SATHI

An ecosystem where each seed tells its own story

Edited by **MOHAN DAS VISWAM**

Seeds are the fundamental units of agriculture, serving as the starting point for plant growth and crop production. The quality of seeds significantly influences agricultural productivity, making their careful selection and management crucial for ensuring robust and sustainable farming practices. Governments play a crucial role in ensuring the availability of quality seeds to farmers by implementing seed regulations, promoting research and development, and facilitating seed certification programs. The Seed Authentication, Traceability & Holistic Inventory (SATHI) project, available at **https://seedtrace.gov.in**, is designed to assist the government in ensuring the timely and accurate distribution of high-quality seeds and eliminating the potential spurious seed from the ecosystem.

SATHI goes above and beyond as a multi-tenant application, seamlessly serving all states

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SATHI, or Seed Authentication, Traceability & Holistic Inventory, strives to create a nurturing digital environment. It aims to oversee seed production, ensure quality certification, and manage distribution with utmost care. The core objective is to offer complete traceability of seeds from their inception to the hands of farmers across successive generations. It envisions a system that not only monitors the journey of seeds but also fosters a holistic approach, acknowledging the significance of each step in empowering farmers and ensuring the authenticity of their agricultural resources.

on a single project instance. What makes it truly exceptional is its remarkable configurability, allowing each state to personalise its experience. Everything from state-specific workflows, unique terminologies, and individualised payment collection methods to data capturing and validation logics can be easily configured to suit the distinct needs of each state.

The vision of SATHI is to alleviate crosscut concerns and elevate the focus on quality assurance activities among concerned officers. By intricately connecting the dots throughout the generations of seed production and

certification, SATHI aims to strengthen the supply chain, enhance overall quality, and prevent any deceptive practices within the seed chain.

The key stakeholders within the SATHI ecosystem encompass diverse entities such as ICAR, Breeder Seed Production Centres, State Seed Certification bodies, State Seed Testing Labs, Central Seed Testing Lab, Seed Producing Companies, Seed Processing Plants, Seed growers, Seed wholesalers, Seed retailers, State Governments, and ultimately, the farmer. Strategic engagement and alignment of objectives among these entities are crucial for achieving the overarching goals of the ecosystem.

The development of the project comprises 2

The SATHI project has proven to be pivotal, serving as a centralised online system for seed traceability, authentication, and inventory management. It effectively addresses the intricate challenges associated with seed production, quality identification, certification and supply chain management. The rollout of SATHI marks a significant breakthrough in the digitalization of core processes, fostering increased operational efficiency, seamless collaboration, and heightened transparency. I extend my heartfelt appreciation and congratulations to the NIC team for their unwavering dedication and sustained efforts in the effective implementation and adept handling of change management, to suit state specific flavours contributing to the success of this transformative initiative.

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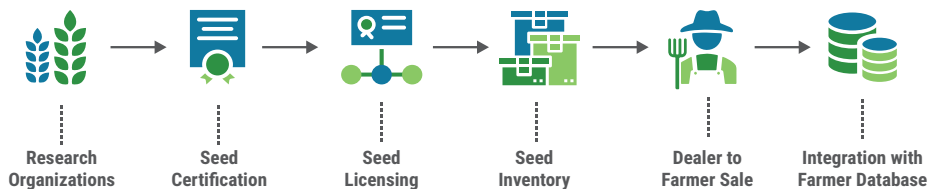
Seed with Valid Certification Only can be sold by Valid Licensed Dealers to the Registered Farmers

▲ **Fig 11.1** **Six Verticals of Seed Chain**

phases. Phase 1 of the project covers workflow automation of Nucleus to Breeder seed production, Breeder to Foundation and Certified seed production processes. Phase 2 of the project will cover seed dealer licensing, seed supply chain and inventory management.

By implementing SATHI, farmers gain comprehensive traceability for the purchased seed bags, along with real-time information on seed availability in their vicinity. This system acts as a robust deterrent against the infiltration of substandard, spurious, or duplicate seed bags into the supply chain, permitting the sale of QR coded seed bags exclusively sourced through authorised channels. The primary focus is on ensuring farmers receive genuine seeds, ultimately contributing to increased agricultural production and enhanced income for the farmers.

Features

The SATHI portal offers following features aimed to enhance and streamline the entire lifecycle of seeds:

● **End-to-End Visibility and Traceability:** The portal provides complete visibility and trace-ability of seeds from their inception to the end of their lifecycle

● **Traceability via Backward Linkage:** It enables the identification of seed sources, varieties, and quality through backward linkage, allowing tracing back to their origin
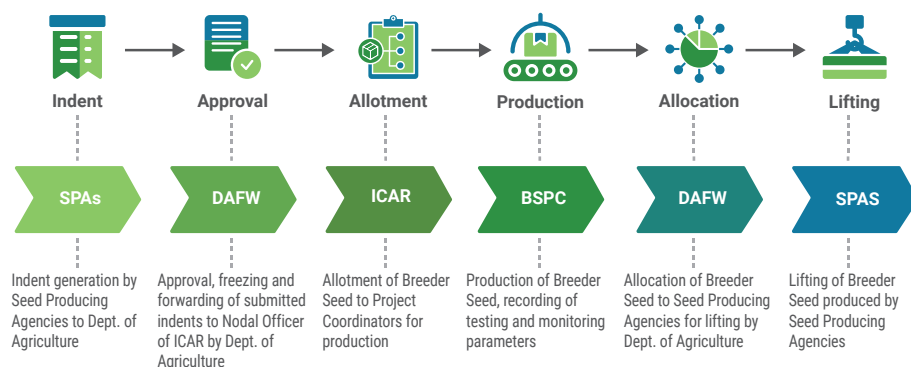
● **Automation of Breeder Seed Processes:** Manual processes like indent submission, allocation, allotment, and lifting for breeder seeds are automated, ensuring efficiency

● **Real-Time Monitoring of Seed Demand and Supply:** The portal facilitates real-time monitoring of the demand for breeder seeds, their allocation, and the supply chain, ensuring timely responses

● **Automation of Seed Certification:** It automates the seed certification system involving registration, inspection, testing, and issuance of certificates, reducing manual intervention

● **Reduced Paperwork and Mobile/Tablet Inspection App:** Paperwork is minimized, and inspection processes are made more efficient through the use of a mobile/tablet app, enabling easier and more effective inspections

On behalf of all the Seed Growers, Seed Producers of Punjab & PSSCA Staff, I salute NIC team for their whole-hearted support to Punjab in transformation from Offline Certification to Online mode. It is really wonderful to work with such an efficient team under the able guidance of NIC Officer and the dedicated team members of NIC Help desk were always available 24 X 7 for support. We look forward to nurturing the seed of relationship shown between Punjab and NIC, to attain exemplary achievement together.

Dr. J.D.S. Gill
Chief Seed Certification Officer
Punjab State Seed Certification Authority

● **Automated Seed Dealer Processes:** The portal automates the registration of seed dealers, facilitates application renewal, and issuance of licenses, thus, streamlining administrative procedures

While trial run of SATHI Phase 2, all the things worked perfectly in the SATHI portal and physical trial done successfully for Supply chain Management.
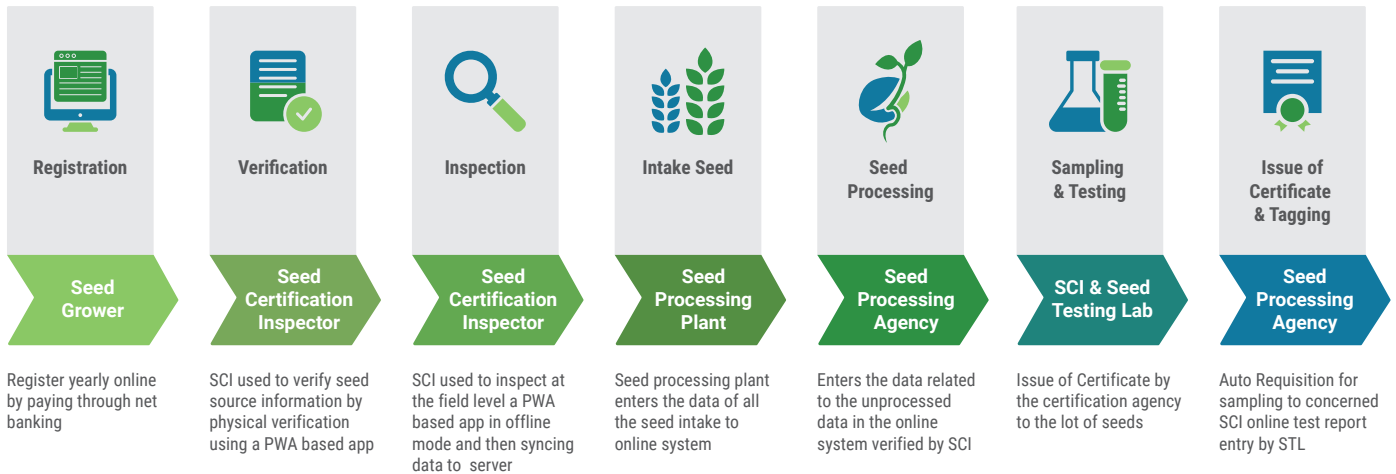
Jyoti
Joint Director (Q&C) & Nodal Officer SPMU
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● **Dashboard-Based Monitoring and MIS:** A dashboard provides comprehensive monitoring and Management Information System (MIS) capabilities, enabling oversight of all seed lifecycle activities

● **Inventory and Sales Monitoring:** It allows for the monitoring of seed inventory and tracks sales to farmers, ensuring better management of supply and demand

In essence, the SATHI portal integrates various technological solutions to automate and enhance the entire spectrum of activities involved in the life cycle of seeds, from sourcing and certification to distribution and monitoring, ultimately bene-

▼ **Fig 11.2** **Nucleus to Breeder Seed Production, Monitoring & Distribution**

Process flow of Seed Certification

Registration	Verification	Inspection	Intake Seed	Seed Processing	Sampling & Testing	Issue of Certificate & Tagging
Seed Grower	Seed Certification Inspector	Seed Certification Inspector	Seed Processing Plant	Seed Processing Agency	SCI & Seed Testing Lab	Seed Processing Agency
Register yearly online by paying through net banking	SCI used to verify seed source information by physical verification using a PWA based app	SCI used to inspect at the field level a PWA based app in offline mode and then syncing data to server	Seed processing plant enters the data of all the seed intake to online system	Enters the data related to the unprocessed data in the online system verified by SCI	Issue of Certificate by the certification agency to the lot of seeds	Auto Requisition for sampling to concerned SCI online test report entry by STL

▲ **Fig 11.3** **Process flow of Seed Certification**

fiting both stakeholders and farmers.

SATHI is engineered on a robust Microservices Architecture, ensuring modular and independent components for seamless operation. Leveraging container-based deployment, SATHI exhibits lightweight characteristics, optimising resource usage. The application achieves high scalability through Kubernetes orchestration, allowing efficient management of containerized instances. With its Big-Data readiness, SATHI employs NoSQL databases, accommodating large and diverse datasets. Importantly, SATHI is developed with a commitment to use open-source technologies, mitigating the risk of vendor lock-in.

Technology Stack

Operating System: Linux

Deployment mode: Container

Modular Architecture: Microservice

Message Broker: RabbitMQ, NATS.io

Database: PostGreSQL, MongoDB, Redis

Orchestration Platform: Kubernetes

Frontend: Angular, html, Javascript, CSS

Middleware: Node.js

Impact

Phase I of SATHI was officially launched by the Honourable Minister of Agriculture, Shri. Narendra Singh Tomar, on April 19, 2023.

Till date, 14 states such as Odisha, Uttarakhand, Punjab, Chhattisgarh, Maharashtra, Rajasthan, Jammu, Kashmir, West Bengal, Himachal, Karnataka, Jharkhand, Sikkim and Assam have been on-boarded and 2 states integrated with API on the platform.

- SATHI already integrated 16 states into the national seed grid
- More than 5678 seed producing agencies are on-boarded
- More than 75330 Seed growers are registered

- Breeder Seed Indents have been received for Kharif 2024

The conduction of a successful trial run of supply chain management has marked a significant milestone in the project's journey. User feedback received during the trial was positive and satisfying. Valuable insights have been gained for further enhancements.

The National Level Workshop on SATHI was successfully conducted in October 2023 to facilitate interactions among stakeholders (Department of State Agriculture, ICAR, and Central Agencies like NSC, KRIBHCO etc.) and to enrich knowledge on SATHI portal. More than 75 Officers from agriculture departments of different States and Centre participated in the workshop in person.

Way Forward

To add more trust and authentication, it is planned to adopt Blockchain technology and set up a 'Seed Blockchain'. The Seed certificates and movement of Seed bags in Supply chain (movement transactions) will be pushed to Seed blockchain. The Authentication and Trace and Track will be through APIs provided by Seed Blockchain. The PoC for the same is demonstrated successfully. To monitor the physical movement of goods, it is proposed that an IoT based tracking system may be integrated with the core supply chain management module.

▼ **Fig 11.4** **Seed Bag Movement**
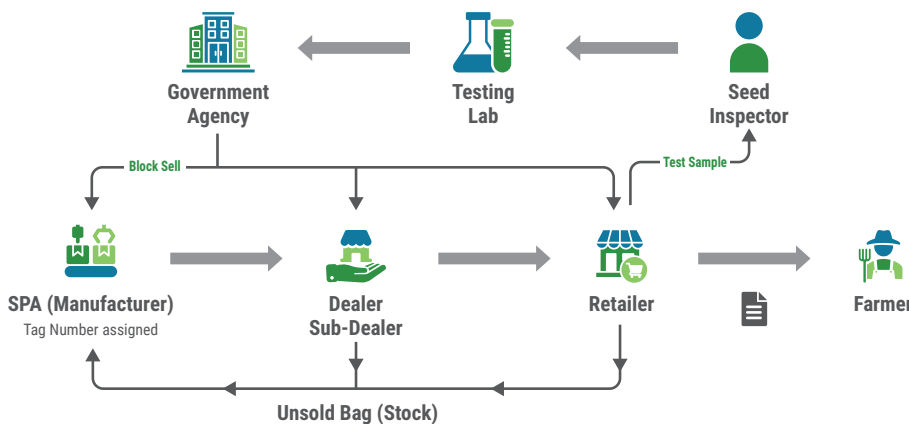
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