AGRI NODE

Open Digital Ecosystem (ODE) Deep Dive

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The Agri NODE Deep Dive has been developed as a part of a larger study on Open Digital Ecosystems led by Omidyar Network India and Boston Consulting Group. It should be read in conjuction with the main report – Building India's Digital Highways: The Potential of Open Digital Ecosystems.

1 Introduction

The agriculture sector contributes approximately 15 percent to India's GDP and employs around 50 percent of the workforce. Approximately 85 percent of the farmers in India are Small and Marginal Holding Farmers (SHFs) who control around 45 percent of agricultural land with an average landholding of less than 2 hectares.1 Additionally, the yield per hectare is also not high, further reducing farm output. In the past, increasing the yield has had limited impact on farm realization as it often leads to price rationalization, thereby nullifying the benefits of the increased yield. The benefits are least visible for SHFs due to their focus on staple crops and inability to store and sell at the appropriate time.

Due to their lack of scale, SHFs face multiple challenges across the farming lifecycle.

- SHFs are highly risk averse in terms of their choice of crops and have shown a proclivity towards low realization crops like wheat and rice (due to Minimum Support Price (MSP) guarantees and limited market access). The adoption of traditional farming practices further limits their productivity.

- An inability to make investments that can enhance price realization and productivity compounds the challenges for SHFs. For example, most SHFs are unable to invest independently in storage infrastructure or mechanization due to the high upfront cost and limited utilization / return on investment at their current scale.

- SHFs face difficulty in accessing routine services like lending, insurance, and government benefits due to the considerable time and procedural requirements (like providing necessary documents) and the consequent trade-off in terms of loss of time and wages. Further, the high transaction costs due to small ticket sizes inhibits service providers from servicing SHFs.

- Poor bargaining power and weak access to markets due to high transportation costs and the presence of intermediaries with greater control.

All the above factors can considerably reduce the farmer's income, further impacting his ability to invest in income-enhancing farm productivity solutions, creating a vicious cycle.

In summary, due to a lack of scale, SHFs are unable to access key services (service providers often find it economically unviable to serve this section of farmers), have poor bargaining power, and need to resort to non-institutional sources of credit, which often have high interest costs. In recent years, digital solutions have been developed by public and private players in an attempt to resolve for some of these issues, especially those related to lack of scale and limited transparency across farmer services. The lack of scale can be overcome by aggregation across SHFs and by minimizing the cost of transaction via digital tools, while limited transparency can be countered by providing greater access to information and data.

There are currently approximately 80+ initiatives for the digitization of data and for building digital applications or services portals. These include National Agriculture Market (eNAM), Farmer Portal mKisan, Soil Health Card digitization, the Pradhan Mantri Fasal Bima Yojana (PMFBY) platform, Meghdoot, etc. States have also taken the lead in this regard with Telangana, Odisha, and Andhra

Pradesh, for example, making considerable progress in bringing together different farmers, farming, and weather-related database to provide better agri extension and advisory services. The aim is to help farmers better plan their farming activities to tackle regional peculiarities and improve their provision of inputs. Further, such initiatives will also facilitate targeted and timely procurement and direct farmer payments through schemes like Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), Rythu Bandhu (Telangana), and KALIA (Odisha). Private service providers like lending institutions and crop advisory companies are also trying to launch user friendly and multi-channel digital applications in an attempt to reach the SHFs and bridge prevailing gaps.

However, many of these initiatives are struggling to reach the necessary scale and desired service levels. Their limited success can primarily be attributed to two factors:(i) lack of access to data that is spread across multiple institutions, (ii) fragmented, disconnected solutions that fail to provide a seamless user-centric journey. In such an environment, an Agri National Open Digital Ecosystem (NODE) can prove to be a viable solution for the multiple challenges faced by the agriculture sector in India. An Agri NODE that allows for interoperability across systems and stakeholders through the required technology infrastructure (for example, payment gateways) and governance mechanisms can help deliver services efficiently by addressing core challenges like limited access to data.

The Agri NODE can be envisioned as an integrated repository of data and services built around a data exchange, helping service providers (either the government or private players) build End-to-End (E2E), customized, and farmer-centric services. The data exchange can help integrate farmer details, land records, tenant records, soil health records, crop survey data, weather and satellite imagery, and irrigation data, amongst others. With open Application Programming Interface (API) access to these registries and digital solutions in lending, insurance, benefits / subsidy transfer, crop advisory, etc., services can be customized and delivered at scale in a cost-effective manner. This can result in improved transparency, access to lending and insurance, a wide suite of marketplace services, increased agricultural productivity, and better value for produce.

It is important to note that the path towards harnessing the true value of the Agri NODE will likely be long and challenging. While the NODE will enable data exchange and interoperability, it is important to note that currently most data is held offline in manual repositories and cannot be routinely digitized. Further, a number of SHFs are unable to access digital technologies. In order to truly generate value from this ecosystem, a concerted offline effort will be required to ensure that the right inputs are made available and that end-users can be effectively on-boarded onto this platform.

This document describes the detailed farmer journey in the Agri NODE, the key building blocks of the digital platform that need to be established, and the governance frameworks and community engagement models that need to be created. It provides a roadmap for the Ministry of Agriculture and Farmers' Welfare (MoAFW), together with state departments, to take this forward.

2 Agri NODE Concept

The Agri NODE is envisioned to be an Open Digital Ecosystem (ODE) comprising multiple users, each with their own 'journey'. For example, a critical component of a farmer's journey could be accessing farm advisory services across the production lifecycle from sowing to harvest and identifying the right service providers, for example, for seeds and fertilizers, equipment rental, logistics and transportation, etc. A trader or warehousing logistics provider's journey could involve accessing crop sowing / production data in a particular district to forecast supply estimates, evaluating the associated logistics capacity requirements, etc.

The Agri NODE can unlock new digitally-delivered services to facilitate and integrate multiple disparate journeys through both public and private participation. By bringing together the required data and technology infrastructure (which may be privately or publicly owned / managed) through interoperable design and common standards, the Agri NODE will be able to augment value for each stakeholder in the agriculture chain. Considering the large number of stakeholders, including central and state governments, data and research institutes, farmers and producer organizations, and private players (lending institutions, traders, and buyers, etc.), it is imperative that a strong governance framework that clearly articulates the rules of engagement in the ecosystem is established.

Exhibit 1 outlines key use cases or journeys in the ecosystem and the interactions amongst the main stakeholders. It is important to note that there are potentially multiple other journeys like livestock management and community stakeholders that are currently not captured but can add immense value.
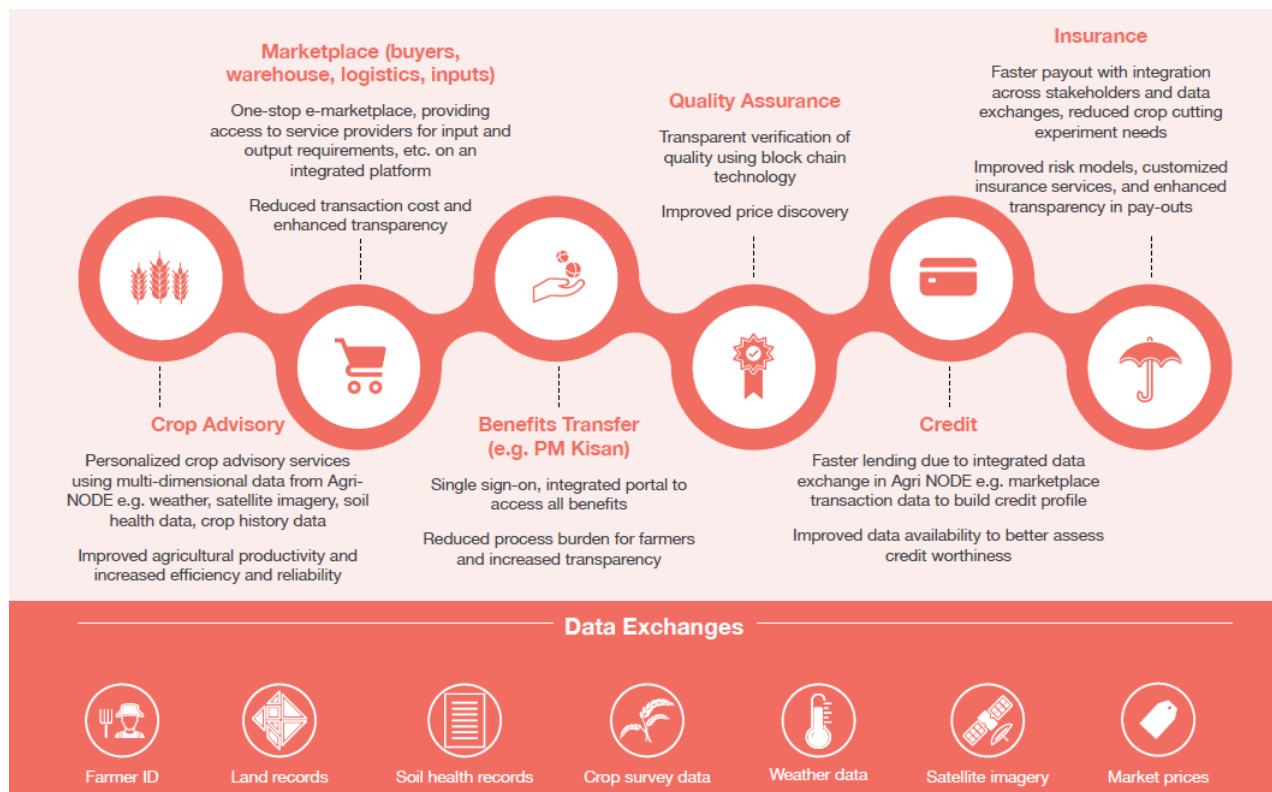

Exhibit 1: Agri NODE Concept

2.1 Goals of the Agri NODE

The Agri NODE is primarily focused on enhancing the farmer's journey and helping him access improved services, either from the government or the private ecosystem. It aims to create a strong foundation for service delivery and improved access for all stakeholders within the agriculture ecosystem. Below, we share the main goals of the Agri NODE.

- **Ease Access to Public Service Delivery for Farmers:** Create an ecosystem where access to and exchange of farmer data can be done in an effective and inclusive manner. This will also enable the government to better target their schemes, design policies, and improve their reach, thereby enhancing public service delivery for farmers.

- **Unlocking Ecosystem Innovation for Improved Service Delivery:** With the Agri NODE building the key enablers and the government focusing on public service delivery, service providers will be able to focus on building market-linked services. Additionally, this will also enable service providers to plug the existing gaps in the ecosystem by leveraging data available on the data exchange, ensuring that the farmer becomes the ultimate beneficiary. Disparate and rich data currently spread across multiple institutions can be used to build affordable, accessible, and competitive end-user services. Below, we share an indicative list of stakeholders who can benefit from the Agri NODE.

- **Crop Advisory Players:** Support the development of robust advisory services with rich multi-dimensional data. This will enhance trust in the ecosystem and accelerate adoption by farmers due to the increased reliability of advisory solutions.

- **Traders and Buyer Organizations:** Enable access to a larger base of farmers with trusted information on crop quality, grade etc., thereby supporting price discovery.

- **Insurance Providers:** Help reduce insurance pay-out delays and operation costs through simulated crop modelling enabled by rich multi-dimensional data from the NODE (rationalization on number of manual crop cutting experiments).

- **Financial Institutions:** Support a transition to digital modes of service delivery. This will help financial institutions better access the remote farmer and reduce the cost of last mile operations (application process) and governance (verification process).

- **Other Providers (for example, logistics, warehousing companies, equipment rentals, seed and fertilizer companies, etc.):** Provide access to a larger base of farmers along with integration of services in areas like effective subsidy transfer to seed and fertilizer companies, etc.

Overall, the Agri NODE will help the end-user, that is, the farmer, address key pain points across his farming cycle in areas like advisory, lending, insurance, benefits, and marketplace services as described in detail in Exhibit 1.

3 Farmer Journeys in the NODE

As outlined in Exhibit 1, several user journeys exist within the agriculture sector. The Agri NODE enables an enhanced experience and access to previously restricted services (for example, farm advisory), eliminates inefficiencies (for example, in accessing government benefits / entitlements) stemming from an absence of shared data, and helps create a holistic user experience. Below, we describe the key farmer journeys in detail to offer a perspective on how the Agri NODE can unlock transformative benefits.

3.1 Seeking Crop Advisory Services

The average crop productivity in India is far lower than the global average, roughly around 40 precent[2] in specific crops like rice. One of the key reasons for this is the adoption of poor farming practices which could be solved through better crop advisory services. For example, an analysis of crop-sowing data in Andhra Pradesh indicated that due to the intervention of crop advisories, yields increased by approximately 30 precent[3] in the state. Crop advisories can play an integral role in lending the necessary support to farmers throughout the crop lifecycle in areas like crop planning, pest control, irrigation control, usage of inputs like fertilizer and pesticides, etc.

Currently, crop advisory services are built by both public and private players, delivering information in the form of Package of Practices (POP) which are like process or rule books and rule-based advisory. However, these solutions are generic in nature. Farmers require advisory support to diagnose specific issues and accordingly deliver the required solutions, for example pest management and crop protection usage. Efforts by many private start-ups to build such accurate and reliable solutions have met with limited success due to lack of access to multi-dimensional data like soil health data, micro weather data, irrigation data, satellite imagery, etc.

In the Agri NODE, farmers can receive accurate and reliable crop advisory solutions derived from rich aggregated data, as explained below.

1. As a first step, the farmer can raise his query through a crop advisory portal or via a phone call. The crop advisory portal can then assist the farmer in selecting and rerouting to the required crop advisory service which might be operated by different public and private players. For example, the farmer can select a specific horticulture or organic farming related crop advisory service on the portal and the portal can then navigate the farmer to the corresponding service.

2. Based on the query, the crop advisory service will access the rich multi-dimensional data from the Agri NODE for diagnosing the situation. For example, when a farmer raises a query for crop disease, the respective agro advisory company can aggregate the specific soil health data, weather data, and satellite imagery of the respective location from the Agri NODE, identify potential root causes for the crop behavior, and subsequently suggest solutions for the query raised.

3. Farmers can also receive proactive advisory for their farm needs starting from the kind of crop to be sown based on expected yield, market intelligence, and irrigation planning to pest and yield control planning.

4. Additionally, the Agri NODE will also facilitate collaboration between agricultural research institutions and service providers by hosting well proven research models specific to crops and pests, on the platform. This will be done through a smart search feature like a crop model engine which advisory companies can use to raise queries and receive the relevant answers instead of building dedicated capabilities in crop research.

Such advisory services that are built on rich and specific data are likely to provide more effective advice. This will encourage further adoption as currently crop advisories are considered to provide only generic and non-reliable solutions which deter farmers from approaching them.

3.2 Access to Input and Output Marketplace Services

A typical farmer needs to access a number of market place services, starting with procuring the right kind of agricultural inputs (seeds, fertilizer, etc.), to availing value added-services during the sowing and harvesting stage. These could include renting farm equipment, connecting with the right traders and buyers for their produce, accessing logistics and warehousing services post-harvest, etc.

However, a few key challenges exist today. First, due to the scale of SHFs, access to several services can be costly. Second, many of the services are fragmented, offline, and not easily accessible. A number of solutions are being developed by start-ups to address these challenges. However, scalability and adoption present a huge challenge in addition to lack of trust and awareness.

In the Agri NODE, an integrated marketplace can act as a one stop shop for a small farmer to manage all his required services. This will eliminate the need for the farmer to search for disparate services, reduce payment setup hassles, and inspire trust with a buy-in from the government (operating key services like MSP procurement through the marketplace). The marketplace will function as follows.

1. Available online service providers (for example, input / seed providers, agri-tech equipment rental firms, etc.), can be integrated via a common platform, offering convenience and choice to the farmer to access all the necessary services across his farming lifecycle.

2. During the pre-harvest stage, the farmer can procure crop inputs like the desired seed variety and required fertilizers from verified providers. Post transacting in the marketplace, the farmer will receive the respective subsidy associated with seeds and fertilizers purchase, with purchase data being connected to the subsidy or welfare department. Over time, agri-input companies can also provide financing for the purchase of inputs on the same portal.

3. Moving to the harvest stage, the farmer can search for nearby farm equipment rentals and book them as per his requirements, depending on the availability in his area.

4. Post-harvest, the farmer can evaluate daily prices on the portal and choose whether he would like to store his produce or sell it. If he chooses the former, he can check the availability of warehousing services in close proximity and store his produce. An added benefit is that the e-receipt generated by the warehouse for crop storage can be used as collateral for short term

loans. Further, market intelligence on pricing will also be provided to the farmer through notifications, thereby helping him decide when to move his produce from storage to the marketplace.

5. Finally, when the farmer decides to sell the produce, he can avail services like bid pooling or supply pooling to meet the requirements of large buyers and bargain with them for the desired price through an online bidding process. Further, he can access pooled logistic services based on availability and reduce his transport cost while transferring the produce to the local '*mandi*' or to the buyer's location.

6. Along with providing E2E farmer services in one place, the platform will also generate rich data captured from individual farmers. The data can be further leveraged by the NODE to develop multiple services for the farmer. For example, linkage of subsidies post farmer input purchases like seeds and fertilizers, use of storage e-receipt for short term loans, improved credit worthiness of landless tenants through past income history from selling produce on the platform, etc. Additionally, transaction data patterns can be used for policy making.

The existing eNAM portal could be scaled to an integrated marketplace considering that it has gained initial traction with farmers who are already on-boarded onto the platform with payments setup and access to ground level infrastructure in some states. Concerted efforts need to be made to help farmers adopt such services on a large scale. This will be discussed further in the community section.

3.3 Access to Government benefits

SHFs are eligible for a number of government benefits and services. Some of the schemes at central and state level include PM-KISAN, Paramparagat Krishi Vikas Yojana (PKVY) for organic farming, Pradhan Mantri Krishi Sinchai Yojana (PMKSY) subsidy for drip irrigation, state level schemes like KALIA in Odisha, Rythu Bandhu in Telangana and Rythu Bharosa in Andhra Pradesh, etc. SHFs face two challenges (i) poor awareness about their entitlements and the required documentation and procedure to prove eligibility and apply for services and (ii) paperwork and procedural issues with the actual application process.

The Agri NODE could resolve these issues with its ability to identify and tag eligible farmers to schemes, provide notifications, and facilitate the entire enrolment and disbursal process.

1. The tagging of a unique farmer Identity (ID) (could be Aadhaar or linked to it) to relevant information like the size of his land holding and other community details will help determine the eligibility of the farmer for a particular scheme. Once eligibility is established, the farmer will automatically be informed through a notification or message.

2. Some of the existing or new schemes like direct benefits or transfer could be automated without the need for an application by the farmer.

3. For schemes that require a separate application, the farmer can use the unified benefits portal where he can view all his applicable schemes at state or central level through a mobile application or the nearest Common Service Center (CSC). The farmer can simply login through his farmer ID, check for all applicable schemes, glean the relevant information, and submit the application by providing his consent to share the data.

4. Further during the application process, the Agri NODE could autofill the relevant documents from respective state department databases like land holding details, crop survey data, etc.

5. Additional documents, if any, relevant to the particular scheme could be submitted along with the application, either offline or online by the farmer. For example, the farmer can additionally submit his proof of purchase of drip irrigation equipment for claiming his subsidy under Pradhan Mantri Kaushal Vikas Yojana (PMKVY) scheme along with his auto-filled land record documents.

6. Integrated notification mechanisms and messages will help the farmer view his application status, thereby increasing trust and transparency.

Farmers in the new ecosystem can chose and apply for applicable schemes and services with minimal efforts, thereby reducing dropouts.

3.4 Access to Financial Services

Access to credit is one of the key needs of a farmer. Farmers in India use credit to purchase inputs like seeds and fertilizers, avail supporting labor and equipment services, etc. However, access to low cost institutional credit is a significant challenge. An estimated 30 percent[4] of agricultural lending is through non-institutional sources, at a rate that is approximately 10 percent[5] higher than average interest rates. While there are a few reasons for this, including small ticket size and the consequent transaction costs for banks and inadequate financial history, one of the key challenges is the farmer's inability to furnish the required documents and the considerable paperwork required for a loan. A recent survey by National Bank for Agriculture & Development (NABARD)[4] revealed that lengthy procedures for the sanction of loans by institutions and demand for collateral security were some of the key reasons for farmers seeking loans from informal sources.

Currently, in order to avail a loan, an SHF has to travel to the local bank where he has to furnish documents like land records, crop history data, etc. To gather these documents, one or more visits to the local government office are required, which can involve long procedural delays and often result in lost time and wages. This opportunity cost, combined with the time-critical and seasonal nature of agriculture, leads farmers to non-institutional sources for credit.

In the Agri NODE, a farmer can complete the entire loan application and disbursement process digitally with minimal hurdles. A detailed farmer journey is explained below.

1. The farmer can visit his nearest bank branch or access the one stop lending portal via the nearest CSC to apply for an agricultural loan.

2. The farmer can evaluate all the available loan offers with the respective interest rates on the lending portal and choose the loan that suits his requirements. Once the farmer has decided which loan he would like to avail, he can complete the application process on the same portal just by providing his farmer ID and loan requirements.

3. Financial institutions, upon receiving the loan application, can access the necessary documents like farmer land records from the Revenue Department, crop cultivation data from the State Agricultural department, and the respective irrigation data of the farmer via the Agri NODE. Once

the farmer gives consent, the required data can be made available to the lending institution to process the loan.

4. With seamless integration and data exchange through APIs, the loan application process becomes faster and more convenient, minimizing on-ground data collection efforts. Further, this can help lower the chance of rejection that stems from the SHF's inability to provide the right supporting data. Lending institutions can have lower loan processing costs as data collection and verification becomes less labor intensive.

Over time, with the creation of a unique farmer ID and data exchange mechanism, SHFs will be able to build financial history and improve their ability to access loans. For example, a farmer selling his produce on the eNAM marketplace can use the transaction data as a source of proving income or those availing warehousing services can use their digital receipts to access instant credit.

3.5 Timely and Transparent Insurance Services

Crop insurance is critical for SHFs as research suggests that two consecutive crop failures can push the famer into a debt trap. When faced with a crop loss, insured farmers face two key challenges. First, potential delays in insurance payouts, and second, a lack of transparency in computing payouts. This has contributed to a sharp fall in the area under crop insurance schemes. As per PMFBY records, the area under crop insurance schemes fell by 17 percent[6] in the two years preceding Kharif 2018.

Currently, the computation of payouts involves running a significant number of manual Crop Cutting Experiments (CCEs) to estimate crop losses. This requires on-ground assessments by local agriculture officials along with a co-observer from the insurance company. The scale of the exercise and coordination required can lead to considerable delays, along with mistrust in the computation and entry of yield data.

With the Agri NODE, the entire insurance application and claims journey can be improved for farmers by integrating large-scale data and automating the entire process across stakeholders.

- For an SHF, enrolling for insurance can be made easier, similar to the credit process described above. Currently, under the PMFBY, a farmer who has taken a loan is automatically enrolled for insurance. This can continue with lenders and insurers exchanging data seamlessly via the Agri NODE. Farmers who have not yet taken a loan can enroll for insurance by providing their unique farmer ID which is integrated with information related to the crop grown and area sown through access to crop survey data maintained by the state agricultural departments.

- With access to such rich integrated data, insurance services can be tailored to different soil, crop, and regional conditions, thereby benefitting farmers.

- In order to estimate premiums and claims, both the government and private sector insurance companies can build simulated yield models using rich aggregated data available in the Agri NODE to automate the process. Access to well-built models can also reduce disputes with consensus through simulated yield data leading to faster payouts. These crop models can rely on data like weather data from private stations like Skymet or public weather stations like India

Meteorological Department (IMD), satellite data from Indian Space Research Organisation (ISRO), and crop survey and crop yield data from state agricultural department.

- In line with the phased approach proposed by the task force of NITI Aayog on crop insurance,[7] CCE will also adopt a phased rationalization process. Initially, it would reduce the number of manuals CCEs and subsequently, migrate to fully simulated yield models where the payments would be computed based on the simulated yield models.

- With linkage to payment services like Unified Payments Interface (UPI), calculated payouts will be transferred to the beneficiary accounts directly.

Further, the existing PMFBY application can be integrated with continuous updation of claim settlements data. This can be analyzed and shared publicly to increase farmer trust and adoption, considering the opportunity cost of their investment on premiums.

3.6 Other Stakeholder Journeys

The Agri NODE services multiple stakeholders, each having their own journey or role in the ecosystem. Stakeholders in the Agri NODE include the farmer, service providers like financial institutions and insurance companies, the government, agri-tech companies, agriculture input companies for seeds and fertilizers, logistics players, warehousing services, equipment rental players, supporting data providers, and the community of Farmer Producer Organisations (FPO's). Data generated across the platform will enable a number of stakeholders to deliver more farmer-centric and relevant services as well as improve their own delivery mechanisms. Some potential examples are listed below.

Cross-cutting Data Enabling a Holistic View: This will help stakeholders identify existing gaps, make targeted investments, and improve their services by investing in areas like better planning. For example, capacity planning for cold storage related services based on expected crop in the market can be done by analyzing seed sales data.

Integrated Delivery: Service providers can collaborate with each other to achieve better last mile delivery services by leveraging data in the ecosystem. For example, an agri input dealer of seeds can also facilitate the last mile delivery of financial services.

Access to a Wider Base of Unserved Farmers: With access to data of remote farmers through the NODE, stakeholders providing services like lending or insurance can reach previously unserved farmers. For example, fintech service providers can access a remote farmer through E2E digitized operations facilitated by the NODE data.

Customized Services at Scale: With access to rich data, services like insurance and crop advisory can be customized and delivered at scale. For example, in the future, the farmer can evaluate the different kinds of insurance services available in the market and select the one that is tailored to his crop, regional weather, farm, and irrigation conditions.

4 Digital Platform Design

The Digital Platform should comprise the key building blocks or minimal digital infrastructure required for users and builders to access services within the Agri NODE. Given the number of digital initiatives, both public and private that are already underway, the digital platform will serve as a bridge across various data registries and applications that exist, as well as, create new building blocks that may be needed. A few key principles need to be kept in mind when designing the platform.

Principles for the Design of Digital Platforms

1. **Be Open and Interoperable**

   Use and / or build open standards, licenses, databases, Application Programming Interfaces (APIs), etc., so that different digital platforms and their components can talk to each other.

2. **Make Unbundled, Extensible, and Federated**

   Incorporate a modular or 'building blocks' architecture. Design such that (i) each block has minimal functionality allowing it to be used in different contexts, (ii) is extensible so that it can be combined with other blocks and repurposed in diverse contexts, and (iii) represents an autonomous data source which is interconnected with other sources rather than creating a single database covering all variables.

3. **Be Scalable**

   Use elastic and flexible design to enable the platform to easily accommodate any unexpected increases in demand and / or to meet expansion requirements, without the need to change existing systems.

4. **Ensure Privacy and Security**

   Adopt a Privacy by Design (PbD) approach that embeds key technology and security features within the core design of the solution to ensure individual privacy and data protection.

5. **Develop Minimally and Iteratively**

   Build incrementally to develop Minimum Viable Products (MVPs) to which additional features can be added in response to new use cases and as our understanding of user behavior gradually evolves.

In order to achieve these principles, the platform should comprise a set of core building blocks that are modular and interoperable. To highlight this concept, we allude to a quote by Richard Pope from his "Government as Platform Playbook", in which he describes platforms as "systems that generally do one thing very well which are – small pieces loosely joined, rather than monoliths that try to handle every edge-case or be too smart."[10]

In technical terms, a Federated Architecture (FA) would serve the required purpose, which consists of modular and interoperable blocks that can be abstracted to a required degree for usage in diverse contexts. As described in the National Digital Health Blueprint, "federated architecture is an architecture that allows interoperability and information sharing between de-centrally organized entities, systems, and applications".[11] With a decoupled federated architecture, building blocks of a platform can be used by a range of public and private sector stakeholders either directly or with minimal customization. This eliminates the need for building a separate functionality from scratch. For example, functionalities like a notification manager or a customer support module can be used by individual applications, thereby improving efficiency and time to market.

In this section, we offer a preliminary perspective on the design of the digital platform, based on the user journeys described above (see Exhibit 2). This is intended to enable a more detailed assessment for creating a Detailed Project Report (DPR) for a full technical design.

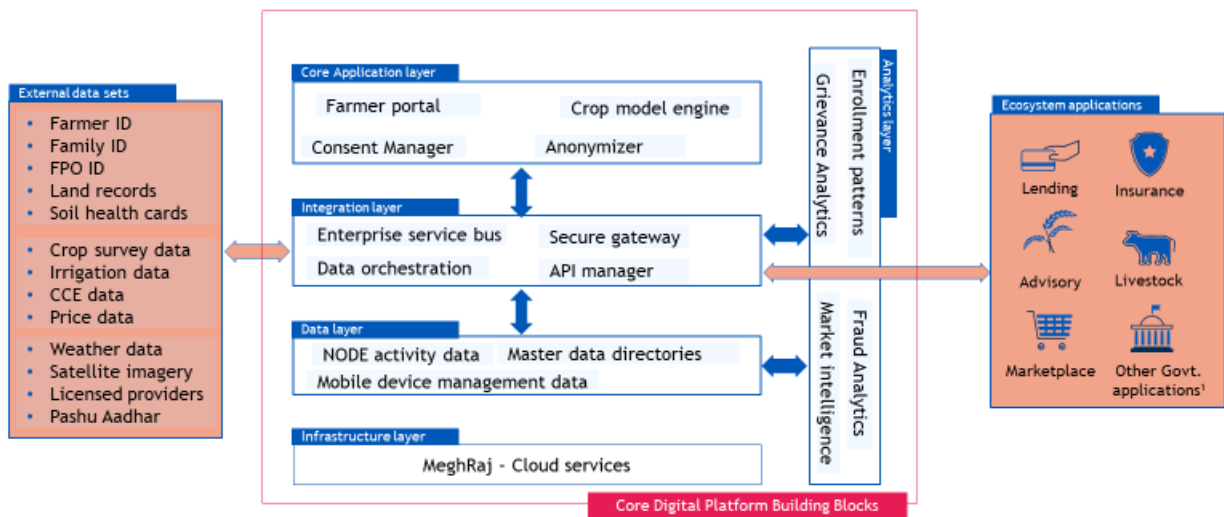**Exhibit 2:** Key Technology Layers of the Agri NODE's Digital Platform

A typical end-user solution will have five layers that are required for service delivery. Each of these layers will have a set of building blocks, which can be used modularly for the development of the different services and solutions. These are.

1. Infrastructure

2. Data Registries

3. Core Applications

4. Analytics

5. Integration

Some of the key databases which can be linked with the Agri NODE are described in Exhibit 3. This list is not intended to be exhaustive.

Data component	Description	Corresponding owner
Farmer Identity (ID)	Farmer ID contains basic identification details like name, address, Date of Birth (DOB), etc. Farmer ID forms the basis for identification for all services accessed via the Agri NODE. It will enable aggregation of all data related to the farmer, held across different databases like land records, soil health card, transaction data, etc.	Central / State Agriculture Ministry
Family ID	Family ID consists of a unique identifier for a family. Each farmer will be tagged to his family ID	State Agriculture Department or State Welfare Department
Bank Account Details	Bank account details of the farmer include his account number, payment details, mobile number, branch location, address, etc.	Public, private and co-operative banks
Financial History	Financial history of the farmer consists of credit history, past income data, etc.	Public, private and co-operative banks
Digital Land Records	Digital land records consist of the owner name, survey number, and the size of the plot	State Revenue Department
Soil Health Cards	Soil health records detailing 12 important soil parameters and fertilizer recommendations	National Informatics Center (NIC) and State Agricultural departments
Weather Data	Weather data comprising information about temperature, rainfall, wind direction and speed, humidity, and predictions on short, medium and long range forecast Hyperlocal weather data can be made available by private companies	India Meteorological Department (IMD), private weather companies
Satellite Data	Satellite data for agriculture consists of remote sensing images that capture the variation in soil, water, and vegetation level data on the ground	Indian Space Research Organisation (ISRO)
Crop Certificate or Crop Survey Data	Crop certificate consists of farmer identification data, survey number, date of survey, crop area, village, and the kind of crop sown in the farm for the particular season	State Agricultural department
Price Data	There are two types of price data 1) Minimum Support Price (MSP) 2) Live market data and predictions, for example, of all the Agricultural Produce Market	APMC, Commission for Agricultural Costs & Prices (CACP), live platform data

Data component	Description	Corresponding owner
	Committee (APMC) *mandis*, eNAM, and the National Commodities and Derivatives Exchange (NCDEX) This can also include transaction data from integrated marketplace services	
Certified Providers	Information about certified providers for agricultural inputs like seeds, fertilizers, pesticides, etc.	State Agricultural department

Exhibit 3: Key Data Sets in the NODE

4.1 Infrastructure

A robust infrastructure is needed to serve as a foundation for the NODE. Selecting the right infrastructure is integral, considering the initial investments involved and the future dependency of all platform services on the base infrastructure. The Agri NODE requires a set of infrastructure services like storage and computing for operating the digital platform.

Among the available infrastructure options, cloud provides certain key benefits in areas like.

- **Scalability:** Services deployed on a large cloud infrastructure can scale much faster versus the traditional infrastructure approach, depending on the varying requirements of NODE services.

- **Reduction in upfront costs:** The pay-per-use model of cloud infrastructure helps in minimizing upfront capital investments.

Considering the benefits of cloud services, a government cloud service like MeghRaj could be a potential option for usage by the Agri NODE. A detailed infrastructure requirement and analysis will need to be done, as part of the DPR preparation.

4.2 Data Registries

A key feature of the Agri NODE is to enable service providers to access relevant data which is currently spread across multiple institutions. It is important to note that the Agri NODE will not own, store or maintain this data but will adopt an aggregator / exchange model, with the necessary privacy and security safeguards in place. The data exchange will connect the required data consumer with the corresponding data provider and facilitate a comprehensive data sharing process.

Further, some specific data may be stored and / or owned in registries held within the digital platform. This could include login or user access data, transaction failure rates, number of requests for specific types of data, etc. Analytics on top of this data can help improve platform usage, adoption, and planning.

Going forward, incentive mechanisms can be designed such that data and insights generated by last mile fin-tech aggregators, Non-Banking Financial Companies (NBFCs), and localized crop advisory companies can also be shared with the ecosystem, thus promoting collaborative solutions.

4.3 Core Applications

The Agri NODE will also have a core application layer. A list of illustrative and non-exhaustive applications is provided in Exhibit 4. It is important to note that certain reference applications may be built which can be used by any service provider for quickly adapting to his needs. For example, reference applications developed for traders or warehousing companies can be downloaded and tweaked with required settings for their specific usage requirements. Certain farmer-facing portals or applications may be created by the Agri NODE in order to provide a truly E2E journey. However, it is important to note that the Agri NODE platform could choose to operate minimally, that is, as a data exchange enabling efficient data connectivity between data providers and data consumers.

Functionality	Features
Consent Manager	• Collects consent from the data owner for data sharing between the data provider and data consumer who has raised the request • Triggers a confirmation request through channels like One-time Password (OTP) messages or automated calls. This is primarily for the farmer, but may be relevant for other stakeholders as well. • Facilitates data sharing in line with the Ministry of Electronics and Information Technology (MeitY) Electronic Consent Framework (ECF) or other applicable policies
Anonymizer	• Removes all personally identifiable information and provides anonymized data, depending on the requested services. • Data once anonymized cannot subsequently be related to any person
Crop Model Engine	• A crop model engine is an analytical model which facilitates collaboration between research institutions and agri-tech start-ups or other service providers • This engine takes queries from users and returns relevant content or answers. For example, a crop advisory company might query for the effect of a pesticide in a particular climatic condition and receive a set of answers or a set of navigable material in response.
Notification Manager	• Manages large scale notification and communication with farmers and other users on topics like consent management, applications status, grievance redressal, etc.
Lending Portal	• The Agri NODE may choose to build certain farmer-centric reference applications • The farmer can view all the available loan schemes and offers by different financial institutions on a single portal

Functionality	Features
	• The farmer can select the loan provider and complete the application process by submitting his farmer ID and loan requirements • The portal can either reroute the farmer to the relevant portal of the financial institution for completion of application or centrally manage all the connected applications integrated through APIs to complete the entire transaction on the portal itself
Benefits Application	• The farmer can view and access all applicable schemes and benefits on a single portal • He can apply for the eligible government benefits or scheme by specifying his farmer ID
Advisory Portal	• Helps view all available crop advisory service provider offerings on a single portal • Provides an option to select or query for required crop advisory service on the portal • Post selection, the farmer will be rerouted to the respective crop advisory service
Information Portal (landing page for all stakeholders)	• Acts as a single stop portal for all information access, announcements, and grievance redressal for all stakeholders
Internal Applications	• Support internal processes like grievance support, performance monitoring, data governance, project management etc. to support the Agri NODE

Exhibit 4: Key Application Services in the NODE

4.4 Analytics

The Agri NODE will also support multiple analytics functionalities which are listed in Exhibit 5. These analytics functionalities are for the activity data generated through the Agri NODE. A few illustrative functions are shown in Exhibit 5. However, this is an indicative list and there could be several other types of feasible analytics functions.

Key Analytics Functions:

Functionality	Features
Enrollment Patterns in Applicable Government Schemes	• Computing key farmer enrollment statistics, relevant Key Performance Indicators (KPIs), anomaly patterns by different conditions like target region, farmer demographics, etc. For example, insights on regions or specific farmer communities who have not been able to access the eligible benefits and the potential root causes along with the stage at which the application has been halted.

Functionality	Features
Market Intelligence	• Market intelligence in the form of expected crop output based on seed input sales data and historical demand data from buyers or marketplaces like eNAM, to prepare for market glut or adversities, etc. • Patterns in targeting of different ecosystem services by different regions, communities, economic indicators, etc.
Fraud Analytics	• Helping identify leakages in different schemes by connecting with external data sources. For example, scenarios where insurance claims or subsidy claims are made on the same land records data.
Grievance Analytics	• Identify top areas of concern based on grievance redressal data sourced through multiple channels like call data, application data, text data, etc. Assist in identifying root causes and required focus areas or regions for intervention.

Exhibit 5: Analytics Services in the NODE

The analytics functions of the NODE include both, a data visualization and a data modelling layer. The data visualization layer will consist of the dashboards used by users like government officials to track key statistics on the progress of government schemes. The data visualization services of the NODE will assist the NODE governance personnel to monitor key performance and governance related statistics. The analytics or data modelling layer will support the NODE visualization layer by processing key insights which will be sent to the relevant players in the ecosystem. Stakeholders can leverage these insights directly or integrate them with their internal dashboards for improving their services.

4.5 Integration Layer

The integration layer will be a key component of the Agri NODE. It primarily consists of an API gateway which connects supporting (data) institutions and service providers. Key features of the integration layer are mentioned Exhibit 6.

Integration Feature	Key functions
Enterprise Service Bus (ESB)	ESB will help integrate all the backend systems of the NODE (translations of data models, deep connectivity, routing, and requests) and help make those connections available as APIs for all the public and private applications of the Agri NODE
Secure Gateway	Secure gateway helps the NODE to connect to external applications in a fast, safe, and secure manner
Data Orchestration	Data orchestration enables the NODE to manage data formatting or transformation between separate services, where requests and responses from APIs need to be split, merged or rerouted
API Manager	API manager will help the NODE to define and manage the entire API environment in an agile manner. For example, setup custom APIs without the need for interfering with the backend systems

Exhibit 6: Integration Layer Features

5 Community

A strong community is essential for a NODE, as its core value lies in the solutions created by the community of builders who build on top of the node, end-users who access these, and facilitators who create an enabling environment. The community primarily consists of three types of actors i) Builders, who either build the digital platforms or build solutions on top–builders could include public institutions, private enterprises, and independent technology contributors, ii) End-users, who in this context will be the farmers or farmer producer organisations (FPOs), traders and buyers, sellers (for example, crop insurance companies or input providers) who access the services created by the builders, and iii) Facilitators, those who contribute to the successful implementation of the NODE–these include players like the Indian Council of Agricultural Research (ICAR), agricultural universities for research, CSCs, etc. This community of stakeholders will transact and collaborate via the platform to help identify and create user-centric solutions, for example, vernacular agro-advisory solutions by local startup communities.

Listed below are five key principles for building a strong and vibrant community.

Key Principles to Build a Vibrant Community

1. **Ensure Universal Access**

   Encourage the build of ODEs that minimize or overcome barriers to access (economic, technical, or social) to ensure inclusion, empowerment of end-users, last-mile access, and user rights, irrespective of their backgrounds.

2. **Drive Participatory Design and End-user Engagement**

   Encourage the participation of all community actors throughout the ODE value chain, that is, plan, design, build, and operate, to facilitate and promote a culture of openness and collaboration, enable the development of user-centric solutions, and facilitate widespread and sustained adoption of the digital platform.

3. **Cultivate a Network of Innovators**

   Proactively engage with innovators to spur the development of new solutions on top of the digital platform.

4. **Be Analytics-driven for Continual User Focus**

   Leverage the data generated by the digital platform to acquire insights around user profiles and engagement, adoption barriers, and platform performance. Analyze user data to improve user-centricity, support robust policy-making, and incentivize the design of new solutions.

5. **Enable Responsive Grievance Redressal**

   Define accessible and transparent mechanisms (offline and online) for grievance redressal, that is, user touch-points, processes, and responsible entities with a strong focus on actions for resolution.

5.1 Ensure Universal Access

The primary end-user of the Agri NODE is likely to be the small-holding farmer. Considering that SHFs usually have low income due to their smaller land holding sizes and lower levels of digital literacy, it is critical that the design of the Agri NODE ensures inclusion and accessibility. If this is not given a concerted focus, the range of applications and services will not reach the farmer, undermining the efficacy of the Agri NODE.

Some of the key barriers that need to be overcome include.

- **Low Digital Literacy:** While encouraging efforts like Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDisha),[36] initiated by Ministry of Electronics and Information Technology (MeitY) to promote digital literacy in rural areas are underway, the overall levels of digital literacy among SHFs is likely to be fairly low. Concerted efforts will be needed to handhold farmers to adopt the Agri NODE. Lessons can be learned from the Digital Financial Services NODE and payments ecosystem where simple technologies have gained considerable penetration across a similar target segment. Beyond awareness generation and handholding, specific actions can be taken to ensure user-centric design. Deep ethnographic research can help build resident knowledge for service providers on farmer needs and pain points, ensuring they adopt farmer-friendly UI/UX features, vernacular based services, and software applications that are adapted to the constraints of feature phones.

- **Lack of Awareness of Available Digital Services:** Despite the launch of multiple digital solutions and applications by the government and private players, their adoption continues to be low. One of the key causes of this is the lack of awareness among SHFs. A number of strategies need to be deployed for improving farmer awareness. It is critical to involve local, grassroots organizations and collectives that are working with farmers throughout the lifecycle of NODE development to ensure that their perspectives are taken into account. These include FPOs, self-help groups, Krishi Vigyan Kendra (KVK) extension workers, Non-Government Organisations (NGOs) / CSOs working with farmers. Further, peer-initiatives such as identifying digitally savvy farmers to serve as awareness champions and trainers within their community can also lead to a positive impact on farmers.

- **Lack of Trust in Digital Transactions:** Lack of trust could also be a key barrier specifically for a risk averse small farmer. Trust building activities need to be targeted towards helping alleviate the apprehensions of farmers especially in areas related to financial transactions. Indicative measures that can be taken to foster trust in the community include.

  - Mass communication efforts from trusted government officials or representatives through press or television to create awareness.

  - Partnering with local communities and individuals whom farmers trust like Village Level Entrepreneurs (VLEs),[37] teachers, and health care professionals who can help spread the message and answer any related queries.

  - Post this, a set of early adopters in the farmer community can be enlisted to help further influence other farmers and assist them in the onboarding process.

Further, the Agri NODE needs to be inclusive not just for the end farmer but also for service providers and other data providers in the ecosystem. This can be achieved through the creation and implementation of non-discriminatory and inclusive policies in the ecosystem, building enabling infrastructure, and ensuring that a level playing field is created for different service providers to encourage greater participation and choice.

5.2 Drive Participatory Design and End-user Engagement

Considering the diversity of SHFs (in terms of language, climatic and irrigation conditions, crops sown, technologies needed, and value chain integration), cookie cutter solutions are unlikely to work. Participatory design is required to ensure that farmer needs are taken into consideration in order to create customized solutions. A few mechanisms to ensure participatory design are described below.

Build Dedicated Feedback Loops: Build feedback loops / surveys to receive direct and regular inputs and feedback from farmers. Apart from online feedback loops, a network of local village entrepreneurs, physical grievance redressal points, regular touch points of farmers like agri input dealers of seeds, fertilizers, pesticides etc. could be created to better understand key farmer concerns.

Engage local experts: Engage local agriculture experts like KVK scientists and agriculture universities that can provide the necessary support to better understand different geographic contexts and local farmer behavior (for example, regional crop patterns, local weather and irrigation conditions, local markets, regional languages, farmer cropping preferences or knowledge).

Success of the Agri NODE is incumbent upon building a critical mass of users to enable network effects in the ecosystem. User engagement is critical for both onboarding and retention on the platform. A strong value proposition for stakeholders is a key criteria for sustainable end user engagement. Along with a strong value proposition, users need to be made aware and supported with handholding in realizing the initial value proposition. For example, one of the key reasons cited for the limited success of the eNAM portal is that it couldn't on-board enough buyers / traders to offer truly differential pricing vs the local *mandi*. On the other hand, the ReMS platform in Karnataka made a concerted effort for user on-boarding, and the resultant impact on pricing and access has led to its sustained success.

Key activities for helping NODE stakeholders become aware of the value proposition and support in onboarding for subsequent realization.

Communication / Awareness Campaigns: Awareness campaigns clearly articulating the value proposition through channels like television, press, and local government offices to highlight the advantages of using the Agri NODE. Industry associations like banking associations, insurance associations, and agriculture traders' associations can be leveraged for this purpose.

Incentives: Incentive creation and their communication both for service providers and end users. For example, initial waiver of API fee or subscription fees could act as incentives for start-ups along with dedicated financial grants for new age start-ups building on top of NODE services.

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Onboarding Support: Support in the form of handholding for large scale service providers like banks, insurance companies, agricultural departments, etc., for adapting large legacy systems to NODE services.

Along with mechanisms to create awareness and support initial user adoption, the core value proposition needs to be clearly defined for all stakeholder. Exhibit 7 shows the value proposition for different sets of stakeholders.

Stakeholder	Value proposition
Farmer	• Improved access to markets, services, and knowledge in a seamless manner • Increase in price realized due to better access to markets, thereby increasing bargaining power • Improved productivity by leveraging personalized crop advisory solutions • Lower costs of operation from access to cheaper lending, pooled logistics, and harvesting services • Timely protection from crop loss with seamless crop insurance services
Service Providers	• Ability to cut down operation costs with reduction in last mile delivery and governance • Reduced time to market for new services • Demand assessment based on the kind of data generated through the NODE • Access to a large farmer base for onboarding
Government	• Data driven policy making helping align programs and policies to on-field outcomes • Monitoring to reduce leakages and fraud while assessing market and supply gaps
Data Providers	• Revenue sharing mechanisms with Agri NODE, helping invest in their current operations • Reduced cost of operations by standardizing their services (for example, data standards)
Research and Development Organizations	• Understand farmer needs and services by connecting to Agri-tech start-ups • Develop better shared models based for on-ground feedback

Exhibit 7: Value Proposition for Different Stakeholders

5.3 Cultivate a Network of Innovators

In order to cater to the farmers' unique needs and encourage on-ground adoption, a vast network of co-creators will be needed. A few mechanisms to enable innovation and the build of diverse solutions are described below.

Incubation and Funding Support: Considering their dedicated capabilities for driving and nurturing agri innovators, long term partnerships could be helpful specifically in areas where new age start-ups

are trying to build for market gaps. Some of the incubators in the Indian context include Pusa Krishi Incubator, Indian Agritech Incubation Network, Research and Innovative Circle of Hyderabad (RICH) Telangana, and agriculture business innovation incubator by ICAR-Central Institute of Fisheries Technology, Villgro, Agri Udaan, etc.

Recently, NABARD set up an INR 700 crore[38] venture capital fund for supporting agriculture and rural start-ups. The Agri NODE can closely work with the fund to identify investment gaps or market gaps and accordingly design start-up-friendly funding terms to accelerate the funding ecosystem. This can be particularly beneficial considering that adequate funding is a major roadblock for many of the start-ups to scale, especially in agriculture.

Direct Support to Agri-tech Start-ups: The Agri NODE could also directly extend support to agri-tech start-ups in areas like time to market via tested data sets through APIs, sandbox environments, and incentives like access to cheap cloud services like MeghRaj. For identified topics of interest (which help meet priority needs) based on data from feedback loops, closer support can be provided through dedicated support from research bodies. Further, interventions like financial grants and networking events (domain experts, govt. machinery support) could also be explored, for example, Maitri Programme by Pusa Krishi Incubator.

5.4 Be Analytics Driven for Continual User Focus

The analytics functionality within the NODE will enable stakeholders to gain insights and drive timely interventions. Analytics generated on the NODE data could help in two ways.

5.4.1 Improving Platform Performance, Design and Usage with Analytics

- **Improving platform design based on stakeholder usage:** Based on stakeholder interactions with the platform, the government can understand which services / features are most in demand and where stakeholders drop off to increase engagement. These could be used as inputs for the digital platform to improve the design (for example, design of one stop portals for farmers).

- **Improve user engagement:** Based on platform adoption and engagement data of farmers and service providers, analysis can be done to assess which farmer groups or service companies are using the platform to target inclusiveness, incentive alignment, etc., (for example, lowering of API fees, alignment of government resources).

- **Grievance redressal:** Grievances can be analysed to identify common pain points or root causes which can also be used to generate NODE ratings mechanisms (for example, application store ratings) for service providers.

5.4.2 Improving Services in the Ecosystem Delivered by the Government or Private Players

Analytics performed on activity data generated through the NODE can be used by government officials across policy and implementation at the central and state level for improving public service delivery.

Private stakeholders (service provider companies, start-ups) can use it for improving their services (design and operations).

Analytics use Cases for Public Service Delivery include.

Improve the Targeting of Government Benefits: Analytics on farmer application data for different services, key insights around adoption of benefits by different regions, communities, etc., could be leveraged to help realign the government's efforts and resources.

Prepare for Externalities: The government can prepare for externalities like conditions where there is potential for market glut or adversity based on supporting data like seed purchase data. For example, seed purchase data for a crop like tomato can indicate the area under tomato cultivation and its entry into the market. Early identification of troublesome crop disease patterns by analyzing pesticide sales data and weather and satellite imagery data can be very helpful to the farmer.

Assist in Long-term Policy Making: Aggregated NODE data could also be used for assisting policy making. Some examples include incentive alignment for different type of activities on the marketplace, fertilizer usage rationale based on soil health card information, and realignment of government efforts in areas like troublesome lending patterns (geography, community).

Improve Accountability: Data generated through the NODE could also be used for improving accountability of government officials like analyzing the time taken at different stages of application, reasons for rejection, etc., thereby helping improve internal accountability.

Analytics Use Cases for Non-Government Players like Ecosystem Service Providers and Start-ups

Improved Targeting of Services: Based on the type of data requests generated through the platform, service providers can identify key market gaps or opportunities. For example, based on lending pattern, fintech aggregators can target regions where lending penetration is low through innovative credit models.

Reduction of Fraud: Services like insurance can also reduce fraudulent claims with the NODE helping service providers identify fraudulent patterns. For example, scenarios where the farmer makes multiple insurance claims for the same crop.

Grievances/Feedback Patterns: Based on the large amount of grievances data assimilated through calls or Interactive Voice Response (IVR), key grievance concerns by all the stakeholders could be analyzed for improving services.

5.5 Enable Responsive Grievance Redressal

Grievance redressal is a key focus as there will be concerns for different stakeholders in areas like exclusion, accessibility, misuse of sensitive or personal data, breach of rules of engagement like data sharing agreements, etc. Effective grievance redressal will be integral in increasing trust and user engagement on the platform. It will also act as a source of data for identifying gaps which in turn could be resolved rapidly through policy and technology interventions. Lack of timely grievance redressal can lead to low engagement, thereby decreasing the number of platform stakeholders. For example, farmers who are unable to get their grievances heard or resolved will naturally tend to move away

from the platform. Though there are authorities like Data Protection Authority of India (DPAI) that have been proposed at a national level for all personal data related grievances, there is a need for targeted channels at the NODE level. Some of these channels are explained below.

Widespread Communication of Policies and Available Recourse: Leveraging online and offline channels to improve awareness through usage of SMS notification, CSCs, landing page of government websites, door-do-door campaigns, offline communication / support at the local *mandi,* etc.

Multiple Channels for Grievance Redressal (Offline and Online): Dedicated online channels through Kisan call center, IVR, WhatsApp handles, etc., need to be setup with continuous tracking of grievance redressal and clearly established timelines. Offline kiosks or identified village level contact points like Village Level Entrepreneurs (VLEs) and government officials could be used for capturing farmer grievances. Other stakeholders like service providers or start-ups will be provided with dedicated grievance redressal portals and a NODE level grievance redressal committee or office.

Leverage Existing Infrastructure and Creation of New Support Mechanisms: Enabling FPO communities, CSCs, and local agricultural offices as offline ground level contact points to represent or aggregate farmer grievances at the ground level. Where required, depending on the reach, new mechanisms like dedicated call centers, offline kiosks near local government offices, and the support of licensed agri input dealers could be leveraged to strengthen the touch points for farmers.

Dedicated Grievance Redressal Committee: Establish a dedicated committee to monitor, oversee, and set policies for the entire process. Data needs to be monitored centrally and failure to offer timely resolution or comply with needs should be met with immediate corrective action.

6 Governance

The Agri NODE, with its wide variety of stakeholders, needs to have a strong governance framework. The governance framework design needs to ensure fair value sharing while policing stakeholder behaviour, and implementing clearly articulated preventive and corrective measures. Accountability for NODEs needs to be ensured by both the laws and rules that govern the ecosystem as well as the institutions that uphold them. This will serve to increase trust, confidence and further engagement with the ecosystem.

Five key principles must be adhered to in order to establish a strong governance framework.

Key Principles for Strong Governance

1. **Define Accountable Institutions**

   Ensure a designated institution for the ODE and create the right legal and organizational structure, operating processes, etc., in line with its objectives. Promote multi-stakeholder governance involving key stakeholders, including government bodies, private actors, and individuals to enhance transparency.

2. **Establish and Align with Robust Rules of Engagement**

   Define clear rules around the responsibilities, rights, and liabilities of all actors in the ecosystem (government bodies, private sector participants, individuals), in adherence with domain specific laws and rules and other overarching national policies and frameworks.

3. **Create Transparent Data Governance**

   Outline clear standards and policies on data ownership, collection and contribution, consumption, and sharing, especially with respect to sensitive personal data. Ensure that these are easily understood and readily available to all users. Establish a set of mechanisms to monitor and drive adherence.

4. **Ensure the Right Capabilities**

   Nurture partnerships and establish Human Resource (HR) policies and practices to attract and retain the relevant talent required to successfully build and operate the digital platform.

5. **Adopt a Sustainable Funding Model**

   Develop a sustainable long-term funding model, which is aligned with the overall goals of the platform, to ensure uninterrupted operations and continuous user-focused enhancements.

In the following sections, we will discuss how each principle can be adopted for the Agri NODE.

6.1 Selecting an Accountable Institution

Need for an Accountable Institution:

A designated, accountable institution is needed to underpin the Agri NODE in order to ensure clear ownership for its success and failure. While there are multiple stakeholders responsible for different journeys, this institution will be the single point of accountability to drive the success of the NODE and act as a fail-safe to ensure continuity and engagement. In the Agri NODE, the accountable institution needs to primarily enable data sharing across the NODE and establish the rules of engagement for different stakeholders.

It is crucial to establish a set of principles to guide the selection of the accountable institution and ensure that it can carry out the required functions. These principles are listed below.

- Be the single point of ownership for E2E delivery and for the success and failures of the NODE. While delivery in distinct use cases may be the responsibility of different stakeholders, the institution needs to have both, the accountability and the authority to facilitate this across the ecosystem.

- Be the primary fiscal decision maker and own the budget and budgetary decisions related to the NODE.

- Make strategic decisions to set the future course and evolution of the NODE, including influencing relevant policy decisions and rules and standards that govern the ecosystem.

- Drive user adoption of the NODE – for both end-users and consumers, as well as, builders who will create solutions on top of the core building blocks.

- Facilitate the representation of key stakeholders in decision-making to ensure fair value sharing and responsible behaviors.

Ownership: As agriculture is a state subject, cooperation between the Centre and State is essential for the effective implementation of Agri NODE. The Agri NODE can explore a multi-stakeholder ownership model between the Central and State governments [for example, a Special Purpose Vehicle (SPV) or Public- Private Partnership (PPP) structure]. This ensures fair representation and shared accountability that is integral for the success of the NODE. Other agencies and departments like NABARD, Department of Financial Services, Ministry of Rural Development could also play a governing role. Finally, private players may also be invited as shareholders in a PPP structure.

Ministry of Agriculture and Farmers' Welfare: Being the central apex body in agriculture, the Ministry could formulate the required rules, regulations, and laws related to agriculture and guide all the stakeholders in the ecosystem.

State Departments: The respective state departments will bring the necessary representation and understanding of the on-ground reality with respect to data availability, quality, and farmer needs. The active involvement of state departments is critical to the success of on-ground implementation of initiatives related to the Agri NODE.

Leadership structure: Having the right leadership team is critical to drive decision-making and performance of the Agri NODE.

An initial illustrative composition has been indicated in Exhibit 8. However, this will require further work to identify the right set of stakeholders.

	Role	Composition
Board of Governors	• Develop the long-term strategy and make strategic decisions for the platform • Sign-off on key strategic and operational decisions • Ensure the right financing models and availability of funds • Acquire the right expertise to guide decisions, for example, those related to risk and ethics, technology choices; form sub-committees as appropriate for special projects	• Chief Executive Officer (CEO) • Ministry of Agriculture and Farmers' Welfare (MoAFW) • Principal Secretary, State Agriculture Department from the five zones of the country on a rotational basis [similar to National Health Authority (NHA)] • Representation from NIC • Domain experts from the agriculture sector • Representation from regulators like National Bank for Agriculture & Development (NABARD)
Management Team	• Develop the short and medium term strategy for the platform • Oversee the operational implementation of the NODE • Planning and budgeting • Ensure smooth operations; stakeholder management, partner management, etc. • Implement new and relevant policies established by the NODE. • Develop strategic partnerships with public and private sector stakeholders to engage in the NODE • Drive user adoption and engagement • Set, monitor, and review KPIs for the platform; identify new features, capabilities required • Resolve technical and operational issues	• Management team led by CEO
Expert Committees	• Provide technical and policy implementation advice to guide specific initiatives • Design adequate policies for platform governance (approved by	• Subset of board members and external experts • Policy advisory experts (for example, agriculture policy experts from NITI Aayog, think tanks)

	Role	Composition
	the Board) For example, establish data sharing standards	- Technical advisory experts [for example, experts from NIC, Unique Identification Authority of India (UIDAI)] - External experts with the experience of building large scale digital platforms across different sectors
Special Sub-Committees	- May be formed for specific topics of focus as when required by the board - Would be a combination of people from the board and management team - Establish relevant committees – these could include. - Technical Steering Committee - Data Policy Committee - Risk Management Committee - Grievance Redressal Committee	- Sub-committees would deliver recommendations on specific points of interest to the board (for example, interoperability standard, platform terms of usage) - Address specific concerns as when they arise in areas like grievance redressal, risk, new technical features, etc.

Exhibit 8: Key Roles and Responsibilities of the Leadership Structure

6.2 Rules of Engagement

In addition to a strong accountable institution and robust leadership structure, clear delegation of roles and responsibilities across stakeholders is needed to ensure that the Agri NODE is properly governed. Based on the interactions in the ecosystem, the Agri NODE consists of three different types of stakeholders.

1. Agri NODE Accountable Institution.

2. Data Providers – stakeholders who provide the data to NODE).

3. Data Consumers – those who use the data shared and built on the Agri NODE.

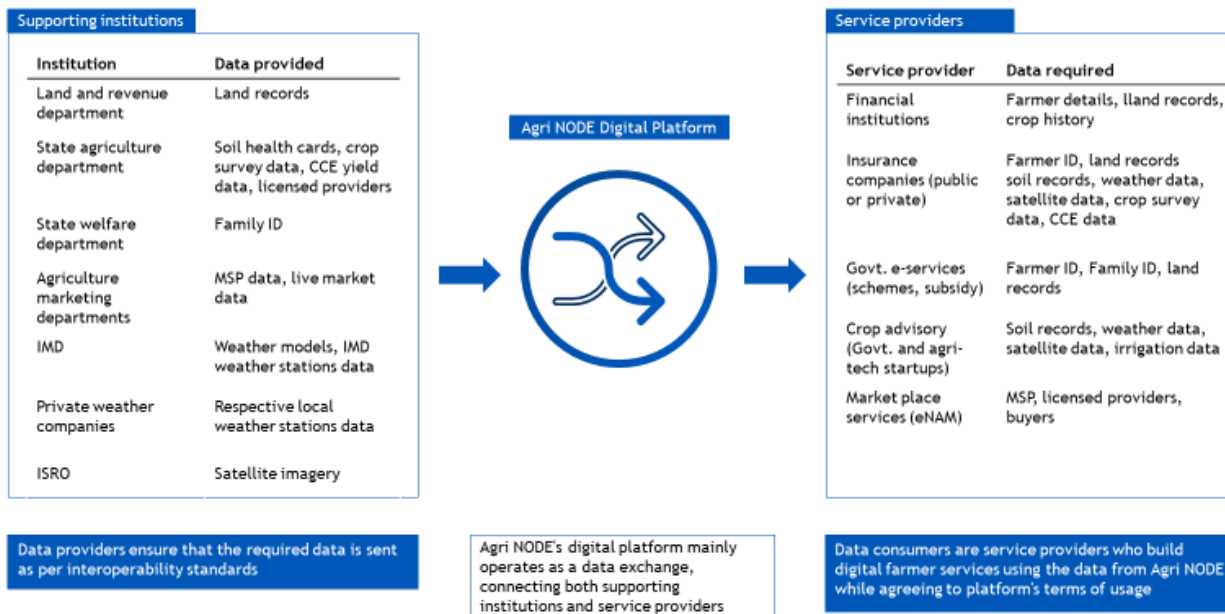This is illustrated in the Exhibit 9.

Supporting institutions

Institution	Data provided
Land and revenue department	Land records
State agriculture department	Soil health cards, crop survey data, CCE yield data, licensed providers
State welfare department	Family ID
Agriculture marketing departments	MSP data, live market data
IMD	Weather models, IMD weather stations data
Private weather companies	Respective local weather stations data
ISRO	Satellite imagery

Agri NODE Digital Platform

Service providers

Service provider	Data required
Financial institutions	Farmer details, lland records, crop history
Insurance companies (public or private)	Farmer ID, land records soil records, weather data, satellite data, crop survey data, CCE data
Govt. e-services (schemes, subsidy)	Farmer ID, Family ID, land records
Crop advisory (Govt. and agri-tech startups)	Soil records, weather data, satellite data, irrigation data
Market place services (eNAM)	MSP, licensed providers, buyers

Data providers ensure that the required data is sent as per interoperability standards

Agri NODE's digital platform mainly operates as a data exchange, connecting both supporting institutions and service providers

Data consumers are service providers who build digital farmer services using the data from Agri NODE while agreeing to platform's terms of usage

Exhibit 9: Different Types of Stakeholders in the Ecosystem

The key roles and responsibilities to be performed by the different types of stakeholders are explained below.

6.2.1 Roles and Responsibilities of the Agri NODE Platform

The key functions and responsibilities of the accountable institution are discussed in Exhibit 10.

	Roles and Responsibilities
Formulate Supporting Business Rules for the Ecosystem	• Create and update data sharing standards across different type of datasets with consensus and buy-in from respective data institutions • Drive implementation of legal policies and regulation, when required, for areas like adoption of standards, rules of data usage, etc. • On-board, register, and licences service providers who have agreed to the terms for usage of data • Open communication and design mechanisms for ensuring clarity and uniformity while adopting standards
Develop Key Building Blocks for the NODE	• Secure required funding for the NODE; either up-front investment or developing the right long-term sustainable funding models • Ensure that the technical platform of the NODE works to meet the required functionalities like data security, scalability, etc., while adopting global best practices

	Roles and Responsibilities
	• Ensure the security of data during the time of data exchange (within the NODE) • Perform vendor due diligence (technical experience, business experience, capability assessment) while outsourcing any key functions
Monitor and Manage the NODE	• Monitor adherence to interoperability standards by the data providers (machine readability, uniformity / nomenclature across fields and details) • Monitor adherence to the terms of use of data by the respective service providers (for example, no reselling data or misuse of data) • Address and manage grievances raised by various stakeholders of the NODE (for example, farmers on data misuse and exclusion, data providers on technical grievances, and service providers on grievances related to licensing and terms of usage) • Facilitate user on-boarding and drive adoption across different stakeholders through required handholding mechanisms, design of incentives, mitigating risks of exclusion, etc., by defining the targeted farmer

Exhibit 10: Roles and Responsibilities of the Platform

6.2.2 Roles and Responsibilities of Data Providers

The key function of data providers is to share the required data with the platform as per the agreed upon data sharing standards. In Exhibit 11, we share some of the key responsibilities of these stakeholders.

	Roles and Responsibilities
Adhere to Data Sharing Standards	• Adhere to data sharing standards set by the Agri NODE
Ensure Data Security and Reliability	• Assume responsibility for their own data security and authenticity while data is residing in their registries • Ensure the validity and accuracy of data through mechanisms like establishing continuous data update with source of data change, for example, land records, or deploying automated tools to monitor and control the quality of data
Remain Operational and Ensure up-time	• Ensure that their systems / infrastructure remain operational at all times to facilitate data exchange
Drive Vendor Compliance with Terms of Use	• Ensure that the implementation agency, vendors or internal employees engaged receive adequate knowledge to ensure compliance with interoperability standards

Exhibit 11: Roles and Responsibilities of Data Providers

6.2.3 Roles and Responsibilities of Service Providers

As the builders of farmer services on top of the digital platform, service providers or data consumers need to be responsible for using data or NODE services in line with the NODE terms of use. We share some of key responsibilities of service providers in Exhibit 12.

	Roles and Responsibilities
Operate as per Terms of Usage	• Adhere to the established terms of use of data, for example, do not share the data or information with any other party unless approved by the Agri NODE
Responsible for Data Security:	• Ensure security and integrity of the data sourced from the Agri NODE even in cases where the implementation is handled by outsourced technology providers (for example, a fintech company which can access the farmer data will be held responsible for security breaches either by itself or because of its vendor)
Responsible for Vendors	• Ensure that due diligence is completed with respect to the outsourced service providers and the due diligence report is submitted to the Agri NODE • Assume responsibility for compliance by its outsourced Technology Service Providers (TSPs) on NODE rules of usage

Exhibit 12: Roles and Responsibilities of Data Consumers or Service Providers

6.3 Data Governance

Data governance is a critical issue for the NODE for several reasons. The scale of personal farmer data exchanged will be unprecedented and the relevant rules need to be established for its collection, storage, sharing, and access by both public and private players. Further, considerable non-personal data will be exchanged by both public and private entities. A vast amount of data will be generated by public and private players due to interactions in the ecosystem, for example, data on the types of inputs or the type of fertilizer that farmers in a particular region are purchasing. This data is valuable as it can be further leveraged to unlock innovative solutions and products in the future. Mechanisms for access, sharing, and reuse of this data also need to be considered to maintain data privacy and sanctity. However, due to the nascence of the digitization efforts currently underway, the quality and reliability of data in the ecosystem is likely to pose a key challenge. For example, land records across states are still in early stages of digitization. This could lead to challenges related to an inability to scan non-machine readable records or lack of provision for continuous updates despite mutation changes due to inheritance, transfer of ownership, etc.

Considering the sensitivity, complexity, and variety of data to be leveraged within the NODE, a robust governance mechanism is needed to ensure maximum shared value creation. Concurrently, the relevant risk mitigation measures need to be implemented to reduce the risks stemming from data

aggregation, exposure of sensitive data, data misuse, and decrease in data sanctity due to lack of quality and reliability leading to low adoption.

Concerns need to be addressed across the different stages of the data value chain from collection and storage to sharing and usage. The key data governance areas that need to be addressed include 1. data security and privacy, 2. data quality, and 3. compliant or fair usage of data.

1. **Data Security and Privacy:** Given the confidential nature of data being shared on the platform, it is especially important to ensure its security and privacy, emphasizing the need to adopt 'Privacy by Design' principles.[11] For personal data, these include.

   - Privacy by default which requires clear purpose specification at the time of data collection

   - Limitation of collection to only what is necessary for the specified purposes

   - Minimizing identifiability, observability, and linking of personal information

   - Storing data only for the required duration

   - Adapting to existing personal data regulations and further sharing and usage with detailed consideration for consent and acceptable data usage where needed

   Additionally, E2E lifecycle protection must be applied to the data to ensure that it is kept secure, encrypted, and access controlled. Further, the platform needs to ensure strong accountability, openness, and transparency with respect to its policies and establishment of a clear complaint and redressal mechanism. Decisions need to be made regarding liability, considering that the ownership of data lies across multiple stakeholders. Clear regulations and frameworks need to be established by the NODE to ensure data security and its handling. To promote trust across the ecosystem, acceptable data security and privacy practices or standards need to be promoted by the NODE owner and adopted by different NODE players.

2. **Data Quality:** Considering the vast amount of data in the system being generated manually and digitally, there is significant risk with respect to data quality, reliability, and usability. Since the platform operates predominantly as a data exchange or hub, the onus for maintenance in terms of quality and adherence to interoperability can lie with the respective institutions who generate and / or own the data. Unless each of these institutions undertakes a set of actions during data collection, including regular data updates, reliability checks, etc., the ecosystem will face challenges. Detailed data quality guidelines and policies need to be articulated and adopted so that the collected data can be used in a reliable manner and for its intended usage. A team led by a Chief Data Officer (CDO) together with a set of Data Stewards can be created within the accountable institution for the NODE along with assigning dedicated data owners for respective dataset from the data provider side to coordinate with this team. This team can monitor adherence to the respective data quality standards and can intervene when needed to handhold the institutions in driving better standards in quality and interoperability.

3. **Data Usage:** Given the variety of data within the NODE, clear rules around data usage and sharing need to be established, along with a liability policy. Access to the data should be provided through a strict registration process which would require strong compliance to the terms of use. Different categories of users and service providers need to be created for selective access to

the data. Non-compliant entities will need to be held responsible under the requisite rules and regulations, for example, under the Personal Data Protection Bill 2019 (PDPB).14 Service providers should agree to be monitored through an audit framework.

Service providers should agree to be monitored through an audit framework. For promoting trust and supporting the entire process, clear data sharing agreements and data usage policies backed by legal regulations need to be formulated and enforced. Data sharing and usage agreements need to be based on a clear delegation of rules and responsibilities across different categories of stakeholders. This could include overarching authorities, NODE owners, data providers, and data consumers. Certain key areas including data ownership, accountability for data security and privacy during different stages of the transaction, dispute resolution mechanisms, etc., should fall under the purview of these agreements.

In order to ensure robust data governance, three types of actions can be taken (i) a set of robust rules and regulations should be established, (ii) a set of institutions can be appointed to create and enforce these rules, and (iii) a set of enabling tools and mechanisms can be actioned to provide support.

1. The domains / matters for which clear rules and regulations are required are listed in Exhibit 13.

Policy	Description	Implementation	Monitoring
Data Quality	Define acceptable data quality at scale. Clearly articulate responsibilities of the platform and data owner on issues related to quality Existing / Reference Standards: Data Quality Guidelines – US General Services Administration[12]	Adhered by data owners	Monitored by NODE
Master and Reference Data	Definition of the principles and tools needed to maintain a single version of reference for data and its attributes Existing / Reference Standards: CDER Master Data Management Policy[13]	Adhered by data owners	Monitored by NODE
Metadata	Definition of data attributes to characterize them in an unequivocal way and locate them in their lifecycle Existing / Reference Standards: Potential for adopting standards from Indian Council of Agricultural Research (ICAR)[14] for crop identifiers, soil features Metadata Standards by Agricultural Metadata Element Set (AGMES)[15] International Committee for Animal Recording's global standard for livestock data[16]	Adhered by data owners	Monitored by NODE

Policy	Description	Implementation	Monitoring
	e-GOV Metadata Standards[17] International System for Agriculture Science and Technology (AGRIS) application profile[18] CEDAR Template Model[19] Directory Interchange Format by Earth Sciences[20] International Organization for Standardization (ISO)/ (Technical Committee (TC) 134[21], ISO/TC 34[22]		
Data Security	Define the target best practices and standards to be adopted in terms of security. Clearly define the responsibilities of stakeholders for security, confidentiality, and privacy. Existing / Reference Standards: National Cyber Security Policy (NCSP)[23] Data Security Council of India (DSCI) Security Framework[24]	Implemented by NODE	Monitored by internal governance bodies
Data Architecture	Description of the target technologies, methodologies, standards, and best practices in data architecture Existing / Reference policies: Development and Environmental Professionals Associate (DEPA) by IndiaStack[25] Interoperability Framework for e-Governance (IFEG)[26]	Implemented by NODE	Monitored by internal governance bodies
Data Interoperability	Define interoperability standards with consensus across stakeholders Existing / Reference policies: Potential for adopting International Committee for Animal Recording's guidelines for data exchange[27] for livestock data exchange Open data alliance methodologies for sensor data exchange[28]	Adhered by data owners	Monitored by NODE
Data Privacy	Adoption of consent framework by MeitY and I Free, Prior and Informed Consent (FPIC), data anonymization, best practices in PbD (for example, 7 principles of Ann Cavoukian)	Implemented by NODE	Monitored by internal governance bodies. Additionally, periodic

Policy	Description	Implementation	Monitoring
	Existing / Reference policies: ECF by MeitY[29] FPIC Standard by the United Nation (UN)[30] DSCI Privacy Framework[31] ISO 27701 (Adapting to data privacy bill)[32] ISO / International Electronic Commission (IEC) 27018:2019[33]		external / third party audits can be undertaken.
Data Sharing Agreements and Terms of Usage	Articulate data sharing agreements and data usage policies with rules and guidelines on usage, monetization, re-sharing, terms of violations, penalties, etc. Existing / Reference policies: Australian Data Sharing Framework[34] Singapore Data Sharing Framework[35]	Adhered by service providers who use data	Monitored by NODE

Exhibit 13: Roles and Responsibilities of Service Providers

2. Data governance bodies can be created within the accountable institution to drive the creation of policies and strategic decisions related to data. Two such bodies could be.

- **Data Council:** Decision-making committee for all data-related matters, for example, policy approvals, conflicts on data quality and data management, etc., involving CDO, Chief Information Officer (CIO), Data Owners.

- **Data Architecture Authority:** Working group composed of CDO, CIO, Data Architects, and their respective resources for the design and development of the Agri data exchange or API gateway architecture and technology roadmap to enable the data sharing platform.

3. Finally, a set of supporting tools like data quality tools, master data management tools, and metadata tools can be created to support the data governance process. For example, clear data structures need to be established with the relevant artefacts to help manage and understand data. This can include.

- **Data Glossary:** Data terms and their commonly agreed definitions.

- **Data Owner Map:** Indicates the data owner and individual / team responsible for the quality of data.

- **Data Dictionary:** Describes the metadata (for example, location, type).

- **Data Flows:** Functional and technical flows of the data in different processes and systems.

6.4 Capabilities

The accountable institution will need to develop a set of core capabilities to build and operate the digital platform and manage the ecosystem. The right talent and expertise is critical for the success of the NODE. This can be sourced either in-house or outsourced to partners or vendors.

Based on the user journeys and proposed design of the NODE, as outlined in this document, six key capabilities have been identified that are integral for the successful build and operations of the Agri NODE.

- **Strategy and Planning:** Includes strategy setting, short and long term planning, creation and implementation of business rules, and policy implementation**.** This will require a mix of i) agriculture domain experts, ii) technology experts, and iii) government officials from state agricultural departments that will provide insights on state priorities.

- **Product:** Includes product development and platform integration. The goal would be to ensure that the technology and data architecture is in line with global benchmarks while the product development process is agile and robust. This would require a mix of people with capabilities to drive agile development process.

- **Data:** Includes setting interoperability standards and data management and security architecture capabilities.

- **Analytics:** Includes capabilities to identify business logic / requirements and translate these requirements into algorithms. Agri domain knowledge will also be required, given the specificity of modelling, for example, crop scenarios, insurance claims.

- **Partnerships:** Includes the identification and on-boarding of partners, vendors, and contract management capabilities. Requires expertise in Request for Proposal (RFP) creation, contract negotiation, reporting and service-level agreement (SLA) tracking, due diligence, and vendor audits.

- **Marketing and User Engagement:** Includes marketing, outreach, identification and on boarding of users, and monitoring their engagement. Requires the ability to coordinate, inform and motivate different stakeholders like farmers, government institutions and service providers to be part of the Agri NODE.

- **Operations:** Includes capability assessment to ensure that the requisite infrastructure and human capabilities are in place, talent management, performance monitoring and grievance redressal capabilities.

6.5 Funding Models

For the Agri NODE to have longevity, it needs to have a sustainable funding model to ensure operational continuity. The Agri NODE needs to consider funding needs across its lifecycle, including the design, build, and operate phases.

- **Initial financing** to bear the cost of design, build, and deployment of the Agri NODE. Cost of build includes pay-out to technology service provider and the cost of hiring and salaries for in-house talent. Deployment cost includes the cost of running awareness campaigns (offline, online) and beta testing groups before full scale launch.

- **Operational financing** to recover the cost of ongoing operations and new developments (upgrades / enhancements). Operations cost include cost for scaling, maintenance, employee retention, and user support.

Initial financing of the Agri NODE:

The Agri NODE needs to be initially financed using public sector or philanthropic capital. Public sector or philanthropic financing aids in the creation of a true level-playing field, facilities a competitive rather than monopolistic market, and keeps vested interests of different actors at bay (for example, prevent unfair value capture by private enterprises). These two financing mechanisms have been further detailed below.

Public Sector Financing: Includes central or state specific Information and Communications Technology (ICT) budgets or a portion of budget from the MoAFW.

Philanthropic Financing: Grants typically stem from three types of sources. These include, i) private foundations or development finance institutions, ii) corporate foundations, and iii) individuals via crowdsourcing campaigns or donations. In addition to monetary support, philanthropic contributions can also be extended through the provision of technology products and / or services, either free or at subsidized rates for the development of the Agri NODE.

Operational Financing of the Agri NODE:

Funding is required even post the launch of the Agri NODE to ensure operational sustainability. This sparks the need for large, recurring investment, which might become difficult to sustain with public sector / philanthropic grants alone. The Agri NODE needs to explore other funding models beyond public sector / philanthropic grants to enable self-sustainability while also being mindful of exclusion risk.

The Agri NODE can adopt cost recovery models for long-term sustainability by charging a fee for the services delivered and channelizing service fees to finance the ongoing operations. These models need to be agile so that they can change over time depending upon the adoption of the NODE. Initially, services can be offered free of charge to encourage adoption. With sufficient scale, revenue generation strategies can be implemented while ensuring that they don't become too prohibitive in nature.

Possible alternatives for cost recovery via user fee charge include.

Pay-per-transaction Model: Within the Agri NODE, transaction charges could be applied for marketplace services for each transaction for logistics players, private warehousing services, agriculture input providers, farm produce buyers, etc.

API Access: Charge fees from external players such as start-ups or service providers across lending institutions, advisory companies, and insurance companies for API access in consensus with data

providers of the NODE. As the final goal of the NODE is to provide improved services to the farmer, the cost of API access should not be too prohibitive. Fees could be charged based on a value sharing mechanism like reduction in loan processing cost (on-ground verification, offline to digital, time to process). Fee could also be charge on an operating cost + margin basis. For example, rich weather data pooled from IMD and private weather stations operated by multiple players can be provided through a single service. Revenue generated from the service can be shared back with the respective players depending on the amount of data contributed to the service, cost of generating data, etc.

Licensing Fee: An initial fee in the form of a licensing fee for buyers, input providers on the market place platform or any other service provider like financing institution, insurance provider, agro advisory company, etc. (cost recovery principle), can be charged.

Subscription Fee: A subscription fee could also be charged in different scenarios, as explained below.

- Players in the Marketplace: Traders, input providers, warehousing providers could be charged a minor subscription fee for their continued use of the platform.

- Service Providers / Start-ups could be charged with a subscription fee for continued usage of the platform.

7 Impact Potential

Initial estimates suggest that the Agri NODE could result in **USD 60-90+ billion (INR 5-7+ lakh crore)** potential benefit for farmers by 2030 through the unlocking of value across the farmer's journey. This is equivalent to a 1.5 times increase in income for adopting farmers. The wide-ranging benefits are described in Exhibit 14.

Driver	Description
Improve Access to Institutional Lending	The Agri NODE can enable farmers to access institutional lending which can lead to interest savings of approximately 10 percent
Improved Price Realization for Farmers	Market access can result in approximately 10-20 percent higher prices, resulting in a direct impact on farmer incomes
Higher Productivity due to Advisory and Custom Farming Solutions	Tailored crop advisory (and precision agriculture) can result in an approximately 10-20 percent increase in productivity

Exhibit 14: Expected Impact from the Agri NODE

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8 Way Forward: Roadmap

In order to initiate work on the Agri NODE and implement these ideas, a feasible starting point needs to be identified. This section presents a brief roadmap for the MoAFW to take this idea forward. We envision this to be a 3+ year's journey to build a scaled up platform across the three phases as explained below.

1. **Establish a Committee to prepare a DPR to Guide the Design and Implementation of the NODE (3-6 months)**

Committee Representation: The committee needs to have adequate representation with a mix of Principal Secretary level officials from State Agricultural departments, officials from the Agricultural ministry, National Informatics Center (NIC), MeitY and other personnel who have the experience in building a large platform like Aadhar, United Payments Interface (UPI), etc. Private sector participation should also be encouraged to understand their needs and perspectives for making the required design choices.

Expected Output of DPR: The DPR needs to address the detailed design and implementation plan for helping deliver the required digital platform, governance, and community layers required for the success of the NODE. Some of these are further explained below.

- Detailed design across all the layers of the digital platform to be laid out with an assessment based on the existing state of data maturity, available applications aided by farmer ethnographic research, etc. An initial Minimum Viable Product (MVP) design needs to be created as a part of the initial pilot for collection of quick feedback. DPR will also develop the RFP guidelines for onboarding of Managed Service Providers (MSPs) to assist with the building of the MVP and the digital platform.

- Governance design and implementation to be detailed with an analysis of potential options around ownership, design of rules of engagement, financing options, guidelines for data sharing, etc.

- For community, strategies around farmer inclusion and adoption, identification of ground level touchpoints, strategies for involving start-ups with support for co-creation along with required grievance redressal mechanisms to be detailed.

- A detailed financial modelling exercise to be performed covering projections for initial capital expenditure and ongoing costs. Based on the projections, suitable financing models to be explored along with guidelines (for example, cost-recovery, non-prohibitive in nature) for acceptable revenue generation mechanisms.

- A project phasing plan needs to be prepared and key milestones need to be identified to track progress and adapt the project management activities.

2. **Establish an Initial Core Organization and Onboard MSPs for delivery of the MVP (6-9 months)**

An initial organization needs to be established for delivering the required MVP. The structure should focus on developing capabilities around strategy and planning, technical architecture and design, etc., for the design and delivery of the MVP. The core organization structure would oversee the MVP implementation in coordination with MSPs. Some of the goals of the organization are detailed below.

- Onboard MSPs for supporting the build of MVP and digital platform only after undertaking adequate due-diligence based on RFP guidelines created as part of the DPR.

- Establish supporting governance activities like launch of policies and guidelines around rules of engagement, promotion of interoperability standards through required rules and incentives, etc., to create trust and engagement in the ecosystem.

- Engage with the community by setting up initial contact points, launching awareness campaigns, etc., for improving adoption. Establish of online and offline feedback loops to monitor the progress of the initial MVP.

3. **Scale up (12-24 months)**

The subsequent scaling up of the platform and widespread adoption would include the following.

- Scale the platform by opening up the ecosystem to more use cases combined with efforts to scale the existing use cases. This needs to be done only after the digital platform design has reached stable state and through learnings from MVP.

- Expand the developer and builder community by launching technical partnerships, creating developer friendly sandbox models, launching custom APIs to help scale the type of services built in the ecosystem, etc.

- Onboard large-scale institutions (major job portals, large scale government and private employers) by providing handholding support with activities like the launch of Project Management Units (PMUs) to guide the transition to NODE services.

- Drive end user adoption through large scale awareness campaigns and scaling of offline networks to support the job seeker adoption process. The grievance processes also need to be scaled and streamlined with dedicated policies and committees to ensure that scaling happens in a sustainable fashion.

Appendix 1: State of Key Data to be Operationalized for the Implementation of the NODE

Data	Current state
Farmer ID	- Initiatives currently underway for the creation of a unified farmer ID database - Alternatively, strong foundational ID such as Aadhaar could be used as Farmer ID while integrating with other key databases like land records for further details - PM Kisan has a large database of roughly seven lakh farmers with farmer IDs linked to land holding information
Family ID	Different state governments like Haryana and Rajasthan are trying to roll out family ID for unified targeting of government schemes
Digital Land Records	- Currently a land record modernization programme is underway as per Digital India Land Record Modernization Programme (DILRMP) guidelines - Computerization of land records has been completed in 87 percent of villages, mutation has been computerized in only 50percent - Real time update of Record of Rights has been done for only 21 percent villages - Geo-referencing is in a nascent stage - In a phased approach, core fields like land holding, survey number, village and district details could be accurately digitized. This will enable a shift to providing access to geo-tagged data, digital crop boundary details, and maps in later stages for advanced applications
Soil Health Cards	- Digital soil health cards are currently available on the Soil Health Card portal managed by NIC - Significant on-ground infrastructure setup required to keep this up to date - Need to provide API access as a number of start-ups currently face challenges in accessing data due to inefficient web scraping mechanisms, etc.
Crop Survey Data	- Currently, crop survey data is digitized in some states (Telangana, Karnataka, Rajasthan); while other states issue manual crop certificates - Need to establish data standards across respective state governments for crop identifiers, time stamps, etc.
CCE Yield Data	- CCE yield data is currently fully digitized with access to field level applications as part of Pradhan Mantri Fasal Bima Yojana (PMFBY) Programme. - While insurance companies now have access to this data, in the future crop advisory companies can leverage this data to build respective crop models

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Data	Current state
Licensed Input Providers	• Currently, the Department of Agriculture issues and renews licenses to verified providers • Data is captured in excel sheets and spread across multiple state portals and the unified farmer portal • As the data needs to be updated seasonally to provide information on the availability of seeds or varieties with providers, there is a need to create a central database on verified providers and their availability that can be updated frequently. This will help marketplace platforms to verify and onboard such providers.
Price Data	• Currently, the MSP is easily accessible on farmer portals • Even though market data from portals like eNAM is currently available, access through APIs is needed for real time aggregation. This will help service providers deliver market intelligence to farmers.
Weather Data	• Currently, IMD provides weather data on its website for free • Private weather companies like Skymet, National Collateral Management Services Limited (NCML) are sourcing data from their own weather stations • There is a need for a formal weather network like open weather to access multiple data sources, improving the density and accuracy of the data required
Satellite Imagery	• Satellite data for agriculture is currently handled by ISRO with Mahalanobis Crop Forecasting Center producing crop yield forecasts using the data • Despite the availability of some datasets on the Bhuvan portal operated by ISRO, there continues to be a requirement for short range and high frequency data. Though some players are accessing this data through a pay per service model, there is a need for more open collaboration and visibility to ensure close working with small scale players in Agri-insurance, advisory services, etc.

Exhibit 15: Status of Key Datasets across Different Stakeholders

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