

# Agri Stack and its impact on the financial services industry









# Foreword

Agriculture has always been the backbone of our economy, playing a pivotal role in ensuring food security and providing livelihood to more than 45% of the population.<sup>1</sup> However, as the industry faces a myriad of challenges – from climate change and resource constraints to market volatility and the growing demand for transparency – it is essential to leverage technological innovations to promote sustainable and inclusive development. A key enabler of this change has emerged in the form of Agri Stack, which is a robust digital framework aimed at transforming how agricultural data is gathered, organised and applied.

In this paper, we explore Agri Stack's profound potential to reshape the financial services industry. By creating a unified platform for data-driven decision making, Agri Stack enables a holistic understanding of agricultural practices, land use, crop patterns and farmer profiles. This digital framework not only promotes enhanced efficiency and innovation but also tackles the persistent challenges that have obstructed financial inclusion for countless small and marginal farmers.

For the financial services sector, Agri Stack offers unprecedented opportunities. It equips banks, insurers and FinTech firms with precise and detailed insights, enabling them to create customised products, manage risks and confidently provide credit to underserved rural communities. In addition, the transparency enabled by Agri Stack fosters better partnerships between public and private entities, boosting trust and decreasing inefficiencies.

I hope you find this report to be insightful.

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1 <https://sansad.in/getFile/loksabhaquestions/annex/1714/AS228.pdf?source=pqals>





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# Introduction

Agriculture is the backbone of India's economy and culture. It encompasses a diverse range of crops, farming practices and smallholder farms that contribute towards generating most of the agricultural produce in the country. The main challenges faced by Indian agriculture include dependency on monsoon rains, outdated farming techniques, high input costs, fluctuating market prices, inadequate supply chain infrastructure and linkages to markets. Although smart technologies are being leveraged to improve farming and facilitate agriculture growth, the lack of accurate, comprehensive and integrated database on farmers, agricultural land ownerships, crops etc. is a major challenge that remains to be addressed.

The implementation of unified and accessible data systems can contribute substantially towards addressing farmers' pain points by enabling adoption of precision farming, improving productivity, and enhancing downstream and upstream supply chain linkages, market access and the penetration of services from various financial institutions.

In this context, Finance Minister Nirmala Sitharaman announced the roll out of Agri Stack, a digital public infrastructure (DPI) for farmers in India, in Union Budget FY25.<sup>2</sup>

Agri Stack envisages a major transformation in the agricultural sector by leveraging digital technologies to create a unified framework for agricultural data management and services. The comprehensive digital framework will integrate various data sources – such as crop information, land ownership, weather forecasts, soil health and market prices – into a unified platform that is easily accessible to farmers and institutions all over India.

Agri Stack will present great opportunities for the stakeholders in the agri value chain including the banking, financial services and insurance (BFSI) sector. The DPI enables financial institutions to tailor their products and services precisely to the needs of farmers and agribusinesses. This integration enables financial inclusion, improves credit risk assessment, and enhances the delivery of insurance and credit services, to meet the evolving demands of the agricultural economy.

This white paper aims to explore the multifaceted effects of Agri Stack on the BFSI sector, with a focus on how digital evolution will innovate financial interactions in the agri value chain and provide opportunities for the growth of all stakeholders.

## 1.1 Brief overview of the agri industry

Agriculture and its allied activities have contributed INR 23.5 lakh crore to the gross value<sup>3</sup> in FY24, producing 332.23 million tonnes of foodgrains<sup>4</sup> during 2023-24 and seeing 45.76% engagement from the total workforce.<sup>5</sup> The Indian food and grocery market is already the sixth-largest

in the world, with retail contributing to 70% of the sales. Post the global disruption in 2019-20 due to COVID-19, India's agricultural exports have grown considerably despite a strong headwind, standing at around INR 4 lakh crore for 2023-24.<sup>6</sup>

**Table 1: Contribution of agriculture to the total gross value added (GVA)**

Year	Share of GVA of agriculture and allied activities	Growth of agriculture and allied activities (%)
2020-21	20.3	4.1
2021-22	19.0	3.5
2022-23	18.3	3.3

Source: <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1909213>

<sup>2</sup> [https://www.indiabudget.gov.in/doc/budget\\_speech.pdf](https://www.indiabudget.gov.in/doc/budget_speech.pdf)

<sup>3</sup> <https://www.ibef.org/industry/agriculture-india/infographic>

<sup>4</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=2058534#:~:text=The%20new%20system%20has%20ensured,LMT%20achieved%20during%202022%2D23>

<sup>5</sup> <https://sansad.in/getFile/loksabhaquestions/annex/1714/AS228.pdf?source=pqals>

<sup>6</sup> <https://www.ibef.org/exports/agriculture-and-food-industry-india>



Although agriculture has contributed significantly to the country's GVA, there is a noticeable decline in growth rates, which highlights the need for sustainable strategies. Some key pain points which directly contribute to this are as follows:

- **No single unified database for farmers:** Agricultural data is independently collected by various entities such as government departments, research institutions, regulators and private organisations.
- **Limited access to formal credit:** Many small and marginal farmers struggle to secure loans from formal financial institutions; however, this can be addressed by Agri Stack.
- **Insurance coverage:** There is a need for more comprehensive and accessible insurance schemes which can provide better protection and financial stability to farmers based on scientific data.
- **High cost of credit:** High interest rates from informal credit sources strain farmers' finances, reducing their capacity for other investments.
- **Complex loan processes:** All of the processes – from application, onboarding, loan origination, credit risk assessment and decisioning to final disbursement – are complex and time consuming.
- **Subsidy misalignment:** Inefficient allocation of subsidies prevents them from effectively supporting demanding geographical areas and using resources in an optimal manner.

In addition to the aforementioned institutional aspects, other indirect factors are listed below:

- **Low investment in infrastructure:** Insufficient investment in critical infrastructure – such as irrigation, storage facilities and supply chain logistics – hampers productivity.
- **Market volatility and price fluctuations:** Farmers have to deal with unpredictable incomes due to price volatility and market fluctuations, further exacerbated by the lack of effective price-stabilisation mechanisms.
- **Lack of financial literacy:** A significant number of farmers lack the financial literacy needed to make informed decisions about loans, insurance and investments.

## 1.2 Analysing the credit flow to agri sector

A key factor for India's agricultural sectoral growth and sustainability is credit flow. Credit flow comprises the financial resources available to farmers and their business through various channels, and ranges from daily operational expenses to long-term investments.

Credit flow to farm sector has experienced significant growth over the last decade. From INR 46,268 crore in 1999-2000, the total disbursement reached INR 13,92,729 crore in 2019-20, with a compound annual growth rate (CAGR) of 19.81%.<sup>7</sup> In 2023-24, the total outstanding for the farming sector stood at INR 24.84 trillion, which represents a 15% growth compared to 2022-23, when it was over INR 21.55 trillion.<sup>8</sup> Even with this phenomenal growth rate in credit flow, significant portion of the farming population is still underbanked. A key point to note here is that 48% of the total disbursement is routed to five southern states of India – Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Kerala – which account for only 17% of the total cropped area of the country.<sup>9</sup>

This disproportionate credit disbursement to southern states is driven by higher financial inclusion and banking penetration, proactive state government policies, significant engagement in high-value agriculture requiring substantial capital, superior irrigation facilities which in turn reduce lending risks, higher awareness and utilisation of credit schemes, and the presence of strong agricultural cooperatives.

Agriculture is a priority sector for credit lending in India. The Government also sets credit flow targets for the same every year. In FY24, the government targeted INR 20 lakh crore for the sector, and surpassed expectations by reaching INR 25 lakh crore. This phenomenal growth and overachievement of credit targets but with disproportionate distribution is showing the credit flow is not reaching to the correct targeted sub segments of agriculture, especially to small and marginal farmers.

To address the same, some initiatives have been implemented, like the Kisan credit card (KCC) scheme which has played a crucial role in providing timely credit to farmers. As on June 2023, total active KCC accounts were around 7.4 crore with total outstanding amount of INR 8.9 lakh crore,<sup>10</sup> which constitutes significant share in the total credit flow to the farming sector – while being directed to individual farmers as well. Moreover, to facilitate access to institutional credit for small and marginalised farmers in order to modernise their activities, the Government has been fixing annual targets for ground-level credit (GLC) for agriculture by RRBs and SCBs.

In the Union Budget 2024-25, INR 1.52 lakh crore<sup>11</sup> has been allocated for agriculture and allied sectors along with DPI for agriculture to be implemented for the coverage of farmers and their lands in upcoming three years.

7 <https://www.nabard.org/auth/writereaddata/tender/2501235626trends-and-patterns-in-agriculture-credit-in-india.pdf>

8 <https://www.financialexpress.com/policy/economy-agri-credit-surpasses-target-rises-15-to-rs-24-83-trillion-in-fy24-3477889/>

9 <https://www.financialexpress.com/policy/economy-agriculture-ministry-releases-2022-23-data-nearly-half-of-farm-credit-goes-to-5-southern-states-3376149/>

10 NABARD Annual Report 2024

11 [https://www.indiabudget.gov.in/doc/budget\\_speech.pdf](https://www.indiabudget.gov.in/doc/budget_speech.pdf)

## 1.3 Technology penetration in agriculture and agri banking

Technology is revolutionising agriculture and agri banking by enabling greater efficiency, productivity and financial inclusion. In agriculture, advancements like internet of things (IoT) devices, drones and precision farming techniques are empowering farmers with real-time data on soil health, weather patterns and crop conditions. Smart sensors and GPS-guided equipment enable targeted irrigation, fertilisation and pest control, reducing resource wastage while maximising yields. Similarly, AI-driven analytics provide predictive insights on crop performance and market trends, helping farmers make informed decisions.

In agri banking, technology is bridging the financial gap for rural farmers through digital platforms and tailored financial products. Mobile banking apps and digital payment systems allow farmers to conduct transactions seamlessly,

even in remote areas. FinTech solutions leverage AI and alternative data to assess creditworthiness, making it easier for smallholders to access loans and insurance. Blockchain technology is also gaining traction, ensuring transparency in supply chains and enabling automated, secure smart contracts for loans and payments. By connecting farmers directly to buyers and financial institutions, these technologies are fostering greater financial inclusion and economic resilience in the agricultural sector.

These innovations collectively address key challenges in agriculture, such as resource inefficiency, market unpredictability and financial exclusion. By integrating technology into farming practices and agri banking systems, the sector is moving toward a more sustainable, productive and inclusive future.





# Emerging digital agriculture

## 2.1 Digital agriculture

AgriTech is a growing sector, with a considerably large funding worldwide. Globally, funding amounting to about USD 58 billion has been witnessed over the years by nearly 26,445 start-ups. India received a total funding of USD 4.5 billion for AgriTech startups till 2024, with investments having started in 2019 itself. The US received the maximum funding, followed by China and India for

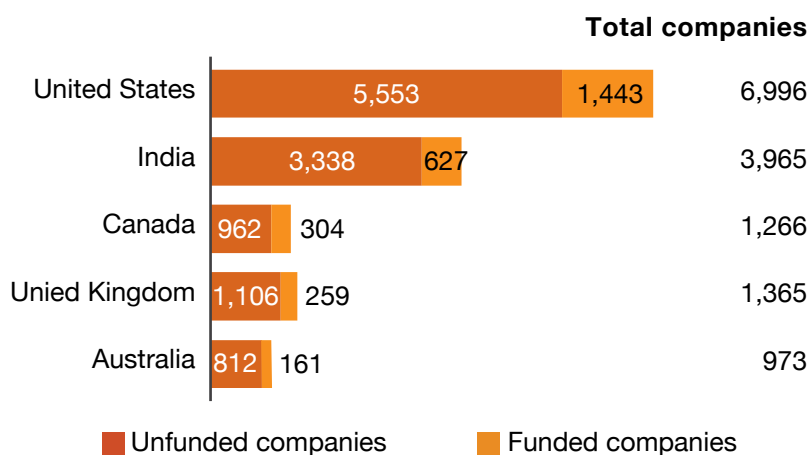
companies providing enhanced farm inputs, software, tech-enabled hardware for crop, livestock, aquaculture and insect farming. In terms of the funding received, Bengaluru, Hyderabad and Mumbai are among the top three start-up hubs in India.<sup>12</sup> Figure 1 highlights the key statistics across the globe in the AgriTech space.

**Figure 1: Global statistics on agritech potential**

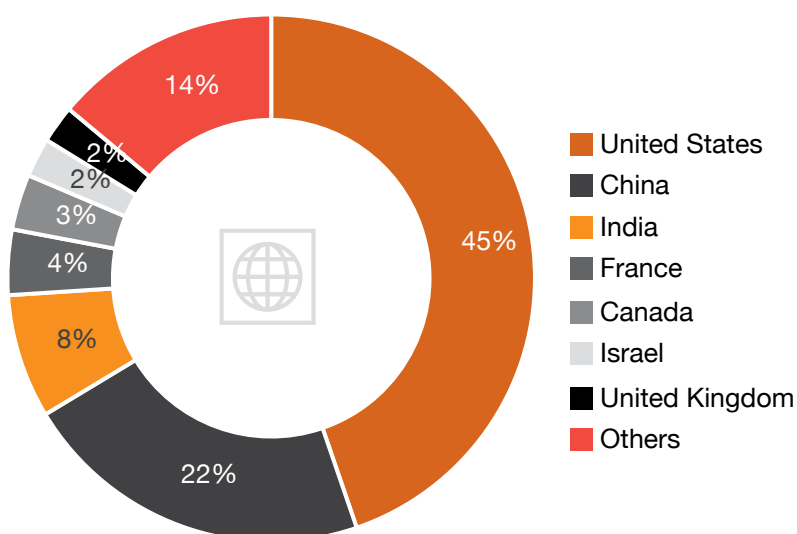
### Key statistics



### Top geographies by companies



### Funding by country



Source: [https://tracxn.com/d/sectors/agritech/\\_8-OCx7Zf21c5QYzq6iONRd31GtL5haydTw9qIEP-m3o/feed-report#description](https://tracxn.com/d/sectors/agritech/_8-OCx7Zf21c5QYzq6iONRd31GtL5haydTw9qIEP-m3o/feed-report#description)

<sup>12</sup> [https://tracxn.com/d/sectors/agritech/\\_8-OCx7Zf21c5QYzq6iONRd31GtL5haydTw9qIEP-m3o/feed-report#description](https://tracxn.com/d/sectors/agritech/_8-OCx7Zf21c5QYzq6iONRd31GtL5haydTw9qIEP-m3o/feed-report#description)

AgriTech is a rapidly evolving field with numerous emerging trends that are transforming how food is produced, managed and distributed. Some of the major emerging trends in AgriTech have been highlighted below:

**1. Precision agriculture:**

- Use of global positioning system (GPS), IoT and remote sensing technologies to monitor and optimise field-level management regarding crop farming
- Precision tools like drones, soil sensors and satellite imagery to make data-driven decisions in order to increase crop yields and reduce resource use

**2. Vertical farming and indoor agriculture:**

- Growing crops in vertically stacked layers or controlled indoor environments
- Utilises hydroponics, aeroponics and aquaponics systems to grow plants without soil, often leading to reduced land and water usage

**3. Automation and robotics:**

- Deployment of robots for tasks such as planting, weeding, harvesting and monitoring crops
- Autonomous tractors, robotic harvesters and drones are becoming more common, reducing labour costs and increasing efficiency.

**4. Biotechnology and genetic engineering:**

- Development of genetically modified organisms (GMOs) and gene-editing technologies to create crops that are more resistant to pests, diseases and environmental stresses
- Enhanced nutritional profiles and improved shelf life of agricultural products

**5. Smart irrigation systems:**

- Advanced irrigation techniques using IoT sensors and AI to optimise water usage
- Drip and sprinkler systems that adjust water delivery based on soil moisture, weather forecasts and crop requirements

**6. Blockchain and supply chain transparency:**

- Use of blockchain technology to create transparent and traceable supply chains
- Ensures food safety, reduces fraud and builds consumer trust by providing detailed information about the origin and journey of food products

**7. Farm management software and analytics:**

- Software platforms that integrate data from various sources to provide comprehensive farm management solutions
- Enables farmers to track crop performance, manage resources and predict yields more accurately

**8. Alternative proteins and sustainable food production:**

- Development of plant-based meats, lab-grown meats and insect proteins to provide sustainable alternatives to traditional animal farming
- Focus on reducing the environmental impact of food production

**9. Climate-smart agriculture:**

- Practices and technologies designed to increase agricultural productivity while reducing greenhouse gas emissions and enhancing resilience to climate change
- Includes agroforestry, conservation agriculture and integrated pest management

**10. E-commerce and digital marketplaces:**

- Online platforms connecting farmers directly with consumers, reducing intermediaries and increasing farmers' profits
- Use of digital tools for market access, price discovery and transaction facilitation

**11. Renewable energy integration:**

- Use of solar panels, wind turbines and bioenergy on farms to reduce reliance on fossil fuels
- Integration of renewable energy systems to power farm operations and reduce carbon footprint

**12. AI and machine learning (ML):**

- AI and ML algorithms used for predictive analytics, crop health monitoring and decision support systems
- Helps in identifying patterns and making real-time decisions to enhance productivity and sustainability





## Case studies

### Case study on PepsiCo India–Cropin: A crop intelligence model to maximise potato yield and quality in India<sup>13</sup>

Most farmers in India have less than 1 ha of farmland and struggle to monitor agri inputs like water, fertilisers and pesticides or weather forecast for optimising yields. Moreover, potato production is heavily impacted by blight crop disease and ground frost.

In this context, a predictive intelligence model at the crop and plot levels has been implemented in Gujarat by PepsiCo India, in collaboration with Cropin, as a pilot project in 51 demo farms in Gujarat and 11 farms in Madhya Pradesh. The purpose is to help farmers maximise potato yields and quality for its Lay's brand.

This predictive intelligence system can generate a forecast for up to ten days in advance, enabling farmers to identify different crop stages and monitor crop health, including early warning of diseases.

Farmers can also access the user-friendly mobile app available in 14 languages. The app has functional dashboards for farm data management and 'plot risk' for crop intelligence. Necessary training is being given to farmers by agronomists to understand the dashboard and derive insights.

### Case study of Agricultural Development Trust, Baramati–Microsoft partnership<sup>14,15</sup>

Farmers face challenges with respect to unpredictable weather conditions, uncontrollable pests and diseases, higher production cost, loss of yield, soil degradation, and connectivity with buyers/sellers.

Agricultural Development Trust, Baramati (ADT) has implemented a modernised, AI-driven AgriTech solution in partnership with Microsoft to help farmers manage their farms and production to overcome these challenges.

ADT deployed Microsoft solutions such as:

- Azure Data Manager for Agriculture (ADMA): ADMA facilitates data-driven farming through integrated data collection from various sources like satellites, weather providers and sensors.
- FarmVibes.AI: It leverages AI to provide valuable insights for farmers on soil moisture, temperature, humidity, pH and other parameters. FarmVibes.AI gives rich geospatial insights for agriculture and sustainability. It can build models that fuse multiple geospatial and spatio-temporal datasets such as satellite imagery drone imagery, weather data to obtain insights (e.g. estimate carbon footprint, understand growth rate, detect practices followed) which are typically hard to obtain when these datasets are used in isolation.

AgriPilot.AI: It uses Azure Maps and Azure OpenAI to provide farmers with actionable insights and recommendations for growing more food sustainably. AgriPilot.AI can radically transform farming with its comprehensive suite of solutions. By harnessing the power of IoT, AI/ML technologies and data-driven approaches, it facilitates precision farming, crop lifecycle management, livestock management, sustainable farming, automated irrigation recommendations, silo management, buyer–seller connectivity through marketplace and supply chain optimisation. These innovations empower farmers with data-driven tools to enhance productivity and sustainability in agriculture.

#### Real-time impact

Farmers have seen more than 20% increase in crop production, while observing a decline in fertiliser cost by nearly 25% via spot fertilisation technique. This is combined with more than 8% reduction in water consumption and about 12%+ decrease in post-harvest wastage. The solutions also benefit the environment by reducing water wastage, soil erosion, deforestation, chemical runoff and greenhouse gas emissions. Furthermore, the solutions support rural development and food security by increasing farm productivity, profitability and resilience.

<sup>13</sup> [Cropin.com/press-release/pepsico-launches-crop-intelligence-model-for-india-in-collaboration-with-cropin/](https://cropin.com/press-release/pepsico-launches-crop-intelligence-model-for-india-in-collaboration-with-cropin/); 4 April 2023

<sup>14</sup> <https://www.microsoft.com/en-us/research/project/project-farmvibes/downloads/>

<sup>15</sup> <https://agripilot.ai/>



The emerging trends and the aforementioned case studies represent a significant shift towards more efficient, sustainable and technology-driven agricultural practices. Such practices will help address many challenges faced by traditional farming, such as resource scarcity, climate change and food security.

## 2.2 DPI for agriculture





Technology has the potential to significantly enhance the lives of citizens and revolutionise governance. Over the past 15 years, India has demonstrated to the world how this can be achieved through an inclusive DPI.<sup>16</sup> This includes digital identity systems, digital payments and consent-based data sharing, all of which have been instrumental in delivering public services during crises such as the COVID-19 pandemic.


The role of technology in improving India’s agriculture has been a topic of widespread discussions in recent times. India Stack, introduced in 2009 by the Ministry of Electronics and Information Technology (MeitY), laid the foundation of India’s digital economy through paperless, presence-less and cashless delivery of services and transactions, with the launch of Aadhaar (biometric digital ID system). India Stack is a collection of open application programming interfaces (APIs) and digital public goods to help India unlock the economic primitives of identity and data.

The key components of India Stack are Aadhaar, e-Sign, e-KYC, digital locker, UPI, digital consent, digital authentication, direct benefit transfer (DBT), Aadhaar-enabled payment system (AePS) and consent architecture.


The four prominent layers of India Stack are given below:

**Figure 2: The India stack layers**


	<b>Consent</b>	Permission on demand
	<b>Cashless</b>	Financial transaction on demand
	<b>Paperless</b>	Documents on demand
	<b>Presence-less</b>	Authentication on demand


**Consent layer**


It is an open store of personal data, owned by the RBI. It allows citizens to utilise contemporary privacy-focused data-sharing.


**Cashless layer**

It is an interoperable payment network, owned by the National Payments Corporation of India (NPCI). Digital transactions are done at a lower cost through Immediate Payment Service (IMPS), AePS, Aadhaar payments Bridge (APB) and UPI.


**Paperless layer**

This layer, owned by the Department of Electronics and Information Technology, stores and retrieves information – e.g. e-Sign, e-KYC and DigiLocker.


**Presence-less layer**

This layer has open API access. The instruments available are mobile Aadhaar and Aadhaar card.

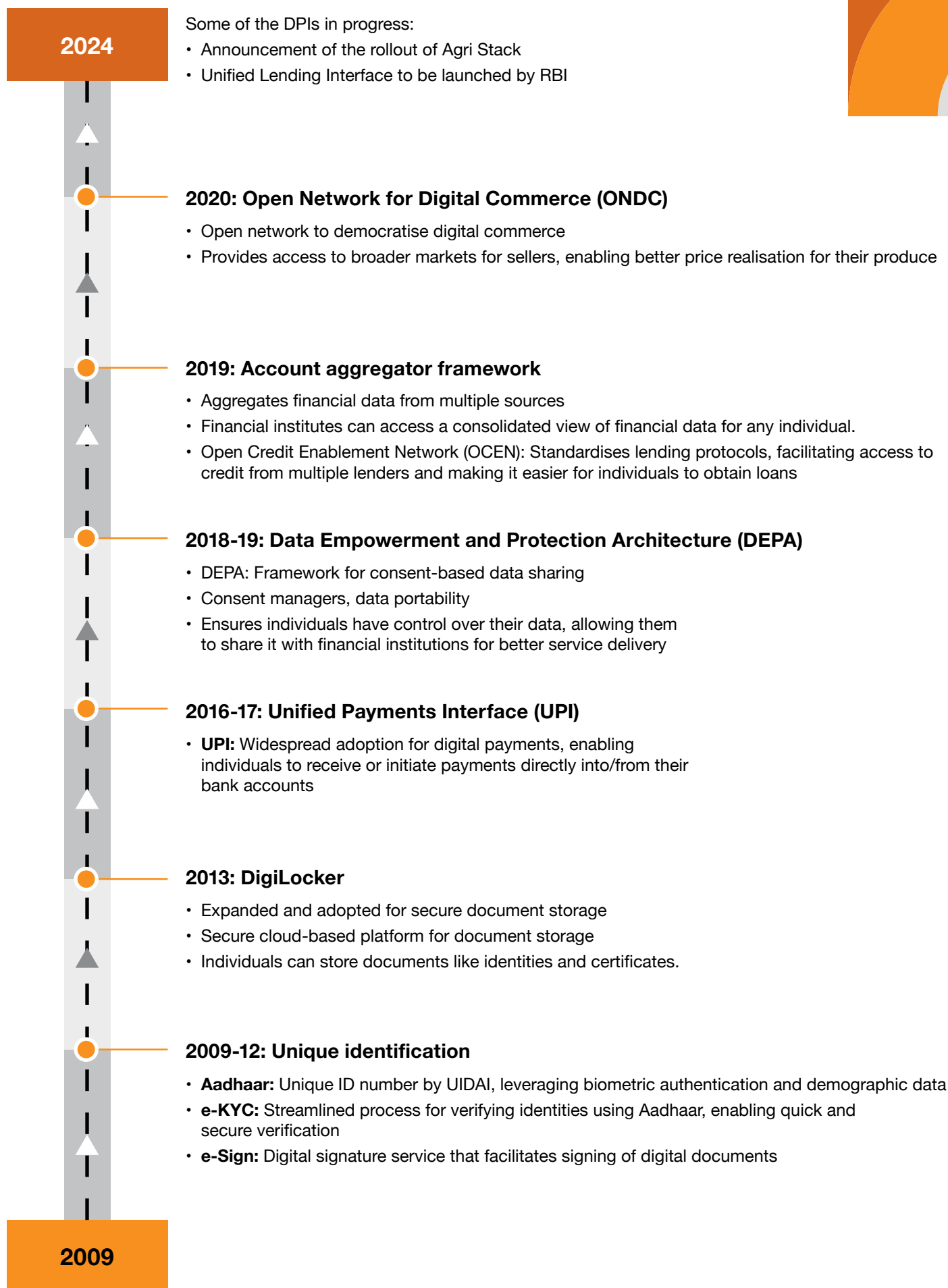
India has issued 1.389 billion Aadhaar enrolments, facilitated over 10 million daily e-KYC transactions and provided more than 500 million individuals access to bank accounts – of which 55% are women and 66% reside in rural areas. In April 2024 alone, India saw over 13 billion UPI transactions, with a cumulative value of USD 230 billion.<sup>17</sup>

16 [https://www3.weforum.org/docs/WEF\\_Advancing\\_Digital\\_Public\\_Infrastructure\\_Agriculture\\_Sector\\_2024.pdf](https://www3.weforum.org/docs/WEF_Advancing_Digital_Public_Infrastructure_Agriculture_Sector_2024.pdf)

17 <https://timesofindia.indiatimes.com/blogs/kembai-speaks/digital-transformation-in-the-financial-sector/>



Figure 3: Timeline of DPIs in India



Source: PwC research

DPI has also enabled effective DBTs across numerous central Government schemes, helping the Government save over USD 41 billion by reducing leakages and transferring funds directly into citizens' bank accounts. This initiative has lifted millions out of poverty, offering new opportunities for education, improved health and a dignified livelihood. By leveraging DPI, India has bypassed traditional stages of development and accelerated financial inclusion, accomplishing something that might have taken 50 years in less than a decade.<sup>18</sup>

India's ascending journey to the global digital leadership is reinforced by the nation's robust **DPI**, which has played a crucial role in enabling effective delivery of public and private services, driving competition, creating markets and facilitating innovation. DPI affirms India's achievement across domains including compliance with Sustainable Development Goals (SDGs) and climate resilience standards, poverty reduction, increased accessibility to quality education, financial inclusion and women's economic empowerment.

DPI is envisaged as an **intermediate layer** in the digital ecosystem that connects a physical layer and an application layer. While the physical layer consists of routers, devices, data centres, servers and the overall connectivity, the application layer denotes various solutions related to service delivery, citizen services, e-commerce, payment transactions, remote education and telemedicine across verticals. This structure enables DPI to act as a platform for **maintaining unique identifications** and offer a secure exchange for **financial transactions and data transfers** across the ecosystem. Following are the key characteristics of an ideal DPI to achieve its objective of ensuring efficient, reliable and accessible services.

**Figure 4: DPI desirable characteristics**



DPI is constructed using open-source software, publicly accessible data, OpenAI models, established standards and freely available content. Under astute guidelines of data security and privacy, it enables free sharing and access to the data and utilises common assets for multiple purposes. The United Nations Development Programme (UNDP) mentions DPI as a critical enabler of digital transformation that can help countries to achieve national priorities. In principle, DPI is not restricted within a geographical territory or a functional department – rather it can be

adopted by both developed and developing nations, as well as public and private entities, to push digital services and initiatives. The success stories of several countries in employing various core themes of DPI to create innovative citizen services attest to the huge potential of this technological innovation.

### Agri Stack

The Agri Stack initiative by the Indian Government aims to create a comprehensive digital ecosystem for the agricultural sector. The vision behind Agri Stack is to integrate various agricultural data streams into a centralised digital platform, providing farmers with personalised and actionable insights. This initiative aligns with the broader goals of Digital India, aiming to leverage technology to enhance agricultural productivity, sustainability and farmers' income.

Based on the foundation laid by India Digital Ecosystem Architecture (InDEA) 2.0, India Digital Ecosystem for Agriculture (IDEA) was created for the ministries of GoI, state governments and departments to implement their own digital ecosystem.<sup>19</sup> Agri Stack is being built by the MoA & FW as an open source, open standard and interoperable product/service, with a federated structure – keeping 'farmer' at the centre of the design, with states' requirements in consideration, ensuring participatory and inclusive design to ensure the sector evolves collectively to help shape the next decade of agriculture in India.

The agricultural sector is a diverse, complex and sensitive ecosystem. For any attempt to bring in digital transformation in this sector, one needs to imbibe an ecosystem approach where the entire agriculture value chain – starting from crop/variety selection and crop management to the market – is involved in the digital transformation journey.

Therefore, it is important that before establishing a digital ecosystem of agriculture, we take a long-term view of aspects like interoperability, data governance, data quality, data standards, security and privacy, besides being open to innovation.

Agri Stack has the potential to revolutionise agricultural research and development, enabling scientists and policymakers to leverage vast amounts of data to identify trends, patterns and innovative solutions for the sector. Agricultural data forms one of the most diverse, complex and huge data ecosystems. The availability of comprehensive agricultural data can also support evidence-based policymaking, leading to targeted interventions and better allocation of resources. The recent MoU between MoA & FW and Department of Space (DoS) to develop the Krishi-Decision Support System (Krishi-DSS) using geospatial technologies and related databases for enhancing evidence-based decision-making capability of all the stakeholders in the agriculture sector is a step in the right direction. The significance of Agri Stack lies in its potential to drive sustainable agricultural growth, improve livelihoods and mitigate risks faced by farmers by bringing all the stakeholders in one ecosystem. By leveraging technology and data-driven approaches, Agri Stack holds the promise of transforming Indian agriculture into a dynamic, resilient and competitive sector capable of meeting the challenges of the future.

<sup>18</sup> <https://dea.gov.in/sites/default/files/Report%20of%20Indias%20G20%20Task%20Force%20On%20Digital%20Public%20Infrastructure.pdf>

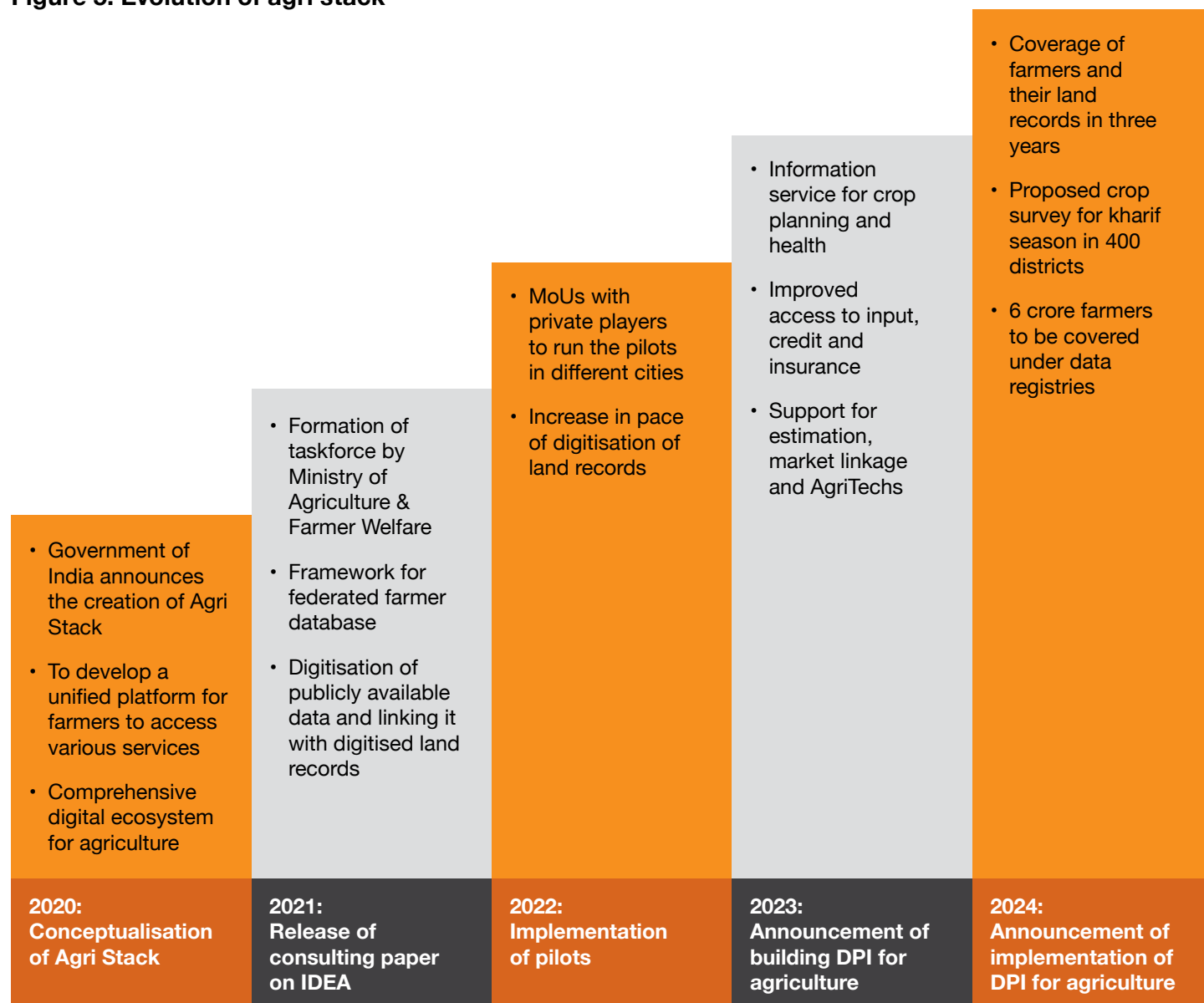
<sup>19</sup> <https://keralaagriculture.gov.in/wp-content/uploads/2022/03/IDEA-Concept-Paper.pdf>



# Agri Stack and digital ecosystem

## 3.1 Evolution of Agri Stack

Figure 5: Evolution of agri stack

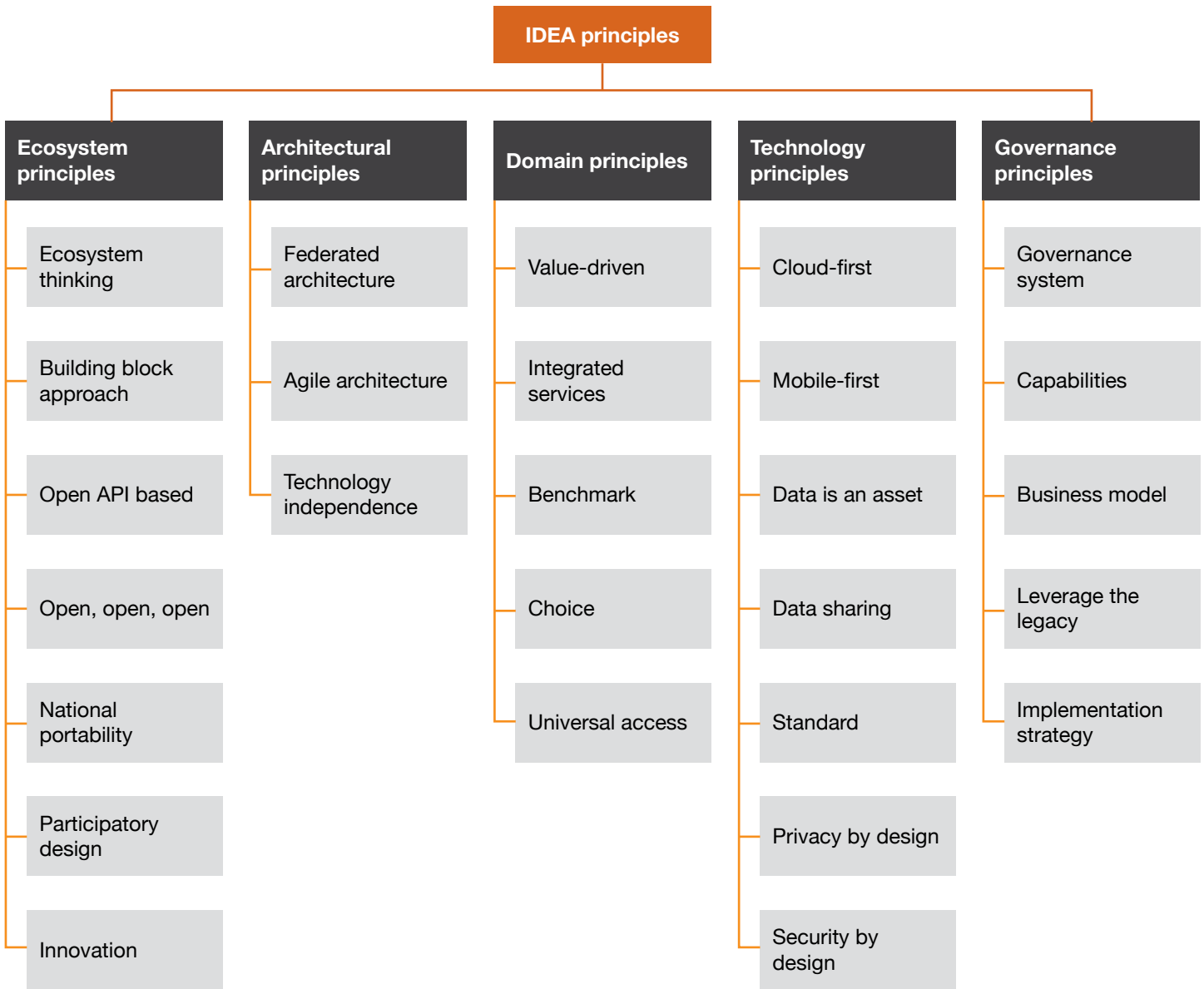


Source: PwC research

Agri Stack creates a unified platform for agricultural data and services. It is a federated farmers' database that will collect data from different sources and make it available to farmers, government agencies and private sector companies. IDEA is envisaged to provide a platform to access and use agricultural data, and Agri Stack is a term used to describe the underlying data infrastructure that will

support IDEA. Agri Stack is a set of standards and protocols that will allow different data sources to be connected and shared. IDEA and Agri Stack can help to improve the productivity, efficiency and resilience of Indian agriculture. Moreover, IDEA will help unlock different opportunities for different stakeholders in the agriculture sector, as shown in Figure 6.

Figure 6: IDEA principles



Source: Consultation Paper on IDEA. Ministry of Agriculture, Government of India. February 2022  
[https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper\\_mod31052021\\_2.pdf](https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper_mod31052021_2.pdf)

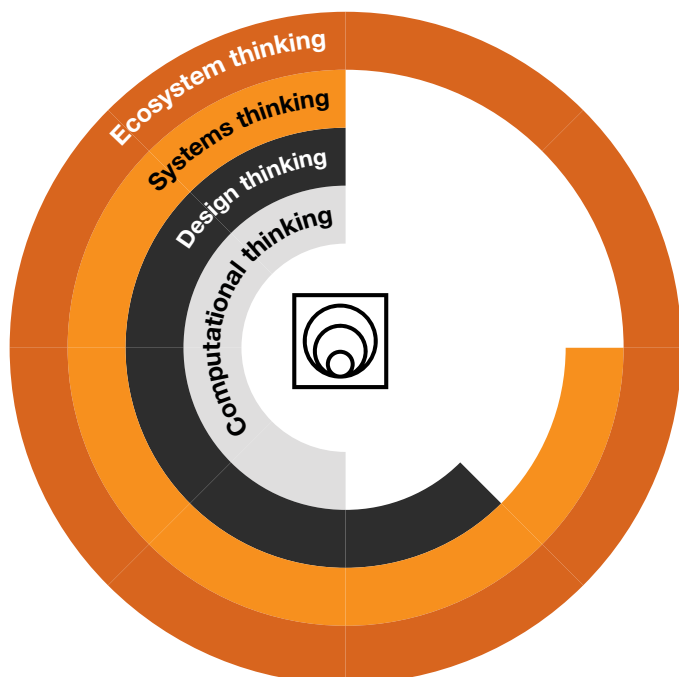
## 1. Ecosystem principles

Considering the complexities of agriculture as a sector, it is imperative to examine the interplay between multiple players of the ecosystem, while attempting to transform the sector. Moving beyond the systems and design thinking methodologies that took us so far, the need of the hour is ecosystem thinking. Thinking ecosystems allow for a new frame and mindset that taps into different and diverse relationships, partnerships, alliances and collaborations that were unthinkable before. Using appropriate enablers through technology and open platforms, the players can come together and collaborate as an ecosystem. The increasing value of participating in ecosystems allows for large and small players to create, scale and serve markets in ways that were unimaginable previously. The ability to

interact and co-create in increasingly sophisticated and novel ways offers new opportunities. Thus, an ecosystem approach allows players to form a bond of shared interest, recognition and purpose. Ecosystems are hard, demanding and complex work. When we commit to having an ecosystem design, we facilitate the creation of a self-organising, scalable and sustainable model. Placing a new scheme or initiative in an existing ecosystem, or worse, ignoring the ecosystem in designing the initiatives, means the product or service will have little impact and become a commodity quickly. Therefore, taking an ecosystem approach while designing an initiative makes it conducive to create an ecosystem that has been enhanced a considerable number of times.



Figure 7: Evolving ecosystem thinking



### Computational thinking

- Solves problems through logical sequencing

### Design thinking

- Puts the key stakeholder – like farmer – at the centre
- Takes an empathetic approach in solving the pain points
- Comprises prototyping, experimentation and testing

### Systems thinking

- Understands complex networks and loops between multiple key players
- Fully explores the relationships among components of subsystems
- Ignores the complexity of interplay between multiple subsystems

### Ecosystem thinking

- Keeps sustainability at the centre
- Enables creation of an open social technical system that is distributed, adaptive and scalable
- Assures autonomy, ensures interoperability

Ecosystem principles focus on all architectures to be built on **ecosystem thinking** where the ecosystem consists of private, public, autonomous bodies and others. It also talks about having **minimal and reusable independent building blocks**. **Open API and open source** should be used as much as possible to make systems portable. The ecosystem principle also mentions designing a national digital system for portability across India. Moreover, it emphasises that **responsible innovation** should be the core of every design, and an **ecosystem sandbox** can be a good enabler for open innovation.



## 2. Architecture principles

Architecture principles promote the idea of an **agile architecture** and adopt **technology-independent** architecture systems. The systems should also be designed in **federated architecture models** for data and applications. **A single source of truth** and **system of records** should be made available while designing architecture.

## 3. Domain principles

**Universal access** and **design choice** are key aspects of domain principles where the farmer should be at the centre of the design. This will help services reach each and every group in the remotest parts of the state. The principles also mention having an **integrated service approach** to help realise the goal of connected farmers. **Benchmarking** with built services and outcomes is also a key attribute along with providing **value** to new and additional users.

## 4. Technology principles

The key technology principle is to build the application on cloud by default and make it mobile-first to enable ease of access of information. Clear policies about **data sharing**, **data privacy**, and **data protection** should be laid out for farmers and other stakeholders. **Data exchange platforms** should be designed for the regulated exchange of data. Set of **standards and protocols** must be established for interoperability and compliance. **Privacy by design** and **security by design** should be at the forefront of the design concept.

## 5. Governance principles

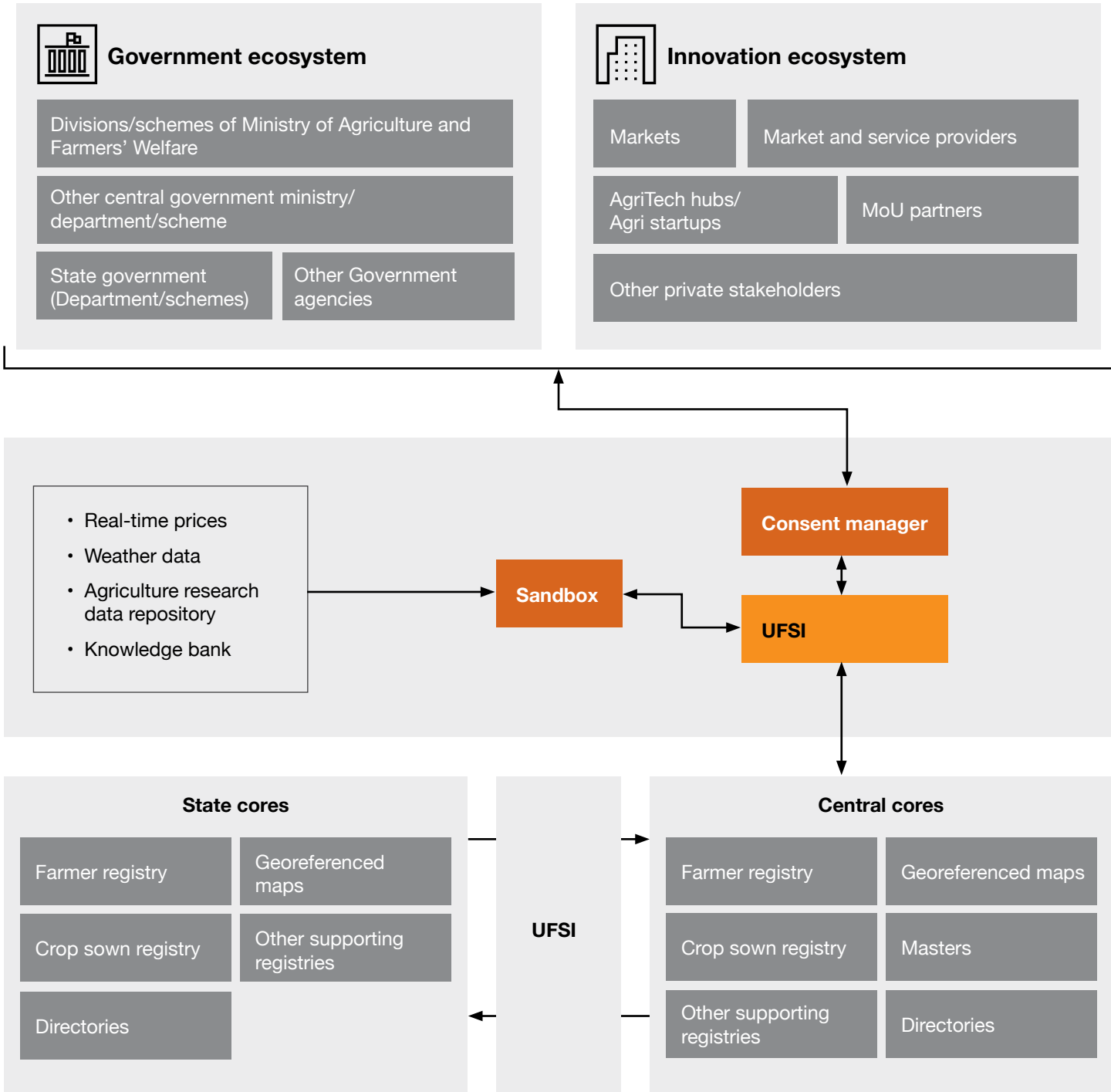
These principles ensure that an accountable and transparent **governance system** is developed. **Capacity building** is also core to enhancing the capability of the ecosystem. Good **business models** should be adopted to sustain all interventions. **Existing systems** should be assessed, leveraged and adopted whenever possible. Clear **implementation strategies** should be designed and planned.

### 3.2 Agri Stack and core blocks

The three important components of Agri Stack – the registries (comprising of three core registries and many other supporting registries), consent manager and Unified Farmer Service Interface (UFSI) – enable an ecosystem where the Government and private stakeholders can facilitate the delivery of digital services to farmers. The

registries comprise three crucial and fundamental building blocks in agriculture (i.e. the farmer registry, geo-referenced village maps and crop sown registry), and several other supporting registries such as seeds, seed dealers, fertilisers and fertiliser manufacturers which may be developed soon.

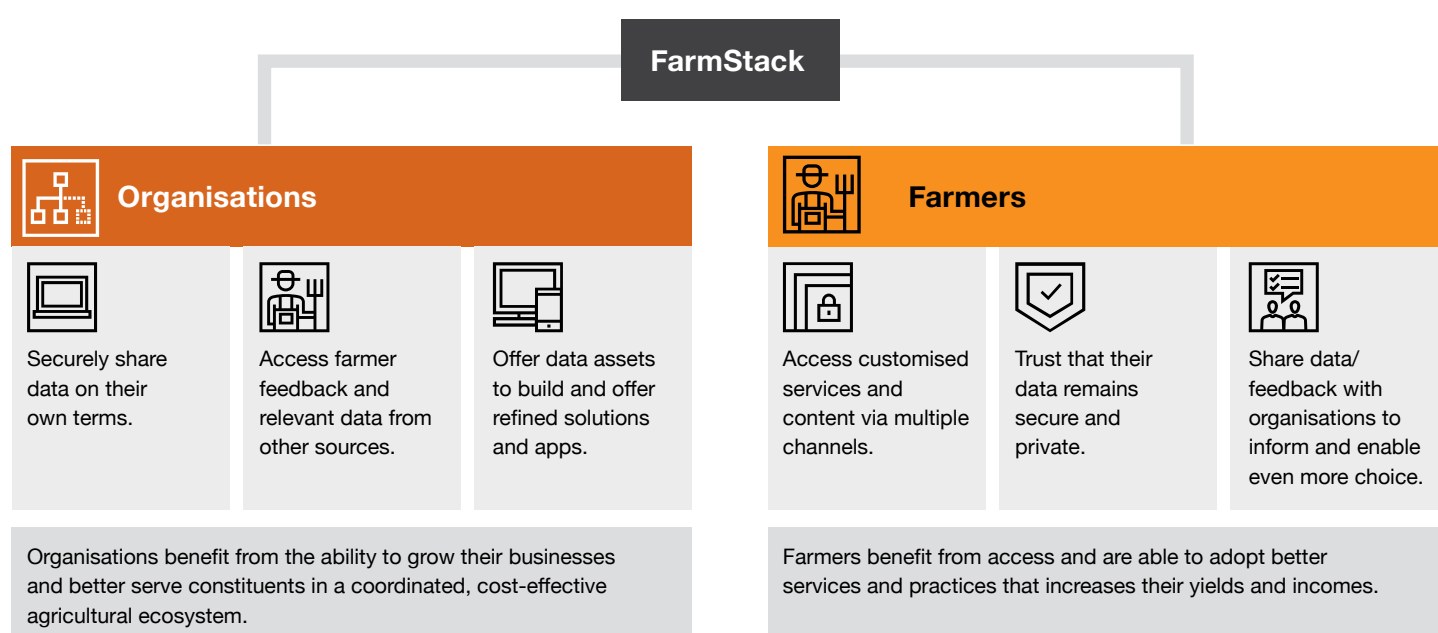
Figure 8: Core blocks of agri stack and involved stakeholders





- 1. Farmer registry:** The farmer registry serves as a federated database of all farmers in India, capturing their demographic and agricultural information. This database will be compiled by the states in accordance with common standards and protocols and will be selectively cached by the centre. The farmer registry will comprise a functional ID which will be based on Aadhaar and be assigned to every farmer to uniquely identify and capture their details.
- 2. Geo-referenced village maps:** In order to identify the place and geolocation of every crop being sown, a registry of digital cadastral maps will be stored that are georeferenced and tied to the coordinates (latitude and longitude) of its real-world location.
- 3. Crop sown registry:** The crop sown registry is intended to be a federated registry of crops that are sown and grown throughout India every season on all farms by each farmer. By introducing smartphone- and image-based (including drone and satellite images in the future) methods of crop survey, it seeks to streamline and enhance previously prevalent paper-based methods of crop surveying. The crop sown registry gives the state and central governments the ability to estimate crop production quickly and more accurately and enables them to better respond to the actual crops grown in the nation, and plan interventions and support to help address crop-specific issues.
- 4. UFSI:** The UFSI is the building block, which is envisaged to play a role comparable to that of UPI in the space of digital payments and enable interoperability across stakeholders in Agri Stack. The UFSI comprises a set of APIs for handling multiple types of transactions in the digital agriculture space and will be used by the government and authorised private users, (i.e. banks, AgriTechs, agri value-chain companies, etc.). The primary role of UFSI is to enable consent-brokered data access to the core registries and provide a centre-state federation of data and also enable a standards-based interaction between various public and private stakeholders.

**Figure 9: FarmStack Ethiopia**



**5. Consent manager:** Agri Stack follows a privacy-by-design approach. The consent manager is architected to ensure that data privacy norms and regulations are being complied during data sharing. It facilitates sharing of anonymised personal data with entities to whom the data principal (i.e. a farmer) has provided prior consent. It also enables easy management of previously granted consent to prevent future sharing of data.

To encourage innovation in the agriculture ecosystem, it is essential that the ecosystem stakeholders work in a safe and controlled environment that enables them to test out their ideas, products and services without impacting the real world. A subset of Agri Stack, the **Agri Stack Sandbox** will provide authorised stakeholders a simulated environment with access to the UFSI along with sample data for various registries and databases, to allow them to test and safely fail or succeed and get authorised access to the Agri Stack ecosystem, thereby encouraging experimentation and rapid prototyping.

## International case study

**FarmStack:** A digital public good (DPG) implemented as DPI in Ethiopia for powering data transfer in agriculture to supercharge collaboration and boost productivity

The DPI approach has benefited 3.5 million farmers in Ethiopia and is part of the open ecosystem of Digital Agricultural Advisory Services. Organisations can build their own applications by leveraging its open data standards that enable data sharing. FarmStack can be used to combine farmer profile information with other datasets (soil, weather and market prices) to create customised videos about improved agricultural practices. The platform increases farming productivity through advisories based on data aggregated seamlessly from various sources. It also facilitates better opportunities for credit through the secure exchange of financial data to determine creditworthiness.<sup>20</sup>

<sup>20</sup> <https://www.undp.org/sites/g/files/zskgke326/files/2023-12/undp-accelerating-the-sdgs-through-digital-public-infrastructure-v2.pdf>

### 3.3 The ecosystem and stakeholders

An agricultural value chain consists of the people and activities that bring basic agricultural products like maize, vegetables or cotton by obtaining inputs and production in the field to the consumer, through stages such as processing, packaging and distribution. The stages of this value chain are given below:

1. **Planning:** Farmer plans to grow a particular crop as per the season. Farmer utilises his/her experience and information gathered from various sources having diverse best practices for crop cultivation. The farmer makes informed decisions on what crop to grow, what variety of seed to buy, when to sow and what best practices to adopt for maximising the yield.
2. **Inputs:** Farmer prepares the seeds, fertilisers, pesticides and other equipment required for ensuring healthy crop cultivation.
3. **On-farm production:** Farmer monitors the health of the land, the crop and its growth.
4. **Storage:** After the crop has been harvested, the farmer stores the bulk in a storage facility till the time it is to be sent to a market or bought by a wholesaler.
5. **Post-harvest processing:** Time to time, the farmer needs to ensure the health of the stored crop by regularly cleaning sorting and packing.

6. **Transport:** The produce is taken from the farm to the storage unit and from the storage unit to the marketplace (mandis) where the crop is sold.
7. **Access to markets:** The farmers have the privilege to sell their produce in the marketplace (mandis).

There are various schemes that are implemented at both centre and state levels. The initiatives that are a part of these schemes cut across the value chain, providing solutions by bridging the gaps present in the value chain.

External agencies such as banks, UIDAI and their applications also interact with the stakeholders who are part of this value chain to offer various services. For example, the integration of PM Kisan with UIDAI offers Aadhaar authentication for farmers using which the farmers can be uniquely identified. Multiple departments interact with each other to provide the necessary services to the farmers and other stakeholders. For example, National Seeds Corporation defines the rules, regulations and standard operating procedures for the import of seeds.

Even after over seven decades of planning since Independence, a majority of the farmers are still facing problems of poor production and/or poor returns.

**Table 2: Key challenges of the current Indian agriculture ecosystem**

Value chain component	Key challenges
<b>Agricultural inputs</b>	<ul style="list-style-type: none"> <li>• Unsustainable use of fertilisers and pesticides, leading to lower productivity</li> <li>• Inadequate data on supply-demand of inputs</li> <li>• High dependency of farmers on traditional distribution channels, resulting in non-scientific usage of agricultural inputs</li> <li>• Instinct-based decision making</li> </ul>
<b>Farming practices</b>	<ul style="list-style-type: none"> <li>• Unscientific practices leading to increase cost of cultivation</li> <li>• Rising labour costs</li> <li>• Climate change</li> </ul>
<b>Harvesting and aggregation</b>	<ul style="list-style-type: none"> <li>• Increased level of intermediation by a network of aggregators, traders and commission agents leads to higher procurement cost for buyers.</li> <li>• Lower realisation rates for farmers due to uncertainty in demand</li> <li>• Lack of primary processing at farmgate</li> <li>• Traditional quality assessment does not offer large-scale quality testing with quick turnaround times.</li> <li>• Lack of quality monitoring during storage and transportation</li> </ul>
<b>Storage and infrastructure</b>	<ul style="list-style-type: none"> <li>• Poor access to storage capacity at farmgate</li> <li>• Bulk arrival during harvest leads to price volatility</li> </ul>
<b>Marketing and trading</b>	<ul style="list-style-type: none"> <li>• Lack of price discovery and intelligence mechanism</li> <li>• Disaggregated and disconnected supply chain</li> </ul>

The challenges specific to farmers are as below:

- Fragmented landholdings leading to poor bargaining power and reduced-price realisation of agri produce
- Fluctuating agricultural growth rate; variability in commodity prices
- Unpredictable changes in monsoon rainfall; adverse impact of climate change; structural inefficiencies in the domestic agricultural market
- Lack of visibility in the agri input sales leading to low crop yields

An ecosystem approach towards developing appropriate technologies and their adoption is the only way forward to address the agriculture sector holistically. Below is a schematic of how technology can solve various challenges across value chain:

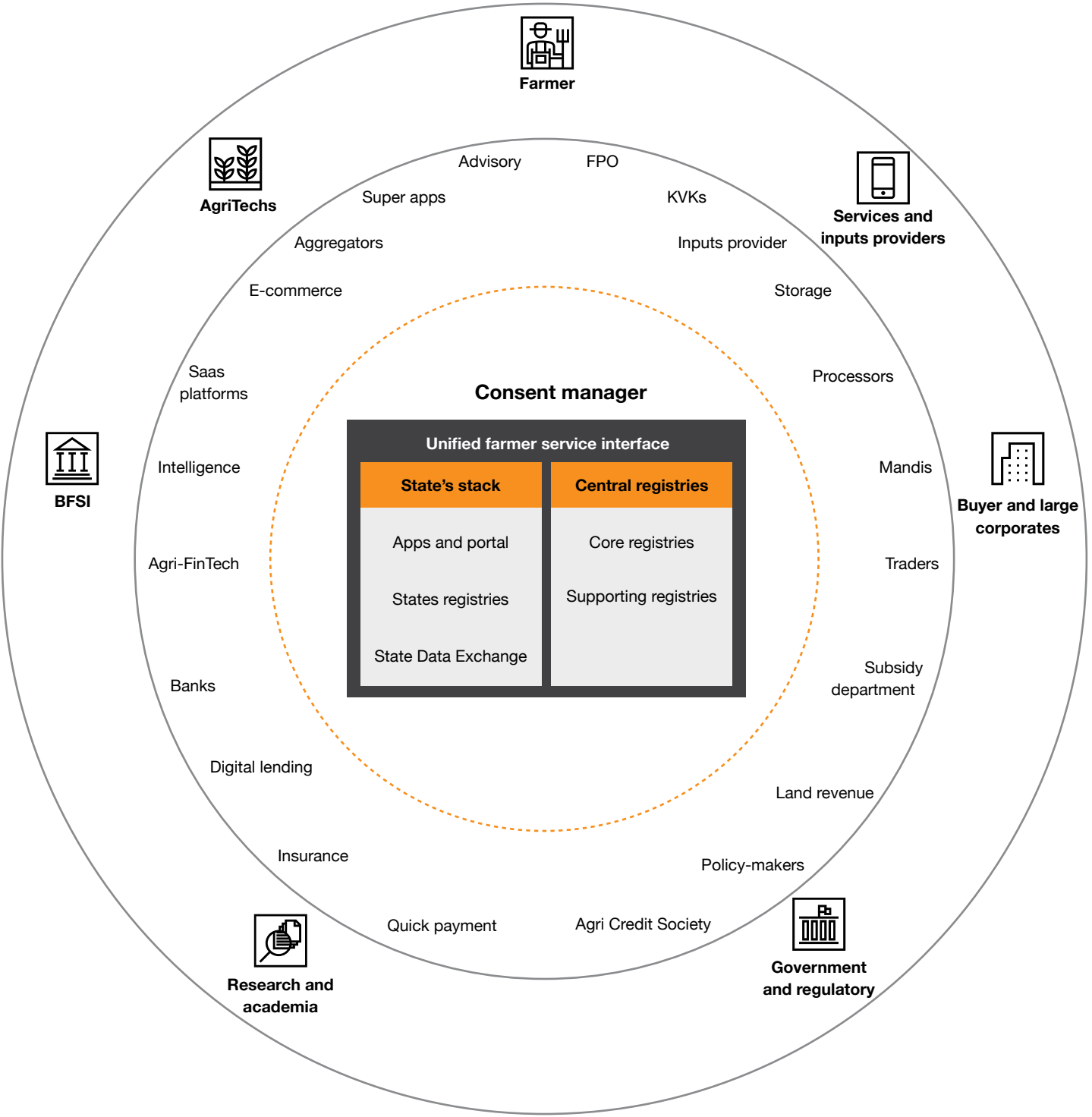
**Figure 10: Impact of agristack on agrivalue chain**

Value chain	As-is	To-be	Core registries	Secondary registries /AgriTech	External agencies
<b>Farm planning</b>	<ul style="list-style-type: none"> <li>• Most small and marginal farmers do very little planning.</li> <li>• Ad-hoc, off the record, physical books, word of mouth</li> </ul>	<ul style="list-style-type: none"> <li>• AI, drone and satellite imagery-enabled farm planning assist; soil conditions analysis; end-to-end advisory</li> <li>• Farm operating system</li> </ul>	<ul style="list-style-type: none"> <li>• Farmer ID registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• Soil health, weather data</li> </ul>	Technology providers
<b>Farm input</b>	<ul style="list-style-type: none"> <li>• Unorganised market, spurious products.</li> <li>• Farmers influenced with price drop lure and local word of mouth</li> </ul>	<ul style="list-style-type: none"> <li>• Demand prediction</li> <li>• E-marketplaces and subscription platforms</li> <li>• Doorstep delivery of agri inputs</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• Seed and input suppliers</li> <li>• Farmer register, GPS</li> </ul>	Technology providers
<b>Production</b>	<ul style="list-style-type: none"> <li>• Production is majorly by tenant farmers; inefficient resource utilisation</li> <li>• Limited access to finance</li> </ul>	<ul style="list-style-type: none"> <li>• Farming-as-a-service</li> <li>• Precision agriculture solution</li> <li>• Predictive pest and pesticides estimation</li> <li>• Ease of access to finance</li> </ul>	<ul style="list-style-type: none"> <li>• Crop sown registry</li> <li>• Farmer ID registry</li> </ul>	<ul style="list-style-type: none"> <li>• State land record portal</li> <li>• E-loan agreement</li> </ul>	Financial services
<b>Processing and handling</b>	<ul style="list-style-type: none"> <li>• Food processing and handling industry is still heavily unorganised.</li> </ul>	<ul style="list-style-type: none"> <li>• Inventory management</li> <li>• Smart warehousing and cold chain solutions</li> <li>• Transportation optimisation</li> </ul>	<ul style="list-style-type: none"> <li>• Farmer ID registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• Food processing agencies</li> </ul>	Technology providers
<b>Distribution and transport</b>	<ul style="list-style-type: none"> <li>• Supply chain infrastructure is siloed.</li> <li>• India's farm supply chain losses are one of the highest in the world.</li> </ul>	<ul style="list-style-type: none"> <li>• Price prediction</li> <li>• Spectral and machine vision-based quality assessment</li> <li>• Blockchain and AI-enabled traceability</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> <li>• Farmer ID registry</li> </ul>	<ul style="list-style-type: none"> <li>• E-loan agreement</li> <li>• State land record portal</li> </ul>	Technology providers
<b>Marketing and trading</b>	<ul style="list-style-type: none"> <li>• Price fluctuations and farmer distress are the realities of every crop season.</li> </ul>	<ul style="list-style-type: none"> <li>• B2B electronic marketplace, hyper-local transport services</li> <li>• Fair price predictor tools</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• Commodity prices/MSPs</li> <li>• Crop monitoring through GIS</li> </ul>	Technology providers



The broader agriculture ecosystem with stakeholders post the implementation of Agri Stack in full form will look like:

Figure 11: Stakeholders and ecosystem

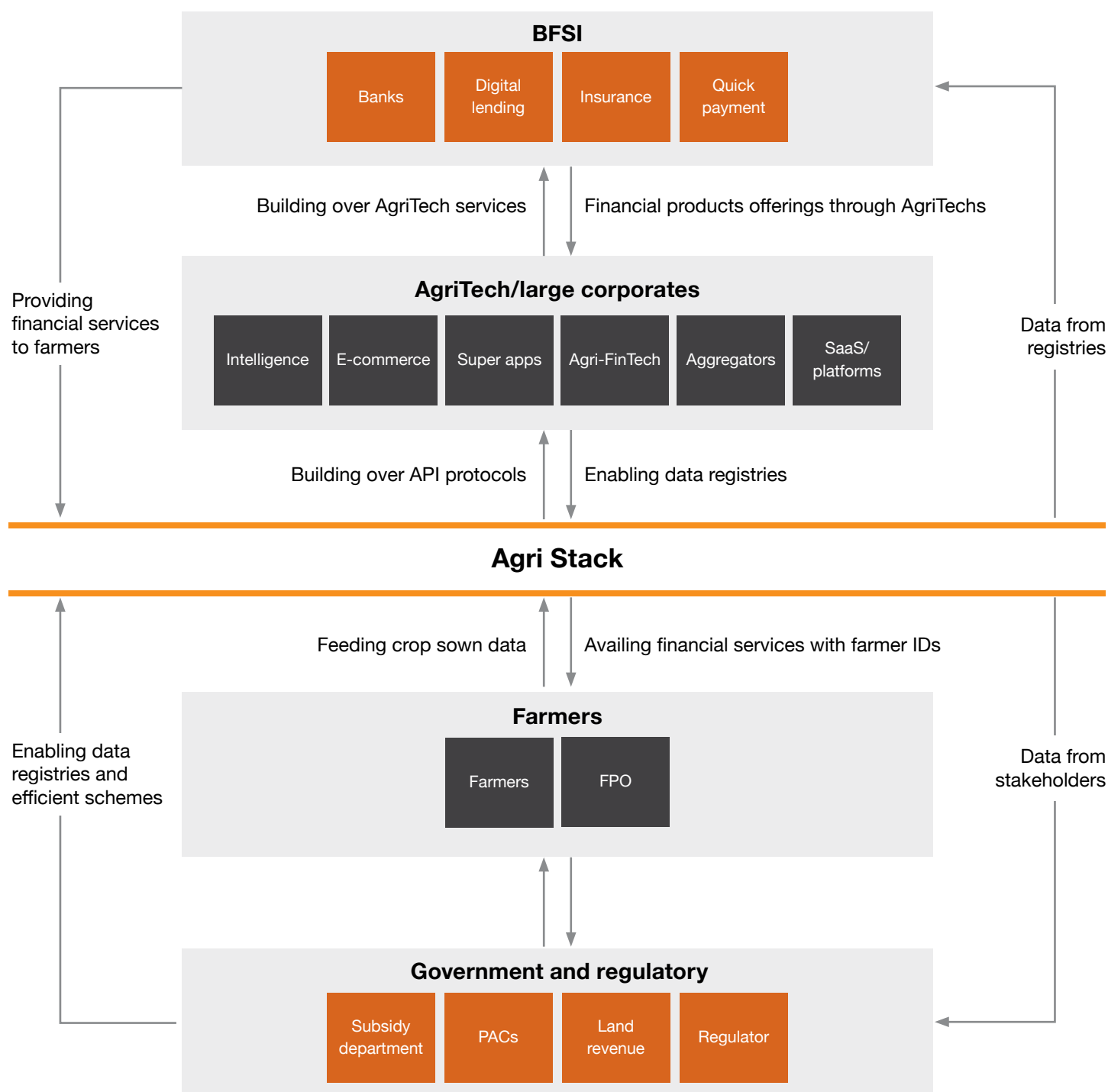


# Impact on financial services industry

Access to credit or capital is an integral part of any value chain and this holds true for agriculture ecosystem also. With the arrival of Agri Stack, the interaction between financial institutions and agriculture sector is set to transform significantly. This is going to impact agri banking or insurance on multiple dimensions like new digital channels, data-driven underwriting practices, process efficiencies, multi-factor risk mitigation techniques and more efficient regulatory monitoring.

Financial services ecosystem with Agri Stack will revolve around four major stakeholders, as highlighted in Figure 12.

**Figure 12: Financial service ecosystem with Agristack**





**BFSI:** Banks and insurance providers will definitely reap benefits from the Unified Farmer Service Interface (UFSI). Financial institutions can leverage the data and services which will be offered by UFSI and AgriTechs to perform data-driven product innovations, digital channels development and evolve risk mitigation techniques.

Agri Stack can enhance opportunities for banks and other financiers – primarily engaged in providing capital through farm and rural loans – who are using technology to better understand the farmer, provide targeted products and reduce loan risks. For example, the State Bank of India (SBI) developed the YONO Krishi app to meet farmers’ finance, inputs and advisory needs.

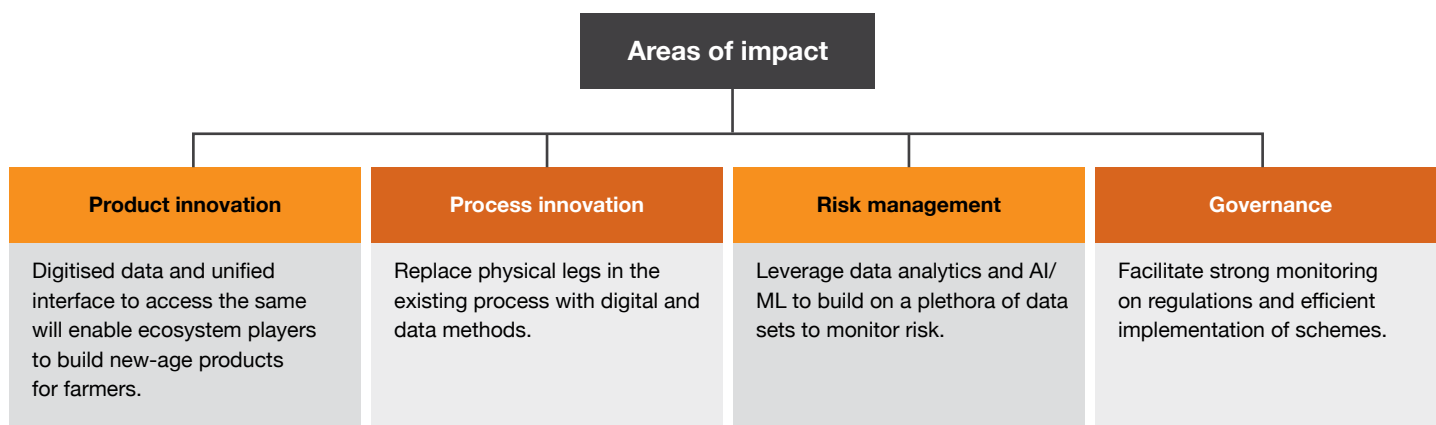
**AgriTechs:** The role of AgriTechs will increase significantly post implementation of Agri Stack in the ecosystem. AgriTechs will be at forefront on product and services innovation and will define the future roadmap of financial services offerings to the agriculture ecosystem. AgriTechs under different sub-segments will lead the innovation in the ecosystem. Sub segments like superapps, e-commerce, supply chain digitisation and FinTechs platforms will provide digital channels to financial institutions to reach out to farmers, data analytics and intelligence platforms will enable financial institutions with alternate data to integrate them in underwriting practices, and SaaS or digitisation platforms will enable core registries database by capturing farmer and field details.

**Large corporates:** Large corporates with digital platforms or superapps will also join AgriTechs in innovating and enable farmers through platforms by offering farm-related services – e.g. ITCMAARS.

**Farmers:** The entire ecosystem will revolve around farmers or farmer groups. Agri Stack will enable farmers with access to financial services. With the digitised identity, land ownership details and cropping pattern, farmers will be benefited by tailor-made product and services offerings by financial institutions. Farmers must also be the primary contributors of data to the core registries. Moreover, they must provide essential information on cropping pattern, farming practices, irrigation sources and yields. This data will form the backbone of the UFSI database and be crucial in creating accurate farmer profiles.

**Government body and regulators:** Government bodies are going to be both a contributor as well as beneficiary of the UFSI. The land revenue offices of state governments are going through digital transformation – along with digitisation of the land ownership records and georeferenced maps of villages, which will further contribute to the UFSI database. Government entities will be significantly benefited in terms of policymaking and subsidies or DBTs to farmers. Analytics over farmers database will enable the Government with data-driven decisioning and policymaking. Farmers’ database will be used to do accurate targeting of subsidies by identifying needy beneficiaries, designing tailored subsidy programmes, and enabling real-time tracking and verification.

**Figure 13: BFSI impact areas**



Digital data and real-time accessibility of the same will pave the way for innovation at product and process levels.

Also, data-driven approach will come at forefront for risk management and regulatory monitoring.



## 4.1 Product innovation

### Digital/embedded finance to farmers

Nowadays, AgriTechs have digital platforms and service offerings throughout the agriculture value chain. These platforms provide applications to digitise field operations, intelligence to support decisioning, e-commerce for inputs purchase, IoT for supply chain monitoring and digital ledgers for quick payments and credit. In addition to AgriTechs, large corporates have farmer-specific super apps to bring the entire ecosystem on web or mobile access points.

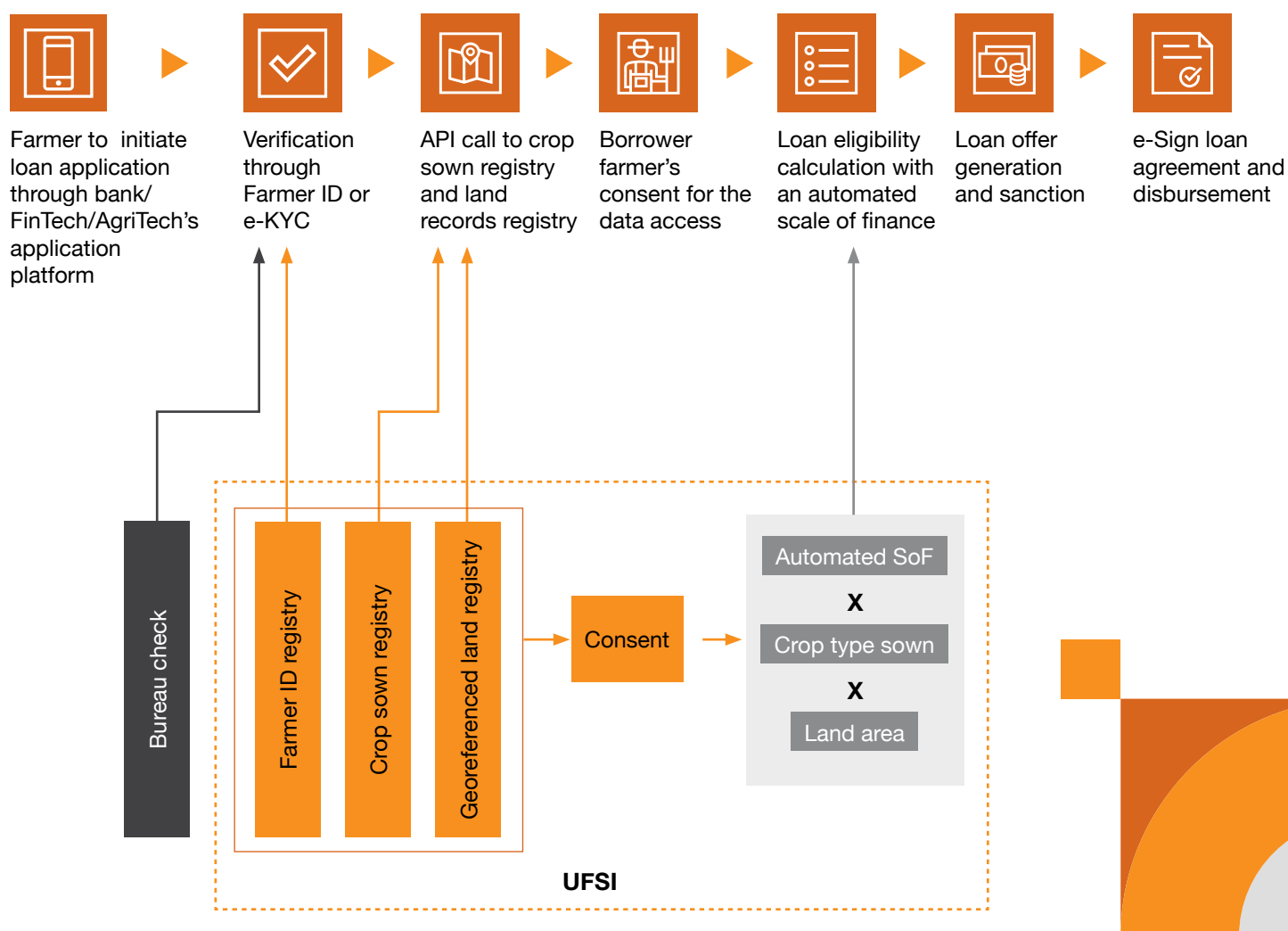
With these evolving product offerings, more and more farmers are now getting onboarded on the digital agriculture ecosystem. Therefore, embedding financial service offerings within the journeys of these platforms should also be looked upon. Digital sachet loans to purchase inputs from e-commerce platforms, quick payments or paperless credit through digital ledgers and digital working capital loans for contract farming through super apps are some of the examples of embedding financial services in the agri value chain journey.

Major roadblock in enabling digital lending to farmers is the non-availability of income and credit history data, as the majority of the farmers are new to credit (NTC). In order to assess the income profile of a farmer, bankers generally assess the income basis – i.e. what is being cultivated by the farmer on what area of the land – which is a manual and time-consuming activity.

The UFSI will pave the path for embedded finance in agriculture. The three core registries will provide details on unique identity, land ownership and crop sown data of farmers through APIs. These data points will help draw farmer profiles which will enable financial institutions to underwrite small-ticket paperless loans to farmers.

An illustrative journey of digital embedded loan to farmer is shown in Figure 14.

**Figure 14: Digital/embedded loan journey for farmers**





## Parametric or index-based insurance products

Parametric insurance products, which are also called as index-based insurance schemes, have the potential to become mass schemes with the introduction of Agri Stack. These insurance products provide payouts based on the occurrence of a predefined event rather than the actual loss experienced by the insured. These predefined events can be inappropriate rainfall, temperature variations or earthquakes where the parameters or index will be rainfall level, temperature threshold and earthquake magnitude, respectively. These insurance products are quick in payouts processing, as once the event threshold is triggered, the payment is made without the need of a detailed on-ground claim investigation. It makes the insurance product cost-effective also.

Now with the availability of geofenced maps and crop sown data, more and more GIS-enabled index insurance products can be offered to farmers. The database of crops and fields can also be used to build advanced crop monitoring AI/ML models. Some of the indexes for parametric insurance are as follows:

- Yield index
- Vegetation index
- Rainfall index
- Temperature index
- Wind speed index
- Drought index

Availability of geofenced maps and crop data will ease the monitoring of farmers’ fields through remote sensing on meteorological and satellite data points.

## Deposit products

When Aadhaar for Indian residents was introduced in 2009, it ushered in the digital economy in India. Aadhaar offers a unique opportunity for the Government to streamline its delivery mechanisms under welfare schemes by direct transfer to beneficiary accounts, thereby ensuring transparency and efficiency.

Aadhaar and the Pradhan Mantri Jan-Dhan Yojana (PMJDY) contributed to financial inclusion on a massive scale and formalised financial transactions through banks, bringing transparency and accountability. The total deposits under PMJDY amounted to INR 2.31 lakh crore through 53.45 crore accounts.

**Table 3: PMJDY beneficiaries (as on 11 September 2024)**

PMJDY beneficiaries (as on 11 September 2024)			
Bank name/type	Rural/semi urban	Total beneficiaries	Deposits
	Beneficiaries (in crore)	(In crore)	(in INR crore)
Public sector banks	26.13	41.66	1,79,975.9
Regional rural banks	8.53	9.96	45,207.62
Private sector banks	0.74	1.65	6,813.89
Rural cooperative banks	0.19	0.19	0.01
<b>Total</b>	<b>35.6</b>	<b>53.45</b>	<b>2,31,997.4</b>

Source: <https://pmjdy.gov.in/account>



The implementation of Agri Stack, India's DPI for agriculture, will pave the way for higher agricultural production, food security and economic growth. The unique identity for farmers will have a massive transformative impact for the financial inclusion of farmers and enhance digital transactions. Farmer ID or farmer registry will become mandatory to avail any benefits under any DBT schemes. Subsidies, Government payments or monetary benefits will be tagged to farmer registries and be routed through linked savings accounts. Thus, Agri Stack will further empower the Jan Dhan–Aadhaar–Mobile (JAM) trinity.

In this scenario, there will be ample opportunities for banks to boost up their deposits by:

- **Tailoring deposit product for subsegments:** Using Agri Stack data, banks can design savings products to cater to subsegments of farmers basis creating farmer profiles. Based on cropping pattern and land ownership data, many farmer profiles can be identified like export farmers, high-value growers, nursery owners etc.
- **Subsidy-linked deposit accounts:** Banks can enable Government agencies to direct transfer more and more subsidies to farmers through linked deposit accounts by designing utilisation-based deposit product. Moreover, banks can enable checks to ensure end use of funds by using features like smart contracts.

## 4.2 Process innovation

### Efficient KCC

The KCC scheme has played a pivotal role in bridging the working capital or credit flow gap to farmers. Over 7.4 crore KCC accounts are active with a total outstanding credit of INR 8.9 lakh crore as on 30 June 2023.<sup>21</sup> KCC loans cater to working capital as well as capital expenditure requirements of agriculture and allied activities of farmers. A typical KCC loan application can take 15 to 30 days to get disbursed due to many manual and physical steps in the process, such as:

- crop type grown and irrigation facility verification at the field to assess the working capital requirement
- updated land record documents from the Government records
- legal vetting by advocates for the land ownership title
- charge creation in Government records.

The core registries of Agri Stack and subsequent offerings by AgriTechs over those have the potential to remove many of the above-mentioned physical steps from the KCC loan journey. Agri Stack, through its unified interface, will enable financial institutions to access farmer identities and digitally validate the land ownership and maps. Also, to assess the working capital requirement, financial institutions can get the crop sown information from crop registries. The to-be KCC loan journey with plugins from Agri Stack and product solution by AgriTechs is illustrated in Figure 15.



**Figure 15: Illustrative to-be farmer finance loan journey**

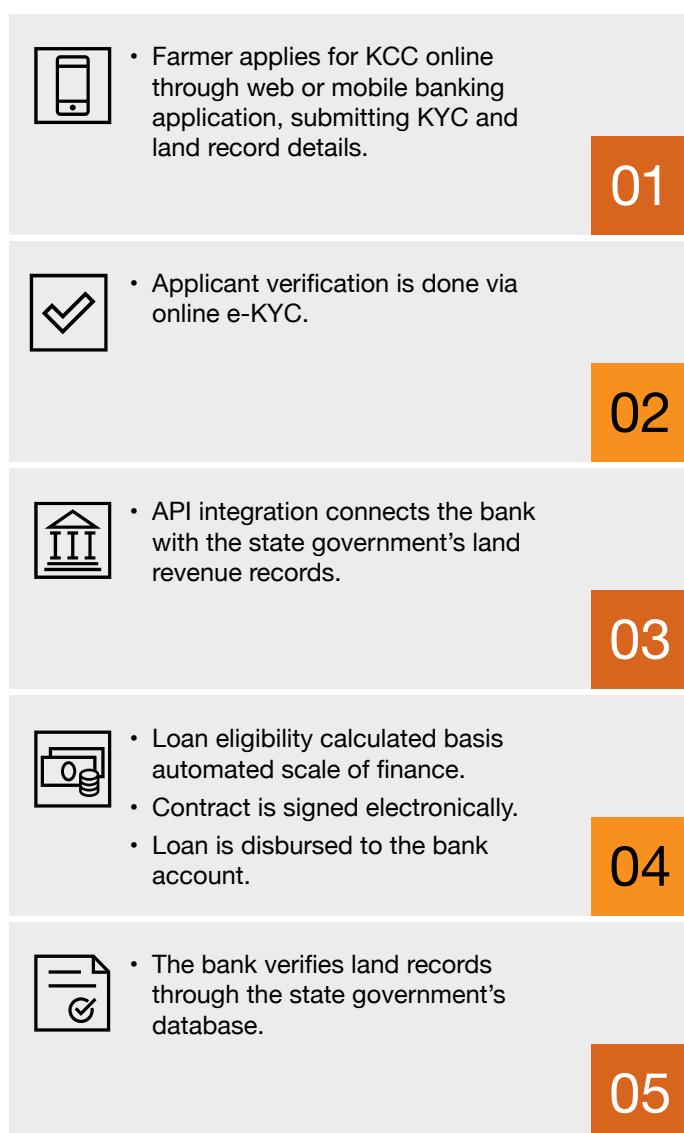
Lending journey	As-is	To-be	Core registries	Secondary registries /AgriTech	External agencies
<b>Loan sourcing</b>	<ul style="list-style-type: none"> <li>• Loan sourcing through branch or physical channel with KYC</li> <li>• Limited bureau check with KYC</li> </ul>	<ul style="list-style-type: none"> <li>• Loan sourcing through branch or digital channel with farmer's unique ID</li> <li>• Bureau check with farmer ID</li> </ul>	<ul style="list-style-type: none"> <li>• Farmer ID registry</li> </ul>		
<b>Loan origination</b>	<ul style="list-style-type: none"> <li>• Physical check on land ownership and crop sown details to assess the working capital requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Land ownership and crop sown details from registries to assess the working capital requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• Commodity prices/MSPs</li> <li>• Crop monitoring through GIS</li> </ul>	
<b>Verification (legal and technical)</b>	<ul style="list-style-type: none"> <li>• Legal check and vetting on land title</li> <li>• Valuation as per Government or market rate</li> </ul>	<ul style="list-style-type: none"> <li>• Legal check and vetting on land title through portal</li> <li>• Valuation as per Government or market rate</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> </ul>	<ul style="list-style-type: none"> <li>• State land record portal</li> </ul>	Empaneled legal/valuation
<b>Underwriting</b>	<ul style="list-style-type: none"> <li>• Eligibility calculation and loan sanction</li> </ul>	<ul style="list-style-type: none"> <li>• Eligibility calculation and loan sanction</li> </ul>			
<b>Documentation and disbursal</b>	<ul style="list-style-type: none"> <li>• Loan agreement execution</li> <li>• Charge creation on the land in the Government's physical records</li> </ul>	<ul style="list-style-type: none"> <li>• Loan agreement e-Sign</li> <li>• Charge creation on the land through portal/ registries</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> </ul>	<ul style="list-style-type: none"> <li>• E-loan agreement</li> <li>• State land record portal</li> </ul>	
<b>Review/ renewal</b>	<ul style="list-style-type: none"> <li>• Visiting land revenue office to check the title status</li> <li>• Field visit to capture crop sown details</li> </ul>	<ul style="list-style-type: none"> <li>• Reverification of land ownership/charge through portal/ registries</li> <li>• Reverification of crop sown through registries</li> </ul>	<ul style="list-style-type: none"> <li>• Georeferenced land registry</li> <li>• Crop sown registry</li> </ul>	<ul style="list-style-type: none"> <li>• State land record portal</li> <li>• Crop monitoring through GIS</li> </ul>	

## Case study: Digital KCC

RBIH and Union Bank of India are running a pilot project on Digital KCC in the state of Tamil Nadu and Madhya Pradesh.<sup>22</sup> RBIH through its Public Tech Platform for Frictionless Credit (PTPFC) is enabling the bank to access land records directly from the state government portal through APIs and data points like satellite feeds, crop sown data and credit history from agri FinTechs and credit bureau.

To avail this loan, farmers can initiate the loan application through the bank's mobile application/ website or through ATMs. The loan process is completely paperless and has reduced the turnaround time from 2–3 weeks to a few hours. The bank is offering KCC loans up to INR 1.6 lakhs under this scheme.<sup>23</sup> The pilot project is currently running in limited areas and new areas will be added soon.

Figure 16: Digital KCC pilot



<sup>22</sup> <https://rbihub.in/fin-wrap-issue-01/>

<sup>23</sup> <https://www.unionbankofindia.co.in/english/kcc-fresh-sanction-stp-features1.aspx>

<sup>24</sup> <https://www.businesstoday.in/union-budget/story/budget-2024-crop-insurance-has-been-given-to-4-crore-farmers-under-the-pm-fasal-bima-yojana-415707-2024-02-01>

## Crop insurance assessment through technology

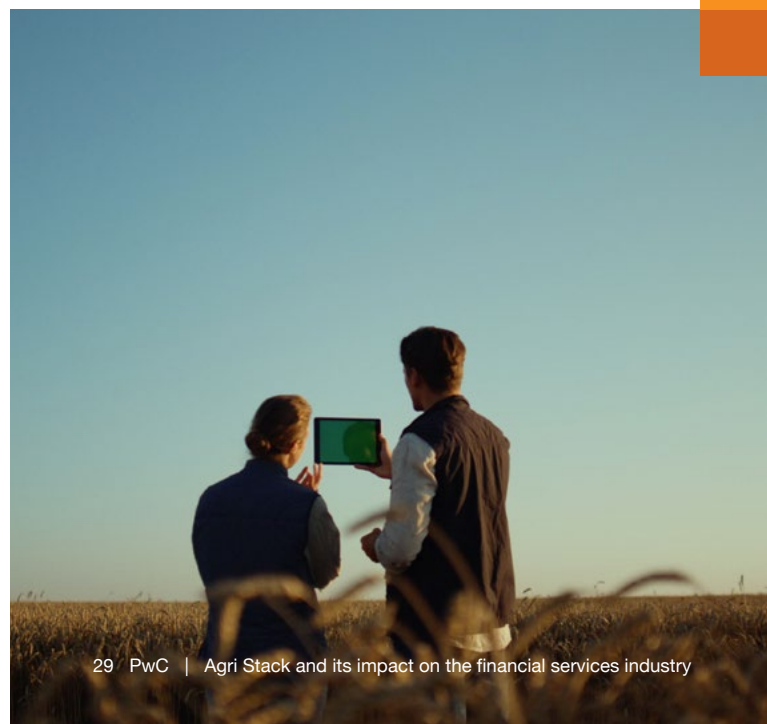
In India, crop insurance to farmers is being provided under the Government's flagship programme PMFBY. Almost 4 crore farmers have been assisted under this scheme till FY24.<sup>24</sup> Under this scheme, farmers can avail insurance for crops notified by the Government for selected geographies. The Government also notifies the insurance providers for all participating districts and states.

PMFBY insures farmers against crop loss due to drought, flood, cyclone, pests and diseases. The insurance coverage provided under the scheme is based on the average yield of the crops for previous years, which is determined by doing crop-cutting experiments (CCE). For any insurance unit (IU), i.e. the area impacted by widespread calamities for the current season resulting in a shortfall in yields, Government agencies perform CCEs to assess the extent of crop loss and insurance claim payouts to the farmer. Farmers located within the impacted IU will be eligible for the insurance claim calculated basis the average yield in the IU, irrespective of the extent of crop loss at the individual's farm.




However, with the availability of geofenced maps of villages through geo-reference maps registry, agencies will be able to perform crop loss assessments at the granular level (i.e. plot level). Mahalanobis National Crop Forecast Centre (MNCFC), along with many AgriTechs, is running pilots to assess yield and crop loss through satellite imagery and data bands. Datapoints obtained from the geofenced map of the farmer's field, crop sown data from the crop registry and crop loss assessment from satellite imagery will make crop insurance under PMFBY more efficient.

Agri Stack will improve the crop insurance scheme in the following ways:

- **Technology-based yield assessment:** Data banks of crop sown and geofenced registries will enable and further evolve AI/ML models to predict yield and assess crop loss.
- **Verification for individual claims:** Geofenced maps and satellite imagery will enable insurance providers to assess crop loss at the individual plot level.



**Figure 17: Crop insurance assessment with Agri Stack**

	As-is	To-be	Core registries	External agencies
 <b>Policy issuance</b>	Farmers can opt and register for crop insurance with KYC.	Farmers can opt and register for crop insurance with their unique farmer ID.	Farmer ID registry	
 <b>Sum assured calculation</b>	Sum assured calculation basis farmers' farm area from land records/documents, crop sown basis farmer's declaration and commodity prices/MSPs	Sum assured calculation basis farmers' farm area from geofenced maps, crop sown type from crop registry and commodity prices/MSPs	Georeferenced land registry Crop sown registry	Commodity prices/MSPs
 <b>Crop loss assessment</b>	Crop cutting experiments by Government, agencies or insurance companies to assess the crop loss at insured area level	In case of crop loss due to natural calamity: Crop loss assessment at the insured area or individual plot level through GIS	Georeferenced land registry Crop sown registry	Crop loss through GIS

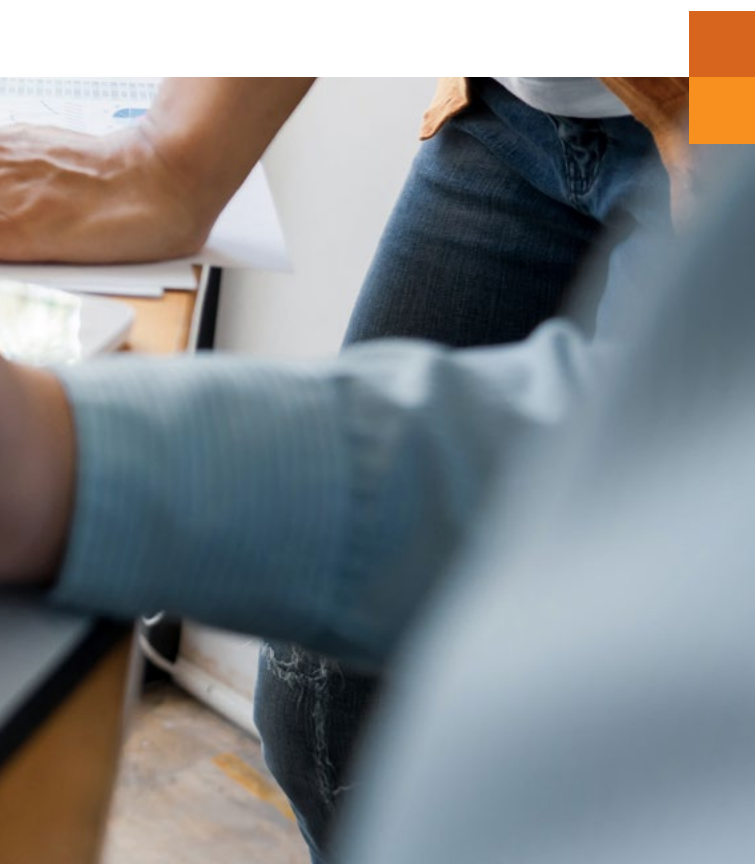




## 4.3 Risk management

The UFSI can significantly enhance risk management frameworks for agriculture loan and insurance portfolios by providing real-time and historical data and analytics related to agriculture. This will allow financial institutions to take data-driven approaches for decision making, portfolio monitoring and developing tailored products. The UFSI can help in risk management in the following ways:

- **Assessing creditworthiness:** The UFSI provides information on the farmer's identity, land ownership and cropping pattern. Consolidating this data with information like credit history and other relevant data will enable financial institutions to draw the complete profile of the farmer to assess the creditworthiness more accurately.
- **Data for predictive analytics:** By analysing the granular cropping pattern along with historical cropping yields, weather pattern, market prices and credit behaviour, financial institutions can forecast potential risks associated with specific region or crop types. Financial institutions can identify high- and low-risk geographical hotspots and adjust lending practices accordingly.
- **Early warning system:** The database from UFSI, along with satellite and meteorological data, can be used to develop early warning systems to alert financial institutions about potential risks emerging due to widespread catastrophe resulting in crop failure or price volatility. This will enable financial institutions to intervene timely and adjust business sourcing plans, collections strategy and lending policies.
- **Data-driven claims assessment:** Integration of satellite imagery, drone imagery and meteorological data with the core registries data will pave the way to help AI/ML models to evolve and mature in order to assess crop losses. This will help insurers to verify claims more efficiently – i.e. they will be able to cross-check the reported crop loss with the help of satellite imagery for individual farmers and ensure the legitimacy of the claim.



## 4.4 Governance

With the introduction of Agri Stack, unique farmer identity will soon become mandatory to avail any Government schemes or financial services. Farmer identity and associated data from other registries will enable Government agencies to adopt data-driven monitoring and governance approach in the following areas:

- **Reducing frauds:** More and accurate data from registries will ensure that subsidies and interest subventions are reaching out to genuine beneficiaries. Regulators can look into the digital farmer profiles and the same will be cross-checked against loan exposures or indebtedness of borrower.

Going forward, AgriTech organisations will come with AI-based data analytics and fraud detection models for effective reduction of frauds similar to Sanchar Saath, an AI-powered collaborative initiative of Department of Telecom (DoT) which aims to combat financial frauds. Sanchar Saathi, through its Digital Intelligence Platform (DIP) is engaging various stakeholders like financial institutions (FIs), Unique Identification Authority of India (UIDAI) and RBI to create a collaborative framework.

- **Regulatory monitoring:** Data from banks and Agri Stack's registries can be used by regulators to track the utilisation of funds and monitor the flow of credit to the correct targeted subsegments. This enables accurate collection and dissemination of critical information for effective regulatory monitoring of Agri Stack Government funds and credit to the farmers.

- **Policy making**

By leveraging trustful data on farmers, farmlands and the use of modern digital technologies, such as data analytics and AI, Agri Stack aims to make service delivery mechanisms more efficient and transparent in the interest of the farmer. Real-time and accurate data will enable Government institutions to design more efficient policies. Some of the areas are:

- near- to real-time data on land ownership and crop sown data to identify agricultural trends
- integrating credit data along with Agri Stack data to get a better understanding of unbanked and underbanked geographies
- enabling faster and paperless ecosystem for crop loans
- direct and transparent benefit transfer
- expansion of PMFBY basis crop sown trends.

- **Training and education programmes**

Investing in comprehensive education and training programmes enhances data governance literacy among users, stakeholders and consumers. Training initiatives on data governance principles, regulatory compliance requirements and emerging technologies empower stakeholders to adopt best practices in data management, cybersecurity and ethical data use.

# Key focus areas for financial institutions to be future-ready

## 5.1 Embrace the evolving AgriTech–FinTech ecosystem

Similar to how FinTechs and new-age startups integrated well with the existing DPIs like UPI, ONDC and OCEN, AgriTechs and FinTechs will continue to be pioneers in innovating tailored products and services for farmers and other stakeholders in the UFSI ecosystem. AgriTechs are well-positioned in the Indian market to complement the offerings of the UFSI by integrating service offerings like satellite imagery, credit patterns, commodity price trends, IoT devices and digital touchpoints with farmers. AgriTechs and FinTechs will further build upon personalised product offerings to cater to the entire agriculture value chain.

Financial institutions can engage with these AgriTechs in the following ways:

- **Partnership with AgriTechs/FinTechs:** Partner with AgriTechs and use their platform as a digital channel to offer financial products to the farmers, either by embedding in the journey or as a standalone offering.

**Example:** TransUnion CIBIL (with its credit data analytics) in partnership with SatSure (with its expertise in farm data) has introduced CIBIL Credit & Farm Report. This helps financial institutions get bureau information and Agri information of the applicant in one place. Agri information comprises the type of crop, crop intensity, land ownership, irrigation or rainfed etc. This enables lending institutions to address critical agricultural lending challenges and reduce loan disbursement time and appraisal costs.<sup>25</sup>

- **Joint venture and co-lending:** Co-develop platforms for digital payments, credit assessment and insurance distribution along with value-added services to cater to the needs of the farmers.

**Example:** Tractor Junction is an AgriTech that has set up a digital marketplace for farmers where they can purchase/finance/insure their tractors or farm equipment. This digital platform enables leading banks and insurance providers in India to provide financial services to farmers at the point of sale.

- **Become a customer:** AgriTechs has a lot to offer to financial institutions – digital platforms as a channel to reach out to farmers or alternate datapoints around farmers to facilitate decision making. Financial institutions can leverage these services to develop digital and data-driven products.

## 5.2 Embracing the state-of-the-art technologies to stay competitive

BFSIs need to embrace cutting-edge technologies to stay competitive and meet the changing needs of the consumers, especially within the agricultural sector.

- **Leveraging GIS and standardisation of data formats:** With a plethora of data formats including remote sensing, Agri Stack will enable financial institutions to do creditworthiness assessment of farmers, integration of data from various sources, customisation of financial products tailored for farmer needs, improved monitoring and overall streamlining of processes coupled with smoother data exchange and automation. To leverage the same, financial institutions should adopt standardised data formats and protocols which are compatible with Agri Stack. Moreover, they must invest in platforms which allow them to process and interpret geoinformatics data on agriculture and integrate the same in the product process.
- **Cloud native:** Financial institutions should consider moving to cloud infrastructures that can handle large volumes of data from Agri Stack. A cloud infrastructure will enable financial institutions to liaise well with the services of AgriTechs/FinTechs, thereby enhancing their ability to scale data analytics and AI/ML capabilities to effectively leverage data from Agri Stack.
- **Blockchain:** Blockchain's capacity to enable real-time processing, maintain immutable transaction records (smart contracts) help banks to introduce traceability, shorten transaction turnaround times whilst also reducing the involvement of middlemen and associated cost. Moreover, with the traceability of agri produce across the entire supply chain adds authenticity to the produce and fetches better prices in the market.

**Example:** Whrrl, an Agri FinTech, provides blockchain-based platform that connects farmers, warehouse and banks, enables farmer to secure instant loans against tokenised receipt of their stored crops.

<sup>25</sup> <https://www.transunioncibil.com/content/dam/transunion-cibil/business/collateral/sheet/agri-cir-asset-sheet-web.pdf>



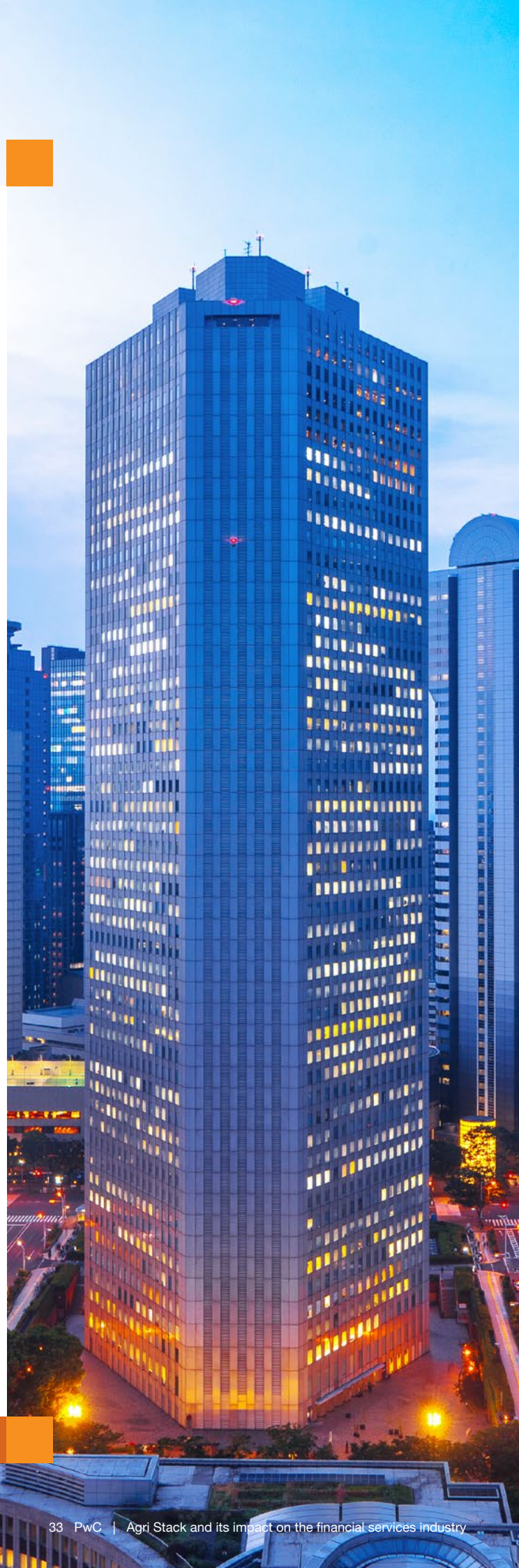
- **AI/ML capabilities:** Develop predictive models to assess creditworthiness, crop loss or yield estimation basis weather, remote sensing and cropping pattern data. Post Agri Stack implementation, loan and insurance underwriting will become highly data-driven, with AI and ML capabilities playing a central role.

**Example:** Government of India launched its nationwide crop insurance scheme - Pradhan Mantri Fasal Bima Yojana (PMFBY). A noteworthy feature of PMFBY is that it encourages the use of AI/ML to accelerate crop loss assessments. Thus, Government of India partnered with Cropin and many other AgriTechs, to leverage their AI/ML-powered digital solution called as Cropin Intelligence to create easily accessible digital records. These records ensure accurate settlement of claims to the farmers in less time.

## 5.3 Change is not a one-shot approach

With the advent of Agri Stack and the increasing penetration of AI and blockchain, Indian financial institutions have to make technology and data as the focal point of business culture for agri banking and insurance. Thus, this opens the pathway for another transformation and change management assumes importance. To bridge this chasm an effective communication, incentivisation and well-designed training programmes are needed to attain the mindset, capabilities and practices that will drive your organisation towards digital maturity.

- **Tech liaisons:** Financial institutions need to liaison with start-ups on AgriTech and FinTech and leverage their platforms as channels and process enhancers.
- **Continuous skill development and learning:** Investing in continuous skill development and learning programmes are crucial for BFSIs to be future-ready. Providing regular training sessions on emerging technologies, data analytics and regulatory changes ensures that employees stay updated with industry advancements.
- **Enhancing digital literacy:** Enhancing digital literacy among the leadership is vital for the successful adoption of new technologies in financial institutions. The leaders should support a 'challenger' mindset that nurtures curiosity and creativity amongst workforces. Incentivisation should be encouraged by the leadership to accelerate the adoption of digital tools and data in this ever-changing market.





# Conclusion

Agri Stack, India's DPI for agriculture is poised to set a global precedent by revolutionising Indian agriculture. The DPI will effectively address the pain points of Indian farmers such as inefficient farming practices, access to credit, Government subsidies, higher input and marketing costs, thus paving the way for higher agricultural production, food security and economic growth. The implementation of Agri Stack is expected to have a considerable transformative impact similar to – or even greater than – that of Aadhaar on financial inclusion and digital transactions.

The Government has devised an ambitious plan to facilitate the implementation of DPI in agriculture under the Agri Stack project. A digital crop survey will be done in 400 districts in FY2024, bringing over 6 crore farmers over the next three years into the formal farmer registry system.<sup>26</sup> This database will centralise all farmer information by using satellite, AI/ML, GPS and visual analytics data. It will serve as a one-stop digital ecosystem connecting all stakeholders in the agri value chain such as farmers, Government agencies, AgriTech companies, suppliers, distributors and financial institutions.

Beginning with the analysis of key issues faced by Indian agriculture such as credit flow and technology penetrations, we've discussed the emerging digital agriculture, Agri Stack and digital ecosystem and their impact on BFSI in terms of product and process innovation, data and analytics, training and cultural shift.

The adoption of Agri Stack by various Indian states is a work in progress and varies considerably across the country. MoA & FW is already collaborating with different entities to run pilot projects in selected districts in different states. Corporate conglomerates and tech providers like PepsiCo and Microsoft Corporation (India) Private Limited are also stepping up their AgriTech game. The outcome has been encouraging so far, with initiatives like ADT Baramati yielding promising results.

Agri Stack and allied Government initiatives will provide an enabling environment for greater collaboration among stakeholders in the agricultural supply chain. With increasing public-private partnerships for the adoption of cutting-edge technologies such as GIS, blockchain, AI, ML and IoT, the BFSI segment (including banks, non-banking financial entities and FinTechs) will be entering an exciting phase of new opportunities and growth in the near future.

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