



## Bharat-VISTAAR: Building a Unified AI-Driven Digital Ecosystem for Farmer Empowerment and Agricultural Governance in India

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India's agricultural sector, supporting over 140 million farmers, has seen rapid digital adoption via AI advisory tools, marketplaces, and data platforms. Yet, challenges like siloed databases, fragmented scheme access, limited multilingual support, and poor last-mile connectivity hinder progress. To address this, the Government of India launched Bharat-VISTAAR (Virtually Integrated System to Access Agricultural Resources), a federated, AI-driven National Digital Public Infrastructure (DPI) for agriculture. This multilingual ecosystem integrates weather intelligence, market prices, scientific advisories, and government schemes (e.g., PM-Kisan, PMFBY, Soil Health Card, Kisan Credit Card) into a unified, interoperable framework. Built on a three-layer architecture—Demand Side (farmer interfaces with voice-first, multilingual access), Network Layer (AI analytics and federated DPI), and Supply Side (validated sources like ICAR, IMD, Agmarknet, NPSS)—Bharat-VISTAAR enables secure data exchange, personalized real-time advisories, and open APIs for state-institution collaboration. Acting as a digital assistant via Bharti-AI, it delivers weather updates, crop/pest alerts, mandi prices, and scheme services to smallholder farmers. By fostering data interoperability, climate-market intelligence, and streamlined governance, Bharat-VISTAAR creates a scalable backbone for transformative agricultural extension in India.

**Keywords:** Agricultural Extension Reform; Artificial Intelligence in Agriculture; Climate-Smart Agriculture; Digital Governance; Digital Public Infrastructure (DPI); Federated Architecture.

### Introduction

In recent years, the agriculture sector has undergone rapid digital transformation through the adoption of artificial intelligence (AI), satellite-based crop monitoring, precision agriculture tools, farm management applications, digital marketplaces, and data-driven advisory

platforms. This digital momentum is reflected in the expanding Agri-tech market. However, despite these technological advancements, structural inefficiencies persist. Agricultural data remains distributed across multiple ministries, state portals, and institutional databases, often operating in isolation. Farmers frequently navigate fragmented systems to access weather updates, mandi prices, research advisories, and government scheme benefits. Multilingual accessibility remains limited in many platforms, and integration between research institutions, meteorological services, pest surveillance networks, and market intelligence systems is often weak. Moreover, the digital divide- particularly among small and marginal farmers continues to constrain equitable access to these technologies. Farmers often rely on multiple disconnected portals for weather, market prices, crop advisory, and scheme benefits. This fragmentation increases time, uncertainty, and dependency on intermediaries. Bharat-VISTAAR has been introduced to provide a unified, AI-driven platform where all essential agricultural services are accessible through a single interface.

Key structural challenges include:

- Siloed agricultural databases across departments
- Fragmented access to scheme benefits and services
- Limited multilingual and conversational advisory systems
- Inadequate integration of research, weather, and market intelligence
- Persistent digital access gaps in rural regions

In this context, Bharat-VISTAAR (Virtually Integrated System to Access Agricultural Resources) was officially launched on 17 February 2026 at the State Institute of Agricultural Management (SIAM) Jaipur, Rajasthan. The launch was organized by the Ministry of Agriculture & Farmers Welfare, Government of India. It emerges as a systemic reform initiative rather than a standalone application. Conceptualized as a National Digital Public Infrastructure (DPI) for Agriculture, Bharat-VISTAAR seeks to move beyond isolated digital tools and create a federated, interoperable, and AI-driven ecosystem. By harmonizing data exchange across central and state systems, enabling multilingual voice-first access, and integrating scientific research with real-time weather and market intelligence, the platform aims to redefine agricultural extension and governance in India. It represents a transition from fragmented digital service delivery toward a unified, scalable, and intelligent agricultural infrastructure.



Rajasthan Chief Minister Bhajanlal Sharma, Union Minister Shivraj Singh Chouhan, and others during the launch of 'Bharat Vistaar', AI Hackathon, Agri Fund, and AI for Agriculture Roadmap, in Jaipur on Tuesday | Photo Credit: ANI

**Figure 1: Launch Event Bharat VISTAAR at Jaipur, Rajasthan (17 February 2026)**

## Why Bharat-VISTAAR? Addressing Structural Gaps

India's agricultural digital ecosystem has expanded rapidly in recent years, with multiple apps and portals providing weather updates, mandi prices, crop advisories, and scheme information. However, most of these technologies operate independently, creating data silos and fragmented user experiences. Bharat-VISTAAR addresses this structural gap by functioning as a federated Digital Public Infrastructure (DPI) that integrates previously disconnected systems into a unified network.

- **Integrated Systems**

Unlike many recent Ag-Tech platforms that focus on a single function- such as weather forecasting, digital marketplaces, or advisory apps- Bharat-VISTAAR integrates weather data, market intelligence, research advisories, and scheme portals within one interoperable framework. This reduces duplication, enhances data interoperability, and enables AI-driven insights based on combined datasets rather than isolated information streams.

- **Inclusive Access**

Most modern agricultural technologies rely heavily on smartphone apps and internet connectivity, which limits access for farmers with feature phones or low digital literacy. Bharat-VISTAAR adopts a voice-first approach, allowing farmers to access services through natural language voice bots and telephony systems. This design ensures broader accessibility and bridges the rural digital divide, making it more inclusive than many app-based Agri-Tech solutions.

- **Local Language Access**

While some recent platforms offer limited regional language support, Bharat-VISTAAR aimed to support over 22 Indian languages through multilingual AI systems. This goes beyond simple translation by enabling conversational interaction in local dialects. As a result, comprehension and adoption improve significantly compared to many existing digital tools.

- **Interconnected Services**

Most digital agriculture platforms specialize in specific services such as advisory, lending, or market linkage. Bharat-VISTAAR, in contrast, connects credit systems, land records, market access, research advisories, and government schemes into one ecosystem. This integrated service continuum enables farmers to move seamlessly from information access to entitlement and market participation, offering a more comprehensive governance model than fragmented vertical technologies.



Figure 2: Official Portal of Bharat VISTAAR

Bharat-VISTAAR is designed to solve the challenge of siloed agricultural data across departments, bridge rural digital divides, enable local language accessibility, and create a unified ecosystem for credit, markets, and technical support.

## Conceptual Philosophy and Governance Principles

Bharat-VISTAAR is built on four key principles. These principles define how the system is designed and how it operates across India's agricultural ecosystem.

1. **Farmer-First Approach**
2. **AI & Multilingual Technology Backbone**
3. **Federated Architecture**
4. **Open & Interoperable Standards.**



### 1. Farmer-First Approach

The Farmer-First principle ensures that the entire platform is designed around the real needs of farmers. The focus is on delivering timely, relevant, and easy-to-understand information such as weather updates, crop advisories, market prices, and government scheme benefits.

This works through:

- Voice-based access for farmers using feature phones
- Simple query-response interaction
- Local language interfaces
- Multi-channel access (web, mobile, assisted centres, and phone)

By reducing complexity and prioritizing usability, the system ensures that farmers can easily access and act upon the information provided.

### 2. AI & Multilingual Technology Backbone

Artificial Intelligence forms the analytical core of Bharat-VISTAAR. The platform integrates data from multiple sources such as weather services, research institutions, market systems, and pest surveillance networks.

This works by:

- Aggregating structured datasets from different departments
- Analysing conditions to provide crop-specific guidance
- Enabling conversational interaction through natural language processing
- Supporting to aim communication in 22 Indian languages

The multilingual AI ensures that farmers can ask questions and receive responses in their preferred language, improving understanding and adoption.

#### 2.1 Bharti-AI: The Core Intelligence Engine

**Bharti-AI** is the artificial intelligence system powering Bharat-VISTAAR. It performs natural language processing, voice recognition, and contextual advisory generation. It

integrates structured datasets from multiple government sources and converts them into simple, actionable responses.

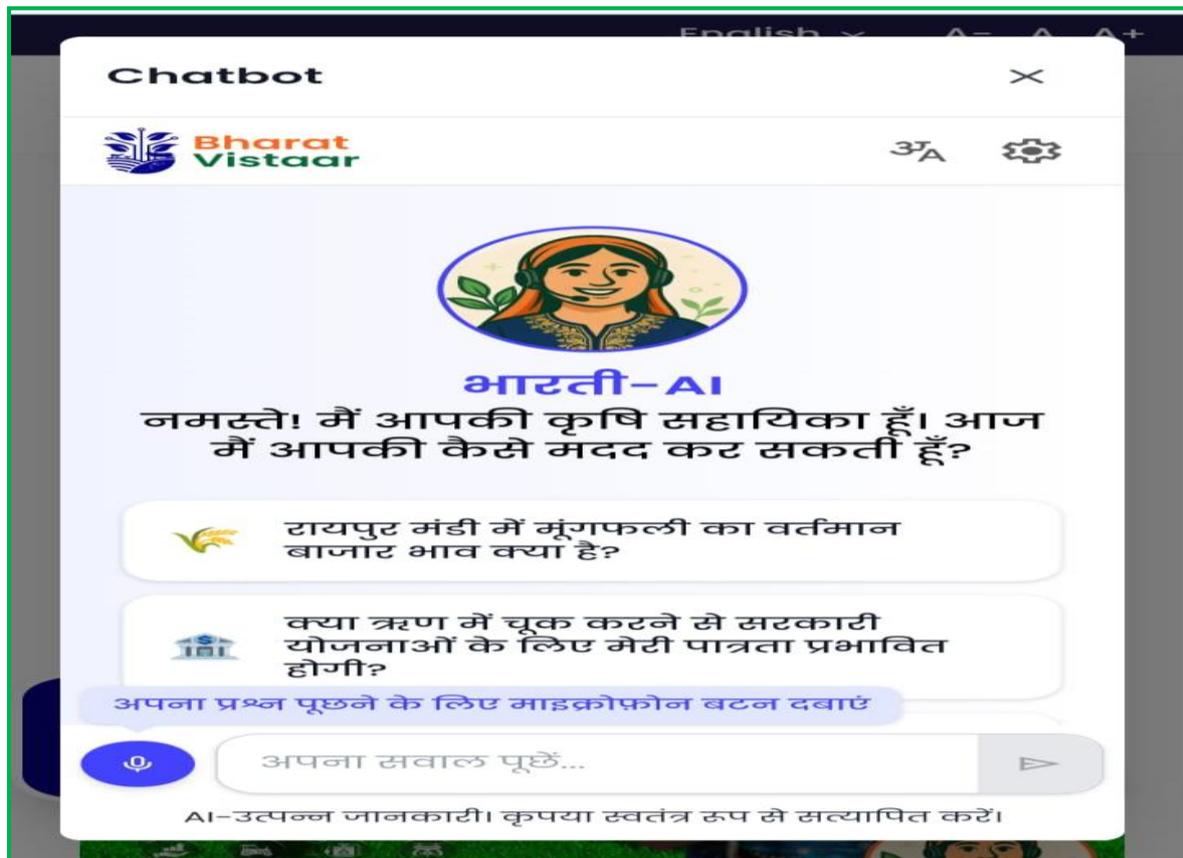


Figure 3: Bharti-AI Chatbot of Bharat VISTAAR

Key capabilities include:

- Location-specific crop advisory
- Weather-based irrigation scheduling
- Pest and disease alerts
- Real-time scheme eligibility detection
- Multilingual interaction in Hindi, English, and other regional languages

### 3. Federated Architecture

Bharat-VISTAAR follows a federated digital infrastructure model. Instead of centralizing all agricultural data into one single database, it connects multiple central and state systems through secure data exchange mechanisms.

#### System Architecture: A Federated Digital Public Infrastructure

Bharat-VISTAAR operates as “One Connected Digital Network” through a Three-Layer Federated Model that connects farmers, digital infrastructure, and verified data sources into one coordinated ecosystem.

#### Demand Side

The Demand Side is the user interaction layer. Farmers and extension workers access services through:

- Web platforms
- Mobile applications
- Assisted service centres
- Voice-based helplines
- Interfaces available in local languages

This layer works as the entry point of the system. When a farmer asks a question such as about weather, mandi prices, or schemes- the query is transmitted to the Network Layer for processing. It ensures simple, multilingual, and voice-enabled access without handling core data itself.

### Network Layer (VISTAAR Network Layer)

The Network Layer is the core Digital Public Infrastructure (DPI). It includes:

- Central Node (national coordination & AI engine)
- State Nodes (state-level system integration)
- Secure data exchange protocols
- AI-driven analytics engines
- Open APIs for interoperability

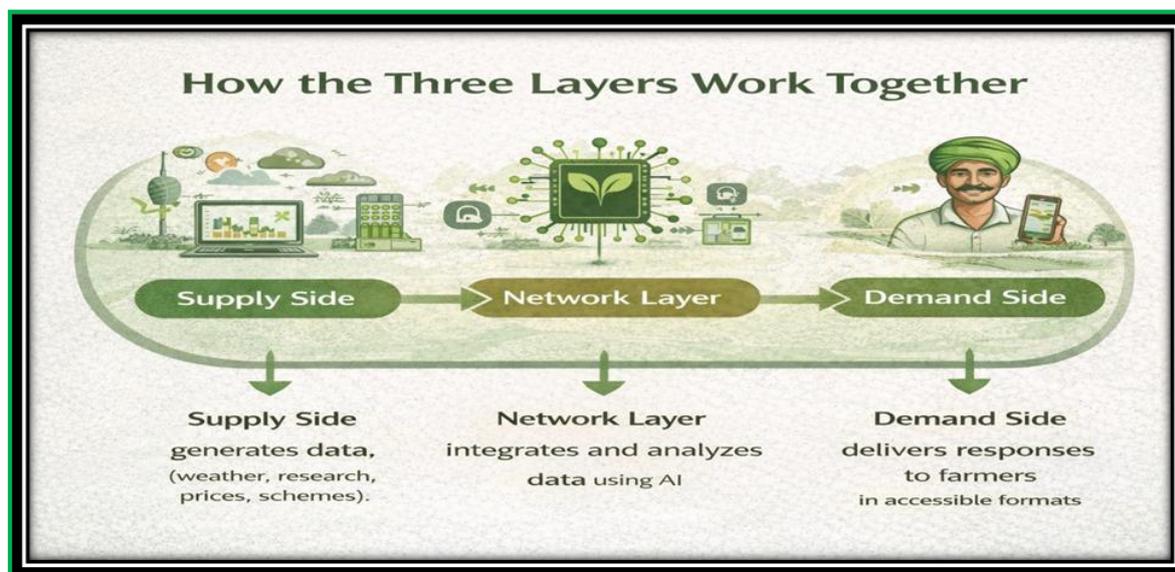
This layer processes incoming queries. The AI engine aggregates data from multiple sources, analyzes it, and generates contextual responses. The federated structure ensures that data remains distributed across central and state systems while enabling secure communication between them.

### Supply Side

The Supply Side represents trusted data providers. It includes:

- ICAR research systems
- IMD weather forecasts
- Agmarknet mandi prices
- NPSS pest surveillance
- State agricultural portals
- Bhashini multilingual AI framework

This ensures that advisories are grounded in validated research, real-time meteorological data, verified market intelligence, and multilingual AI frameworks.



This structured flow ensures reliability, scalability, inclusivity, and secure governance. The federated model allows new states, partners, and services to join without disrupting the system, making Bharat-VISTAAR a flexible and expandable Digital Public Infrastructure for Agriculture.

### Open & Interoperable Standards

The platform is built on open standards that allow various stakeholders to participate within the ecosystem. Government departments, research institutions, cooperatives, and partners can integrate their services into the network.

This works through:

- Open APIs for service integration
- A Provider–Seeker participation model
- Plug-and-play onboarding for new systems

This approach enables collaboration, faster scaling, and continuous innovation within a structured framework.

Together, these four principles ensure that Bharat-VISTAAR operates as an inclusive, intelligent, scalable, and interconnected Digital Public Infrastructure for Agriculture. It unifies advisory services, scheme access, research outputs, and market information into one coordinated digital ecosystem that empowers farmers with timely and reliable support.

## Core Functional Components

### AI Advisories

- Personalized crop health alerts
- Weather-based advisories
- Machine learning-powered predictions

### Integrated Government Schemes in Bharat-VISTAAR

Bharat-VISTAAR integrates major agricultural schemes including:

- Kisan Credit Card (KCC)
- Pradhan Mantri Kisan Samman Nidhi (PM-Kisan)
- Pradhan Mantri Fasal Bima Yojana (PMFBY)
- Soil Health Card (SHC)
- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
- Seed Authentication, Traceability & Holistic Inventory (SATHI)
- PM Annadata Aay Sanrakshan Abhiyan (PMASHA)
- Agriculture Infrastructure Fund (AIF)
- Sub-Mission on Agricultural Mechanization (SMAM)
- Per Drop More Crop (PDMC)

Farmers can check eligibility, application status, documentation requirements, and benefit tracking through the unified interface.

### Multilingual Support

- 22+ languages
- Text and audio-based interfaces

### Voice Access

- Natural language voice bots
- Query-based assistance without typing

### Open APIs for Innovation

Agri-Tech startups and partners can:

- Build applications on the VISTAAR ecosystem
- Integrate advisory services
- Contribute data and solutions

The screenshot displays a user interface with several key features:

- Weather Update:** 28°C Sunny, Jaipur, Wind: 1: 0 km/h.
- Market Rates:** Wheat ₹ 2,400 / Qtl, Jaipur Mandi.
- Pest Alert:** Brown Plant Hopper Risk in Paddy.
- Govt Schemes:** PM-KISAN Scheme Apply Now.
- Crop Advisory:** Represented by a plant icon.
- Soil Health:** Represented by a soil and magnifying glass icon.
- Livestock Info:** Represented by a cow icon.
- Agri Schemes:** Represented by a government building icon.
- Latest Advisory:** Tomato Blight Control. Check for blight symptoms and use recommended fungicides. View Details.
- Mandi Prices:** Chana (Gram) ₹ 5,100 / Qtl, Bikaner Mandi. More Rates.
- Support:** Dial Helpline 155261 and Chat with AI-Assistent.

## Ecosystem Roles: Provider- Seeker Model

Bharat-VISTAAR supports flexible ecosystem participation.

- **Provider Platform**

Host and publish advisories, schemes, or datasets at scale.

- **Provider**

Contribute expertise or domain-specific services.

- **Seeker Platform**

Develop farmer-facing applications integrated with VISTAAR.

- **Seeker**

Consume network services.

**Design Advantage:** Organizations may assume one or multiple roles within the ecosystem, ensuring flexibility, collaborative scaling, and innovation across the agricultural digital landscape.

## Practical Applications for Farmers

Bharat-VISTAAR supports farmers at different stages of agricultural production:

- **Pre-Sowing**

Crop selection guidance based on soil and climate data.

- **Crop Growth Stage**

Weather-based irrigation scheduling and pest alerts.

- **Harvest Stage**

Mandi price comparison and marketing advisory.

- **Post-Harvest Stage**

Scheme support and crop insurance claim guidance.

The platform reduces the need for multiple physical visits to government offices and improves timely decision-making.

## Support for Researchers and Policy Planning

Bharat-VISTAAR provides structured access to agricultural datasets for researchers and policymakers.

Researchers can:

- Analyze crop productivity trends
- Study pest outbreak patterns
- Examine scheme utilization data
- Conduct regional agricultural assessments

The integrated digital infrastructure supports data-driven agricultural policy and extension reforms.

## National Impact and Scaling Potential

The platform aims to empower over 140 million farmers across India by creating a unified digital ecosystem that connects multiple states and union territories within a common agricultural infrastructure. By integrating diverse public institutions, research bodies, cooperatives, and private-sector partners, Bharat-VISTAAR facilitates coordinated service delivery at a national scale. Active state-level integrations such as, Bihar Krishi, and Amul AI illustrate how regional systems can seamlessly connect to the central network while retaining their operational autonomy. This federated integration model demonstrates scalable national interoperability, enabling consistent data exchange, advisory dissemination, and service access across different administrative and geographic contexts.

## Transformational Implications

### 1. From Fragmentation to Integration

#### Structural Shift

Fragmented Information Systems → Unified AI-Driven Ecosystem

Bharat-VISTAAR transforms agricultural extension by consolidating previously disconnected portals—weather, research, market prices, and government schemes—into a

coordinated digital infrastructure. Instead of operating in silos, these systems now function within a federated and interoperable framework.

## 2. Data Interoperability Across Ministries

- Standardized APIs enable structured data exchange.
- Central and state departments remain autonomous while connected.
- Reduces duplication and inconsistencies.

## 3. Personalized Advisory Systems

- AI-driven analytics process integrated datasets.
- Context-specific crop recommendations are generated.
- Advisory shifts from generic to farmer-focused guidance.

## 4. Real-Time Weather and Market Intelligence

- Integration with IMD for live weather forecasts.
- Agmarknet integration for mandi price updates.
- Pest surveillance inputs for risk alerts.

## 5. Unified Scheme Lifecycle Management

- Single-window access to schemes.
- Eligibility checks, benefit tracking, and grievance redressal.
- Integrated administrative workflow.

## 6. Innovation-Friendly Open API Model

- Open, interoperable digital standards.
- Provider–Seeker ecosystem participation.
- Plug-and-play integration for partners.

## 7. Scalable Federated DPI Model

The federated architecture ensures:

- National scalability
- Secure data governance
- Standardization across states
- Long-term sustainability

By mirroring successful digital governance frameworks, this model enables scale, interoperability, and systemic transformation in agricultural service delivery.

## Future Directions

The future development of Bharat-VISTAAR is oriented toward transforming the platform from an integrated advisory system into a predictive, adaptive, and fully automated digital governance ecosystem. The following dimensions outline its scientific and technological evolution.

### • Full Lifecycle Scheme Automation

Full lifecycle scheme automation refers to the end-to-end digitization and integration of government agricultural schemes within a single interoperable platform. This includes:

- Automated eligibility verification using integrated land records, crop data, and farmer databases
- Digital application submission and document validation
- Real-time benefit tracking
- Direct benefit disbursement monitoring
- Grievance redressal management

This requires structured data harmonization across ministries, standardized metadata frameworks, and rule-based or AI-assisted eligibility engines. By integrating administrative workflows into the digital infrastructure, transaction costs are reduced and governance efficiency improves. The system transitions from an information portal to a process-oriented digital governance mechanism.

### • Predictive Decision Support Systems (DSS)

The next phase involves strengthening predictive analytics capabilities to support farm-level decision-making through data-driven modeling.

**a. Crop Suitability Models**

These models integrate soil characteristics, historical yield data, climatic patterns, and agro-ecological parameters to recommend optimal crop choices. Geospatial analytics and machine learning classification techniques can be applied to improve regional crop planning.

**b. Market Trend Forecasting**

Time-series analysis, econometric modeling, and AI-based demand-supply forecasting algorithms can predict price movements. This supports strategic crop marketing and reduces price volatility risks.

**c. Climate Risk Modeling**

Using climate simulation models, probabilistic rainfall forecasts, and extreme weather scenario mapping, the system can assess production risk. Integrating meteorological data with crop growth models enhances resilience planning.

**d. Input Optimization Algorithms**

Decision algorithms can determine optimal fertilizer application, irrigation scheduling, and pest management strategies based on real-time and historical datasets. This improves resource-use efficiency and sustainability.

Together, these components convert Bharat-VISTAAR into a comprehensive Decision Support System (DSS) grounded in predictive science.

**• Advanced AI Integration**

The platform's evolution will include deeper integration of advanced AI technologies.

**a. Conversational AI Upgrades**

Enhanced natural language understanding (NLU) and contextual memory systems will enable more accurate and personalized interactions in multiple languages. This supports complex query handling beyond simple information retrieval.

**b. Satellite Data Integration**

Remote sensing technologies can provide real-time crop health monitoring through vegetation indices (e.g., NDVI), soil moisture estimation, and acreage assessment. Integrating satellite imagery with AI analytics strengthens crop monitoring and early warning systems.

**c. IoT-Enabled Farm Data Systems**

Integration of sensor-based data (soil moisture sensors, weather stations, irrigation systems) can provide farm-level precision insights. IoT connectivity combined with cloud analytics enables real-time farm management recommendations.

These enhancements will expand the platform's analytical depth and improve accuracy in advisory generation.

**d. State-Level Customization**

Given India's diverse agro-climatic zones, uniform advisory models are insufficient. Future development includes state-specific and region-specific modules tailored to:

- Agro-climatic classifications
- Cropping patterns
- Local soil conditions
- State-specific schemes and policies

Through modular architecture and federated nodes, states can integrate localized datasets and extension services without compromising interoperability. This ensures contextual relevance while maintaining national standardization.

**Scientific Significance of the Roadmap**

Collectively, these future directions transform Bharat-VISTAAR from a data integration platform into a predictive, adaptive, and scalable agricultural intelligence system. By combining lifecycle governance automation, predictive modeling, advanced AI integration, and regional customization, the platform positions itself as a next-generation Digital Public Infrastructure capable of enhancing productivity, resilience, and institutional efficiency in Indian agriculture.

## Conclusion

Bharat-VISTAAR represents a landmark evolution in India's digital agricultural transformation. By harmonizing advisory systems, scheme governance, research dissemination, and market intelligence within a federated AI-driven infrastructure, it addresses longstanding structural inefficiencies in agricultural service delivery. Its multilingual, voice-first, open-API-enabled architecture ensures inclusivity, scalability, and innovation. As the system matures into a predictive decision support framework, it holds the potential to significantly enhance climate resilience, improve farmer income stability, and strengthen India's agricultural governance ecosystem. Bharat-VISTAAR thus stands not merely as a digital platform, but as a foundational infrastructure for the next generation of agricultural transformation in India.

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