FACE
CII-Jubilant Bhartia
Food and Agriculture Centre of Excellence

CII
Confederation of Indian Industry

AgTIVE 2019

AgTech Innovations for Viable Enterprise

We would like to acknowledge the contribution of Mr. Vikas Mishra and Ms. Ritoja Basu from CII's Food and Agriculture Centre of Excellence (FACE) in putting together this publication.

TABLE OF CONTENTS

FOREWORD

Globally, the innovation ecosystem has been garnering long due attention and recognition. Startups around the world have been responsible for net value creation of $2.8 trillion between 2016 and 2018, almost as much as the Indian GDP. [1]

Initiatives in India such as NABARD's $100 million venture capital fund for equity investments in agricultural startups, are providing the needed support to boost innovation in the space. Similarly, Dutch banking major Rabobank in partnership with impact investor Caspian has launched an Agri focused debt financing fund to be invested in data driven startups that improve productivity of the sector.

Several Incubators and Venture Capital Firms are active in India today, and there is increasing footprint in terms of financing support, technical assistance, business mentorship, etc. This study covers a snapshot of key Incubators and Accelerators that are actively handholding the startups in the sector. The role played by them and the services they offer have been studied and presented for future entrepreneurs who aim to transform the sector.

CII National Council on Agriculture believes that technology-led growth is the only way to create sustainable, market efficient solutions for Indian agriculture.

In this backdrop, CII's Food and Agriculture Centre of Excellence (FACE) presents AgTIVE 2019 (Ag-Tech Innovations for Viable Enterprise). The study is an attempt to understand, analyze, and draw insights from and for the rapidly evolving agri-technology innovation ecosystem in the country.

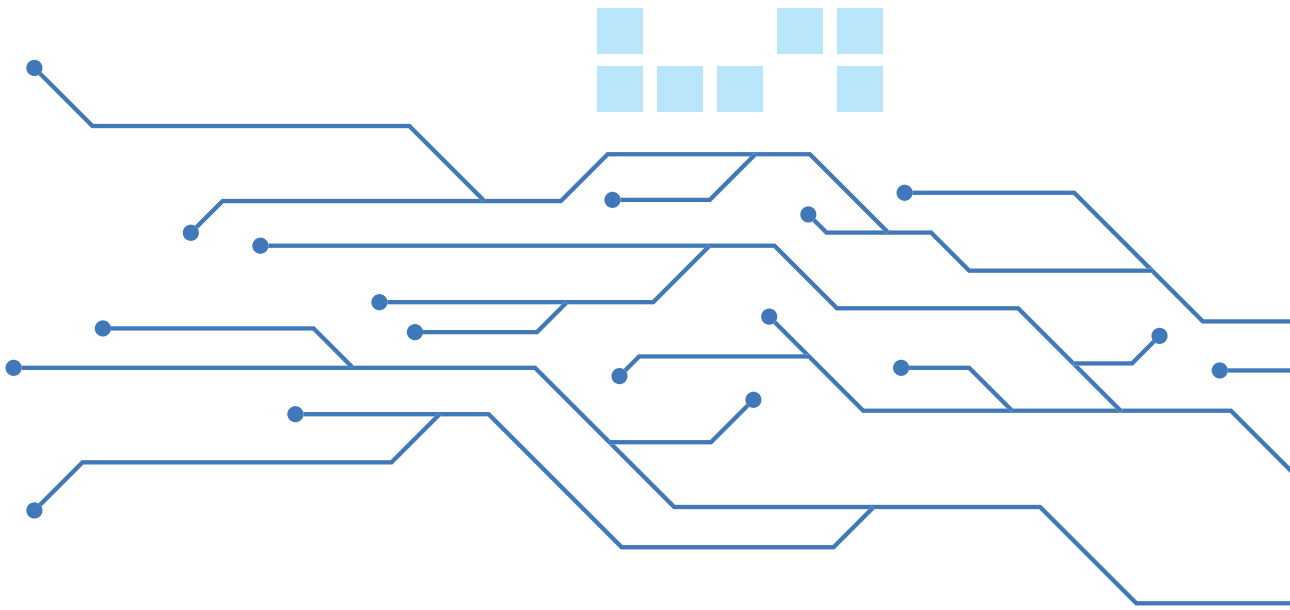
The study is in two parts. The first part of the study provides qualitative and quantitative analysis based on rigorous primary and secondary research covering global, regional and domestic trend analysis, technology analysis, funding and revenue, geographic segregation and the overall Ag-Tech ecosystem in India.

The second part of the study comprises detailed Case Studies on 35+ Indian ag-tech ventures. Each Case Study covers key aspects such as the technology being deployed, intellectual property possessed by the venture, challenges faced, business models, key partnerships market penetration, financial analysis and the requirements enabling rapid scaling up.

With a unique founding team at its heart, every venture follows a distinctive business model which caters to different segments of customers ranging from businesses, industry, government, end-consumer, and the farmers.

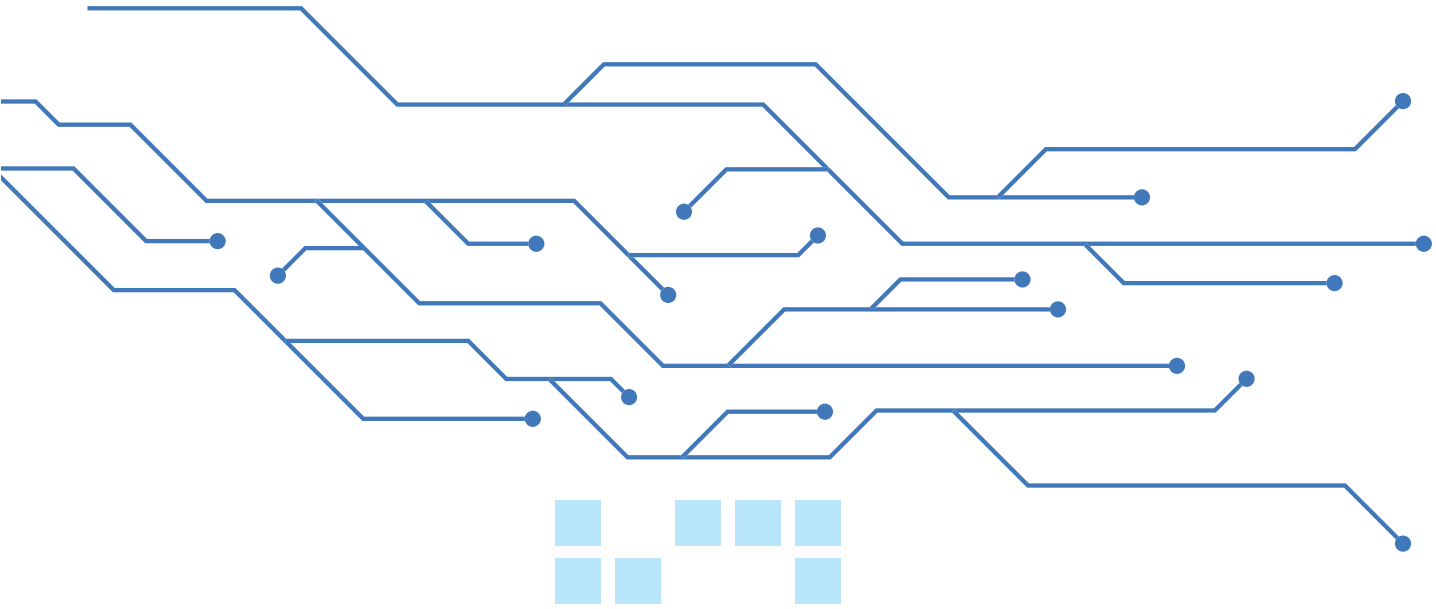
I hope this study provides you with insights into the Ag-tech innovation ecosystem in the country today.

Salil Singhal
Chairman, CII National Council on Agriculture
and Chairman Emeritus, P I Industries Ltd



PART 1

TRENDS AND ANALYSIS



1.1 Introduction

> The digital age has seen an advent of technological evolutions that have revolutionized all aspects of everyday lives. Sectors such as healthcare, biosciences, telecom, energy, automobiles, amongst others have leveraged technology solutions towards reaching heights Agriculture is following suit..

Innovation today is neither limited to the most advanced economies nor restricted to highly technology-based sectors. It is now a global phenomenon impacting all sectors of the economy, including agriculture.

While the pace of uptake of technology in agriculture has not been at par with other industries; the past decade has seen ag-tech investments worth billions of dollars globally from a wide range of investment agencies, venture capitals, and angel investors.

Agricultural growth contributes directly to food security. It also supports poverty reduction and acts as an engine of overall economic growth across much of the developing world. With the world's population growing by 82 million each year, coupled with reducing cultivable land, the pressure to produce more from less is increasing. Further, with climate change affecting traditional weather patterns, the enterprise of agriculture is further vulnerable.

Technology innovations enable farmers to shift from input-intensive to knowledge-intensive agriculture. There is a direct correlation between adopting technology and higher crop productivity as it saves time and labour, reduces drudgery, cuts down production cost in the long run, reduces post-harvest losses and boosts crop output and farm income.

The challenges faced towards ensuring today's and tomorrow's global food supply will continue to push the sector toward technological innovations; more so as sociocultural changes are influencing the production of and demand for food.

Over the past 15 years, the pace of agricultural innovation has increased with advances in genomics, software, communications, logistics, and technology. The wave of innovation is enabled by the shift in corporate R&D towards software, advanced hardware, and service offerings. The integration of embedded software and sensors in farm equipment, in the soil, and on the animals, along with the establishment of network connectivity amongst all agriculture stakeholders through cloud-based systems and shared analytics, presents significant potential to increase the output. Such innovations are enabling major gains in yields, asset productivity, and sustainability which are the key factors in meeting the escalating demand for food.

AgTIVE 2019 (Ag-Tech Innovations for Viable Enterprise) attempts to understand and map the innovation ecosystem in the country and draw insights by studying companies at different stages of their lifecycle.

The study features 35+ detailed Case Studies on companies across the Indian Agri-Value Chain. Mature ventures, upcoming innovations, and new tech on the horizon have been carefully analyzed to understand the technologies, business models, funding sources, issues and challenges, and the requirements for scaling up.

1.1.1 Classification (based on 2018 -19 revenue)

- Advanced – Revenue of Rs 10 cr +
- Mid – Revenue of Rs 1-10 cr
- Early Stage - Revenue of Rs 10 lacs - Rs 1 cr
- On the Horizon - Pre-Commercial - Rs 10 lacs

**Within each section the start-ups are arranged alphabetically.*

1.1.2 Objective

The study was undertaken with the objective of:

- Mapping the AgTech innovation ecosystem in the country
- Providing a comprehensive analysis of successful AgTech ventures
- Mapping the global operational geographies accessed by Indian ventures
- Presenting an investment guide for VCs and Impact Investors with revenue and growth-based stage division of ventures

1.1.3 Methodology

The data for the study has been collected through online surveys and in-depth interviews with the Founders/Representatives of the ventures. Collected data has been interpreted and analyzed to draft detailed Case Studies, which form Part B of this study.

Study Methodology

Pormising AgTech Ventures identified and invited to participate in the study

Secondary research on published scientific journals, studies, reports

Comprehensive template designed to encapsulate multiple data aspects

Drafting of Case Studies and Analysis based Part-A

Extensive interviews with Founders & CEOs of Ventures to record core primary data

1.2 Trends in Agriculture Technology

> Technological development in the field of agriculture has happened at a varied pace across different geographic zones globally. This section discusses the ag-tech trends in advanced economies such as the United States, Australia, and certain European Countries; across South-East Asian nations that are geographically and economically similar to India; and also looks at the leading technologies that are impacting the Indian agriculture sector.

1.2.1 Global AgTech Trends

Agriculture as a sector has seen an influx of technological innovations that are transforming the entire value chain, from farm to fork. Precision agriculture technologies and data-based analytics are making farming an insight driven occupation in developed countries.

Farmers and agri-businesses have a whole host of options to choose from the technology range—such as Sensors, UAV Drones, Big Data and IoT, Artificial Intelligence and Machine Learning, Robotics and Machines. These technologies allow farmers to collect, analyze, and understand different aspects of their operations and implement real time changes. This makes the farms more controlled, bringing precision to crop and livestock management.

The AgTech sector globally is projected to reach $43.4 billion by 2024[2]. The farmers as well as the agri-industry are embracing this transformation and using technology as a resource to make agriculture a sustainable and scalable sector.

Some of the key technology trends revolutionizing the sector in different ways are discussed below:

Artificial Intelligence (AI) and Machine Learning

Artificial Intelligence has its applications across the entire spectrum of the agricultural chain. It is used by all other technologies to generate meaning from the tremendous amounts of data generated by them.

Advancement in AI has allowed machine learning and analytics to mine data and generate trends towards better management of on-farm and post-harvest activities, better risk mitigation practices, as well as better management of allied activities such as dairy farming.

Productivity has been improved through autonomous farm operations, identifying best genetic traits for high yielding seeds, reducing post-harvest losses through robot-based techniques, etc. Meanwhile AI has allowed risk mitigation though processing satellite and drone images towards identifying stressed farm areas and thereby advising mitigatory measures; as well as providing insights to banks and insurance companies towards better financial access and faster claim settlements. The ancillary segment of dairy farming has also been significantly impacted by AI-towards efficient value chains and traceability.

Usage of Unmanned Aerial Vehicles (Drones)

Visual inspection of the farm is an important aspect through which the farmers can observe and monitor the crops. The only way this can be done for a farm spanning multiple acres is through air. Drones are enabling the farmers to get a real-time bird's eye view of the farms. They are being used widely across the world to monitor crop health, track and combat drought, pest attacks, soil health issues and other environmental factors.

PwC estimates the addressable industry size for drone-based solutions in agriculture to be $32.4 billion[3] while the market size in the US alone is estimated to increase from $1.2 billion in 2019 to $4.8 billion in 2024, growing at a CAGR of 31.4%.[4]

Drones gather real-time data that is processed to develop 3-D maps of a farm which are used for analysis of soil, and planning seed planting patterns. Hyperspectral and thermal sensors attached to the drones can identify the dry areas in a field and suggest ideal irrigation levels, locate zones with infections and pest attacks and produce multispectral images to track changes in plant health. Early detection of an oncoming blight attack or draught can help plan for mitigatory strategies and save the crops. The vegetation index calculated by the data generated by sensors helps keep track of the farm health and enable precision farm management. Corn, Soybean, and

Wheat farmers in the US can save an estimated $1.3 billion annually by increasing the outputs and reducing the input costs through drone-based farm monitoring.[5]

Drones equipped with ultrasonic devices and laser scanners like the ones manufactured by Aerobatics are used by farmers in the US for early pest detection and crop inspection.[6] Heavy payload drones are used for precision planting of seeds; spraying fertilizers, pesticides, and micro-nutrients on standing crops; reducing the manual labour time and making the entire process more precise and efficient. The drones scan hundreds of acres within hours and spray the exact areas with exact amount of chemicals resulting in less spill-off to the water streams enabling a more sustainable approach to agriculture.

Big Data and Internet of Things (IoT)

Big Data and IoT hold the key for transforming the complete agriculture value chain. The data can benefit stakeholders in multiple ways and levels. In developed countries, IoT, along with sensors embedded on machines is streamlining and optimizing the collection, inspection, and the distribution of agri resources. Business Insider projects that 75 million farms worldwide will adopt Big Data and IoT based solutions by 2020 growing at an annual rate of 20%.[7]

Insights drawn from the collected data are used to prescribe input products and farming practices to the farmers, which helps them enhance productivity and improve efficiency of the farm. The companies use the data to develop targeted products and strategies. Big Data tools can help track and monitor the goods in the supply chain and provide trace back linkages to the consumers and locate the point of disturbance for the business.

IoT enabled tagging and monitoring of production and logistics chain provides data that can track a product in a household back to its very source (farm). This farm to fork linkage has enabled the producers in ensuring safety and quality of food to the consumers and given consumers an insight into the source of their food along with the inputs (fertilizers, pesticides, temperature, antibiotics) used for growing their food. The number of data points gathered on an average farm stands at 190,000 at present and is expected to grow to 4.1 million by 2050.[8]

Sensors

In developed countries such as US and Australia where the average farm size is several hundreds of acres, sensors placed strategically across a farm are allowing farmers to monitor and manage the crop remotely. These next generation sensors have technologies such as image recognition, soil moisture and nutrient monitoring, crop health monitoring, etc. They generate real time information which is processed by analytical programs and relay precise information to the farmer. Based on this information, farmers make the required changes which results in higher yields and economic returns and reduces the wastage and over-usage of input products. Sensors are also helping improve water sustainability by alerting the farmer about over-irrigation and automatically controlling the amount and period of irrigation for a farm. According to The Australian Farm Institute, cropping system gains will increase by 10-15% owing to increased

input efficiency and output. Meanwhile, findings by Meat & Australia suggest a productivity gain range of 4-9% for animal production monitoring and 4-13% for animal health monitoring. Sensing technologies could also lead to a 13-26% productivity gain for soil fertility and 9-11% for improved feed allocation in livestock systems, by 2020.[9]

The Australian Farm Institute estimates digital agriculture, through input efficiencies and increased output, will provide gains in the order of 10–15% in cropping systems. While needing additional validation; Meat & Livestock Australia's preliminary findings on the impacts of digital agriculture suggest productivity gains could be in the range of 4–9% for animal production monitoring and 4–13% for animal health monitoring. In addition, sensing technologies could contribute to digital agriculture delivering a 13–26% productivity gain for soil fertility improvements and 9–11% for better feed allocation in livestock systems.

The role of sensors are not limited to farms and livestock, and have made their way into agricultural equipment and machines. Similar to their work on the farm, they track the health of the machine by analyzing various parameters. Sensors can manoeuvre a machine over uneven terrain using navigation systems, map the amount of crop planted and harvested, measure the breakdown time, and alert the farmer of any unusual behaviour. Global on-farm application of IoT based Sensors will increase to 75 million in 2022 from 30 million in 2015, at a CAGR of 20 percent.[10]

Robotics

Automated Robots combined with AI are improving productivity and resulting in faster and higher yields. Both US and Europe are facing a shortage of human labour for agriculture, introduction of robots into the fields has helped tackle this problem to a certain extent. Robots work faster and more precisely, they are flexible and manoeuvrable and are being used in a variety of different farms. The major functions they perform are spraying, seeding, weeding, and harvesting.

'See and spray' robots manufactured by Blue River Technologies in the United States can reduce agrochemical usage by 90%. The machine uses Computer Vision to analyze the crops in its track and spray them with precision thereby reducing the excess amount of chemical used in traditional spraying methods. The robot is also capable of weeding out the non-essential plants thus reducing the labour and time requirements by performing multiple operations at once.[11]

Robots are now being used for harvesting not only the staple crops like paddy, wheat, and corn, but are also deployed for specialty crops like fruits, nuts, and vegetables. These crops are delicate and have great variation in size and shapes. Abundant Robotics in the US has developed an automatic apple-picking robot that uses artificial intelligence and computer vision that locate the apples ready to be harvested and a vacuum robotic arm carefully plucks them from the tree branch.[12]

The developed world is in the middle of Agriculture 4.0 which is aided heavily by digital transformation of sector through advanced technologies. The sector has seen steep rise in yields while reduction in wastage. Technology is bringing the integral element of sustainability to the sector and the market size is expected to reach $12.8 billion by 2022.[13]

1.2.2 AgTech Trends in South East Asia

The 10 nations in South East Asia have a population of nearly 150 million who are directly or indirectly working in the agriculture sector. In countries such as Lao and Vietnam, over 50% of the total population is dependent on the sector for its livelihood.[14] Much like India, the region has small farms and limited penetration of technology. Transformation of the sector will directly translate into improvement of livelihoods for the vast majority of population dependent on it.

Mobile Phones

Increasing mobile connectivity among SE Asian farmers is at the core of the digital transformation of agriculture in the region. A Google & Temasek report indicated that over 51% South-East Asian mobile phone consumers are active internet users, and the figure increased at a rate of 21% between 2015 & 2018.[15] The mobile phone is not just a talking tool for the farmers who actively use it for financial, logistics, and input management purposes.

Several governments have initiated agri-helplines for the farmers that provide information about soil nature, seed variety, farming practices etc. Farmers get weather updates on the phone and plan the next step accordingly. The data generated by technology tools such as drones, sensors, satellite imaging is processed and relayed to the farmer through phone applications. Farm management applications allow the farmer to monitor the nutrient level and water requirement in farm remotely.

Widespread adoption of smartphones by the farmers has ensured agricultural growth for the region and allowed them to access valuable data for informed decision making.

Blockchain

Blockchain technology is being used to create a secure database of recorded transactions between the farmer and the aggregator, help Agri businesses manage inventory, and provide traceability to the end consumer. A means to track the origin point of a product would result in increased transparency across the South East Asian markets and facilitate international trade.

BlocRice, a project launched by Oxfam in Cambodia, uses blockchain framework to connect farmers with buyers and ensures timely payments.[16]

Hydroponics

Decreasing agricultural land and increasing shortage of water have led to the adoption of Hydroponics technology in the region. Cityfarm, a Malaysia-based startup, allows soil-less farming in cities to produce fresh produce to the residents through several rooftop vertical farms.[17]

While the mentioned technologies are promising, SE Asia needs interventions that are most suitable for the region. The small farms in the region limit the widespread adaption of precision agriculture solutions such as drones and sensors. Government restrictions in the countries have hindered the large-scale adoption of drone application in the region. Following the lead of other South Asian countries like China and India, the SE Asian nations can gain tremendously by allowing a widespread use of UAVs in agriculture.

Innovations focusing on the post-harvest section of the Agri-value chain can impact the sector monumentally. Majority of fresh produce is grown in small farms which are located away from urban markets. Inadequate logistics services along with the remote locations lead to an average loss of 30% between the farm and the market.[18] Precision logistic chains with RFID tagging and GPS enabled trucks along with cold chains in the region can bring a steep decline in the wastage. The Vertical Farming market in Asia-Pacific is projected to reach $4 billion by 2024 with Hydroponics being the key technology responsible for this growth.[19]

Interventions in the financial aspect of agriculture for credit scoring and digital lending solutions are also crucial for betterment of the sector in the region. In the absence of a sound mechanism, farmers pay baseless interests to lenders and have limited options.

Singapore: The AgTech Hub of South East Asia

Singapore is emerging as a leader in terms of technological innovations impacting agriculture. Geographically limited to restricted arable area, the country's potential as a vertical farming hub is well recognized. Other areas of expertise include indoor grow systems, alternative proteins, aquaculture and more.

The environment of innovation in agriculture technology is enabled and encouraged by a pool of funding sources for AgTech startups and a healthy ecosystem of Venture Capitals and Incubators. Recently in July 2019, Enterprise Singapore, through its investment arm Seeds Capital, appointed seven investment partners under Startup SG Equity - a scheme that encourages private sector investment for start-ups. Under this partnership, more than USD90 million worth of investments will go into early-stage tech start-ups with food and agri-tech solutions.[20]

1.2.3 AgTech Trends in India

With a rapidly increasing population, India is set to overtake China as the most populated country in the world by 2027.[21] The increasing population will put pressure on the agricultural sector to produce more. This increase can only be achieved by widespread inculcation of technology in the sector.

The sector presently employs over 50% of the country's workforce and faces challenges such as shortage of manual labour, over-dependence on monsoon, falling groundwater level, segregated land holdings, amongst others. Technological interventions are attempting to address these and improve the efficiency of the sector.[22]

Advent of Precision Agriculture which includes an entire host of innovations such as Artificial Intelligence, Blockchain Technology, Drones, Satellite Imaging, Sensors, Robotics and many other advanced technologies, is providing the sector means to tackle the challenges and benefit all the involved stakeholders. A Tech Mahindra study recorded an output increase of 63.86% for tomato and 28.14% for brinjal upon deploying Precision Agriculture solutions.

One aspect of Precision Agriculture is satellite-based farming, which uses pictures taken by satellites for site-specific crop management. It is also useful for monitoring droughts and flood like situations and advising the farmers about changing weather scenario.

Data gathered using multiple sources is processed by machine learning modules to generate useful insights and give precise information about the best sowing time, when to grow a crop, which variety of crop is best suited for a particular geography and soil type, best time to apply insecticides and fertilizers etc.

Despite tremendous infusion of technology in the agriculture sector, deployment of certain innovations such as specialized robots and automated machines are not at par with the global uptake. Conditions such as uneven farming lands and high operating costs, make successful on-ground application difficult. Implementation of these technologies for cultivation of high value commodities is needed to absorb the cost of deployment and make their use mainstream.

Majority of technology intervention in India through precision agriculture is led by AgTech start-ups. They are present across the entire value chain; ranging from remote sensing, farm management, market linkage, agri-finance, to IoT and big data. One important outcome of the Precision Agriculture revolution in India is farm mechanization which is witnessing a radical change owing to the influx of Farming-as-a-

Service (FAAS) based start-ups that bring latest technological innovations to the farmers without them having to invest a huge amount of capital. The domestic Precision Farming market was estimated at $85 million in 2018 and is projected to grow at a CAGR of 10% between 2020-2024.[23]

Aided by conducive policies by the government and a strong ecosystem of incubators, accelerators, and venture financiers, AgTech innovations hold tremendous potential to revolutionize the agricultural sector. Emerging technologies coupled with the entrepreneurial spirit will integrate the entire value chain and remove systemic errors and benefit the most important stakeholder in the entire sector, the Indian farmer.

Key Recent Investments

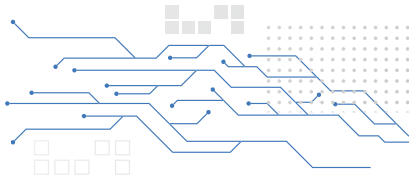
- **Samunnati** raised $55 million in Series D funding from Nuveen, the investment management arm of Teachers Insurance and Annuity Association of America (TIAA)
- **Ninjacart** raised additional $10 million to close its ongoing Series C round from Tiger Global, debt venture fund Trifecta Capital, along with Tanglin Venture Fund, Steadview Capital, and ABG Capital.
- **WayCool** raised $16.9 million in equity and debt from Caspian, LGT Impact, and Northern Arc Capital.
- **EM3** AgriServices raised $10 million in Series B funding from Aspada and London based Global Innovation Fund (GIF)
- **AgNext** raises undisclosed amount of pre-Series A funding from Kalaari Capital
- **Intello Labs** raised $2 million Seed round from Omnivore and Nexus Venture Partners
- **DeHaat** raised $4 million pre-Series A from Omnivore and AgFunder in the form of equity and $2.84 million in venture debt from Trifecta Capital
- **Gramophone** raised $3.5 million in the form of equity funding from Info Edge, Raveen Sastry (Myntra co-founder), Asha Impact, and Better Capital

This section looks at the various segments of Indian Agriculture which are witnessing an increasing penetration of technology interventions through start-ups.

Technologies for Predictive Risk Management

Indian farms are exposed to several risk factors, both natural and anthropogenic such as unpredictable weather conditions, degradation of soil quality, inadequate nourishment of crops, crop loss due to pest attack or disease, over or under irrigation of a farm leading to crop loss. These risks affect the farm throughout the farming process in different stages. At present, several Indian companies are utilizing a wide range of technology tools to predict these risks and attempt to mitigate them.

Towards mitigating risks from vagaries of weather, companies/start-ups are leveraging satellite imagery and remote sensing tools for predictive solutions. **Skymet Weather** is a leader in this segment; the company uses satellite data, remote



sensing, and artificial intelligence to monitor weather patterns and predict the forecasts, in turn providing agricultural risk solutions to several government and private organizations. Another satellite image processing company called **Satsure Analytics** uses satellite remote sensing for soil moisture monitoring, disaster management, and weather advisory among others. The company provides rainfall and weather forecast information that is used by financial organisations, agri-input companies, and research organizations both in India and internationally.

Risk mitigating solutions are also being delivered by leveraging drones. Many start-ups are exploring uses cases and practical applications for drone technology. Amongst these, a Bengaluru-based start-up, **Aarav Unmanned Systems** (AUS) is utilizing self-designed drones to collect data for monitoring and analyzing the farms and recommending farmers and businesses about any oncoming pest attack or diseases. The company also provides other solutions such as measuring the impact of a natural calamity like floods on farms and generates insights which are used by several sectors such as banks and NBFCs for efficient and transparent dispersal of insurance to the farmers, and by the government to analyze the impact and formulate future mitigatory strategies. Other start-ups such as **InDrones** are also foraying into this segment.

Towards efficient farm management, start-ups such as **AgNext** are leveraging a host of technologies that can monitor the farm and inform the farmer about any unexpected change. Timely interventions based on data collected from multiple sources give farmers enough time to mitigate or manage it. Data insights generated by these companies can enable the user to decide the quantity of produce to grow based on market trend analysis thus preventing wastage after harvesting.

Extension activities are being strengthened through digital platform such as **ApniKheti**, which provides free advisory to farmers about any issue that they are facing. The company works with researchers and scientists from leading agricultural institutions in the country to understand the problem faced by a farmer and provide solutions to solve that problem. The company has an application and a website on which a farmer can post the questions.

Access to finance is also a major challenge for ventures in the AgTech space. Farmers struggle to get their farms and crops insured against any unforeseen calamity. **Samunnati**, an agri-value chain enabler steps in to fill this space by providing several customized financial services for farmers and businesses. The company banks on the social and trade capital of the farmer and doesn't take comfort from hard collaterals.

Technologies for Farm and Crop Management

Farmers in India have been dependent on traditional methods for managing their farms and keep a check on the growth of crops. Lack of data backed package of practices have led to farmers growing a crop with least market demand or applying more chemicals to the farm and degrade the soil quality. Accessing new and advanced machineries that reduce the labour requirement and increase the efficiency of operations is a challenge due to their expensive cost. Companies are using various technology tools to address some of these challenges.

DigiAgri Technologies is one such start-up that uses remote sensing, artificial intelligence, IoT, and many other technologies to provide data driven, real-time insights to farmers. The company advices farmers about the best crops to grow, date-wise farm plan encompassing the entire crop cycle, quality and quantity of chemicals to be used etc. The insights are also used by banks, aggregators, input companies, and the government for multiple purposes.

Towards input optimization, mechanization start-up **Distinct Horizon** has developed a

solution that helps the farmer deploy fertilizers more precisely in the ground which not only ensures better nutritional uptake by the plant but also prevents surface chemical run off; thus, preventing soil degradation, farm land atrophy, and water pollution.

With an aim to bring latest technology and mechanization to farmers, in a dependable and affordable manner, **EM3 Agri Services** offers customized services for the entirety of cultivation cycle; soil preparation, seeding, sowing, crop maintenance etc. The company has a host of precision farming machinery in its portfolio including harvesters, laser levelling machines, transplanters, deep ploughing machines, among others. This 'Uberisation of Agriculture' by EM3 can solve the skilled labour shortage for farming and benefit the farmers.

Bringing innovation to the dairy segment, **StellApps** is leveraging IoT and big data analytics to provide end to end technology solutions to the sector. The company has applications that use data generated by its sensors to monitor milk production and cattle health. It provides financial services such as cattle insurance and e-Wallet. StellApps enables dairy farmers with end to end farm management technology that optimizes the operations and increases the production both in terms of quality and volume.

An astonishing 35% of total crop yield is lost to pest attacks every year.[24] To tackle this multi-billion-dollar crop loss, farmers tend to spray the farms haphazardly with any and every available pesticide. This leads to magnification of harmful chemicals in human diets and damages the soil quality of the farm. With sustainability awareness increasing, recent years have seen an increase of Indian start-ups involved in developing bio-fertilizers.

Barrix Agro Sciences, an agri-biotechnology start-up has combined pheromone technology with colour alluring wavelengths to develop traps that can rid a farm of pest infestation without letting the chemicals enter the food chain or the soil. Meanwhile, **Miklens Bio** has developed eco-friendly bio-fertilizers, bio-pesticides, and plant growth enhancers that uses Agri-Microbial Technology to synthesize compounds

from microorganisms. Combinations of these compounds are used by the company to develop organic, residue free products that do not harm the environment and enhance the quality of the produce.

Technologies for Post-Harvest Management

Need of innovation and technology is most dire in the Post-Harvest sector. The country incurs a loss of over INR 92,000 crore every year due to poor market access, inadequate supply chain, lack of cold storage facilities, and multiple layers of intermediaries between the farm and the fork.[25] By circumventing this loss, the country can feed 5 crore more citizens every day.[26] Several companies are working to address these gaps and aid the sector.

Towards demand-led production, **Ninjacart**, a fresh produce supply chain company has developed a technology centric model that forecasts the demands of consumers and provides farmers with detail insights about the type and quantity of a produce to be grown. This ensures that the entire production is mapped to demand, and the losses are minimum. The company uses GPS enabled transport, and high-tech logistics chain to supply fruits and vegetables to its customers. The company has a transparent mechanism through which the farmers are paid within 24 hours of procurement of produce.

FoodPrint is a blockchain enabled traceability platform developed by Jivabhumi. The platform digitizes the supply chain and provides traceability and monitoring of the produce at every stage during the entire supply chain. Stage-wise traceability renders the process accountable for any losses incurred at any specific stage and provides targeted aspects that can be improved and optimized.

Procuring fresh produce from farmers in their GPS and cold storage enabled trucks, **Waycool** is bringing accountability and transparency to the post-harvest chain in Tamil Nadu. The company works closely with its partner farmers and advices them to grow the produce according to data generated from the market. The predictive analytics help the company to generate trends so that the farmers can only grow the required volume of crops. The farmers are paid within 24-48 hours electronically. Removing multiple layers of middlemen, the company ensures that farmers get a better price for their produce.

Realizing the need for low-cost sustainable storage for Indian farmers, **New Leaf Dynamics** has developed a renewable energy based cold storage solution called GreenCHILL. Each unit can cool up to 1500 liters of milk or 15 metric tons of crops and is highly customizable depending upon the farmers need. The system uses biogas, cow dung cakes, crop residue pellets, and other farm waste as energy source. This not only provides the farmers with a means to store their crops safely, but also deals with the farm waste and crop stubble problem.

Towards post-harvest value addition, start-ups such as **S4S Technologies** have developed a Smart Conduction Dryer that uses solar thermal energy to rapidly dry 50 different kinds of fruits, vegetables, fish, and spices. The dryer is portable and can be purchased by individual farmers who can't traditionally access multi-tonnage capable industrial dryers due to limited quantity of the produce. The dried produce can be sold back to the company which in turn supplies it to food processing companies and the hotel industry. This solution increases the produces' shelf life by 6-12 months and also sells at a premium over fresh produce, thus augmenting farmers' incomes.

1.2.4 Trends in Type of Technology

Overall 38 ventures across the agriculture value chain leveraging different advanced technologies have been studied. Depending upon the type of technology, they have been categorized into four segments.

1. Data Analytics (UAV, Remote Sensing, Soil Sensors)

Usage of remote sensing technologies through drones and satellite image processing are gaining momentum. Geo-spatial images generated by several satellites, processed by machine learning algorithms, help in monitoring of weather patterns thereby providing farmers' useful information like oncoming floods or draughts, and rainfall patterns. In combination with its vast network of sensors, **Skymet** is one such venture advising several governments and industries about weather data backed farming practices. Meanwhile, Agri-Drones such as those manufactured by **InDrones** and **AUS** are monitoring the farm health in real time. The companies use proprietary algorithms to detect stressed areas which need intervention.

2. Mechanization & Automation

The farms of India have tremendous applications for automated robots such as those developed by **GRoboMac** and **Kinemach**. Struggling from shortage of manual labour during the crucial phases of sowing and harvesting, introduction of remotely monitored robots can increase the output multifold by increasing the preciseness of the process. Following the principle of frugal innovation, **Sickle Innovation's** harvesting machines reduce the time and effort of the process while its sorting and drying instruments ensure an overall increase in quality.

3. Post-Harvest (Assaying, Logistics, Storage, Traceability, Sustainability)

During the study, it was observed that a significant number of ventures are active in the Post-Harvest phase of the farming cycle leveraging Big Data, IoT, AI, and many other digital technologies for their offerings. With widespread percolation of mobile phones and internet, data generation sources have multiplied exponentially. The companies use this data to extract a wide range of insights that are relevant to them. For example, **Ninjacart** and **Waycool** leverage the technology to keep a check on market conditions and accordingly suggest the farmers about the requirements, while **FoodPrint** uses the technology in combination with blockchain to bring traceability and transparency to the value chain. The applications of sustainable technologies are tremendous and much of it remains yet untapped, presenting new opportunities for innovators like **A2P Energy** which has deployed a combination of machine learning algorithm to map the stubble burning areas and a mechanized product to convert paddy stubble into useful products such as bio-char and pellets.

4. Value Chain Management (Inputs, On-Farm, Hydroponics, Finance, Post-Farming)

Maximum number of participants in the study comprised of ventures operating across the farming value chain ranging from pheromone-based fly traps from **Barrix** that reduce the amount of chemicals used in farming and bio-fertilizers and bio-pesticides from **Miklens Bio** that use by-products secreted by a consortium of microbes. Biotechnology is also being leveraged for the ancillary segments, such as high-quality cattle feed being formulated by **Krimanshi** offering macro and micro nutrients, making the cattle healthier and increasing the milk production. Agri-Spray Drones are being used by **THANOS** for spraying fertilizers and nutrients with great precision on standing crops, thereby reducing the time and labor for the farmer. End to end farm management solutions offered by **AgNext** and **CropIn** are increasing the overall efficiency while products tailor made for the sector by **Samunnati** are providing the much-needed financial impetus to the sector.

1.2.5 Business Model Trends

Three key business models were observed across the companies covered in the study.

Business to Business (B2B)

The model involves delivering services or products to business, some of which work with the farmers (B2B2F), or to businesses that use the inputs for a product of their own.

Business to Customer (B2C)

The model involves delivering services or products directly to customers, in this case farmers.

Business to Government (B2G)

The model involves delivering services or products directly with the government. Usually, these ventures are involved with the processing of satellite data for generation of useful insights for agriculture planning.

The B2B model is more commonly followed than the B2C model. Under the B2C model, the customer in the AgTech space is the farmer and it is difficult for the companies to work directly with the farmer owing to several reasons such as limited acceptance and scalability. Interestingly, none of the companies were following a solo B2G model, however, multiple had government clients and private clients both.

Several ventures also follow a combination of these business models, catering to both end customers and businesses as clients. The model involves delivering services or products to businesses which work with the farmers (B2B2F), or to businesses that use the inputs for a product of their own.

1.2.6 Trends by Area of Deployment

The focus group of ventures studied were also analyzed based on area of deployment of products and areas of operation. Eighteen of the ventures were observed to be operating across multiple Indian locations/regions; while 9 also reported to have global presence, indicating India's growing competitiveness in the segment.

Within India, the Southern Region was observed to be most conducive towards tech innovations for agriculture, with 9 of the AgTech ventures studied operating solely in the region. The presence of a strong entrepreneurial ecosystem, incubation and venture capital opportunities across the region are supporting the growth of tech ventures. The ventures active in the region encompass the entire agri value chain, with **THANOS** using its spraying drone to aid farmers with chemical spraying on fields, **NaPanta** providing detailed market trends, farm plans, and a whole host of information to the farmers through its digital platform, **FoodPrint** with its blockchain framework providing farm to fork traceability to the sector, and **Waycool** innovating the food procurement and distribution process thus making the entire supply chain highly efficient.

In North India, the ventures active are working to address different problem areas. While **Nentoir** is using satellite image processing technology to analyze farm lands and develop irrigation systems, **Cattle Mettle** is providing high-quality animal feed to the dairy industry, **A2P Energy** is helping solve the problem of crop residue burning, whereas **EF Polymer** is making farming easier in the water deficient state of Rajasthan with its water retention polymer.

In the western part of the country, **Proximal Soilsens** has developed an indigenous sensor system to monitor the soil conditions in a farm, while **GRoboMac's** Computer Vision guided robot helps pick cotton and other crops much faster than manual method and with extreme efficiency. Meanwhile, **Samudra Network** is digitizing FPOs through its AI based application module.

Interestingly, none of the ventures were observed to be operating focused on the Eastern Region of India. While AgTech start-ups do have a presence in the region, it is part of their Pan-India presence including the Eastern and North-Eastern States. Organizations such as the **Bill & Melinda Gates Foundations** and **TATA Trusts** are attempting to address this gap and support ventures that can have a large-scale impact.[27]

Maximum ventures analyzed in this study are present in more than one region. **Samunnati** is providing financial and market linkages services in 15 states across the country, while **Ninjacart** through its tech enabled procurement and distribution chain is providing fresh produce to its clients in 7 cities. Working on over 300 acres of farmland daily **EM3** is present across Madhya Pradesh, Gujarat, and Uttar Pradesh; and **BigHaat** is shipping a whole host of agri-input requirements to the remotest corners of the country. Meanwhile, **Sickle Innovations** is providing harvesting machines to orchards throughout the Himalayan states, while **AgNext** has begun working with the Tea Board of India for quality testing of tea across plantations in Assam and Darjeeling.

Transcending the national boundary, a significant number of companies are taking Indian AgTech Innovation to the world. Using Machine Learning algorithms and HADOOP based Big Data platform, **SatSure Analytics** is providing satellite imaging-based analytics to businesses and government in India as well as Japan, Brazil, Switzerland, Zimbabwe, Nigeria, among others. In another successful example, **Stellapps** is providing cold chain management and dairy management solutions to clients in France, East Africa, and Nepal. **Miklens Bio** is exporting its organic bio-fertilizers and bio-pesticides to United States, Canada, Mozambique, and Mauritius; while **MyCrop Tech** is working with clients in Vietnam, Thailand, Indonesia, Philippines, and Iraq, providing farm management solutions and market insights.

1.3 Incubators and Accelerators

> India is going through an era innovation in agriculture. Rapid commercialization of technology into viable ventures is important to ensure that the research is transferred out of the laboratory and put to use in the real world. Among all the stages a startup traverses in its growth journey, there is none more perilous than the phase between initial capital investment and establishment of a steady revenue stream, also known as the Death Valley Curve. As the name suggests, it is during this phase that a very high number of startups cease to exist because of lack of resources, guidance, poor strategizing, inability to access market and many more variable reasons.

Undoubtedly the most important aspect for an AgTech venture is financing, but beyond financing, several critical elements such as technical assistance with product development, business plan optimization, feasibility analysis, physical operating space and laboratories, etc. define the success rate of the venture.

Technology-Business Incubators (TBI) and Accelerators provide a plethora of these services to startups in the nascent life cycle stages. The Incubators provide physical office space and infrastructure services to startups at a price much lower than that in the market. TBIs help startups secure funding and locate resources such as technically skilled manpower, marketing activities, traversing the legal route in terms of patents or incorporation of the venture. Both incubators and accelerators have a panel of expert industry mentors (senior leaders across the sectors) and entrepreneurs-in-residence (seasoned entrepreneurs with experience of developing multiple successful (and at times unsuccessful) ventures who mentor and guide the innovators. These experts help formulate several business plans along the venture founders, these plans are simulated according to market conditions, competitions, benefits-per-cost, and many other parameters to devise a plan with highest probability of success.

Many incubators have been established with the help of the government and the industry. Leading universities and business schools have also established entrepreneurship cells to foster innovation and enable technology transfer. Discussed in brief below are some key institutions that incubated and accelerated a large number of companies from the focus group of the study:

1. Centre for Innovation, Incubation & Entrepreneurship (CIIE) – Indian Institute of Management Ahmedabad (IIM-A)

CIIE was set up by IIM Ahmedabad in partnership with the Government of India and the Government of Gujarat as a platform to provide incubation and seed funding support to ventures that have mass-impact capabilities.[28] The centre is devoted to backing ventures that are deploying technology to solve major hurdles faced by the country in multiple impact areas including agriculture.

It provides incubation, mentoring, training, knowledge dissemination, seed-funding, and best practice research to entrepreneurs and helps convert ideas into viable, scalable businesses.

2. Villgro

Villgro is a social enterprise incubator with an aim to create an ecosystem that supports social entrepreneurs to build impactful, scalable businesses that have the potential of disrupting the agricultural sector with innovations that can be implemented at a mass level.[29]

The platform incubates, mentors, and funds startups that are:

i. Early Stage,
ii. Innovation based,
iii. For profit, and
iv. Impact the lives of the underprivileged sections of the country directly

Villgro is in the process of replicating its model in Kenya, Vietnam, and Philippines and through its incubation partners, impact social ventures across the world.

3. Indian Institute of Technology Madras Incubation Cell (IITMIC)

The Incubation Cell at IIT Madras is a Technology Business Incubator established by Startup India, DIPP and NSTEDB, Dept of Science & Technology, Government of India.[30]

IITMIC supports technology and knowledge based ventures through their start-up phase and helps them become scalable. The Cell provides services such as space and infrastructure, access to business support services, training and mentoring, and seed funding. It works with technologies developed solely by IIT Madras or in partnership with an external institution, and with startups that are being mentored by IIT Madras members.

4. Association for Innovation Development of Entrepreneurship in Agriculture–National Academy of Agricultural Research Management (a-IDEA NAARM)

a-IDEA, the Technology Business Incubator of ICAR-NAARM is one of the few TBIs dedicated to agriculture focused technologies.[31] It supports a broad spectrum of technologies in the entire agriculture value chain from farm to fork. The Incubator's objective is to nurture, support, and scale technologies that can bring efficacy in the value chains, improve productivity, and benefit all the stakeholders involved in the sector. Some of the focus areas of a-IDEA are: Precision Agriculture, Innovative Food Technology, Sustainable Inputs, Supply Chain Technology, Fisheries, Soil, Water & Weather Technology, IoT and ICT in Agriculture, Agri-Biotechnology, Post-Harvest Technology, Farm Mechanization, Vertical-Urban Farming, etc.

The Incubator provides the following services to ventures active in the above mentioned space:

i. **Ideation** – Screening & supporting ideas, proof of concepts, technology designs through annual Ideation events that help in screening and identifying potentially scalable ideas.

ii. **Incubation** – Through its incubation programs, a-IDEA supports early stage ventures and provides access to office and infrastructure, on-farm testing facilities, mentoring and guidance, networking and fund raising through pitching events, and technology linkages to augment scalability.

iii. **Acceleration** – The Accelerator Program is an annual, PAN India competition that provides existing venture access to expert mentors, technology support and validation, business model development, refinement and launch of products, capacity building workshops, and access to funds through pitching rounds. The program, in essence, accelerates the growth process of a startup.

5. Indigram Labs Foundation (ILF)

ILF is a Technology Business Incubator supported by the National Science & Technology Entrepreneurship Development Board (NSTEDB), Department of Science and Technology, Government of India. The Foundation's vision is to promote creativity and innovation in multiple sectors with special focus on agriculture. ILF incubates ideas and provides them with mentoring, infrastructure, technology evaluation, business model optimization, and funding service and nurtures them into scalable ventures. The Foundation also accelerates existing startups and helps them achieve their goals through focused mentoring and guidance.[32]

The Incubator has supported and accelerated the maximum number of startups from the Focus Group for the research study.

6. Pusa Krishi Incubator – Indian Agricultural Research Institute (IARI)

The Pusa Krishi Incubator, a part of the Zonal Technology Management and Business Promotion Development (ZTM-BPD) Unit at ICAR-IARI is an innovation hub and Agri-business incubator. It offers technical and business mentorship, access to government grants and funding platforms, as well as expert mentoring.[33]

The Incubator has several incubation programs that are run throughout the year and are focused on early-stage agri startups. There is a dedicated platform for startups at the pre-commercialization stage having a minimum viable product. It also has an array of available technologies developed by IARI that can be licensed by established companies and startups.

One offering that makes PKI unique is its specialized Intellectual Property Facilitation Centre (IPFC) that provides cost effective and efficient IPR related services to Agri Startups and MSMEs.

7. Society for Innovation & Entrepreneurship (SINE), Indian Institute of Technology Bombay (IIT B)

The Society for Innovation & Entrepreneurship, selected by the Department of Science and Technology (DST), Government of India as a 'Centre of Excellence', is one of the earliest Technology Business Incubators established in an academic institution. SINE provides Pre-Incubation, Incubation, and Acceleration to startups at differently stages in their life cycles.

SINE provides technology startups with mentoring and guidance, product development, testing, and certification, infrastructure & technical support, financial support, access to a wide network of business and technology leaders, exposure and visibility to the venture through several seminars and media, among other services.

8. Agribusiness and Innovation Platform (AIP) of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

AIP is a public-private partnership initiative of ICRISAT that helps its mission by upscaling technology and research outcomes through agribusiness ventures. The core objective of AIP is to identify and promote grassroot innovations in agriculture and to provide support to entrepreneurs for establishing sustainable Agri-Enterprises. It serves as a platform of technology exchange between ICRISAT & its partners and the private & public sector.[34]

AIP through its distinct programs incubates innovative ventures and provides them with services such as product development, infrastructure and market connect, funding and mentorship. It also has a Intellectual Property Facilitation Cell that helps ventures with secure relevant patents and helps in licensing of available technologies.[35]

9. YES SCALE Accelerator – YES BANK

YES SCALE is a platform accelerator for scaling up of innovations in key impact sectors including Agriculture through technology, mentorship, funding, and commercial support. The platform has dedicated agri-acceleration program 'AgriTech'. It brings together experts from both private and public domains, investors, and resources to help tech startups translate the gap between idea and implementation. AgriTech has 3 focus categories: farm tech, food tech, and supply chain tech, each dedicated to a subsection of the agri-value chain.[36]

The program offers technology ventures with technology support, testing and validation of the product, funding and access to different grant sources, mentorship from industry experts, help accessing global markets, etc.[37]

10. SIDBI Innovation and Incubation Centre (SIIC) Indian Institute of Technology Kanpur (IIT K)

SIIC at IIT Kanpur was established in partnership with Small Industries Development Bank of India (SIDBI) with the objective to nurture technology driven innovation and entrepreneurship. SIIC comprises of 8 incubation centers and a dedicated IP & Tech-Transfer Cell.[38]

The Centre provides technology development and validation services, infrastructure, mentoring and funding support, networking activities through several events, and facilitating patents and trademarks through its IP Cell.

1.4 Challenges and Way Forword

> Startups in every sector face multiple challenges throughout their life cycle. The challenges and obstacles have a higher degree of difficulty for ventures active in the Agricultural sector in India because of the sheer diversity and number of people involved across the entire value chain.

The study analyzed challenges faced by the Focus Group and categorized them into: Initial Challenges & Challenges to Scaling Up.

1.4.1 Initial Challenges

Discussed below are some of the main challenges that the companies faced in the initial days of their inception:

1. Lack of Ecosystem Support

Despite arduous efforts by the government to boost innovation and entrepreneurship, there remains a mismatch between the existing need of fostering AgTech startups and resources available. Companies such as EF Polymer initially had difficulty getting incubated and receiving the support required at a nascent stage such as mentor guidance, product development facilities, access to experts to formulate market entry strategies etc.

2. Dearth of Knowledge Resources

Lack of access to knowledge banks, which could be in the form of information repository, industry experts, senior academicians, is another challenge that many startups faced while developing and refining their products and business models. Availability of reliable information is crucial for a venture to understand the market and the sector they are entering. Owing to this, NaPanta couldn't access accurate information for developing Agri-advisory benchmarks for its digital platform. Distinct Horizon couldn't find the needed guidance to optimize the design of its machine and had to develop multiple prototypes for performing several trials, which led to time and cost overruns.

3. Barriers to Technology Adoption

Indian agriculture has been traditionally dependent on manual labour for all its operations. Technology based interventions that are bringing efficiency and speed to the sector are all new concepts for the grassroots farmers to comprehend. Companies using advanced technologies, such as sensors from Pycno and farm management platform by CropIn, are often met with scepticism by the farmers who are concerned about technology replacing their livelihood and the possible misuse of their data collected by private entities.

4. Lack of Technically Skilled Manpower

One of the biggest hindrances faced by any new venture in the agricultural space is finding people who understand the sector and have the skills to work on advance technologies such as developing machine learning algorithms, interpreting the data generated by a drone, mapping a farm with a sensor system, or operating a blockchain based dairy farm software. The technically skilled workforce that exists is hesitant to work for a startup or an early stage venture, which can be attributed to the lack of entrepreneurial spirit in the country which equates working for startups as lack of job security and not a chance to learn and be part of a path breaking enterprise.

5. Dearth of Data Stack Availability

Data of different geographical locations, markets, weather, soil types, crop types, and many other is needed to make a viable advanced technology-based model. An effective artificial intelligence or machine learning algorithm needs to churn an extremely large amount of data to become precise and efficient, developing a platform that can offer different resources to the stakeholders also utilizes large amounts of data about the market conditions and patterns. At present there isn't a centralized repository of different varieties of data stacks to be used in agriculture. The companies resort to generating data themselves which consumes crucial time and depletes the resources that can instead be deployed toward scaling up of operations.

6. Need for Funding

Perhaps the most crucial challenge any startup tackles is with funding. Working in a sector dependent heavily upon natural factors such as climatic changes and monsoonal rains, AgTech ventures aren't always the first choice of investment for major funding sources. Development of technology, hiring of specialists, licenses and permissions, every fundamental step involves significant amount of funding. With a burn rate faster than cash influx rate, a skewed cash flow, due to the non-digital payment modes and delayed payment cycles, don't inspire the utmost confidence in investors.

1.4.2 Challenges to Scaling Up

Discussed in detail are the key challenges that hinder the scaling up of a venture:

1. Policy and Regulation Challenges

Many advanced technologies are new entrants in the agricultural technology sphere. Policies and legislations around development and usage of these technologies has not evolved at the same pace. Importing certain components like the radio module to manufacture a drone indigenously is complicated and time-consuming owing to multiple permissions required. The import duty for importing a single piece of equipment to develop a prototype is the same as importing large number of units for commercial purposes. Certain multispectral cameras and sensors used for farm surveying come under 'Luxury Goods' category and invite high duty. UAV startups THANOS, AUS and InDrones frequently struggled with these issues.

Products from Miklens Bio despite of being organic and biological in nature, fall under the 'Water Soluble Fertilizer' category which is a non-subsidized category of Agri-input products. An absence of a dedicated category for such products hinders Miklen's market expansion.

Finished agricultural products like the ones manufactured by Sickle Innovations come under the Zero percent tax category, but to manufacture this equipment, the raw material involved attracts standard tax rates. This causes the startup to bear the tax burden.

2. Challenges of Payment and Cash Flow

Dairy farmers have a barter arrangement with the cooperatives that procure products from them and in return supply them with cattle feed and other input products. Maintaining a similar arrangement is not feasible for a startup.

Another hindrance to maintaining a steady revenue stream is the prevalent credit cycle in many sub-sectors, especially the dairy industry where farmers get paid in an interval of every 15 days by the dairies, they sell their produce to. In turn they need to purchase products from startups like Krimanshi or avail services from StellApps at a credit period ranging from 15 days to many months. Active working capital stream is the oxygen for the survival of any nascent venture, and the credit-cycle system is a major impediment to scaling up.

3. Challenges to Validation and Benchmarking

Technologies from AgricX Labs and Intello Labs used to sort, and grade various agricultural produce, lack a federal standard against which they can be compared. This causes trust deficit among the customers toward these technologies and poses a challenge toward their rapid adoption.

4. Insurance & Storage of Raw Material

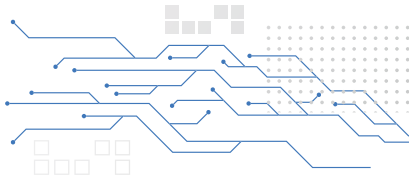
Certain companies utilize the remnants of the farming process as raw materials for their products. A2P Energy uses paddy straw to manufacture energy pellets and bio-char, EF Polymer uses the leftover fruits and vegetables from mandis and polymerizes them to create its Water Retention Polymer. Such raw products are volatile. While A2P faces issues getting the highly flammable dry paddy straw insured, EFP has a hard time convincing cold storage owner to store leftover produce.

1.4.3 Way Forward

Overall, the ecosystem for ag-tech startups in the country is promising. The government, through several initiatives such as the RKVY-RAFTAAR and Atal Incubation Mission, are playing their part in boosting innovation and entrepreneurship in the sector. Meanwhile, large industry players are also opening up to partnering with startups. Several Incubators and Venture Capital Firms are active in India today, and there is increasing footprint in terms of financing support, technical assistance, business mentorship, etc.

Nonetheless, several factors remain to be addressed towards further enabling the ag-tech ecosystem and unleashing the full power of available technological innovations towards improving India's agriculture growth trajectory.

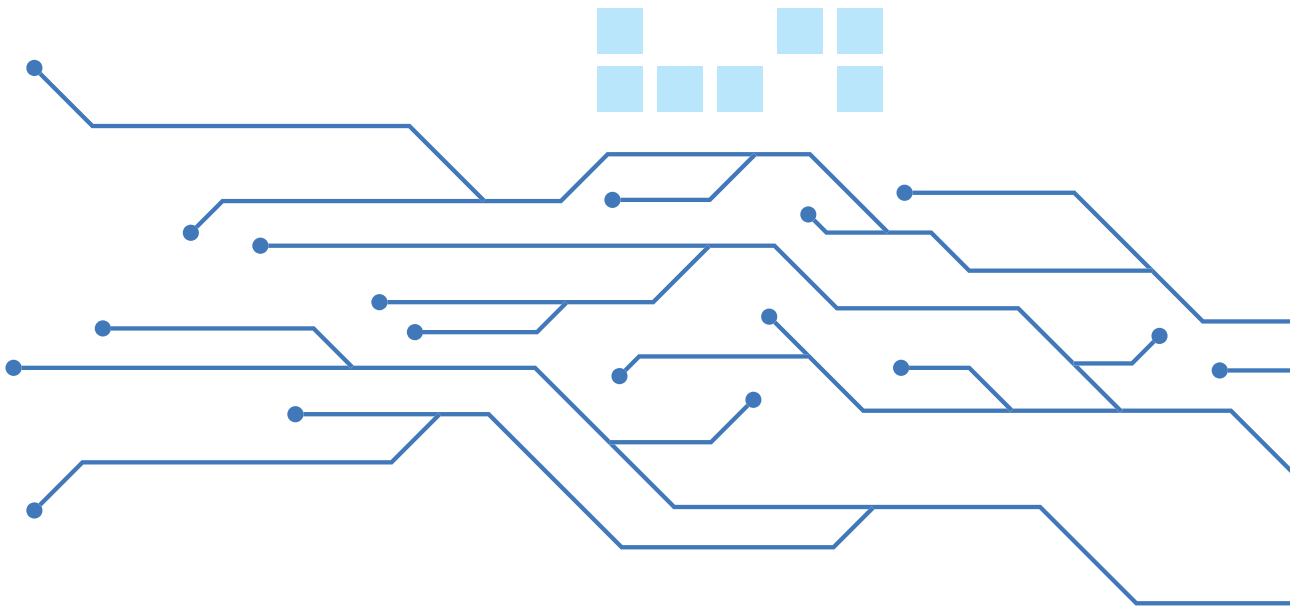
Since Data availability is a primary requirement for many advanced technologies such as Artificial Intelligence, Blockchain, Satellite Image Processing, etc.; creation of a unified single data authority is crucial for tech ventures to develop and deploy their technologies at scale.



Several ventures covered in AgTIVE 2019 have mentioned that finding skilled personnel, who understand the complexities of agricultural sector and can develop technology solutions, is a challenge. In line with this, youth need to be involved into agriculture through institutionalised engagements such as dedicated agricultural hackathons and symposiums, towards both creating interest as well as offering alternative employment avenues.

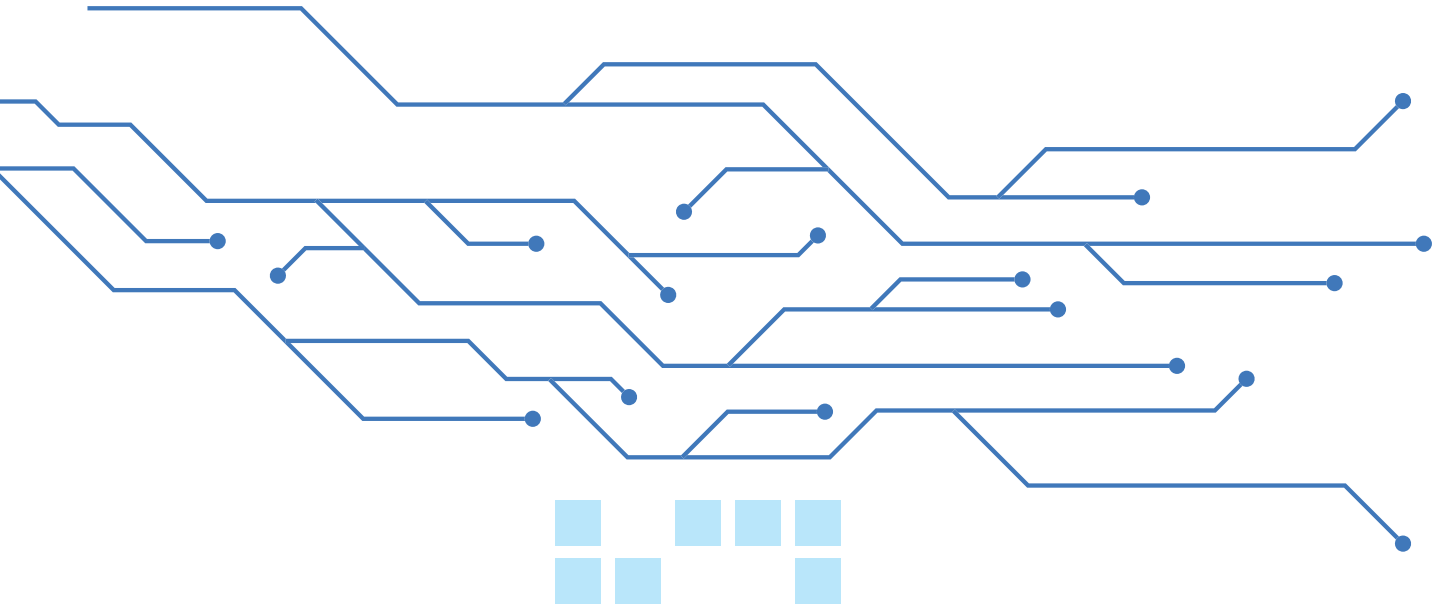
On the regulatory side several challenges remain. For instance, for Ag-mech startups developing drones and sensors, the approval process for importing crucial components is time and capital intensive. Further, obtaining licenses for deployment is also challenging. Streamlining these approval and licensing processes will save the startups crucial time and help them enter the market quicker. Similarly, in the post-harvest space setting up standards for ag-tech ventures providing services such as assaying, sorting and grading, would enable them to penetrate markets faster.

Innovation is a global phenomenon and no single company can research and develop the entire spectrum of technological marvels possible in agriculture. Going forward, collaboration between Government, Industry, and Startups will be key towards improving the enterprise of agriculture in India.



PART 2

SPOTLIGHT ON INNOVATIONS

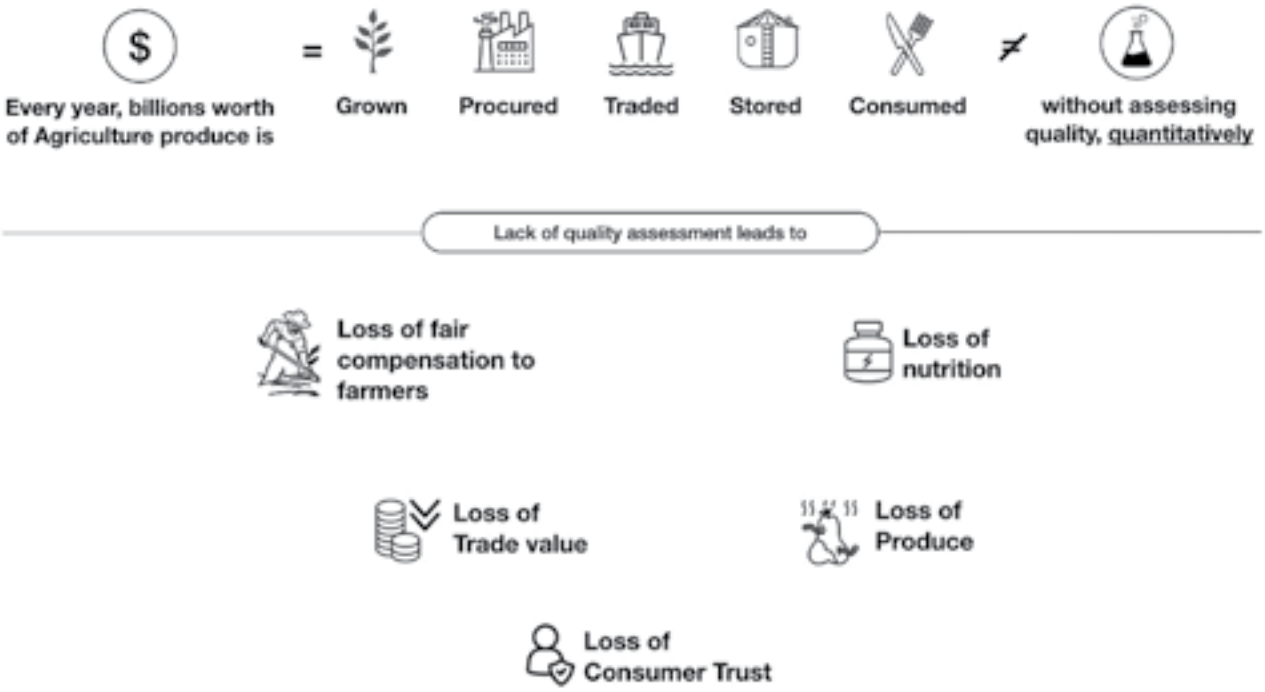


2.1 ADVANCED STAGE VENTURES

AgNext

AgNext designs quality assessment and process monitoring solution for agro-food businesses. The company offers digital agriculture solutions to the agriculture community, which are critical for stakeholders to improve quality, optimize costs and ensure food traceability. AgNext has developed a disruptive product Qualix (focusing on quality, traceability, and integrating AgData) to benefit various stakeholders in the agriculture value chain, including farmers, regulators and industry.

Problem being addressed



Product Description

AgNext offers services and products that are researched and developed in the AgNext Labs. The farm advisory services are based on a technology stack. This stack primarily consists of 3 data types:

AI Based Image Analytics

Artificial Intelligence based image processing algorithms for physical tests and replace the traditionally followed methods.

AI Based Spectral Analytics

AI based spectral analytics for instant chemical tests.

AI Based Sensor Analytics

AI based Internet of Things sensors to build data insights and replace intuitional quality driven processes.

Solutions

Assess and Manage Post-Harvest Procurement:

- Better price realisation for buyers and producers
- Uniform quality standards of agricultural products
- Create trust, transparency and traceability

Monitor and Control your Inventory:

- Full stack data platform for warehouse, silos etc.
- Assess and monitor the quality of produce at a click of a button
- Reduce transaction risk for buyers

Buy and Produce the Best in Quality

- Automated quality auditing as per certification agencies
- Maximise your profits by minimising loss due to quality using AI
- Deliver the best quality to your clients

Qualix Device Implementation

Intellectual Property

AgNext has one patent and is in the process of applying for 11 more. It is also in the process to apply for trade-mark for the company name.

Initial Challenges Faced

Business Model Formulation - Biggest challenge AgNext faced was of formulating the business model in agriculture and then developing the technology. AgNext learnt that a product-based approach is extremely difficult to scale up in agriculture. Also, point solutions will only impact certain segments and not the entire value chain. The processes of growing, buying, and processing are constantly interlinked, thus AgNext came up with its Technology Stack model which benefits the entire value chain. AgNext

in the very initial stage of conception, followed a Business to Farmer approach and created a farmer centric product and solution. It faced a lot of difficulty as farmers were not keen on adopting a new technology. Thus, AgNext decided to follow a Business to Business approach in future and create technologies that benefit farmers and every other stake holder in the value chain as well.

Policies and Regulations - Another constant challenge is regulations and policies related to the technologies that AgNext is developing, especially imagery. There is a void of dedicated legislation for the use of satellite imagery and it creates a problem while applying these solutions.

Business Model

AgNext follows a Business to Business to Customer model where it works with business that take the technology and its benefits further to the farmers.

AgNext identifies a problem in the value chain and develops a targeted solution. It works along with the client to deploy the solution to the farmer base.

The benchmark AgNext has for partnering with a client is to maximize the impact of the technology so that it can be harnessed by a large user base, and to scale the solution to a maximum possible extent.

Market Presence

AgNext is present across the country with clients in all the segments from tobacco to tea.

It is presently working with the Tea Board of India for quality testing of tea using image processing and will be installing the solutions across the tea plantations in Assam and Darjeeling. This solution will be deployed at over 1200 locations and impact over two million farmers by January 2021. The pilot studies for the technology are ongoing.

It is working with the Government of India on an undisclosed solution that will be installed in over 6000 mandis all across the country.

Key Partnerships

STEP-IIT Kharagpur - Incubation

Omnivore Capital - Funding

aIDEA-NAARM – Funding and Acceleration

Kalaari Capital - Funding

Financial Analysis

AgNext is revenue generating and profitable.

Requirements for Scaling-up

Pilot Needs

AgNext is seeking pilot opportunities with the government and leading corporates to implement innovative technologies at the grass roots level.

Policy Needs

Startups like AgNext have to compete with established corporates for tenders released by the government. Startups do not have the same resources as large players to compete for a tender process. Tender schemes should give opportunities to startups to directly implement the solutions.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Taranjeet Singh Bhamra	CEO	B-Tech & MBA	16
Ms. Sparsh Kaur	CPO	MBA	12
Mr. Pritam Ghanghas	Head-Embedded Systems	B-Tech	14
Mr. Amanpreet Singh	Head of Sales	MBA	20
Mr. Aman Kumar	VP-Technologies	B-Tech	20
Mr. Ashish Pareek	VP-Finance	CA	13
Ms. Tara McCartney	Director of Engagements	Masters	20

QualiX Tea

QualiX IoT

Agricx Lab

Agricx Lab is a precision agriculture start-up involved in portable, smart assaying services for agricultural produce. The company provides portable, quick, accurate and easy to use quality assessment tools that remove subjectivity from quality-based assessment and make grading and transactions smoother and cost efficient. Agricx has developed a solution suite that uses artificial intelligence (AI), computer vision, machine learning (ML) and spectroscopy to yield objective, precise, and rapid quality assessment of produce.

Product Description

Agricx offers a platform that can assess and report the quality specifications of the produce, using Artificial Intelligence, Spectroscopy – Molecular Analysis, and Hyperspectral- Chemical Analysis. The platform provides Portability, Digitization (automation) and Assessment (using ML/AI). There are three distinct segments to Agricx's value proposition:

Customizable Application for Businesses

Agricx offers an Artificial Intelligence-Machine Learning powered application that extensively analyses pictures taken from a heterogenous sample and grades them based on physical characteristics like colour, shape, size, external deformities etc. The application has three variants at present:

- **Agricx GRADE** – Application to assess the quality of produce from image
- **Agricx PROCURE** – Procurement solution with automated decision making and real time payment settlement
- **Agricx CART** – Online marketplace for simplified selling of produce

Spectrophotometric Grader

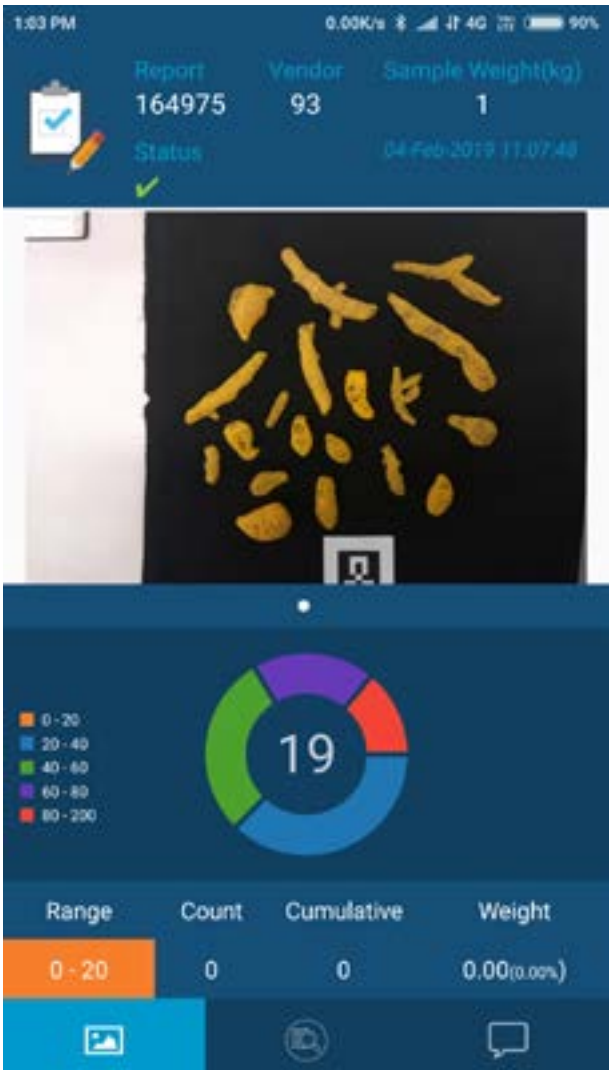
It is a hand-held spectrophotometer that records reflectance/absorption values and is primarily used for chemical assaying. It measures dry matter, brix value, moisture level, chemical composition, sucrose-glucose levels, etc. A regular spectrophotometer is extremely large and requires samples to be transported to it, leading to delay in the transaction of produce and decreasing its shelf life. Agricx has innovated this technology and made it compact enough to fit in a human palm and fast enough to deliver near real-time results. The device is the size of a matchbox and is powered by an AI ecosystem. The company has partnered with McCain to conduct trials for the product.

Hyper-Spectral Camera

It is a futuristic device currently under development and expected to be operational in 2020. It uses Near Infra-Red (NIR) wavelength to determine internal damages in a sample.

Free App for Farmers

As part of its CSR activities, Agricx has developed a 'Lite' version of its existing application which will be launched in 2019 and will be free to download. Target users for this app are farmers and traders who can test the produce and receive limited, but accurate and reliable information, which will then enable them to extract the corresponding prices.



Snapshot of Agricx Application

The price of the Application on offer depends upon the level of customization required by the customer. It has an accuracy level of above 95%.

Presently Agricx offers the app for Potato grading and is working to add more products in its portfolio. The Application requires a minimum of 8-megapixel camera and is available on Android platform with the iOS version under development.

Intellectual Property

Agricx has filed for patents for its AI and Mechanism of the Spectrometer. Going forward, it plans to file additional patents for the rest of its products. Agricx has also trademarked the company name and is working to get the product names trademarked as well.

Initial Challenges Faced

- The manual system used in warehouses and distribution centres presently consumes a significant amount of time, the results are based on physical observation and are highly subjective. The available laboratories are not in the close vicinity of these distribution centres and the entire process of transporting the sample of the produce to the laboratory and getting the results costs the dealers and farmers crucial time. But, this practice is ingrained in the minds of the procurers, dealers, and farmers, as this process is traditional and has been used for many decades. Thus, convincing these customers of the value proposition of its products was a major challenge that Agricx faced early on. It conducted pilots and Proof of Concept studies with several customers and established the efficiency and reliability of the technology, thus overcoming this challenge.
- To shrink the massive spectrophotometer into a handheld device while keeping it cost effective and increasing the efficiency was another major challenge faced by Agricx.

Business Model

Agricx follows a Business to Business approach, working with food processing companies and large trading houses. It has a monthly licence fee and fees per report (chemical and image).

With its 'Lite App' it will introduce a Business to Customer model. Even though the app would be free for the users, Agricx would benefit from the data that is processed through it, which will help it improve its technology as well.

Market Presence

Currently operational in Uttar Pradesh, Madhya Pradesh, and Gujarat, Agricx is working with industry giants like McCain, Mahindra, Olam, and with multiple large cold chain companies.

It plans to expand to South-East Asia, China, and certain European countries soon.

Key Partnerships

Agricx has raised Seed Funding from CIIE-IIM Ahmedabad and Ankur Capital.

Financial Analysis

Agricx projects a positive revenue flow and expects to break-even in the next 3-4 years.

Requirements for Scaling-up

Funding Needs

AgTech startups have a longer Return on Investment period and have difficulty accessing funds in an efficient and transparent manner even though funds dedicated for Agriculture sector are available with several public and private bodies.

Policy Needs

In the Indian agricultural scenario, government is still the largest stakeholder on the business front as well. Agricx needs that a certain share of business opportunities should be allocated to the startups that are helping the sector with innovative solutions. There should be a provision for making such business opportunities available for startups.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Saurabh Kumar	Founder & CEO	MBA, Marketing	21
Ritesh Dhoot	Founder & CTO	Engineering	22

Barrix

Barrix Agro Sciences is an Agri-Biotechnology startup that produces eco-friendly pheromone based Integrated Pest Management (IPM) and Integrated Plant Nutrition Management (IPNM) solutions. The company's goal is to use technology for reducing the dependence of agriculture sector on chemical based inputs, thus making the whole grains, vegetables and fruits healthier for consumption. Also, the fodder grown using these products is free of residual pesticides and thus better for the cattle.

Product Description

Barrix has two categories of products:

Integrated Pest Management

The core of Barrix' technology is pheromones secreted by different pests. In natural conditions the pheromones act by attracting the pests toward them. Barrix has researched and developed artificially synthesized pest specific pheromones that attract both the sexes of that particular pest toward them. Barrix has integrated the pheromone technology with physical traps to develop on-farm implementable solutions which can be broadly categorized into:

- **Fly Trap** – The fly trap is an instrument designed by Barrix to match the flying pattern of different pests. It is made of sturdy plastic body and can withstand heavy rains, winds, and UV rays. It can be hung in orchards and farms at a height of 3-5 feet. The center of the trap consists of pest specific pheromones which attract the flies. It is designed in a way that the flies can enter from different sides but once inside they are trapped inside. The company offers different traps for different pest such as fruit flies, vegetable flies, etc.
- **Fly Lure** – Using sex-specific pheromones combined with an advanced isomer platform the company has developed a Lure trap to attract and trap male flies or a specific species. By removing the male flies from the farm, the Lure trap removes the chances of reproduction leading to removal of that pest species from the farm ecosystem.
- **Chromatic Trap** – Combining pheromones and Color Alluring Technology, the company has developed photochromatic stickers that trap pests of a specific species. The pheromones are embedded in the sticker which is made with a non-drying water and weather resistant material with a highly adhesive surface. The pests are attracted to the sticker and get trapped on the surface. The company uses colors with different wavelengths of visual spectrums which appear as green crops to the pests. The Chromatic Traps come for different pest types and in different photochromatic colors such as yellow and blue.

Integrated Plant Nutrition Management

Barrix manufactures organic fertilizers covering both macro and micro nutrient in nano form which are needed for the plant growth. The products cover different aspects of the crop cycle and have nutrients specific for development of different parts of the plants. The products are categorized as: Chelated Plant Micronutrients, Plantcharger, Rootcharger, Maya among others.

The product prices range between INR 50 to INR 1000 in India.

Intellectual Property

Barrix has applied for 14 patents that cover the entire technology aspect of the company including development, processing, formulations and design of its products.

Challenges Faced

Partnerships – In the initial phase the company faced issues with finding partners to distribute and sell its products. Being a startup manufacturing organic inputs it couldn't offer the same margins as established players. The company also approached several state governments for implementing its products as it makes farming sustainable and organic but wasn't able to get its word across to the right people. Through extensive on farm demonstrations by its staff members the company reached out to farmers and conducted pilots. After the demonstrations that lead to quantifiable increase in the yields the company was approached by agri-input distributors and suppliers.

Skilled Manpower – The company faced issues with getting technically sound manpower to come work for an AgTech startup. It needed people who understood the products and the agricultural ecosystem for on ground work in the rural areas. It had to hire and train non-technical staff for deployment of the product in the market to tackle this issue.

Housefly Trap Implementation

Business Model

The company works on a Business to Business (B2B) model where it supplies its products to Agri-input distributors, Agri-businesses, and contract farming companies.

The companies clients include Dupont, Bayers, Syngenta, Namdhari Seeds, Monsanto, Krishi Rasayan among others.

The company is also shipping its products to Sri Lanka, Nepal, and Bangladesh under a distribution model where the distributors sell the products under the companies brand name.

Market Presence

The company is present in 13 states across India through direct marketing and distribution channels. It has international presence in Bangladesh, Nepal, and Sri Lanka. These countries have a similar agricultural ecosystem and needs as India.

The company has worked with over 1,000,000 farmers by March 2019 and aims to reach at least 2 million farmers by March 2022.

Key Partnerships

Centre for Innovation Incubation and Entrepreneurship

CIIE – IIM Ahmedabad – Incubation

omnivore

Omnivore Capital - Funding

Financial Analysis

Barrix will be breaking even and will be profitable with a revenue of INR 15 crores in the year 2019-20.




Requirements for Scaling-up

Partnership Needs

Barrix wants to partner with the government for implementation of its products. Its products are free of chemicals and can make the produce better in quality with an efficient reduction in pest leading to higher yields. It is looking for piloting opportunities with State and Central government and governmental bodies for its products.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Lokesh Makam	MD & CEO	1. D.Pharma, B.Pharma from Bangalore University 2. MBA in Pharmaceuticals Management	20
Dr. Kannan	Head – R&D	M.Sc, M.Phil, Ph.D (Entemology)	26
Mr. Chaco Muller	Head – Sales & Marketing	Chemical Engineer from Mangalore University	24
Mr. Umakanth V V	CFO	1. Chartered Accountant, ICAI, New Delhi 2. B.Com from Bangalore University	12

CropIn Technology Solutions

CropIn is a Business to Business (B2B), full-stack AgTech organization that provides SaaS solutions to agribusinesses globally. CropIn's suite of products enable various stakeholders in the agri-ecosystem to adopt and drive digital strategy across their operations.

Product Description

Using cutting-edge technology like big data analytics, artificial intelligence, machine learning, and remote sensing, CropIn creates an interconnected network enabling clients to analyze and interpret data to derive real-time actionable insights on standing crop. With the vision to 'maximize per acre value' and the mission to 'make every farm traceable', CropIn adds value to agri-businesses by increasing efficiency, scaling productivity, and strengthening sustainability across the board. Thus far, CropIn has digitized over 5 million acres of farmland and enriched the lives of nearly 2.1 million farmers, while gathering data on 265 crops and 3,500 crop varieties in 30 countries. The SaaS solutions offered by CropIn are crop and location agnostic and are available on the web and mobile devices.

CropIn's innovative products are currently offered in a B2B model and caters to customer segments like Agri-input companies, Seed production companies, Government, Development agencies, CSR arms, Exporters, Banks, Insurance companies and Commodity Traders.

SmartFarm

A robust & flexible farm management solution which enables complete digitization of farms, data-driven decision-making, and provides visibility of people, processes and performance on the field.

SmartRisk

A predictive and prescriptive solution that is powered with AI and Machine Learning capabilities. SmartRisk leverages agri-alternate data, and provides risk mitigation and forecasting for detecting cropping patterns, monitoring crop health and for effective risk assessment. Proprietary machine learning algorithm built on satellite and weather data is used to give insights at plot and region level. These insights can be leveraged by the agri-stakeholders like farmers, agribusinesses, banks, insurance companies to create more value for their crops.

mWarehouse

A comprehensive solution for pack house, processing & export companies that enables Farm to fork traceability & compliance, quality control and flexible inventory management.

SmartSales

A comprehensive CRM & input channel management solution, that helps predict and improve sales and ensures end-to end performance management of sales team.

AcreSquare

A mobile application for B2B farmer engagement. Using this application, agribusinesses can directly interact with farmers and provide them all the necessary information required to maximize per acre value of land.

Intellectual Property

CropIn's patent approval is in progress for its technology. It has trademarks for the company and product names and logos.

Initial Challenges Faced

Technology Adoption

CropIn initially faced challenges with acceptance and adoption of its technology by the target customer segments. Showcasing the value of its solutions to an audience who have been following traditional agricultural practices and are apprehensive about technology adoption was challenging. CropIn made the platform user friendly, available in offline mode i.e. no internet connectivity required, and accessible by making it available in local languages, which made it easier for rural adoption.

Business Model

- CropIn follows a Business to Business model and works with everyone who works with the farmer such as Agri-input companies, Fruit and Vegetable Exporters, Seed Companies, Banks, Farming Companies, Insurance companies, Government and Development Agencies.
- Multiple engagement models are present such as SaaS (software as a service) model, partnering with local companies in other countries. CropIn has an evaluation mechanism for partnering and is on the lookout for channel partners
- It has two pricing models: per acre-based model or per user model

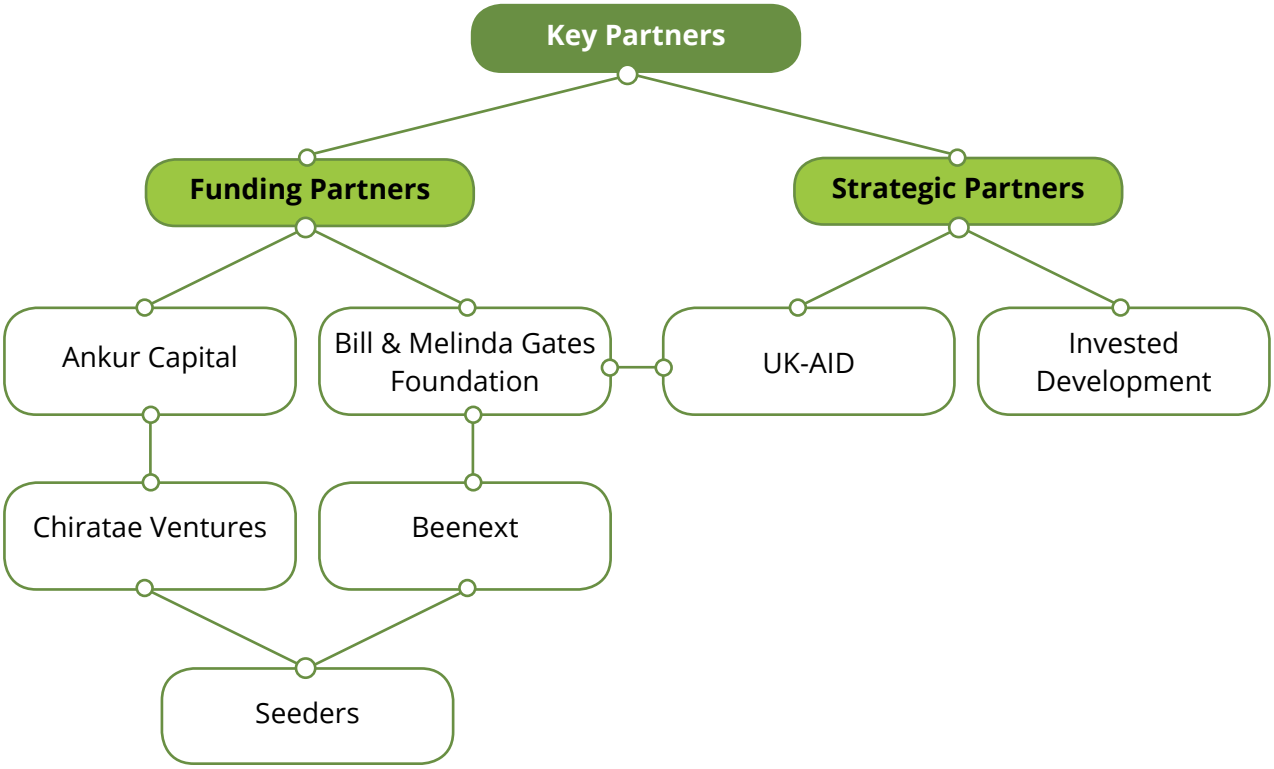
Market Presence

CropIn is headquartered in Bengaluru, with a regional office in Delhi, and teams across the globe – South East Asia, Europe, Latin America, Nigeria, Ghana etc.

With implementations in over 30 countries across the world, CropIn has clients all over India in both the Government and Private sector. CropIn has impacted over 2 million farmers and digitized over 5 million acres of farmland so far. CropIn aims to be a global AgTech leader and wants to strengthen its foothold in all the countries it is active in presently.

Vinukonda Field Agent

Key Partnerships



Financial Analysis

CropIn is operationally profitable and has raised a funding of USD 12 Million till date.

Requirements for Scaling-up

Partnership Needs

CropIn is seeking partnerships with the government to implement its solutions for the small and marginalized farms across the country and help them increase productivity and profitability.

Funding Needs

CropIn is also looking for debt financing from government banks for expanding the business and access to the Agricultural ministry in all the states.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Krishna Kumar	Founder & CEO	BE, VTU	12
Mr. Kunal Prasad	Co-founder & COO	MBA, Great Lakes Institute of Management / BE, BIT	20
Mr. Jitesh Shah	CRO	MSE, Clemson University	26

EM3 Agri Services

EM3 Agri Services is an AgTech startup with a goal to bring technology and mechanization to the farmers of India in an affordable and dependable manner.

Product Description

Shortage of skilled labor and unaffordability of precision farming machines by small and marginal farmers are major hindrances in the process of raising the productivity of Indian farms. EM3, through its innovative Farming-as-a-Service (FaaS) model, is offering farmers reliability and accessibility to cutting edge technologies from around the world at affordable rates.

Under the pay-per-use model, EM3 offers services under their brand name "Samādhān" to the farmers for the entirety of cultivation cycle including – land development, soil preparation, seeding, sowing, planting, crop maintenance, harvesting, and post-harvest field management. Farmers can choose the services based on their requirement and can book their service through our app, contacting our call-center or visiting our Samadhan Centers. The operations are carried out by machines and trained operators from the company. Farmers are charged on a per hour or per acre basis depending upon the type of services rendered.

EM3 has a host of advanced machinery in its portfolio including an array of tractors, harvesters, laser levelling machines, transplanters, deep ploughing machines, pulverizers among others. The company is also providing Soil tests for farmers to let them know the exact nature of the soil and the correct nutrients it requires. It also works with farmers owning advanced machineries, allowing them to become our partner franchisees and deploy these machines as part of the company's portfolio. The company terms this as 'Uberisation of Agriculture'.

Samadhan Kendras

EM3 operates in several states across the country through its centers called Samadhan Kendras. Each center is equipped with a certain number of machineries covering the entire range of services offered by the company. The centers are managed by professionals from the Agri sector and are equipped with IT enabled systems that can handle complex precision farm operations throughout the farming cycle.

The centers are managed and tracked remotely from the company headquarters in Delhi which helps keeping the service quality in check.

The company approaches farmers through various marketing efforts including re-directing customers to visit our Samadhan centers. Demonstration of services is a major route for customer acquisition as the farmers can first-hand witness the quality and efficiency of the services provided.

The company also has a mobile app and a call center for farmers to place their orders. The cost of the services varies according to the type of operation to be carried out, and

the size of the farm or the time spent on the service.

EM3 has strategic partnerships with key industry stakeholders. The company has a partnership with Mahindra, the world's largest tractor manufacturer, and will be utilizing their technical innovations in farm services. The company has also partnered with Indian Oil Corporation Limited (IOCL) to setup Samadhan Kendras in rural areas. American tractor manufacturer, John Deere, provides technical support to the tractor and harvester fleets operated by EM3. The company is also working with large agriculture sector companies like Bayer, Hindustan Uravarak and Rasayan Limited (HURL). EM3's partnership with DCM Shriram and EID Parry includes mechanizing the sugarcane crop and helping the farmers with higher yields and lower costs. The company uses satellite-based technologies from Trimble, a global provider of advanced location-based navigation.

The company has also signed an MOU with Govt of Rajasthan to setup 1250+ Samadhan Kendras which work as partner franchisees of EM3 and provide farm mechanization services to the farmers. 300+ of these centers are already functioning in the state and the rest will be set-up during next 3 years, creating rural entrepreneurs and providing employment.

Going forward, EM3 wants to transition into a complete Agri-marketplace that offers a wide range of farmer centric services throughout the crop lifecycle including credit and insurance services. Utilizing the vast amount of data generated by working with a large number of farmers, the company wants to use analytics to increase its portfolio with the services that are required the most by the farmers. It is also planning to bring Post-Harvest technologies for drying, packing and safely storing the produce.

EM3 Product

Intellectual Property

The intellectual property of EM3 lies in its business model of Uberising the Agri services industry. It has several strategic tie ups with global manufacturers for procuring and maintaining its fleet of machines.

Challenges Faced

Gaining Farmer's Trust

Initially when the company started its operations and approached farmers, it was termed as a seasonal visitor that has lack of knowledge of the farming ecosystem in the rural India and with its fancy gadgets it trying to charm the farmers into giving up their hard-earned money. The company tackled this problem by investing substantial capital into setting up the Samadhan Centers and having expensive machinery stationed outside the center so as to send a message to the farmers that it is here to stay for good. It also gave demonstrations to selective farmers and the increased output as a result of those demonstrations further helped in building the trust. Also the fact that the company is providing operations through the crop cycle ensures constant interactions with farmers.

Skilled Manpower

Getting quality and skilled manpower was a major challenge for the company. It was difficult to find and employ technical people with knowledge of operating and maintaining advanced machinery. Hiring office staff was also a challenge as people were not keen on leaving their jobs in established industries and working for an AgTech startup. The company tackled this problem by hiring people with knowledge and providing them with extensive technical training. The partner companies providing the machines to EM3 also helped with training of the employees.

Business Model

EM3 follows a Farming-as-a-Service (FAAS) model and offers its services on a pay-per-use basis to the customers. The company owns and operates its own portfolio of machines and is also working with farmers owning tractors, harvesters, and other machines. It allows these farmers to rent out their products thus providing them with an additional source of income.

The company has strategic tie ups with global Agri-mechanization companies for advanced machinery. The company provides them with a gateway of increasing their market presence in India while making otherwise expensive technology accessible to the farmers.

The primary customers of the company are farmers across several states in the country. It has also tied up with state government of Rajasthan for setting up Samadhan Center across the state.

Market Presence

The company started its operations in selected districts in Madhya Pradesh in 2014. It is now present across Madhya Pradesh, Rajasthan, Uttar Pradesh and Andhra Pradesh. The company has signed an agreement with the Government of Rajasthan for establishing over 1250 Samadhan Techno Center across the state.

The company is currently serving over 1200 acres of farmland on a daily basis and has worked with over 40000+ farmers so far. It wants to focus solely on India and aims to expand its presence across the country in the near future. The company believes that with over 394 million acres of arable land, India needs technology interventions and provides sufficient scope of development to the company.

Key Investors

Aspada Investments - Funding

Global Innovation Fund - Funding

Financial Analysis

EM3 has broken even and is profitable with reported annual revenue of INR 40+ crores for the year 2018-19.

EM3 Fleet

Scaling-up

Ecosystem Development

EM3 believes that private sector alone cannot address the several problems plaguing the Agricultural sector in the country. The government must play an active role in developing an ecosystem conducive for the growth of technology-based interventions offered by startups like EM3. Bringing ease of access and transparency to process involved in opening a venture and accessing different markets in the country would help the startups tremendously.

Skill Development

Major requirement for scaling up for the company is availability of technically skilled manpower. Creating a pool skilled workforce will help the company expand rapidly.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Rohtash Mal	Founder Chairman & Managing Director	IIT, Delhi (BTech) & IIM, Calcutta (MBA)	40 + years of Experience
Mr. Adwitiya Mal	Co-Founder & CEO	Bachelors (with Honours) Degree in Economics from Delhi University & MBA from the Simon School of Business, University of Rochester	10+ years of Experience
Mr. Hemanth Kumar Guruswamy	President (Operations)	IIM – Ahmedabad (PGDM /MBA) & B.E from College of Engineering, Guindy, Chennai	25+ years of Experience

Miklens Bio

Deriving its name from words Microbe (Mik) and Microscopic Lens (Lens), Miklens Bio is an Agri-Biotechnology startup involved in research and development of bio-based inputs. The product categories include Plant Protection, Plant Growth Promoters, Bio Pesticides, Bio Fertilisers.

Miklens Bio' technology boosts both yield and quality of the crop in a chemical free and residue free manner.

Product Description

Miklens Bio uses Agri-Microbial Technology (AMT) for developing its products. Using AMT, Miklens Bio has been able to roll out products across various categories.

Agri-Microbial Technology (AMT)

Organic products in the market presently use microorganisms. A certain strain of a microbe is identified and used either as a pesticide or a fungicide. This strain is multiplied and sold commercially. The drawback of this process is that these microbial strains are live in nature and thus are prone to issues such as sensitivity to physical conditions and limited shelf life of 9-12 months. Thus, the liquid solution containing these microbes loses its efficacy.

Miklens Bio addresses this problem by identifying the microbes or a consortium of microbes. The microbes come from identified species and are tested to be harmless for human food chain. These are multiplied using fermentation process and subjected to conditions of extreme stress like high temperatures or concentrated solutions. This causes the microbes to release bio metabolites which can act as pesticides, fungicides, and growth enhancers. This technology is the core of Miklens Bio' product development and is termed as Agri-Microbial Technology (AMT).

Unlike chemical products, AMT based products can be used for multiple generation of pests, as pests do not develop immunity against them owing to their biological nature of action. This ensures that the cost of production for the farmer is lesser as repeatability is lesser and usage efficiency is better unlike chemical products.

Since the AMT products are organic in nature, they do no leave any harmful residue on the crop. Another advantage of these products is that they cannot be reverse engineered as they consist of by-products from a consortium of bio metabolites.

The shelf life of AMT products is 3-5 years and the cost of production to the farmer as quantified in the pilot studies is 20-25% cheaper in comparison to the industry leading chemical products.

Miklens Bio is also conducting trials for Bio-Herbicides and the product will be ready by 2020.

Intellectual Property

Microbes exists biologically and cannot be patented but the process of utilizing them for a distinct purpose is novel. Miklens Bio has 6 patents for different processes and products and has applied for another. It also has trademarks for the company logo and name.

Initial Challenges Faced

Product Optimization

Primary challenge Miklens Bio faced was with consistency in terms of results while doing trials for the products. For e.g. Efficacy of a product is highest between 0-20 degree Celsius, but to optimize it to be active till a temperature of 40-50 degrees was challenging. It took over a year of trials to perfect the products and make them viable for Indian conditions.

Product Specific Legislation

Government regulations are the biggest challenge for Miklens Bio in India. Its product falls under 'water soluble fertilizer' category. This category is not subsidized in India. Almost 99% of water-soluble fertilizers are imported from other Asian manufacturing giants and are synthetic (chemical based). Miklens Bio's product gives a maximum NPK (Nitrogen-Phosphorous-Potassium) value of 12 which is equivalent to NPK value of over 30 from chemical fertilizers. The approval process for Miklens Bio's product from the FCO (Fertilizer Control Order) is 5-7 years long. Products such as Miklens Bio have a dedicated category for them with a separate approval mechanism in US and Europe, a similar mechanism is absent in India.

Business Model

Miklens Bio follows a strict Business to Business (B2B) model and works with Agri-Businesses,

Miklens Products

Agri-Input Companies, etc. The company works on distributor-based supply chain model. Before entering into business with any distributor, the company does stringent due diligence. It works exclusively with large scale dealers having an elaborate network across the country.

The company also caters to the global market and exports its products to over 4 countries. It has signed a Memorandum of Understanding with a Canada based Agri-Input companies to be its sole distributor in the United States and Canada. The company follows similar models with partner companies in other countries.

Market Presence

Miklens Bio is present in most Indian markets except Madhya Pradesh (MP), Western Maharashtra, certain parts of Andhra Pradesh and Uttar Pradesh. These markets will be accessed once Miklens Bio has optimized its dealers and distribution model for them. Miklens Bio has impacted over 13000 farmers by April 2019. It aims to reach 100,000 farmers by mid-2020.

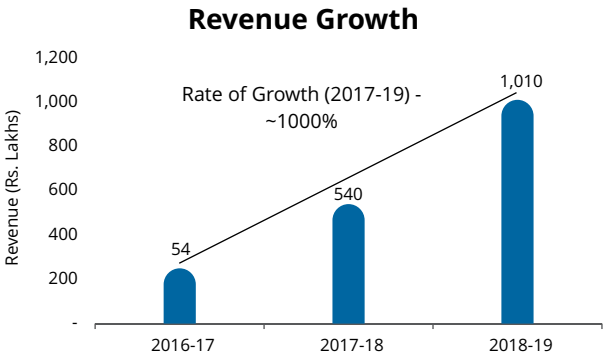
Miklens Bio also exports its products internationally to United States, Canada, Mozambique, and Mauritius, and follows the same dealer/distributor model for these countries.

Key Partnerships

Miklens Bio has been boot-strapped till now and undertaking projects with BIRAC (Biotechnology Industry Research Assistance Council) and major Agricultural Universities in India.

Financial Analysis

Miklens Bio went commercial in 2016 and closed the FY 16-17 recording a revenue of INR 54 Lakhs. The company broke even in the subsequent year with INR 5.4 crores in 2017-18 and INR 10.1 crores in 2018-19.



Requirements for Scaling-up

Policy Needs

Miklens Bio needs the approval process for its products to be easier and transparent. At present since there is limited knowledge of the product, there is an absence of a specific law in place for products that utilize bio metabolite extracts from microbes and they are subjected to standard process for chemical or live microbe products, thus some of the testing they are asked to undergo is irrelevant for them. This is not only time consuming but extremely expensive as well and hampers the growth of a tech-startup.

Funding Needs

Miklens Bio' primary requirement is investment as it wants to invest in its own laboratory for equipment like Chromatographs, Fermenters etc. Also, to sell the products internationally, toxicology tests are essential and each toxicology test for a product is expensive, thus funding is required for Miklens Bio to sell more of its products internationally.

Core Team Profile

Name	Designation	Educational Qualification
Mr. Santosh Nair	Managing Director	Master in Financial Management from NMIMS
Mr. Oinam Nganthoisana Chanu	Sr. Scientist	M.Sc. in Biotechnology from Bangalore University
Mr. P. Rama Krishna Reddy	Sr. Manager Production	Master of Science (Chemistry) from Nagarjuna University
Mr. Rikesh Srivastav	Regional Manager	M. Sc. From Ram Manohar Lohiya University
Mr. Sanjay Das	General Manager-Eastern Region	M. Sc. From Kolkata University
Mr. Abhilash K P	Principal Scientist	M.Sc. in Biotechnology from Tumkur University
Mr. Srinidhi C S	Sr. Scientist	M. Tech in Biotechnology from Tumkur University
Mr. Basawaraj C	Manager Finance	CA (Inter) , ICAI

Ninjacart

Ninjacart is a Fresh Produce Supply Chain Company that uses technology centric solutions to supply fresh fruits and vegetables to businesses. The company's innovative model has disrupted the fresh produce procurement and distribution process in India and has helped farmers realize a better price for their produce while benefiting businesses, and help end customers access quality produce in a cost effective manner.

Product Description

Ninjacart has developed a highly efficient supply chain model for procurement and distribution of fruits and vegetables to businesses such as Kirana (grocery) Stores, Restaurants, and Retail Chains.

The company develops weekly forecasts for demand and plots the customer growth plan for the entire week. It combines the historical demand data and present market conditions to prepare weekly sales and procurement forecasts. Forecasting helps the company to reduce wastage of produce by procuring only the needed amount. Post forecasting, the weekly indent is given to the partner farmers based on their existing harvesting calendar.

The company researches product prices from different markets and analyses them to set prices for its products. Based on the indent, the farmer brings the produce to the nearest collection center where it is checked against stringent quality standards, weighed and packed to be sent to the distribution centers in front of the farmer to ensure transparency. The farmer gets a receipt of the transaction and money is deposited in the account within 24 hours.

The produce is brought to fulfillment centers and batched according to the distribution centers.

Segregated Produce Post Sorting

The company has its proprietary 'Queuing Technology Model' through which high volumes of product is processed and queued with negligible error margin. The model has pre-set conditions which make it less dependable on physical communication between team members. It can move and dispatch the produce to distribution centers in less than 30 minutes post its arrival at fulfillment centers.

From the distribution centers, the orders travel in GPS enabled last-mile-vehicles to the customers. The driver is equipped with a smartphone for

tracking the route and tracking the payments which are deposited in the collection centers at the end of a delivery run. Ninjacart has over 70 fruits and vegetables that the customer can choose from.

Ninjacart follows a 'One-Touch Method' where the produce is only physically touched once throughout the entire process when it is brought by the farmer to the collection center and packed to be sent to the distribution center. This removal of repetitive human contact with the fresh produce helps reduce wastage and ensures better quality with longer shelf life.

From a sourcing perspective, the company has identified horticultural hubs across the country where a particular product is grown. It has established collection centers in the vicinity of these hubs where the farmer can bring his/her produce. It has an agnostic approach toward land size and amount of produce grown by the farmer while partnering with them. The only factor that the farmers must adhere to are the pre-defined quality standards, and fulfilling the accepted indent, therefore maintaining consistency in the entire supply chain. The company ranks farmers based on the consistency and gives them feedback on improvement.

Ninjacart offers 100% traceability of its products. Through RFID tagging of each crate, it can trace the produce back to the farmer from whom it was procured, the exact time and location of procurement, the employees who handled it during the entire process and the vehicle it was delivered, among many other factors.

Ninjacart has extensive demand, supply, pricing, and market forecasts for the past four years. It is now working on a Farmer Development Program where it will leverage this data to provide customized plans to its partner farmers about growing patterns and standard practices for improved quality.

Intellectual Property

Ninjacart's Intellectual Property lies in disrupting an age old business model of supplying produce to the Kirana Stores and making it highly efficient and reliable. More than 40% of the total cost incurred by the customer is incurred in the supply chain process. By optimizing the supply chain and removing multiple layers of middle men involved the company is reducing the operational cost and transferring the benefit to the farmers while making the produce cheaper for retailers and end customers. Building a supply chain that can accommodate variables that change every day like demand, supply, selling price, purchase price, etc. is the company's Intellectual Property.

Challenges Faced

Business Model Optimization

Ninjacart entered an uncharted space in terms of business models. There weren't any India-centric templates available for the company to base its model upon. Initially it started as a Business to Customer (B2C) platform and focused on delivering fruits and vegetables through a mobile application to domestic customers. They had a 60-minute delivery promise for the orders placed through the application. The company followed this model for initial 6 months and deduced that is neither profitable, nor scalable. This inspired them to research the troubles faced by Kirana Store owners who spend 3-4 hours everyday in mandis for purchasing fresh produce and further pay for the transportation of this produce to their shops. There were many wholesale delivery companies for other non-perishable grocery items but an absence of a major chain for the fresh produce. Hence Ninjacart pivoted to a Business to Business (B2B) model.

Business Model

Ninjacart is a Business to Business (B2B) company working primarily with Kirana Stores (95%) and Restaurants (4%).

It follows a Daily Order System where customers can place an order on the mobile application (available for both Android and iOS) between 11 am - 8 pm and the order will be delivered before 8AM the following day. The company has a 99% fulfillment rate and a 98% on time delivery rate. The payments are collected by the delivery executives from the store owners and deposited at the distribution centers. The farmers are paid by the company within a 24 hour time period of bringing the produce to the collection centers.

The farm advisory vertical that the company is working on will be a free of cost service that it will provide to its partner farmers.

Market Presence

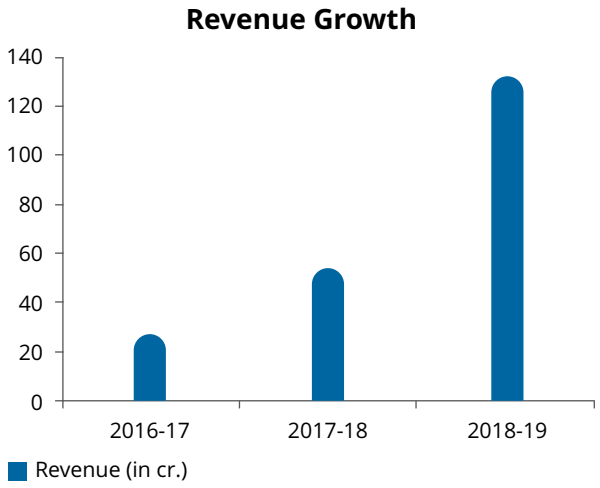
Ninjacart is operationally present in 7 cities – Delhi, Mumbai, Pune, Ahmedabad, Chennai, Bengaluru, and Hyderabad. It serves over 70,000 customers every month with a target to reach 100,000 customers per week by the end of 2019. It sources the produce from 18 states across the country and 20,000 partner farmers.

The company wants to increase its presence in the existing cities and expand into new customer segments and new product categories before expanding to other cities.

Key Investors

Financial Analysis

Ninjacart is targeting to be city level positive in 3 out of the 7 cities by the end of 2019.



The company had a revenue of INR 27 crores in 2016-17, INR 54 crores in 2017-18, and INR 132 crores in 2018-19. The revenue grew at a rate of 388% between 2016 and 2019.

Requirements for Scaling-up

Policy Needs

Under the current tax regime, purchase and sale of unprocessed food like fruits and vegetables is exempt from GST. However, companies like Ninjacart, which are involved in the supply chain side of it can't do not get the benefit of Input tax credit of the taxes that they pay on purchase of assets (crates/machinery if any) and services. Such organizations would benefit from a provision whereby they can claim a refund for the taxes that they pay.

Sorting in Progress

Core Team Profile

Name	Designation	Educational Qualification
Mr. Thirukumaran Nagarajan	CEO	IIM-K (PGDM, Finance and Operations); CEG (B.E., Electrical and Electronics)
Mr. Kartheeswaran Kandaswamy	COO	IIM-A (PGP, General Management); CEG (B.E. , CSE)
Mr. Vasudevan Chinnathambi	Co-Founder	SOIL (MBA); SASTRA (B.E., Biotechnology)
Mr. Sharath Loganathan	Co-Founder	IIM-K (PGDM, Marketing & Operations), Anna University (Bachelors in Mechatronics Engineering)
Mr. Ashutosh Vikram	Co-Founder	IIM-K (General Management & Strategy), BIET Jhansi (B.Tech Computer Science)

Samunnati

Samunnati as an organization has taken a 'Value-Chain' view of agriculture by focusing on each buy-sell transaction. It works with farmers, agri-processing companies, trading companies, FMCG companies, and all the intermediaries between in these. It provides financial and market linkages to each one of these intermediaries to meet the working capital deficit. By removing this deficit, Samunnati helps the entire value chain progress to a higher value equilibrium.

Product Description

Samunnati works on both demand and supply side of the value chain. On the supply side it works with enterprises that work with the farmer through Farmer Producer Organisations (FPOs), Cooperative Societies, Self Help Groups (SHGs), and other social enterprises. On the demand side it works with the entities that represent demand in the market such as packing houses, grading companies, food processing companies, modern traders, mandi agents.

Samunnati brings in an innovative value chain approach to Agricultural lending, offering customised solutions, both financial as well as others. Traditional lending products in the agricultural sector are asset backed, rigid and often fail in ascertaining creditworthiness of the value chain player. Samunnati leverages on the strength of transactions as well as the existing buyer-seller relationships. A cash-flow based approach is followed and products are designed to cater to the needs of the client. Risk is mitigated by considering the value chain in which any enterprise is functioning, rather than following a transaction-based approach. Samunnati takes up intense client engagement and Deduction at Source (DAS) to reduce the risk further.

The company has two categories under which it offers its services:

1. Financial Services

Samunnati has following working capital services for its clients:

- **Input Loan** – The company provides loan for purchasing input requirements such as seeds, fertilizers, pesticides, machines, etc.
- **Procurement Loan** – The loan is given to clients for purchasing outputs. A food processing company would take it to purchase the produce from and FPO, and an FPO might take the same loan to procure produce from its member farmers. The loan is taken in situations where the money is received from the ultimate buyers of the output.
- **Receivable Financing Loan** – This is a bill discounting loan which is given to cover the period between the completion of sales of the produce and

the actual payment. It is used by clients to circumvent their working capital shortage during the credit period.

- **Capital Requirement Loan** – It is given for capital intensive investments such as purchasing Bulk Milk Chillers, Grading-Sorting-Packing Machinery, Drip Irrigation System, Infrastructure Development etc.

All of Samunnati's loans are EMI based instead of Bullet Loans which are more prominent in the agricultural sector.

The company is different from a traditional NBFC or Bank as it doesn't draw comfort from any form of hard collateral from its borrowers but instead from two different capital types:

- **Social Capital** – The affinity between the members of a cooperative or a SHG where they cross guarantee each other is termed as the groups Social Capital.
- **Trade Capital** – The relationship between a buyer and a seller that determines the factors through which they transact with each other is termed as Trade Capital.

The company's entire under-writing is based on these two forms of capitals instead of hard assets and that makes it access many such categories that are hitherto considered 'High Risk' by mainstream banks and NBFCs. The risk taking capability where the company is willing to take exposure on entities with weak balance sheets is what differentiates it from the other institutions.

2. Market Linkage Services

Other than the services around working capital requirements, Samunnati also provides market linkages to its clients where it introduces suppliers to buyers and vice versa, thus helping diversity this pool and help connect the customers with each other enabling them to benefit from the working capital linkage that comes out from their association.

The company facilitates transactions between buyers and sellers in the absence of sufficient comfort between the two through Trade Credit. It acts as an intermediary and allows the transaction to pass through itself while not physically taking control of the products but having the title of the goods change on paper. Samunnati then acts as the trader and sells the products to the while taking ownership of the risks. Through its Market Linkage services, Samunnati is enabling a broad trade ecosystem as one of the bottlenecks in the sector is limited pool of buyers and sellers, thus de-risking the customers and helping them grow.

3. Aggregations, Market Linkages, and Advisory Services (AMLA)

Named after the Indian gooseberry, Samunnati's AMLA range of services are based on the thought process that a purely lender based model cannot succeed in agriculture and it has to be bundled with aggregation and advisory services. It works with aggregations of farmers who obtain loan through it and help them with market linkages, and customized advisory about improving and optimizing their business.

Samunnati considers itself an internal stakeholder in the Agri Value Chain and not an external financing company and offers products customized for the economic activities of the borrowers and customers.

Intellectual Property

The uniqueness of its business model where it provides a whole host of services such as advisory and market linkages along with facilitating the capital requirements while not taking comfort from hard assets but from Social and Trade Capital is the company's intellectual property.

Challenges Faced

Business Model Optimization – The primary challenge that the company faced was associated with the category of customers it aimed to serve. Working in the agricultural sector, there were certain risks such as Agro-Climatic Risks, Geo-Political Risks, etc. on which the company didn't have any control. Thus, it had to build a model that is more resilient than regular financing models. Since it was solely dedicated to the agricultural sector, it didn't have a de-risking segment that could insulate it from the risks of the Agri sector. The company optimized its model to include the soft assets as collaterals and to work with farmer federations and cooperatives to avert these risks and make the model scalable.

Business Model

Samunnati follows a Business to Business to Customer (B2B2C) model. It believes in the principle of aggregation as the Indian smallholder farmers are too segregated to serve individually and have a high risk on the Time-Risk-Cost-Scale Paradigm. Owing to the high risk, the company works primarily with aggregators with good social as well as trade capital. . The aggregators from a supply point of view can be Cooperatives, FPOs, SHGs. Mutual Benefits Trusts, and Social Enterprises that serve the purpose of aggregating the requirements of the members and providing them with services while procuring outputs from them.

From a demand point of view, the customers that Samunnati works with are Small and Medium Enterprises, Agri-Input Companies, Food Processing Companies, Farmer Producer Organisations and other Community Based Organisations.. It works with both SMEs and publicly listed companies for providing them with ad-hoc working capital requirements and linking them to the appropriate market segment.

The company has mapped the entire Agri Value Chain and filtered out several risk types. It uses this model to provide customized products to its clients and not follow a pre-set template. The loans given by Samunnati can range between a tenure of 5 days to 5 years and an amount of INR 5 thousand to INR 5 crores. Example: For a dairy sector cooperative, Samunnati would provide Input Loan to purchase cattle, Procurement Loan to procure milk from the member farmers, Working Capital loan to cover the credit period between selling of milk to a customer and receiving of payment, Capital Requirement Loan for purchasing Bulk Milk Chillers, Pasteurization Machines etc. It would also help facilitate linkages with new clients that the cooperative is not serving presently. Thus, covering the entire operational landscape of its client.

Market Presence

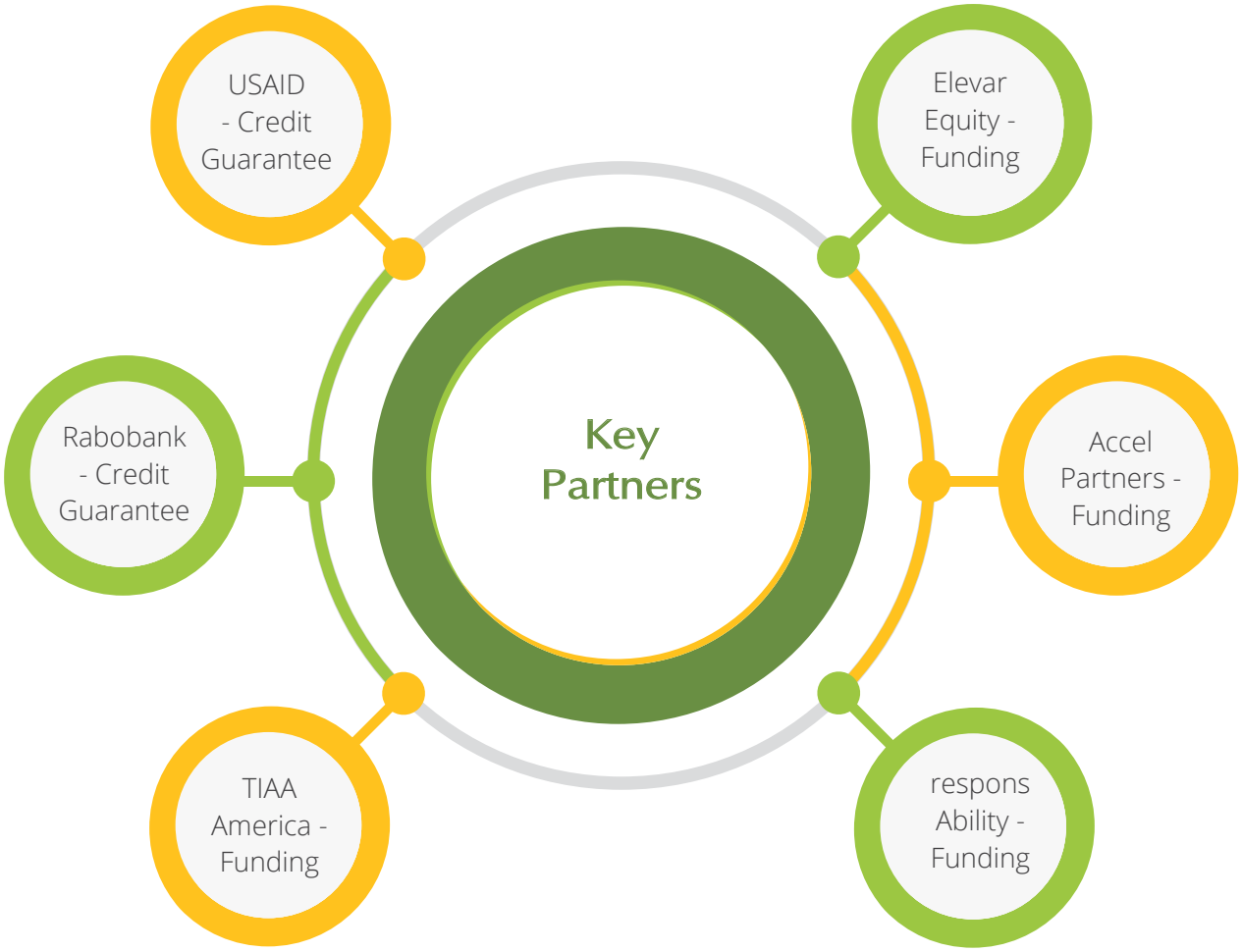
Samunnati is present in 15 states across the country and in 34 Agri-Value Chains that it has mapped into 5 broad buckets – Fresh Produce, Livestock, Commodity, Inputs, and Food Processing.

The company is headquartered in Tamil Nadu and present in Karnataka, Telangana, Andhra Pradesh, and Kerala in Southern India; Gujarat and Maharashtra in Western India; Orissa, Chhattisgarh, Bihar in Eastern India; Delhi, Rajasthan, and some parts of Uttar Pradesh in Northern India. In totality, it is present across all agrarian states in the country for both commercial crops and staple crops. It has a stronger footprint in Southern and Central India and is working to establish stronger presence in Northern and Eastern parts of the country.

The company's agenda is to focus on India primarily and use the insights generated from the smallholder agricultural value chain model in a strategic advisory capacity in countries with similar geographic and economical structures like India.

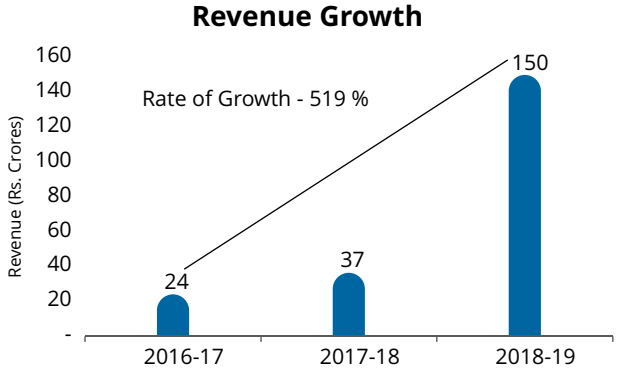
Samunnati is serving 760 customers across the country and has disbursed over INR 2000 crores in capital till date. It has Assets Under Management (AUM) of around INR 600 crores. The company has benefitted in excess of 2 million farmers till 2019.

Key Partnerships



Financial Analysis

Samunnati has Broken Even and is profitable since 2018. The company had a revenue of INR 24.2 Crores in 2016-17, INR 36.7 Crores in 2017-18, and INR 150 Crores in 2018-19.



Requirements for Scaling-up

Policy Requirements

- Samunnati recommends the government to consider Agricultural NBFCs on par with Banks and NBFCs. Agriculture is considered as a priority sector for lending activity by Banks whereas NBFCs are yet to be considered as a vehicle of delivering financial inclusion to the agricultural sector. Agricultural NBFCs like Samunnati should be classified as priority sector lenders on par with the banks.
- The government has many schemes such as CGCMSE and Credit Guarantee Schemes by NABARD, FSAC etc. which are only available for commercial banks. The same schemes should be extended to Agricultural NBFCs too.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Anilkumar SG	CEO & Founder	MBA – Asian Institute of Management	30+ years

Skymet Weather Services

Skymet Weather Services Private Limited is India's leading weather & agriculture risk monitoring company, providing real time weather information, weather forecasts and agriculture risk solutions to government, non-government organizations and agencies.

Product Description

Skymet provides real time and accurate weather forecasts at the hyper local level, thus making it India's largest IoT based weather sensor network operator.

The company has a network of over 6500 + Automatic Weather Sensors (AWS), over 250 Air Quality Sensors, and 1000 Lightening Detector Sensors that can detect Lightening to Cloud to Ground which is required to predict the areas under thunderstorms and hailstorms. Apart from an elaborate sensor network, it also has a fleet of drones used for data gathering at farm/village level. The company also employs on ground staff for collecting localized micro-data specific to an area or a farm. The employees are trained to operate and maintain the AWS setups using smartphones and also to capture crop pictures and videos.

The entire operation of Skymet's business is centered around three products – SWIMS, ARMS and SkymetOne.

Drone Deployment

Product 1 – Raw Data Collection and Assessment

Skymet generates raw data for a region for its clients: primarily insurance companies. It installs a weather station in the crop growing areas where an insurance scheme from their client is in place. The quality check and verification of data is done by Skymet and a certificate is provided to the insurance company at the end of the season/pre-specified time period. This data certificate enables the clients to take informed decisions about insurance claims for that area.

Product 2 – Historical Data Hindcasting

Skymet has used the present-day weather datasets to hindcast and create graded dataset starting from 1951. This dataset offered as a product by the company has weather and crop pattern grid for every 10kms across the country. This is used for historical analysis of weather performance for a given period and its effect on the farms and crops. The company also has productivity data from external sources. These datasets can be correlated to deduce the performance and production of a farm in a given weather condition at a particular point in time. The company has created similar product for the Bangladesh Government which was sued to design the National Crop Insurance scheme for the country. World Bank has evaluated the product and provided support for adopting it in Bangladesh and Sri Lanka.

Product 3 – Skymet Weather Information Management System (SWIMS)

SWIMS is the flagship product of Skymet and is primarily used by insurance agencies, banks, Agri-input companies, etc. to predict and optimize their supply chain activities. Other than Businesses, many tech-savvy farmers are use the service as well to plan their crop cycle based on the weather predictions. Three components of SWIMS are:

1. **Historical Dataset** – Hindcasted Cadastral Data
2. **Current Weather Data** – Real time data about weather patterns and climactic conditions
3. **Weather Forecast** – Near future and long-term future weather forecast and advisory

   Primary data source used by SWIMS is satellite data which is further enriched with the following datasets:

   - **Sensor Network Data** – Data generated by Skymet's network of weather, air, and lightening sensors
   - **On-Ground Data** – Data recorded by the on-ground employees by visiting the farms
   - **Government Data** – Land record data, demographic data, socio-economic data etc. Skymet has strategic tie up with the government for obtaining this data
   - **Drone Data** – Final layers is the data generated by Skymet's drones

Based on the application usage of clients, data from either of these sources can be selectively used to create a customized solution.

Product 4 – Agricultural Risk Monitoring System (ARMS)

1. **Insurance Module** – The primary requirement for this module is cadastral data on crop risk. Skymet has used satellite data to analyze crop risk for the entire country for the past 10 years. Based on this analysis and ground radar data, it has created insights on the crop performance in different geographies on the basis of weather and satellite conditions. The company has defined Risk Indexes for different areas and crop types. This module is subscribed by Insurance and Agri-business companies who use it to understand historical risk in a certain geographical location and customize their products accordingly. Crop health, crop acreage, distressed areas, per acre productivity are some of the factors covered under the module.
2. **Banking Module** – Skymet has created a dedicated module of ARMS for the banking sector with an additional layer of Farm Risk Assessment. The farm level data is combined with the standard analytics used for the Insurance Module in this module. This module is used by the banks to keep a track of ownership of farm land details, farm performance etc. This information is compared to the farmer's declaration and helps the banks with Farm Loan related decisions.

ARMS aims to bring transparency in the banking and insurance sector related to crop and farm related activities. The product is used by leading public and private sector insurance companies and banks.

Product 5 – SkymetOne

Skymet's Business to Customer (B2C) platform for individuals who can subscribe to different information at different levels such as location specific weather forecast and data.

Product 6 – Skymet Weather Application

Skymet's free to download application that provides real times weather information, hyperlocal weather forecast, air quality index, weather alerts and videos to general public, free of cost. The application is a brand awareness tool to increase the company's recognition.

Intellectual Property

Skymet's most important intellectual property is the data recorded from its Automatic Weather Stations, Air Quality Sensors, Field Agents, and other sources.

Another important IP for the company is its proprietary algorithms and analytical models. These algorithms are based on Machine Learning and can process complex datasets to generate useful outcomes.

Skymet has filed for several international patents to protect its IP globally. The company has Trade Secrets for its data and algorithms and is working towards filling for patents for the hardware applications of the products.

Automatic Weather Station

Challenges Faced

Data Generation

Unavailability of data sets for agricultural purposes was a major hindrance faced by Skymet. In the initial stage, there was a lack of agricultural data to be used for banking and insurance purposes. Primary focus was on satellite data which is of little use during the monsoon season as the satellites were unable to capture fine details because of the dense cloud cover. Skymet circumvented this hindrance by using Drones for capturing the data and overlaying different datasets to develop a comprehensive model.

Skilled Manpower

Lack of technically skilled manpower is a regular challenge that the company faces. It needs dedicated resources to maintain and operate the Automatic Weather Stations across the country, record the crop related data on ground, operate and maintain the drones, etc. Skymet trains technically unskilled staff to perform different actions based on the requirement and deploys them at different locations. Finding people who can multitask and perform the necessary duties is a major hurdle in scaling-up for the company.

Business Model

Skymet follows both Business to Business (B2B) and Business to Customer (B2C) models:

B2B

SWIMS, ARMS, Raw Data Collection, and Data Hindcasting are products targeted toward businesses. These are subscription-based products where the clients can customize the services based on their requirements and pay accordingly.

B2C

The SkymetOne platform is targeted toward individual customer who need localized data for a specific location. This is a pay-as-you-go model where the prices vary according to the level of data needed.

Skymet also earns revenue by advertisements on its web portal and mobile application. Going forward, the company plans to make these platforms advertisement free.

Market Presence

Skymet's focus has been toward having a pan-India presence. With its network of weather stations and sensors, it covers over 30% land area of the country and over 70% of the total agricultural area. It has subscribers and customers from the entire country.

Skymet impacts over 20 million farmers annually. Data and insights generated by it are used for loan settlements and crop insurance assessment of farmers across the country.

Skymet also has a dedicated YouTube channel generating over 400+ videos monthly, for dissipating weather-related information and the channel has over 500,000 subscribers. During the monsoon season the channel gets over 10 million views monthly with a watch time of over 13 million minutes monthly.

Key Partnerships

Villgro - Funding

Omnivore Partners - Funding

Daily Mail General Trust - Funding

Insurance-Resilience Fund - KFW Bank, Germany - Funding

Financial Analysis

Reportedly, Skymet is revenue generating and profitable with an annual revenue of INR 28 crores for 2018-19.

Requirements for Scaling-up

Industry Partnership - The data that Skymet is generating holds untapped potential for serving the agricultural, credit and insurance sector. New and innovative products can be created using this data in ecommerce, banking and many other sectors. This data can be used in conjuncture with agrometeorological data sets which has been historically captured to determine a more accurate correlation between geographical parameters and agricultural performance. Skymet is seeking partnerships with the industry for developing such products.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Jatin Singh	Founder and MD	M. A., International Relations & International Communications, Boston University, Boston, USA. B.A. (Honours), Political Science, Kirori Mal College, University of Delhi, India	30+ years
Yogesh Patil	CEO	PGPXM, Great Lakes Institute of Management, Chennai, India B.E (Electronics), Dr. D Y Patil College of Engineering	14+
Vivek Singh	Deputy CEO	MBA (IT), Sikkim Manipal University DNIIT (2 Year Advance Diploma in Information Technology), NIIT, Lucknow B.Sc. (Mathematics, Comp Science), Lucknow University, Lucknow	14+
Dr. Makarand Kulkarni	Chief (Product Planning and Quality)	Ph. D, Atmospheric Sciences, University of Pune, Pune, India M.Sc., Space Sciences, University of Pune, Pune, India B.Sc., Physics, Shivaji University, Kolhapur, India	10+
Dr. Sudhakar Manda	Chief, Remote Sensing and GIS	Ph.D.: From Delhi University, Delhi on Groundwater exploration using Remote Sensing, Geophysical and Structural methods in Mathura-Bharatpur region Master of Science (M. Sc.): Geology with specialization in Hydrogeology.	21+
GP Sharma	Chief Meteorologist	Presently Pursuing PhD in Atmospheric Sciences from Bharthiar University, Coimbatore MBA, Osmania University MSc in Nuclear Physics, IIT Roorkee	35+
Rekha Mishra	Head of Market Research	MBA (Master of Business Administration) from Institute of Professional Excellence & Management, Ghaziabad B.Sc. (Biology) from CSJM University Kanpur	15+

StellApps Technologies

Stellapps is a Product and Service provider start-up that offers end-to-end technology solutions to the dairy industry. Its mechanization tools and applications leverage Internet of Things (IoT), Big Data, Cloud, Mobility, and Data Analytics to improve dairy supply chain parameters including milk production, milk procurement, cold chain, animal insurance and farmer payments.

Product Description

Stellapps is a one stop solution for dairy farmers offering a combination of machineries and applications for milk production, cattle health management, supply chain optimization, e-Wallet for farmers, and insurance of cattle.

SmartFarms™ (Milk Production Application)

SmartFarms uses big data for analysis of productivity, yield management, animal activity and health, management of fodder, and veterinary care. It is a cloud-based system for managing farms and cattle, right from milk production to keeping the farmer informed of the payments made. It uses data analytics for providing the user with animal health, breeding, fodder management, productivity, and yield management information.

SmartFarms constitutes of the following devices and applications:

- **mooON device (Activity Meter)** – A sensor-based device that is put on the leg of the cattle and conveys data to the same cloud where all the data for one farm is fed and can be accessed by the user. It can keep track of cattle health, movement, and temperature, thus helping in preventive health care, lactation cycle management, and artificial insemination. The data can be accessed by the veterinarian in real time through the cloud.

- **mooON application (Herd Management System (HMS))** – The HMS is an application to access and monitor information about cattle health, production, veterinarian visits etc. HMS uses the data fed to the cloud by the sensors to give the user accurate information in a single location.

smartAMCU™ (Milk Procurement Device)

Smart Automatic Milk Collection Unit (AMCU) integrates Advanced Analytics and Management Information System to enable real time recording of milk procurement data which is stored in the common cloud and made available to the user. SmartAMCU makes milk procurement simple for both farmers and collection centers.

ConTrak™ (Coldchain Management Application)

ConTrak™, the Cold Chain Management Application uses sensors and web-based monitoring and reporting for Bulk Milk Coolers, Silos, and Cold Rooms. The ConTrak devices controls the cold unit and reports any change in quantity of milk stored.

mooPay™ (Farmer Wallet Application)

Enabling the farmers to make real-time payments at the point of purchase of products, AgRupay allows them to get greater cost benefits and makes the money collection process simpler and efficient.

MooKare™ (Cattle Insurance Application)

Monitoring real-time condition of the cattle, MooKareTM0 provides the farmers with accurate health, mortality, and yield estimates. This enables the farmers to have an easy insurance and claim process and ensure that they pay animal specific insurance premiums.

smartMoo IoT Router and Application Suite

SmartMoo IoT router and controller gathers data using sensors that are embedded in milking systems, attached to animals, on the cold storage units, and transmits this data to the Big Data Cloud Service Platform (SDP) where it is analyzed and conveyed to the users.

Data from all the Stellapps products can be accessed using an android based phone or tablet and on a Computer. Farmers with low end cell phones can get SMS alerts.

Cost of the system depends on the size of the farm and the requirement, with the cost increase being directly proportional to the number of sensors required. For a sample farm with 10 cattle, the entire range of Stellapps' portfolio will cost a little over INR 1 lakh.

Intellectual Property

Stellapps has applied for patents for the SmartAMCU system and have trademarks registered for 'Stellapps' and 'smartMoo'. For rest of the products, trademarks have been applied and are under the process for approval.

Initial Challenges Faced

Technology Acceptance

Dairy Co-operatives have had more traditional channels in the milk procurement sector for a very long time. Hence Stellapps had to show them the proof of concept and convince them of the benefits of using the technology in order to secure their orders.

Business Model

Stellapps follows a Business to Business approach where its target clients are Cooperatives and Private players who can either buy the products or get them on contract for the dairies under them.

It has recently started the retail wing to serve the end user directly as almost 50% of the dairy sector in India is fragmented and run by individual farmers.

Market Presence

Stellapps has over 100 clients all over the country with their Head Office in Bengaluru and Regional Offices in Delhi and Gujarat. It has field staff present in multiple other states as well. It wants to establish itself all over India, Gujarat is a huge potential market and it wants to follow an incremental approach there, i.e. to enter one market and then gradually introduce more products and features there before entering another market. It has a strong presence in Bihar where the Bihar Co-operative is its second biggest client after Hatsun Agro Products.

Stellapps has entered the international market as well with presence in France, East Africa, and Nepal. In France it has opened an office on its own and has not tied up with any private or government player. There it is focusing on the ConTrakTM vertical which is being used by the farmers to increase the shelf life of milk by optimizing the cold storage controls. Dairy farms in France are large and technologically more advanced and thus Stellapps is catering to them directly.

In Nepal and Africa, it has implemented the smartFarms™ package containing all their products and features for several clients. It attends conferences, seminars and exhibitions to approach clients. It has also appointed consultants for various states in India for business development.

Stellapps plans to launch the Herd Management System, which is a part of smartAMCU right now, as a standalone Cattle Management System for the global market.

Key Partnerships

Incubation
IIT Madras Incubation Cell (IITMIC) incubated Stellapps and provided a part of Pre-Seed Funds

Pre-Series Investor
Omnivore Capital Management Advisors Private Limited

Series A Investor
Binny Bansal, Venture, Highway Blume Venture, 500 Startups, Beenext, ARUN Seed

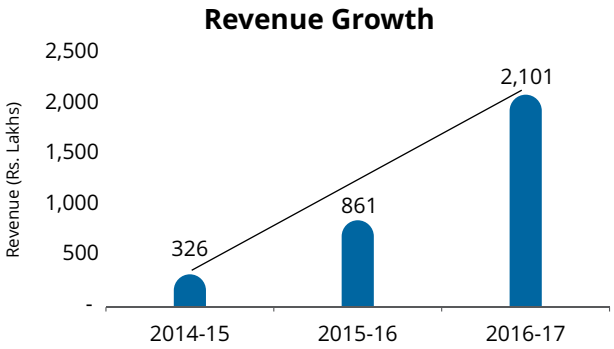
Series B Investor
The Bill and Melinda Gates Foundation, ABB Technology Ventures, Qualcomm Ventures, IndusAge Partners

Market Presence
Hatsun Agro Product Purchase the entire product range, giving Stellapps their first measure market presence

Cattle Monitoring Device

Financial Analysis

Stellapps recorded a phenomenal revenue growth, which grew at a Compounded Annual Growth Rate (CAGR) of 153% between 2014-2017.



Requirements for Scaling-up

Infrastructure Needs

Stellapps' first and foremost need from the government is to provide proper infrastructure in the villages to boost next generation technologies. In absence of proper electricity, its clients are using solar panels to power their devices. Stellapps uses a powerful 12 decibel radio system which can catch signals with just one single network bar on the phone, but even to do so, proper mobile reception infrastructure must be present. Thus, it needs from the government to provide better mobile, electricity and internet services.

Policy Needs

The National Dairy Development Board (NDDB) and other Governmental bodies follow guidelines from the Government for conventional method of milk procurement. Since there is an absence of appropriate legislation for the role of advanced technologies such as IoT in Milk Procurement, it is difficult to approach these bodies and procure their orders. Thus, defined guidelines for application of advance technologies in the dairy industry would help startups scale up faster.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Ranjith Mukundan	Founder & CEO	◆ Bachelor's degree in Electronics & Communication Engineering from BIT, India ◆ MS in Telecom & Software Engineering from IIT, Chicago	20+
Mr. Ravishankar Shiroor	Founder & Business Development Head	◆ B.E. - Electronics and Communications from National Institute of Engineering, Mysore, India ◆ M.Tech – Telecommunications from IIT Madras, Chennai, India	20+
Mr. Ramakrishna Adukuri	Founder & Chief Architect Cloud solutions	◆ M.Tech in Computer Science & Information Technology, IIT Kharagpur	20+
Mr. Venkatesha Seshasayee	Founder & Chief Architect Vertical solutions	◆ B.E Computer Science from Bangalore University	20+
Mr. Praveen Nale	Founder & Chief Technical Officer	◆ B.E Electronics from Visvesveraya Regional College of Engg, Nagpur ◆ M.Tech – Computer Science from IIT Madras, Chennai, India	20+

WayCool

WayCool is a food distribution company that sources its products directly from farmers and aggregators through a technology enabled, mechanized, and partially automated supply chain. The company leverages multiple distribution channels towards meeting the demand of both businesses and end consumers. WayCool's product portfolio includes, fresh produce (ie, fruits & vegetables), rice, dal, maida, and value-added products.

Product Description

WayCool procures the produce at the farm gate where it is weighed and graded based on physical parameters like size and shape of a specific crop type. During the time of procurement, the farmers are given an invoice with details of procurement and payment, which is done in an electronic, cash-less manner within 24-48 hours.

The produce is transported in WayCool's cold chain equipped, GPS enabled trucks to the distribution centers. Cold chain in the trucks help keep the produce fresh while they are being transported through an automated temperature controller which can be optimized at the back end. The traceability of the trucks also ensures the shortest route between farmgate and distribution center thus reducing the time and further increasing the produce's shelf life.

The distribution centers are mechanized and partially automated with minimum human involvement in the packaging process. Post packaging, the produce is transported to the company's customers which are Hotels, Restaurants, Caterers, and Retail Outlets. Each batch is RFID tagged and can be traced back to its very source.

Partner Farm

The company provides its partner farmers with a set of instructions to grow pesticides free produce consistently that can pass all accredited tests and safety measures. The company analyzes market conditions to forecast the demand-supply ratio based on which it provides the farmers with specifics on what is to be grown and how much is to be grown. This ensures that the entire produce of the farmers is procured, thus reducing wastage and benefitting the fiscal conditions of the farmers.

Intellectual Property

WayCool's innovation lies in its technology enabled supply chain model providing end to end procurement and distribution services with a traceability factor to ensure the consistency

in produce quality. The company has several copyrights and trademarks.

Challenges Faced

Business Model Optimization: Entering a domain that was relatively unexplored, the company tried several models early on for its procurement and distribution operations. After several tests, it formulated the present model.

Consistency of Quality: Working with a large number of farmers and FPOs, the company initially faced challenges with maintain consistent quality across its product range as there were several sources of procurement. By testing its products for chemicals and advising its partner farmers on standard procedures, it ensured that consistency was achieved.

Business Model

WayCool follows a B2B model and works with clients in HoReCa (Hotels, Restaurants. Caterers) Sectors as well as Retail Outlets. It also has its own retail outlet 'SunnyBee' through which it sells its produce directly to end consumers thus also following a B2B2C model. From a procurement perspective, the company works with individual farmers as well as Farmer Producer Companies/ Organizations (FPC/FPO). It partners with FPOs having 500-1000 farmers under them. It works with at least two source regions for product procurement to ensure year round availability of produce.

Market Presence

The company supplies over 250 tons of food to over 5000 clients daily in 13 cities including Bengaluru, Chennai, Coimbatore, and some tier 2 cities. It works with over 35,000 farmers directly and through FPOs for procurement of produce.

In the second phase of expansion the company would start operations in Hyderabad and Pune.

Key Partnerships

Aspada Investments: Funding

Caspian Impact: Funding

Northern Arc Capital: Funding

Financial Analysis

WayCool is profitable with tonnage and funding for scale

Requirements for Scaling-up

Partnership

- The company wants to partner with both industry and government to work with a large number of farmers and enable the adoption of new and better technologies thus helping them become self-sustainable.
- It also wants to work with industry to enter new markets and supply chemical free, healthy produce to clients.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Karthik Jayaraman	CEO & Co-Founder	B. Tech from IIT Madras Master's degree from Purdue University MBA from Indian School of Business	
Sanjay Dasari	Co-Founder	Graduate degree from Babson College of Entrepreneurship with a concentration in Finance and Strategic Management	5+

Sunny Bee Outlet

Yuktix Technologies

Yuktix is an AgTech startup that provides risk management and crop health solutions for pre and post-harvest stages of agriculture. It aims to provide the sector with solutions for managing farming related risks, improve productivity and reduce wastage.

Product Description

The core technology of Yuktix consists of new generation wireless sensors that can continuously monitor farm weather, soil conditions and warehouse environment and a decision system software that combines data with algorithms to produce actionable intelligence. Yuktix is developing new generation wireless machines that do not require availability of grid power and can operate over large areas, two of the conditions for creating digital systems for Agriculture.

Yuktix provides ankiDB cloud software to do device management and creating application dashboards. The emphasis is to enable low code dashboards to visualize and share data that can be done out of the box. This helps individuals and companies reduce the IT bill and be productive from the installation zero day. The ankiDB software provides report generation and alarm features so anomalies can be detected in real time. It analyzes the data and sends the reports to the dashboard which can be accessed by the customers for knowledge-based decision making.

Yuktix provides the following farm digitization systems for data gathering and solution implementation:

GreenSense

Micro Weather Station

The MWS monitors air temperature, humidity, pressure, rainfall, windspeed, wind direction, solar radiation, evaporation, and temperature. The hardware IP was developed by Yuktix to allow easy customizations and reduction of input cost.

Different variable of interest to agriculture practitioners are measured using semiconductor and analog sensors, rain gauges and soil sensors. The data from these sensors is collected by the Micro Weather Board and is sent to the cloud using a SIM card. The data is processed by the ankiDB software and actionable reports are displayed on the dashboard.

The insights generated from the system can be used for providing nutrients to the

crop, prediction and mitigation of pest attacks, disease prediction for the crops and monitoring of environmental conditions for farm planning. The micro level real time data from the field can be utilized to analyze weather and soil conditions and develop advisories. The weather stations can be deployed easily and have been in use at Agriculture trading companies, contract farming companies, research institutes as well as individual farmers. The work is in progress to provide weather forecasting and frost predictions.

Satellite Imaging

YukTix farm management dashboard provides satellite images that are used to develop Normalized Difference Vegetation Index (NDVI), Vegetation Cover and Health Change Map. The data can be used to locate stress host spots and allows inspection of a large area at a glance. This is suitable for large plantations that want to monitor conditions and trouble areas over time at a glance.

GreenSense

YukTix GreenSense is an off-grid precision agriculture product for open field agriculture, climate-controlled agriculture, orchards and vineyards. The innovation is in developing a pure off-grid solution that can run without grid power for years without the need to change batteries. The small size factor helps to deploy the green sense products in any setting, you just drop the sensor in any location and start receiving the data. The use of next generation IoT wireless technologies allow green sense node to communicate for kilo meters without the use of extra boosters or antennas. Multiple of green sense products can be deployed together to provide a comprehensive health picture of farm or plantations. At present the company provides temperature, humidity and soil moisture sensors. The work is in progress to add Lux sensors for light measurements. The green sense soil sensors can be deployed to regulate irrigation and save water. This can be useful in areas reeling under water stress.

All the data like soil moisture readings at different depths of root zone, rainfall, temperature and humidity is relayed in real time so the practitioner does not have to wait for the next day reports. You can monitor conditions in real time and mitigate the risks on the spot.

The insights generated can be used for ideal irrigation practices (to turn on or off the irrigation system based on moisture at different depths in the soil) and monitoring crop health.

ColdSense

Yuktix ColdSense is an award-winning solution (winner of the Indo Israel Innovation challenge) suited for post-harvest produce monitoring. The warehouse conditions are difficult to monitor without wiring as typically the storage arears have metal walls and signals do not penetrate through thick concrete walls. This also means that it is hard to deploy a solution in ad hoc fashion without making changes to the infrastructure. Yuktix cold sense product with its innovative wireless technology can work through thick concrete walls and metal posts and thus obviating the need for wiring and complicated infrastructure changes. You just walk in and drop the cold sense nodes inside the warehouse and start monitoring the stored produce health in real time. Yuktix has provided solution for Chili, Tobacco and potato warehouses. Right now, the sensors can measure temperature, humidity and carbon dioxide levels. More sensors can be added on demand.

Accurate monitoring of temperature conditions allows owners to do thermodynamic modeling and decide on optimal chiller operations, thus saving the energy cost and leading to savings.

Cold sense is battery powered wireless monitoring solution for Cold Storages and warehouses that provides continuous monitoring of the stored produce and alerts the operators for even the slightest of deviations from the prescribed conditions.

The software can analyze and provide an index score to categorize the different floors as well as locations of warehouse to see their performance every day. This allows the management to quantify the operational risks.

Intellectual Property

YukTix is in the process of obtaining multiple patents for its innovations. It has also applied for a trademark for the ankiDB software name.

Challenges Faced

Product Development - Being in the Agro-electronics space, Yuktix initially faced challenge with getting all the components together and finding a manufacturer to develop the prototypes. Commercial manufacturers worked on bulk orders and did not have a provision of manufacturing low number of units. Yuktix overcame this challenge by working with the local manufacturers and by assembling certain components itself.

Human Resource - Another challenge was to create a team with experience in agriculture, Internet of Things (IoT) and hardware manufacturing. Being a startup in the agriculture sector and with limited funds it was a challenge to attract quality talent. Also, it was difficult to locate mentors and resource who were experts in the domain to guide Yuktix on product development.

Business Model

YukTix follows a purely Business to Business to model and works with a contract farming companies, seed manufacturers, tea and coffee companies, vineyards, Agri-input companies etc.

There is a onetime cost for purchasing the systems which varies according to the need and customization required by the customer and then recurring charges for reports and analytics, and the data sim.

Market Presence

Yuktix is working with clients across the country at present in Punjab, Tamil Nadu, Karnataka, Telangana, and Uttar Pradesh. It plans to expand outside India and depending upon future funding would either partner with companies active in other countries or set up its own offices and sales channels.

Key Partnerships

Yuktix has been bootstrapped so far and is actively seeking investment from both public and private organisations.

Financial Analysis

Yuktix launched its first product in 2014 and is profitable on operational, case-by-case basis. It aims to break even by January 2020.

Requirements for Scaling-up

Policy Needs

The process of getting certification for hardware products in agriculture is time and resource intensive. If this process could be made easily maneuverable and transparent, it would help startups like Yuktix enter the market early and save capital resources.

Partnership Needs

The process of getting certification for hardware products in agriculture is time and resource intensive. If this process could be made easily maneuverable and transparent, it would help startups like Yuktix enter the market early and save capital resources.

Funding Needs

The company is seeking funding from public and private sources to expand its team and scale up the production.

Multiple GreenSense Installations

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Rajeev Jha	Founder	Graduation - IITK, PGDSEM - IIM Bangalore	20+
Shailendra Singh	Co-Founder	B.Tech (ECE)	7+

2.2 MEDIUM STAGE VENTURES

Aarav Unmanned Systems

AUS is a startup that designs enterprise grade drones and deploys fully integrated end to end solution stacks to aid in data collection and analytics for several industrial applications including agriculture. It provides drone-based surveying services for precision agriculture applications. It also creates 3D models of geographical regions to help in planning and construction of irrigation channels and watershed development

Product Description

AUS is primarily a drone manufacturer that has two types of drone configurations, equipped with mapping purpose RGB camera or specialized multispectral sensors -

Multispectral Mapping Drone

AUS operates two types of drone platforms. A Vertical Take-Off (VTO) multi-copter drone and fixed wing drone equipped with a specialized multispectral imaging sensor that covers 40-50 hectares and 200-300 hectares per flight respectively and can measure various aspects of a farm like Vegetation Indices, crop pattern, distressed farmland, chlorophyll content level, crop density etc. at a very high resolution and accuracy.

Traditionally, the farm survey is done manually by either human inspection or by taking pictures from a handheld camera, making the process slow and inefficient. Drone based multispectral surveying solves this problem by taking high resolution pictures and creating a map of the farm in which distressed regions can be identified and appropriate action can be taken. The data generated by the drone is sent through a cloud for processing and analyzed by

AUS T500i Fixed Wing Drone

AUS using its proprietary algorithms in under a day

Using this analysis, the agronomists and specialists (employed by the client) advise the farmers about the measures that need to be taken to improve the yield or mitigate a pest attack. The analyzed map has different indices that identify different stresses in different regions. Based on these indices, pesticides, fertilizers, or other inputs are recommended to the farmer. For a crop cycle of 3-6 months, the survey is done at least 3-4 times to provide analysis on every stage of crop growth.

Topographical Survey Drone

Horizontal Take-off drone that can cover 400-500 hectares per flight and is used for large scale applications like irrigation canal planning, command area development and watershed development. The traditional method of collecting information for this purpose involves manual data gathering over different terrains which is a time and resource intensive process. AUS conducts high resolution and accuracy aerial survey of the area and analyzes the information by developing a 3D map. The map is used to calculate cultivable area, terrain details, identify potential catchment locations and existing natural canals. The information is then used to design the irrigation system.

The entire system including drones, software, and analysis is offered as a package to the customer.

Intellectual Property

AUS has IP over multiple aspects of their solution covering the software and hardware design of the drones and operational methodologies.

Challenges Faced

Importing Components

The primary challenge faced by AUS was unavailability of few selective components locally, needed to build the drone. The components were not available locally and had to be imported. The regulations for importing a single piece of equipment for research purposes are same as importing large number of units for commercial purposes and was time and capital intensive. For research the parts are needed in a time efficient manner to develop the product and enter the market at the earliest. AUS lost a significant time due to this.

Import Duty

Another regulatory challenge faced by AUS was high duty for imports. Certain multispectral cameras and sensors that are used for surveying a farm land come under the category of luxury goods and the duty for them is as high as cameras used for personal photography. While the duty for agricultural imports is very low, the duty AUS paid to import these cameras and sensors was high, thus costing them a large amount of capital.

Data Set Generation

Gathering of data was another major challenge that the company faced early on. The agricultural economy has a highly varied set of data and the topography and features of the land change every 100kms. To develop machine learning and Artificial Intelligence (AI) algorithms, a startup needs a wide variety of data. There aren't any such data stacks available in either public or private domain in India, thus this process also created significant challenges the company's progress as well.

Business Model

The company follows a strict Business to Business (B2B) model and has done Proof of Concepts (POC) studies for precision agriculture applications with several state governments and Agri-input companies. It is looking to work with commercial farming companies and cooperative farming societies to set up centers of drones that would cover a certain set of villages to survey large areas and distribute the reports and solutions to the farmers.

AUS works with state governments and private companies to design irrigation projects. At present it is working with the government of Rajasthan covering 300 villages for designing irrigation system and watershed development. It is also working with the Governments of Gujarat,

Maharashtra, Rajasthan, West Bengal, Andhra Pradesh, and Telangana for implementing drone-based precision farming solutions and 3D mapping of land for irrigation and other purposes.

Market Presence

AUS is present across India working in six above mentioned states presently. It has plans to expand to multiple other countries and would access different markets depending upon future funding.

Financial Analysis

AUS hasn't broken even yet but has been operationally profitable since January 2018. It projects breaking even by December 2019. The primary sources of revenue for the company are its mining and irrigation verticals and it plans to scale up the Precision Agriculture vertical in the coming year.

Key Partnerships

Requirements for Scaling-up

Partnership Needs

AUS is seeking partnerships with agronomy, seed production and contract farming companies and with the government for conducting large scale pilots for drone-based precision agriculture solutions. The pilots would cover multiple districts in a state and create several use cases which could be replicated throughout the country.

Funding Needs

AUS is actively seeking funding from in the form of grants and non-equity-based support from both public and private sources to scale up its operations and bring down the cost of the technology. At present the solutions are 30% cheaper than international competitors and can be made available at eve lower costs in future.

Policy Needs

Government could evaluate the importable technologies and categorize the equipment needed for agricultural research and development under the relevant category. This would reduce the duty on equipment such as multispectral cameras and sensors and help the startups save time and money.

Data Needs

The company needs a stack of agricultural data sets for different districts in every state. Startups need access to data to bring in new technology solutions. This lack of data availability in the public domain is a key barrier for development of these solutions. Thus, creation of a unified single data authority is recommended, which can be accessed by the public.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Vipul Singh	Co-founder & CEO	BTech (Aerospace Engineering), Amity Institute of Aerospace Engineering Research and Studies	7+
Suhas Banshiwala	Co-founder & CTO	MTech (Electrical & Electronics Engineering)	7+

BigHaat

BigHaat is a startup focusing on digitizing the Agri-Input supply chain by linking farmers to input manufacturers in a transparent manner.

Product Description

BigHaat is an electronic platform where farmers can buy quality farm inputs across all the segments from seeds to pesticides to crop nutrition to implements machinery.

BigHaat's portfolio includes a wide range of products like fertilizers, seeds, pesticides, growth promoters and enhancers, and farm implements (small tools and instruments) which are affordable and useful to the farmer but not easily available. It has introduced several such instruments to the platform.

BigHaat brings together Technology and Data to provide personalized crop advisory to the farmers and helping them to improve on their productivity, yield and income.

BigHaat works closely with all the leading Agri-Input companies and drives the initiative of passing the benefits to farmers. It works closely with the manufacturers giving reach to their products and helping farmers access quality products. It is an engagement and advisory enterprise for the farmer, providing them guidance throughout the cultivation process.

Before partnering with an Agri-Input company, the BigHaat agronomy team performs a due diligence of the product literature and reports. For organic products, it checks the organic certificate. BigHaat follows this stringent process before collaborating with any company for selling their products on the platform.

For customer acquisition, BigHaat's first target are tech-savvy champion farmers in a village. It targets them and initially and after establishing trust with them, through word of mouth, more farmers are introduced to the platform. The farmers can access the application through a smartphone. If the smartphone is absent, farmers can give a missed call on the BigHaat helpline and the advisory team reaches out to them to understand their need and issues and recommend solutions and products accordingly.

BigHaat provides free advice to the farmer over any farming related query irrespective of the fact whether the farmer is buying its products or not. BigHaat has a database based on region, soil, season, etc. which it leverages to advise the farmers.

In future BigHaat will also offer demand-supply based advice on what the farmers should grow and to the corporates on the quantity and location of produce. BigHaat will leverage big data analytics and build this model.

BigHaat is also developing its Agrilytics platform to provide business intelligence and predictive analytics to Agri Input producers to improve their efficiencies in distribution and marketing.

Intellectual Property

BigHaat is planning to file for process patents for its models. It has a trademark for the company name.

Challenges Faced

Market Acceptance

Building trust with the farmers was a challenge initially and BigHaat addressed it by approaching them with premium brands that had recognition in the market but weren't easily available. BigHaat collaborated with all leading brands and went to the field and created awareness among the farmers giving them assurance of the quality and originality of the product. It set up a customer engagement team (an agronomy team) where farmers can get the relevant and right advisory. This also created tremendous bonding and trust with the farmers. This is what helped build the trust factor with the farmer.

Logistics

Logistics was also a challenge initially as BigHaat were dependent on India Post for delivery. This was not efficient and caused delays in delivery. BigHaat researched and collaborated with different logistics service providers for different parts of the country and overcame this challenge. At present it works with 10+ delivery partners that can service even the remotest of village.

Business Model

BigHaat follows a Business to Business model (It considers farmers as a business unit). It works with all leading national and international Agri-Input brands. Revenue source for the company is the commission charged from the brands that use the BigHaat platform for selling their products. The Agrilytics platform has a pay-per-use business model.

Market Presence

BigHaat has a farmer base of over 5 lakhs across the country. Through its awareness creation activities, branding and marketing campaigns, BigHaat aims to reach over one million farmers by 2020. Farmers from 6300 pincodes (out of 20,000 delivery pincodes in India) have transacted on BigHaat.

Key Partnerships

Ankur Capital, an early stage venture capital fund has invested in BigHaat.

Financial Analysis

BigHaat has tripled its growth in the last financial year aided by its deeper brand penetration and rural internet penetration.

BigHaat Application

Requirements for Scaling-up

Policy Needs

Presently, dedicated regulations for eCommerce models in Agriculture are undefined. The fulfilment centers have a time consuming and strenuous requirement process. Easing the process of operating and penetrating a market by bringing in dedicated regulation for eCommerce businesses would make it easier for startups like BigHaat.

Logistics Needs

Private logistics players are capital intensive to work with even if the products are meant to help the farmer. Government has a dedicated postal service 'India Post', considering that startups like BigHaat are helping the farmer and providing sustainable solutions, it can make an Agri Logistics vertical of India Post that can access the remotest of villages and deliver essential resource in a time efficient manner.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Sateesh Nukala	CEO	M.Tech, NIT Calicut	20
Mr. Sachin Nandwana	Director	B.E	16
Mr. Kiran Vunnam	VP, Strategic Marketing	M.Tech, NIT Calicut	20
Mr. Kiran Singam	Technology Leader	B.Tech	15

DigiAgri Technologies

DigiAgri is a technology-based farm management platform that provides data driven, customized, near real-time insights to farmers. The platform connects all the stakeholders in the agri-value chain: Farmers, commodity aggregators, financial institutions, service providers, and government. The focus of the company is to follow a 'whole farm approach' providing holistic solutions to the farming covering all aspects of the process.

Product Description

DigiAgri has three products -- DigiAgri (Platform for Farmers and Stakeholders along with mobile applications for farmers and stakeholders), FPO Tracker (Application for FPOs and Co-operatives), AgFin (Real-time Credit Rating for Input Financing) and F3 (Fresh, Fast and Fare Application for Farm Output Procurement Application).

DigiAgri develops customized advisory based on three sources of data:

- **On-Ground Data** – This includes farmer profiles, farm profiles, crop patterns, soil profiles. The company has designated employees called as Farmer Mitras. Each Farmer Mitra covers 140-150 farms in a district and records the data on the smartphone provided by the company.
- **Agronomic Data** – This includes good agricultural practices, pest profiles, product profiles, sensor data – This data is generated through both primary and secondary sources. The company installs IoT enabled soil sensors on the partner farms to record crucial data. Big data analytics is used to keep a track of cropping pattern and pest profiles.
- **Third-Party Data** – Including Historic/ Current weather patterns, commodity prices and yields – DigiAgri has strategic tie ups with providers of weather, pricing and yield related data.

All three datasets are processed through DigiAgri's proprietary algorithms to generate customized farm plans and insights. These insights are utilized by different stakeholders for different purposes.

Farmers

DigiAgri provides complete farm plan to the farmers including what to grow, when to grow, how to grow. Based on contextual data it informs farmers about the most profitable crops for a particular season. The farm plan has a date-wise chart on when the farmer should start the crop cycle. Depending upon the crop type and soil profile, it advices the type and quantity of fertilizers/pesticides to be used. Once the harvesting is complete, the company also helps them in selling the produce through its market linkage platform.

Agri-Input Companies

DigiAgri provides data driven insights to companies helping them optimize their operations. It has a database of farming pattern for a given area and estimates on prospective requirements for Agri-inputs in that area. It advices companies on the type of product that the farmers may need during a particular time in the crop cycle.

Commodity Aggregators

It helps aggregators identify the sourcing points for a specific quality of a specific crop. It factors the estimated amount that will be produced by farmers and sources to acquire different produce.

Banks and Insurance

DigiAgri leverages its farmer database and provides banks and insurance companies with information that helps them device real time credit rating for a farmer. The company has in depth information on the farmer and makes financial decision making data driven, removing the factor of assumptions and estimations.

Government

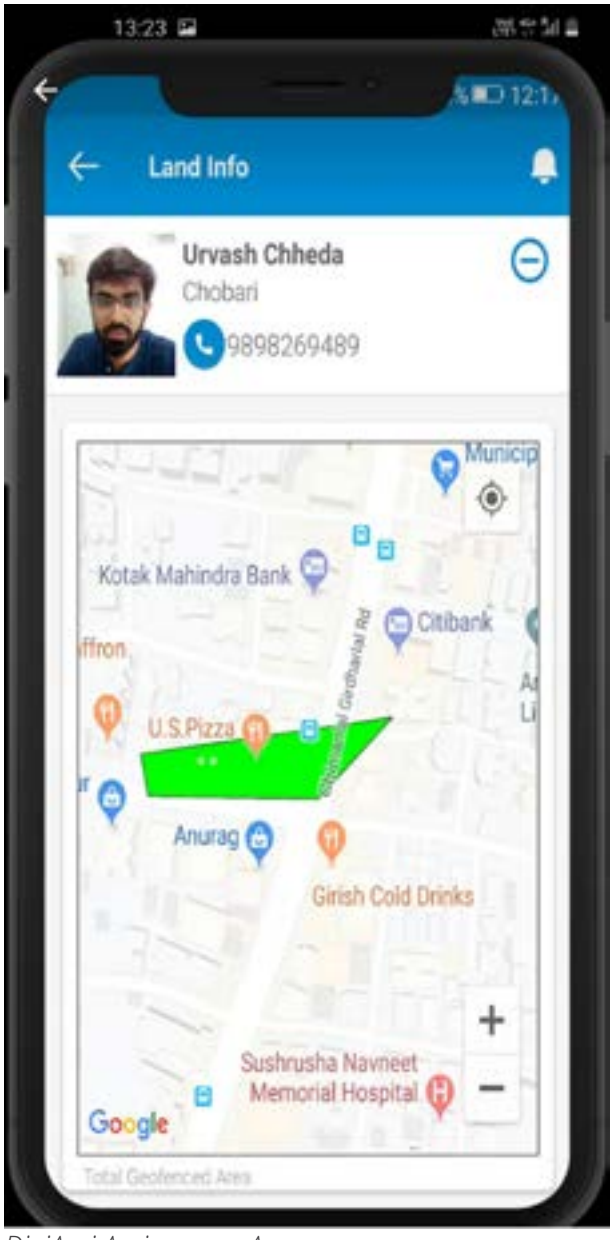
Insights generated by DigiAgri are used by several international governments for policy interventions, benefits tracking, impact assessment, among others.

Non-Government Organizations

NGOs utilize DigiAgri's insights for benchmarking purposes for their on-ground projects. German development agency Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) used the data for its activities on the ground for its project 'Mechanized Initiatives in Agriculture'. The insights help the NGOs with comparative data to present to donors and other stakeholders.

The Information is provided to the farmer through Farmer Mitras. There are also SMS alerts for farmers. Tech savvy farmers can download the DigiAgri app and get recommendations through it. Farmers can also place orders for specific products through the Farmer Mitra which are collected by them directly from the distributor and delivered to the farmer.

A team of agronomists employed by the company develop the Farm Plans and advices for the farmers. Going forward DigiAgri will have a Machine Learning model for the same, but significant amount of data needs to be generated to make it feasible.



DigiAgri Agripreneur App

Intellectual Property

DigiAgri has created algorithms for over 200 varieties of 40 crop types. These algorithms include 5 parameters – variety of crops, land, weather, demand, and cost of cultivation. These algorithms are the core IP for the company. Since algorithms/software cannot be patented in India, the company uses Trade Secrets to protect its IP. It is in the process of applying for patents for the same in the Singapore and UAE.

Challenges Faced

Data Collection

Primary hurdle DigiAgri faced early on was collection of on ground data. Not all farmers had access to internet and smartphone. The company needed to record pictures and videos covering several parameters. This was a time and resource intensive process as the company had a set of employees travel to different locations for the purpose. It tackled this issue by employing local youths as Farmer Mitras and giving them training and guidance about collection of data and advising the farmer. This provided employment for the local youth and eased the process of data collection for the company.

Data Privacy

With multiple stakeholder sharing their data on the platform, the privacy of data is an issue. There aren't any clear guidelines about Data Privacy and utilization in India. Due to lack of legislation, it is used as per individual interpretations. This is a major challenge that the company faces regularly as interpretations differ from client to client.

Business Model

The company provides Farm Plans to the farmers without charging them anything. It follows a Business to Business (B2B) model and the revenue sources are the insights and analysis provided to its clients across the value chain: Agro-input companies, Banks, Insurance companies, etc.

DigiAgri's business model has two players, customers and audience. The audience are the farmers that receive advice and knowledge-based services. In turn the data collected from the farmers is processed and used to develop insights which are utilized by the customers. Thus, the company charges only the customers.

Revenue Sources

- **Platform-as-a-Service**: Corporate farming companies, government organisations, NGOs and development agencies etc.
- **Data Insights**: Agro-Input companies (fertilizer, chemicals, seeds), commodity aggregators and buyers, government bodies, banking and financial service companies, etc.
- **Commissions**: Agro-input (fertilizer, chemicals, seeds), banking and financial services companies, other ancillary product/service companies, commodity sales, etc.

Market Presence

DigiAgri has worked with clients across the country and world. In India it is working with over 4000 farmers directly in Gujarat, Kerala, and Rajasthan. It has impacted over 30,000 farmers and is working at various stage in India, Vietnam, Thailand, UAE, Uganda, Indonesia, Philippines, and Nepal.

The company follows a Joint Venture/Franchisee model while working outside India. It acts as a technology provider for its clients in these countries and all on ground implementation is done by the client companies.

The company aims to have a pan-India presence and increase its global presence impacting over 2 million farmers by 2022.

Key Partnerships

DigiAgri Technologies was bootstrapped.

Financial Analysis

The company became operational in May 2019 and is profitable. Its revenue for the year 2019-20 till date was above INR 1 Crore.

Requirements for Scaling-up

Agri Data Sets

Government has tremendous amounts of data that it generates and records but is not being put to use at present. This data set can be packaged and made available to startups like DigiAgri to develop intelligent algorithms for addressing several problems across the Agricultural domain.

Data Privacy Guidelines

Defined guidelines around usage of data with clear Do's and Don'ts will help all the stakeholders in the entire value chain including the startups, clients receiving insights, and farmers sharing the data. This will also help startups build credibility with international clients as it would remove the ambiguity around data sharing and usage.

Industry Partnerships

DigiAgri is seeking partnerships with the industry players that work with farmers either as part of their business models or under their Corporate Social Responsibility (CSR) activities. DigiAgri can partner with them to digitize the farms and generate insights that they can use.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Deepak Pareek	CEO	BE, SVNIT	20
Mr. Sanket Thakkar	Chief Product Officer	MCA, Nirma University	8
Mr. Nabil Azhar	Chief Strategy Offices	MBA, Lebanese American University	15
Mr. Ronak Koradia	Chief Technology Officer	MCA, Nirma University	8
Mr. Niraj Shah	Chief Operations Officer	BE, Gujarat University	7

InDrones Solutions

InDrones Solutions is an Unmanned Aerial Vehicle (Drone) solutions company, specializing in Precision Agriculture solutions. The company uses its indigenous fleet of drones for generating actionable information which can be utilized for improving crop yield and land quality.

Product Description

InDrones has three categories of drones in its portfolio. All three categories fall under 'mini and micro' classes as per Directorate General of Civil Aviation (DGCA) regulations.

The drones under the Micro class are under 2kgs, carry 300gms of payload and have a flight time of 30 minutes. The drones under the Mini class are multirotor drones with a payload capacity of 800gms and flight time of 50 minutes. InDrones also has a third category of V-Tall hybrid drones that take off like a vertical drone and transition into a fixed wing drone midair.

The drones can survey farms extremely fast, at very low cost and with extreme clarity of data. They record high resolution realistic pictures and are mounted with multispectral sensors, capable of sensing the reflectance (sunlight reflected) of the crop.

Data captured by the drone is transferred to the computer system over the cloud and processed by a multi-layered AI using photogrammetry and computer vision for further advanced analytics like digitization and plant counting.

All the data is of interest to the end customer and the information generated is a realistic georeferenced picture of the farm. Farmer can correlate it with the farm and act on the problem at that exact geolocation.

InDrones maps different aspects of a farm such as areas infested with pests and diseases, rate of growth of crop, under/over irrigated areas, crop classification etc. These are used to take timely interventions and improve the overall crop health and yield.

Apart from the services provided, InDrones offers custom built drones to the clients. These drones can be used for imaging, surveillance, etc. depending upon the client's need. The drones are built indigenously and only some parts are imported.

Intellectual Property

InDrones has trademarked the company name and is in process of applying for patents for their design and algorithms.

Initial Challenges Faced

Data Collection

Farm health mapping using Artificial Intelligence algorithms involves inputting a vast amount of farm data across multiple seasons. InDrones' needs data from at least 3 crop seasons to design a map. The company faced challenge finding partners who were ready to invest time and capital for 3 seasons before getting results. It overcame this challenge by partnering with research institutions and conducted pilots in synergy with them. It also applied for a grant from the Biotechnology Industry Research Assistance Council (BIRAC) for the project 'Practical Approach in Using Drone Technology for Farmers'.

Equipment Import

Importing certain components needed to manufacture the drone like 'Radio Module' was a challenge for InDrones as the approval process to import any such technology is time consuming and delays the technology development cycle for a startup. InDrones used lower powered locally available technologies like Wi-Fi and Bluetooth modules to overcome this challenge. In the recent times these issues are being answered by the government with digitization.

Business Model

InDrones follows a Business to Business model at present with focus on research organizations, corporate farming and substantially large farmers. Individual farmers have not been their focus due to small farm size and inability of the farmers to invest for multiple cycles of data generation. The company has a pay-per-use and a subscription based model.

Market Presence

InDrones works with clients across the country, their first project was in Orissa with International Center for Agriculture Research in the Dry Areas (ICARDA) and second and third in Maharashtra and Mysuru. The company aims to be present across the country in the coming years. It plans to work with FPOs with 50-500 member farmers for farm assessment and surveillance.

The company worked with ICARDA to measure health of crops planted over fallow land and to understand the multi-spectral signatures captured by satellites, drones, and handheld sensors over the same area.

Insights drawn from InDrone's data was used by the company to advice its farmers and to plan further production.

Automated Tree Counting

Key Partnerships

InDrones has been bootstrapped so far with various services offered by Drone Mapping technologies and working partnerships with ICARDA, Mahyco, etc.

Financial Analysis

InDrones has broken even, but agricultural services remain a minor part of the revenue stream. The Geographic Information System (GIS) and Mapping, and Industrial Inspection services are major revenue sources for InDrones. As the technology matures and customer demand increases, the agri vertical will also scale-up.

Requirements for Scaling-up

Policy Needs

The process of seeking approval for importing equipment for manufacturing the drones could be made easier and less time intensive, this will ease the research and development, and market entry for startups such as InDrones.

Partnership Needs

InDrones is seeking partnership opportunities with both private and public sector organisations to conducting large scale precision agriculture studies.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Pravin Prajapati	CEO	Mechanical Engineer, Mumbai University	07
Mr. Ravi Singh	CTO	Automobile Engineer, Mumbai University	07

Intello Labs

Intello Labs is an Agri-Tech startup that uses artificial intelligence tools including computer vision and deep learning, to build a platform for grading and quality monitoring of agricultural commodities. Intello Labs provides an image-based solution, delivered through a smartphone app, which helps in bringing transparency and standardization to quality assessment, reducing value risk and wastage in the agriculture supply chains. It has developed a ready-to-use solution for fruits, vegetables and spices. Intello's AI can generate instantaneous quality metrics based on a photo taken on a basic smart phone.

Product Description

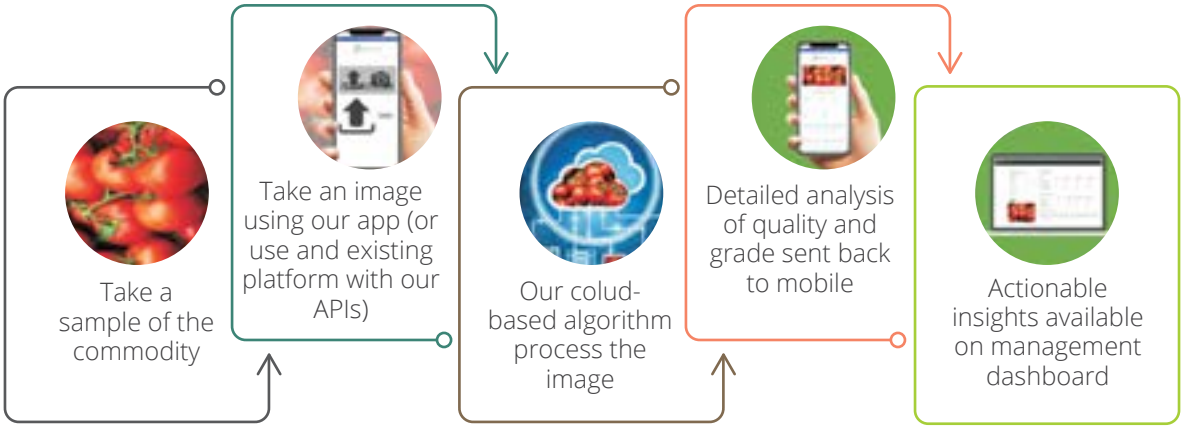
Intello Lab's flagship product deals in assaying of food and agri commodities:

Agricultural Product Grading

Intello Labs has developed an application that tests, grades and analyses the visual quality parameters or agricultural products. They presently offer services for testing and grading of wheat, tomato, potato, onions, and cardamom. They are in the process of adding 6-7 more commodities to their portfolio, including coffee, tea, and grapes. The app can be customized for each individual client based on the requirement thus deepening the knowledge of that commodity. Following are the key features of the technology:

- Quality testing time reduction from 15 minutes to 2 minutes
- Real time data sharing across multiple locations and screens
- High accuracy rate – 95%
- Standardization of quality assessment across platform and removal of subjectivity

Commodity Grading Process



Currently, Intello Labs is focused on issues that can be detected visually, although later it plans to move into other wavelengths such as near infrared where it could detect more detailed information about crop quality such as protein content, BRIX etc. The company aims to become the de-facto quality platform across agribusiness value chains for trading, procurement, grading, pricing, marketing, and traceability.

Intellectual Property

Intello Labs has the company and brand names trademarked and have applied for multiple patents for its product in India and US.

Challenges

Data Gathering

For an algorithm to process an image and generate accurate results, a significantly large dataset needs to be created. To create this data-set, large quantities of defected and discarded produce needs to be processed and defined within the AI ecosystem. The challenge that Intello Labs faces is to get the needed quantities of produce. To meet this challenge Intello Labs tries to procure the defected and damaged produce from the Agri-Mandis.

Business Model

Initially, the company plans to focus on large enterprise clients like Retailers, Traders and Food processors, before eventually switching to a Software-as-a-Service (SaaS) model to small businesses, traders, and farmers.

Intello Labs will bring its innovation to the farmer after it has been accepted by the industry. Unless the analysis and results are understood and accepted by the market, it would be of little use to the farmer.

The application is customizable according to the requirements of the customer. There is a one-time customization and purchase fee for the app and post that monthly usage fee for its use.

Market Presence

Headquartered in Gurugram (India), Intello Labs has a global presence with offices in South-East Asia, Europe, and the United States.

It works with Trading Companies in South-East Asia and with Wheat Companies in Europe and USA. Their global operations are carried out from their offices in Singapore, Stockholm and Texas.

Key Partnerships

Indigram Labs - Incubation and Funding

Nexus Venture Partners - Funding

Omnivore Capital - Funding

Financial Data

Intello Labs has raised a seed round of INR 14 crores from Nexus Venture Partners and Omnivore, which will help to strengthen the product and scale rapidly globally

Scale-up requirements

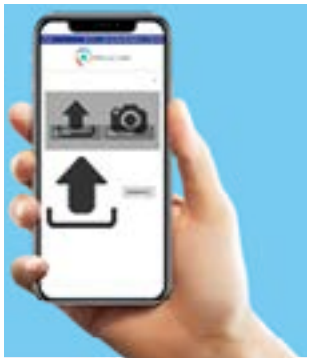
Policy Needs

A central body to certify Artificial Intelligence based quality analysis would enable the company to access more markets as the customers would trust the validations and not dispute the analysis.

Partnership Needs

Intello Labs is seeking partnership with the Government to deploy its technology on the online trading platform for agricultural commodities (eNAM). Introducing quality-based grading of commodities to the system would make it more robust and efficient and create opportunities for startups like Intello.

Open the Mobile App and place near commodity



Click the image and Submit

Image processed to give output result of quality

Product Deployment for Quality Analysis

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Milan Sharma	CEO	IIT Bombay	10 years
Mr. Nishant Mishra	CTO	IIT Bombay	10 years
Ms. Himani Shah	CFO	IIT Bombay	10 years
Mr. Devendra Chandani	Head Sales and Business	MDI Gurgaon	10 years

Hon'ble President of India Shree Ram Nath Kovind Felicitating Intello Labs

Jivabhumi-FoodPrint

Jivabhumi is an AgTech startup that connects farmers directly with commercial buyers and consumers. The company has partnered with farmers, farmer producer organizations for aggregating the produce and making it end to end traceable using its Blockchain enabled platform called FOODPRINT.

Product Description

Jivabhumi has two product verticals in its portfolio catering to direct customers as well as businesses:

Farm Produce Supply

Jivabhumi aggregates produce from its partner farmers and FPOs and sells it through different channels to a variety of customers. It has an eCommerce platform where individual customers can order the produce which would then be delivered to their homes. The company supplies produce to major retail chains as well as the HoReCa sector. The company works with a large number of organic farmers and the organic produce is sold through the online channel, as well as to corporate clients.

FoodPrint

FoodPrint is a Blockchain enabled traceability platform that digitizes the supply chain and provides farm-to-fork traceability of the produce. The platform works by digitizing the information of every single stakeholder involved in the entire supply chain process including farmers, FPOs, aggregators, suppliers, and sellers. The data about the farmers is collected by Field Representatives employed by the company who visit individual farmers and record different parameters such as farm size, type of produce, farming methods, inputs used, estimate yield, etc. on their smart phones. The Representatives also deliver Package of Practices curated by agricultural experts for the company to the farmers for maintaining the quality of the produce in each cycle. The platform enables the end user to trace the produce back to its original source through a QR Code.

FoodPrint was originally developed by the company to be used inhouse for better tracking of the produce. The platform was commended by the company's clients and received considerable attention from other similar AgTech companies. This led the company to offer FoodPrint as a product to interested customers under a Software as a Service (SaaS) model.

Intellectual Property

The core technology behind FoodPrint is based on Blockchain which being a software is not patentable in India at present.

Challenges Faced

Skilled Manpower

The primary challenge that the company is facing is lack of technically sound workforce that is willing to work for an AgTech startup. The sector has a shortage of qualified individuals who understand the agricultural ecosystem and have the skills to develop a complicated Blockchain framework. Also, it is difficult for a startup to match the compensation offered to these individual by established organizations. The company deals with this challenge by outsourcing a significant part of the product development and having fewer developers inhouse.

Quality Consistency

Working with a wide range of farmers the company initially faced issues where quality of produce varied between different batches. The company trained the farmer with similar package of practice to ensure the uniformity in the produce grown.

FoodPrint Dashboard

Business Model

The company has both Business to Business (B2B) and Business to Customer (B2C) models:

B2C

Jivabhumi sells farm produce to customers through the online platform. The customers can get weekly/monthly subscription of prechosen produce and can pay according to the subscription plan. This is the only customer centric vertical of the company.

B2B

The company sells produce to the HoReCa sector. The orders are placed at least a month in advance to allow the company to deliver efficiently.

The FoodPrint vertical is a solely business oriented vertical. Presently the company is doing 8 paid-pilots for the platform with leading food processing companies. The technology is being tested by India's leading "Spices and Ready to eat" food provider for procurement of Byadgi Chili with around 100 farmers and will be implemented to 2000 farmers in the second phase. Another pilot is being done with a client for Maize aggregation and procurement in Northern Karnataka with over 1000 farmers. The company is also piloting with an Organic Certifying Agency which is implementing the technology at the grassroot level among the farmers in Jharkhand. Another major producer of medicinal plant products is using FoodPrint for plants like Aloe Vera, Tulsi, Moringa etc.

Market Presence

The eCommerce vertical of Jivabhumi is active only in Bengaluru whereas the company supplies bulk produce to clients in Karnataka, Pune, and Hyderabad. The company works with over 3200

farmers and 15+ FPOs at present. It has mapped 1820 hectares of farmland on the system.

FoodPrint is being piloted at multiple locations in Karnataka, Tamil Nadu, and Jharkhand with over 3000 farmers in total.

The company wants to expand the FoodPrint vertical globally and offer it to companies in developed economies such as North America and Europe involved with importing organic produce from India who want to trace the produce back to its source.

It is in talks with two companies in East Africa for deploying the platform. Depending upon these negotiations, the company's first international foray would be in Africa. In the next phase it would enter the South East Asian market by 2022.

Key Partnerships

NSRCEL – IIM Bangalore – Incubation and Funding

a-IDEA NAARM – Acceleration and Market Linkage

KIIT-TBI – Incubation and Funding

Yes Bank – Yes Scale Accelerator – Acceleration and Industry Partnerships

Financial Analysis

The company started its operations in February 2016 and broke even by March 2017. The produce selling vertical is profitable while the paid pilots are meeting the expenses of the FoodPrint vertical. The company had a revenue of INR 1.3 Crores in 2017-18 and INR 2.5 Crores in 2018-19.

Requirements for Scaling-up

Partnership Needs

The company is actively seeking opportunities to partner with private and government organizations for piloting the FoodPrint platform. With government the company is seeking opportunities for implementing the technology under a pilot program to selected FPOs.

Manpower Needs

Jivabhumi needs quality workforce to implement its technology globally and to reduce the dependency on external sources for developing and maintaining the platform. Skilled manpower is needed to become a world-class enterprise in order to cater to the rising international interest in FoodPrint.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Anil Nadig	Co-Founder	Bachelor of Engineering	18+ Years
Mr. Srivatsa TS	Co-founder	Bachelor of Engineering and IIM-B Alumnus	18+ Years

Krimanshi Technologies

Krimanshi or Project Cattle Mettle is a start-up that manufactures high quality cattle feed by utilizing unconventional ingredients like agricultural waste and crop stubble. Its ingenuity is in improving the production of milk and health of the cattle and helping deal with a serious problem of stubble burning, and productively utilizing fruits and vegetable leftovers, which would traditionally go to waste.

Product Description

Krimanshi researched different type of food streams and processed them into cattle feed to bring down the input cost and make the process more sustainable for small dairy players.. Concentrated feed which is a mixture of grains, oil seed cakes and agricultural waste is pelletized and sold in 50-kilogram packets. Instead of conventionally sold cattle feed in mashed or loose powder form, where the wastage is as high as 5% at farm level handling; Krimanshi provides cattle feed in the form of pellets, where wastage is just 1%. Using stubble, banana leaves, sugarcane tops, and, fruit and vegetable leftovers as raw material, Krimanshi is providing much better nutrition at a competitive price while also helping with the problem of waste management and stubble burning.

Currently, Krimanshi sells 4 varieties of feeds, of which three varieties matches the specified standards under Bureau of Indian Standards (BIS)

The first variety of Krimanshi's cattle feed is a low energy economical feed that is focused on sustaining non-milk producing cattle. Traditionally, when the cattle stops producing milk, their commercial value dissipates, and the farmers don't focus on giving them a healthy diet. This feed is to solve this problem by meeting the cattle's nutritional needs at a lower cost.

The fourth type of feed is a premium high energy feed that is focused on making the animals healthier which leads to an increase the yield and quality of milk.

The uniqueness of Krimanshi's product is the inclusion of essential nutrients in to its feed in the form of natural fruits and vegetables (in dried-powdered form) to its top of the line product. The lower cost products are priced at par with the competition in market.

There are two direct impacts of feeding quality feed to the cattle, first is the increase in quantity and quality of milk, second is better health of cattle. Farmers save a significant amount on medicine and veterinarian bills by providing adequate nutrition to their animals.

Using Krimanshi's feed, farmers have reported upto 20% increase in the milk production with an increase in the quality of milk as well and a reduction in the frequency of sickness among cattle.

Intellectual Property

Krimanshi has the company name Trademarked and is in the process of applying for patents its product and processes.

Challenges Faced

Mode of Payment

Cooperatives have a Barter arrangement with farmers where they supply them with cattle feed and procure milk in the form of payment. A similar arrangement is difficult to maintain in the case of startups like Krimanshi. This is a major challenge that's preventing the company from accessing a much larger readily accessible customer base.

Cash Flow

The credit cycle in the dairy industry is time consuming. Although farmers get paid every 15 days from the dairies; they want the cattle feed on credit from Krimanshi and this credit period ranges between 1-3 months at least. Working capital from a continuous revenue stream is a crucial resource for a startup. This delay in payment because of the credit is an impediment to Krimanshi's ability to scale-up operations. It also leads to cases of bad debts while dealing with small farmers who many a times fail to pay back for the products consumed.

Business Model

Krimanshi operates on a Business to Business (B2B) and B2B2C model and works with Cooperatives, Local distributors of cattle feeds, retail chains, and distributors of seeds and fertilizers. It works with organisations like the Ambuja Foundation to supply feed to all the farmers under the Foundation's Farmer Producer Organisations (FPOs).

It also works with the State Governments and has received a work order for INR 10 lakh from the Rajasthan Pollution Board, Government of Rajasthan, to utilize the crop residue and stubble, and help decrease the pollution levels.

Market Presence

Krimanshi is selling its products in 4 districts of Rajasthan presently – Jodhpur, Pali, Nagaur, and Bikaner. It is in the process of expanding to Bengaluru. Going forward, Krimanshi expects to enter the markets of Madhya Pradesh, Chhattisgarh, and Jharkhand.

Krimanshi has benefitted over 5000 dairy farmers and other stakeholders by April 2019. It aims to reach over 100,000 farmers by 2024.

Financial Data

- Krimanshi broke even in the first quarter of 2019

Krimanshi Product

- Going forward, it plans to raise funds of INR 2 crores. It will close the first round of INR 1 crore from undisclosed investors by May 2019 and is projecting the final closure by October 2019.

Key Partnerships

Startup Oasis (CIIE - IIM Ahmedabad) - Incubation, Funding, Mentoring under INVENT program funded by DFID and Govt. of India

VillGro – Incubating, Funding and helping them enter the Bengaluru Market

Yes Bank Agritech Accelerator - Yes-Scale Product –– Godrej Agrovet working jointly as an industry partner

Scale-Up Requirements

Partnership Needs

Krimanshi is actively seeking partnerships with large scale cattle feed and agricultural input manufacturers to expand its market presence and sell its products in different geographical locations. It also wants to work alongside the government to provide government Animals Shelters and 'Goshalas' with its quality products.

Policy Needs

The locally manufactured cattle feed that are sold in unpackaged manner do not adhere to strict standards. Local manufactures add more than the permissible amount of Urea to their forms of feeds such as mash or puree. Expanding the purview of the norms to cover locally manufactured feeds would weed out unorganized manufacturers that add substandard and hazardous contents to their products to increase the milk production. Such an initiative would help startups like Krimanshi that are providing high quality and nutritious products to the dairy farming sector.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Nikhil Bohra	Founder CEO	B. Tech. Biotech	9
Mr. K K Bohra	Director, Product Head	PhD, Chemistry	39

New Leaf Dynamic

New Leaf Dynamics Technologies is an enterprise with a mission to reduce food wastage and provide energy access to remote areas of India. The company provides environmentally sustainable cold storage solutions, which do not require traditional energy sources and instead are powered by agricultural waste.

Product Description

New Leaf designs and manufactures an off-grid, compressor-free, renewable energy-based refrigeration system called GreenCHILL. It is powered by farm-waste such as biogas, cow dung cakes, biomass and crop stubble pellets, wood and hay, etc. It provides safe storage and cooling of perishable goods like fish, fruit, vegetables, flowers and other agricultural produce, at the village or farm level, before transport to a market or to a processing facility.

Each GreenCHILL unit can cool up to 1,500 liters of milk or 15 metric tons of perishables goods without the need for electric grid power or diesel generator backup. The system can cool down to 0°C while maintaining the required humidity levels.

GreenCHILL can be customized for these applications:

- Cold Storage
- Bulk Milk Cooler
- Ripening Chamber
- Fish Cold Storage
- Pre-Cooler

GreenCHILL can be installed in plains or on hill tops with very little resources. All it requires is a water connection and a small 500 W home inverter to run the cold storage

Intellectual Property

New Leaf has applied for 2 patents: First is for the Main Refrigeration System which has been developed and second for the Hot Water Generation System which is jointly owned by New Leaf and IIT Patna. It also had Trademarks for the company and product names.

Challenges Faced

Product Demonstration

The first few customers needed to see the machine working before making the purchase. Being headquartered in Delhi, it was cumbersome for New Leaf to have its shipped and installed at every customer location. Once initial systems were installed, potential customers were invited to see and inquire about GreenCHILL. Also, since it is more expensive compared to a traditional cold storage, farmers had to access bank support to procure the machine. Banks too were hesitant toward loaning money for device that doesn't have any precedent in the market. This problem was also addressed by giving the proof of concept to the bank and showcasing them the long-term economic benefits of the technology.

Scalability

Large players were interested in the technology from the beginning but had large order sizes and at an economical price. Being a startup, it wasn't feasible for New Leaf to meet their demands. They also had concerns about the practical ability of the device. Now, after visiting the sites where GreenCHILL is installed and analyzing its commercial and ecological viability, companies like Big Basket are in talks with New Leaf to collaborate and use their product.

Business Model

- New Leaf works with Businesses, Government, and directly with farmers.
- It works with Seed Distributors, Fertilizer Manufacturers, Farm Equipment Providers etc. and leverage their connections to reach the farmers and create a market.
- Government of Punjab has procured 2 GreenCHILLs from New Leaf as part of a pilot program and these are installed in Hoshiarpur and Kapurthala.
- It is working with The Energy Resource Institute (TERI) to implement GreenCHILL and develop innovative technologies to utilize crop waste for cold storage, milk chilling, and air conditioning purposes.
- It also works with Public Sector Banks and NABARD to help the farmers with loans and subsidies.
- GreenCHILL can be customized for size and need of the customer and for a 15-ton unit, the cost is around Rs. 15 lacs.

Market Presence

The company started with approaching the farmers directly in Gujarat through its on-ground sales and marketing team. Interested customers approached it from the neighboring state of Maharashtra. Eventually, a company in Maharashtra partnered with it and created a separate vertical within its organization to market and sell GreenCHILL.

At present it is present in Gujarat, Maharashtra and Madhya Pradesh. It is focused on making the product economical and scalable and wants to expand to different states of India starting with Punjab and Haryana by December 2019.

GreenCHILL Installation at Kapurthala, Punjab

Key Partnerships

Indian Institute of Technology (IIT) Patna -DST funding for joint R&D

Government of Punjab – Partnership for running pilot programs

The Energy and Resources Institute (TERI) - Application of GreenCHILL for Energy Conservation

National Bank for Agriculture and Rural Development (NABARD) and Public Banks – Farmer subsidies and loans

Financial Data

The company went operational in 2017 and has not broken even yet. It had a revenue of INR 70 lacs in 2017-18 and INR 1.5 crores in 2018-19.

Requirements for Scaling up

Funding Needs: It is seeking investment from the Industry to scale the product and to decrease the cost by half which would double the number of machines manufactured.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Anurag Agarwal	Director	B. Tech, Mechanical Engineering, IIT Kanpur	07
Mr. Akash Agarwal	Director	BS, Business Management, University of Utah, 2013	5

Science for Society (S4S) Technologies

S4S is a food preservation startup that has innovated multiple dehydration technologies for processing of fruits and vegetables. The company has also developed a supply chain model to provide market linkage for the dehydrated foods , and sells ready to eat/cook dried products under its own brand name DesiVidesi.

Product Description

S4S has developed four proprietary dehydration technologies which are used for drying a large number of agricultural produce:

Solar Conduction Dryer (SCD)

SCD is the first technology developed by the company and is based on solar thermal energy principle. The dryer is portable, easy to assemble and disassemble, and maintain. It is completely independent of external electric source and is free of batteries, wires, and other electric components. SCD can dry around 50 different kinds of produce like fruits, vegetables, fish, spices, etc. Post drying, the shelf life of produce increases to 6-12 months at room temperature and retain up to 85-90% of nutrient content. The SCD is the only dryer that the company sells to the farmers. It costs INR 35,000 and can dry up to 3 tons of produce per year. The company is developing a miniature version of the SCD for household customers who can use it to make chips, dry onions, garlic, chilies etc.

HaldiTech

Farmers growing ginger and turmeric showed interest in the SCD but were unable to use it due to large volumes of produce. Considering this demand, the company developed HaldiTech, a low temperature drying technology specifically for tuber crops. Drying Turmeric through conventional drying methods takes over 30 days but HaldiTech can do the same in 24 hours. The dried turmeric retains 40% more curcumin compared to conventional methods. Similarly, ginger dried through HaldiTech retains 25% more ginger oil.

HaldiTech is available only at the company's factories/ processing units. It is not available to be purchased by individual customers.

SmartDry

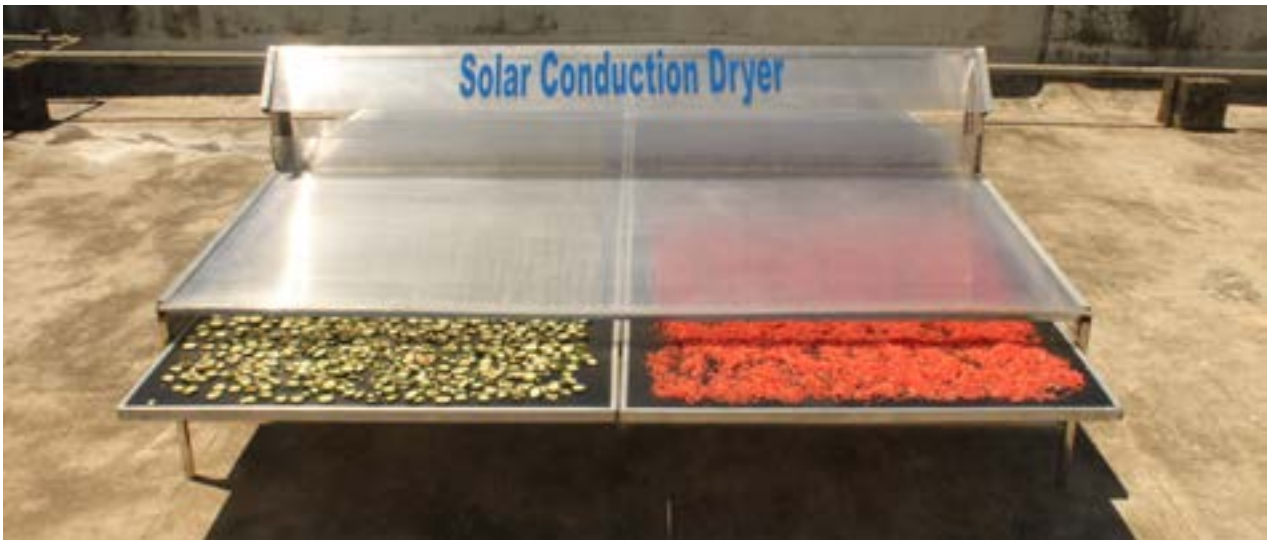
SmartDry is S4S' industry grade dryer for bulk drying of cooked produce like rice, pulses, vegetables etc. The dryer has a digital interface and can be operated with a smartphone to maintain the temperature and pressure, and to shut the machine on and off. The technology uses air circulation in a pattern that makes the machine highly efficient which reduces the operating costs. The cost of drying per kilogram is 25-30% less than other commercial dryers.

FrostDry

FrostDry is company's most sophisticated technology and is used for drying high value products. The technology behind FrostDry is sublimation in which water within the produce is first converted to ice and then directly vaporized. The company has made fundamental changes to the process and made it more efficient. The machine has less removable components and is easy to maintain as well. The cost of drying for customers is 25-30% less than the conventional machines.

Based on these four technologies, the company has three distinct business verticals:

- SCD as a product – S4S' Solar Conduction Dryer is available to be purchased or rented by the farmers. The company also offers market linkage to the farmers where it procures the dried produce and sells it to its food processing clients.
- Drying as a service – S4S uses HaldiTech, SmartDry, and FrostDry to offer commercial drying services to the farmers. Farmers can use the company's technology as a pay-per-use model and process their crops. The company also procures the produce in bulk and sells it to hotels, restaurants, catering companies, food processing companies etc. The benefit dried produce has over fresh produce is its elongated shelf life and reduction in volume. The dried produces can be rehydrated by the clients and used for several purposes.
- 'DesiVidesi' Brand – S4S sells dried kale chips, beetroot chips, dried amla etc. under its brand name DesiVidesi. The brand is present in retail outlets in the state of Maharashtra and throughout the country on eCommerce platforms like Amazon.



Solar Conduction Dryer

Intellectual Property

S4S is protecting its technologies through a multitude of patents. For SCD it has the Indian patent while the international patent is in process. For HaldiTech, the company has obtained both Indian and international patents. It is in process of patenting the other two technologies as well.

Challenges Faced

Customer Acceptance

Initially the company faced some difficulty in convincing the farmers of its technology. Farmers dry the produce under the sun and did not find a solar based dryer appealing or beneficial to them. After demonstrating the reduction in time taken to dry the produce, and its increased shelf life, farmers adopted the technology rapidly.

Market Linkage

Farmers were traditionally selling their produce to the mandis but after adopting to S4S' technology, they had difficulty finding the customers for the dried produce. They approached the company with this issue and it decided to procure this dried produce and market it itself. This inspired the company to develop more technologies and market processed produce to the industry.

Business Model

S4S has both Business to Business (B2B) and Business to Customer (B2C) verticals:

- B2B - The Solar Conduction Dryer are sold or rented to the farmers. Some Farmer Producer Organizations have also purchased the SCD from the company. FPOs buy 15-20 dries and offer to member farmers for drying their produce.
- Selling processed produce to HoReCa sector and food processing companies is the second B2B vertical. Dried fruits and vegetables are compact and can be stored easily and relieve the HoReCa sector of the efforts of cutting and peeling 100s of kgs of fresh vegetables daily.
- S4S also offers commercial drying services to farmers, FPOs, and commercial farming companies.
- B2C – DesiVidesi is the only business to customer product of the company. it is a healthy snack brand launched for the general public and is available at both physical and digital retail outlets.

Market Presence

The company supplies dehydrated fruits and vegetables to its client all across India and has two operational facilities in Mumbai and Aurangabad. It is currently exploring key partnerships with logistics companies to enable faster and more efficient delivery of products.

The company has sold the Solar Conduction Dryer in 22 states of the country. The dryer has also been installed at 1200 sites in Sri Lanka, Kenya, Nepal, Bangladesh, Thailand, Myanmar, Vietnam, and

Smart Dryer

Key Partnerships

Dell Social Innovation Challenge - $50,000 Grant

BIRAC - Grant for Women Empowerment

Bill & Melinda Gates Foundation - Strategic Support

US AID - Support for Accessing Global Market

UK AID - Support for Accessing Global Market

Financial Analysis

S4S went commercial in 2013 and Broke Even in 2017 with a revenue of INR 60 lacs for 2016-17, INR 1 crore for 2017-18 and INR 6 crore of 2018-19.

Requirements for Scaling-up

Certification and Licensing

A company needs multiple certifications and licenses for operating in the Agro-mechanical and food processing domain. Getting each of these certificates such as the ISO certificate costs a considerable amount of capital. These licenses and certificates should be cost-competitive for startups allowing them to spend the capital in scaling up.

Partnership

S4S wants to partner with industry for solving specific problem statements and devising customized solutions. It is working with a client to increase the curcumin percentage that can be extracted from turmeric by using the company's technologies. Similarly, it wants to partner with other private players for such targeted solutions.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Dr. Vaibhav Tidke	CEO	PhD (Chemical Engineering)	9 years
Dr. Tushar Gaware	CTO	PhD (Chemical Engineering)	9 years

Name	Designation	Educational Qualification	No. of years of experience
Ms. Shital Somani	Key accounts Division Head	MBA	9 years
Mr. Swapnil Kokate	R&D Head	M Tech (Polymers)	8 years
Ms. Nidhi Pant	B to C Division Head	B Tech (Oils)	7 years
Mr. Ashwin Pawade	Supply Chain	M Tech (Mechanical)	8 years
Mr. Ganesh Bhere	Head HORECA Division	M Tech (Chemical Engineering)	9 Years

Haldi Tech Dryer

SatSure Analytics

SatSure Analytics is a startup that provides dynamic data-based insights on farm and crops. The analytics are used for monitoring farm and crop health in near real time by decision makers across the Agri-value chain. It is essentially providing the stakeholders an estimate for the underline value of their assets: Farm and Crops. It enables them to take timely interventions by providing data backed decision intelligence across geographies and seasons.

Product Description

SatSure uses data from multiple sources to create customized advisory and analytics for its clients which include government, banks, insurance companies, Agri-input companies, and contract farming companies.

SatSure is a platform where the core technology is processing images and devising insights from those images overlaying with other data quickly.

The company processes satellite images using its algorithms. Satellite imagery is the primary data source supplemented by several other micro and macro sources such as weather stations and drone generated data. The data is layered together and processed by Machine Learning algorithms supplemented by a HADOOP based Big Data platform.

The company offers a technology stack consisting of the above technologies which is used by different sectors. It provides information on sowing time and pattern, variations in crop health, expected yields, and harvesting time and patterns.

Banks and insurance providers use the analytics to monitor crop health and harvest area for estimating the prospective yield and insurance/ loan rates. They use these reports for focusing on particular zones for targeting their services to the farmers. The information is also used by banks and insurance providers to keep the Non-Performing Assets (NPA) Ratio under check.

The company follows a Software as a Service approach to offer the technology stack to its customers. The data analysis and delivery are done on Amazon Web Services (AWS) cloud server.

SatSure has a web portal and an app for people to access the data. The portal is live on the Andhra Pradesh government's website and the information is public. The application is only downloadable by government authorities such as Agri Officers, Circle Officers, Extension Officers etc. The application is a data acquisition tool which is used for collecting, verifying and validating the reports that SatSure has generated using satellite imagery, drones etc. The govt representatives working in the Agricultural sector validate the data during their field trips.

SatSure works with several satellite image companies, both public and private to get the

primary data. It also works with several drone companies for location specific data.

The application is customized depending upon the requirement of the customer and given as an enterprise app which is usable only by that customer. It is not downloadable publicly from any platform.

Intellectual Property

SatSure core intellectual property are its Artificial Intelligence Algorithms. Since these cannot be patented in India at present, the company protects them through Trade Secrets. It has filed for patents internationally for the same.

Initial Challenges Faced

Information Validation

Initially SatSure struggled with getting the information validated from on ground sources. Representatives had to physically travel to different sites to collect the data and compare them with the data from satellites and other sources. This challenge was addressed when the company started working with the government. Now it works closely with several state governments which support it in validation and verification.

Data Acquisition

SatSure's primary data source are satellite images. However, to build an algorithm, the information from satellite images needs to be collated with data from micro sources such as drones, sensors, and physical surveillance. Lack of availability of a repository of data set in the public domain is a constant challenge. SatSure answered this challenge by doing constant trials on ground. It partnered with different AgTech firms across India and was given access to their on-ground data for building the algorithms.

Business Model

SatSure follows a Business to Business/ Government (B2B/B2G) business model. Through its clients it works with customers and farmers as well (B2B2C).

The company has worked with leading agri-input, contract farming, and manufacturing companies in India and internationally. It has several work orders from the government and also grants from the ministries. It is providing them with intelligence that will help improve their farm resource management, benefits transfer process, activity planning etc.

The company has a subscription-based revenue model which is customizable depending upon the client's needs.

Market Presence

The company is present pan-India and has international clients in Nigeria, Ivory Coast, Myanmar, Switzerland, Zimbabwe, Tanzania, Brazil, Bolivia, and Japan. It has international offices in Zurich, Switzerland and London, United Kingdom.

SatSure has both go-to-market partnerships and direct engagement model with clients in these countries. It works solely with private clients outside India. It has partnered with an undisclosed partner in Central America to address the language barrier and enter the market.

The company has expansion plans in US, Japan, and Australia and projects entering these markets by December 2020. Expansion will be engaging with financial institutions, banks, and insurance companies. This sector forms the core client base for SatSure. It would enable financial inclusion process in agriculture for these clients who will use the data for verification and credit ratings of farmers.

Key Partnerships

NASSCOM 10000 Startups - Incubation

Startup-O Singapore - Incubation

Ministry of Agriculture - Agri Grand Challenge - Incubation

SatSure has also signed a Memorandum of Understanding with Antrix Corporation, the commercial wing of Indian Space Research Organization (ISRO) for working on geospatial big data analytics and its application in Indian agriculture.

Financial Analysis

The company broke even in 2018, within 24 months of going commercial. Its revenue grew from INR 75 lacs in 2017-18 to INR 6.6 crores in 2018-19 with a profit of INR 3 crores.

Requirements for Scaling-up

Data Standards

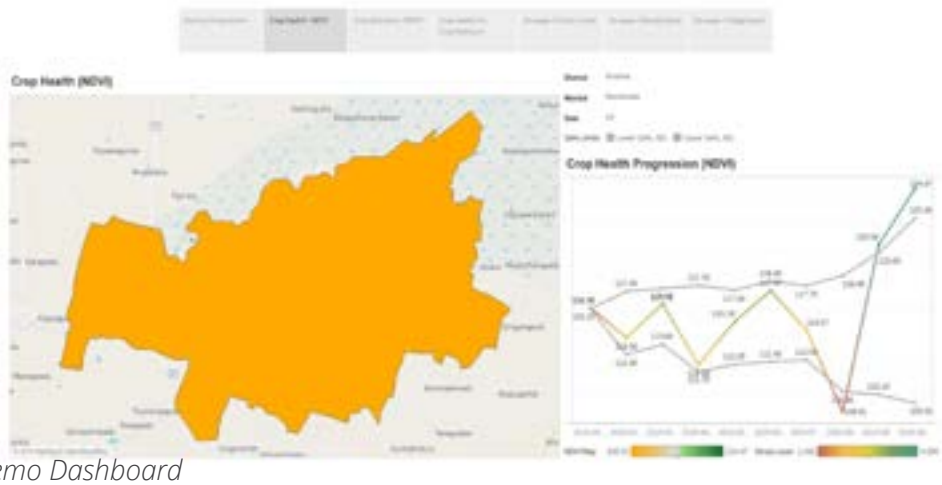
Data is slowly becoming a commodity and for startups with operations around the world, the acceptability of genuineness of data is a challenge. An international client needs assurance to trust data from a startup from another country. A centralized, governmental, Data Standardization body on the same lines as ISO Certification will help the startups globalize.

Data Availability

Lack of data availability in the public domain is a key barrier for startups working on technology solutions based on data analytics. Creation of a unified single authority that makes data repository available in public domain would be beneficial.

Mapping of AgTech Ecosystem

Reports and studies on new innovations and start-ups in the AgTech domain on an annual basis would help connect the players, new and established, and map the entire ecosystem. This will be helpful for several stakeholders including Agri input companies, farmers, and policy makers for understanding and implementing the technology disruptions taking place in the sector.



Crop Health Demo Dashboard

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Prateep Basu	CEO	Bachelors in Aerospace Engineering from Indian Institute of Space science and Technology (IIST) Masters, International Space Univeristy, France	7 Years of Experience
Rashmit Singh Sukhmani	Global Head, Products	Bachelors in Physical Sciences from Indian Institute of Space science and Technology (IIST) Masters in Business Administration, Canada	5 Years of Experience
Ishan Tomar	CTO	Bachelors from Indian Institute of Space science and Technology (IIST)	7 Years of Experience

Sickle Innovations

Sickle Innovations is a farming solutions start-up that designs low-cost and innovative machines towards improving conventional farming practices. The machines address the problems related to non-availability of farm labour with prudent design and technology intervention. Sickle's designs are human centric and provide economic farming solutions for micro-farms and large farms alike.

Product Description

Sickle Innovations' products fall under two broad categories— Pre-Harvest /Harvest and Post-Harvest

Pre-Harvest/Harvest Machines

Under this category, Sickle Innovations manufactures hand operated mechanical devices that help in the pre-harvesting/ harvesting stage.

These machines range from fruit harvesters to weed removers and seed transplanters, each costing below Rs 10,000 on an average. These tools aim to increase farmer profits either by reducing the labour cost or by increasing the value of the crop. For example, the mango plucking device plucks the mango off the tree with its stock still intact, thus increasing the shelf life of the fruit and ensuring that the farmer can fetch a better price for it.

Following are some of the Hand Operated Devices available:

- **Transplanter** – These machines are capable of transplanting 4000-6000 seedlings per day per person without the need to bend down. The seeds are embedded in the soil at an appropriate depth thus reducing the pressure and making the roots healthier.

Apple Colour Grader

- **Fruit Picker Machines** – Currently Sickle offers machines to pick Mango, Apple and Peer, and Litchi. They are constantly researching and developing machines to cater to other crops as well. Using their machine, the fruit can be picked while standing aground and thus eliminating the need to climb the tree. The machine eliminates the problem of sap burn and increases the shelf life of the fruit.

Post-Harvest Machinery

The second category is of the post harvesting machines that are customised according to each customer's requirement and are more expensive compared to the hand-held machines. Presently, these machines are used for two main purposes, namely sorting/grading and drying:

- **Apple Grading-Sorting Machine** – It uses a conveyor belt mechanism on which the apples pass through a camera module which takes 360-degree pictures of the fruit. These pictures are analysed by an Artificial Intelligence algorithm that segregates them based on quality, shape, colour, and size. This image-based grading and sorting is highly efficient in comparison to the traditional manual alternate and much faster with a speed of 1 article per second and a maximum of 10 articles per second. Although the machine is currently only available for apple, it can be customized for other crops by changing the mechanism and tweaking the AI.
- **Saffron Dryer** – Saffron is the most expensive spice in the world and is grown in abundance in the northern state of Jammu and Kashmir. Traditionally it is dried in open air causing it to lose its colour and essential oils. Sickle's Smart Dryer solves this problem by providing a weight based auto cut off mechanism that shuts the dryer down when the optimum drying has been achieved. This helps the saffron retain its natural colour as well as essential oils and is thus sold with a 10-20% increment in price comparison to the traditionally dried product. Going forward, Sickle plans to adapt the same technology for drying apple, apricot, and large cardamom.

Intellectual Property

Sickle has multiple Indian and International patents for its designs and has applied for Trademarks for the company and product names.

Initial Challenges Faced

Existing Benchmarks

Given the innovative nature of its products, getting appropriate approvals and licenses to sell its machines was a challenge Sickle faced. Such products had not been assessed and approved in the past and the precedence to do so was absent.

Human Resources

Sickle faced difficulty in finding and hiring professionals with ample knowledge of mechanization in agriculture who were willing to work in a startup. Thus, manpower was a major challenge the company faced early on. As it grew, it was able to recruit and retain the talent.

Business Model

Sickle primarily follows a Business to Customer model selling the products directly to the farmers. The company also follows the Business to Business model, however, with very limited clients who are mostly in the Horticulture Mechanization domain.

Market Presence

Sickle has a strong presence in Jammu and Kashmir, Himachal Pradesh, and Uttarakhand. It plans to expand to the North-Eastern states of India in the next phase of development by December 2020.

Sickle has impacted 5000 farmers by March 2019 and aims to reach over 100,000 farmers by December 2020.

Key Partnerships

SID – IISc Bengaluru - Funding

CIIE – IIM Ahemdabad – Incubation and Funding

ZTM-BPD – IARI - Incubation and Funding

Financial Analysis

Sickle's first two years after incorporation were solely dedicated to Research and Development.

After commercially launching in 2016, Sickle saw phenomenal growth and broke-even within 20 months (in 2018) of commercialization. Since the commercial launch, the company has earned a revenue of over Rs 1 crore.

Requirements for Scaling-up

Policy Support

- Dryers used in post-harvest processing of produce qualify as "Industrial Products" and come under the 18% Goods and Service Tax category. Sickle have miniaturized the technology and made a portable dryer. The end user for this product is the farmer. Including these products in the 0-5% GST category would make them more easily accessible by the farmer.
- Presently the subsidy process for an Agri-Mechanical product is different for every state. A company must apply for subsidy in each state independently. This creates a difficulty for startups in terms of time and finances. A centralized process to apply for subsidy for agricultural products would allow startups save crucial resources.
- If a special status can be provided to newly launch products by startups to avail subsidy and government orders, it will help popularizing the technology in less time and it will encourage more such products in agri domain.

Core Team Profile

Name	Designation	Educational Qualification
Mr. Nitin Gupta	Director, Sales & Marketing	Master of Design, IISc Bangalore
Mr. Vijay Kumar Reddy Vadde	Director, Product Development	Master of Design, IISc Bangalore
Mr. Malik Kumar Meena	Business Manager	PG Diploma in Rural Marketing, IRMA

2.3 EARLY STAGE AGTECH COMPANIES

A2P Energy

A2P Energy (Agri 2 Power) was launched with the objective of solving the crop residue burning problem by creating useful by-products from crop residue and thereby increasing farmers' income while ensuring sustainability. On one hand A2P solves the paddy straw burning problem by collecting the straw, promoting entrepreneurship within the village community and thereby helping increase farmer's income. On the other hand, the fuel produced by straw can replace conventional fuel in the boilers such as wood and coal, thus promoting sustainability.

Product Description

Presently A2P is utilizing paddy straw from 450 acres of farmland in the state of Punjab. In the straw collection process the presence of large and continuous fields is necessary to avoid wastage of resources, A2P uses its propriety machine learning model on top google earth's API to extract the satellite data for Punjab to recommend optimum location for paddy straw collection. It processes the collected straw to develop the following products:

Energy Pellets

A2P collect paddy straw in balled form during harvesting season and processes it into energy products like pellets. The first stage of making the pellets is commercialized and A2P has supplied pellets for energy purposes to clients like Pepsi, Hindustan Unilever Limited and a few pharmaceutical companies.

Bio-Oil

A2P is working on a project with the Indian Institute of Petroleum to extract oil from pellets and blend it with diesel to test on automobile engines.

Bio-Char

A2P is working on R&D projects with Punjab Agricultural University for utilizing pellets as bio char to be used as a soil conditioner. Prospective customers for the product are Farmers and cooperative societies

Other products in pipeline

Animal feed, Nano-cellulose and Activated Carbon.

On an average, annually A2P saves the following gasses from being released into the environment.

Material/Gas	Kgs
Particulate Matter	2,700
CO	54,000
CO2	13,14,000
Ash	1,79,100
SO2	1,800

Intellectual Property

The ongoing research is based on IPR for the new products like Bio-Diesel, Bio-Char, Nanocellulose, etc.

Challenges Faced

Insurance for raw material

The raw material used by A2P is dried paddy straw, which is flammable and thus causes a risk of catching fire. Thus, getting insurance for the same is a big challenge that A2P faces regularly.

Infrastructure

Cost of Electricity and frequent outages is another challenge. The process of processing paddy involves continuous power supply which is an issue in the state of Punjab.

Raw Material collection

The time after the paddy straw harvest to new crop sowing is only 21 days, so the challenge is to col-lect paddy straw for full year of operations in 21 days' time.

Business Model

A2P's business model is based on value chain principle and it works with all the stake holders in the paddy straw value chain, starting from farmers to the consumers of pellets. The main idea is to generate value for all the stakeholders in the value chain. It utilizes paddy straw from 450 acres and currently using the it to make pellets and then selling these pellets to different stakeholders. The revenue from the sale of the pellets makes it a viable business.

A2P caters to manufacturing sector by providing energy pellets, oil companies for Bio-Oil, and FPOs and cooperatives for Bio-Char.

A2P supplies the pellets to MNCs like Pepsi and HUL which has helped them to reduce the usage of conventional fuel and replace it with paddy straw pellets.

The company primarily sells through In-person sales and its website to sell the products. it also has a network of distributors and leverages eCommerce portals for reaching a wider customer base.

A2P's business also has the following social impact-

- **Employment Generation**: Employment generation for at least 50 local people during straw collection and for 12 people during pellets manufacturing throughout the year.
- **Entrepreneurship Activity**: Three local entrepreneurs are being supported through straw collection and transportation activity.

Market Presence

A2P is currently present in Punjab where the problem of crop burning is acute. It sources the straw from the farmers and then sells products in Punjab itself to keep the supply chain costs low.

The company is planning to expand in Punjab by opening at least one more plant by end 2019. In the next phase of expansion, A2P will target the state of Haryana and Uttar Pradesh.

A2P Impact Numbers (As of 2019) – To be depicted graphically in design

Paddy Straw utilized (tonnes)	900
Paddy Straw to fuel conversion facilities	1
Acres Saved from burning	450
Farmers Supported	45

Key Partnerships

Aston University United Kingdom: Technology and Funding

Punjab Agriculture University: R&D on using Bio-Char as a fertilizer

Indian Institute of Petroleum: Testing Bio-Oil for blending in diesel

The Oglesby Charitable Trust: Funding and Mentorship

Coromandel Fertilizers: R&D on Bio-Char as a fertilizer

A2P Products

Financial Analysis

A2P is revenue generating, operationally profitable.

Requirements for Scaling-up

Funding Needs

Presently A2P has one manufacturing plant. Through the plant, last year it managed to save 450 acres of paddy straw from open field burning and this year having upgraded the plant it aims to prevent 1500 acres of paddy straw from burning. This 1500 acres is an optimal area which can be catered by one such plant.

A2P aims to multiply such plants which can cater to paddy area under approximately three villages. In order to do so, it is seeking need funding as each such setup requires 50 lakhs of capital equipment and about 75 lakhs in working capital. The opportunity is huge, and the problem of paddy straw burning is also serious, A2P can add 15-20 new plants every year but need external funding. With the present model and revenues, it plans to put up two new plants every year.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Sukhmeet Singh	Founder	B.Tech (Mech), MBA (ISB, Hyd)	16
Dr. Robert Berry	Director and Mentor	BA and PhD, The University of Texas at Austin	30
Ms. Priyadeep Kaur	Director	MBA, Symbiosis	15

EF Polymer

Eco Friendly Polymer (EFP) is an agri-tech startup with the aim to address the issues of unavailability of water for agriculture in the drought prone areas of the country. The company aims to enable the farmers to optimize the use of water and improve the yield of the crop. It also provides them with an organic alternative for enriching the soil quality.

Product Description

Eco Friendly Water Retention Polymer (EFWRP) is made from bio-waste such as fruits and vegetable remain and contains natural starch and other organic monomers. The waste is dried, grinded, mixed with natural polymerization catalyst compounds, and boiled. Post boiling, it is exposed to solar radiation in a solar dryer to induce polymerization and form EFWRP.

The product is spread across the plantation area of the crop and acts as a superabsorbent and absorbs water during irrigation. This absorbed water is made available to the plants gradually and the polymerized chain prevents it from evaporation or draining. The life of EFWRP is 4-6 months and upon degradation, it enriches the soil with essential minerals and nutrients present in the fruit and vegetable remains.

The product is made without adding any chemical and is 100% organic. Over multiple cycles, use of EFWRP enriches the soil and increases its water holding capacity.

Intellectual Property

The company has applied for a patent for the formulation, process, and final product.

Challenges Faced

Ecosystem support

The venture was started by a group of students studying in Udaipur, Rajasthan. In the initial stage, they were unable to find practical help such as funding, product development advice around them. The company had difficulty finding organized ecosystem support for commercializing an agricultural technology. There was a lack of dedicated mentoring at a university level and the advice given by professors was majorly academic in nature. The company was recognized by the Rajasthan government under 'Challenge for Change' program. This recognition helped them to get mentoring, and acceptance by the farmers for their product.

Product Application on Ground

Product Validation

The company needed to get the product tested at various stages of development from government laboratories. The process to check levels of different constituents in the product doesn't require a long time and can be conducted within hours, but to access these testing facilities, the company had to wait for 25-30 days as the facilities were limited and the company did not have the resources to access a private testing facility. This delayed the company's commercialization.

Storage of Raw Materials

The raw material to manufacture EFWRP consists of fruit and vegetable waste from the mandis, and other Agri-bio wastes. This material is biodegradable and needs to be stored in a cold storage before it is processed to make the final product. The company had trouble locating and storing its raw material in a cold storage as most of them store harvested crops. Due to this, the raw material got spoilt multiple times. The company resorted to purchasing limited quantities of raw material to mitigate this challenge.

Dissipation of Funds

EFP received several monetary awards and grants from the government for its innovation, but the funds took over 7-8 months to reach them. A startup needs constant cash flow to sustain and a time period of 8 months to receive the funds can slow down the development process and delay the commercialization.

Business Model

EFP follows a Business to Business model and has partnered with Agri-Input products wholesalers in the state of Rajasthan to sell the product to the farmers. The company will also partner with online sellers of Agri products with a focus to serve the horticulture sector, vertical agriculture farms, and nurseries.

The company has started selling EFWRP commercially in the last quarter of 2018 and has already received work orders from several national and international clients.

The product is priced between INR 120-150 for the end customer.

Market Presence

The company will launch its product across the state of Rajasthan and gradually expand to Gujarat, Haryana, Punjab, and Uttar Pradesh in the first phase by December 2019, and to rest of the Indian states in the second phase by 2020. Drought prone and water scarce states will be targeted first by the company. It has plans to expand internationally to other developing markets as well and has received interest from a private company from South Korea.

Key Partnerships

IIM Ahmedabad – Power of Idea Program – Funding, Mentoring, Networking Opportunities

Startup Oasis, Government of Rajasthan - Mentoring

National Innovation Foundation – Mentoring, Opportunities to interact with Government and Industry leaders

Okinawa Institute of Science and Technology, Japan - Incubation, Funding, Mentoring

Financial Analysis

EFP went commercial in November 2018 and has generated a revenue of INR 5 lac till April 2019. The company projects breaking even by December 2019.

Requirements for Scaling-up

Infrastructure Needs

- A quick testing and validation of its new products would greatly help a startup like EFP develop the product quicker and expedite the market entry. The company needs access to such labs that can perform the necessary tests and validate the process faster than the present scenario.
- The company also needs access to Cold Storages that can store the raw material used to manufacture the product. Present Cold Storages only store harvested or processed produce and turn the company away as it wants to store Agri-bio waste products.

Funding and Partnership Needs

EFP is actively seeking private and public investment to scale up its production and establish a plant for manufacturing of its product. It is also seeking partnerships with the government to implement the technology in drought prone states, and with the industry to uptake the technology as part of Corporate Social Responsibility (CSR) activities for helping the farmers.

Core Team Profile

Name	Designation	Educational Qualification
Mr. Narayan Lal Gurjar	Co-Founder & CEO	BTech, Agricultural Engineering
Mr. Puran Singh Rajput	Co-Founder & Director	BTech, Electrical Engineering
Mr. Shashi Pratap Singh Shekhawat	Head – R&D	BTech, Agricultural Engineering
Mr. Buddhi Prakash Gurjar	Co-Founder & COO	BTech, Agricultural Engineering

NaPanta

NaPanta is a digital platform designed to provide real-time crop management techniques, pest and disease management solutions, market price information, etc. It enables the farmers to make informed decisions for agriculture-related problem. The real-time information in farmers' hands empowers them to make informed decisions to reduce their crop expenditure by up to 20% and increase the yield by up to 15% with overall profitability going up by a third.

Product Description

The company has developed a digital agriculture platform called NaPanta that has detailed information for any specific crop on seed varieties, seed characteristics, pest/disease mitigation, pesticides and fertilizers, buying or selling, dealer information, cold storages, Agri-equipment rental, etc. It is a one-stop solution for any farm related information.

Presently this information is available at a district level. NaPanta offers the following services at present:

- Farm Management: NaPanta helps farmers manage all their farm activities using its platform.
- Agri M-Commerce: Farmer can buy inputs through the digital agricultural platform
- Support for Insurance: Farmer can buy Crop Insurance by using this platform.
- Agri-Input Management: Tracking and monitoring of inputs helping farmers and businesses (Agri-input companies, commercial farming companies, etc.) with faster decision making and procuring quality inputs.
- Chemical (Labeled) Products: Farmer can access 3500+ labeled chemical products and their alternatives in the market and its detailed usage on various crops using its platform.
- Expenses Tracking: NaPanta's app allows users to input all the expenses for a crop. This helps in tracking farm expenses and advice on optimal resource usage, thus controlling excess expenditure.
- Yield Management: Users can track the harvested yields and understand crop performance and resource efficiency.

NaPanta is working on a customized advisory solution using a satellite imagery-based data analytics model.

Intellectual Property

NaPanta has licensed the technology for its platform and has trademarks for the company name.

Initial Challenges Faced

Knowledge Resources

Knowledge gap was a major issue NaPanta faced early on, getting reliable information to create a database was difficult. Incubation by ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) helped solve this challenge by providing access to reliable information and information sources.

Business Model

NaPanta has both Business to Farmer (Customer) and Business to Business model present. The company is working on a customized advisory model as well which will leverage satellite imagery to provide personalized advice to the farmers.

In the B2B model, NaPanta works with Agri-Input companies and uses the Internet of Things and Big Data Analytics to provide location focused data on crop pattern and quantity, pest attacks, etc. Companies use these to articulate their marketing strategy.

The entire range of services of NaPanta is available to the farmer without any cost. M-Commerce is the revenue source for the company. The business pays a subscription fee for the app and different advisory services are charged differently.

Market Presence

NaPanta is present in Andhra Pradesh and Telangana and is planning to expand to another 15 states like Uttar Pradesh, Madhya Pradesh, Haryana, Maharashtra, Karnataka, Tamil Nadu, etc., by December 2019. The company has impacted over 200,000 farmers with a daily user count of 5,000 by September 2019.

Key Partnerships

AIP ICRISAT – Incubation and Mentoring

Collaborated with SBI YONO to provide Agro Adivsory for thier Farmers

Collaborated with Bajaj Allianz to provide Agro Adivsory for thier Farmers

Nominated for REX KARMAVEER GLOBAL FELLOWSHIP Award by ICONGO and UN

Financial Analysis

NaPanta went live in 2017 and have started generating revenue from April 2019 onwards. It projects breaking even by September 2020.

Requirements for Scaling-up

Partnership Needs

- NaPanta is seeking partnership with the government or the agricultural department to provide pilot opportunities with ICAR (Indian Council of Agricultural Research) and other Agri-Universities. The sharing of agricultural agro advisory and pest management data with these institutions is also something that the government can help startups like NaPanta with.
- NaPanta is seeking collaboration with Industry. Companies can partner with NaPanta as part of their Corporate Social Responsibility (CSR) activities and adopt a village or take farmers in an area under their umbrella and help them get information and analytics to increase their yield and raise their income.
- NaPanta is seeking partnership with banking institutions like NABARD, World Bank, etc for various agricultural initiative projects to enhance the farmer's productivity and profitability.

NaPanta Application

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Naveen Kumar V	Founder & CEO	MBA, PGDB	8 Years of Banking Experience with ICICI and HDFC Banks in India and 5 years of Entrepreneurial Experience
Mr. Srinivas K	Co - Founder	M Tech	12 years of Full Stack Experience in world class IT Projects.

Pycno

Pycno Agriculture is a tech-startup that has designed a system for monitoring real time soil and environment parameters of the farms thus enabling farmers to make knowledge backed decisions for increasing the yield and reducing input expenses.

Indian farmers are under pressure to increase production to meet the need of the growing population. Factors such as resource scarcity, land degradation, and climate change are causing severe distress to the farmers. Pycno aims to use Precision Agriculture tools to help tackle challenges of resource scarcity, land, degradation, and climate change.

Product Description

Pycno's system senses soil moisture, soil temperature, air humidity, air temperature, sunlight, and rainfall. The capacitive soil moisture sensor can measure moisture at different depths of 30cm, 60cm, 90cm, and 120cm depending upon the plant type and the depth till which the roots grow. Entire array of sensors is connected and enclosed in one system which is powered by a solar panel and houses a global sim. The data is sent to the cloud using the global sim and analyzed by crop specific algorithm developed by Pycno. The reports suggest ideal farming practices and that the farmers should adopt and parameters that can be changed to maximize the yield.

The farmers can access the dashboard on a phone or on a computer by logging into the website and can visualize all the data from all the sensors. Farmers can also get SMS and phone calls on the current situation in the farm about situations like over or under irrigating and what exactly they are doing right now and what they can do to improve it. If the temperature is rising above a certain limit and if there is over irrigation, the dashboard sends a notification to the farmer and they can take appropriate action. Farmers can find out about good irrigation practices and whether the roots at different depths are getting water or not.

Pycno has developed algorithms to analyze 11 crops so far and is constantly researching to cover more crops. It works on Okra, Cucumber, Potato, and Tomato in Uttar Pradesh, on Sugarcane in Maharashtra, Rice and Cotton in Punjab, and Tea and Coffee in Mysuru.

The system is enclosed in a single unit with no movable parts. All sensors are interconnected to each other and the signal transponder that houses the sim. The average life span of the product is 5 years and due to the absence of assembled and movable parts, the maintenance cost is negligible. Pycno is developing sensors to measure soil acidity and nutritional levels and would assimilate them in the present system.

Intellectual Property

Pycno is in the process for applying for patents for the whole system including the algorithms and their applications on a physical product.

Challenges Faced

Technology Adoption

Technology adaption among the farmers was another challenge. Farmers were skeptic about sharing data with a private entity and did not understand the technology and its benefits. To overcome this challenge, Pycno installed sensors without charging the farmer and provided them with useful results, this helped with the trust building and validation for the technology.

Product Development

Optimizing the product to be resilient against climatic factors was also a challenge that the company faced. The initial scanners were once exposed to 6 days of continuous rainfall and despite being waterproof, they couldn't withstand the prolonged water exposure and stopped working. The future scanners were exposed to different forms of stresses and are not completely waterproof and can withstand temperatures more than 60 degrees Celsius, among other severe physical conditions.

Business Model

Pycno works directly with farmers presently, following a Business to Customer model. There is a one-time charge for the sensor system and a recurring revenue model for reports and global sim charge. For small and marginal farmers, Pycno has a provision of providing the sensors free of cost and charging only for the reports and analysis. The system is priced between INR 10000-15000 for the Indian market.

The company is developing an advisory vertical for businesses. It would provide market demand and supply, crop pattern and harvesting, and other relevant information to companies working in the agricultural domain. The vertical will become operation by December 2019.

It is also developing its weather station which would aid it in advising both farmers and businesses about weather patterns and rainfall levels. The system will be 40% cheaper than competition and will become operational by 2020.

Market Presence

Pycno has clients in over 26 countries including Australia, USA, and several European countries. In India it is present in Karnataka, Maharashtra, Uttar Pradesh, Tamil Nadu, and Punjab. The company is working toward a pan-India presence to expand internationally as well.

Presently, Pycno is working with 56 farmers globally. In India, the company is working with 13 farmers from Karnataka, Tamil Nadu, Maharashtra, Uttar Pradesh, and Punjab, and with 43 farmers from Vietnam, UAE, Australia, Europe, and USA.

Pycno Sensor

Key Partnerships

Government of Australia – Incubation, Mentoring, and Funding

ZTM & BPD Unit ICAR-IARI – Incubation, Mentoring, Funding

Cisco Systems – Mentoring and Funding

HAX Accelerator – Mentoring and Funding

Financial Analysis

Pycno has broken even and is profitable with a revenue of INR 34 lacs for 2017-18 and INR 70 lacs for 2018-19.

Requirements for Scaling-up

Policy Needs

Approvals and Licenses - Being a mechanical startup, Pycno had to get several approvals and licenses before its product. This process needed significant capital and took several months. A fast track approval mechanism for startups would help them save time and resources and get operational faster.

Faster Fund Dissipation – Pycno received several grants from the government to develop its product. The grant money dissipation takes considerable time to reach the company. Faster processing of grants would help startups to scale up faster.

Partnership Needs

Pycno is seeking partnerships with the Industry for conducting pilots and helping dissipate the technology at the grass root level.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Nahuel Lavino	CEO	MSc Mechatronics BSc Robotics	6+
Mr. Marios Georgiou	CTO	MSc Microelectronics BSc Robotics	6+
Mr. Gaurav Tyagi	Head - Sales & Business Development	Bachelor of Engineering (BE)	6+

THANOS Technologies

THANOS Technologies is a specialized drone manufacturing and services startup that specializes in UAV applications in the agricultural domain. It designs, tests, and provides services for drones in the Nano, Micro, Small and Medium categories (as per DGCA classification). Building drones that have high endurance and heavy payload is its specialty. Its primary focus in the agri space is drone based spraying and it also offer mapping and surveying services to make the spraying process efficient.

In terms of efficiency where manually 5-6 acres are covered in a day, THANOS' drones can cover 30-35 acres in a day (5-6 times more).

Product Description

THANOS currently offers spraying drones as a product and maintenance-repair as a service.

Agri-Spraying Drone (ASD)

The principle offering of THANOS Technologies is its Agri-Spraying Drone which is designed and manufactured completely inhouse. Some components are imported whereas some are built either locally or by themselves using a 3-D printer. The ASD has one of the highest flight times in the industry (20+ minutes) with a payload of around 10 kilograms. It weighs 24.5 kgs falls under the 'Small Drone' category (2-25kgs) as categorized by the DGCA. THANOS was able to achieve these unprecedented levels by building its own battery packs. It wanted the drone to do extensive work on the fields without the need to land and charge too often. Thus, it designed a novel cooling mechanism for the Lithium ion-based battery packs that enables the drone to stay in air for extended period of time with a heavy payload.

Traditional spraying methods involve dilution of chemicals with a large quantity of water, as a result the droplets roll off the plants and enter the soil and subsequently the water streams. ASD solves this issue by using significantly lesser amount of water, resulting in a smaller droplet size of water and chemicals which doesn't slide off the plant surface. This also solves the problem of under-dosage of chemical.

The drone creates a downward wind-effect (air from propellers) that causes lateral movement in the plants and allows the chemicals to penetrate the middle and bottom layers of the plant as well, thus directly increasing the efficiency and the crop yield. Also when humans move through a field, they brush up against the plant, damaging it and causing some strands to fall (Eg.- Cotton flower dropping due to human contact). Even though miniscule, this causes the yield to go down by 1-2%. Using a drone eliminates this problem altogether.

Manually, two people take an hour to spray an acre of land, whereas ASD can cover 1.4-1.5 acres within 8 minutes and over 7 acres per hour (including the charge time). It operates at a maximum height of 1-1.5 meters. The risk of chemical washing away and wastage is avoided by flying the drone at this height. Spraying is done in ideal weather conditions. The moisture levels in the air shouldn't be too high and it shouldn't rain within the next 24 hours of spraying. Also, wind speed should be less than 5 kilometers per hour as speeds higher than this can cause the chemicals to be carried away and end up on non-target areas. The temperature should be optimum as well because high temperature can cause the droplet to evaporate.

The cost of spraying is INR 500-600 per acre and the ASD costs INR 5.5 lakhs.

In future it will add Artificial Intelligence algorithms to ASD. This will combine Agri-Intelligence with spraying and give an insight on the problems, identify the exact problem spots that need spraying, and help quantify the exact amount of chemical that needs to be sprayed.

Designing and Repair Services

THANOS also design custom drones based on specific client requirements. These can be drones with a specific payload capacity, configurable attachments, desired flight times etc. It also has repair and maintenance service available that cover all other indigenously and commercially built drones. The revenue from these services help fuel the development for Agri vertical. In due course it plans to start a separate division within the company for Agriculture services.

THANOS is also venturing in Non-Agri applications such as Payload Delivery Drones and High Endurance Surveillance Drones in the next 1-2 years. THANOS already has working prototypes of the same and is looking at building market ready products over the coming months.

Intellectual Property

THANOS has trademarked the company name and is in the process of applying for a patent for the Agri-Spray Drone. It is also planning to patent the battery mechanism for its unique design and configuration. The battery uses its indigenous cooling system which extends its life and increases the flight time of the drone.

The drone design is constantly being researched upon and improved. The company's aim is to include as many indigenously built parts to it and be the first in business to get the most efficient combination of Drone-Battery pack. It will apply for another patent for the improved drone design after its completion.

Initial Challenges Faced

Policy and Regulations

Drone technology is a relatively new entrant in the agricultural technology sphere and is bound by regulations and restrictions. Importing certain components (Radio Module) was, and remains, a complicated and time-consuming process as there aren't many Indian alternatives available for them. This is expected to be resolved shortly as the govt. is working to allow import of certified/tested Radio Modules.

Knowledge Resources

Domain knowledge gap was another major issue. Getting advice from the experts in the domain was difficult and lack of knowledge delayed their commercial launch by at least a season. It eventually collaborated with Subject Matter Experts and designed the ASD according on their inputs. It was advised to conduct small trials in different areas of the country for every configuration and specification to best optimize the process.

Business Model

THANOS follows a Business to Business (B2B) and a Business to Customer (B2C) model and works with farmers, agri-input companies, and FPOs.

The company has a Per-acre charge for farmers where the company representative operates the drone and does the spraying on farmer's field. It follows a rental based model for businesses where THANOS makes available the drone and the pilot and the clients use it for spraying, research, and other on-field purposes.

Market Presence

THANOS has worked with over 25+ farmers and businesses in Telangana and Andhra so far. Its goal is to be present in Telangana, Andhra Pradesh, Maharashtra and Karnataka by end of 2020, and to expand to at least 10 other states by 2021. It aims to have a pan-India presence and explore foreign markets by 2023.

Key Partnerships

CIE-IIIT Hyderabad – Incubation and Mentoring

AIP-ICRISAT – Incubation, Mentoring, Helped participate in Agri events, Connections with FPOs

Surge Impact Foundation (SIF) – Technology evaluation and feedback

Research and Innovation Centre of Hyderabad – Connected with prospective customers and partners

Financial Analysis

THANOS plans to break even by August 2019 in terms of total capital invested in the venture. It has started getting profitable on a case by case basis. The company had a revenue of INR 1.35 lacs for 2017-18 and INR 26.3 lacs for 2018-19 with a growth rate of 20X between 2017-18.

Requirements for Scaling-up

Funding Needs

Capital is THANOS' foremost need for scaling up. It is looking for investments from corporate and government sources both.

THANOS - 10 L - Agri Drone

Policy Needs

Presently the approval process for using an Unmanned Aerial Vehicle for commercial purposes is sector agnostic. Thus, though THANOS' Agri-Spraying Drone operates at a height of 15-20 feet in farmlands which are primarily outside the population centers, it still comes under the same category as other drones, which makes the process of receiving clearances unnecessarily cumbersome. In line with this, a separate category of Agri-specific drones is recommended to be created for simplifying clearances.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Pradeep Palelli	Co-Founder and CEO	B.E. (Hons.) Electronics & Instrumentation from BITS-Pilani (2004-2008)	11
Mr. Prathyush Akepati	Co-Founder and CTO	BPT in Physiotherapy from Dr.MGR Medical University (2006) EPM from IIM-Calcutta (2010)	13

2.4 INNOVATIONS ON THE HORIZON

Agro2o

Agro2o, deriving its name from the chemical formula for Water – H2O, is an Agri-Mechanical start-up developing technologies based on the combination of hydroponics and automation. The motivation behind the venture was based on the market research finding that individuals who want to grow plants, herbs and flowers at the comfort of their home are limited by the following factors: Space, Time, and Knowledge.

Agro2o is addressing these factors by providing a solution where people can grow plants with a press of a button, giving them a chance to connect with nature by growing their own organic, chemical free produce.

Product Description

The product is a circular device that can sit on a table top in a room or an indoor garden and is fitted with LED glow lights which emit lights of a specific wavelength that induces photosynthesis, enabling the plants to grow without sunlight.

At present, the device has a 12-plant capacity, and gives users options to grow herbs, green vegetables, and ornamental plants. However, only a single type/species of plant can be grown at a time. The device is currently in its Beta testing phase.

The device is embedded with an Artificial Intelligence module that monitors the growth of the plants and enables it to water the plants and provide them with appropriate nutrients without the need of human intervention. Thus, solving the challenge that busy individuals, living in sunlight deficient apartments in metropolitans face.

Agro2o Device

For a user it is a three-step process, first they need to decide what they want to grow, then they need to put the seed kit and nutrient cartridge into the device. The device then identifies the amount of water, nutrient and light needed by that specific plant type and optimizes the conditions to enable the plants to grow to their full potential. The Artificial Intelligence growing algorithm can be customized for different plants and different growth stages. It can decide the amount of resources needed by the same plant at different stages of the growth cycle and can provide them to it at appropriate times. The water in the device is recycled and lasts for 3 weeks, the nutrient cartridge is plant specific and lasts for one whole crop cycle (ranging from 3 weeks to 3 months depending upon the plant type).

Providing precise plant specific nutrients dispensed in a water-based medium can result in a 20% faster growth rate when compared to the traditional method.

Agro2o is offering a smarter solution to the user, that enables healthy and quality lifestyle, connecting back to the nature and growing their own food while also removing harmful VOCs (Volatile Organic Compounds) that are present in indoor air and can't be filtered out by normal air purifiers.

The core inspiration is Hydroponics – the technology to grow plants without soil. It uses 95% less water and the crops grow vertically. The productivity can be as high as 200% compared to conventional methods. With water becoming scarce, Agro2o believes hydroponics holds the solution for present and future challenges.

Agro2o's idea is to have multiple other applications for hydroponics in future. Their core focus as a company is on innovation and affordability. With their present device they are providing innovative technology at an affordable price. They are constantly doing R&D and advancing the technology, the idea is to innovate and to make the technology affordable and then to disseminate that technology at mass level.

Intellectual Property

Agro2o has registered trademarks for its brand-name and logo. It has applied for 2 patents for design innovation and process of the device.

Initial Challenges Faced

Initial Support

Agro2o is working in Agri-mechanical space and a mechanical, hardware-based product requires significant capital investment before it is launched in the market and that level of expenditure is a challenge for a startup. It had difficulty finding a support system that fosters such startups and helps them throughout the development cycle.

Business Model

Agro2o plans to have both Business to Business (B2B) and Business to Customer (B2C) models; however, B2C would be its mainstay. It will be a subscription-based model where there would be a onetime charge for the device and return orders for the nutrient cartridges which it will sell through their website. Once it has built the customer base, it plans to partner with other eCommerce players as well.

It will enter the market with two models differing in ease of use and features but with the same capacity and operation mechanism. The tentative cost for these will the between INR 8000-12000.

Market Presence

Agro2o's primary target market will be the top 10 tier-1 Indian metropolitans starting with Delhi, Mumbai, Hyderabad, Kolkata, and Bengaluru. These cities have high urban population that leads a busy lifestyle and lives in comparatively smaller residential spaces.

Financial Data

Agro2o aims to breakeven within 18-20 months of commercial product launch. Its Beta Product is currently being tested and the product will launch by December 2019.

Key Partnerships

Incubation Partners

Electropreneur Park, Ministry of Electronics and Information Technology, Govt of India.

Research and Knowledge Partner

Department of Plant Molecular Biology, University of Delhi

Requirements for Scaling-up

Funding Needs

Agro2o's first and foremost requirement is of funds from external sources. It has been bootstrapped so far and is actively seeking investments.

Initial Support Needs

Agro2o needs from both public and private stakeholders to nurture futuristic innovations that are working to benefit the agricultural sector and make it sustainable and efficient. A support system is needed to handhold such startups, understand their requirements and help them connect with the appropriate resources. A platform dedicated to advanced and niche technologies in the Agri-tech space is recommended.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Mr. Yash Vyas	CEO	Bachelor's degree, NIFT	8
Mr. Ashish Goel	Technical Lead	BTech, Electronics and Communications Engineering from Govt. College Etawah, CSA University, Kanpur	12
Mr. Rochak Vyas	Lead - Marketing	MBA-Marketing, Christ College, Bangalore	8
Mr. Vivek Pandey	Technical Consultant	MBA, ISB Hyderabad, BTech, Electronics	15

CultYvate

CultYvate is a precision agriculture company that uses Artificial Intelligence, Internet of Things (IoT), and Satellite Imagery to develop farming solutions for smart irrigation and smart fertigation. The solutions aim to optimize the water consumption of a farm to increase the quality and yield. CultYvate's solutions mitigate the losses and reduce the expenditure on inputs and water consumption.

Product Description

CultYvate has two distinct systems that constitute its automated Fertigation System. The systems combine sensors, valves, switches and flow meters to regulate the supply of water and nutrient to the farm:

Smart Irrigation System

The system analyzes static and dynamic parameters to optimize the water used for irrigating a farm. The static parameters such as crop and soil type are collected at the beginning of the season and dynamic parameters such as crop age, wind speed, solar intensity are collected in real time every day through a network of IoT enabled soil sensors. The data is processed through an AI algorithm that identifies the power supply voltage to adjust the duration of water flow to ensure precision irrigation by maintaining the balance between water available and water needed by the crops. The system uses a combination of soil sensors, flow meters and valves, and satellite data.

Smart Nutrition System

The system uses a balanced nutrition approach with pH balancing and integrates nutrition requirements with smart irrigation devices and dosing pumps. Sensor based measurement of level and concentration of nutrients enables precision fertigation of the farm. The data is collected through the sensor network and processed by cloud based AI module helps farmer schedule fertigation based on the recommendation of the agronomist and crop nutrient demands while balancing the pH in real time.

The Smart Irrigation and Smart Fertigation System limits human involvement in the process and ensures precision irrigation and application of fertilizers

Intellectual Property

The company is in the process of applying for multiple patents for its systems.

Challenges Faced

Data Resources

Lack of centralized data sets was a hindrance the company faced while developing its algorithms and analysis modules. The company collected large primary data sets through satellite imaging records and created the algorithms.

Knowledge Resources

The company needed mature players who could guide it with the development of technology but couldn't find any such resources to collaborate and work with.

Business Model

The company is currently piloting with several clients and will follow a Business to Business model when it commercially launches its products by December 2019. Its target clients would be FPOs, Commercial Farming Companies, drip irrigation companies and Agri-Input Companies etc.

Market Presence

The company is conducting paid pilots with banana, pomegranate, grape and tobacco farmers across Karnataka & AP and will initially focus on expanding its footprint across these two states.

Field Installation

Key Partnerships

NSRCEL, IIM Bangalore - Incubation Seed Fundiing

IISc Bangalore - Funding

Financial Analysis

The company is currently pre-commercial and will offer its products from December 2019. It projects breaking even within 18-24 months of going commercial.

Requirements for Scaling-up

Funding

CultYvate is seeking funds in the form of grants and equity investment to accelerate the commercialization process and enter the market.

Partnerships

The company is seeking partners for pilot opportunities and commercial tie ups.

CultYvate System

Core Team Profile

Name	Designation	Educational qualification (Degree, University)	No. of years of experience
Mr. Mallesh T M	CEO & Founder	BE, Bangalore University	20 years of IT experience and 20 years of passionate farming experience
Ms. Bhavana Mallesh	Co-founder	MS, Birla Institute of Technology and Science	20+ years of experience across all areas of building software
Mr. Arun K	Advisor	MS, Birla Institute of Technology and Science	Formulates and plans the Strategic Vision, Go to Market, Technology and Marketing of the organization
Dr. Swapna Priya K	Director	PhD – Plant Pathology, FRI university, Dehradun	13 years of experience in Research, ICT agri and Product management




Distinct Horizon

Distinct Horizon is an Agri-Mechanization company with a vision to develop socially relevant innovations that can lead to sustainable rural development. It has developed a machine for deploying the Urea Deep Placement (UDP) process. Its major focus is to significantly impact the economics of the farmer by using the UDP technology. Its secondary goal is to minimize the pollution caused by the agricultural sector in the environment.

The conventional method of broadcasting fertilizers in a field leads to global warming, water pollution, ozone layer depletion, and soil degradation. The Nitrogen present in the fertilizers broadcasted on the surface of the soil is exposed to oxygen in the air and is converted to Nitrous Oxide which is a major greenhouse gas. Nitrous Oxide emission from farming is one of the major causes of Global Warming & Ozone Layer depletion. The excess fertilizer run off causes eutrophication in the water bodies.

By adopting the UDP method, farmers can save up to 40% on the fertilizer costs while increasing the yield by at least 25% and increasing the soil and crop health simultaneously. By deep placing the fertilizer, more nutrients are absorbed in the soil in comparison to the broadcasting method. The nutrients in the fertilizers/urea, deep placed by the UDP method, are more readily available to the plant roots which absorb them with help of the microorganisms present in the soil. The crop thus grown is better in health and more resistant to diseases and climate change.

Product Description

Distinct Horizon's UDP Powered Applicator allows the farmer to automatically deep place fertilizer briquettes. The machine comes in three variants

- Tractor attachment
- Engine powered hand-steered device
- Power tiller attachment

The procedure of application remains the same for all three variants, however, which variant to use differs from terrain to terrain. Tractor attachment is the company's primary focus as it is faster and efficient. Power tiller and Hand

steered variants are useful for terrains where tractors cannot function. Also, for long duration crops where UDP is required more than once, the other two variants are better suited as operating a tractor between sown crops or on a growing field is many times not feasible.

Currently, the machine has been developed to work on paddy fields, while trials are ongoing for the sugarcane version. Distinct Horizon will constantly research and develop it for different crops with a focus on maize in the near future.

Distinct Horizon initially developed a product which was an independently powered machine (Engine Powered Device) and then developed a tractor attachment and a power tiller attachment of the same.

While the scientific practice of urea deep placement is not new and has been researched over 40 years; its implementation was difficult as it was labor intensive. The design and engineering of Distinct Horizon's applicator now makes the practice of UDP feasible.

Intellectual Property

Presently Distinct Horizon has two Indian and two international patents and one provisional patent for its technology design and mechanism.

Tractor Driven UDP Applicator

Initial Challenges Faced

Knowledge Resources

Knowledge mismatch was a major challenge Distinct Horizon faced early on. The initial designs of the UDP applicator were made while accommodating geographical and design constraints determined by agricultural scientists. Hence the final product was defined by these constraints and became extremely capital intensive to manufacture. The real-world parameters were not accounted for while building the initial prototype. This problem was solved by the help of advice and guidance by Tata Chemicals on understanding the technology barriers and making the machine feasible and scalable.

Machine Manufacturing

Identifying the right fabrication places early on was a challenge as being a mechanical startup Distinct Horizon needed a workshop to design and build its prototype. It couldn't find this facility as most incubators did not have a dedicated mechanical laboratory. Commercial factories did not take orders for a single prototype, they wanted large orders or demanded a very high price for manufacturing a single piece. Distinct Horizon overcame this problem by building it's own workshop along with a test field and working with local manufacturers.

Business Model

Distinct Horizon went commercial in March 2019 and follows both Business to Business and Business to Customer models. It caters primarily to farmers and farmer groups, machine renting companies and Custom Hiring Centers (CHCs). The third category of customers is foundations like the TATA Trust and Dr. Reddy's Foundation who as part of their Corporate Social Responsibility (CSR) activities, want to help the farmers.

The company has delivered four machines to TATA Chemicals Society for Rural Development and one to International Fertilizer Development Center (IFDC) for implementation in Bangladesh. It has several orders from private clients and will deliver them by July 2019.

DH has worked with over 450 farmers during its testing and Proof of Concept Stages. It aims to impact over 10,000 farmers by February 2020 and 1 Million by the end of 2022.

Market Presence

Distinct Horizon is set to enter Uttar Pradesh, Telangana, Tamil Nadu and Odisha by mid-2019. The next focus will be Maharashtra and South-East Asia by December 2020. A major undisclosed African fertilizer company has also shown interest in the UDP Applicator.

Key Partnerships

TATA TRUSTS

TATA Trusts - TATA Trust has been DH's partner since the inception. It helped DH understand the problem statement and provided mentoring, funding and strategic guidance throughout the development phase.

IDEO

IDEO Designs – IDEO is a global design and innovation firm, it is DH's only equity-partner. IDEO has partnered with DH for designing of the machines and provided constant mentoring

Financial Analysis

Distinct Horizon projects to Break-Even by December 2019.

Requirements for Scaling-up

Funding Needs

Distinct Horizon is seeking investments from both government and industry both to commercialize and enter the market.

Market Access Needs

The company is seeking support from the government to expand its outreach and access a wider market. Access to the Government owned Rental Centers would help the company cater to more farmers. Government's Krishi Vikas Kendras (KVKs) use several machines for demonstration and research purposes, access to them would also help the company attain greater recognition and acceptance by the market. Similar support from other partners such as CSR as well as distribution partners (both conventional and various startups) would help demonstrating the benefits and ensuring access to the technology for farmers.

Core Team Profile

Name	Designation	Educational Qualification	No. of years of experience
Ayush Nigam	Co-Founder & CEO	BTech - IIT Madras - Mechanical Engg	11
Santosh Kumar	Co-Founder & Head-Operations	Masters - IMT Ghaziabad & Electronics Engg	11
Dr. Ajit Kumar Nigam	Co-Founder & Head-Strategic Collaborations	PhD Management (Organizational Behaviour) - IIT Guwahati & MS - Manchester University, UK	40

GRoboMac

GRoboMac is a precision agriculture robotics startup with a focus on increasing the productivity of labor-intensive operations in the farm. It aims to address the issue of unavailability of manual labor when the demand is at its peak (for example during the harvesting season). The company is presently working on a solution for harvesting cotton which is a labor-intensive process and suffers from high labor costs, scarcity of expert cotton pickers, and wastage of the produce due to picking of non-bloomed or semi-bloomed crops.

Product Description

The company has indigenously developed an autonomous robotic machine for harvesting cotton. The machine has a 3-Dimensional (3D) vision camera which in synchronization with a machine learning (ML) algorithm, detects and locates cotton ready to be harvested.

The camera records live feed of images which are processed by the image processing software. The machine is equipped with robotic arms that have a human hand action mechanism. These arms dislodge the cotton and through a vacuum mechanism and transport it to a sterile storage compartment. This ensures that the cotton remains untouched and undamaged. Multiple arms that operate independent of each other can be mounted on a machine which can move between the rows of plants performing the task of multiple human hands but with greater speed, accuracy, and efficiency.

The software can be customized to pick cotton of a certain age and exclude the trash, semi/non-bloomed cotton. The robotic arms and the software are indigenous and proprietary while using commercially available 3-D camera. The camera system including the software, and the robotic arms can be mounted on an electric powered vehicle while a diesel-powered vehicle is under development. The system can be mounted on a tractor or any other farm vehicle, provided that the vehicle should be highly maneuverable in order to optimize the movement and functions of the arms and the camera. A regular tractor can be used to deploy the machine in a large farm whereas a miniature tractor can implement it in a greenhouse or a small farm. The company can provide options of 4,5, or 8 arms for the machine depending upon the mounting vehicle and the customer' needs

GRoboMac is developing software and working on customizing the machine to work on other horticultural fruits and vegetables like capsicum, gherkins, cucumbers, etc. It is also researching and developing the machine to perform multiple other functions as well like pruning, topping, weeding etc.

The Cotton Harvesting machine has been field tested and would be available commercially by August 2019.

Intellectual Property

GRoboMac has filed for three patents that cover different aspects of the technology. It is in process to get the company name trademarked as well.

Challenges Faced

Access to Funding

GRoboMac is an Agri-mechanical startup making advance robotics products. The capital to develop and test the technology is high and the Return on Investment (RoI) time compared to a purely software-based product is relatively longer. Owing to this longer RoI time, it is difficult for the company to raise funds. This lack of funding and capital resources is a major challenge for GRoboMac.

Business Model

GRoboMac will follow Business to Business model where it will sell or rent out its machine to companies providing Farming as a Service (FaaS) or to commercial farming companies. It is also in talks with stakeholders in the cotton farming domain like seed producers and textile companies for implementing the solution on ground.

The company is looking to partner with commercial tractor manufacturers to develop a controllable tractor or a vehicle to deploy its system. Such a partnership would expedite GRoboMac's market entry as it will bypass the need to develop and refine its own vehicle. It will also save time and money for getting approvals and licenses for a new vehicle.

Market Presence

The company's target market in India are the cotton growing states of Gujarat, Maharashtra, and Telangana. After successfully establishing itself in India, GRoboMac will target large cotton producing African countries.

Key Partnerships

VillGro – Incubation and Funding

Govt of Karnataka - Startup Karnataka Program - Funding

NASSCOM – CoE for IoT and AI - Funding

Financial Analysis

GRoboMac will launch the product by June 2019 and projects breaking even by July 2021 (within 24 months of the launch).

Requirements for Scaling-up

Funding Needs

GRoboMac is actively seeking funds to expedite the product testing process and expand the testing parameters in order to better calibrate the machine and perfect the technology. Funds would also enable the company to employ and retain quality workforce to handle its operations.

Partnership Needs

The company is looking for partnership opportunities with Farm Vehicle Manufacturing companies to implement its technology on an existing tractor platform or to develop a vehicle platform for the same. This would help GRoboMac enter the marker earlier than if its manufacturing its own vehicle. Tying up with an established company would also help with sales and aftersales services.

On-Field Product Implementation

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Manohar Sambandam	CEO	ME , IISc, Bangalore	31 years
Mr. Suresh Kumar Bopparaju	Chief Strategy Officer	ME, IISc, Bangalore	32 Years

Kinemach Engineering and Machines

Kinemach is an Agri-Mechanization startup that offers machines and designing services for the agriculture sector.

Currently, land preparation machines use a rotary mechanism or simple technologies such as mixtures and grinders to prepare the land for sowing the crops; however, many farmers still prefer to prepare the land by hand, making it a labor intensive and time-consuming process.

Kinemach's innovation replicates the human hand action, thus offering farmers an alternative for the manual labor-intensive process.

Product Description

Kinemach currently offers a set land-preparation equipment, and also designs other customized equipment based on client's needs.

LandPro

Kinemach's Land Preparation Equipment is a machine that replicates the human hand action of working on soil and does multiple activities such as ploughing, digging, and weeding. Traditionally farmers would need different machines and equipment to perform these activities. Landpro is a self-powered walk-behind machine that has a spading action on soil. Its second and third generation versions will be equipped with technologies like autonomous driving and electric transmission.

Kinemach also offers a tractor attachment version of its innovation which is called LandPro Plus.

Designing Services

Kinemach designs customized machines for agricultural and other mechanical businesses based on the client needs. So far, they have designed an Image Based Cotton Plucker and a Stubble Removal Machine for different clients.

LandPro

Intellectual Property

Kinemach has patented its innovation and will file subsequent patents on different versions and improvements of the machine.

Challenges Faced

Subsidy

Kinemach is facing challenges for procuring subsidy for its machines. Nonsubsidized cost of the machine is between INR 2-2.5 lakh. This machine can perform the task of 3 different machines but since these machines are subsidized, all 3 of them are available for a price less than Kinemach's machine. The process to get subsidy for an agricultural machine is time and money extensive. The testing and certification costs INR 4 lakh for machines with a pre-certified engine and INR 10 lakh for a non-certified engine. Post the certification, the manufacturer must reach agreements with each state that it plans to launch its products in, individually. It is difficult for startups like Kinemach to maneuver this process.

Cash Flow

Another challenge Kinemach is facing is the seasonality of its product. The machines cannot be sold year-round, thus hampering a continuous revenue flow. This model is not feasible for a startup which requires constant cash flow to sustain itself. To offset this challenge, Kinemach is manufacturing and designing other non-agricultural machines and trying to establish a regular cash flow, post which it will shift the focus back to Landpro.

Business Model

Kinemach is open for both Business to Business and Business to Customer models. Its primary focus is farmers, but it is in talks with FPOs and Farm Machinery rental companies as well.

Market Presence

Kinemach hasn't entered the market yet but they are actively looking for different channels to start selling LandPro. It wants to establish a strong after-sales mechanism so that they can serve the farmers efficiently.

Key Partnerships

Mahindra and Mahindra has mentored Kinemach throughout the conceptualizing, designing, and manufacturing stages. It has also received a grant from National Institute of Design.

Financial Analysis

Kinemach is profitable through its non-agricultural verticals. The main source of revenue for the company is its Machine Design vertical.

It is yet to launch LandPro commercially.

Requirements for Scaling-up

Partnership Needs

Kinemach is actively seeking partnerships with both private and public organisations to help it enter the market. This could either be through a licensing or a distribution-based model.

Policy Needs

The subsidy process is different for all states and involves significant time and resource to procure subsidy for each state. A centralized system of obtaining subsidy for agricultural products would be beneficial for startups such as Kinemach and help them scale up and dissipate the technology.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Ashwanth MP	CEO	BTech in Mechanical Engineering from CUSAT	5+
Mr. Jerish John	CTO	BTech in Mechanical Engineering from CUSAT	5+

On-Field Product Implementation

Knoxia Technologies

Knoxia is an electronics product development company that manufactures technological tools for implementation in agriculture.

Product Description

The company utilizes technologies such as Internet of Things, Artificial Intelligence, Machine Learning, Big Data Analytics & Cloud Computing to develop multiple products:

Smart Spectrophotometer

Knoxia is developing a soil testing solution combining spectrophotometry with IoT and GPS modules for testing the quality of soil, mapping and analysis of soil data and providing remedies and solutions through an AI based cloud platform. The device uses VIS-NIRS (Visible-Near Infra-Red) reflection spectroscopy to predict soil acidity, macro-nutrients such as phosphorus, potassium, calcium, magnesium, Sulphur, and several micro-nutrients such as iron, manganese, boron, molybdenum, copper, zinc, chlorine, & cobalt. The information from the device would be stored on the cloud through and mapped geographically through IoT and GPS technology. The data can be used to monitor and improve the soil quality by both public and private entities.

The company has also manufactured several devices for its public sector clients:

Portable CO2 Analyzer

IoT based smart device to analyze the effects of Carbon di-Oxide in packaged food

Fish Freshness Analyzer

Smart wireless device that uses impedance spectroscopy to detect the freshness of fish

Cold Storage Air Measurement Device

RFID based smart tag reader, web & android application to measure ethylene gas, temperature, and humidity for cold storage containers

Precision Seed Drill

Microprocessor based smart system for precision farming seed & fertilizer drill

The company has also worked with several non-agricultural clients to develop devices and applications to be deployed in railways, defense and multiple other sectors.

Intellectual Property

Knoxia will file for process and product patent for its Smart Spectrophotometer Device. The patents for other devices manufactured under contract are owned by the respective clients.

Challenges Faced

Skilled Manpower

The company needed workforce with multiple technical skills and had extreme difficulty in finding and recruiting such talent. It circumvented this limitation by hiring interns from engineering schools in Lucknow and Kanpur.

Business Model

Knoxia follows a Business to Business/ Government (B2B, B2G and B2C) model working with public institutions for developing custom technological devices. The company will offer its Smart Spectrophotometer to both private and public clients. It is also in the process of licensing the technologies it developed for public sector institutions and bring them to market.

Requirements for Scaling-up

Partnership

Knoxia is seeking partners to co-develop the Spectrophotometer and also for its commercial market launch. The company is also seeking partners to deploy the other four technologies developed by it that it is in the process of licensing.

Market Presence

Knoxia has worked with clients such as CIAE, Bhopal, IARI Delhi, IIT Kanpur, CIPHET, Ludhiana and many other across the country. The company will offer its Smart Spectrophotometer to clients throughout India based on the demand.

Key Partnerships

Knoxia is in talks with VillGro for incubation under the social incubator. The company is primarily bootstrapped.

Financial Analysis

Knoxia plans to launch the Smart Spectrophotometer by Early 2020 and projects breaking even within 15 months of the launch. The company had a revenue of INR 6 lakhs in 2017-18 and INR 10 lakhs in 2018-19.

Incubation & Funding

The company is seeking funds to further research and develop the agricultural vertical and incubation for mentoring, access to facilities, and market access support.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Mr. Sushil Verma	Director	M.Sc. (Electronics + Diploma in Embedded Systems)	15 years
Mr. Suresh Kumar Bopparaju	Chief Strategy Officer	ME, IISc, Bangalore	32 Years

Nentoir

Nentoir leverages Geo-Spatial data to build Geo-portal platforms. These are used to help in building agricultural irrigation and drainage systems over large catchment area in uneven terrains.

Survey for building the irrigation systems in the traditional manner is a time and resource intensive process in uneven terrains and usually takes over a few months for a normal catchment area which can range between 5-10 sq. km. It involves physical analysis of terrain by civil engineers who must travel and visually inspect all the factors. By using the Geo-Portal platform from Nentoir, the same work can be done in a few days by use of geospatial data on our platform.

Product Description

Nentoir has built an algorithm platform that analysis Geo-Spatial, Meteorological, and large amounts of other data to build a Geo-Portal. The data maps are sourced from various organizations. These organizations have access to High Resolution Satellite Images. These images are available in the public domain as well and can be purchased by private enterprises after permissions from relevant authorities. As Jammu and Kashmir is a sensitive State, it is challenging for a private party to obtain these images. Nentoir works only with the government at present and the images are procured with their help.

The Platform is self-analyzing and is built on Artificial Intelligence algorithm. On the platform the locations in consideration are pinpointed, based on their geographical coordinates – latitude and longitude. Further, terrain analysis is done to virtually build all the possible drainage pattern, including the naturally existing ones.

While building an irrigation map, Nentoir tries to avoid using pumps or electricity as far as possible in the entire system and focusses on gravity for transporting the water. The Gravity Irrigation System has zero dependence upon electricity. It takes the meteorological data into account and finds the pre-existing water reservoirs, streams, and rainfall patterns, it uses these resources and existing natural drainage patters while building a system.

Nentoir's platform is also used for optimizing Agri-Food supply chain. Cold chains and warehouses are to be built at an optimum distance between the farms and the markets increasing the supply chain's efficiency.

Intellectual Property

Nentoir is in process of filing a process-based patent and are working along with its incubator for the same. It has applied for a trademark for the company name.

Initial Challenges Faced

Startup Ecosystem

Lack or absence of entrepreneurial ecosystem in the state of Jammu and Kashmir was the biggest challenge. When the founders approached the state nodal agency for entrepreneurship, they were suggested to start a dairy or a poultry farm, or something more mainstream. Founders couldn't find any investment for a technology startup from them. In 2016, govt came up with the Startup India program under which they were incubated and were given an opportunity to grow at TBIC SMVDU.

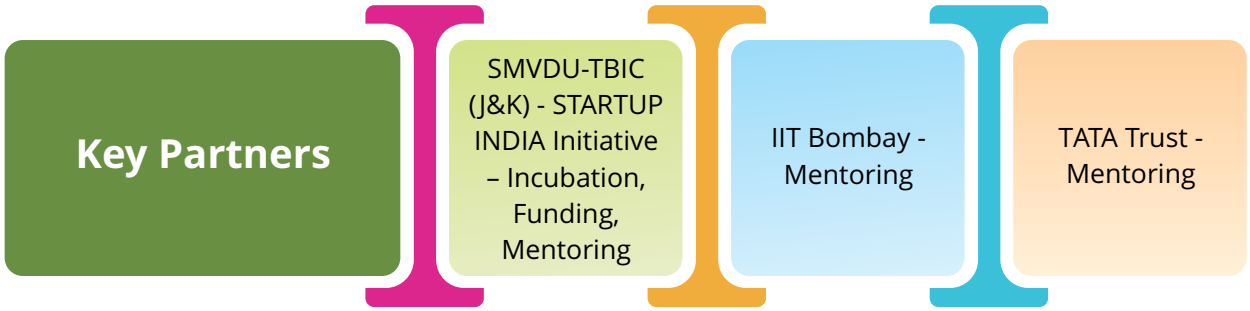
Business Model

Nentoir is working on B2B model. Presently, Nentoir's only client is the Jammu and Kashmir government, but it will seek corporate clients as well once the technology platform is well developed to suit the requirements of clients from other sectors.

Market Presence

Nentoir is present only in J&K presently and will be expanding to other similar states like Himachal Pradesh and Uttarakhand in Phase I by 2020 and to Punjab, Haryana, Uttar Pradesh and other Agriculture intensive states in Phase II by 2021.

Key Partnerships



Financial Analysis

Nentoir are bootstrapped with funds from the incubator and have two work orders from J&K government. It is projecting Breaking-Even by the last quarter of 2019.

Challenges Faced

Partnership Needs

Nentoir wants to partner with the industry for conducting pilots. It also wants more corporates to tie up with startups in the state of J&K. This would bridge the gap in the state and would make provide corporates with newer markets and startups with partners and users for their technologies.

Core Team Details

Mr. Ishan Verma, Founder & CEO of Nentoir is a Civil Engineer with 7+ years of experience. The founding team at Nentoir is NIT Karnataka and GCET Jammu Alumni. During their M.Tech at NIT K, the founding members came across the useability and scope of GIS in future. During this period Karnataka was building it's geoportal (the first state in India to do so). In next couple of years the team got entrepreneurial exposure by qualifying for Eureka by IIT-B and TATA First Dot. Nentoir was officially founded in early 2017 and is being incubated at technology business incubation centre.(TBIC SMVDU, J&K)

Proximal Soilsens

Proximal Soilsens incubated at IIT Bombay is a startup working toward improving the crop yields and saving water through controlled irrigation. Proximal Soilsens develops indigenous technological sensors and systems for precision farming.

Product Description

Proximal Soilsens has developed an indigenous, modular SMART© (Sustainably Managing Agriculture in Remote Terrain) sensor system which consists of:

- Soil Moisture and Temperature Sensors - Inserted in the soil to any depth as required by the crop. It can be inserted in the soil from 15 cms to beyond 1 meter.
- Air Temperature and Humidity Sensors - Ambient, above the surface sensors.
- Signal Processing Unit – The low power SPU transmits the data from the sensors to the cloud using a global SIM.
- Solar Panel – The system is powered by photovoltaic cells and not dependent on power from the grid. The energy is stored in a battery and can be used in absence of sunlight for 3-4 days.

The height of the system can vary between 1-3 meters based on crop height to ensure that the crop doesn't shadow the solar panel. All the parts can be replaced individually. The system can work on a battery even without solar panel for 3 months if the frequency of the sampling of data is 6 to 8 hours.

The data from the sensors is transferred to the company's computer system and is analyzed for different parameter. The outputs and advise about ideal moisture, temperature, and humidity are provided to the user using a mobile application. The company is also working on integrating disease prediction based on the sensor and weather data with the existing mobile app. This will tell the farmer about occurrence of disease in advance and the remedial steps to be taken. The application is being developed for both Android and iOS platforms.

Proximal Soilsens aims to deploy the system in farms, poly-houses, research labs for controlled irrigation resulting in reduced water usage and improved yield.

Intellectual Property

The patent for the technology is owned by Indian Institute of Technology – Bombay. The company has obtained an exclusive license for the same from the institute and is in process of applying for a trademark for its name.

Initial Challenges Faced

Market Entry

Entering the market with a hardware-based product is a challenge for the company. The risks are high with a physical technology in comparison to digital solutions, thus it faced difficulty in finding a partner to access the market. The company is in talks with and industry partner and will enter the market by mid-2019.

Business Model

Proximal Soilsens has done multiple commercial pilots since 2017 with Mahindra and Mahindra, Coromandel International, Indian Institute of Oilseed Research (IIOR), World Bank POCRA (Project on Climate Resilient Agriculture) Project etc. The company is in the final stage of talks for partnership with an undisclosed partner for launching the product at a wider scale in the Indian market by December 2019. Apart from offering a complete system, it is also planning to sell soil moisture sensors individually. It plans to follow a Business to Business approach and work with agri-input companies, commercial farming, and any other business that works with farmers.

The complete system along with the mobile application costs around INR 20,000 which is 20% the cost of similar imported systems. It has the cost advantage because it designs, develops and manufactures its own soil moisture sensors. It is also developing other sensors which are required for precision farming. The benefit of indigenous sensors is after sales services - repair and replacement.

Market Presence

Proximal Soilsens has conducted pilots in Maharashtra, Gujarat and Telangana and is exploring to move to other states. With its partner company, it will launch the product across India.

Key Partnerships

Society for Innovation and Entrepreneurship (SINE) IIT – Bombay – Incubation

Research and Innovation Circle of Hyderabad (RICH) – Market Connect

UnLtd India - Incubation

Empower, Zone Startups - Acceleration

Soilsens wants to partner with AgTech companies working in data analytics domain, who utilize data from the ground sensors and provide advisory to the farmers as well as motor and drip irrigation companies.

Financial Analysis

The company has grants from Biotechnology Industry Research Assistance Council (BIRAC) for INR 48 lacs and Millennium Alliance (FICCI-USAID Joint Program) for INR 30 lacs.

In addition to the abovementioned grants, the company has also been paid (undisclosed amount) for the commercial pilots.

On-Field Product Implementation

Requirements for Scaling-up

Partnership Needs

The company is looking to partner with AgTech startups providing analytics based advisory to farmers and provide them with the relevant data gathered from its sensors.

Funding Needs

The company is seeking funding from both government and industry for scaling the technology.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Dr. Rajul S Patkar	CEO	PhD, IIT Bombay	15+
Dr. Mangesh R Gurav	CTO	PhD, IIT Bombay	3+
Prof. V Ramgopal Rao	Promoter	PhD, Universitaet der Bundeswehr Munich, Germany	20+
Prof. Maryam Shojaei Baghini	Promoter	PhD, Sharif Univ. of Technology	15+

Proximal Team Recieving Millennium Award

RAAV Techlabs

RAAV Techlabs is a quality analysis and data analytics company which develops and designs non-destructive food and beverage testing solutions. Any solid or liquid based agricultural produce can be analyzed for its nutrition; adulteration type and thereby deducing value via specialized solutions.

The solutions developed by RAAV can be deployed at all stages of the agricultural supply chain where the stakeholders can check/sort/procure top quality agricultural produce efficiently.

Product Description

RAAV Techlabs has two key products in its portfolio:

Fruit Analyzer

Hand-Held Spectrometer device measures the interaction of light with matter is able to analyze it qualitatively and quantitatively. Different product attributes are measured using different scientific standards, such as the level of sweetness of a fruit is checked on the basis on BRIX Rating by measuring the accumulation of Sucrose-Glucose-Fructose. The shelf life is determined by measuring the moisture and chlorophyll content. The spectrometer has a measuring accuracy of (+/-) 0.5% for nutritional parameters and the shelf life prediction for any product is accurate up to (+/-) 0.25% or (+/-) 6 hours.

Based on these parameters the company provides two statistics for the products: Ripe By & Used By. Presently the device is aiming to analyze Grapes, Sapota, Mangoes, Papaya, and Apple. The company is working to add more fruits, vegetables, and grains to the list.

Milk Analyzer

This device is based on the principle of Raman spectroscopy and is in the form of a 'Cuvette based Solution'. The sample is introduced into the cuvette and placed inside the spectrometer following which the results are displayed in 3-5 seconds post scanning. It provides nutritional levels of fats, proteins, carbohydrates and water present in the sample. It can also detect and quantify the presence of adulterants like urea, antibiotics, melamine, detergents etc. The company is working to increase the count of detectable adulterants. The device has an accuracy of (+/-) 0.2% which the company has verified by using HPLC (High Performance Liquid Chromatography).

The software is built into an android phone with a miniature receipt printing machine connected to it. This reduces the power requirement and the number of personnel required throughout the collection process. Both the hardware and the software cannot be manipulated, thus increasing the reliability of the process.

Business Model

RAAV Techlabs is following a Business to Business (B2B) approach and the target clients would be Export, FPOs, Grocery Chains, Milk Procurement Companies, APMCs, e-Commerce Companies.

RAAV envisions to bring multiple types of agricultural commodities under one umbrella to increase quality standards and traceability across various levels of the supply chain.

Intellectual Property

The company has applied for separate product and process patents for both the Fruit Analyzer, and the Milk Analyzer devices.

Challenges Faced

Data Availability/Access to farms

Developing an efficient analysis module requires processing of large data sets through it. The company found it difficult to access these data sets. There is a lack of centrally operated data source, as a result it resorted to collection of samples on its own. The company worked with several vendors in multiple markets to test their samples in a non-invasive manner and get the desired data.

FRU Phone Add-On

Market Presence

The company will enter the market by December 2019 with a focus on New Delhi in the first phase and gradually expand to Maharashtra, Karnataka, and Ahmedabad. It is presently piloting its technologies with Big Basket, Mahindra & Mahindra, APMC's.

Key Partnerships

- Villgro - Incubation
- NIDHI Prayas, DST, GoI - Funding
- Yes Scale Yes Bank - Acceleration
- Rabo Bank - Funding

Financial Analysis

The company has raised significant funds in the form of grants. It is projecting Breaking-Even within 24 months of commercially entering the market (December 2019).

Funds raised by the company:

- Department of Science and Technology (GRANT) – INR 5,00,000
- Government of Gujarat (GRANT) – INR 10,00,000
- YES SCALE Accelerator (GRANT) – INR 20,00,000
- Rabobank and Villgro – INR 40,00,000

Requirements for Scaling-up

Access to Facilities

For manufacturing precision equipment such as the spectrometer, the company needed a Class 10 Clean Room (completely dust and grind free environment). Such facilities are only available with the government and access to private entities is subjected to a license which is granted after a rigorous review. The license process costs in excess of INR 2-3 crores and is beyond the ambit of most AgTech startups. The company proposes that a license for using these facilities for developing civilian products to be used in Agricultural space should be created along with a stringent monitoring mechanism to keep a check on the manufacturing.

Policy Needs

- For bringing its product to market, the company applied for Federal Communication Certification (FCC) and Consumer Electronic (CE) Certification in 2017. The approval mechanism for both these applications is time sensitive and is delaying the time to market for the company. The same should be expedited to save crucial time for startups like RAAV.
- The company recommends a policy change in the eNAM (fruits and vegetables) grading system to include nutritional parameters, taste and presence of adulterants to the existing policies of eNAM, which currently uses shape, size, colour and presence of external defects to determine price of produce. This will result in better pricing opportunities for farmers and other stakeholders of the agricultural supply chain

Partnerships

RAAV Techlabs is looking to partner with both public and private enterprises to pilot its technologies and conduct end client validation.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)
Rahul Kumar	CEO & ML/Backend Expert	(B.Tech., Computer Science) – NIIT University
Varshnee Raj	CTO & Embedded Systems Designer	(B.Tech., Electronics and Communications) - NIIT University
Abhinandan Bhargava	CMO & Product/UI Designer	(B.Tech. Computer Science) - NIIT University
Alphonse Dhas Antony	COO & Research Head	(B.Tech. Biotechnology) - NIIT University

Samudra Network

Samudra Network is an AgTech startup with a goal to digitize the agri value chain around Farmer Collectives (Producer Organizations/ Companies (FPOs & FPCs)/ Federations/ Co-Operatives) and relevant ecosystem players like agri buyers, input suppliers and agri finance institutions.

The company provides tools for FPOs in the form of a digital platform which tracks all their business transactions and activities, increasing efficiency, business tracking and reducing chances of manual error and fraud in reconciliations. Additionally, it is also in the process of developing a digital market network which will allow FPOs with better market connect opportunities by linking them to different stakeholders like buyers, agri-businesses, financial companies and banks, and logistics companies.

Product Description

Samudra Network has two core products in its portfolio, one of which is operational and the other under development:

FPO Digitization Solution

The solution is a mobile based application that is used for digitization of every activity taking place in an FPO. It is based on a cloud based ERP platform with an aim to leverage technologies like machine learning, blockchain for tracking and traceability in the agri value chain.

The application is downloadable on android based smartphones and in addition to the mobile application Samudra Network gives the user access to dashboards where all the information, analytics and insights can be accessed.

The application can be used by FPO members to record all transactions during the buying and selling process of farm produce which in turn helps in generating buyer and farmer side insights on the dashboards. FPOs aggregate farm inputs and sell them to their member farmers, the application helps with inventory management for these inputs and tracks purchase indents, sales, credit outstanding, and many other aspects. The application also helps FPOs to communicate & interact with their member base via notifications and info messages.

The company is working on adding an analytics and machine learning based module to the application which will predict input requirements based on the demand captured over a crop cycle, estimated

FPO Digitization Solution

yield based on past recorded data and explore areas like crop pricing patterns and forecast for the next season etc. FPOs can share dashboards with their business insights with Agri Finance institutions and other ecosystem partners to enhance working partnerships and better access to ecosystem resources.

The company is also aiming to make their solution ready with Application Programming Interfaces (APIs) and want to work with other AgTech companies, government and industry players within the ecosystem for creating a full digital stack of enablers for the Farmer collectives.

Market Network Platform

Samudra Network is developing a market network platform that will be a combination of – an agri social network platform like LinkedIn where companies and individuals can discover and search for other stakeholders in the agri ecosystem, a marketplace platform like Alibaba where farmers, FPOs and other ecosystem players can trade, buy, and sell different commodities, and a workflow management platform like Salesforce where the FPOs and other players can run a complete workflow of all the marketplace transactions. Samudra Network is combining these three distinct capabilities into a single market network dedicated to the agricultural sector.

The company plans to bring together the ecosystem of FPOs presently using the Digitization Solution along with the buyers, sellers and agri finance companies involved with them. It projects a network affect where buyers, sellers, and FPOs would bring other stakeholders to the platform and would interconnect to form different linkages. The company aims to create a data driven agricultural marketplace with a systemwide approach of creating linkages between Agri-businesses, input suppliers, buyers, banks and insurance companies, logistics companies, among others. The platform would enable users to discover and leverage previously inaccessible resources within the vast agricultural ecosystem. The network would be able to leverage technologies like the blockchain framework which will allow complete transparency, permissioned control, traceability and tracking of all transactions.

Samudra Network Dashboard

Intellectual Property

The company would be looking to apply for relevant IP protection for the unique way of using the data and technology.

Challenges Faced

Business Model Optimization

After developing a solution that was relevant for the rural economy and usable by the agri value chain, the company decided to work with the farmer collective model of co-operatives, federations and FPOs to bring its solutions in an assisted manner closer to the farm. The company has adopted an approach to bring a full ecosystem of enablers to the Farmer Collectives, thereby helping to drive success for these institutions where farmers have a direct share of the success. . . The company is working on ways to optimize the business model with the wider agri ecosystem, so as to reduce any costs related to digitization towards the farmer collectives and supply side.

Skilled Manpower to drive adoption

The company needed professionals with a good understanding of rural development and the agricultural sector as well as those who could work in the rural areas to help with the digitizing of client FPOs. Finding such workforce at scale was a major challenge for the company. It adopted an approach to partner with NGOs that had skilled workforce and employees and were working in the rural areas with proven credibility in the farmer community. This skilled workforce from the NGOs is being trained by the company for the deployment of the product.

Data Resource

Unavailability of an extensive and centralized data stack that has information on growing patterns, value chains, staples and cash crops, cropping pattern across the country, is a constant challenge that the company still faces. This is circumvented by doing on ground primary research backed by secondary research from segregated sources.

Business Model

The company follows a Business to Business (B2B) model and works exclusively with medium to large FPOs and Co-Operatives at present.

The company deploys the technology initially without any upfront cost and charges a certain percentage of every transaction taking place through the application as the fee under a recurring-revenue model.

The company is working to build a revenue stream model for the Market Network product. The product can have a transaction based model similar to the Digitization app or a subscription based model.

Market Presence

Samudra Network is headquartered in Bangalore with presence in Gurgaon.

It started piloting in 2018 with 4 FPOs and scaled it up to 15 FPOs in Karnataka. The solution was commercially implemented at all of these 15 FPOs after successful completion of the pilot studies. It is presently working with 20 FPOs with over 30,000 direct and indirect member farmers. It is in the process of implementing the solution in Maharashtra and Gujarat by July 2019.

The company has also started working with wholesale buyers and agri finance institutions to bring these linkages to the FPOs and also allows

FPOs to share their business opportunities and performance with these stakeholders via dashboards.

The company aims to reach an estimated 50 FPOs and 100,000 farmers by the first quarter of 2020.

Key Partnerships

Being the winners of the Agri Grand Challenge – Ministry of Agriculture, Samudra Network is in the process of being incubated at KIIT-TBI at Bhubaneshwar.

The company has strategic partnership with Initiatives for Development Foundations (IDF), an NGO working for the betterment of farmers in the country. IDF has helped Samudra Network connect to the FPOs across Karnataka.

Financial Analysis

The company has conducted several paid pilots since January 2018 and has commercially implemented the solution in 15 FPOs since December 2018. It is in the early stage of revenue generation and hasn't broken even yet.

Requirements for Scaling-up

Partnership Needs

Samudra Network is actively working to build partnerships with Agri Buyers, Agri Finance and Input supplier players for supporting the network of FPOs, Federations and Co-Operatives. The company is in dialog with FPO, Federation and Co-Operative promoter institutions, NGOs to onboard and expand the Farmer Collective network. The company is actively looking to partner with more governmental bodies like NABARD and SFAC that work with a large number to FPOs across the country to implement Digitization tool under them as part of a pilot program which can further be scaled.

Data Needs

Considering the advent of advance technologies and data driven analytics, a centralized governmental hub of agricultural data is the need of the hour to boost startups like Samudra Network to work better and more effectively help the agri ecosystem solve the demand and supply imbalance thereby creating more sustainable revenue streams for farmers.

Core Team Profile

Name	Designation	Educational Qualification (Degree, University)	No. of years of experience
Rajiv Bhatia	Co-Founder	Executive Education Program, London Business School B.E Elec Eng, University of Pune .	18 years
Sneha Lakshman	Co-Founder	M. Des IIT Mumbai BFA Chitra Kala Parishad	

References

1. The Global Startup Economy Is Growing, But Who Is Left Out, Forbes Magazine https://www.forbes.com/sites/danestangler/2019/05/09/the-global-startup-economy-is-growingbut-who-is-left-out/#1f0e45505e16
2. Global $43.4 Billion Precision Agriculture Market Analysis 2014-2025, Business Wire https://www.businesswire.com/news/home/20170313006084/en/Global-43.4-Billion-Precision-Agriculture-Market-Analysis
3. Clarity from above, PricewaterhouseCoopers https://www.pwc.pl/pl/pdf/clarity-from-above-pwc.pdf
4. Agriculture drone market to be worth $4.8 billion by 2024, Institutional Real Estate Inc, https://irei.com/news/report-agriculture-drone-market-worth-4-8-billion-2024/
5. Drones could save farmers millions, Des Moines Register https://www.desmoinesregister.com/story/money/agriculture/2015/07/21/drones-farm-savingsagriculture-millions/30486487/
6. Aerobotics Official Website https://www.aerobotics.com
7. IoT Transforming The Future of Agriculture, IoT World Congress https://www.iotsworldcongress.com/iot-transforming-the-future-of-agriculture/
8. Agriculture's need for analytics and IoT, The Institute for Operations Research and the Management Sciences https://www.informs.org/ORMS-Today/Public-Articles/April-Volume-44-Number-2/Agriculture-sneed-for-analytics-and-IoT
9. National Rural Issues: Transformative Technologies, AgriFutures Australia https://www.agrifutures.com.au/wp-content/uploads/publications/16-032.pdf
10. How IoT is being used for Australian agriculture in 2019, Tech Republic https://www.techrepublic.com/article/how-iot-is-being-used-for-australian-agriculture-in-2019/
11. Blue River Technology Official Website http://smartmachines.bluerivertechnology.com/
12. Abundant Robotics Official Website https://www.abundantrobotics.com/
13. Four Ways Robotics Will Affect Agriculture in 2019, Robotics Business Review https://www.roboticsbusinessreview.com/agriculture/4-ways-robotics-change-agriculturein-2019/
14. AgTech in South-East Asia an Untapped Opportunity, Sankalp Forum http://www.sankalpforum.com/agtech-in-southeast-asia-an-untapped-opportunity/
15. South-East Asia Mobile Internet Usage Increasing Dramatically, Medium Magazine https://medium.com/financex/southeast-asia-mobile-internet-usage-increasing-dramatically-bb63266affb5
16. Can Blockchain help rice farmers fight poverty, Oxfam America https://www.oxfamamerica.org/explore/stories/can-blockchain-help-rice-farmers-fight-poverty/
17. Cityfarm Official Website https://cityfarm.my/
18. Tech's potential lies downstream for South-east Asia's small farms, The Business Times https://www.businesstimes.com.sg/garage/tech%E2%80%99s-potential-lies-downstream-forsouth-east-asia%E2%80%99s-small-farms

19. Vertical Farming Market - US$4 Billion for Asia Pacific by 2024, Business Insider https://markets.businessinsider.com/news/stocks/vertical-farming-market-us-4-billion-for-asiapacific-by-2024-1002410528

20. SEEDS Capital appoints seven partners to co-invest in agrifood tech startups, Startup Singapore https://www.startupsg.net/announcements/4909/seeds-capital-appoints-seven-partners-to-co-invest-in-agrifood-tech-startups

21. In just 8 years, India will overtake China as world's most populous country: UN report, The Hindu Business Line https://www.thehindubusinessline.com/economy/india-will-overtake-china-as-worlds-most-populous-country-in-2027-un-report/article28021947.ece

22. Precision Agriculture & Potential Market in India, Tech Mahindra https://www.techmahindra.com/sites/ResourceCenter/White%20Papers/New_Gen_Services/PrecisionAgriculture-PotentialMarket-India.pdf

23. India Precision Agriculture Market By Technology, TechSci Research https://www.techsciresearch.com/report/india-precision-agriculture-market/4029.html

24. Pests eat away 35% of total crop yield, says ICAR scientist, The Hindu https://www.thehindu.com/news/national/pests-eat-away-35-of-total-crop-yield-says-icarscientist/article17368426.ece

25. Study on Post-Harvest Losses, ICAR-CIPHET http://www.ciphet.in/study-on-post-harves-losses.php

26. If India cuts post-harvest losses, over 5 cr people could be fed for a year – at Rs 50 per day, The Financial Express https://www.financialexpress.com/opinion/if-india-cuts-post-harvest-losses-over-5-cr-peoplecould-be-fed-for-a-year-at-rs-50-per-day/892535/

27. Bill & Melinda Gates Foundation and Tata Trusts join hands to set up India Agritech Incubation Network, Tata Trusts https://www.tatatrusts.org/article/inside/bill-and-melinda-gates-foundation-and-tata-trusts

28. CIIE, IIM-A Official Website https://www.iima.ac.in/web/areas-and-centres/research-centres/ciie

29. Villgro Official Website https://www.villgro.org/about-us/

30. IIT-M Incubation Cell Official Website http://www.incubation.iitm.ac.in/about-us

31. a-Idea, ICAR-NAARM Official Website https://aidea.naarm.org.in/

32. Indigram Labs Official Website http://indigramlabs.org/

33. Pusa Krishi Incubator, ICAR-IARI Official Website http://pusakrishi.iari.res.in/

34. ICRISAT Official Website http://www.aipicrisat.org/about-us/

35. Ibid

36. Yes Scale Accelerator, Yes Bank Official Website http://www.yesfintech.com/yesscale/aboutus/

37. Ibid

38. SIIC, IIT-Kanpur Official Website http://www.iitk.ac.in/siic/d/incubation

NOTES

NOTES

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has more than 9100 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 291 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

India is now set to become a US$ 5 trillion economy in the next five years and Indian industry will remain the principal growth engine for achieving this target. With the theme for 2019-20 as 'Competitiveness of India Inc - India@75: Forging Ahead', CII will focus on five priority areas which would enable the country to stay on a solid growth track. These are - employment generation, rural-urban connect, energy security, environmental sustainability and governance.

With 68 offices, including 9 Centres of Excellence, in India, and 11 overseas offices in Australia, China, Egypt, France, Germany, Indonesia, Singapore, South Africa, UAE, UK, and USA, as well as institutional partnerships with 394 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.

FACE

CII-Jubilant Bhartia
Food and Agriculture Centre of Excellence

FACE is CII's Centre of Excellence dedicated to building efficiencies across the agricultural value chain from farm to fork. FACE is charged with the mission of improving competitiveness of India' agriculture and food sector by catalyzing innovation, building capacity and enhancing productivity across the value chain. FACE works with farmers, companies, development institutions and the government to

- Improve on and off-farm productivity through the dissemination of best practices and technological innovation
- Invest in capacity building initiatives and skill development for supply chain participants across the value chain
- Strengthen linkages across the value chain through market access initiatives, thereby reducing losses and increasing farmer incomes

FACE's service portfolio comprises commodity specific value chain assessments and supply chain advisory services for food and agri businesses, training and consulting services in the area of food safety, and sectoral research across different market segments. FACE also works on projects in PPP mode, to develop business models that are scalable and replicable across geographies.

For further information, contact:

Vikas Mishra

Food and Agriculture Centre of Excellence
Confederation of Indian Industry
24-25 Institutional Area
Lodi Road, New Delhi - 110003, India
Email: vikas.mishra@cii.in