



# **Seven Principles** For Mobilizing Open Data To Power India's Agri Stack

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- **The Agri Collaboratory [TAC]** is a non-compete, not-for-profit Agriculture Think and Do Tank, co-creating Digital Public Goods for Agriculture in Open Source, along with the Ecosystem and the government. Formed in 2021, it focusses on Open-source technologies, collaborating across Government, Private and Academic institutions. TAC is working on a national use case (**Project AgCx**: Automated Rural Finance Assessment) to establish a holistic, low cost, digital assessment for small Farmer households, to help access institutional finance. It plans on using real time, consented private and public data flows and an Agri Data Exchange working with Government of Telangana, Samunnati, , iSPIRT, Research & Innovation Circle of Hyderabad [RICH], IISc [IUDX Team] and several Agri Tech Start-ups.
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# Abstract

Digitalization is transforming existing agricultural business processes and services and enabling new means to deploy innovative services and products at scale. At the core of these services and innovations is open data. In India, Central and State Governments, academic, research institutions, and the private sector have done critical work in conceptualizing different approaches and aspects of an AgriStack to digitally transform agriculture. Recognizing the need to integrate these efforts and incorporate use cases, CGIAR Research Initiative on Digital Innovation, in partnership with The Agri Collaboratory (TAC), organized a consultation workshop in Delhi in November 2022. Participated by 70 stakeholders representing 54 organizations, the workshop enabled in-depth discussion on the design principles of thematic use cases and facilitated a broader debate on the specific building blocks needed. This document summarizes key principles discussed throughout the workshop.

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# I. Executive Summary





Digital innovation offers opportunities for the agricultural sector to transform into a sustainable and profitable activity by ensuring reduced input costs, high yields, improved quality, and high market prices. However, several challenges exist in ensuring that digital innovations are transformative, inclusive, and sustainable. These include i) lack of common digital taxonomy ii) fragmented and disconnected solutions with little interoperability iii) poor institutional capacities in embracing digital initiatives and iv) low trust due to absence of strong safeguard measures.

Against this background, Government of India aims to develop a “National agri-stack”, on the lines of India Stack, which will contribute towards increasing the income of farmers and improving efficiency of the sector. Union Finance Minister of India announced in budget 2022-23 that Digital Public Infrastructure (DPI) for agriculture in the country will be built as open-source using open standards and function as an interoperable public good. The adoption of Agri Stack based approach could result in almost INR 5-7+ lakh crore benefit for farmers by 2030.

Since the publication of concept paper on Agri Stack, there has been several discussions across the agriculture ecosystem to conceptualize Agri Stack. Recognizing the need to integrate these efforts and incorporate use cases, CGIAR Research Initiative on Digital Innovation, in partnership with The Agri Collaboratory (TAC), organized a consultation workshop in Delhi in November 2022.



The participants included representation from government, private enterprises, start-ups and academia etc. This report has been prepared based on the inputs from 70 stakeholders representing 54 organizations who participated in the workshop. Apart from contributions to the core theme of building a 360° view on building an Agri Stack, the workshop also included brainstorming to chart the ways that an agri-stack could support use case across the following four thematic areas (i) Credit and rural finance for the smallholder farmers and livestock keepers, (ii) Actionable and context specific advisory for farmers and livestock keepers, (iii) Market linkages and price forecasting to reduce food wastage, and (iv) Identifying common digital building blocks for agriculture that can be built in Open Source as a Digital Public Good. The detailed session-wise summary is available in the annexure. This report consolidates the inputs received from all the stakeholders, and outlines seven key principles which will be central for the success of Agri Stack. These 7 principles are also strongly aligned with the principles outlined in the consultation paper published by Government of India in June 2021. These include:

i) Common digital taxonomies: The development of digital taxonomies is of utmost importance to facilitate the interoperability of data, which will unlock the potential that exists in current data that are otherwise often siloed and dated. The various components of digital taxonomy include: master data, standardized specifications, directories and registries and data models and schemas.

ii) Establishing identity: Know Your Farmer (KYF) norms will help collect data from different entities within the regulatory boundaries and reduce the cost of acquisition, making service delivery quicker, more efficient, and cost-effective.

iii) Creation of marketplace for buyers and sellers: Technology should be leveraged to create a unique digital list of sellers and buyers along with a verification mechanism. Practices such as Unique Digital Identity, verification systems, third-party auditing and certification, and rating systems for all the players involved in the ecosystem should be promoted.

iv) Data sharing based on ORGANS principles: Development of robust data management and sharing policy that clearly states the do's and don'ts of data sharing would largely reduce the uncertainties and apprehensions in data sharing, both in public and private entities.

v) Flexible architecture: Agri Stack should support a multi-modal delivery system (e.g., mobile, radio, YouTube channels, WhatsApp), and stakeholders will apply the right technology based on the local context. Architecture should support deployment of solutions that give relevant, timely, and context-specific information, and due care must be taken to avoid information overload.

vi) Open source and federated platform: Agriculture being a state subject, it is crucial to adopt a federated architecture that allows for necessary checks and balances in the centralization and decentralization of data sharing. Also, creating trustworthy and usable open knowledge repositories through credible sources that are curated using standard protocols and compliance mechanisms, is crucial.

The mechanisms for data sharing should be easily comprehensible for anyone to share their knowledge and experiences and should leverage existing networks.

vii) Partnership driven use-case led implementation models: A collaborative model wherein different stakeholders come together to create a platform that can deliver value-added information to the farmer and simultaneously benefit all the stakeholders, is need of the hour.

Analysing the current work undertaken by Government of India in building Agri Stack, the next steps should focus on:

- **Development of common digital taxonomies** through creation of committee of experts from Academia, National and International thinktanks and Government institutions.
- **Reengineering e-NAM** along the lines of GeM to provide additional services such as unique digital Identity of buyers and sellers on the platform, verification systems, third-party auditing and certification, and rating systems. A committee may be constituted to prepare a roadmap for facilitating such a transformation.
- **Formulation of Data sharing and Management policy** considering aspects such as data localization, cross-border flow of data, simplified license agreements in easy-to-understand format besides protecting the confidentiality of data while leveraging the potential of data for the benefit of farmers. An expert committee may be constituted to study best practices and produce draft specific for agriculture sector while adhering to the proposed measures under Digital Personal Data Protection Bill 2022.
- **Creation of vibrant and active open community** which will oversee the development and implementation of Agriculture Data Exchange and operationalization of Open-source platform.





## II. Background

Agriculture continues to play a critical role in the Indian economy by providing employment to almost 46.5% of the country's labor force, as per Periodic Labour Force Survey in 2020-21. Agriculture also contributes to almost 18% of the Gross Value Added (GVA) of the economy<sup>1</sup>. India today is a world leader in the production of many commodities such as dairy, cereals, spices, fruits, vegetables, rice, wheat, cotton, and others, and it has consistently maintained a trade surplus in agricultural products over the years<sup>2</sup>. India's share in world trade of agriculture exports increased from 0.52% in 1990 to 1.71% in 2019, primarily driven by exports of rice, marine products, spices, meat, and sugar. The achievements of the Indian agriculture sector are impressive yet today it faces several challenges. The Situational Assessment Survey (SAS) report of 2021 finds that the average monthly income of an agricultural household stands at a low of 10,218 INR, and the average size of the holding of 0.512 Hectares; 86% of the farmers fall under the category of small and marginal with holdings size less than 2 Hectares<sup>3</sup>. Farm mechanization in India is also low at 40-45%.

Digital innovation offers opportunities for the agricultural sector to transform into a sustainable and profitable activity by ensuring reduced input costs, high yields, improved quality, and high market prices. Digital technologies, such as precision farming, artificial intelligence, drones, the Internet of Things, and remote sensing, are fundamentally reshaping the prevailing agricultural practices in India. A few of these shifts captured in the report of FAO include the shift from push-based agro-advisory services to pull-based, direct delivery to farmers bypassing local middlemen in farm inputs, the shift from common advisory services to customized, the emergence of multiple platforms for delivery, including those of e-Commerce, a shift in lending practices to farmers based on transactions than that based on collateral<sup>4</sup>.



1. <https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap07.pdf>  
2. <https://www.nabard.org/auth/writereaddata/tender/2709224946trends-and-performance-of-indias-agricultural-trade-in-the-midst-of-covid-19-pande>  
3. <https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap07.pdf>  
4. <https://www.fao.org/documents/card/en/c/cc0017en/>

Challenges existing in ensuring the digital innovations are also transformative, inclusive, and sustainable. These include:

- First, presence of a huge digital divide, especially in digital infrastructure and digital literacy across geography (rural vs. urban), age groups, and gender.
- Second, the lack of data standards impedes interoperability. As noted by the Committee on Doubling Farmers Income–Vol XI, 2017, juxtaposing datasets generated by 130 million farmers spread across 6.54 lakh villages and speaking 800 different languages in an interoperable manner is next to impossible.
- Third, lack of strong data governance mechanisms is leading to low trust in digital solutions.
- Fourth, lack of open datasets is another critical challenge faced by the sector, hampering innovation.
- Fifth, the low capacity of various institutional players involved in the agriculture ecosystem from both government and non-government is leading to slower and delayed adoption of digital innovations.
- Sixth, agriculture data are diverse, such as genomic, agronomic, social, nutrition, environment, geospatial, and food safety data, and is scattered across government, institutions, farmers, industry, and websites.
- Lastly, today, dozens of digital applications implemented by different agencies are generating diverse information, however, with little interoperability, and often duplicating effort and cost and adding little value to the overall ecosystem.

In light of these challenges, the government is pioneering the concept of Agri Stack, on the lines of India Stack<sup>5</sup>, which revolutionized the financial sector. The India Stack is uniquely built through public-private partnership as a digital public good (DPG) – a shared resource in which each stakeholder has an equal interest (See Box 1 for more details).

5. <https://tigerfeathers.substack.com/p/the-internet-country>

6. <https://www.oxfordonline.org/research/democratising-technology-for-the-next-six-billion>

An Open API framework, which is central to the design of India Stack, has encouraged competition, spurred innovation, and mobilized large-scale investments<sup>6</sup>. Three underpinnings that make open source successful include

**Trust:** Users can transparently view what the platform/code intends to do,

**Pre-competitive virtuous cycle:** Pre-competitive parts of the platform, which are necessary and foundational, is built and maintained by the community, saving time and money, and

**Quality:** The attraction of passion-driven people in building the platform leads to a better quality of end-product.

There are multiple pilots underway today basing the same principles of India Stack, such as GeM and Airline OTA, Open Credit Enablement Network (OCEN), Open Health Services Network (OHSN), Digital Sky, and LiveStack. In the domain of agriculture, ITC's Metamarket for Advanced Agriculture and Rural Services (MAARS) built as privately owned full stack adopts a platform-based approach to deliver value-added services to the farmers (See Box 2 for more details). The adoption of Agri Stack based approach could result in almost INR 5-7+ lakh crore benefit for farmers by 2030<sup>7</sup>. Union Finance Minister of India, in budget 2022-23, announced that Digital Public Infrastructure (DPI) for agriculture in the country will be built as open-source using open standards and function as an interoperable public good<sup>8</sup>.

Government efforts are unlikely to yield results without addressing some of the challenges discussed in this report. Further, emphasis must be on a set of core principles which will guide the policymakers in building an Agri Stack where interests of all the players in the agriculture ecosystem are protected. After analysing the current work undertaken by Government of India in building an Agri Stack, a workshop was conducted on 10th Nov 2022 bringing in sectoral experts from multiple organizations to suggest a way forward. The participants included representation from Government, Private enterprises, Start-ups and Academia etc. This report was prepared based on the inputs from 70 stakeholders representing 54 organizations who participated in the workshop. Apart from contributions to the core theme of building a 360° view on building an Agri Stack, the workshop also included brainstorming among four thematic areas:

7. [https://www.opendigitalecosystems.net/pdf/Agri-NODE-Concept-paper\\_New%20Cover\\_vF.pdf](https://www.opendigitalecosystems.net/pdf/Agri-NODE-Concept-paper_New%20Cover_vF.pdf)

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

- Credit and rural finance for the smallholder farmers and livestock keepers.
- Actionable and context specific advisory for farmers and livestock keepers, especially to prevent pest and disease.
- Market linkages and price forecasting to reduce food wastage
- Identifying common digital building blocks for agriculture that can be built in Open Source as a Digital Public Good.

The detailed session-wise summary is available in the annexure. This report consolidates the inputs received from all the stakeholders and outlines seven key principles which will be central for the success of Agri Stack. These 7 principles are also strongly aligned with principles outlined in the consultation paper published by Government of India in June 2021<sup>9</sup>. These include: (i) Common digital taxonomies, (ii) Establishing identity, (iii) Creation of marketplace for buyers and sellers, (iv) Data sharing based on ORGANS principles, (v) Flexible architecture, (vi) Open source and federated platform, and (vii) Partnership driven use-case led implementation models.

9. [https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper\\_mod01062021\\_1.pdf](https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper_mod01062021_1.pdf)



## India Stack

The three layers which are the backbone of India Stack include

- i) Identity layer: Use of Aadhaar (a 12-digit unique biometric-based identifier) for identification anywhere and anytime without the need for physical documentation,
- ii) Payment layer: Unified Payment Interface (UPI) allows people to transfer money digitally, securely, and instantly by simply creating a VPA (Virtual Payment Address), and
- iii) Data empowering layer: Allowing data to move freely and securely. Data Empowerment and Protection Architecture (DEPA) provided for a secure mode of transfer of data.

The benefits of India Stack include the following:

- Banking penetration increased from 17% to 81% in just seven years compared to 46 years taken in other parts of the world.
- Using the CoWIN application, India vaccinated more than a billion population twice in a single year.

India Stack's success can be attributed to the following two factors:

- i) Long-term orientation through sustained efforts over 10-15 years while avoiding bear hugs from the government, and
- ii) Convergence in thinking among policymakers, developers of digital public infrastructure, and market players.

## ITC-MAARS

- ITC-MAARS offers a combination of physical and digital interventions to deliver personalized advisories to the farmers. The source of information for developing solutions is from partner organizations, remote sources, and physically captured data from the fields. The bespoke advisories are further scientifically validated and personalized as per the farm profile before being shared with the farmer.
- ITC MAARS provides a platform that harmonizes the various services and helps their implementation at a larger scale. ITC intends to collaborate with agri-tech start-ups to offer a full complement of agricultural solutions that allows start-ups to plug in their service offerings and develop a comprehensive suite of bespoke solutions for farmers enabling various levels of personalization across different profiles of farming.

# 1. Digital taxonomies

Agri Stack should also embrace the same principles of India Stack for delivering digital services to farmers. This involves creating data taxonomies and developing principles of interoperability and data governance mechanisms. The development of digital taxonomies is of utmost importance to facilitate the interoperability of data which will unlock the potential that exists in current data, which is otherwise often siloed and dated.

Similar to the Electronic Health Record (EHR) standards notified by the Ministry of Health and Family Welfare, Government of India<sup>10</sup>, the creation of digital taxonomy is an important step in the building of Agri Stack. The various components of digital taxonomy include:

- **Master Data:** A standard classification of codes set by a certified authority at the national level should be made available as a core mechanism for bringing uniformity in data and creating a reliable source of authentic repository of static information and allowing seamless interoperability. This reduces the effort and time for developing a database separately either by the state government or private sector. For example, the international codes for the classification of crops developed by FAO. In agriculture, there is a need for the creation of multiple master databases such as crops, seeds, land-use classification, fertilizers, pesticides, mechanized implements, agricultural practices, sources of credit, conversion units, and crop diseases.
- **Standardized specifications:** Creation of standardized specifications for assessing physical quality, grading, and the presence of chemical residues. The standardization inspires trust and will fetch premium value for the farmer. For example, today, products certified to be produced from natural and organic farming practices fetch higher value in the market.
- **Directories and registries:** The standard information is organized in the Directories and Registries of legal and public entities. These include testing labs, quality control labs, agricultural clinics, business incubation centers, plant protection institutes, agriculture institutes, and extension and training centers. This information can be integrated with a master data repository.

10. <https://main.mohfw.gov.in/sites/default/files/17739294021483341357.pdf>

- **Data models and schemas:** On the lines of Health Level 7 (HL7) standards, which provide for the secure exchange of health information across two computer systems, there is a need for the development of such standards in the agriculture sector. Most of the farmers' records exist only in physical form and local language and lack standardization. Owing to the lack of universal standards of data exchange, APIs that are meant for data portability becomes a hurdle for integration. For example, one computer system provides an output of crop names in a local language and the other in English. For the system integration of two computer systems, one has to build a huge database mapping to connect these information datasets. National Data Analytics Platform (NDAP) is one platform of the Government of India where all datasets are standardized according to one common schema.

## National Data Analytics Platform (NDAP)

- According to NITI Aayog, the objective of NDAP is to – democratize access to public government data by making data accessible, interoperable, interactive, and available on a user-friendly platform. It hosts foundational datasets from various government agencies, presents them coherently, and provides tools for analytics and visualization.
- As of writing, NDAP hosts over 766 datasets covering 15 sectors and 46 ministries. In the domain of agriculture, hosted datasets include agriculture census, input survey, land-use statistics, livestock census, marine fisheries census, and scheme-level information.



## 2. Establishing identity

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Along the lines of India Stack, attention should be paid to building the identity layer. Much like to Know Your Customer (KYC) norms used in the banking industry, Know Your Farmer (KYF) norms in the farm sector will be highly beneficial. KYF norms will help collect data from different entities within the regulatory boundaries and reduce the cost of acquisition, making service delivery quicker, more efficient, and cost-effective.

- **Electronic Farm Record (EFR):** EFR maintains the data collected through KYF norms. This data may include demographic information of a farmer and topographical information of his farmland. Additional information on the availability of public facilities near a farmer can also be captured, which can be leveraged later to provide better service to farmers/ beneficiaries. When the EFR is created, due care also should be taken into account for the inclusion of tenant farmers and women farmers. These farmers can be recognized based on crop transactions.
- **Data Collection:** An optimal combination of techniques may be used while collecting the data, which may include – manual collection or digital collection using technology such as mobile phones, drones, or the Internet of Things. Technology capture should be designed in such a way that farmers can capture the details without any additional effort. For example, illiterate farmers may record the message in their local language along with photos of their crops. Also, the technology adopted should be context-specific, given the varying conditions on the ground, making certain technology options unviable for adoption. Different forms of technology, such as Edge Computing, Cloud Computing, and Fog Computing, may be relied upon depending on the on-ground circumstances.

### 3. Marketplace for buyers and sellers

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A reliable list of farm input sellers and produce buyers will address the trust issues. Technology should be leveraged to create a unique digital list of sellers and buyers along with a verification mechanism. Many such practices already exist today. For example, Government e-Market Place (GeM), a portal implemented by the Government of India, has a unique verification system for stakeholders on the GeM platform. It also provides a rating system that evaluates performance on a continuous basis. Third-party assessment of the quality of products by sellers also promotes trust in the products<sup>11</sup>. Agri Stack should promote practices such as Unique Digital Identity, verification systems, third-party auditing and certification, and rating systems for all the players involved in the ecosystem.

From the perspective of improving access to credit, technology firms may leverage the platform to use the farm-level information disaggregated by gender, such as transactions, crop data, plot characteristics, or farmers' behavioral parameters, captured to devise comprehensive credit ratings. Banks can make use of this credit rating system to provide loans at low costs but with reduced transaction costs. The focus should be on providing 'purpose neutral' loan products, at low cost and in shortest period of time and help lenders monitor credit usage to improve loan recovery rates. RBI Innovation Hub pilots in Tamil Nadu and Madhya Pradesh have demonstrated that it is possible to process a loan in 2 to 8 minutes, but it depends on land title information and crop data. The challenges in current loan disbursement system are outlined in Box 4.

11. [https://assets-bg.gem.gov.in/resources/pdf/GeM\\_handbook.pdf](https://assets-bg.gem.gov.in/resources/pdf/GeM_handbook.pdf)

## Challenges in the current loan disbursal system

- 70-90 million small, marginal, tenanted and women farmers do not get access to institutional credit largely due to lack of collateral.
- Current farming credit assessment (ref RBI 2019 report) is largely linked to operating farm area in the absence of any other authenticated data.
- Regulatory norms do not allow start-ups to provide quick loans for fear of getting audited.
- Kisan Credit Cards (KCC) has low penetration, high NPAs along with low margins that do not encourage start-ups to innovate and justify operations.
- Farm transaction data exists, yet it exists in silos between the Government and private sector, in non-standard formats, and is of questionable accuracy.

Consensus is also required on who can be lenders. Further, roles of Farmer Producer Organizations (FPOs) and Joint Liability Groups (JLGs) are important in generating digital cash flow data, which could then be leveraged in product design. Provenance technologies such as Blockchain can also help in securing finance through Carbon Credit mechanisms when farmers use emission-saving measures in the field.

## 4. Data sharing policy

The next important aspect is to design policies that will balance the concerns of protecting the confidentiality of data while leveraging the potential of data for the benefit of farmers. There are different types of data, such as public data, private data, and personal and non-personal data. While efforts should be taken to build open data systems, it is also crucial to comply with the law of the land, which states that privacy is a fundamental right. Therefore, there is a need for anonymizing the farmer data and creating Anonymized Electronic Farm Record (AEFR) for sharing across the system. The digital identity of the farmer should be reliable, private, and anonymous.

Along the lines of India Stack, there is a need for the development of a consent manager to reduce the uncertainty during data sharing and conform with the law of the land. Multiple consent managers are already operational in sectors such as Fintech and Health-tech, and similar consent managers can be emulated in the agriculture sector.

Development of robust data management and sharing policy that clearly states the do's and don'ts of data sharing would largely reduce uncertainties and apprehensions in data sharing, both in public and private entities. The policy should clearly specify the guidelines for data sharing, such as the type of data that can be shared, the type of beneficiaries that can access the data, and the grounds on which the data can be shared. The ORGANS principle should be the basis for data sharing by consent managers (See Box 5 for details on the principles and Figure 1 for details on how consent managers work)<sup>12</sup>.

Compared to the existing complicated design of end-user license agreements, which are filled with jargon and aim to minimize the liability of data fiduciaries, the agreements should be designed in simple easy to understand language and aim to protect the rights of data principals. For example, UK Government publishes associated document in simple easy to understand language. Data fiduciaries should be mandated to implement various safeguard measures such as encryption and anonymization methods to protect the integrity of personal data and also undertake frequent review of the security measures. Adequate

12. <https://www.niti.gov.in/sites/default/files/2020-09/DEPA-Book.pdf>



attention should also be given to data localization. Any transfer of data outside the jurisdiction of the country should be based on informed consent from data principal and assurance of similar data protection measures among shared countries.

## The ORGANS principles

- **Open standards:** Use of open standards in the design of consent architecture
- **Revocable:** Revocable by an individual at any time
- **Granular:** Provided that for each time the data is shared besides stipulating how long data can be accessed
- **Auditable:** Digital logs of consent
- **Notice:** Informs all concerned parties whenever data has been requested, sent, or denied
- **Secure:** Secure by design

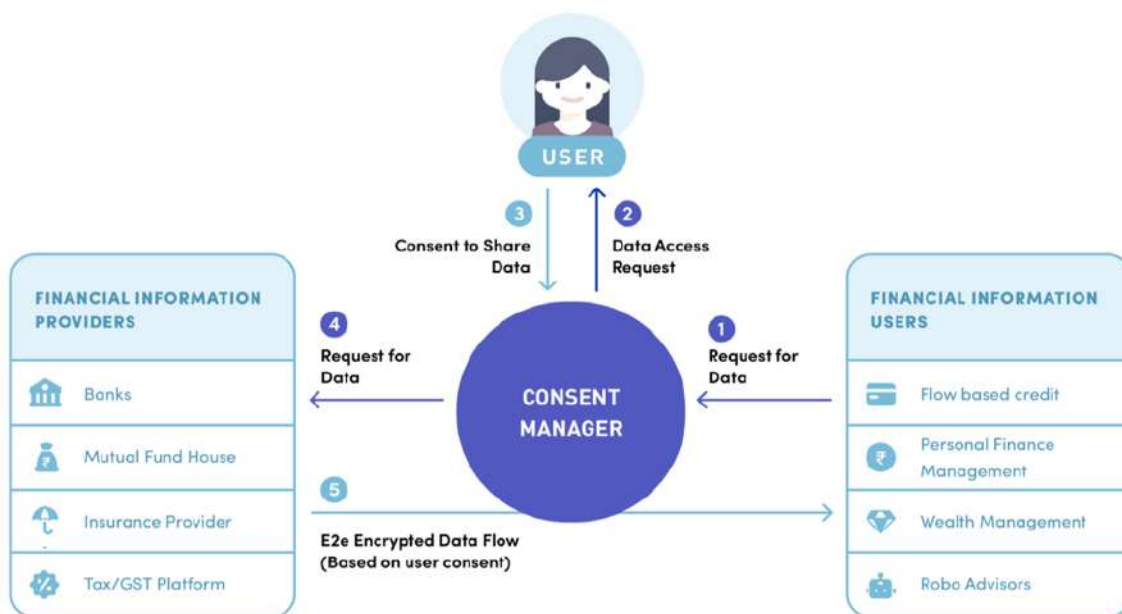


Figure 1 Consent Management Architecture (Source: Data Empowerment And Protection Architecture - Draft for Discussion report of NITI Aayog)

## 5. Flexible architecture

The data shared and integrated by various players in the Agri Stack should lead to provision of customized, timely, and demand-driven advisory to farmers. There is a need for a distinct shift in advisory-services approach i.e., from providing generalized advisory services, such as weather conditions and soil conditions to farm-specific services, which may include the type of crop to be cultivated, expected price realization, quality inputs availability, focus on reduced input, timely identification of pests, and support mechanisms (See Box 6 for challenges in the current system).

### Challenges in the current advisory services

- Lack of actionable advice and means to measure the usage of advice
- Low trust in the system
- No uniform package of practices
- Lack of platform for the exchange of data leading to data silos
- Lack of focus on climate resiliency

Agri Stack should support a multi-modal delivery system (e.g., mobile, radio, YouTube channels, WhatsApp), and stakeholders will apply the right technology based on local context. Mechanisms should be put in place to grade the quality of information exchanged through the platform through feedback rating or other assessment mechanisms– ‘data used for advisory should have quality control and standardization mechanism’. Farmers should be given relevant, timely, and context-specific information, and due care must be taken to avoid information overload. As a result, emphasis must be on providing value-added information.

## 6. Open-source Technology

To promote trust and enable faster scalability, the technology stack should be based on the principles of federated architecture and open source. Agriculture being a state subject, it is crucial to adopt a federated architecture that allows for necessary checks and balances in the centralization and decentralization of data sharing. The type of data (e.g., master data, directories, and registries) maintained as a common repository needs to be agreed up-on by central and state governments to avoid data duplication and protect the constitutional rights of the states. Creating trustworthy and usable knowledge repositories through credible sources that are curated using standard protocols and compliance mechanisms, is crucial. The mechanism for data sharing should be easily comprehensible for anyone to share their knowledge and experiences, and should leverage existing networks. For example, Dharam Kanta networks that exist today can be digitalized to support value creation.

Technology can support maintaining the credibility of the data. Blockchain can facilitate tracking the provenance of products, carry detailed attributes of product production and management processes across the agri-value chain, and ensure authenticity. The reliability of data also enhances the trust in the peer-to-peer sharing of knowledge and best practices.

The openness of the platform also encourages multiple players to offer value-added products on top of the core layer. As emphasized by Sumer Johal of the Linux Foundation, pre-competitive parts built by a community encourage a virtuous cycle of saving time and money. Given the prevalence of small and marginal farmers in the Indian agriculture ecosystem whose willingness to pay is low due to low income, aggregation of farmer requirements at the FPO level becomes desired to implement any technological solution.

The availability of standardized digital contracts wherein the interests of farmers are at the centre stage will be critical. Like ITC-MAARS, a platform-based approach wherein multiple firms can offer complementary value-added services leading to the overall improvement in farmers' welfare.

This includes different players such as firms offering uberization solutions for transport needs, warehouse firms offering storage needs, audit firms offering certification services, lenders offering credit services, or firms offering credit rating services.

The open-source nature of the platform also means that due care must be taken to ensure that the core data is validated and clean. Efforts should be made to create a vibrant and active community that will strengthen core as well as common tenets of a platform, which may range from digital taxonomies, consent management architecture, and principles of data sharing to infrastructure availability data.

## 7. Partnership-driven use-case led approach

A collaborative model wherein different stakeholders come together to create a platform that can deliver value-added information to farmers and at the same time benefit all the stakeholders, is needed. A data-sharing mechanism should be designed keeping in mind the principle of incentivizing data generators. There needs to be a focus on aspects of data which do not create a conflict of interest, both from the collectors and users of data.

Ex-secretary J. Satyanarayana, MeitY (IAS retired) remarked that setting up an Agri Stack requires a multi-pronged 4P approach – Policies, Platforms, Protocols, and Partnerships. Telangana State is one of the frontrunners in using the 4P approach in setting up a state-level Agri Stack system (See Box 7 for more details).

### Use of the 4P Approach in Telangana State

- **Policy:** The Agriculture Data Management Policy 2022 includes consent-based processing and sharing of data, technology and operational safeguards for data security and privacy, and grievance redressal.
- **Platform:** Agriculture Data Exchange (ADEx) is based on principles of open standards, open protocols, and open APIs to provide for efficient discovery of agriculture data and convert 1-to-1 data transfer to N-to-N data exchange, thereby creating a force multiplier effect.
- **Protocols:** Agri-JSON-based approach enables standard-compliant sharing of data.
- **Partnerships:** Multiple collaborations across various stakeholders such as Government of India, Academia, Agriculture research bodies, and dynamic start-ups community.

## 8. Conclusion

Digitalization will help Indian agriculture to be globally competitive and self-sustainable. Presently, there are multiple digitalization initiatives launched by Government of India include: electronic National Agriculture Market (eNAM), Farmer Portal, mKISAN, Digitization of soil health card, Forecasting Agriculture Output Using Space Agro-meteorology and Land based observations (FASAL), Kisan Call Centre and Crop Simulation model<sup>13</sup>. Similarly, state governments have launched several such initiatives. However, many of these initiatives are yet to reach scale or desired service standards owing to issues of: i) Lack of common digital taxonomy ii) Fragmented and disconnected solutions with little interoperability iii) Poor institutional capacities in embracing digital initiatives and iv) Low trust due to absence of strong safeguard measures. Against this background, Government of India aims to develop a “National agri-stack”, on the lines of India Stack, which will contribute towards increasing the income of farmers and improve efficiency of the sector<sup>14</sup>.

Government of India has already undertaken several preparatory steps in development of Agri Stack. Firstly, the publication of concept paper on India Digital Ecosystem for agriculture which emphasizes on aspects such as interoperability, data governance, data quality, data standards, security and privacy, open innovation and federated architecture<sup>15</sup>. Secondly, creation of federated farmer database at national level integrating data on farmers, farmlands, crop insurance, soil health card, farm machinery and kisan credit cards. Once completed, this will be world’s largest and diverse database for farmers. Thirdly, initiating engagements with leading Agritech players for building Proof of Concepts (POCs) which will be scaled across the nation if found beneficial to the farmers. Fourthly, development of eNAM as Platform of Platforms (PoP) to facilitate several services such as Trading, Warehousing, Transportation, Quality Assaying etc<sup>16</sup>. However, these efforts are unlikely to yield results without addressing some of the challenges discussed in this report. Further, there needs to be emphasis on core principles which will guide the policymakers in building Agri Stack where interests of all the players in the agriculture ecosystem are protected.

13. <https://agricoop.nic.in/Documents/annual-report-2021-22.pdf>

14. [https://agricoop.nic.in/Documents/inviting%20proposals%20from%20leading%20IT%20companies%20\(2\).pdf](https://agricoop.nic.in/Documents/inviting%20proposals%20from%20leading%20IT%20companies%20(2).pdf)

15. [https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper\\_mod01062021\\_1.pdf](https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper_mod01062021_1.pdf)

16. <https://agricoop.nic.in/Documents/annual-report-2021-22.pdf>



Analysing the current work undertaken by Government of India in building Agri Stack, the next steps should focus on:

- Development of common digital taxonomies through creation of committee of experts from Academia, National and International thinktanks and Government institutions. Given the diversity of agriculture sector data, a knowledge institution in each domain may be identified to create digital taxonomy and collaborate with others for building consensus on taxonomy.
- e-NAM visualized as platform of platforms providing value-added services such as Trading, Warehousing, Transportation, Quality Assaying etc., can be reengineered along the lines of GeM to provide additional services such as Unique Digital Identity of buyers and sellers on the platform, verification systems, third-party auditing and certification, and rating systems. A committee may be constituted to prepare a roadmap for facilitating such a transformation.
- Formulation of Data sharing and Management policy considering aspects such as data localization, cross-border flow of data, simplified license agreements in easy-to-understand format besides protecting the confidentiality of data while leveraging the potential of data for the benefit of farmers. An expert committee may be constituted to study best practices and produce draft specific for agriculture sector while adhering to the proposed measures under Digital Personal Data Protection Bill 2022<sup>17</sup>
- Creation of vibrant and active open community, which will oversee the development and implementation of Agriculture Data Exchange and operationalization of Open-source platform. A community, on the lines of iSPIRIT which played a stellar role in development and operationalization of India Stack, needs to be set-up and nurtured.

17. <https://www.meity.gov.in/writereaddata/files/The%20Digital%20Personal%20Data%20Protection%20Bill%20%202022.pdf>

### III. ANNEXURE

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# 1. Plenary Sessions

## i) iSPIRT: India stack Learnings

(Shri Sharad Sharma, Co-Founder, iSPIRT Foundation)

India stack, a set of building blocks, help streamline the flow of people, money and information.

- Physical identity to Digital identity – Firstly, it was implemented to shift the identification of people from physical to digital.
- Physical Money to Digital money - Secondly, focus shifted to flow of money in the form of UPI.
- Digital Consent - Finally, it shifted the focus to flow of personal data/information, and it has taken the form of DEPA – Data Empowerment and Protection Architecture, one of those manifestations is in the financial data space and the whole network is called Account Aggregator (AA) network. It is regulated by all financial services regulators coming together.

**Delivery of Inclusion:** Shift from physical KYC to digital eKYC helped us to bring Jan Dhan to life as at that time eKYC was costing Rs 2 Vs Rs 60 for opening physical accounts. So, the streamlining of identity helped in bringing Jan Dhan to life. In 7 years, we went from 17 % penetration in the population for bank accounts, to 81 %. The Bank of International settlements has estimated that it has taken most countries an average of 46 years to achieve this.

**Reform of Social Services:** Popular examples include, Direct Benefit Transfer (DBT), CoWIN enabled India to vaccinate more than a billion people twice in the same year. This was possible because we used the system to manage the flow of people through Aadhar, flow of information through digi -locker and flow of money through the digital payment system

**Creation of New Ecosystems a.k.a Open Networks:** India Stack can help us create new ecosystems and these ecosystems can be founded on the principles of open networks – they do not have monopolies – and yet they are effective instruments to solve problems of people. Not just the governments, even private sector is coming forward to solve people problems using these networks.

The approach of creating an open network system is based on open network principles. A case in point being the Open Credit Enablement Network (OCEN), which is to bring cash flow lending at scale to small business in India and the design model for that is Rajini and a conceptual model.



**Conceptual Model for an Open Network: Overcomes Myths and addresses 5 elements:**

### Myths of Opensource:

- Open protocols lead to Decentralization
- Small sellers want open networks

### Design elements of Open Network Conceptual Model:

- No rouge intermediaries
- Match Supply – Demand
- Manage Market Power
- Dispute Resolution
- Network Statements



**Multiple open network pilots underway. Eg:** GeM and Airline OTA, Open Credit Enablement Network (OCEN), Open Health Services Network (OHSN), Digital Sky, LiveStack (WeSPIRIT) and ONDC (semi-iSPIRIT), SEBI Bonds (tbd).

### **What does it take to get network pilots right?**

- **Long View:** Sustained efforts over 10-15 years while avoiding Government bear hug. People see only success of the pilots. Eg: UPI pilot saw 3 valleys-of-death in its launch.
- **Playground Orchestration:** Playground building focusses on hard problems and creates value for society and entrepreneurs. Efforts are required in bringing Delhi (Policy), Bengaluru (Digital Public Infrastructure), and Mumbai (Market Players) together. These three things need to come together to unleash many experiments – of which only few will succeed.
- **Quad Outcomes:** The market ecosystem has multiple layers of which Technology Service Providers (TSP's) form the fulcrum around which market change happens.

We have to build new Public Tech - Digital Public Infrastructure (DPI) which comes in two forms – platforms (GPS, Aadhar), and protocols (SMTP, UPI, DEPA, OCEN). Public tech should not be confused with government tech.

- **Type 1:** Laws and Rules – Policy Makers
- **Type 2:** Market Based – Policy Makers + Micro Economists
- **Type 3:** With Tech Spine - Policy Makers + Micro Economists + Platform Technologists
- **Type 4:** Data Rich - Policy Makers + Micro Economists + Platform Technologists + Data Scientists.

## ii) Linux

(Shri Sumer Johal, Executive Director, Linux Foundation)

Open source has been a strong force in driving digital revolution that has created trillions of dollars in the public as well as private sectors. It can be stated that pretty much everything in this world runs on opensource.

Its underpinnings are in the basics of how computer stacks work and there are mainly 3 reasons why opensource is so successful:

- **Trust:** Having the source to look at and open allows users of the source and users of that code to have trust and adoption across ecosystems that these technologies are adopted on. Especially in India where agriculture is a state subject, for the central government to play a vital role in setting a roadmap that could engender trust, is possible if it is built on opensource, which ensures transparency.
- **Pre-competitive Virtuous Cycle Enabling:** People assume that opensource is a bunch of people creating free stuff that nobody pays for. However, there is a community that comes together and builds a precompetitive piece of stack whether it is cloud computing, ML, AI or sensors etc., the precompetitive parts are the kind of mundane but necessary pieces that are not competitive, not proprietary, but everybody needs them. It does not make sense for multiple people to make the same common thing but rather build it once, maintain it, and it is not proprietary - which saves a lot of time and money. And in fact because it is more robust, much more secure as patches are being made all in one place. That is a big reason why private companies are able to build product over opensource and create trillions of dollars of value.
- **Quality and Security:** When community comes together, because of social and peer dynamics amongst technical people, quality of software built in opensource over time has a benefit of passion driven people not just money driven conversations. Passion does help in building a better quality product. Because you build it once and maintain it for many, and those many contribute to bug fixes and patches, ideas, the resulting software becomes a software of much higher quality and as an example of that would be Linux – the operating system – is now powering the whole world from nuclear submarines to departments of defence



- **Relevance of open-source for agriculture:** In the world of Agriculture there are some massive issues around water, pest management, nutrient response, land management, soil management and livelihoods that are in the greater interest of public good but government alone cannot accomplish much in this regard, and it needs to include communities to solve these.

In such a scenario open-source paradigm becomes a perfect vehicle for convening digital public goods. In Agriculture, digital public goods are necessary because there is a huge necessity because agriculture needs so much of information – soil data, weather data, data on markets, information of how to market the agricultural produce.

Our food ecosystem is completely broken because a third of the people are hungry while a third of total food produced is wasted. To fix this, digital system has a tremendous potential to revolutionize the agriculture similar to what the green revolution did in the 60's and 70's. Hence open-source is an important element to bring into the agriculture stack.

### iii) Nurture.Farm

(Shri Dhruv Sawhney, Chief Operating Officer, Nurture.Farm)

One of the first areas that is important to focus on is to talk about where the current systems exist, where the current AgTech ecosystem is evolving to.

- We are at first stage of that journey where there is a lot of digitization that is happening of eCommerce opportunities, both at the input stage as well as the output stage.
- It is typically what happens in any new ecosystem and industry that evolves, these are some of the low hanging fruits, and we are starting to see some great solutions, whether it is bio solution, farm mechanization, certain advisory leveraging data sciences and remote sensing opportunities that are now prevalent and have been around for the last few years.

**Second stage of evolution:** The first stage has paved the way for platforms that can deliver end-to-end service, end-to-end opportunities and convenience for farmers. Nurture.farm is one such platform and multiple such platforms will emerge in years to come.

- Platforms need to emerge to start creating language, the right taxonomy, the right interoperability between AgTech opportunities to create and deliver meaningful solutions at scale.
- In times to come when everyone need not to or have the need to create acquisition models and spend on them.
- The role that the platforms have to play in the second stage is to create some sort of an Agri Stack which will form the basis of the next set of solutions which will accelerate value creation and convenience to farmers. These dialogues are essential to form the dictionary that is required.

**Third stage of evolution:** In other industries such as B2C and FMCG one can see the success of e-commerce and digitization, a lot of growth has happened because large platforms have emerged and created the space for innovations to happen based on that.

Nurture.farm started to build the foundational work and this can lead to creating a more unified interoperable language that will lead to third stage of evolution that is eminent in the next 18-24 months.

- If we talk about what is the data stack that is required, in terms of identifying farmers, in terms of creating their creditworthiness, in terms of unlocking the next evolution of financial solutions. All of these cannot happen in isolation by everyone trying to rediscover the wheel.
- The need is to focus on critical things such as privacy – what is public vs what is private? How do you protect the data for farmers and the consumers in this instance? How do you create the right language which people can contribute to and also leverage.
- We have seen the benefits that UPI has unlocked at scale, and there is a need to come together and see how do we create trust within our systems, within our platforms, that can actually lean on each other and not compete with each other.

## iv) ITC - Metamarket for Advanced Agriculture & Rural Services (MAARS)

(Shri Rahul Gouraha, VP, New Business, ITC MAARS, ITC Ltd)

ITC MAARS is a mobile enabled digital platform to empower farmers with access to modern tools, right quality of inputs at right prices, besides market and financial linkages.

- **Customised Services:** Developed on the foundation of e-Choupal, the new platform offers a combination of physical and digital interventions to deliver personalized advisories to farmers. The source of information for developing solutions are from partner organizations, remote sources, and physically captured data (from fields). The bespoke advisories are further scientifically validated and personalized as per the farm profile before being shared with farmers, and building a monetization model in the MAARS platform.
- **Demand Driven value Chain:** Brining the market value chain directly to farmers, is one of the key challenges that is being addressed through MAARS platform. Currently, the value chain between farmers and the processor is a multi-nodal chain and the demand and supply are disconnected. The aim of the MAARS system is to unlock the market value chain and evolve into a demand driven value-chain.
- **Farmer Producer Organisations (FPOs) and engagement centres:** are a key node to connect the farmers to various services. FPO's has a huge potential to serve as enablers in improving the farm livelihood through direct linkage with the individual farmers. Harnessing the power of FPOs can also provide significant competitive advantage to the Food Processing sector. It is crucial to increase the intellectual capacities of the FPO's.

- **Scaling Platform:** The MAARS platform enables large scale penetration of the services offered by agri-tech companies that are unable to scale.
  - It provides a platform that harmonizes the various services and help them implement at a larger scale.
  - It intends to collaborate with agritech start-ups to offer a full complement of agricultural solutions that allows start-ups to plug-in their service offerings and develop a comprehensive suite of bespoke solutions to farmers enabling various levels of personalization across different profiles of farming.

## v) World Bank

(Shri Parmesh Shah, Global Lead-Rural Livelihoods & Agriculture)

- **Digitization of FPO's:** Globally, less than 3 % of the good FPO's have been digitized. There is a need to digitize FPO's and digitally enable them to be a service provider with an enterprise solution.
- **Prerequisites:** Digitization, data platform, innovation ecosystem, knowledge and learning and institutional reach are the key prerequisites.
- **Inclusion:** For small holding farmers, this must be made a public good for effective implementation.



## 2. Break-out Sessions

### i) Break-out Session 1: Credit and Rural finance for smallholder farmers and livestock keepers.

#### List of stakeholders represented in the break-out session



#### Outcomes of the breakout session

The first break-out session was held with sector experts from various financial institutions ranging from banks to start-ups working on enabling agri-credit to farmers. During the deliberations, it was suggested that a comprehensive credit score be developed along with revamping the existing loan products while applying a gender lens and keeping the end users engaged in the product development process.

While there is an account aggregation ecosystem emerging, there has to be a mechanism to ensure visibility in the cashflows. There needs to be a universal composite credit score encompassing behavioural as well as asset parameters, also bringing in the data quality and integrity standards.

Finally, the rural finance and credit ecosystem has to leverage the carbon credit mechanism.

#### Problem Statement

To simplify rural loan assessment for small and medium farmer households, facilitate purpose-neutral loan products, at low cost and in shortest period, and help lenders monitor credit usage to improve loan recovery rates.

## Context of this session

To explore avenues to extend purpose-neutral loans based on credit history, backed by insurance, cash flow lending based on need of rural households by disrupting existing process by leveraging technology, embed all regulatory and KCC requirements in the system and democratize farmer outreach and minimize touch points.

### Current Reality (to debate)

#### Farmer's Perspective

- 70% of the Loan available to large profitable farmers
- Medium/Small/Marginal (MSM) farmers - 84%
- 50% of MSM and 30% of Agri household avail non-institutional credit
- Multiple cash requirements for household
- Limited cash flow throughout the year
- Limited access of credit to MSM farmers from recognised institutions
- Evergreen loans - same set of farmers
- Limited fresh credit inflow
- Loan waiver through public welfare schemes- termed as defaulter
- Timelines and availability of loan

#### Lender's Perspective

- Credit assessment, monitoring & recovery is difficult
- Definition of Farmer in his environment is varied: type of farmers, his crop, irrigated of rain-fed, soil type, climatic condition, storage and market access
  - Poor or incomplete paperwork
  - Poor Visibility of loan usage
  - Poor Visibility of loan usage
  - Poor Visibility of the farmers cash flows
  - Lack of Trust in repayment
  - Lack of standardisation of data across states

## Why is this problem important to the lender? How do they benefit out of it?

While it is established that 84% of farmers are micro / small / medium (MSM), it is also necessary to identify and define tenant farmers. Mostly the banks definition for a farmer is based on the one who owns the land and not the cultivator. While it is also difficult for tenants to get lease deeds done but data are available on – which farmer is getting how much urea – it can be treated as a proof of cultivation. Similarly, milk receipts in a bank account can establish proof of ownership of cattle. Currently, data on how much paddy is being procured, data on quantity of urea applied by a farmer – through which proof of cultivation can be established – etc. exist in silos and different formats and with questionable accuracy.

Even if tools are developed to assess credit worthiness of farmers, whether or not a farmer is actually farming – bank will always say it is a high-risk loan. For Agri loans, system comprising of disbursing and collecting partners is needed. OCEN networks can solve the problem.

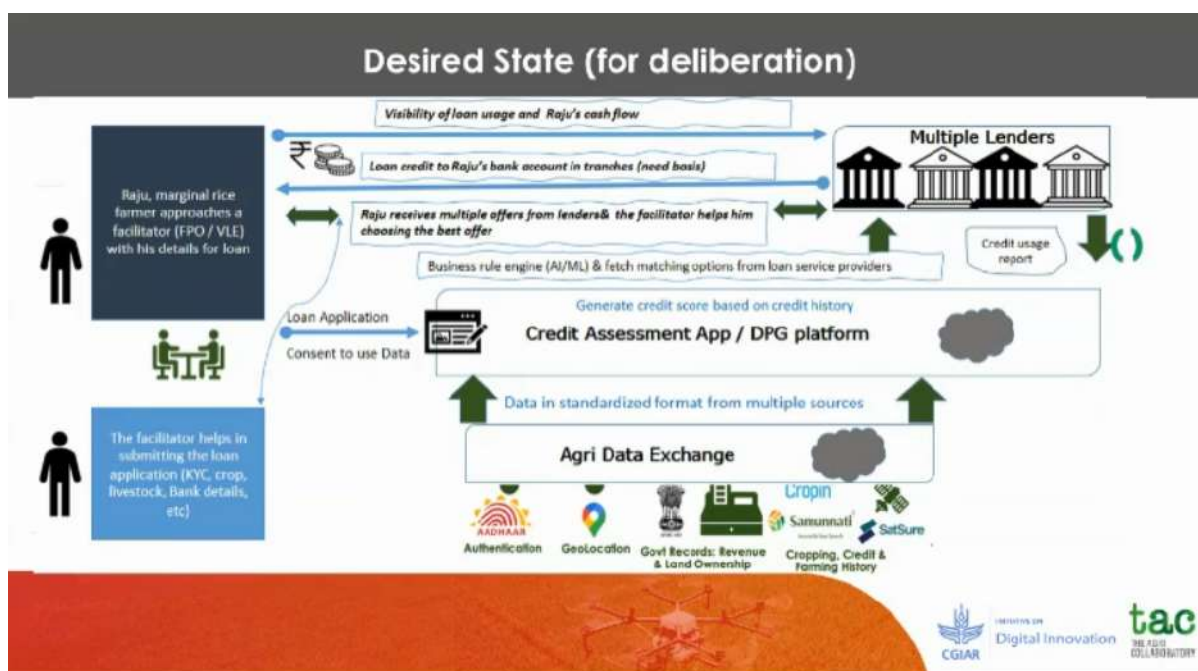
Term loans will not be possible in this space so different types of lending products need to be promoted over a lending registry. Each loan will become a multiparty loan. Account aggregator model was suggested over IUVX model. There is need for rethinking on types of loan products tied to specific situation based on the farmer and context. Ultimately markets will decide which system will work.

### **How can we make the process to Access to Credit be simple – light touch?**

One of the key things hindering the Agri loan across India is the automation of renewals of Agri loans. In today's time an auto loan can be availed in 10 -30 minutes, but an Agri loan takes about 15 days. Reserve Bank Innovation Hub – Pilots in Tamil Nadu and Madhya Pradesh showed that it is possible to process loans in 2 – 8 minutes. Three frictional points were identified: the time it takes to process a loan, the paperwork, and the additional expenses for a farmer to avail the loan (transportation and loss of wages). However, the land record data and crop data were sufficient information for the bank to process the loan.

A banker also does not know how digital finance space works as much as platform players do. For bankers it is high cost for a small ticket loan. For such products to work, the prospective system has to be accurate and has to be of a certain scale. One principal and customer approach might not work but a platform player coming in to share the transaction costs, makes it viable for lending institutions to lend. KCC has wafer thin margins that do not allow start-ups to innovate and justify operations.

Even banks hold data stacks, which are in different stages of evolution making it difficult for start-ups to intervene and innovate in the KCC space that is also highly regulated. The regulatory norms do not allow start-ups to provide quick loans for the fear of getting audited. A framework that is regulatorily acceptable by RBI and the banks needs to be developed.



## What does a Lender expect as data while sanctioning loan, the levers that help decide?

Establish that a certain activity is happening on a parcel of land – whether a farmer is an owner or a cultivator. If we have a record of who is supplying how much paddy at the mandi, it can be established as a proof of cultivation. If we are able to capture all the cash flows of a farmer over a period of time, and understand it, we can establish a credit score.

The data available in the current form is not coherent for a bank to make any decision. Also, there are multiple players providing digital financial solutions and improvising on their individual models. From a lenders point of view, do we have the right tools to assess in place or are we still adopting traditional tools?

Government of Telangana is working on building an Agri exchange platform. Based on each use case, the government will ask which data sets they will need and make it available through API's. Experiment with similar model is being done in the MSME space called OCEN. As farmers need assistance in applying for loans, a borrowing agent would be required for applying for a loan. It can be an FPO or over time it can become a digital agent. The beauty of a digital system is that it can be sent to many lenders at once. Even GeM uses the same protocol.

## The operating Data Levers

Operating Levers	Data Elements	Sources
<b>Farmers</b>		
Personal history	Aadhaar, bank account, mobile no.	Loan farm - verified by UIDAI, mobile company & bank database
Crop and other insurance	Ban details- ITax details, electricity, mobile payments, labour income, microfinance, lending details, KCC, Fasal Bima, PM Kisan	Loan farm - verified by insurance company
Credit, payment discipline & income patterns		Database of banks, HiMark, Cibil, Equifax, Itax, NRLM, KCC, Mobile company database, electricity department
Other sources of income	Dairy, Fisheries, Poultry, Livestock, Kirana shop, Tailoring, Trading	
Standard of living	Mechanic	
<b>Farm</b>		
Ownership boundary of land details, along with area and boundary of land	White goods owned, House structure, Vehicle ownership	Loan farm- verified/populated from database of Fisheries, animal husbandry department
	White goods owned, House structure, Own or leased, digital land coordinates, land papers with boundary	Loan farm, traffic department database
		Revenue department, agri department, copy of land document - with loan form, if formal lease- letter of owner,

## Project AgCx: Mulkanoor and Jammikunta Experiments

TAC has created a small credit assessment report by collecting information from varied vendors and created one simple view and checking veracity of data from Government of Telangana data and collecting information from the field. That info is being pushed to Agri dept of Government of Telangana to collate information from opensource to data, which is being checked by Agri dept. This is being done to get a sense on the quality of government data once gets access to it. The standard assessment report is being created after collecting information from different stakeholders and comparing it with government data to identify the gaps.

TAC is creating a questionnaire to identify- what is the farmer's problem. TAC is also creating a model to check if cash flow lending is possible by testing it out with groups of farmers based on the information TAC has collected for 3,000 farmers.

## Recommendations

A high-level summary of the elements that has been discussed in detail are:

### Policy

1. Develop trust & collaboration for data sharing.
2. Product innovation for lendable approach
3. Include carbon credits while assessing

### Infrastructure

1. Government backed data repository for all datapoints related to Agri ecosystem.

### Data

1. Leverage existing infrastructure like account aggregator and OCEN framework for agri-lending
2. Interoperability of the data
3. Define land records & boundaries as DPG and allow community driven corrections to it.

### Others

1. Digitizing the FPO's
2. Create an incentive mechanism for all the stakeholders in the Agri ecosystem
3. Wallet or card-based system that enables visibility on the usage of loans



## ii) Break-out Session 2: Actionable and context specific advisory for farmers and livestock keepers including to prevent pest and diseases

### List of stakeholders represented in the break-out session



### Outcomes of the break-out session

The break-out session was held with sector experts and large and small market players in the private sector to address the challenge of developing actionable and context specific advisories for small/ medium farmers to improve yield, and income, and early warning on pest and diseases of plants, and animals to reduce losses.

### Revised Problem Statement

Provide optimal package of practice advisory for farmers to improve their yield, and income, and further provide advisory/tools for early detection and cure of pest and diseases of plants, and animals to reduce losses. Prevent misuse/overuse of inputs (pesticides/ fertilizers/herbicide), and provide advisory on the quality.

## Key strategic/ operating levers to deliver the objectives

Owing to lack of a standard metric to define small or a medium scale farmer it was recommended to keep the advisory services open for all instead of limiting to just small/ medium scale farmers.

While reducing the losses is one key objective, the focus should also be towards reducing the misuse or overuse of crop production products or fertilizers/ pesticides/ herbicides or any other kind of inputs provided to farmers. It is essential to ensure that the advisory translated and communicated to farmers, provides the right message, and is backed by scientific evidence.

The thought process behind identifying the key strategic levers or the key operating levers for the advisory package of practice or detection and cure of pest or disease in crops/ animals, is meted out through few of the key inputs listed below:

- **Trust from farmers:** Trust from the farmer is a key aspect.
- **Advisory should be demand driven:** Advisory provided to farmers should be leaning towards the demand. Instead of a top-down/ push approach, one needs to understand the requirement landscape and tailor the advisory to suit the requirement of the end-user.
- **Timely Accurate/ Customized/ Localized:** Advisory should be personalized/ localized and provided in a timely fashion.
- **Crop centric and Farmer centric advisory:** Avoid one advisory for all. Customization is required for different user groups. Sample user groups are literate vs illiterate, tech savvy vs non-tech savvy farmers, and gender-based information packages. Advisory should be context specific and personalized.
- **Advisory in various areas** such as protected cultivation.
- **Customise the advisory based on the available infrastructure** in the ecosystem. Content of advisory (crop specific, livestock specific, fisheries, disease, pests etc.) and the mode of advisory (mobile, radio, YouTube channels, WhatsApp).

- **Grade the advisory:** Owing to lack of common denominator to assess the data quality, it is recommended to grade the advisory where possible.
- **Data quality:** Clean the map data and create digital soil maps.
- **Data sets:** How they should interact with each other? How different stakeholders share datasets?
- **Formats/ Interoperability:** Lack of platform/ processes for various stakeholders to share datasets without compromising credibility, data quality.
- **Information Overload:** Advisory fatigue due to too much information from too many sources.

### **Develop data elements required/needed to support the levers**

Some of the key areas for delivering advisories were deliberated by the committee:

- Levers and data elements required for generating advisory to the farmer.
- Which crop to grow? When to harvest? Where to sell?
- Pest and disease identification.
- Early warning system for pest and diseases based on external factors like weather, new insects, and pathogens.

**Use Case** - Advisory on establishment of crop (When/What/ How). The data types, data elements and sources required for the above advisory are as follows:

Data Types	Data Elements	Sources
- Types of soil and its condition	[Soil type, soil nutrients, soil moisture]	Ministry of Agriculture, Gol
- Water availability	[rainfed, irrigated]	State Department of Agriculture
- Pests and diseases in the past	[Past pest/ disease/ infection and weeds]	Research Institution
- Weather conditions	[Historical, present, predictive]	State Agriculture Universities
- Market availability of inputs	[Price, demand and supply, how many farmers have taken up and how many can be accommodated]	Large Private Sector – ITC, Kuza, Satsure, Plantix
- Farm mechanization	[Seeds, fertilizers, vaccination, pesticide]	Metrology Department
- Available subsidy	[Data on availability of equipment]	
- Human resources	[List of subsidies per crop]	
	[Availability of labour]	

## Create tools for early detection of pests and diseases

- Early detection for pest and disease and provision of information on quality and use of inputs and services
- Demand driven information – Provide tailor-made information to suit the end-suer. Advisory should be time- and context- specific and personalised – e.g., crop and livestock specific
- Different types of information targeting various user groups. Create information packages for literacy based, gender based (use of radio based on the end users)
- Providing personalised advisory to the last mile farmer in the local language for all crop growers/ livestock producers
  - Personalised advisory: There are various aspects to it. One example would be customised content
  - Quality of the advisory: Who is responsible for the quality of advisory. In-case it does not work who is liable
  - Data dissemination: How is the data communicated to the last mile farmer? Government creates content in collaboration with the research institutes. Private sector can help in the dissemination. Processes and institutional framework for data access and quality check of the data

## **Current barriers to implement a uniform package of practices (that are released by State Agriculture Universities regularly)**

- Despite abundant availability of advisory services, the reasons for lack of information about the advisory services or the differences in package of practice across regions can be attributed to:
  - Lack of actionable advice, and the means to measure the usage of advice
  - Package usage is dependent on trust, resources, situation of the crop and livestock producers
  - Accessibility of information at the institution level and the usability at the last mile level
- It was observed that there is no uniform package of practice at present. Though common operating guidelines are provided by the universities, the conditions differ region wise based on factors such as soil health status, etc. Land is divided based on eco system, agro-climatic conditions, site specific nutrients. Advisory should evolve to suit the requirement and personalised accordingly.

## **Collaboration between public and private sectors to make advisories more informative and validated. What enablement options can government provide?**

To make advisories more informative and validated:

- Create systems for sharing/exchange of data (public, private and research institutes) such as Agri data exchange
- Focus on aspects of data, which do not create conflict of interest, both from the collectors and users of data. To create the standardization and uniformity
  - Identify the datasets
  - Identify the format for data sharing
  - Incentivization
- Identifying the process for the PPP

## Safeguards against challenges faced by farmers, such as loss of crop, due to an advisory without affecting the scale up of digital tech solutions

Safeguarding farmers from advisories that do not work:

- Provide advisory backed by scientific evidence. Usage of the advisory is, however, the individual's/ farmer's responsibility
- Provide additional risk mitigation strategy like government schemes
- Standardized and quality check on input data - Input data used for advisory should have quality control and standardization mechanism

## Recommendations

A high-level summary of the new elements have been discussed in detail here:

### Policy

1. Incentive systems for data exchange for private players – Data Exchange

### Infrastructure

1. Government body for easy access of Open data Infrastructure  
Government Standards
2. Community of practice of different data element

### Data

1. Allocate resources for high quality data production and sharing
2. Interoperability of data. Streamline the format
3. Resources for data production & safeguarding data
4. Find existing sources and make them available after validation

### Others

1. Consider climate resilient agriculture practices



### iii) Break-out Session 3: Market linkages and price forecasting to reduce food wastage

#### List of stakeholders represented in the break-out session



#### Outcomes of the break-out session

The break-out session was held with sector experts and large and small market players in the private sector to evaluate and recommend solutions for small/medium farmers and livestock keepers to facilitate easy and seamless access to both input and output markets along with access to value chain players, warehousing and logistical support for the output, with the aim of reducing input costs, improving price discovery for output and minimizing post-harvest losses.

#### Policy

- Capturing farmer level data should be made mandatory as a single source of truth (to be captured at the time the events in the farm occur)
- Service providers (Digital) in each village via SLA
- Standardized specs for physical quality, grades, chemical residues

## Data

- **Land Geo-location:** One of key challenges highlighted during the discussions is the change in the mobile numbers of farmers. To address this challenge, it is proposed to link the mobile number of farmers with the land, crop wise.
- **Aadhar number of the farmer and the other players:** Create a reliable source of sellers and buyers to address the trust issues
- **Unique identity of all players on one platform:** Create a unique identity, a digital profile of all the suppliers and buyers on the platform to validate the credentials, to eliminate the duplicates/ multiple identities
- **Data on specs:** physical quality, grades, chemical residues, composition, validation of all buyers, variety-wide crop production, prices from different markets – Linking data to the farmer, to the farm, to creating the standardization specs. Digital entity of the crop, the people and farmland everything together.
- **Authenticity of data:** The authenticity of the data supported by this policy
- **Crop assessment:** Crop variety identification using NDVI data that allows crop monitoring
- **Mechanization data to be collected on the operation:** The idea is to ensure that data captured manually is also verified across the entire supply chain, like block chain. It is important to get the credibility.
- At the farmland when the plant is photographed, there are high level algorithms that process the data to tell what stage the plant is in and able to perhaps recognise if something is wrong. The farmers can submit the on-ground data and can seek relevant advisories that would address the farmer's concerns.

## Infrastructure

- **Storage with Geo location:** Provision of necessary infrastructure required for geo location-based data storage to reduce the wastage
- **Dharam Kanta Network:** These networks act as a single source of truth
- **Digital connectivity in remote areas (fixed/mobile device):** Consideration of most viable technical solution to a particular area
- Taking advantage of the range of computing resources and data storage assets such as Fog Computing, Edge computing, Cloud Computing
- Human resources to capture data at the source
- Shared facilities for the segregation of farm produce

## Other

- Risks to be assessed and mitigation plans: Deep dive into the risks involved in creating the single source of truth, sharing of data, or creating the digital road
- Standard contracts digital: Digitizing the contracts to keep them seamless and to maintain them as the single source of truth
- Third party quality certifiers: Exporting goods will require 20 different certifications. Creating a reliable third party network will reduce the cost and seamlessly enable the supply chain
- Aggregation of farmers/ FPOs produce at the village level: This will be required at the intermediate level. In democratising the platform this will be required at the first or the second step

## Recommendations

A high-level summary of the elements that has been discussed in detail here:

### Policy

1. Data capture – Farmer level made mandatory (to be captured at the time of event) (Single source of truth)
2. Service provider (digital) in each village via SLA
3. Standardised specs for physical quality, grades, chemical residues

### Infrastructure

1. Storage with geolocations
2. Dharam Kanta network
3. Digital connectivity in remote areas (fixed/ mobile devices)
4. Fog computing, Edge computing, Cloud computing
5. Human resources to capture data at the source
6. Shared facilities for the segregation of produce

### Data

1. Land geolocation
2. Aadhaar number of farmers and other players
3. Unique identity of all players on one platform
4. Data on specs –physical quality, grades, chemical residues, composition, validation of all buyers, variety wide crop production, prices from different markets
5. Authenticity of data
6. Crop Assessment, Variety identification (NDVI)
7. Dharam Kanta info,
8. Mechanization data to be collected on the operation

### Others

1. Consider climate resilient agriculture practices
2. Risk to be assessed and mitigation plans
3. Standard contracts digital
4. Third party quality certifiers
5. Aggregation of farmers/ FPO's produce at the village level

#### iv) Break-out Session 4: Open Data Interoperability, Digital Public Infrastructure, Digital Public Goods, and farmer centric, open Agri Stack will accelerate sectoral transformation

##### List of stakeholders represented in the break-out session



##### Outcomes of the break-out session

The break-out session was held with sector experts from government, think tanks and large and small market players in the private sector to explore and recommend – the building blocks for forming a foundational layer to accelerate sectoral transformation, evaluate possible options to address the current challenges in data interoperability (standardization, calibration etc.), data privacy and regulation, data sharing, farmers' trust, governance of the data, and increasing adoption of the farmer centric solutions being developed in agricultural innovation ecosystem that foster data driven and evidence based policymaking.

- **Electronic farm records (EFR):** Aims to collect the demographic information of the farmer and the topographical information of the farm land. Additional information may include availability of public facilities and other details which then can be leveraged to provide better service to the farmer/beneficiary. Much close to KYC norms used in banking industry, Know Your Farmer (KYF) norms in the farm sector will be highly beneficial. Such KYF

norms will help collect data by different entities within the regulatory boundaries, and reduce cost of acquisition making service delivery quicker, efficient and cost effective.

- **Anonymized Electronic farm records (AEFR):** Through the interactive session with the agri-corporates, public, research bodies, and funding agencies, the need for anonymizing the farmer's data is clearly important to safeguard their privacy concerns. Further, there are many ways for anonymizing and aggregating the data.
- **Consent Manager:** Consent is considered as a key attribute in building the Digital Public Infrastructure in the agri sector. There are different types of agricultural data such as open data, public data, private data, personal and non-personal data, and it becomes crucial to comply with the law of the land that states– privacy is a fundamental right and ensure safeguards for not transgressing anyone's right to privacy. Keeping consent purely as a gatekeeping mechanism, consent manager helps reduce uncertainty during data sharing with conformity of the compliances statutory and regulatory compliances, and is hence considered a fundamental building block. Multiple consent managers are already operational in other sectors such as Fintech and Health-tech and similar consent managers can be emulated in the agriculture sector.
- **Interoperability protocols:** Unlocking the potential of exhaustive data that are currently in silos, interoperability makes the data highly valuable and builds on adding value as it progresses through the system. To overcome the roadblocks that currently prevent utilizing the full potential of data, it is important to establish certain protocols for interoperability, which becomes crucial in developing the digital infrastructure in the agriculture sector. Some of the large business transformation projects such as UPI have been successful due to implementation of strong protocols, on which the large-scale transactional information could be processed.
- **Master Data:** While data is being collected, the creation of master data becomes very crucial which makes data interoperable across multiple systems. A standard classification of codes set by a certified authority at

national level should be made available as a core mechanism for bringing uniformity in data and creating a reliable source of authentic repository of static information and allows seamless interoperability. This reduces the effort and time for re-inventing the wheel for developing a database by the national or state government or private sector. For example, the international codes for classification of crops developed by FAO, National Industrial Classification (NIC) codes, National Classification of Occupations (NCO) etc.

- **Directories and Registries:** Another key building block for Digital Public Infrastructure in the agri sector is maintaining the standard information of Directories and Registries of legal and public entities. This information can be integrated with the master data repository.
- **Data models/ Schemas:** Institutionalizing and homogenizing the Data Models/ Schemas helps in accelerated development of various solutions in the form of technology applications for expedited service delivery.
- **Data management and Sharing policy:** Creating a robust data management policy clearly stating the do's and don'ts of data sharing would largely reduce the uncertainties and apprehensions in data sharing, both in public and private entities. The policy should clearly specify the guidelines for data sharing such as type of data that can be shared, beneficiaries that can access the data, grounds on which the data can be shared, conditions for data sharing, etc.
- **Technology governance for enforcing policies:** The effective technology governance ensures that the systems and data are consistent and trustworthy and do not get misused. Technology governance becomes increasingly critical as organizations (State/ Central, Public/ Private) face data privacy regulations and rely on enterprise reporting and analytics applications to help optimize operations.



- **Federated architecture:** Agriculture is a state subject, hence it is crucial to adopt a federated architecture which allows for necessary checks and balances in centralization and decentralization of data sharing. The type of data (as discussed in the previous points, e.g., master data, directories, and registries, etc.) that may be maintained as a common repository need to be also defined as part of the data management policy thereby avoiding data duplication and protecting the constitutional rights of the states.
- **Open-source Knowledge:** Farmers need to be equipped with the latest knowledge to make informed decisions. Currently vast knowledge is available but is either disjointed or isolated. Creating trustworthy and usable knowledge repositories through credible sources that are curated using standard protocols and compliance mechanisms, is crucial. The mechanisms for data sharing should be easily comprehensible for anyone to share their knowledge and experiences. The open-source knowledge repository development may be driven by the universities/ educational institutions and supplemented by the individual contribution including the farmers. The reliability of data also enhances the trust in the peer-to-peer sharing of knowledge and best practices.
- **Agri Sandbox:** In order to foster cutting edge innovation that may not be well-served under existing regulatory conditions, Sandbox set-up provides an opportunity for start-ups/ agri-corporates to test innovations before going for commercial launch. While many sand box programs have already been established in the financial and health sectors, Agri sandbox would bring a unique attempt at building a test bed for the agri-based companies for their innovations in products or services so that validation can be done not only for regulatory compliances but also for the domain, agri sector practices, technology (standardization, openness, security, privacy, etc.).

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