INITIATIVE ON
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POLICY BRIEF

Seven Principles for Mobilizing Open Data to Power India's Agri-Stack

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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, a lot of work has been done by the Central and State Governments, academic, research institutions, and the private sector in conceptualizing different approaches and aspects of an "Agri-Stack" 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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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, there exist several challenges 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 the absence of strong safeguard measures.

Against this background, the Government of India launched an initiative that aims to develop a "National agri-stack," on the lines of India Stack, which will contribute towards increasing the income of farmers and improving the efficiency of the sector. The adoption of Agri-Stack-based approaches is expected to result in almost INR 5-7 lakh crore worth of benefits for farmers by 2030.

Since the publication of the concept paper on Agri-Stack, there have been several discussions across the agriculture ecosystem to conceptualize it. 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. This report, prepared after consultation with 70 stakeholders from 54 organizations, outlines seven key principles which will be central to the success of Agri-Stack. These seven principles, which also strongly align with principles outlined in the consultation paper published by the Government of India in June 2021, include:

i) Common digital taxonomies: Digital taxonomies can facilitate the interoperability of data.

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 a unique database of buyers and sellers: 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: The 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: Architecture should support the deployment of solutions that give relevant, timely, and context-specific information.

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.

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

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[1]. 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[2]. 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. Despite such impressive achievements, the Indian agriculture sector today 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[3]. 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-

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[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-pandemic.pdf
[3] https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap07.pdf

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 based on collateral[4].

There exist several challenges in ensuring that digital innovations are transformative, inclusive, and sustainable. 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, the lack of strong data governance mechanisms is leading to low trust in digital solutions. Fourth, the 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 is diverse, namely genomic, agronomy, social, nutrition, environment, geospatial, and food safety data, and is scattered across government, institutions, farmers, industry, and websites. Today, dozens of digital applications implemented by different agencies generate diverse information, however, with little interoperability and often duplicating effort and cost and adding little value to the overall ecosystem.

[4] https://www.fao.org/documents/card/en/c/cc0017en/

In light of these challenges, the government is pioneering the concept of Agri-Stack, on the lines of India Stack[5], which has 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).

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

i) Trust: Users can transparently view what the platform/code intends to do,
ii) 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;
iii) 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) 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 approaches could result in almost INR 5-7 lakh crore[7] worth of benefits for farmers by 2030[8].

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[5] https://tigerfeathers.substack.com/p/the-internet-country
[6] https://www.orfonline.org/research/democratising-technology-for-the-next-six-billion
[7] Approximately 61.3 – 85.8 billion USD (using the currency rate as of 17th January 2023).
[8] https://www.opendigitalecosystems.net/pdf/Agri-NODE-Concept-paper_New%20Cover_vF.pdf

Box 1. 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.

Box 2. 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 them implement them at a larger scale. ITC intends to collaborate with agri-tech startups to offer a full complement of agricultural solutions that allows startups to plug in their service offerings and develop a comprehensive suite of bespoke solutions for the 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[9], the creation of digital taxonomy

[9] https://main.mohfw.gov.in/sites/default/files/17739294021483341357.pdf

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 re-inventing the wheel for developing a database by the state government or private sector. For example, the international codes for the classification of crops developed by FAO. In the case of 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.
- 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. They also lack standardization. Due 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.

Box 3. 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

Along the lines of India Stack, attention should be paid to building the identity layer. Much close 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)** maintains the data collected through KYF norms. This data may include demographic information of the farmer and the topographical information of the farmland. Additional information on the availability of public facilities near the farmer can also be captured, which can be leveraged later to provide better service to the farmer/ beneficiary. 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**: From the perspective of market linkage, it is always important to capture the data at the farm level along with location-wise details. An optimal combination of techniques may be employed 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 conditions on the ground vary, 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. Database of Buyers and Sellers

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[10]. Agri-stack should promote such practices 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, 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. 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 record data and crop data. The challenges in the current loan disbursal system are outlined in Box 4.

[10] https://assets-bg.gem.gov.in/resources/pdf/GeM_handbook.pdf

Box 4. Challenges in the current loan disbursal system

- The current regulatory norms do not allow startups to provide quick loans for fear of getting audited.
- Kisan Credit Cards (KCC) has wafer-thin margins that do not allow startups to innovate and justify operations. The overall KCC space is also highly regulated.
- Farm transaction data exists, yet it exists in silos and in different formats and is of questionable accuracy.

There is also a need for a consensus on who can be lenders. Further, the role 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 employ 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, which helps 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 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 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)[11].

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 language and aim to protect the rights of data principals. For example, UK Government publishes an associated document in easy-to-understand language. Data fiduciaries should be mandated to implement various safeguard measures such as encryption and deidentification methods to protect the integrity of personal data and also undertake frequent reviews of the security measures. Adequate attention should also be given to data localization.

[11] https://www.niti.gov.in/sites/default/files/2020-09/DEPA-Book.pdf

Any transfer of data outside the jurisdiction of the country should be based on informed consent from the data principal and assure of similar data protection measures among the shared countries.

Box 5. The ORGANS principles

- **O**pen standards: Use of open standards in the design of consent architecture
- **R**evocable: Revocable by an individual at any time
- **G**ranular: Provided for each time the data is shared besides stipulating how long data can be accessed
- **A**uditable: Digital logs of consent
- **N**otice: Informs all concerned parties whenever data has been requested, sent, or denied
- **S**ecure: Secure by design

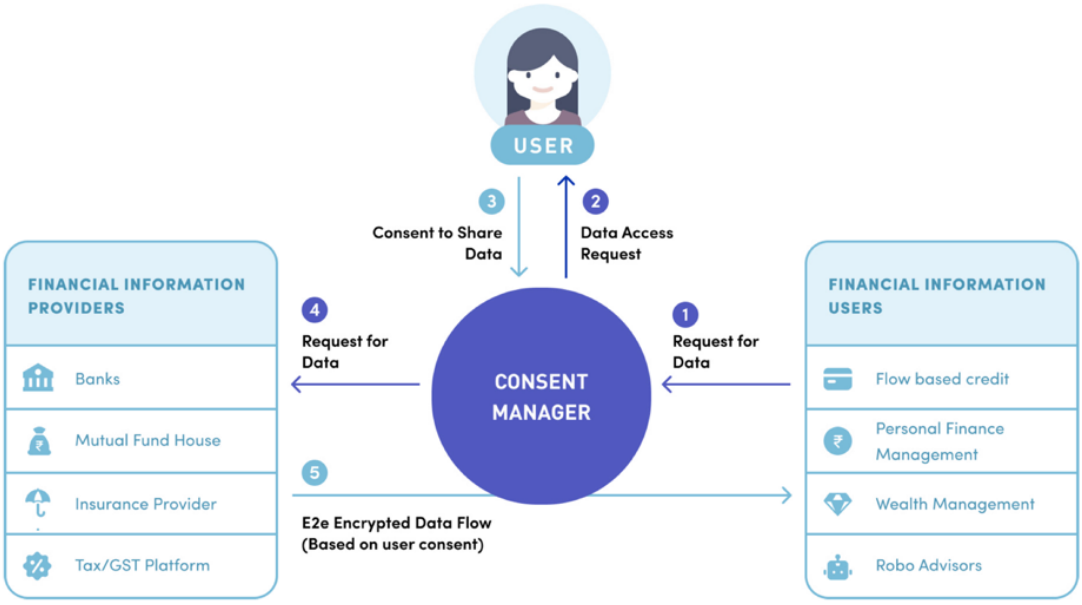

Figure 1 Consent Management Architecture (Source: Data Empowerment And Protection Architecture - Draft for Discussion report of NITI Aayog)

5. Flexible Architecture

The data shared and integrated by various players in the agri-stack should lead to the provision of customized, timely, and demand-driven advisory to the farmer. There is a need for a distinct shift in approach 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, availability of quality inputs, including the focus on reduced input, timely identification of pests, and support mechanisms (See Box 6 for challenges in the current system).

Box 6. 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 the 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 Nature

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 also conformed upon so as 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 mechanisms 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 center stage will be critical. Similar to ITC-MAARS, a platform-based approach wherein multiple firms can offer complementary value-added services lead to the overall improvement in farmer 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. There should be efforts towards

the creation of a vibrant and active community that will strengthen the core and common tenets of the platform, which may range from digital taxonomies, consent management architecture, and principles of data sharing to infrastructure availability data.

7. Partnership-driven Approach

A collaborative model wherein different stakeholders come together to create a platform that can deliver value-added information to the farmer and, at the same time, benefit all the stakeholders is needed. A data-sharing mechanism should be designed by keeping in mind the principle of incentivizing data generators. There needs to be a focus on aspects of data which does 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).

Box 7. 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 Govt of India, Academia, Agriculture research bodies, and dynamic startup community.

Conclusion

Digitalization will help Indian agriculture to be globally competitive and self-sustainable. Today, there are multiple digitalization initiatives launched by the Government of India. Some of these include the electronic National Agriculture Market (eNAM), Farmer Portal, mKISAN, the digitization of Soil Health Cards, Forecasting Agriculture output using Space Agro-meteorology and Land-based observations (FASAL), Kisan Call Centre, and crop simulation model[12]. Similarly, state governments have launched several such initiatives. However, many of these

[12] https://agricoop.nic.in/Documents/annual-report-2021-22.pdf

initiatives are yet to reach scale or desired service standards due 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, the 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 the efficiency of the sector[13].

The government of India has already undertaken several preparatory steps in the development of agri-stack. First, the publication of a concept paper on India's Digital Ecosystem for agriculture, which emphasizes aspects such as interoperability, data governance, data quality, data standards, security and privacy, open innovation, and federated architecture[14]. Second, the creation of a federated farmer database at the national level integrating data on farmers, farmlands, crop insurance, Soil Health Cards, farm machinery, and Kisan Credit Cards. This will be the world's largest and most diverse database for farmers once completed. The third is the engagement with leading Agritech players for building Proof of Concepts, which will be scaled across the nation if found beneficial to the farmers. Fourth is the development of eNAM as a Platform of Platforms (PoP) which facilitates several services such as trading, warehousing, transportation, and quality assaying[15]. However, these efforts are unlikely to yield results without addressing some of the challenges discussed in this report. Further, there needs to be an emphasis on core principles that will guide the policymakers in building the Agri-

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

[14] https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper_mod01062021_1.pdf

[15] https://agricoop.nic.in/Documents/annual-report-2021-22.pdf

Stack, where the interests of all the players in the agriculture ecosystem are protected.

This report, prepared after consultation with 70 stakeholders from 54 organizations, outlines seven key principles which will be central to the success of Agri-Stack. These seven principles are also strongly aligned with principles outlined in the consultation paper published by the Government of India in June 2021[16]. These include i) common digital taxonomies, ii) establishing identity, iii) creation of a unique database of buyers and sellers, iv) data sharing based on ORGANS principles, v) flexible architecture, vi) open source and federated platform, and vii) partnership-driven implementation models.

Analyzing the current work undertaken by the Government of India in building agri-stack, we propose that the next steps should focus on the following:

- Development of common digital taxonomies through the creation of a committee of experts from academia, national and international think tanks, 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 to build consensus on taxonomy.
- The e-NAM can be re-engineered along the lines of GeM to provide additional services such as the 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.

[16] https://agricoop.nic.in/sites/default/files/IDEA%20Concept%20Paper_mod01062021_1.pdf

- Formulation of data sharing and management policy considering aspects such as data localization, cross-border flow of data, and simplified license agreements in an 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 a draft specific to the agriculture sector while adhering to the proposed measures under Digital Personal Data Protection Bill 2022[17] .
- Creation of a vibrant and active open community that will oversee the development and implementation of Agriculture Data Exchange and operationalization of the open-source platform. A community on the lines of iSPIRIT, which played a stellar role in the 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%2C%202022.pdf