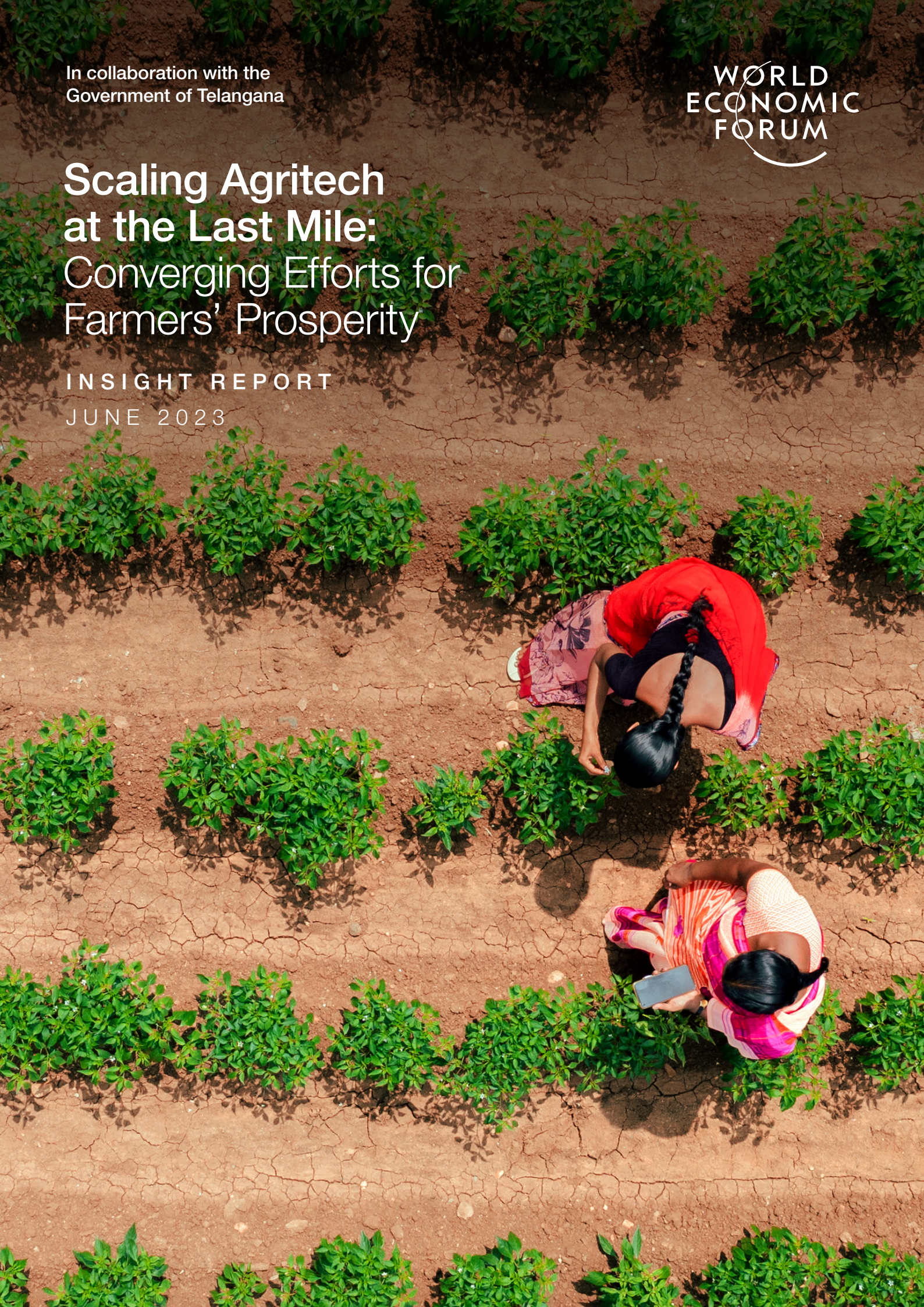
In collaboration with the
Government of Telangana

WORLD ECONOMIC FORUM

Scaling Agritech at the Last Mile: Converging Efforts for Farmers' Prosperity

INSIGHT REPORT

JUNE 2023



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Foreword

The technologies of the Fourth Industrial Revolution have immense potential to transform agriculture. Project Saagu Baagu demonstrates how public-private partnerships can bring together stakeholders to drive this transformation.

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Managing Director,
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Across the world, food security is a critical challenge that requires multistakeholder collaboration. Governments, businesses, innovators, civil society and farmers cannot achieve the vision of global food security in isolation. The challenges before them include climate change, soil degradation, natural calamities, disrupted supply chains and the continuing fallouts of the COVID-19 pandemic.

India, one of the largest producers of food in the world, is working on ambitious targets to transform the state of agriculture in order to feed its growing population – poised to cross 1.5 billion by 2030 – while keeping the well-being of farmers at the forefront, especially smallholder and women farmers. The Indian agricultural technology or agritech sector is expected to lead this transformation through path-breaking innovations to make agriculture more inclusive, sustainable and efficient. Technological integration will also create more jobs, particularly for young people.

Telangana, one of India's fastest growing states, has initiated project 'Saagu Baagu' in partnership with the World Economic Forum's Artificial Intelligence for Agriculture Innovation (AI4AI) initiative, supported by the Bill and Melinda Gates Foundation and implemented by Digital Green.

The project demonstrates how different stakeholders can come together to transform the agricultural sector, in a time- and outcome-bound manner. Saagu Baagu also demonstrates the approaches that can help scale technologies and bring about behavioural shifts among farmers by building trust in the adoption and active use of agritech services.

Saagu Baagu has impacted the lives of more than 7,000 chilli farmers, and is now progressing to its next phase. Learnings from the project are relevant for other emerging economies that face similar challenges in their agricultural sectors and want to promote the integration of agritech services. We hope this report will create interest among different governments, private sector and civil society actors to adopt and implement such initiatives in their respective countries for the well-being of farmers and the benefit of all.

Executive summary

Public-private partnerships in which governments enable the scaling up of Fourth Industrial Revolution technologies in agriculture can create confidence among all stakeholders to invest in and adopt emerging technologies.

The Indian agricultural sector is driven by smallholder farmers, who own more than 85% of the landholdings and contribute 51% of the country's production. Climate change, natural disasters and soil degradation have added to the economic aftermath of the COVID-19 pandemic to create a challenging environment for agriculture. Indian farms are expected to support the food security of more than 1.5 billion people by 2030. This situation calls for a complete transformation of India's agricultural sector.

The convergence of artificial intelligence and emerging technologies with agriculture provides a brilliant opportunity for India to make its agriculture more agile, data-driven and efficient, while continuing to focus on farmers' well-being, uplifting rural households' standard of living, feeding the population and aligning agriculture to face the climate challenge.

India's agritech market is estimated to reach $24.1 billion by 2025.[1] Today, agritech start-ups in India are exploring solutions involving robotics, big data, smart equipment, internet-of-things sensors and farm management software. Precision agriculture know-how and farm advisory services based on existing and new data sources – soil health cards, weather data, farm- or tractor-based sensors, etc. – can be shared through multiple channels to unlock an economic opportunity of $25 billion through a 15% increase in productivity.[2]

In this backdrop, the World Economic Forum's Artificial Intelligence for Agriculture Innovation (AI4AI) initiative designed a public-private partnership (PPP) to scale agritech services in India, in which central and state governments play an enabling role.

Telangana is one of the fastest growing states in the country, and its growth is partly fuelled by its agricultural sector. The Government of Telangana became the first in India to adopt this framework in the shape of Project Saagu Baagu (meaning "agricultural advancement") in partnership with the World Economic Forum, supported by the Bill and Melinda Gates Foundation and implemented by global development organization Digital Green. The project was initiated in the Khammam district in eastern Telangana, with a focus on the chilli value chain.

The project is rolling out the following initiatives in a phased manner:

- More than 7,000 farmers are directly getting access to advisory, quality-testing and e-commerce services in the first phase, which will be scaled to include other crops and districts in the second phase, to cover at least 100,000 farmers in Telangana.
- The second phase will create an agricultural data exchange and agri-data management framework to pave the way for enabling a data-sharing platform to support agritech services.
- The second phase will also include India's first agricultural sandbox.

This report captures the context, theory of change, approach and outcomes of the first phase of Project Saagu Baagu. It aims to provide recommendations for other Centres for the Fourth Industrial Revolution, governments, bilateral and multilateral institutions and the private sector to scale technologies of the Fourth Industrial Revolution in the agricultural sector in a PPP mode.

↑ **Image credit:** Digital Green

Introduction

Indian agriculture is at the cusp of a transformation that will enable it to feed 1.5 billion people by 2030 while improving the livelihoods of 500 million smallholder farmers.

Globally, 2 billion people depend on some 500 million small farms for their livelihoods.[3]

As in many developing countries with large agrarian economies, India's marginal and small farmers (who own less than two hectares of land) possess 86% of land holdings, covering 47.3% of the total cultivable area and contributing to 51% of the country's agricultural produce.[4] With every passing generation, land holdings have fragmented further.[5]

These smallholders struggle to capture much of the value of their products, which typically travels through numerous intermediaries with whom farmers negotiate from a position of disadvantage due to their lack of access to markets, pricing and grading information and services. Farmers receive as little as 25% of the final selling price of their crop, throttling productive investment and slowing the transition from subsistence to market-oriented farming.

Rural women farmers face additional hurdles, especially in the market. Although they work on farms as heads of households, alongside their husbands, or as hired labourers, they face deficits in opportunity, information and agency as compared to men.

Farmers' limited access to modern machinery, logistics and analytical data – such as on soil composition and climate patterns – leaves them at a disadvantage. The pandemic caused further problems as many regional markets were closed or operated at limited capacity, leaving produce to rot. Added to that is the worsening fallout of climate change in a sector already prone to the worst effects of adverse weather and natural processes such as soil degradation and pest attacks. The Indian Council of Agricultural Research predicts that climatic changes could reduce irrigated rice yields by 7% by 2050.[6]

While facing these critical systemic challenges, Indian agriculture is expected to continue producing more food – enough to feed an estimated 1.5 billion people by 2030. In this situation, the welfare of farmers, especially smallholder farmers, and improvement in farm income are essential to ensure that agriculture provides a viable livelihood for existing and coming generations. Yet, rising input costs and low returns from farming, as well as increasing wages in the non-farm sectors, have caused investment in agriculture to shrink even as young people become reluctant to take up farming. Meanwhile, increasingly erratic and unpredictable rainfall is compounding farming risk.

It is imperative for Indian agriculture to transform itself into a more agile, data-enabled and efficient sector. In this regard, agritech has proved to be a game changer. Agritech hinges on collating technological innovations such as artificial intelligence, big data analytics and cloud computing to offer better climate resilience, higher crop yields and a regulated pricing system. Agritech firms in India have made tremendous inroads in assisting farmers with precise information on farming techniques, including crop protection, nutrition, cultivation, harvesting and logistics.

The Indian agritech sector has come a long way, from 43 start-ups in 2013 to more than 1,000 in 2020. The increasing investor interest is a response to expanding internet penetration and availability of high-quality farmer inputs that provide entrepreneurs the opportunity to address issues such as lack of finance and post-harvest and supply-chain losses. The agritech sector has proved surprisingly resilient during the pandemic.

Agritech is now part of the Digital India initiative. Under the Digital Agriculture Mission 2021-2025, the Indian government has signed five agreements to accelerate agritech projects using technologies such as machine learning, big data analytics and blockchain.

Even with current growth, agritech has only tapped a fraction of the market opportunity. A report by the Ministry of Electronics and Information Technology of the Government of India has stated that data-enabled agritech services can unlock $65 billion worth of opportunities by 2025. While agritech has come up with some path-breaking technological and business innovations, what is needed is an ecosystem that fast-tracks their scaling up alongside risk-management measures that safeguard farmers' interests. In 2020-21, the Centre for the Fourth Industrial Revolution's Artificial Intelligence for Agriculture Innovation (AI4AI) initiative conducted multiple stakeholder consultations to identify the critical ecosystem challenges as well as enablers that can bolster agritech use cases in India. These consultations highlighted the lack of reliable data, high cost of on-ground delivery of services, need for agricultural domain expertise and scope to converge with or benefit from government schemes.

These consultations helped conceptualize a PPP framework to scale agritech services in a given geography or pertaining to a given crop. In this framework, governments enable different incentives that address targeted ecosystem challenges to encourage agritech businesses to invest in a particular geography or crop. Telangana became the first state to adopt this framework in the shape of Project Saagu Baagu, with a focus on the chilli value chain in its first phase that started in 2022.

Saagu Baagu is a path-breaking initiative that reflects the Telangana government's commitment to improving farmers' lives and well-being. This initiative is a success story of how multiple stakeholders can work for a common vision and bring about sustainable transformation in the agriculture sector. We intend to scale the initiative to other districts and value chains in the near future. The World Economic Forum has been a critical partner in this initiative that is being successfully implemented by Digital Green and its partners.

Hanumant K. Zendage, Special Commissioner, Agriculture, Government of Telangana, India

1 Project Saagu Baagu

Data enablement, coupled with domain knowledge and convergence with other government schemes, creates incentives to unlock private sector investment for transforming the agricultural value chain.

Telangana is helping with responsible and scalable deployment of emerging technologies in agriculture, which is the highest priority sector for India.

Ramadevi Lanka, Director, Emerging Technologies Wing, Department of Information Technology, Electronics and Communication, Government of Telangana

142%

Increase in contribution of agriculture to Telangana's state value

Telangana is one of the newly formed states of India and is located in the southern part of the country. The state counts agriculture among its priority sectors. The contribution of agriculture and allied sectors to its gross state value added has increased by 142% from Rs 762.13 billion ($9.27 billion) in 2014-15 to Rs 1,843.21 billion ($22 billion) in 2020-21.[7] An estimated 5 million farmers with an average landholding size of 2.77 acres cultivate 40.53% of the state's land area. About three-fourths of farmers and agricultural labourers own mobile phones and motorbikes, but the growth of digital communication infrastructure has not arrested the decline in agricultural growth. On average, 3% of agricultural land every year has been diverted for non-farm uses over the past 10 years.[8]

At the same time, Telangana's farmers are transitioning from growing cereals to commercial crops, a transition that is fraught with challenges. The commercialization of agriculture has resulted in high-input, high-output, high-risk agriculture, in which small and marginal farmers find it difficult to compete.[9] Faster farm mechanization in recent years has increased the economies of scale, but more so for large farmers so that small farmers earn smaller profits per unit area – in a farming space inhabited mostly by tenants and small landholder farmers.

As a result, the Telangana government has been focusing on strengthening its rural districts as revenue-generating centres, pushing for the digital transformation of agriculture to improve farmers' income. Given the ubiquity of small landholders and the need to solve their problems, emerging technologies turn farmers into important stakeholders who can collaborate with the two other crucial stakeholder groups – governance institutions and market players – for creating macro-level impact at the start-up and farming ecosystem levels.

Against this background, Project Saagu Baagu seeks to transform the state of agriculture in Telangana by deploying emerging technologies in a scalable, inclusive and sustainable way. As envisioned, the project would rope in at least 100,000 farmers over four crop cycles and establish readiness to scale the interventions across the state.

The state Department of Agriculture is leading Saagu Baagu with support from the Professor Jayashankar Telangana State Agricultural University (PJTSAU) and the Department of Information Technology, Electronics and Communications, in partnership with the Centre for the Fourth Industrial Revolution India of the World Economic Forum. The project is supported by the Bill and Melinda Gates Foundation. Digital Green, a global not-for-profit organization, is implementing it on the ground as a project implementation partner (PIP), and is leading a consortium of three other start-ups, AgNext, KrishiTantra and Kalgudi.[10]

Saagu Baagu is planned as a five-year, focused effort to be rolled out across multiple districts for select priority crops such as cotton, chilli, turmeric, groundnut, Bengal gram and paddy.

"Through the public-private partnership approach we have been able to work with the Government of Telangana to scale up cost-effective and improved data linkages between farmers, markets and other partners to enable sustainable impact. Through the Saagu Baagu programme of the Government of Telangana and the Centre for the Fourth Industrial Revolution India of the World Economic Forum, the Gates Foundation has supported Digital Green to test and scale digital innovation in chilli-growing areas, and the project has been a success story of collaboration, coordination and convergence between agricultural ecosystem players.

Dr Srivalli Krishnan, Senior Programme Officer, Bill & Melinda Gates Foundation

1.1 Theory of change

For the World Economic Forum's digital technology interventions in agriculture in India, small farmers are the primary stakeholders. Saagu Baagu promotes technological collaborations between the public and private sectors as an effective way to boost the incomes of small and marginal farmers.

Long-term outcomes: Saagu Baagu aims to improve the smallholder farmer's income by using agritech services to foster inclusive, efficient and sustainable agriculture. Although these three impact areas – inclusivity, efficiency and sustainability – may have different meanings in different contexts, their definition with regard to AI4AI and Project Saagu Baagu are as follows:

- Inclusivity: The ubiquity of small-scale farmers in the Indian agrarian landscape has not translated into better credit facilities for them. Without credit history and, sometimes, clear land titles, they are obliged to borrow from informal moneylenders at higher rates than banks offer. Data-driven credit scoring and digital financial services can provide much needed and affordable formal finance to smallholders, especially women.

- Sustainability: Climate resilience as well as improved yields and profits are essential for agricultural sustainability. Given their limited access to land, tenant and smallholder farmers must use inputs optimally to make their operations sustainable and efficient. With technologies and tools such as artificial intelligence (AI)-based weather and crop advisories on application of water and other inputs, agritech can assist smallholders in making informed decisions about managing their operations.

- Efficiency: Currently, post-harvest value chains are marked by subjective quality assessment, losses during transportation and storage, and lack of storage facilities. Technology can help improve these operations – for instance, AI- and spectroscopy-based quality testing can provide objective quality certification to help farmers realize better prices for their produce.

↓ **Image credit:** Digital Green

> As agriculture is an unorganized sector, reaching out to individual farmers or building infrastructure is uneconomical for start-ups, and governments can solve this by opening up underutilized resources to the private sector.

Preconditions for achieving the outcome: It is imperative that agritech service providers get an enabling business environment to scale their operations in an efficient and sustainable way. In consultations, stakeholders identified four conditions that must be created:

- **Data enablement**: Data is a key driving resource for agritech services. Currently, agritech service providers deploy their resources to collect different datasets to develop and refine their solutions. Largely, these are 15-20 datasets collected in various combinations. Yet, the government may already have all or some of these datasets, but stored in a fragmented manner across different agencies and departments. Efficient and timely access to these government datasets can tremendously reduce private sector effort and help them create more customized services for farmers.

- **Support for on-ground operations**: Farmer awareness, onboarding, adoption and active use of technological services require boots on the ground. Many agritech operations such as procurement of output or delivery of inputs require physical infrastructure such as warehouses. As agriculture is an unorganized sector, reaching out to individual farmers or building infrastructure is uneconomical for start-ups, and governments can solve this by opening up underutilized resources (human and physical) to the private sector, possibly at a subsidized rate. These resources may include last-mile delivery channels in the form of farmer producer organizations, self-help groups and common service centres that provide a range of e-governance facilities to citizens.

– **Create domain knowledge:** Many entrepreneurs providing agritech services in India are tech specialists and not necessarily agricultural experts. This skill gap must be filled to avoid shortcomings in the technological solutions they provide. This can be done through a sandbox approach where innovations are tested, improved and validated in controlled environments, for instance at agricultural universities, with support from scientists.

– **Converge with government schemes:** Both central and state governments offer multiple schemes that can help expand agritech infrastructure and services on the ground. Governments must open up these schemes to start-ups.

The intervention: Based on the AI4AI PPP framework, the Telangana government has conceptualized Saagu Baagu to better utilize emerging technologies such as AI, the internet of things and blockchain to improve the lives of marginalized and small farmers. To identify relevant technology use-cases all along the value chain, the project uses existing knowledge to identify critical challenges and highlight specific points where agritech services can play an impactful role. This defines the scope of the project (Figure 1).

FIGURE 1 **Project scope**

BOX 1 **Why chilli**

Telangana is one of the most important chilli-producing states in India.[11] In 2019-20, the state produced 328,000 tonnes of chilli on 210,000 acres of land. The area cultivated with chilli and its production in Telangana accounted for 11.4% and 16.9% of all-India area and production, respectively.[12]

Telangana's key chilli-growing districts are Khammam, Mahabubabad, Gadwal, Suryapet and Warangal (Rural). Due to favourable weather and a drop in the international demand for cotton, many farmers in Telangana have switched to chilli cultivation.[13] However, this change has created challenges for small farmers with low risk-taking abilities as chilli is a high-cost and high-risk crop.[14]

Not only are hybrid chilli seeds costly, the wages for labour are high too. Further, climate change has increased the incidence of pests and diseases, and changed rainfall patterns such that heavy rains are followed by dry spells.

Further, farmers must contend with a lack of regulated markets, big price fluctuations for their produce, lack of storage facilities and non-availability of quality inputs.[15]

Saagu Baagu aims to fill these lacunae so as to create more resilient, informed and prosperous farmers' communities.

Image credit: Digital Green

> **Project Saagu Baagu has disseminated its customized advisory content among 17,408 farmers via multiple channels to help them manage their chilli crops and improve their production quality. Farmers have realized an average increase of Rs 1,870 per 100kg ($22.86/100kg) in sales when compared to traditional channels, with savings on commissions, transportation and packaging and the enablement of transparent pricing. Learnings from these interventions will allow for the replication and transferability of technologies and approaches to a broader set of commodities and additional geographies.**
>
> Rikin Gandhi, Chief Executive Officer, Digital Green

Impact assessment

Indicators to assess the project's outcome and impact are listed in Table 1.

TABLE 1 **Impact assessment**

Quantitative impact	Qualitative impact	Areas of improvement
Economic impact – Improvement in yield – Decrease in cost of cultivation – Increase in revenue (farm-gate price) – Profit/loss from sale of produce – Increase in net household income **Environmental impact** – Quantity of fertilizers, pesticides and other chemicals used – Water usage – Quantity of carbon emissions – Wastage/loss along post-harvest supply chain **Inclusivity impact** – Number of smallholder farmers impacted – Number of solutions implemented and targets achieved	**Trust and transparency** – Information asymmetry removed – Improvement in returns for market actors – Improvement in trade relations **Behaviour and adoption** – Adoption and active use of agritech solutions – Resolution of behavioural challenges in adoption and compliance with advisories	Identification of areas of improvement along different indicators for scaling up in the next phase

1.2 Project approach and design

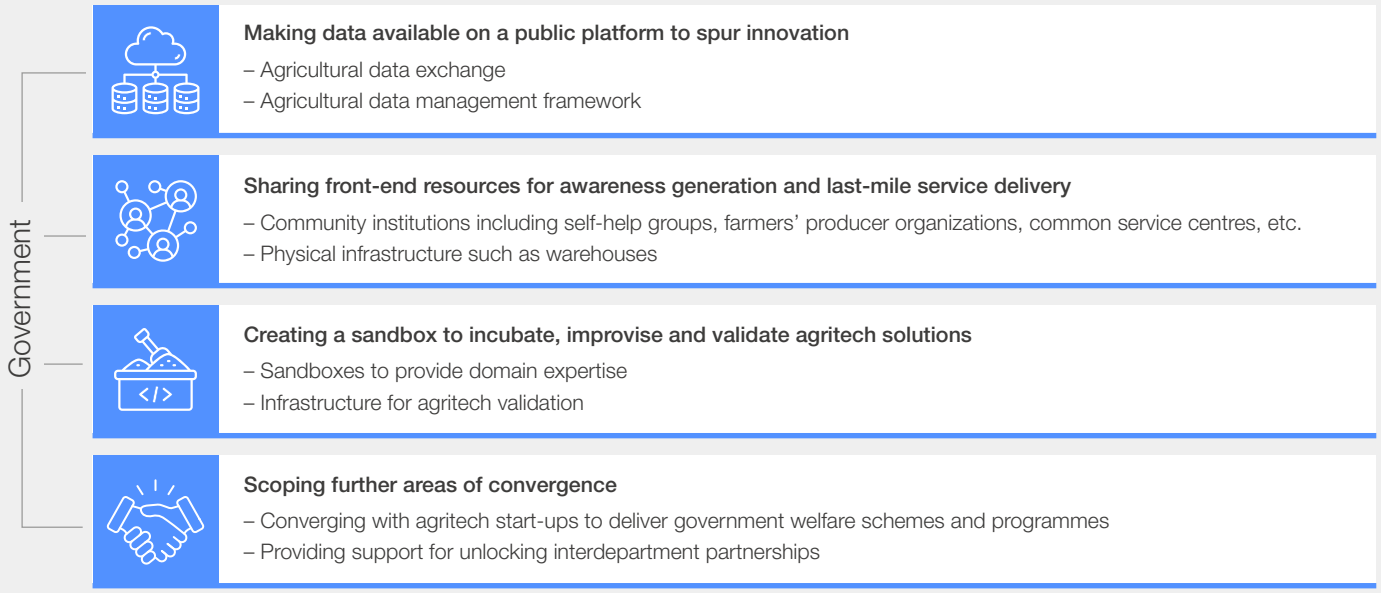
Considering the dynamic nature of the agricultural sector and the need for varying expertise and strengths to achieve the targets, Saagu Baagu is envisioned as a multistakeholder initiative. The project stakeholders and their respective responsibilities are mentioned in Table 2.

TABLE 2 **Stakeholders and responsibilities**

Stakeholders	Roles and responsibilities
Government of Telangana	Its Department of Agriculture and Department of Information Technology, Electronics and Communications manage the project. The government has committed to the PPP framework for scaling agritech in the state, including the setting up of an agricultural data exchange.
World Economic Forum	The Forum's Centre for the Fourth Industrial Revolution India has provided thought leadership to design the initiative and convene multiple stakeholders to take part.
Bill & Melinda Gates Foundation	It funded the project implementation partner, Digital Green, to execute the project on the ground.
Digital Green	It is implementing the project as the lead partner for a consortium that includes the companies AgNext, KrishiTantra and Kalgudi.
Professor Jayashankar Telangana State Agriculture University (PJTSAU)	It provides domain knowledge and expertise to develop and oversee the project; it is also supporting the development of an agricultural sandbox.

FIGURE 2 **Scaling Fourth Industrial Revolution technologies in Indian agriculture**

The World Economic Forum's public-private partnership framework provides for an enabling role for the government to support scale-up of digital innovations



In alignment with its theory of change, Saagu Baagu includes different incentives to address the preconditions for success such as data enablement. These interventions follow the PPP principle wherein government support encourages and incentivizes agritech service providers to deploy their resources and scale their services, as described in Table 3.

Image credit: Digital Green

TABLE 3 | **Government support through PPP**

PPP enablement areas	Specific interventions
Data enablement	**Data exchange and policies:** The Forum is supporting the Government of Telangana in developing the country's first agricultural data exchange and has drafted an accompanying data management framework. This will enable a two-way flow of data between the government and the private sector.
Reducing cost of on-ground operations **Convergence with government schemes**	**On-ground delivery of agritech services:** The delivery of agritech services to farmers improves the efficiency of farm operations, reduces costs and ensures better prices and market discovery. Project Saagu Baagu is leveraging on-ground resources including community resource persons supported by the Department of Agriculture to onboard farmers and support them in adopting new technologies. The delivery of a set of technologies including AI/chatbot-based advisories, AI-based produce quality testing and soil testing, and an e-commerce platform has been initiated in Khammam district.
Domain knowledge	**Agricultural sandbox:** The Forum is supporting the Telangana Department of Agriculture and PJTSAU in developing a framework for the country's first agricultural sandbox that would support incubation and validation of emerging technologies. Through the sandbox, PJTSAU will support agritech companies in refining their solutions by providing domain expertise and use of the university's test farms to generate empirical evidence.

The three interventions noted in Table 3 are at different stages of development or implementation. While the data exchange is under development and may be launched by August 2023, the sandbox is at a concept stage and may be launched by the end of 2023.

The on-ground implementation of the first phase of the project – the delivery of technological services – is at an advanced stage, with 7,000 farmers already registered to receive a range of services. Advisories, however, are being provided to nearly 15,000 farmers, as any progressive farmer with access to a mobile phone can connect with a chatbot to receive advisories or attend video sessions.

> **There cannot be peace or prosperity in the world when 10% of our people go to bed hungry. By leveraging technology to achieve sustainable agricultural growth, we can tackle global hunger. AI can empower farmers to make informed decisions about resource allocation, optimize crop yield, and identify diseases and reduce waste, paving the way for a better future and enabling them to rise.**
>
> Mohit Kapoor, Group Chief Technology Officer, Mahindra Group

1.3 Delivering agritech in partnership

The project is implemented by a consortium of four organizations delivering different agritech services to more than 7,000 farmers.

Digital Green is implementing the project on the ground in partnership with AgNext, KrishiTantra and Kalgudi. As the project implementation partner, it is focusing on the following specific activities and technologies across the chilli crop cycle:

- **Farmer data aggregation:** Digital Green has developed and deployed Kisan Diary Enterprise, an Android-based app for farmers to control and capture data. This helps strengthen market access, especially for small landholders within farmer producer organizations and other collectives that aim to improve farmers' access to inputs, knowledge, finance and markets. The app helps consolidate input demand and output supply data at the right time, which reduces information asymmetry between buyers and sellers for sale of both inputs and outputs. Reduced information gap allows sellers to stock required quantities in advance. Ultimately, this helps farmers in getting the required inputs and selling the produce in the market at better rates. To allay privacy and security concerns, Saagu Baagu also acts as a data interoperability use case to test out secured data exchange between consortium partners.

- **Digital extension, advisory and capacity building**: Digital Green has developed an AI-based WhatsApp chatbot in collaboration with web development and mobile app company ColouredCow to ensure the easy sharing of customized advisories with farmers, especially women and low-literacy individuals, on a real-time basis.

- **Soil testing**: Digital Green has partnered with KrishiTantra to offer an AI-based soil testing facility that provides results on 12 parameters in 20 minutes. Earlier, farmers would rely on laboratories that would take 20-25 days to send the results.

- **Quality testing:** Currently, chilli quality assessment is done through visual inspection, resulting in subjectivity and high price fluctuation. Quality assessment service provider AgNext is providing AI- and stereoscopy-based quality testing for issuing quality certificates. These machines are installed at marketplaces or market yards to ensure objective grading and better price realization.

- **Market linkage through e-commerce**: Kalgudi, an e-commerce platform, is providing input and output market linkages as well as advisories to farmers. By bringing together farmers, processors and traders on a cohesive and horizontal online platform, Kalgudi has helped farmers discover expanded markets and negotiate deals more transparently.

1.4 Challenges

Changing traditional practices

Behaviour change is essential to drive adoption of agritech services on the ground. Existing business norms and practices such as farmers' purchase of inputs on credit from nearby dealers, or preferring to sell produce to local aggregators for ready cash, require long-term efforts to change. Access to credit continues to play a critical role in this shift, especially when farmers prefer quick cash over future gains.

Tech validation

It is important that alongside scaling agritech and supporting innovations, farmers' interests be safeguarded. Thus, validation of technology is a critical requirement. Not many institutions provide validation of emerging agritech services. Thus, to establish the credibility of emerging innovations in the agritech space, such validation platforms should be established at agricultural universities across the country.

BOX 2

WhatsApp-based chatbot

In this AI-enabled function, a push-based mechanism enables farmers to enrol for automated crop advisories on WhatsApp.[16] Once a farmer has selected their crop's current age, they start receiving regular automated advisory messages. Based on previous pilots, the messages are sent at 7:00 a.m. for paddy and 6:00 p.m. for chilli, which allows enough time between the advisories for farmers to read and understand them thoroughly.

Through the pull feature of the bot, farmers are able to interact with the bot at their convenience. By selecting their crops and stages, farmers can get informative and action-based content whenever they want. To encourage farmer engagement, the bot checks about their willingness to act on the advisories. The bot also seeks images of their farms.

CASE STUDY 1

M. Venkata Narayana's experience with informational videos

M. Venkata Narayana is a smallholder chilli farmer in Kachirajugudem village in Khammam district in Telangana. His family of four depend on their three acres of land for a living. The husband and wife grow chilli, cotton and paddy and herd livestock on it, and their two sons help with spraying and other activities during their school holidays.

For many years, the family followed traditional agricultural practices to deal with pest infestations. In recent years, these infestations had become more frequent, as had unpredictable weather conditions, affecting their yield and income.

One day, Venkata Narayana attended a meeting where a community resource person (part of a government-supported cadre) explained how farmers could receive explanatory videos directly on WhatsApp, and shared a video on the transplantation of chilli and its benefits.

His interest piqued, Venkata Narayana attended more meetings to learn about more innovative farming and pest management practices, and signed up for the WhatsApp advisories. "I have studied until 10th grade, so I am very comfortable using WhatsApp on my phone. With just one click, I can easily watch videos and adopt new practices, which have helped improve the condition of my crops."

2 Project outcomes

Saagu Baagu has impacted more than 17,000 chilli farmers through advisory, quality testing and market connect.

By exacerbating pest attacks and droughts, climate change is posing the biggest challenge for chilli farmers and preventing them from increasing their produce and incomes. The 7,000 farmers enrolled with Saagu Baagu have started utilizing technology and making changes to alleviate the effects of the climate crisis. The project provides farmers with a range of services relevant to the entire crop cycle to meet their various needs.

Advisories

- Digital Green with support from the Telangana government has created a cadre of community resource persons who are trained to onboard farmers and ensure their engagement, for instance by disseminating videos. They conduct sessions that are open to all farmers, whether or not they are enrolled with the project. By March 2023, 17,408 farmers had attended 673 sessions on pest and disease management of chilli crops and received advisories through AI-based chatbots.

Soil testing

- KrishiTantra has provided AI-based soil testing services to a majority of the onboarded farmers.

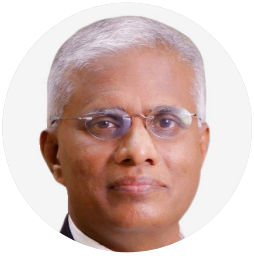
Quality testing

- AgNext has deployed three machines for quality testing. By March 2023, 3,976 farmers had got their samples tested and received quality certificates. Since quality certificates are useful only if traders and buyers accept them – in a change from the traditional practice of visual assessment – the AgNext team carried out orientation sessions with 35 traders from January to March 2023.

E-commerce

- As an e-commerce platform, Kalgudi has enabled B2B (business to business) and B2C (business to consumers) sales of processed red chilli. Digital Green has listed 5,000 farmers with the Kalgudi market access platform in the chilli-producing districts of Telangana. Kalgudi also organized two buyer-seller meets in September 2022 and March 2023.

- Data from the initial period of chilli trading under Saagu Baagu shows that farmers are earning Rs 1,870 per 100kg ($22.86/100kg) more in sales when compared to traditional channels, by saving on commissions, transportation and packaging, and thanks to transparent pricing.



Digital technologies of the Fourth Industrial Revolution are changing the rules of the game. Project Saagu Baagu, the first of its kind in Telangana, aims at mainstreaming digital innovations involving both technologies and services/solutions so as to provide farmers with detailed insights to make data-based operational decisions that can reduce risk, minimize costs, improve efficiency, optimize yields and boost profit margins. That's why I believe that this public-private cooperative framework for effectively deploying digital innovations in agriculture is going to be a game changer in building climate resilient, sustainable food systems.

Dr Praveen Rao Velchala, former vice-chancellor,
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Conclusion

Learnings from the first phase of Saagu Baagu have helped refine the PPP model. In the second phase, the project will incorporate other crops and geographies while setting up an agricultural data exchange and sandbox.

The Saagu Baagu project has proven an effective enabler for mainstreaming emerging technologies for the benefit of farmers and the wider agricultural system. It holds the potential to demonstrate a self-sufficient agritech ecosystem where farmers utilize the power of data digitization to access need-based services.

Saagu Baagu's design has sustainability built in, as all the agritech services provided by partners are affordable. Gradually, with the building of trust and value realization, farmers may begin to pay for these services in the long run. Since these services require local workers to operate and maintain the machines and handhold farmers as they learn to use e-commerce platforms, they create local employment opportunities.

As the first phase of the project is about to end, its learnings will be consolidated and the next phase initiated with additional crops and in more districts. Learnings have been very helpful in refining the PPP model. The establishment of an agricultural data exchange and agricultural sandbox will provide an additional impetus to the project and scale the use of agritech in the state and beyond.

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