सत्यमेव जयते

Department of Agriculture, Cooperation & Farmer Welfare

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Contents

1. Context of Digital Agriculture

1.1. Challenges of Agriculture Sector

1.2. Digital transformation of Agrifood Systems

1.3. Need for Ecosystem Thinking

1.4. Idea behind IDEA

2. The Idea Perspective

2.1. Digital Opportunities

2.2. IDEA Vision

2.3. IDEA Objectives

2.4. IDEA Value Proposition

3. IDEA Principles

3.1. Ecosystem Principles

3.2. Architecture Principles

3.3. Business Principles

3.4. Technology Principles

3.5. Architecture Governance Principles

4. IDEA Architecture

4.1. Building Blocks

4.2. IDEA Architecture

5. IDEA Standards

5.1. Standards Landscape

5.2. Approach to developing standards

5.3. FAIR Standard- a possible game changer

6. Implementation Framework

7. Conclusion

ISSUES FOR CONSULTATION

Annexures

1. Context

1.1. Challenges of agriculture sector

India's agriculture sector accounts for about 15.9 % of the country's US$ 2.7 trillion economy and 49% of employment (2018-19)[1]. Viewed from the socio-economic point, agriculture is the most important sector that needs focus and attention at all levels. The call of the Government of India to achieve the goal of Doubling Farmer's Income (DFI[2])by 2022, in a way, epitomizes the need to pursue all possible ways of increasing the agricultural productivity and profitability of the farmers. It also touches upon the need to accelerate our efforts to achieve the Sustainable Development Goal of ending hunger, poverty, and malnutrition in a sustainable manner. Agriculture cannot be seen in isolation. It should be seen as an integral part of a larger ecosystem spanning the entire primary sector including horticulture, animal husbandry, fisheries, dairy, poultry, and other allied activities.

Several studies undertaken recently in India, including the one on DFI have brought out the problems afflicting the agriculture sector. The recommendations of these studies include, *inter alia*, ensuring timely availability of inputs, an increased focus on measures to enhance the productivity - especially of small and marginal farms, adoption of modern agricultural practices, optimal use of inputs, choice of the right crops through macro and micro-level planning, availability of near real-time information on prices and markets, enhanced efficiencies in the post-harvest operations like storage, logistics and food processing, affording the farmer a greater role and share in the value chain, diversification, and above all, addressing the issues relating to information asymmetry across the entire agricultural cycle. Such long and complex agenda calls for a concerted action both on the policy and implementation fronts, in the form of *Green Revolution 2.0*.

The major challenges of the agriculture sector are:

a) Food Sufficiency but Nutrition Deficiency.

b) High import of edible oil and oilseeds.

c) Yield plateaus.

d) Degrading soil, Water stress.

e) Inadequate market infra/linkages.

f) Unpredictable, volatile prices.

g) Post-harvest losses, wastages.

h) Lack of crop planning due to information asymmetry.

1.2. Digital Transformation of Agrifood Systems

Digital technologies are transforming all the sectors of the economy and the society in innumerable ways. Communications, banking, payments, travel, energy, healthcare, taxation, and governance have significantly benefited by deploying digital solutions. Agriculture and allied sectors call for '*doing more with less*' if the challenges depicted above are to be overcome effectively or more so converted into opportunities to leapfrog. In a recent report the World Bank Group has underpinned the need for the agriculture sector to embrace digital technologies. '*The digital revolution—and the data it generates—are key to building an agriculture and food system that is efficient, environmentally sustainable, equitable, and able to link the world's 570 million farms with 8 billion consumers*'. The Bank has suggested 7 strategies to achieve the much-desired digital transformation. These are depicted in Figure 1:

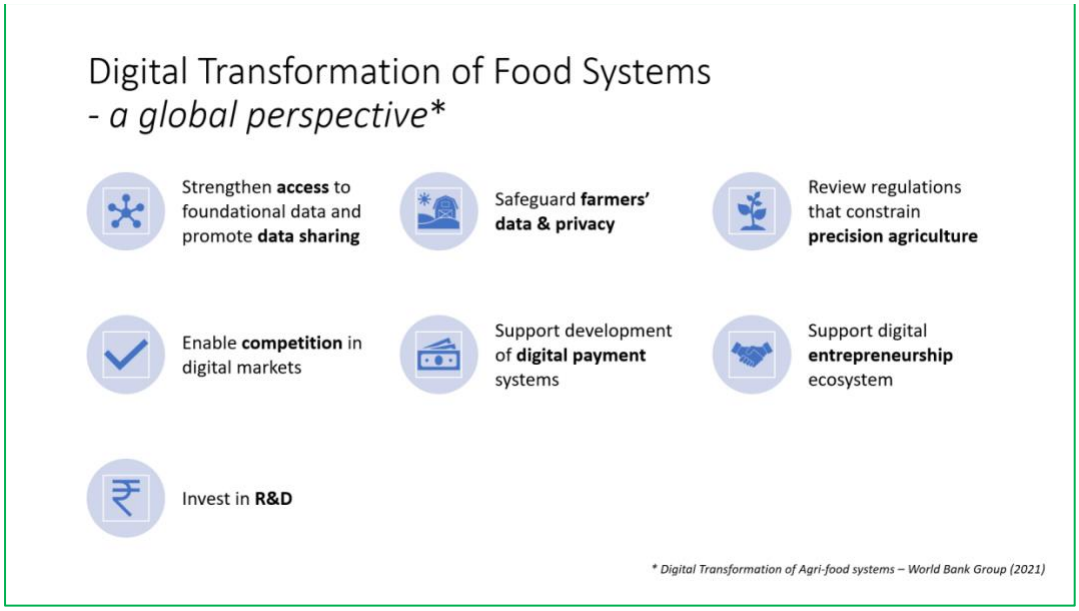


Figure 1: Global strategies for transforming food systems

A holistic approach to adoption of digital technologies, the critical role of data, the requirement to ensure that the farmer has agency and control over his/her data, the paramount importance of privacy through protection of personal data, and the need to leverage emerging technologies for precision agriculture are key takeaways from the global perspective.

1.3. Need for Ecosystem Thinking

Agriculture sector is a large, diverse, heterogeneous, complex, and sensitive ecosystem. Any attempt to transform the sector needs to imbibe an *ecosystem thinking* and a digital ecosystem.

A digital ecosystem is a distributed, adaptive, and open socio-technical system with properties of self-organization, scalability, and sustainability.

The agriculture value chain extends from crop/ varietal selection and crop management to the market. It involves public and private players in agricultural inputs and services as also logistics. Establishing a digital ecosystem of agriculture needs to take a long-term view of aspects like interoperability, data governance, data quality, data standards, security and privacy, besides promoting open innovation. A significant requirement is adoption of a decentralized, federated architecture that assures autonomy to the service providers and all other actors and ensures interoperability at the same time.

1.4.The idea behind IDEA

Against the above backdrop, the Department of Agriculture, Cooperation and Farmer Welfare (DoAC&FW), Government of India (GoI) constituted a Task Force (TF) and a Working Group (WG) consisting of domain experts and technology experts to design a blueprint for digital agriculture. The TF co-chaired by Sri Sanjay Agarwal, Secretary MoAC&FW and Sri J Satyanarayana, former Secretary MeitY, GoI and coordinated by Sri Vivek Aggarwal Additional Secretary DoAC&FW, met 8 times during 2019-21. The compositions of the TF and the WG are given in **Annexure 1 and Annexure II respectively.**

The TF and the WG realized quite early that an ***ecosystem approach*** was the only way forward to address the agriculture sector holistically. Moreover, it was felt appropriate to draw from the national architecture principles and patterns designed by the Ministry of Electronics and IT, especially the India Digital Ecosystem Architecture (***InDEA***). Accordingly, the initiative was named IDEA ('InDEA Digital Ecosystem of Agriculture').

The Ministry aspires that the IDEA initiative would place the farmer in the centre of the agriculture ecosystem leveraging open digital technologies. Some of these aspirations are articulated succinctly below.

The farmer takes informed decisions on what **crop** to grow, what **variety** of seed to buy, when to **sow,** and what best practices to adopt to **maximize the yield**.

The **agriculture supply chain** players plan their production and logistics on precise and timely information.

Precision agriculture becomes a reality with access to the right information at the right time.

Farmers know whether to sell or store their produce, and **when, where and at what price to sell.**

Farmers get the benefits of innovative solutions and personalized services driven by **emerging technologies** with protection of privacy.

2. The IDEA perspective

2.1. Opportunities

Digital technologies, and especially the emerging technologies like AI/ML, IoT and DLT open immense opportunities, if we create the right architecture and an enabling environment. Figure 2 gives a bird's eye view of the array of opportunities that the IDEA initiative can create.

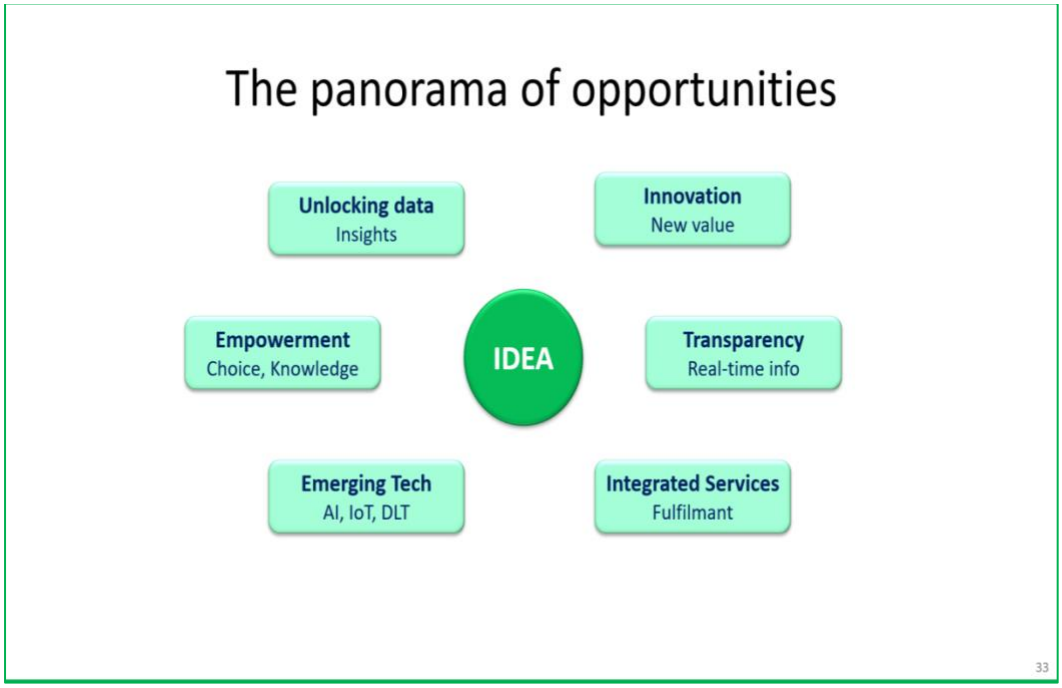


Figure 2: Opportunities provided by IDEA

2.2. IDEA Vision

The following vision statement reflects the medium- and long-term outcomes sought to be attained by the IDEA initiative.

> *"To build a **National Digital Agriculture Ecosystem**, to elevate Indian Agriculture Sector to higher levels of efficiency and productivity, and to improve the welfare and income of farmers"*

2.3. IDEA Objectives

The objectives of National Digital Agriculture Ecosystem are as follows:

1. To enable the farmer to realize **higher income and better profitability** through access to **right information** at the right time, and from innovative services.
2. To enable **better planning and execution** of policies, programs, and schemes of the Central and State governments, and, also of the private sector and Farmers Producer Organizations (FPOs)
3. **To enhance efficiencies** in the usage of resources including land, water, seeds, fertilizers, pesticides, and farm mechanization by providing easier access to information

4. To provide **location-specific** and personalized extension services across agriculture lifecycle, with simultaneous protection of privacy of personal data.
5. To build **capacities** across the gamut of digital agriculture and precision agriculture
6. To promote adoption of **standards** for interoperability and seamless exchange of information across ecosystem, while ensuring that he digital rights are properly managed.
7. To give a fillip to **R&D and Innovations** in agriculture through access to high-quality data
8. To adopt the best principles of **cooperative federalism** while working with the states and union territories for the realization of the vision of IDEA.
9. To formulate and leverage PPP frameworks for realizing the '*power of the digital*'.

2.4. IDEA Value Proposition

In line with the value-centric, and stakeholder-centric approaches required to build the digital ecosystem of agriculture, a mapping is done around the major stakeholders and the related 'value nodes.' The result of the mapping is depicted in **Figure 3**.

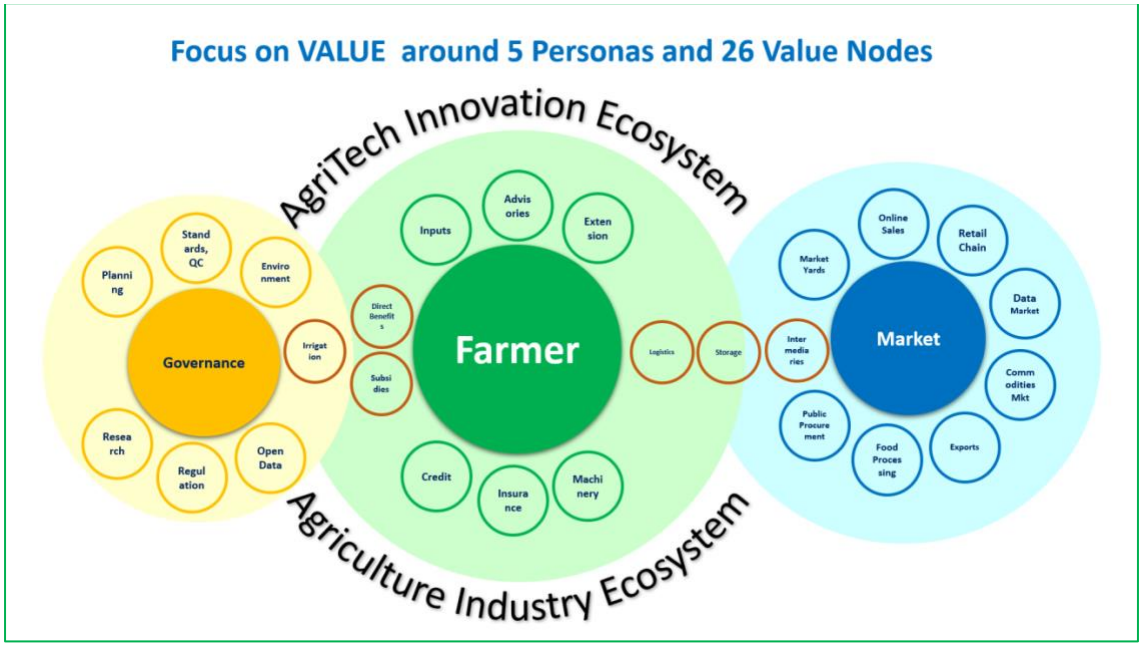


Figure 3: Mapping of agriculture value chain

The salient features of the agriculture value chain are given below:

a. The value is mapped around 3 direct stakeholders – farmer, governments/ governance and the market, and 2 supporting ecosystems – Innovation and Agri Industry.

b. 'Value nodes' are functional areas in which value can be enhanced or new value created through innovation.

c. The big picture view enables interrelationships of various value nodes to be visualized and leveraged for realizing value on an end-to-end basis.

d. The objectives of IDEA highlighted in section 2.3 can be realized by planning all activities around the value nodes.

e. The list of value nodes is non-exhaustive and can be modified or enhanced depending upon the context of design and implementation.

3. IDEA Principles

Any large and complex system can only evolve around a set of commonly agreed principles. Multiple systems in the ecosystem can be designed or redesigned to align with the common principles to ensure interoperability-by-design and conformance-by-design. The Ministry of Electronics and IT, GoIin its ongoing initiative on **InDEA 2.0** has formulated a comprehensive set of principles for guiding the design of digital ecosystems. It addresses the requirements of the Ministries, States and Departments embarking on a holistic digital initiative. The set of InDEA 2.0 principles is proposed to be leveraged for designing the IDEA Architecture. These principles are to be considered for adoption by the Central and State Governments as also all the private entities of the agriculture ecosystem.

The **IDEA Principles** are presented below in 5 categories.

3.1. Ecosystem Principles

1. **Ecosystem Thinking**: Design all digital initiatives as *ecosystems*, and NOT as *systems*.
    - Ecosystems span across Centre and States, public and private, and are composed of several autonomous, interoperable, and federated systems.

2. **Building Block approach**: Architect and design systems and ecosystems in terms of **minimal and reusable** Building Blocks.
    - Categorize the Building Blocks as Core, Common or Reference Building Blocks basing on the degree to which they are to be decentralized. All the building blocks shall be able to evolve **orthogonally,** thereby meaning that any building block can be modified without requiring the other building blocks to make any consequential changes.

3. **Open API-based**: Adopt the principle of 'Open-API by default'. Exceptions shall be justified.

4. **Open, Open and Open**: Design the digital systems to be built on open source, to be published as open source, and to conform to open standards. Exceptions shall be justified.

5. **National Portability**: Design national digital systems and platforms for portability across India.

- Factor the requirements of localization and diversity, inclusion, and special needs.

6. **Participatory Design**: Drive participatory design and end-user engagement at all stages of the digital initiative.
    - To enable this, establish a set of robust and transparent rules of engagement for the ecosystem players.

7. **Innovation**: Enable and promote innovation, and 'responsible' deployment of emerging technologies. Establishing an 'ecosystem sandbox' can be good enabler of open innovation.

3.2. Architecture Principles

1. **Federated Architecture:** Adopt a Federated Architecture model for designing digital ecosystems – especially data and applications.
    - Architect around the constructs of **Single-Source-of-Truth**, **System-of-Records, and 'unbundled applications'.**

2. **Agile Architecture:** Permit the architecture to evolve in an agile and iterative manner.
    - Do not restrict or constrain the potential by being prescriptive when not necessary. Adopt the principles and methods suggested in Agile IndEA Framework[3]

3. **Technology Independence:** Architect systems to be technology-independent.

3.3. Business (Domain) Principles

1. **Value-driven:** Focus on providing additional or new value to the user. Plan to Define, Design and Deliver **value**. (Pl see **Figure 3**)
    - Measure service levels (planned and achieved), impact and outcomes.
    - Adopt the methods suggested in Digital Service Standard[4].

2. **Integrated Services**: Identify, design, and deliver integrated services that cut-across agency boundaries - public and private, to realize the goal of Connected Government.

3. **Outcome-driven**: Define service levels and outcomes benchmarking with the best and build services around such outcomes. Work backwards to re-engineer the processes - where necessary.

4. **Choice**: Provide choice, by design, to the farmer.

5. **Universal Access**: Ensure that the digital services are accessible to all the target groups, including those residing in remote areas and to the disadvantaged groups. Ensure that the benefits of IDEA reach small and marginal farmers.

3.4. Technology Principles

1. **Cloud First**: Adopt the principle of Cloud First or Cloud-by-default and leverage the full range of benefits offered by the cloud technologies.

2. **Mobile First**: Design the delivery of all digital services through mobile by default.

3. **Data is an asset**: Design data systems in a manner that creates, supports, maintains, and enhances value to the ecosystem. Promote establishment of *Data Exchange(s)* that enable regulated exchange of data for public purposes, innovation, and research, and for permissible commercial purposes.

4. **Data sharing:** Lay down clear policies specific to the agriculture domain that enable and regulate the sharing of data, in conformance with the applicable **data protection regulations**.

5. **Standards**: Specify the existing technology and data standards applicable to the ecosystem and define methods to ensure compliance with the same. The technology standards recommended by IndEAFramework[5] may be followed.

6. **Privacy-by-Design**: All entities participating in IDEA shall ensure to protect the personal information and publish a privacy policy(ies) that conform(s) to the principles of Privacy-by-Design.

   Security-by-Design: All entities participating in IDEA may design and enforce a cybersecurity policy that conforms to the principles of Security-

by-Design, and an ISMS (Information Security Management System) that conforms to the ISOs relating to information security.

4. IDEA Architecture

Designing the architecture for an ecosystem is a new concept. While Enterprise Architecture has been well established globally, it is not so with Ecosystem Architecture. The concepts like National Public Digital Platform, National Open Digital Ecosystem are emerging in India. A few attempts are in the offing in this area – National Digital Health Blueprint (NDHB)[6] and National Digital Education Architecture (NDEAR) are examples in point. InDEA 2.0 is an ongoing effort of the Ministry of Electronics and IT, GoI to create a set of reference architecture patterns for designing ecosystem architectures by various Ministries and States.

InDEA 2.0 has proposed a set of Architectural Patterns meant to be adopted up by the Ministries of GoI, State Governments or small departments to design their own ecosystem architectures. The IDEA Framework adopts the **Domain Architecture Pattern** proposed by InDEA 2.0 and customizes it to suit the needs of the agriculture domain (ecosystem).

1. Building Blocks

The architectural patterns are defined in terms of Building Blocks. It is expedient therefore, to define the term 'Building Block' in the architectural parlance.

A Building Block is a reusable package of business or technological functionality.

Representing an architecture in terms of a set of building blocks brings the following advantages:

a. The functionality can be reused in toto in multiple use cases and solutions with a marginal effort, thereby cutting down design and development time.

b. The specifications and requirements of each building block can evolve independently of other building blocks or components, adding greatly to the flexibility and innovation.

c. Building blocks can be made to interoperate with other building blocks in a standard way, through pre-defined APIs, thus making the integration of the systems and ecosystems easier and faster.

d. Since a building block is technology-agnostic, it should be possible to realize a building block in several different ways without impacting the boundary or specification of the building block.

e. In substance, a building block may comprise of data, application, or a set of interfaces.

Figure 4 is a technical representation of a typical building block. While TOGAF has recently introduced two types of building blocks, namely Architectural Building Block (ABB) and Solution Building Block (SBB)[7], it is felt adequate to use the term Building Block to represent both in the context of IDEA.

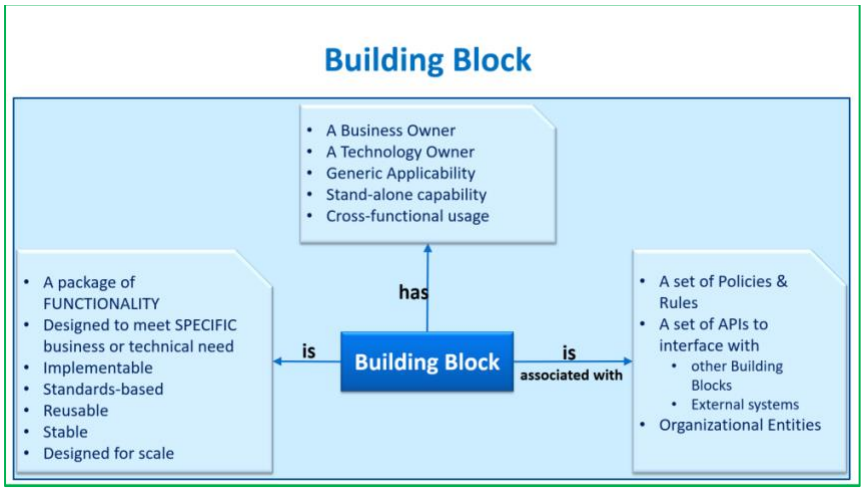


Figure 4: Building Block defined.

In line with InDEA framework, Building Blocks are categorized into three - depending on the degree to which they are decentralized. These are defined below:

a. **Core Building Blocks**: A core building block acts as the single-source-of-truth at the national level or provides a centralized functionality required for interoperability. By virtue of their critical and central nature, the core building blocks are designed, developed, and maintained by the government.

b. **Common Building Blocks**: A common building block is a reusable functionality or application with the key objective of ensuring uniformity and / or to prevent duplicative development work. Common Building Blocks are developed and hosted by the Ministry on a multi-tenant framework, and can be shared by the States and other ecosystem entities optionally.

c. **Reference Building Blocks**: A reference building block has a generic functionality which can be customized as needed. It is developed by the Ministry and the code is published as open source for download by the States or private sector organizations.

2. IDEA Architecture

The IDEA architecture is derived from the 'InDEA Domain Architecture Pattern', by including the core, common and reference building blocks relevant to the agriculture sector.

Figure 5 represents the IDEA Architecture. The salient features of IDEA Architecture are described in what follows. (an enlarged figure is provided in **Annexure**)

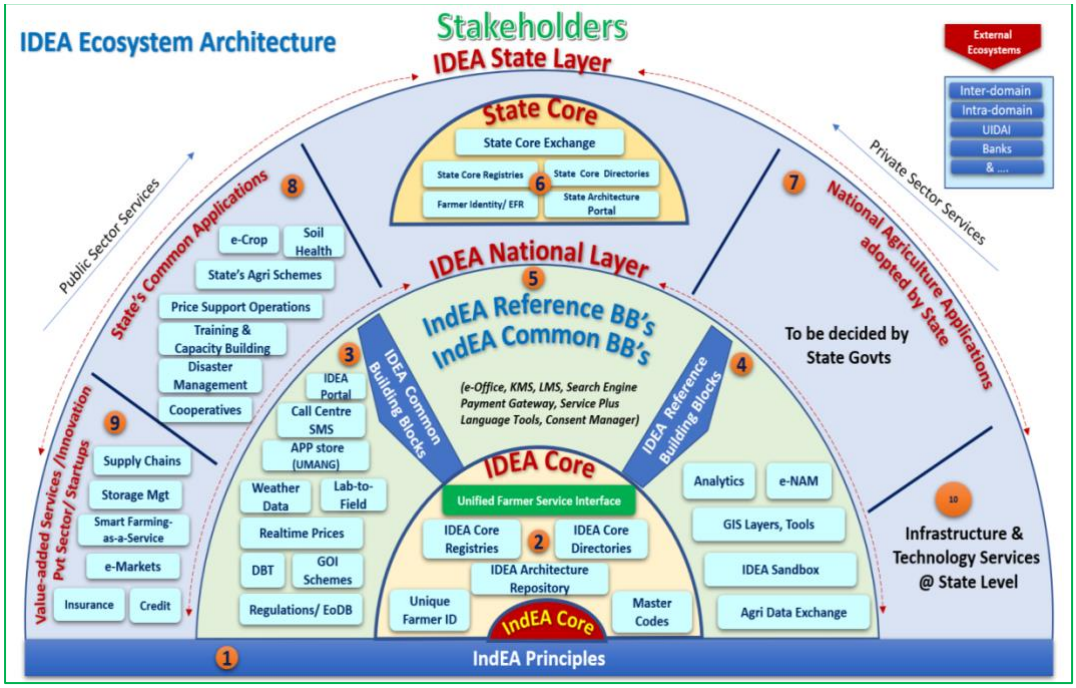


Figure 5: IDEA Ecosystem Architecture

Salient Features of IDEA Architecture

IDEA is a layered architecture and is federated. Core layer, national layer and State layer are independent but are interoperable as per need.

The architecture is crafted in 10 major components, serially numbered, and explained below.

1. **InDEA Principles**have been adopted in toto. These are stated in section 3 above. All the entities participating in IDEA may comply with these principles.

2. **IDEA Core**: IDEA Core has the minimal but foundational building blocks, required for most other building blocks and most of the entities participating in IDEA.

i. **Unique Farmer ID (UFID)**: A unique **number** assigned to every farmer, and unique across the country. It is a random number. The role of the UFID building block is

   i. to validate that the demographic details and the associated identifier (Aadhaar Number, Mobile number, or other permitted ID)provided for assigning the UFID are unique across the country

   ii. to generate and return the UFID, the validated identifier, and demographic data to the authorized seeker

   iii. to store a copy of the UFID, the demographic data and the validated identifier, and

   iv. to authenticate the user when an API call for authentication is received along with UFID, using a multi-factor authentication mechanism as prescribed.

   v. The regulations applicable to personal data shall apply to the UFID database, to protect the privacy of personally identifiable information.

   The UFID Building Block DOES NOT CAPTURE OR STORE any transaction data.

ii. **IDEA Core Registries**: Core registries are a set of databases that contain the unique identifiers of entities, products or services required to be registered with an authority of the Central Government under a statute, rule, or notification. An entry to the any of the Core Registries can be made only after the designated statutory authority has approved its registration. Each registry contains details of the registered entity, product, or service, along with its identifier, registration particulars, period of validity, location(s), and other details required to be provided while seeking registration.

iii. **IDEA Core Directories**: Core directories are lists of entities, locations, products, authorities, offices, and services maintained centrally for administrative convenience and easy reference by the user systems across the country. They contain information akin to that in a registry, except the registration details, as it is administrative but not statutory in nature.

iv. **Master Codes**: Master codes are identifiers of locations, products and classifications that need to be adopted uniformly by all organizations across the country, for uniformity and interoperability.

A non-exhaustive list of Core Registries, Core Directories and Master Codes is provided in Annexure III.

v. **Unified Farmer Service Interface (UFSI)**: UFSI is the most important CORE Building Block of IDEA. It plays a unifying role.

UFSI is envisaged to play a role comparable to **UPI** (Unified Payment Interface) in the space of digital payments. While UPI has transformed the payment systems by optimizing the underlying processes and providing a set of APIs for identification, authentication, and authorization, UFSI is required to handle multiple types of transactions in the digital agriculture space. Hence, the design, development deployment, and management of UFSI is likely to be more complex. The following considerations should weigh with the design of UFSI.

a. Given that majority of the digital services and transactions in the agriculture space happen within the State jurisdictions, a monolithic architecture of UFSI would pose problems of management and scalability. A federated architecture is preferable.

b. GoI can establish the first instance of UFSI to handle services and transactions (i) involving the central government or its agencies, and, (ii) pan-India or cross-border (intra-national and international) transfer of data.

c. The States will have the option of joining the national UFSI to meet their data exchange requirements or establish their own FSI and federate the same with UFSI. The architecture of FSI's can follow the prototype of UFSI for faster implementation.

d. Private agencies may register and operate on the UFSI or FSI or both depending on the nature and geographical spread of their operations.

e. An active collaboration of the Ministry with NPCI (National Payments Corporation of India) would lead to a faster design and implementation of UFSI.

Figure 6 provides a high-level view of the UFSI. Essentially UFSI enables the data providers and data consumers to exchange data in an efficient, transparent and streamlined manner.

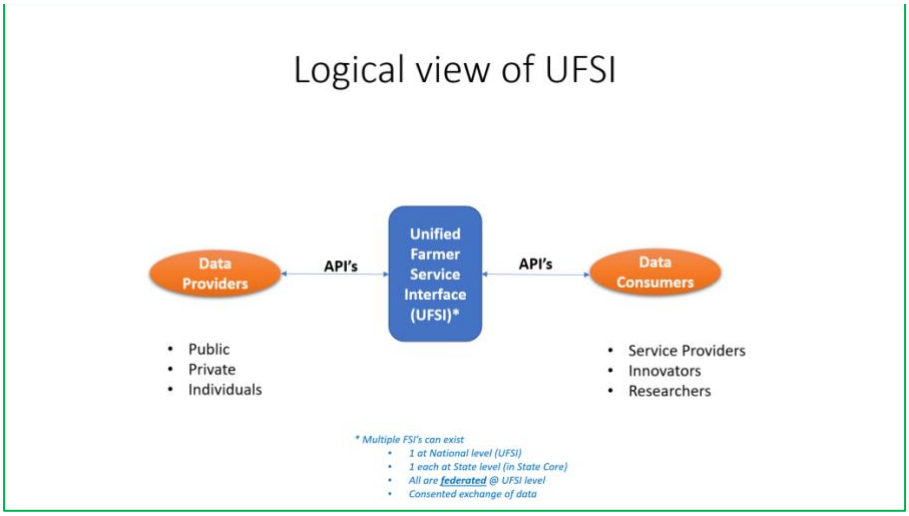


Figure 6: Unified Farmer Service Interface

vi. **IDEA Architecture Repository**: IDEA is not a static document. It evolves with need to accommodate more functionality in some of the building blocks, with the advancement of technologies and emergence of innovative products and solutions. Keeping this in view, IDEA architecture shall be developed as a dynamic portal. All the artefacts, building blocks and code updated continually, would be hosted on the IDEA Portal. The portal will have the requisite features like user registration, authentication and authorization, search and discovery, performance monitoring, downloads, alerts and notifications on updates, FAQs, adoption toolkits and help desk. IDEA Portal shall eventually be a one-stop-shop for all architectural needs of the ecosystem. The portal will offer **IDEA-as-a-Service**.

The example of South Korea in this area is quite instructive.All the common modules and common components required by most of the public sector organizations have been designed and the source code with instructions for deployment is hosted on a common portal (https://egovframe.go.kr/eng/main.do). This has reduced duplicative work.

3. **IDEA Common Building Blocks**: The high-level functionalities of the ten IDEA Common Building Blocks are mentioned below. These are *register-and-use* or *subscribe-and-use* or *plug-and-play* applications with configurable functionalities, with a short time to deploy, typically a week at the most.

IDEA Common Building Blocks

i. **IDEA Service Portal**: IDEA Service Portal (different from IDEA Architecture Portal described earlier), provides the user interface for all the stakeholders. It has all the dynamic and interactive functionalities to deliver a wide range of information and e-Services offered by the Ministry and its associated departments and agencies to farmers, agri-industry, supply chain actors and officials of the Ministry and the States. **IT IS A ONE-STOP-SHOP** for all the domain services delivered by the Central Governments to its stakeholders**. It shall comply with the Digital Service Standard notified by MeitY**.

ii. **IDEA App Store**:IDEA App Store (**IAS**) translates the principle of Mobile First into reality. It is designed and built adopting the Enterprise App Store (EAS) architecture, standards, and features. IAS is a one-stop-shop for all the apps developed by the Ministry. It will subscribe to the **UMANG** platform established by MeitY GoI and extends it by additional functionalities specific to the agriculture sector. It will have multi-lingual capabilities.

iii. **Call Centre**: The existing Kisan Call Centre system(s) may be re-aligned to be in tune with the IDEA principles and integrated.

iv. **SMS (Messaging)**: In the context of farmer-specific, farm-specific, personalized advisories being possible with the implementation of IDEA, the existing arrangements for sending out SMS advisories may be reviewed and aligned to IDEA. Use of chatbots may also be made part of the communication plan.

v. **Weather Data**: Multiple sources of weather data exist. This Building Block organizes the data into open and priced, and acts as a single point of access to the multiple datasets on weather through standard APIs.

vi. **Lab-to-Field**: A well-established network of Agriculture Universities, Research Stations, and the specialized research institutions of ICMR dot the country. They create significant amount of cutting-edge knowledge on new crop varieties and crop management methods. The **Lab-to-Field Building Block** will be designed to be the storehouse of all such knowledge and good agriculture practices and available through appropriate APIs to not only the extension officers of the central and state governments but also to the innovation ecosystem and agri-industry. **The objective is to ensure that there is very little lag between the creation of knowledge and its widespread use by the farmers**.

vii. **Real-time Prices**: This is one of the most pivotal building blocks that affects the agriculture economy. This building block provides an integrated access to the vast amount of data on prices of agricultural commodities across the country and abroad. A large number of innovative solutions useful to the farmers and market players can be built around this building block.

viii. **DBT**: The multiple benefit schemes of the Central Government relating to the Farmer are brought together in a unifying environment, with efficiency, transparency, and farmer-centricity as the goals. This building block shall operate in a **truly federated manner**, architecturally and operationally.

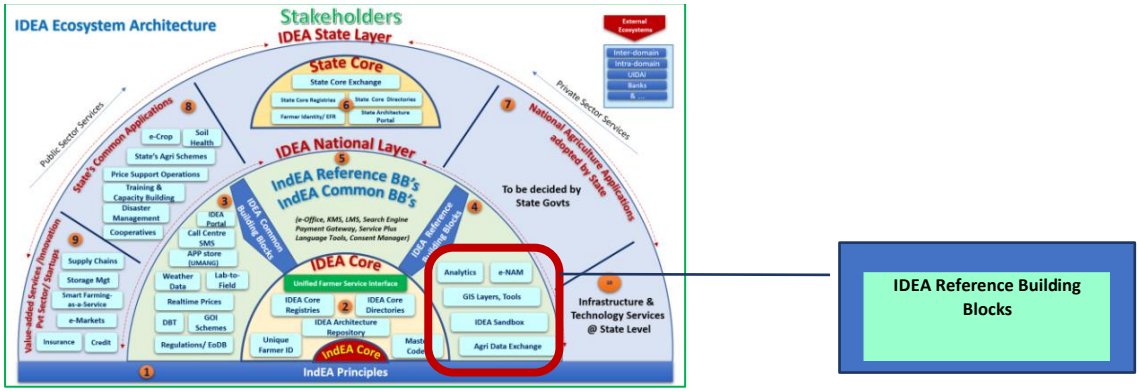
ix. **GoI Schemes**: This building block brings uniformity in the way multiple schemes of GOI relating to agriculture and farmer welfare are delivered. Integrated delivery and cross-referencing of the beneficiaries across multiple schemes is a desirable feature, subject to the applicable consent requirements. Monitoring, analytics, and impact analysis can be achieved in an integrated/ coordinated way.

x. **Regulations and EoDB**: This building block addresses the need for re-engineering, simplifying and reducing paperwork relating to obtaining licenses and permissions for a wide range of agri-businesses. Its twin-goals are to enhance Ease-of-Doing-Business and effectiveness of enforcing the agri-related regulations.

The States can emulate these building blocks in designing and implementing their own applications in consonance with the above.

4. IDEA Reference Building Blocks

Reference Building Blocks are applications with generic functionality available for download and customization. These are preferably built using open source software, products and components. An illustrative list of five reference building blocks is included in IDEA Architecture. These are briefly discussed below.



i. **Analytics**: These are tools useful for general statistical analysis or those developed for analytical needs specific to the agriculture sector. Examples of the former are monitoring of trends of crop sowing, crop condition, results of CCEs, physical and financial progress in implementation of GoI programs. Examples of the latter are – tools for prediction of commodity prices, market intelligence and weather prediction. It is desirable that a set of tools that can yield quick results are identified, enhanced to meet the IDEA principles and standards, and positioned as reference building blocks/ applications. These could include well-stabilized applications.

ii. **e-NAM**: Keeping in view the need to speedily modernize and automate all the market yards across the nation, the e-NAM application may be converted into a reference application and hosted, to enable the AMCs that have adequate resources to take up fast track implementation.

iii. **GIS Layers and Tools**: Given the critical role of geo-spatial technology in the agriculture sector, a set of OSS Products in geo-spatial technology may be positioned along with the most popularly used layers. This would open large opportunities for innovative products to emerge.

iv. **IDEA Sandbox or I-Box**: The goal of the I-Box is to promote open innovation by creating a Minimum Enabling Environment (MEE). The MEE consists of both technology environment and facilitatory environment. The technology environment has the capabilities of (a) testing and validation of innovative solutions for conformance to IDEA principles and standards (b) validation w.r.t compliance to the norms and (c) assurance of no harmful effects. The facilitatory environment includes (a) enablement of access to data for training, testing and validation of algorithms (b) validation for compliance to AI Ethics (c) certification for conformance and (d) access to domain and technological knowledge required by the startups.

I-Box would provide equitable opportunities to all innovative solutions (innovators) which satisfy the minimum eligibility criteria for entry into the I-Box. I-Box would have appropriate governance structure comprising of technical and domain experts. Figure 7 provides a high-level architecture of an Ecosystem Sandbox (ESB), termed I-Box in the context of IDEA.

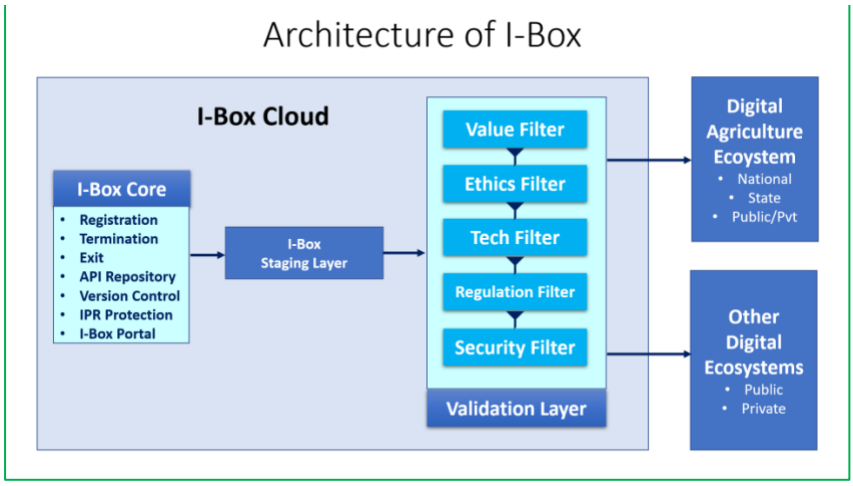


Figure 7: High-level architecture of I-Box

v. **Agri Data Exchange(ADEx)**: ADExis proposed as a key enabler of data economy. Data of appropriate quality is an asset that has multiple ways of creating economic value through its innovative use in a regulated environment. Agricultural data forms one of the most diverse, complex, and huge data ecosystems. However, several studies including the DFI report show that the apparent and latent value of data is not exploited to any significant extent currently for several reasons like (a) lack of qualitative data (b) incomplete datasets (c) lack of an organized and trustworthy system for exchanging of data and (d) lack of interoperability standards.

IDEA proposes to address all these challenges systematically by promoting the establishment of Agri Data Exchange(s). The concept of Data Exchange is at a nascent stage globally. A brief description of a 6-

layer Reference Model of Data Exchange designed by C4IR India, World Economic Forum is shown in **Annexure IV**.

5. InDEACommon Building Blocks and Reference Building Blocks

InDEA 2.0 framework is at an advanced stage of development by the Ministry of Electronics and IT, GoI. It has identified and included several Common Building Blocks and Reference Building Blocks. These are generic applications that help increase productivity or provide shared infrastructure environment, and tools that enable build applications. A set of these readily available applications, tools and infrastructure is proposed to be adopted/ adapted to be part of IDEA Architecture. The benefit is a quick and uniform implementation across the landscape of agriculture sector. These can be useful to both public and private sector entities.

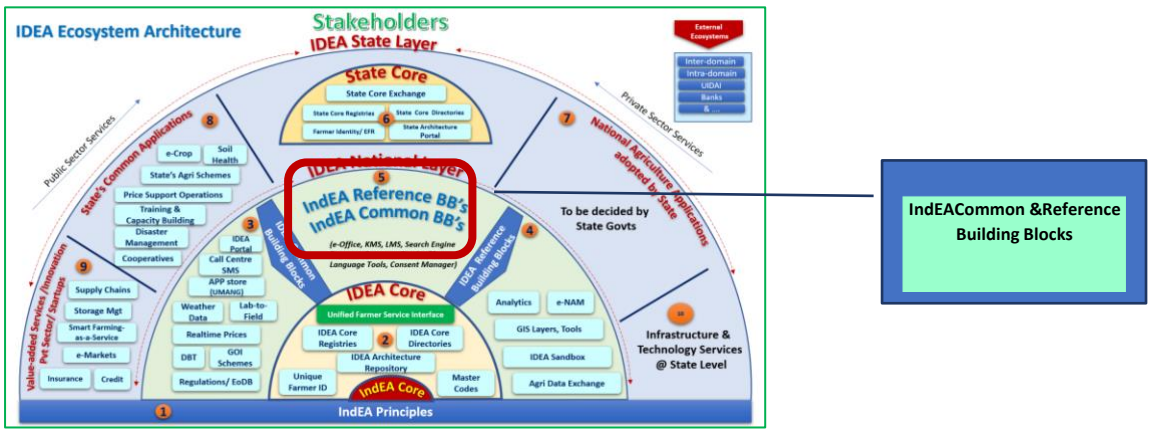


Table 1 provides an overview of the functionality of these building blocks being borrowed from the InDEA Framework.

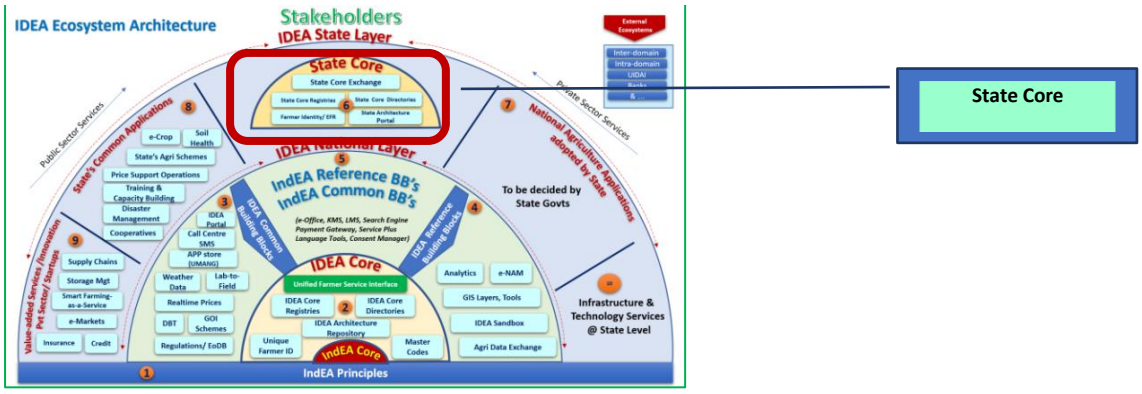
Sl No	Common/Reference Building Block of InDEA 2.0	Functionality
1	**e-Office**	• Creates paperless environment through e-Files. • Complies with all the office procedures prescribed by Central/ State Secretariat Office manuals • Well stabilized and user-friendly • Complies with security and confidentiality requirements. • Can be launched in a short time of 4 to 8 weeks for small to large offices (10 users to 10,000+ users) • Maintained by NIC at notified licensing cost per user
2	**KMS (Knowledge Management System)**	• Bundled along with e-Office • Enables systematic organization of knowledge of the Ministry or department for easy access by the employees while processing the files. • Knowledge includes Office Memos, Policy documents, domain-specific knowledge
3	**LMS (Learning Management System)**	• Designed and developed by NIC, based on LMS Standards • Currently contains several courses on e-Governance. • The Ministry can host a wide variety of courses and content on Agriculture domain that can be used across the country. • Can be a useful tool for self-paced capacity building.
4	**Search Engine**	• Under development by NIC/MeitY
5	**Payment Gateway**	• UPI and BHIM can be leveraged
6	**Service Plus**	• A platform for rapid development and deployment of digital services – G2C and G2B • Deployed by several Ministries and Governments • Developed and supported by NIC
7	**Language Tools**	• A set of tools called 'Bhasha' that provide capabilities for translation, building of web-sites in local languages • Useful in sending communications to the farmers in their language • Compliant with relevant Standards.

8	**Consent Manager**	• Developed to comply with the Consent requirements under the privacy laws. • Critical for ensuring that all projects relating to data sharing comply with the applicable regulations • Well established through its extensive use in Digi Locker
9	**e-Mail**	• e-mail system developed by NIC on Outlook platform. • Can enable the Ministry to enforce the e-Mail policy of GoI strictly across all its offices.

It is recommended that the Ministry collaborates closely with NIC and MeitY to (i) satisfy that the above applications conform to / made to conform to IDEA principles and DSS standards (ii) provides necessary budget and (iii) implements these applications in a time-bound manner in all its offices across the country. This would enhance internal efficiency and productivity significantly.

6. State Core(s)

InDEA 2.0 framework is designed keeping in view the federal structure of Government in India. Several subjects, including Agriculture are dealt with by both the Central and State Governments by undertaking various schemes. Moreover, the concept of Ecosystem Architecture can succeed only if the Central and State Governments have interoperable and compatible systems in place. Hence a State Core has been proposed by InDEA 2.0 The basic function of the State Core is to act as a bridge (i) between the various state departments and agencies and (ii) between a State department and the corresponding Ministry of GoI.



The State Core represented in the IDEA Architecture, therefore, does not relate to the agriculture sector alone, but provides similar functionality to multiple departments. With wider adoption of InDEA 2.0 Framework, the State Cores are expected to be established in several states. The Ministry of Agriculture may make a coordinated effort with MeitY, GoI in accelerating the establishment of state Cores, with the requirements of agricultural sector taken care of in the first phase of such State Cores.

The functionalities of the building blocks comprising the State Core are not described here as they are identical to those of the IDEA Core but applied at the State level.

7. National Agriculture Applications adopted by the State(s):

Over the last 2 decades, several applications relating to agricultural sector have been developed by the Ministry and the organizations under it. It is desirable that the States examine these applications and adopt them if they meet their requirements. Appropriate customizations may be needed to suit local requirements. It is a fundamental first step that the Ministry scrutinizes the applications w.r.t their conformance to IDEA Principles and architecture, before offering them to the States. **Annexure V** provides the top applications under this category and indicates the owner of the application, besides the major States which have adopted each application.

8. States' Common Applications

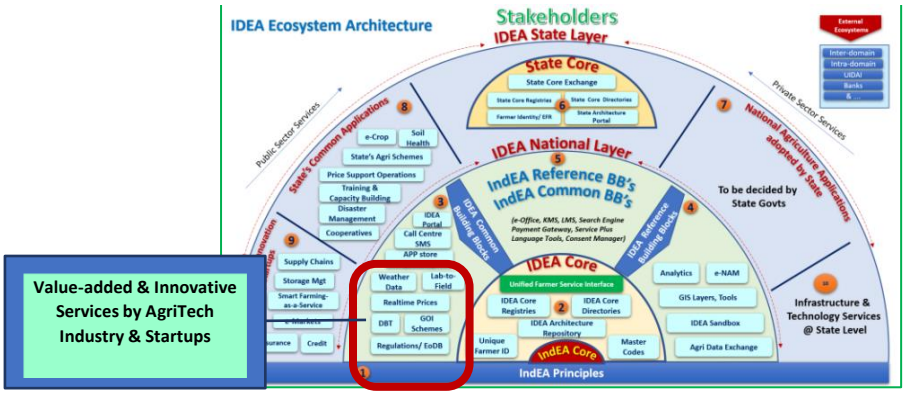
As in the case of the Ministry of Agriculture, GoI, several States have developed large applications with state-wide footprint. These are time-tested and the field functionaries are well-acquainted with using them. In line with the IDEA Principles, such well-established legacy applications need to be mainstreamed into IDEA. The following broad guidelines are given in this regard.

a. The States may prepare an inventory of applications (and Apps) in the agriculture domain that have a state-wide footprint and are stabilized at least over a year.

b. The applications may be audited critically in association with the IT department of the State, NeGD Division of MeitY and the Digital Agriculture Wing of the Ministry of Agriculture, GoI. The purpose of the audit is to assess the degree of its compliance to the IDEA principles set out in this report, identify the gaps and explore ways and means of enhancing the applications to conform completely to IDEA Principles, besides the Digital Service Standard notified by MeitY.

c. Special emphasis may be laid on the feasibility of achieving (with a reasonable effort in 3months) - (i) interoperability with other correlated applications of the State, State Core and IDEA Core, through an API-based approach (ii) conformance of the database(s) to the MDDS standards notified by MeitY (iii) compliance with security and privacy requirements (iv) scalability (v) use of open standards and open source products (vi) amenability of providing access to the data by digital service providers and innovators to be permitted (vii) availability of services through mobile. (viii) possibility of offering the application to the common pool for adoption by the other States

d. An indicate list of themes in which such 'common' application can be identified is shown in part 8 of the IDEA Architecture depicted in **Figure 5** (ante).



9. Value-added services and Innovative services

Data is the new oil. When managed properly, it can fuel innovation and support several value-added services. With the promise of IDEA streamlining the digital systems of agriculture, both in the public and private sectors, high quality, real-time data is expected to be accessible openly or made available for a cost. With this scenario being possible soon, especially through the establishment of I-Box and Agri Data Exchange(s), we can expect a large number of value-added services and innovative services being developed and delivered by the industry and startups.

The possible list of innovative services across the agriculture value chain are given in **Table 2**.

Table 2: Illustrative list of Value-added & Innovative services

Sl No	Theme / Segment of Agriculture Value Chain	Value-added Service Innovative Service	Value Proposition	Technologies to be used

1	**Crop Planning**	Macro Crop Planning	• Planning the extents, locations and varieties of crop to be grown in different agro-climatic zones • Focus on import substitution, nutrition, and export revenues	• AI • ML • Statistical Models • Big data
		Micro Crop Planning	• Advisories to the farmers 4-6 weeks ahead of each season, on what crops/ varieties to sow • Advisories on optimal sowing windows	• AI • Soil data • Satellite data
2	**Cultivation**	Smart F-a-a-S (Smart Farming-as-a-Service)	• Providing an entire range of digital services to the farmer in respect of crop management • Through aggregation of innovative services provided by multiple service providers on a single app. • The portfolio of services could include o Rapid soil testing o e-Soil Health Card (on mobile) o Integrated Nutrient Management o Uberized farm machinery services o Hyper-local weather advisories o Pest prediction and management advisories o Credit services o Insurance services	• Aggregation platform • ML • IoT • Drones • Satellite data • PoS devices
3	**Supply Chain**	Logistics	Logistics services for transportation of inputs and produce	• Blockchain
4	**Market**	Market Connect	• Market Intelligence o Demand & Price prediction • Storage o warehousing o cold chain o eNWR • Produce Aggregation Services • Hyper-local connect (F2C) • Online Retail	• AI • Satellite data • IoT
5	**Quality**	Quality Testing	• Rapid quality testing & certification @ o Public Procurement o Market Yards o Exports o Retail	• IoT
		Traceability	• Exports • High-value produce • Organic produce	• Blockchain

6	**Data**	Data Exchange	• Unlocking the potential value of data • Ease of availability of data for innovation and research • Fair distribution of 'data value' to all participants/ data owners, including farmer	• Digital Technologies

10. Infrastructure and Technology Services

Several components of the technology and infrastructure can be sourced in a standard way to enable faster implementations. These include the cloud infrastructure, video-conferencing, visualization, document management and analytics. Institutionalized arrangement may be made at the State level to provide all such technology-related services on a shared basis, along with 24x7 support. This would free the domain personnel from a lot of infructuous effort in procurement/ discovery of resources and troubleshooting.

5. IDEA Standards

Standards are like the CNS of a large digital ecosystem like IDEA. They enable and streamline seamless flow of information across the entire ecosystem instantaneously as per need. A significant, intensive, large, and coordinated effort is needed in standard setting in the agriculture sector. A high-level approach is provided for the samein this section.

1. Standards Landscape

Figure 8 depicts the landscape of standards in the agriculture sector. An overview of the IDEA standards is given in what follows.

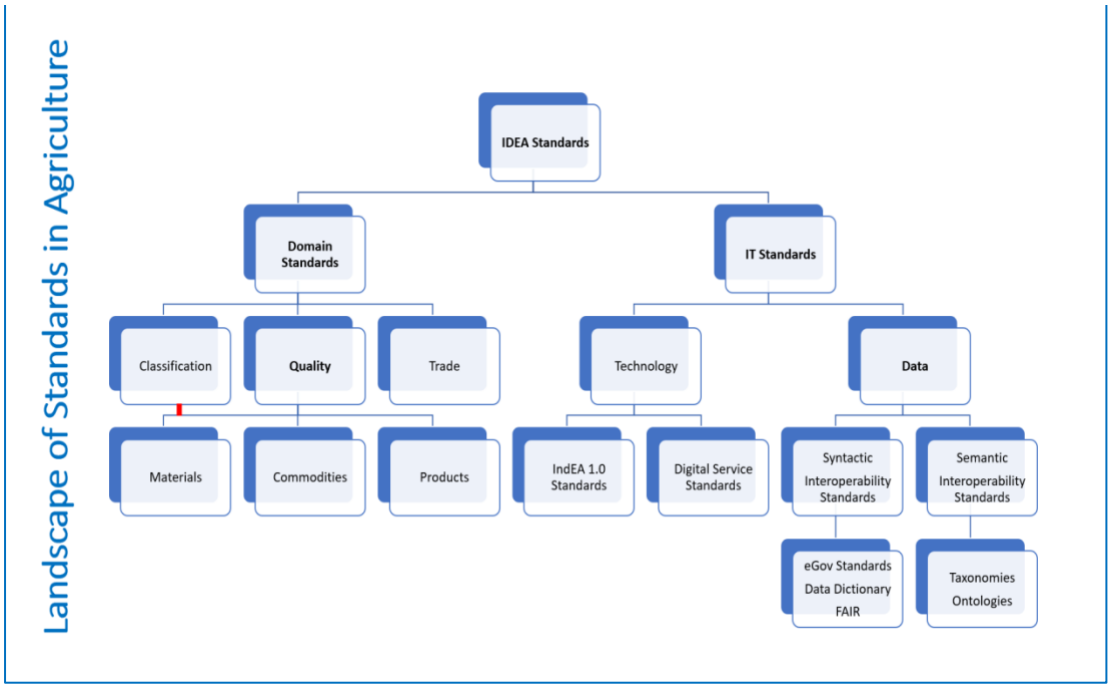


Figure 8: The Standards landscape of IDEA

a. IDEA Standards or standards required for the digital ecosystem of agriculture sector fall into two categories – domain standards and IT Standards. The former deal with the standards relating to the agricultural commodities and products, and the materials used to produce them. IT Standards can relate to the various technologies and the most important ingredient of IT namely, data.

b. The domain standards are meant to classify the various commodities, products, and materials, lay down quality norms and the terms and processes used in trading in the commodities and products. Some of these standards are available and are listed in the **Table 3.** Significant and systematic work needs to be commissioned by the Ministry in promoting and supporting the development of the complete set of standards required in the domain space.

c. Development and enforcement of the domain standards enables innovative products and solutions to emerge in the areas of Quality Testing, Conformance certification, traceability, supply chain optimization and enhancing the efficiencies in trading and commodity exchanges, besides transparency in various transactions in the ecosystem.

Item	Applicable Standard
Definition and classification of commodities	• FAOSTAT commodity list • Food items (commodities) • CPC ver.2.1 expanded for agriculture (crops, livestock, and derived products) and correspondences to FCL
Definition and classification of agricultural inputs	• Definitions & classifications of agricultural machinery and equipment • Definitions and classifications of pesticides • Definitions and classifications of fertilizers
Land use	• Definitions and classification of Land Use, Agricultural Practices, and Irrigation
Agricultural Inputs	• Definitions and classification of Land Use, Agricultural Practices, and Irrigation

Table 3: List of domain standards available in agriculture sector

d. In the context of IDEA, IT Standards serve the following critical objectives:

- Enable interoperability of various systems in the central and state governments and the private sector.
- Development of solutions which are scalable across the country.
- Automation of several repetitive activities through machine-readability of information using a combination of methods that leverage the syntactic and semantic interoperability.
- Sustainability of the IT solutions over a long period.

e. 3 sets of IT standards available today are shown in Figure 8. These are

(i) an exhaustive list of standards applicable to the hardware, software, networking, and security areas of IT provided in **IndEA 1.0 Framework** (compiled in 2017 and need to be updated).

(ii) **Digital Service Standard(DSS)**, notified by MeitY, GoI in 2019 that lay down the norms for the design, development, and deployment of IT Solutions to provide digital services to the stakeholders.

(iii) A set of **MDDS** (Metadata and Data Standards)[8] notified by MeitY to define the most used data elements (fields) while designing databases.

2. Approach to developing Data Standards for IDEA

An important gap that impedes the development of interoperable solutions in the IDEA ecosystem is the absence of standards for defining the various data elements, entities, and activities of the agriculture ecosystem in a globally understood way. A step-by-step approach is needed for developing these standards, as shown in **Figure 9**, starting with the easy ones and advancing the development to more complex tasks with time.

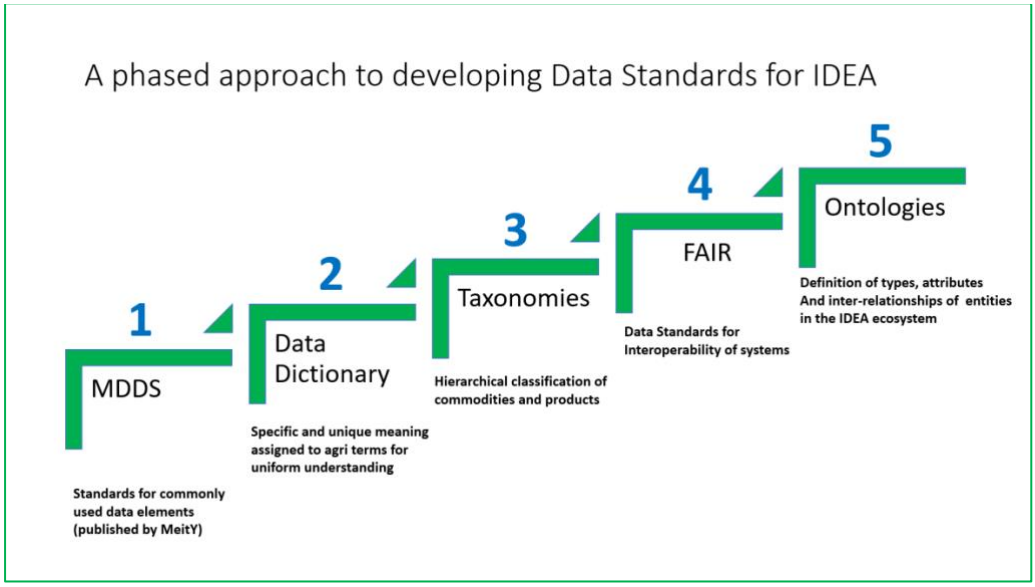


Figure 9: Approach to developing Data Standards for IDEA

The following guidelines are suggested for the systematic and time-bound development of standards

a. An organization dedicated to the development of standards may be established bythe Ministry.

b. A multi-stakeholder governance system may be established with representation from academia, governments (central and state), and industry.

c. A set of multi-disciplinary teams may form the organization structure, to be responsible for development of domain standards and IT standards.

d. Adequate budgetary resources may be provides to the organization with specific timelines and deliverables.

3. FAIR Standard

While the various standards may be developed in a phased manner, a special focus may be laid on the development of interoperable data standards on the lines of FHIR in respect of the health sector. Tentatively named as FAIR (Fast Agriculture Interoperability Resources), these standards can be shaped on the lines of the corresponding health artifacts.

This calls for a seamless exchange of information in machine-readable form between organizations and systems that span the ecosystem. Significant opportunities, like the following, can open up if the challenge of interoperability in agri-informatics is addressed by establishing data standards.

- Bridging a huge gap that exists in the national, regional and global food systems.
- Development of innovative digital agriculture systems that provide an array of value-added services to the stakeholders
- Paving the way for the evolution of a huge digital agri-ecosystem, and a number of open, interoperable, public digital platforms
- Enabling horizontal and vertical scaling of the numerous deployments of emerging technologies in the space of food systems, including crop yield estimation, stress prediction, price forecasting, food grading, precision farming and AI-powered advisories to farmers

The proposed FAIR initiative will have significant impact in multiple dimensions as indicated below:

- FAIR will enable automated exchange of information in real-time across the entire chain of food systems, nationally and globally. This will enhance the velocity of all operations across the agriculture value chain.
- Increase profitability of farmers by empowering them to take the right decisions at the right time on various farm activities, enable reducing the input costs due to more efficient supply chains, increase the yield due to accurate AI-enabled advisories, and provide market linkages by deploying innovative IT solutions.
- Governments can make more timely interventions to reduce the stress of the farmers, by taking up a data-driven approach using emerging technologies.
- Collectively, the above benefits can make a positive impact on the SDGs.

FAIR will have to develop standards for over 100 datasets in the agriculture ecosystem. Eventually it can be extended to the entire primary sector, which includes animal husbandry and fisheries.

6. Implementation Framework

Implementing IDEA is a challenging task, given the wide scope, multiple dependencies, and complexities in coordination across the country. A federated implementation structure is best suited with clear definition of roles and clear division of responsibilities between the Central and State Government. A significant role needs to be played by the private sector in the co-creation of the various artifacts' and solutions, as also adoption and implementation at the field level. The following broad guidelines are suggested in this regard:

a. IDEA is proposed to be implemented on a mission-mode, by establishing a National Mission on Digital Agriculture (NMDA) with a dedicated team of experts. An autonomous and professional wing within the just-established National Farmers Welfare Society.

b. A multi-stakeholder IDEA Advisory Council will be established to guide NMDA.

c. Counterpart organizations may be established at the State-level, with partial funding from the Ministry, preferably under a central sector scheme.

d. An effective PPP Framework will be formulated after co-designing it with the private sector. The framework should allocate responsibilities, risks and rewards between the public and private sector.

e. The adoption of IDEA may be incentivized by linking a portion of the central assistance in the agriculture sector to the progress achieved in implementing IDEA.

f. NMDA may be required to draw up a comprehensive plan of capability building for the design, development, and implementation of IDEA. The plan should address the capabilities required at the policy, technology, management, and program implementation levels.

g. A three-year action plan may be developed for implementing IDEA across the country. The plan may specify the milestones, deliverables, and timelines. The action plan may include the following:

i. Establishment of National Mission on Digital Agriculture (NMDA)

ii. Design and development of Federated Architecture of IDEA

iii. Design, development, and implementation of IDEA Core

iv. Assessment of legacy systems of Centre & States for conformance to IDEA Principles and Architecture and enhancing the same to conform.

v. Design and notification of Policies on Security, Privacy and Consent Management and Data Sharing, in consultation with States and Industry.

vi. Establishing UHID system and publication of relevant APIs

vii. Design, development / enhancement of IDEA Common Applications

viii. Formulate appropriate Central Sector Scheme for IDEA

ix. Establishing a dedicated institution for setting IDEA Standards

x. Notification of PPP Framework for implementation of various components of IDEA.

h. An impact assessment framework may be designed to assess the outcomes and impact on the targeted beneficiary groups.

7. Conclusion

IDEA is an idea whose time has arrived. Adoption of a holistic ecosystem approach to address the multiple challenges faced by the agriculture sector is of national importance, to fulfil the aspirations like Doubling Farmer's Income and achieving the SDG's. A multi-stakeholder approach is essential with government playing the role of an enabler of the ecosystem players, rather than acting as a builder of digital systems.

Issues for Consultation

1. Vision and Objectives

1A – Is the idea of IDEA necessary for India' Agriculture ecosystem?

< Is the proposed Digital Ecosystem a high priority for realization of the aspirations like DFI and SDG's?>

1B- Is IDEA feasible?

<Is it practicable to implement IDEA in the Indian environment and conditions with a reasonable assurance of making the required impact on productivity, production, and profitability? Are factors like small holdings, digital illiteracy, resource constraints, and last mile connectivity so serious as to defeat the goals of IDEA?>

2. IDEA Architecture

2A – Is the 3-level Architecture proposed for IDEA appropriate?

<IDEA is conceptualized as 3 level - Core, National and State levels, keeping in view the federal structure of the Government. Is this structure suitable for the agriculture ecosystem also, which also contains private, startup and NGO systems? >

2B – Does IDEA capture the spirit of Federated Architecture correctly and adequately?

<IDEA is founded on the principles of Federated Architecture – Federated Databases, Federated Applications and Federated Governance. What are the technological concepts, products, standards and protocols that reinforce/ enable the Federated Architecture?>

2C –IDEA Architecture is designed in terms of Building Blocks. Is this appropriate?

<IDEA is composed of Building Blocks – Core BBs, Common BBs and Reference BBs. Is this realistic? Can the Reference Building Blocks be managed for maximum adoption across the country, taking care of regional and linguistic variations? Are these useful to the private sector also?>

3. IDEA Standards

3A – Is the approach to development and adoption of Standards proposed in IDEA appropriate?

<IDEA has identified the broad areas requiring Standards to be developed and/or adopted. Is this the right approach?>

3B – Is FAIR feasible? [Fast Agriculture Interoperability Resource]

<IDEA advocates development of FAIR as an interoperability standard, on the lines of FHIR in respect of health data. Is this a fair comparison? Is FAIR feasible, useful?>

4. IDEA Implementation Framework

4A – IDEA proposes development of a PPP framework for its implementation. How to develop such a framework?

<What are the design considerations for developing a PPP Framework for implementing IDEA?>

4B – Can IDEA attract/ facilitate fresh investments in Digital Agriculture?

<IDEA needs to be implemented by public and private sectors in unison. Does the IDEA framework inspire adequate confidence in the private sector to make the required investments in developing products and solutions based on IDEA framework? What are the enablers/ catalysts to be put in place for such investments to happen?>

5. Agri Data Economy

5A – Is Agri Data Exchange[ADEx] necessary?

<IDEA suggests the need to establish Agri Data Exchange for faster and purpose-driven exchange of data. Is there a business case for establishing Data Exchange for the agri sector? Given the large landscape, variety of commodities and activities in the agri ecosystem,

is there case for multiple Data Exchanges, focusing on multiple groups of crops/ commodities?>

5B – What should be the implementation model for ADEx?

<Should ADEx be a government-led or private sector-led initiative? What kind of incentives, if at all, are required to be provided by the Central/ State Governments to promote ADEx(s)?>

5C – What are the regulatory requirements for ADEx?

<ADEx(s) deal with huge data that can consist of personal and non-personal data. Are the proposed provisions of PDP Bill, and the Report on Non-Personal Data Governance Framework adequate to regulate the ADEx(s). If not, what other regulatory provisions are required?>

6. Innovation around IDEA

5A – Is IDEA Sandbox [I-Box] necessary?

<IDEA suggests the need to establish IDEA Sandbox [I-Box] forfacilitating, enabling and promoting open innovation in agri-tech space. Is there a functional justification and a business case for establishing I-Box for the agri sector? >

5B – What should be the implementation model for I-Box?

<Should I-Box be a government-led or private sector-led initiative? What kind of incentives are required to be provided by the Central/ State Governments to promote I-Box(s)?>

7. Other Suggestions

< Pl provide any other suggestions not covered by the above questionnaire>

Annexure I - OM on Constitution of Task Force

F.No.Z-11018/10/2019-IT
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
***

Krishi Bhawan, New Delhi
Dated the 7th October, 2019

OFFICE MEMERANDUM

Subject: Constitution of Task Force for the development of Centralised Farmers' Database and creation of framework for Digital Ecosystem of Agriculture.

The Department of Agriculture, Cooperation and Farmers Welfare is envisaging to develop a comprehensive Centralised Farmers' Database based on Revenue land records for better planning, monitoring, strategy formulation and smooth implementation of DBT schemes. This Centralised Farmers' Database shall be useful for various activities like issuing soil health cards, dissemination of crop advisories to the farmers, precision farming, smart cards for farmers to facilitate e-governance, crop insurance, settlement of compensation claims, grant of agricultural subsidies, community/ village resource centres etc. Under the aegis of the IndEA project, the Ministry of Electronic and Information Technology (MeitY) has proposed to assist this Department in creating a framework and implementation plan for India Enterprise Architecture (IndEA) for Digital Ecosystem of Agriculture (**IDEA**).

2. With the approval of the Hon'ble Minister, Agriculture and Farmers' Welfare, a Task Force is constituted with the following composition to finalise the concept note / blue print for pilot projects and to suggest further course of action to be taken for development of land records based Centralised Farmers' Database and creation of framework for Digital Ecosystem of Agriculture :-

i)	Secretary, Deptt. of Agri., Coop. and FW	-	Chairman
ii)	Shri J. Satyanarayana, former Secretary, Meity and ex-Chairman, UIDAI	-	Co-Chairman
iii)	Pr. Adviser (Agri), NITI Aayog	-	Member
iv)	President and Chief Executive Officer, NeGD	-	Member
v)	Addl. Secretary (IT), DAC&FW	-	Member
vi)	Director General, NIC	-	Member
vii)	Pr. Secretary (Agri), Govt. of Andhra Pradesh	-	Member
viii)	Pr. Secretary (Agri), Govt. of Uttar Pradesh	-	Member
ix)	Secretary (Agri), Govt. of Meghalaya	-	Member

x)	Secretary (Agri), Govt. of Maharashtra	-	Member
xi)	Joint Secretary (IT), DAC&FW	-	Member & Convener
xii)	Joint Secretary (Crops) and CEO, PM KISAN, DAC&FW	-	Member
xiii)	Joint Secretary (Land Regulations), Deptt. of Land Resources	-	Member
xiv)	Dy. Director General (Agri), NIC	-	Member
xv)	Director (IT), DAC&FW	-	Member and Co-Convener
xvi)	Any other member(s) co-opted by the Chairman	-	Member

3. The Terms of Reference of the Task Force will be as follows:

i) to finalise a concept note / Blue Print for the pilot project(s) and to take this initiative forward for full fledged development of a Centralised Farmers' Database linked with land records;

ii) to identify the schemes of the DAC&FW and services to be integrated and to create a framework and implementation plan for Digital Ecosystem of Agriculture; and

iii) to form Working Groups / Sub-Committees to take these initiatives forward.

(Rakesh S. Nayal)
Under Secretary to the Govt. of India
Tel. 2338 2926

To,

(i) Shri J. Satyanarayana, Former Secretary, MeitY and ex-Chairman, UIDAI
(ii) Pr. Adviser (Agri), NITI Aayog
(ii) President and Chief Executive Officer, NeGD
(iv) Addl. Secretary (IT), DAC&FW
(v) Director General, NIC
(vi) Pr. Secretary (Agri), Govt. of Andhra Pradesh
(vii) Pr. Secretary (Agri), Govt. of Uttar Pradesh
(viii) Secretary (Agri), Govt. of Meghalaya
(ix) Secretary (Agriculture), Govt. of Maharashtra
(x) Joint Secretary (IT), DAC&FW
(xi) Joint Secretary (Crops) and CEO, PM KISAN, DAC&FW
(xii) Joint Secretary (Land Regulations) Deptt. of Land Resources
(xiii) Dy. Director General (Agri), NIC
(xiv) Director (IT), DAC&FW

Copy to : **PPS to Secretary (AC&FW)**

Annexures II - OM on Constitution of Working Group

489645/2020/IT SECTION

F No Z-11018/10/2019-IT
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Information Technology Division

Krishi Bhavan, New Delhi

Dated 6th February, 2020

OFFICE MEMORANDUM

The Department of Agriculture, Cooperation and Farmers Welfare, through its OM of even number dated 7th October 2019, constituted a Task Force for, *inter alia*, creating a framework and implementation plan for IndEA Digital Ecosystem of Agriculture (IDEA). The Task Force was authorized to form Working Groups/ Sub Committees to take the initiatives forward.

The design and development of IDEA Blueprint involves detailed work involving experts in the areas like the agriculture domain, information technology and program planning. Keeping this in view, the following multi-disciplinary Working Group is constituted for the design and development of the IDEA Blueprint:

1. Shri J Satyanarayana, former Secretary, MeitY and former Chairman, UIDAI – Chairman
2. Shri Rajesh Verma, Special Secretary, DAC&FW – Member
3. Shri Rajeev Chawla, ACS (e-Governance), Govt of Karnataka – Member
4. Shri. Jitendra Kumar, Senior Advisor(Agriculture), NITI Aayog, GoI - Member
5. Shri Abhishek Singh President & CEO, NeGD, Ministry of Electronics & IT, GoI – Member
6. Smt Ranjana Nagpal, DDG, NIC – Member
7. Shri. P.C.Prasad, Deputy Secretary, Dept of Land Records, Ministry of Rural Development – Member
8. Shri Anil Rai, ADG(ICT), ICAR – Member
9. Dr. Raka Saxena, Principal Scientist, ICAR – National Institute of Agriculture Economics and Policy (NIAEP) – Member
10. Shri S.S.Tomar, Addl Commissioner (Crops), DAC&FW, GoI - Member
11. Shri P.K.Prusty, Deputy AMA, Directorate of Marketing Infrastructure(DMI), DAC&FW, GoI – Member
12. Dr. T.P.Singh, Director, BISAG, Department of Science & Technology, Govt of Gujarat
13. Shri Sanjay Kumar Rakesh, Additional Chief Secretary & Agriculture Production Commissioner, Government of Tripura – Member
14. Dr Saurab Garg, Principal Secretary, Agriculture, Government of Odisha – Member

89645/2020/IT SECTION

15. Shri Gagandeep Singh Bedi, Agriculture Production Commissioner, Government of Tamil Nadu - Member
16. Shri Vivek Aggarwal, Jt Secretary (IT), DAC&FW, GoI – Member- Convener

Special Invitees

1. Shri Prashant Mehra, Chairman & Co-Founder, Platform Commons Foundation
2. Shri Varad Pande, Investment Partner, Omidyar Network India

The Working Group may co-opt any member or invite any expert as special invitee and assign any task to them. The Working Group may also form Sub-Groups for specific tasks as deemed necessary.

Technical and secretarial support to the Working Group will be provided by a team under the guidance of DAC&FW, GoI

The Terms of Reference of the Working Group on IDEA shall be as follows:

1. To define the context, scope, vision and objectives of IDEA.
2. To define a set of principles for the evolution of IDEA
3. To develop the Architecture of IDEA and to identify the Building Blocks for the development and evolution of IDEA
4. To identify the Standards and Regulations required to be adopted and/ or complied with by the ecosystem players
5. To recommend an appropriate institutional framework for the implementation of IDEA Blueprint in a phased manner
6. To suggest an indicative action plan for the implementation of IDEA
7. To adopt a consultative approach while developing the IDEA Blueprint, involving public review, consultations with the State Governments and the Industry.
8. To make any other recommendation required for the successful implementation of the Digital Ecosystem of Agriculture.

The Working Group may submit its draft report to be put in the public domain within 2 months and submit final report within a period of four months.

(Vijay Rajmohan)
Director (IT)
Phone: 011-23386681

To

As per list attached.

OM on Constitution of Working Groups – Sub Group A

F No Z-11018/5/2020-IT
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Information Technology Division

Krishi Bhavan, New Delhi
Dated 14th February, 2020

OFFICE MEMORANDUM

Subject: Constitution of Sub-Working Group-A

The undersigned is directed to refer to OM of even number dated 31 January 2020, constituted a multi-disciplinary Working Group for, *inter alia*, design and development of IndEA Digital Ecosystem of Agriculture (IDEA) Blueprint. The Working Group was authorized to form Sub-Working Groups to take the initiatives forward.

2. The design and development of IDEA Blueprint involves detailed work and broad areas of IDEA Blueprint were finalized by the Working Group in its first meeting held on 11 February 2020. The Working Group constituted four sub-working groups and assigned specific areas to each of them. The sub-working groups have experts in the areas like agriculture domain, information technology, institutional framework and program planning. Keeping this in view, the Sub-Working Group-A is constituted to contribute in the design and development of IDEA Blueprint:

a) Shri Vivek Aggarwal, Jt Secretary (IT), DAC&FW, GoI – Chairman
b) Shubha Thakur, Jt Secretary (Crops), DAC&FW, GoI-Member
c) Dr. Randhir Singh, ADG(Extension), ICAR - Member
d) Smt Ranjana Nagpal, DDG, NIC – Member – Convener
e) Shri. Vijay Rajmohan Director(IT), DAC&FW, GoI Member Co Convener
f) Shri. B. K. Prushty, Deputy AMA, DMI Faridabad, DAC&FW, GoI – Member
g) Shri Brahmanand Jha, Sr. Consultant, NeGD, Ministry of Electronics & IT – Member
h) Shri Prashant Mehta, Chairman & Co-Founder, Platform Commons Foundations-Member.
i) Shri Pravesh Sharma, Managing Director, Kamatan Farm Tech Pvt. Ltd., Bangalore - Member

3. The following are the Terms of Reference of the Sub-Working Group-A:

a) Assess the transformative requirements contained in the Report of the Committee on DFI, Report on Policies and Action Plan for Secure and

Sustainable Agriculture prepared under the aegis of PSA to GoI, SDG's relating to Agriculture and research work conducted by the Ministry in the recent past.

b) Establish the justification for digital and technological interventions required to drive the transformation agenda for the agriculture sector in particular and primary sector in general.
c) Define the Vision, Objectives and Core Principles for the development and/ or evolution of the Digital Agriculture Ecosystem.
d) Study national and international best practices in the use of technology for enhancing the realization of outcomes envisaged for the agriculture sector.
e) Prepare an illustrative list of digital services that should be promoted.

4. The Sub-Working Group-A may present its work in the form a presentation in the Working Group meeting to be held on 25 February 2020 and followed by a draft Word document report for discussion in the Working Group meeting to be held on 6 March 2020. The consolidated draft report, from all four sub-working groups, to be put in the public domain within 2 months and the final report within a period of four months.

14/2/2020

(Vijay Rajmohan)
Director (IT)
Phone: 011-23386681

To

1) Shri Vivek Aggarwal, Jt Secretary (IT), DAC&FW, GoI – Chairman
2) Shubha Thakur, Jt Secretary (Crops), DAC&FW, GoI-Member
3) Dr. Randhir Singh, ADG(Extension), ICAR - Member
4) Smt Ranjana Nagpal, DDG, NIC – Member – Convener
5) Shri. Vijay Rajmohan Director(IT), DAC&FW, GoI - Member – Co-Convener
6) Shri. B. K. Prushty, Deputy AMA, DMI Faridabad, DAC&FW, GoI – Member
7) Shri Brahmanand Jha, Sr. Consultant, NeGD, Ministry of Electronics & IT – Member
8) Shri Prashant Mehta, Chairman & Co-Founder, Platform Commons Foundations-Member.
9) Shri Pravesh Sharma, Managing Director, Kamatan Farm Tech Pvt. Ltd., Bangalore – Member

Copy to:

1) Sh. J. Satyanarayana, Ex-Secretary (MeitY)
2) Sh. Rajesh Verma, Special Secretary (IT)
3) Sr. PPS to Secretary (AC&FW)

OM on Constitution of Working Groups – Sub Group B

F No Z-11018/5/2020-IT
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Information Technology Division

Krishi Bhavan, New Delhi
Dated 17th February, 2020

OFFICE MEMORANDUM

Subject: Constitution of Sub-Working Group-B

The undersigned is directed to refer to OM of even number dated 31 January 2020, constituted a multi-disciplinary Working Group for, *inter alia*, design and development of IndEA Digital Ecosystem of Agriculture (IDEA) Blueprint. The Working Group was authorized to form Sub-Working Groups to take the initiatives forward.

2. The design and development of IDEA Blueprint involves detailed work and broad areas of IDEA Blueprint were finalized by the Working Group in its first meeting held on 11 February 2020. The Working Group constituted four sub-working groups and assigned specific areas to each of them. The sub-working groups have experts in the areas like agriculture, information technology, institutional framework and program planning. Keeping this in view, the Sub-Working Group-B is constituted to contribute in the design and development of IDEA Blueprint:

a) Smt Neeta Verma, DDG, NIC – Chairman
b) Smt Ranjana Nagpal, DDG, NIC – Member
c) Shri Sarbajeet Singh, STD, NIC – Member
d) Shri Samarth Ram, NIC, Karnataka – Member
e) Ms. Kavita Bhatia, Director (MeitY)
f) Shri Vinay Thakur, NeGD, Ministry of Electronics & IT, GOI – Member
g) Shri Bhooshan Kumar Luthra, Sr. Consultant (IT), DAC&FW, GoI - Convener
h) Shri Prashant Mehra, Chairman & Co founder Platform Commons Foundation, Bangalore-Special Invitee
i) Dr Pallab Saha, The Open Group - Special Invitee
j) Shri Gaurav Goel, Samagra, Odisha- Special Invitee

3. The following are the Terms of Reference of the Sub-Working Group-B:

a) Define the Principles of the Federated Architecture of IDEA, which operate at multiple levels like national, State, District and Block levels.

b) Identify and define the Building Blocks required to be established at each level, in different layers like Infrastructure, Data, Technology and Application Building Blocks.
c) Define the high-level functionality of each of the Building Blocks identified
d) Establish the need for a unique identifier for the Farmer, and if so justified, define the structure of such identifier.
e) Design a framework for interoperability of all the Building Blocks of the ecosystem, based on open standards.

4. The Sub-Working Group-B may present its work in the form a presentation in the Working Group meeting likely to be held on 25 February 2020 and followed by a draft Word document report for discussion in the Working Group meeting likely to be held on 6 March 2020. The consolidated draft report, from all sub-working groups, to be put in the public domain within 2 months and the final report will be prepared within a period of two months thereafter.

(Vijay Rajmohan)
Director (IT)
Phone: 011-23386681

To

1) Smt Neeta Verma, DDG, NIC – Chairman
2) Smt Ranjana Nagpal, DDG, NIC – Member
3) Shri Sarbajeet Singh, STD, NIC – Member
4) Shri Samarth Ram, NIC, Karnataka – Member
5) Ms. Kavita Bhatia, Director (MeitY)
6) Shri Vinay Thakur, NeGD, Ministry of Electronics & IT, GOI – Member
7) Shri Bhooshan Kumar Luthra, Sr. Consultant (IT), DAC&FW, GoI - Convener
8) Shri Prashant Mehra, Chairman & Co founder Platform Commons Foundation, Bangalore-Special Invitee
9) Dr Pallab Saha, The Open Group - Special Invitee
10) Shri Gaurav Goel, Samagra, Odisha- Special Invitee

Copy to:

1) Sh. J. Satyanarayana, Ex-Secretary (MeitY)
2) Sh. Rajesh Verma, Special Secretary (IT)
3) Sr. PPS to Secretary (AC&FW)

OM on Constitution of Working Groups – Sub Group C

F No Z-11018/5/2020-IT
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Information Technology Division

Krishi Bhavan, New Delhi
Dated 17th February, 2020

OFFICE MEMORANDUM

Subject: Constitution of Sub-Working Group-C

The undersigned is directed to refer to OM of even number dated 31 January 2020, constituted a multi-disciplinary Working Group for, *inter alia*, design and development of IndEA Digital Ecosystem of Agriculture (IDEA) Blueprint. The Working Group was authorized to form Sub-Working Groups to take the initiatives forward.

2. The design and development of IDEA Blueprint involves detailed work and broad areas of IDEA Blueprint were finalized by the Working Group in its first meeting held on 11 February 2020. The Working Group constituted four sub-working groups and assigned specific areas to each of them. The sub-working groups have experts in the areas like agriculture, information technology, institutional framework and program planning. Keeping this in view, the Sub-Working Group-C is constituted to contribute in the design and development of IDEA Blueprint:

a) Shri Abhishek Singh President & CEO, NeGD, Ministry of Electronics & IT – Chairman
b) Shri Anil Rai, ADG (IT), ICAR – Member
c) Dr. Ashok Kumar Singh- Director IARI – Member
d) Shri P.C. Prasad, Deputy Secretary, DoLR, GOI – Member
e) Smt Pratibha Lokhande, STD, NIC – Member
f) Shri Vijay Rajmohan Director(IT), DAC&FW, GoI - Member - Convener
g) Shri S. S. Tomar, Add. Comm. (Crops), DAC&FW, GoI - Member
h) Shri D. K. Yadav, ICAR – Member
i) Sh Varad Pande, Investment Partner, Omidyar Network India - Special Invitee

3. The following are the Terms of Reference of the Sub-Working Group-C:

a) Identify the areas within the Agriculture Ecosystem that require Standards to be adopted.

b) Identify and define the Standards to be adopted by all the players in the ecosystem for realizing the vision of IDEA.
c) Identify and list out the Regulations to be complied with by the ecosystem players.
d) Identify the areas in which Regulations are to be formulated and notified, and define the aims and objectives of such regulations.

4. The Sub-Working Group-C may present its work in the form a presentation in the Working Group meeting likely to be held on 25 February 2020 and followed by a draft Word document report for discussion in the Working Group meeting likely to be held on 6 March 2020. The consolidated draft report, from all sub-working groups, to be put in the public domain within 2 months and the final report will be prepared within a period of two months thereafter.

(Vijay Rajmohan)
Director (IT)
Phone: 011-23386681

To

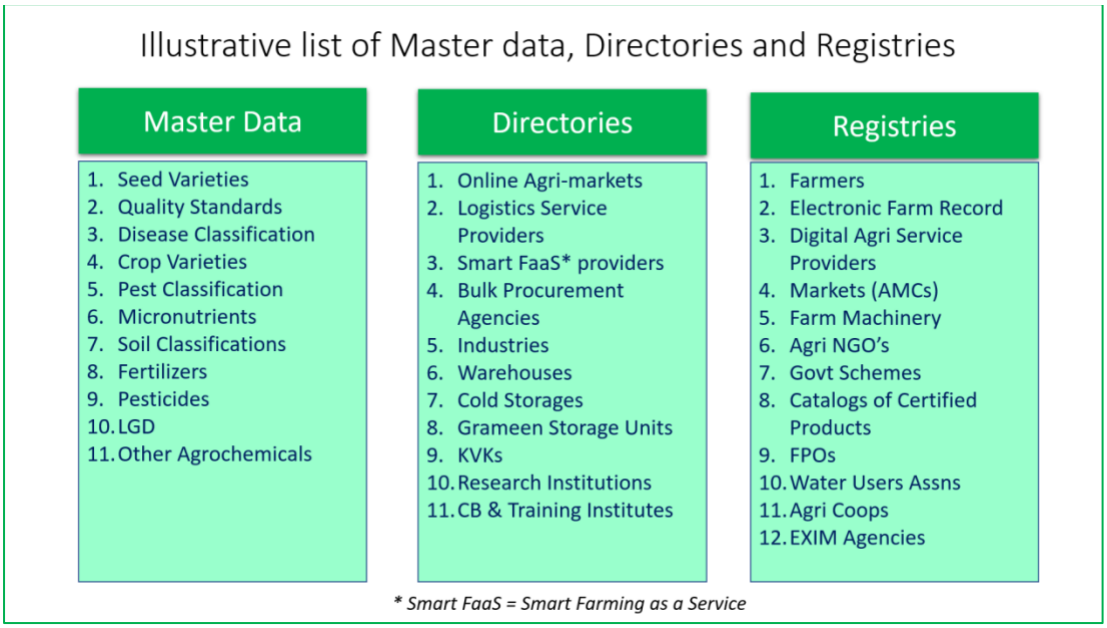
1) Shri Abhishek Singh President & CEO, NeGD, Ministry of Electronics & IT – Chairman
2) Shri Anil Rai, ADG (IT), ICAR – Member
3) Shri Dr. Ashok Kumar Singh- Director IARI – Member
4) Shri P.C. Prasad, Deputy Secretary, DoLR, GOI – Member
5) Smt Pratibha Lokhande, STD, NIC – Member
6) Shri. Vijay Rajmohan Director(IT), DAC&FW, GoI - Member - Convener
7) Shri S. S. Tomar, Add. Comm. (Crops), DAC&FW, GoI - Member
8) Shri D. K. Yadav, ICAR – Member
9) Shri Varad Pande, Investment Partner, Omidyar Network India - Special Invitee

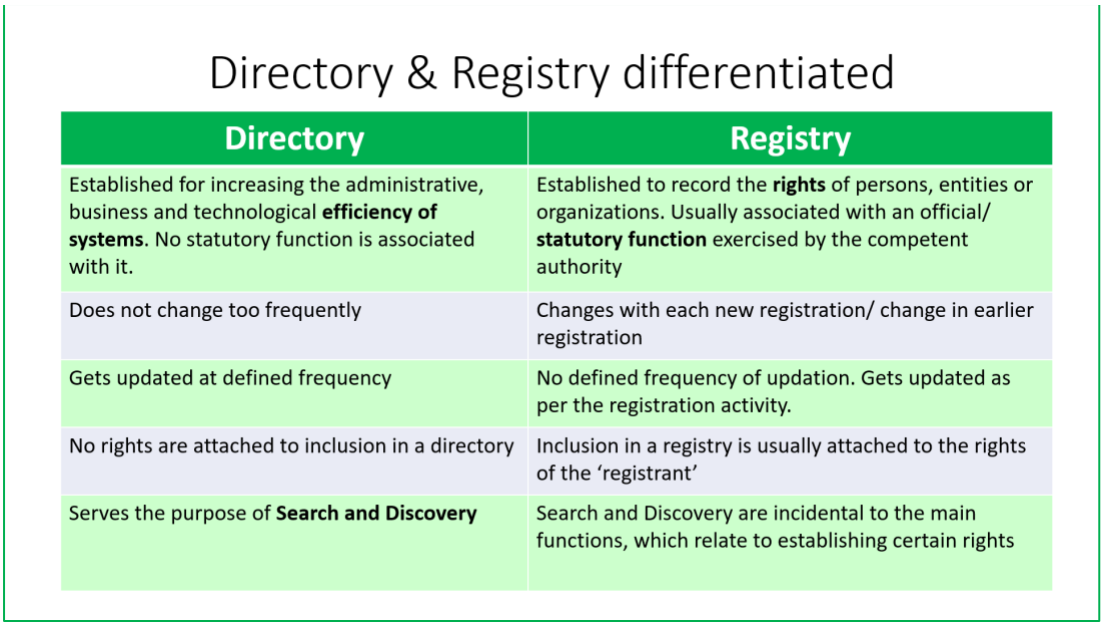
Copy to:

1) Sh. J. Satyanarayana, Ex-Secretary (MeitY)
2) Sh. Rajesh Verma, Special Secretary (IT)
3) Sr. PPS to Secretary (AC&FW)

Annexure III (see Section 4.2(2))

Illustrative list of Core Registries, Core Directories and Master Codes in Agri Sector





Directory	Registry
Established for increasing the administrative, business and technological **efficiency of systems**. No statutory function is associated with it.	Established to record the **rights** of persons, entities or organizations. Usually associated with an official/ **statutory function** exercised by the competent authority
Does not change too frequently	Changes with each new registration/ change in earlier registration
Gets updated at defined frequency	No defined frequency of updation. Gets updated as per the registration activity.
No rights are attached to inclusion in a directory	Inclusion in a registry is usually attached to the rights of the 'registrant'
Serves the purpose of **Search and Discovery**	Search and Discovery are incidental to the main functions, which relate to establishing certain rights

Annexure IV (see Section 4.2(4))

Reference Model of Data Exchange (DEx)

1. Overview

Data Exchange (DEx) is a critical building block in the evolution of data economy. Multiple Exchanges need to evolve to meet the widely varying requirements of the various sectors of the economy to realize the full potential. This model outlines the technical, regulatory, and operational requirements of the DEx. Considering that itis a nascent concept with very few functional exchanges available globally, it is felt appropriate to provide an illustrative reference model of DEx that incorporates all the features and requirements..

2. Value proposition and objectives of Data Exchange

It is a necessary first step for the sponsors of a DEx to set out clearly the sector(s) that the DExM proposes to address, and the value proposition of the DEx in specific terms. This is essentially required to see that the critical mass of data providers, data consumers and other service providers are convinced of the viability of participating in the DEx initiative. While the value proposition depends substantially on the sector, the following is an illustrative list of objectives that DEx could pursue and offer.

a. Ease of **discovery** of data critically required for business operations.

b. Deriving the full economic value out of the 'internal' data, which is anyway created by an organization for its business purposes.

c. Availability of data required for **innovation using AI** and other emerging technologies.

d. Being able to provide value-added, integrated, and end-to-end services to the customers using the **combinatorial power** of different datasets obtained from multiple sources.

e. Development of services that **promote public good** by using data, which was not easily available in pre-DEx situation.

f. Enhancing the transparency of businesses and the public sector through analysis of data and deriving **insights** into the functioning and performance of various organizations.

g. Accelerating **research** in areas of public interest like health, education, agriculture, and environment.

h. Inculcating '**data discipline**' among various organizations in their effort to participate actively in the DEx ecosystem.

3. Scope of Data Exchange

DEx needs to play the role of a facilitator. It should be data-agnostic, technology-neutral, fair, and equitable through the transparency of its governance systems. Considering this, a DEx needs to limit its scope to establishing the **Minimum Enabling Environment** with the mission of connecting the data providers and data consumers by merely acting as an 'intelligent bridge' between them. The scope of the DExneeds to be carefully delineated by the sponsors spelling out what the DExwill do, and equally importantly, what it *will not* do. The minimal technical and functional capabilities of the DEx are indicated in what follows.

4. Logical Architecture of Data Exchange

Figure A gives a high-level view of the DEx in terms of the various components and their respective capabilities.

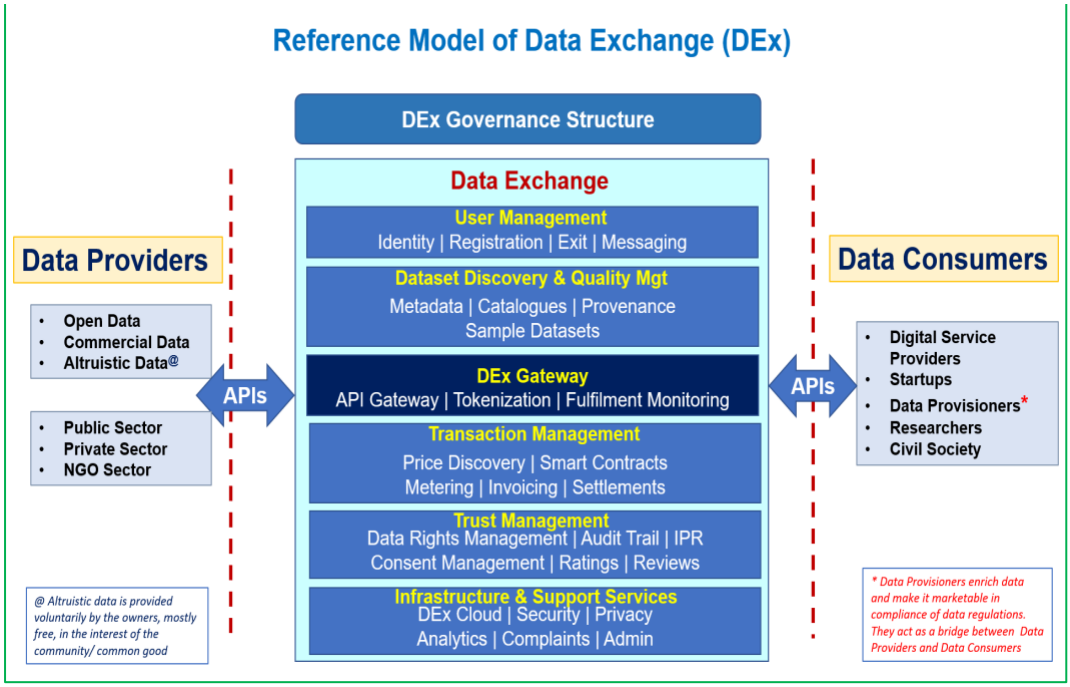


Figure A: Reference Model of DEx

The salient features of the structure, as below.

a. The 6 components of the DEx represent 30 capabilities in the areas of technology, regulation, and management. These are considered adequate to form the Minimum Enabling environment.

b. The promoters of DEx should detail these capabilities into a set of granular requirements and specifications that inform and guide the actual implementation.

c. Open standards, open source components and agile development methodology are recommended.

d. The 6 components should be developed adopting the principle of orthogonality.

5. Guidelines for Implementation

a. A **multi-stakeholder governance structure** should be established to ingrain trust, and to balance the interests of diverse groups of stakeholders. Considerations of gender, equity and sustainability should weigh with the sponsor in arriving at the constitution.

b. The initiative can be **government-led or business-led** depending on the sector or theme. Government-led DEx implementations should consider PPP model or partnership model in preference to an RFP-based or least-cost-based procurement. The partner should have adequate expertise in the sector and its data space and should have adequate stake in the success of the venture.

c. An appropriate business model may be devised to ensure that the DEx is financially sustainable. It is preferable that the sponsor bears the capex of the MEE and the operational costs are recovered through service charges to be collected from the participants of DEx.

d. While selecting a partner for the DEx project, is essential to eliminate any possible conflict of interest in terms of technology or the use of data.

6. Conclusion

Data Economy promises a lot. Catalyzing the development of a few data exchanges is an essential first step. This note provides a high-level guidance for its implementation.

Annexure V (see Section 4.7)

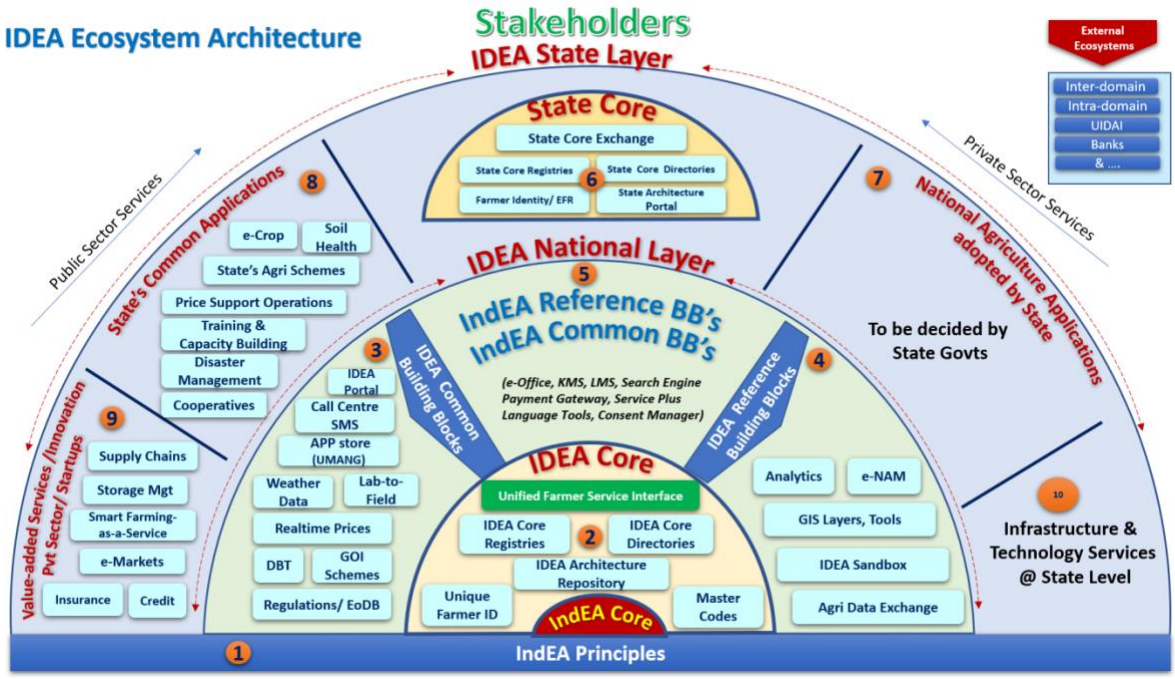
Major Applications developed by the Ministry of Agriculture

(to be considered by the States for adoption)

Sl No	Name of the Application	Overview of Functionality	Website/ URL	Contact details of Developer/ Nodal Officer
1	PM-KISAN	May be seen through URL	www.pmkisan.gov.in/	NIC Team M/o Agriculture
2	Soil Health Card		http://soilhealth.dac.gov.in	
3	Agri-Clinics and Agri-Business Centre		http://www.agriclinics.net/	
4	Agrimarket Portal		https://agmarknet.gov.in/	
5	DBT Central Agri Portal		http://dbtdacfw.gov.in	
6	DBT Farm Mechanisation		http://agrimachinery.nic.in	
7	Department of Agriculture, Cooperation and Farmers Welfare Website		http://agricoop.gov.in/	
8	Farm Analysis Package 2.0		http://farmap.dac.gov.in	
9	FQCS		http://fqcs.dac.gov.in	
10	SEEDEXIM		http://Seedexim.gov.in	

Annexure VI

IDEA Architecture (see section 4.2)



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4. https://negd.gov.in/digital-service-standard
5. http://egovstandards.gov.in/sites/default/files/IndEA%20Framework%201.0.pdf
6. https://www.nhp.gov.in/NHPfiles/National_Digital_Health_Blueprint_Report_comments_invited.pdf
7. http://egovstandards.gov.in/sites/default/files/IndEA%20Framework%201.0.pdf
8. http://egovstandards.gov.in/sites/default/files/IndEA%20Framework%201.0.pdf