QC-Tech360 Documentation

Cacaotech-360

Documentation for the Tracking and Tracing module for the Cacao Tech 360 platform.

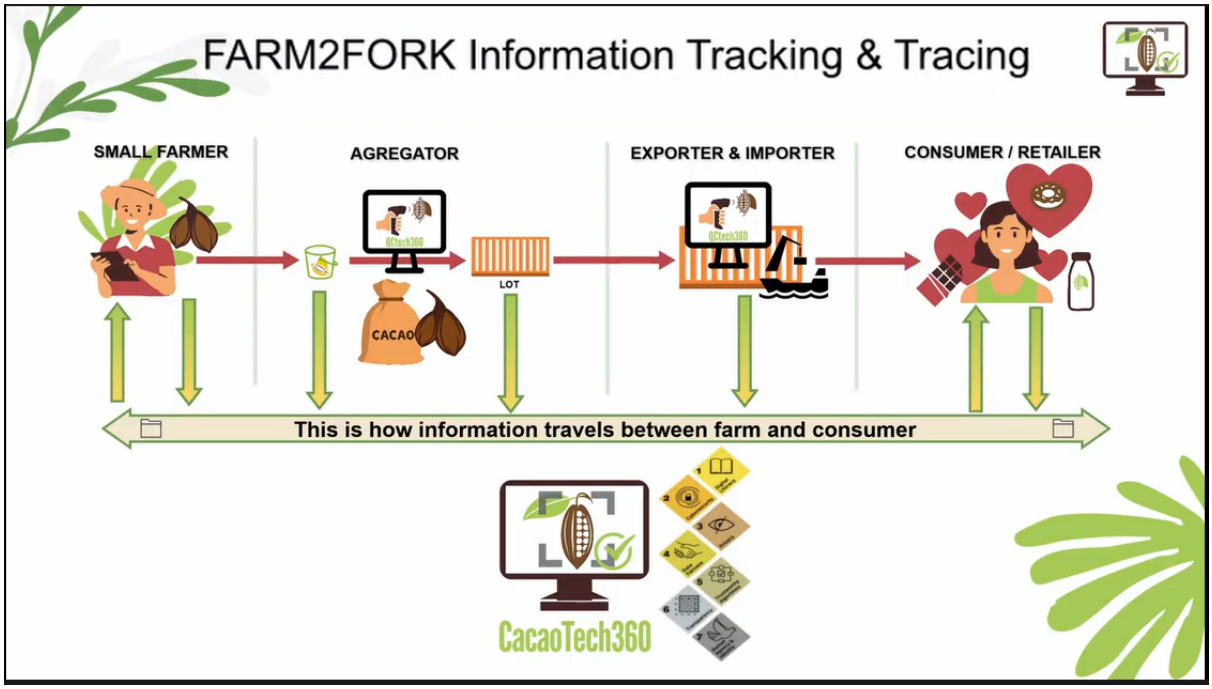
Last updated: 30.10.2025

Please note that the document is will be updated regularly.

1. Overview

1.1 Purpose of the System

The Cacaotech-360 system provides an end-to-end process for onboarding farmers, managing compliance, and ensuring full traceability of cacao fruit from farm to production. It begins with the registration of farmers and their farms, creating a secure digital foundation for all subsequent activities. Once registered, each farmer goes through a verification and approval stage, after which they are activated as official suppliers. Communication between San Jose and its farmer network is managed directly within the platform, using familiar tools such as WhatsApp or email, while deliveries are recorded and tracked through the Cacao Fruit Flow Module. Together, these modules form a seamless process that supports transparency, compliance, and efficiency, while reducing the administrative burden for smallholder farmers.



1.2 Key Features and Modules

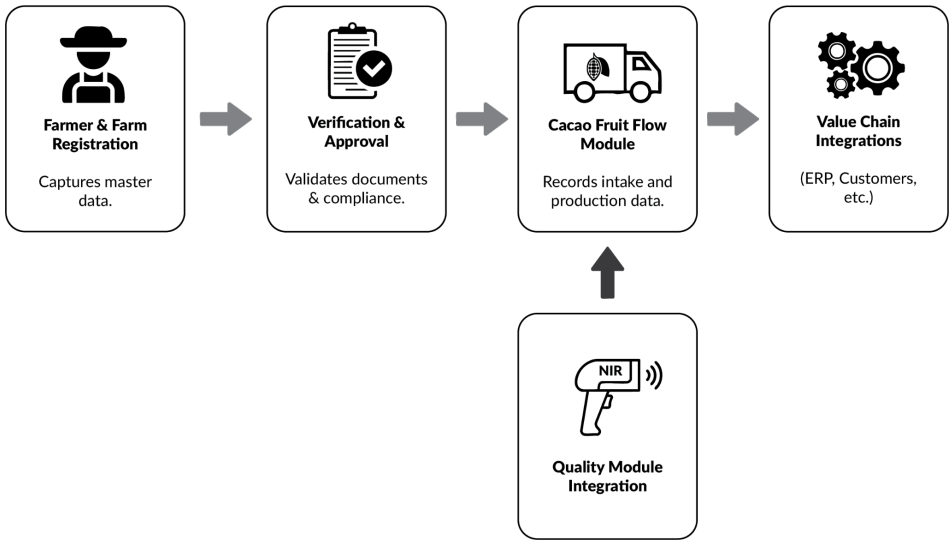
- **Farmer & Farm Registration**: Captures and securely stores farmer and farm master data.
- **Verification & Approval**: Validates documents such as EUDR compliance, organic certification, and land-use rights.
- **Farmer Communication**: Provides two-way communication channels via WhatsApp, email, or other messaging services.

- **Cacao Fruit Flow Module**: Records intake, production data, and quality parameters from harvest to processing.
- **Quality Module Integration**: Links predictive analytics and QC results from MicroNIR scans directly to farmer batches.

  Value Chain Integrations: Ensures data exchange with ERP systems, certification platforms, and customers.

Open sources tools used

Tool	Open Source	License	Notes
React	Yes	MIT	
Refine	Yes	MIT	Framework built on top of React
Node.js	Yes	MIT	Runtime environment
Strapi	Yes	MIT	Headless CMS
PostgreSQL	Yes	PostgreSQL License	Database
Docker	Yes (Engine)	Apache 2.0	Containerization platform



- Current Status

Minimum Viable Product (MVP)

Technology Readiness Level (TRL) – **6**

- Technology demonstrated in a relevant environment.
- See description at EU and NASA.

User-centred customization and co-development:

TRL6 means that the existing system's features and its individual modules will have to be customized for the intended use as specified by the user. As per the user-requirements, new system features and modules might need to be co-developed for the well-defined use (e.g. adapted for the particular value-chain actors or connected to the already existing information system) in order to deliver the expected functionalities.

Getting on with CacaoTech360:

- **The onboarding materials are available here:**

  FARM2FORK – data solutions (SPA) (website)
  https://www.youtube.com/watch?v=taPaebI4QWw (promo video)

- **Software demo**
  https://www.youtube.com/watch?v=s86K87PBCos

- **Software licence**
  Once the use-case is defined and validated, users will be required to purchase the licence where the use, terms and conditions will be specified. The cost of the solution will depend on the level of customization and scale of application required by the user.

- **Purchase**
  Once the use-case has been defined and the level of customization achieved, **user will be provided:**

1. Agreement to access the user-licence (cost of the whole solution will depend on the complexity and scale of the use-case)
2. Instructions to download the relevant application and with validated model

3. User can choose receive the training of how to use the system in the intended process (reccommended)
4. Based on the use-case, user might opt for regular system review, maintenance and updates (recommended)

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2. System Architecture

The Cacaotech-360 system architecture is designed as a modular, scalable, and privacy-first platform that connects every actor in the cacao fruit value chain, from smallholder farmers to end customers.

2.1 Modular Design

Cacaotech-360 is composed of the distinct but interconnected modules listed in section 1.2. This modularity ensures flexibility: components can evolve independently while still operating as part of one connected platform, balancing inclusivity for farmers with no digital tools, interoperability with advanced farm management systems, and seamless integration with San Jose's internal ERP and customer-facing systems.

2.2 Technology Stack

The system is built on a modern web-based architecture with:

- **Frontend**: React with Refine framework for customizable user interfaces.
- **Backend**: Node.js and Strapi for API and content management.
- **Database**: PostgreSQL for secure and scalable data storage.
- **Integration Layer**: REST APIs and webhooks for real-time synchronization with ERP and third-party systems.
- **Cloud Deployment**: Role-based access control, ensuring compliance with security and data privacy standards.

2.3 Privacy & Security

Privacy-by-design is at the core of the architecture. Farmer details are securely stored, with controlled access rights ensuring only authorized San Jose staff can view personal data. For external stakeholders such as customers, anonymized batch-level

information is shared—allowing for tracking and tracing without exposing sensitive farmer identities. All data exchanges are encrypted, and audit logs are maintained for accountability.

2.4 Scalability & Future-Proofing

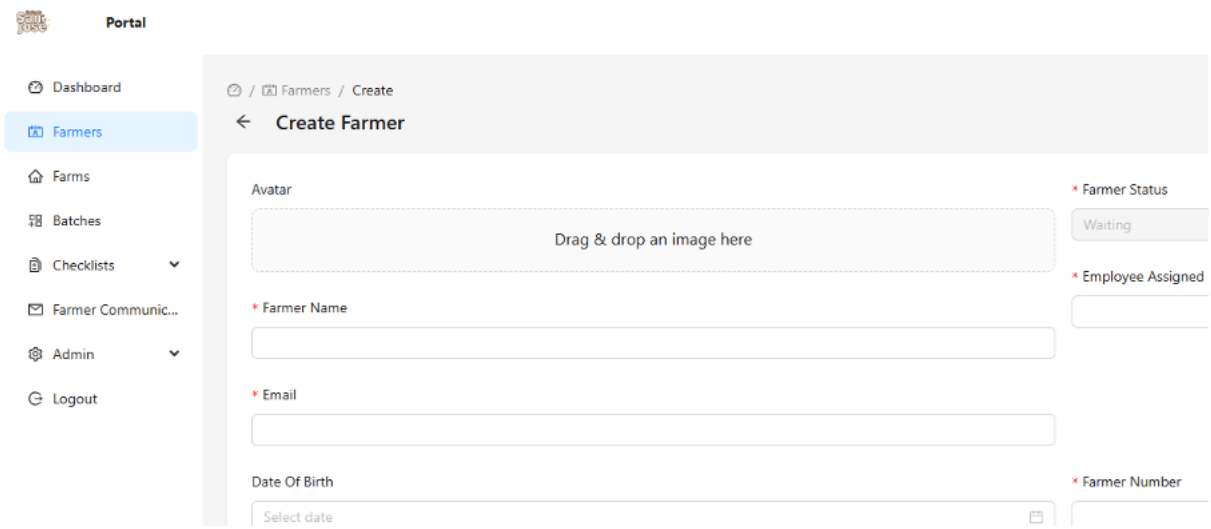
The architecture is designed to be scalable across geographies and adaptable to future requirements. Additional modules (e.g., carbon footprint tracking, biodiversity monitoring, or advanced predictive analytics) can be added without disrupting the core. This ensures that Cacaotech-360 not only supports San Jose's current operations but also grows with evolving regulatory, market, and customer demands.

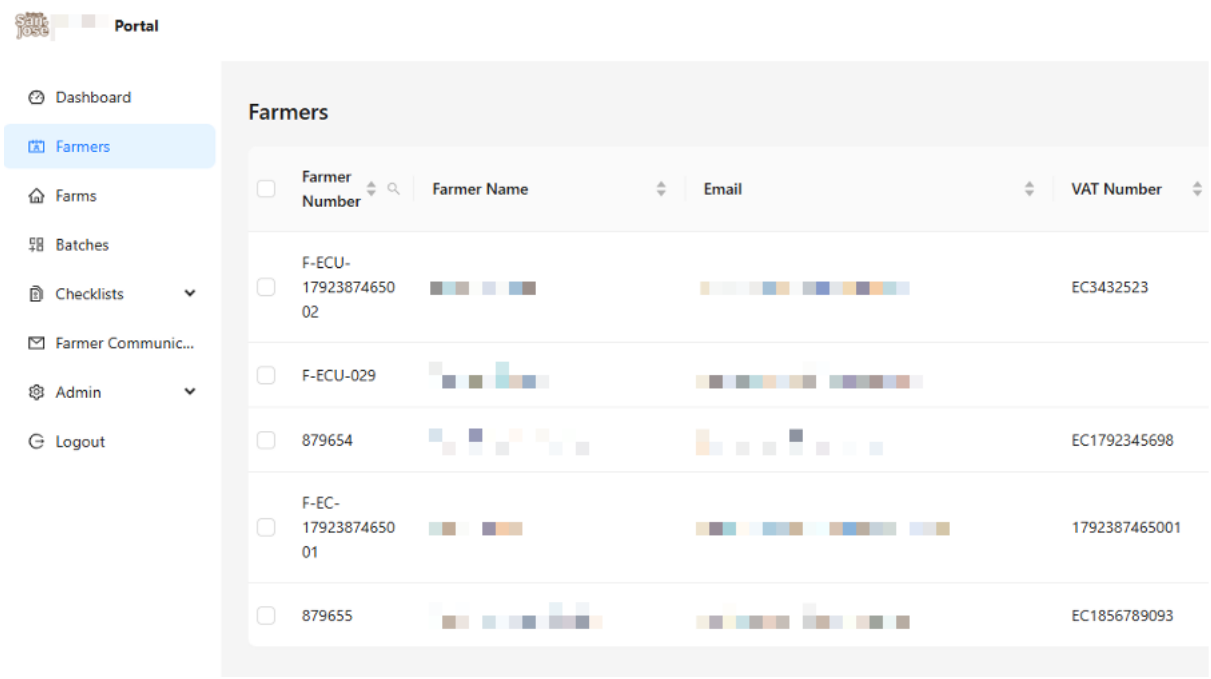
3. User Guide: Core Workflow

This chapter provides a step-by-step guide to the main operational workflows within the Cacaotech-360 system.

3.1 Farmer & Farm Onboarding

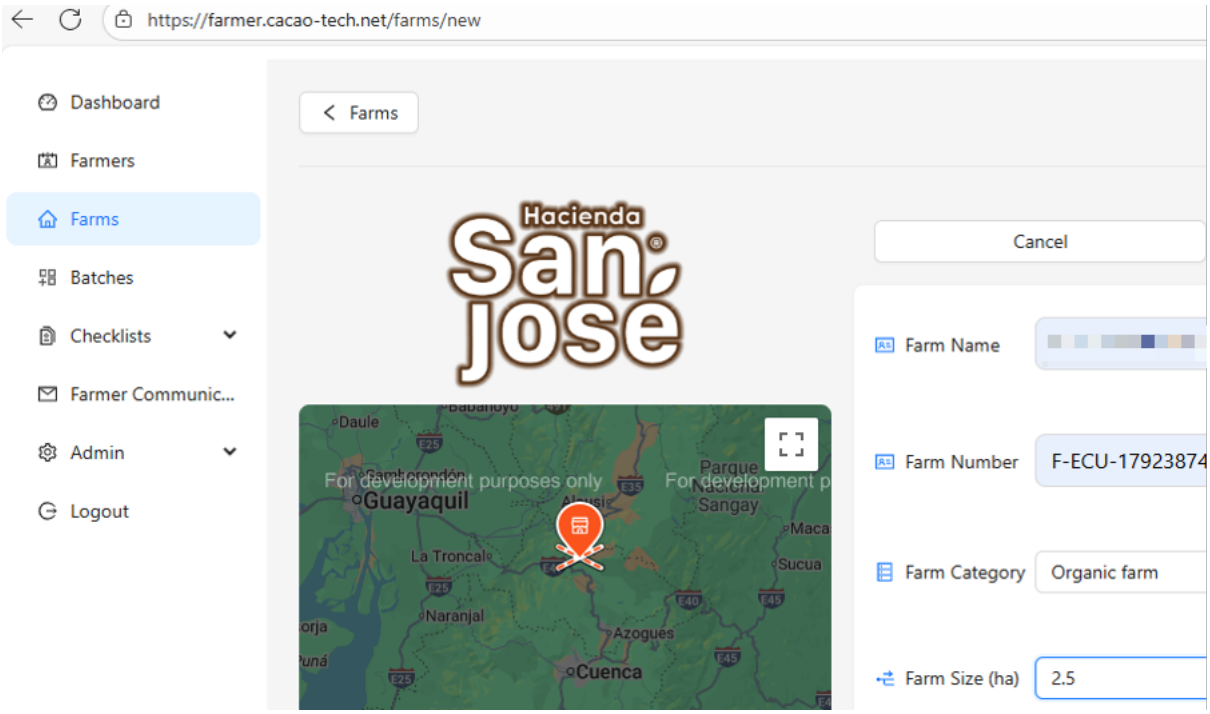
The farmer acceptance process begins with the creation of a digital record for each farmer in the San Jose system. A staff member enters the “Farmers” section of the portal and registers the farmer by filling in a form with all relevant details. Some fields are mandatory, such as the farmer's name, email address, gender, and a unique farmer number, while additional information such as date of birth, address and VAT number can also be recorded. At this stage, the system automatically sets the farmer's status to **Waiting**, indicating that the farmer has not yet been verified.





3.1.2 Farm Registration

Alongside the farmer's personal record, the farms linked to that farmer are also registered in the system. In the “Farms” module, details such as the farm name, a unique farm number, farm category, size in hectares, and the pod variety cultivated are entered. The farm's location can be pinned on the map, providing a precise origin record for traceability and EUDR compliance, since coordinates or polygon data can demonstrate whether or not the land is deforested. This creates a complete picture: a verified individual farmer linked directly to their registered farms.

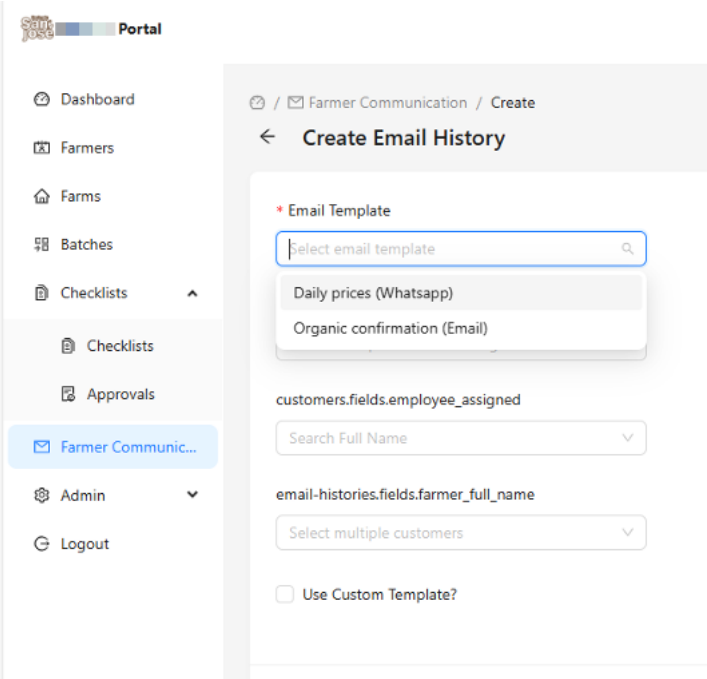


3.2 Farmer Verification & Approval

Once a farmer has been registered and is shown with the status **Waiting**, the assigned San Jose employee takes responsibility for verifying the information provided. The verification step involves reviewing documents that prove the farmer is eligible to supply cacao fruit, such as proof of EUDR compliance, organic certifications, and land-use rights. To make this process efficient, the application allows all supporting documents to be uploaded directly into the system and stored with the farmer's digital record. When the verification is complete and all required documents have been uploaded and validated, the farmer's status is updated from **Waiting** to **Active**, officially recognizing them as a supplier.

3.3 Farmer Communication

The farmer communication module provides a direct, reliable, and secure channel for information exchange. Integrated with the farmer database, the module enables San Jose to reach farmers individually or in groups through their preferred communication method, such as email or WhatsApp. Communication can be targeted—reaching all farmers at once, or only specific groups, such as EUDR certified farmers. The module also supports two-way communication, and all exchanges are automatically stored in the farmer's communication history, ensuring transparency.



3.4 Cacao Fruit Flow Module (Tracking Deliveries)

This module is designed to capture and manage the entire journey of cacao fruit from the moment it arrives at San Jose. When a delivery of cacao fruit arrives, staff record the intake directly in the module. Each record is linked to the specific farmer and farm, guaranteeing transparency. Core information such as intake batch ID, intake date, delivered volume (kg), and fruit quality indicators (pH and Brix) is stored. The same record then continues into production, where details such as harvest and production dates, volume, and pulp variety are tracked. This creates a full digital record of the fruit's transformation, linking raw material intake directly to production outcomes.

4. Installation and Access

4.1 Accessing the Platform

The Cacaotech-360 system is a web-based application. Users can access the platform through a standard web browser using the credentials provided to them.

4.2 User Roles and Permissions

The system operates with different user roles to ensure data security and appropriate access levels. Key roles include:

- **System Administrator** (San Jose Staff): Full access to create, view, and manage farmer records, verify documents, and track all batches.

- **Farmer**: Limited access, primarily for communication and viewing their own delivery records (future feature).
- **Downstream Customer** (e.g., Pacha de Cacao): Access to anonymized batch-level data for traceability and quality control.

4.3 Server and Deployment Requirements

This section outlines the technical requirements for the hosting environment where the Cacaotech-360 application is deployed. This information is intended for system administrators and IT personnel.

4.3.1 Deployment Architecture

The application is designed to run in a containerized environment using **Docker**. All necessary Docker configuration files are provided by the development team (Vanilla Gorilla), simplifying the deployment process.

4.3.2 Server Specifications

The following minimum specifications are required for the hosting server:

- **Virtual Machine**: 1 VM instance
  - CPU: 4 cores
  - RAM: 16 GB
  - Storage: 50 GB SSD (minimum)
  - Operating System: Ubuntu LTS (Long-Term Support)
- **Database**
  - Database System: PostgreSQL
  - Minimum Version: 17
- **Networking and Security**
  - Domain: A registered domain name is required
  - Subdomain: A subdomain for specific system components (e.g., the farmer portal) is required
  - SSL Certificate: A valid SSL certificate must be installed to enable HTTPS encryption for all connections

5. Integrations

A key strength of the Cacaotech-360 system is its ability to integrate seamlessly with other systems across the value chain.

5.1 General Integration Capabilities

Cacaotech-360 can connect with third-party systems—including certification bodies, logistics providers, financial platforms, and internal ERP systems—so that critical information flows automatically between stakeholders. The system can exchange data with larger farmers or cooperatives that already operate their own management platforms, synchronizing data rather than duplicating it.

5.2 Integration with the QC-Tech360 Quality Module

Cacaotech-360 integrates directly with the QC-Tech-360 quality module, which uses MicroNIR technology to assess the quality of cacao beans and pulp. Quality results, such as CUT test classifications, origin, and confidence scores, are automatically linked to the corresponding farmer, farm, and batch records within Cacaotech-360. This ensures that quality information travels seamlessly alongside traceability data, providing a digital quality profile for each batch.

5.3 Integration with Downstream Partners (Example: Pacha de Cacao)

The integration with customer systems, such as that of Pacha de Cacao, ensures that relevant batch information flows seamlessly from supplier to customer while respecting privacy. When San Jose records a delivery, the core batch data is automatically synchronized with the customer's portal. To protect farmer privacy, personal identifiers are not shared. Instead, batches are transferred with anonymized references that still allow for full tracking and tracing. This model creates a balance: customers gain reliable and transparent data, while farmers' privacy is safeguarded.