mr Bibhu Prusty, Senior BDM, a-IDEA, ICAR-NAARM, Hyderabad
42. Dr B.S.Yashavanth, Scientist, ICAR-NAARM, Hyderabad

**Note: The designations and affiliations of the participants are as on date of BSS**

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