Turmi Technologies PLC – Farmer Financing & Management Platform

Developer Requirement Specification (Detailed Document)

Executive Summary

Turmi Technologies PLC provides end-to-end managed services for small and medium-scale farmers in Ethiopia. The company's model ensures farmers gain access to **input financing**, quality **agricultural inputs** (seeds, fertilizer, animal feed), and **technical guidance** through partnerships and its own seed multiplication farms. Farmers are onboarded under **contract farming agreements**, and their farms are continuously monitored throughout the **planting, growing, harvesting, post-harvest, and repayment stages**.

The repayment model is flexible — farmers can repay in **produce** (a portion of harvest) or **cash**. Turmi Technologies also offers a buyback option, purchasing the farmer's share of produce at a negotiated price.

The platform digitizes this process — creating a **farmer management and financing web application** with intelligent analytics to improve decision-making, ensure transparency, and enhance productivity.

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1. Project Overview

The Turmi Tech Farmer Financing & Management Platform is a two-phase development project:

- **Phase 1 (MVP):**
  Focuses on the agent and admin portal for farmer onboarding, KYC, contract generation, financing workflow, farm activity tracking, and repayment management.
- **Phase 2:**
  Introduces AI modules for satellite-based farm monitoring, yield prediction, risk scoring, crop recommendations, and market intelligence (price forecasting, livestock auctions, and e-commerce for animal feed). All monetary transactions and financing values are expressed in **ETB (Ethiopian Birr)**.

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2. System Users and Roles

1. **Admin**
    - Full access to system data and configuration.
    - Approves financing, manages user roles, and generates reports.
2. **Agent**
    - Onboards farmers, verifies KYC, records GPS farm boundaries.
    - Manages contracts, updates farming activities, and documents repayments.
3. **Partner / Investor**
    - Reviews farmer portfolios.
    - Approves financing or investment requests.
    - Tracks performance metrics and repayments.
4. **Farmer (Indirect User)**
    - Represented by data collected via agents or self-onboarding in future versions.

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3. Functional Requirements

3.1 Farmer Onboarding & KYC Module

Purpose: Capture and validate farmer details, map farm boundaries, and register contracts.

Data Fields:

- **Individual:** First Name, Middle Name, Last Name, National ID (optional), Gender, Date of Birth, Contact Number, Address (Region, Zone, Woreda, Kebele, House No.), GPS Boundary Coordinates.
- **Business:** Legal Name, TIN, Business Type, Owner Details, Address, GPS Coordinates.
- **Supporting Documents:** Photo ID, Land Ownership Certificate, Optional Kebele Verification Letter.

Functions:

- GPS mapping using Google Maps API or OpenStreetMap.
- Store KYC documents as encrypted files.
- Assign agent and verification status.
- Generate unique **Farmer ID**.

3.2 Contract Management

Purpose: Create digital agreements between Turmi and farmers.

Features:

- Select contract type from dropdown:
    - *Animal Feed Farming* (Alfalfa, Napier, Cowpea, etc.)
    - *Animal Husbandry* (Cattle, Sheep, Goat, Poultry)
- Auto-fill fields based on contract type:
    - Input financing package (seed, fertilizer, feed)
    - Repayment schedule (produce/cash)
    - Buyback price and quantity range

- Digital signature support (touch input or uploaded image)
- Auto-generate contract as **PDF** with timestamp and unique ID.

3.3 Input Financing Workflow

Purpose: Track input requests, disbursement, and repayment.

Stages:

1. **Financing Request** (initiated by agent)
2. **Review & Approval** (admin/partner)
3. **Input Disbursement** (recorded in ETB or produce (% or weight in ton))
4. **Usage Monitoring** (linked to farm workflow)
5. **Repayment Tracking** (produce or cash)
6. **Loan Closure / Renewal**

7.

Data Captured:

- Amount financed (ETB)
- Items provided (seed, fertilizer, equipment)
- Expected yield and repayment period
- Current balance and payment history

3.4 Farming Progress Workflow

Purpose: Document all farm operations and track performance.

Workflow Stages:

- Land Preparation
- Planting
- Irrigation/Fertilizer Application
- Growth Monitoring
- Harvest
- Post-Harvest Processing
- Storage/Transport
- Repayment (produce/cash)

Each stage includes date, GPS check-in, photos, and notes.

3.5 Repayment Module

Purpose: Manage repayment records and outstanding balances.

Features:

- Log repayments in **cash (ETB)** or **produce (kg, quintals, liters)**.
- Auto-convert produce repayments to ETB using current market rates.
- View balance and payment history.
- Generate repayment reports per farmer or per cooperative.

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4. Phase 2 – AI and Data Intelligence

4.1 AI Credit and Risk Scoring

Goal: Predict likelihood of repayment based on:

- Historical yield data
- Past repayment behavior
- Farm size and type
- Weather and soil conditions
- Satellite-derived crop health indicators

Tech Stack:

- Model: TensorFlow or similar
- Data: Historical farm data, satellite imagery, weather APIs
- Output: Numeric score (0–100) + qualitative label (Low, Medium, High Risk)

4.2 Satellite Image Processing and Farm Monitoring

Goal: Use AI and satellite data to predict yield, detect stress, and assess risk.

Data Sources:

- Sentinel Hub or Google Earth Engine
- MODIS Vegetation Index (NDVI)

Functions:

- Detect vegetation health trends
- Predict expected yield for specific feed crops
- Identify drought, pest, or flooding risks
- Generate alerts for underperforming farms

4.3 AI-based Price and Market Prediction

Purpose: Model feed and livestock price trends to optimize offtake.

Inputs:

- Historical prices
- Seasonal variations
- Transportation and storage cost data
- Demand trends from local markets

Outputs:

- Predicted price curves for upcoming weeks/months
- Recommended selling or storage strategies

4.4 E-Commerce and Auction Platform

Goal: Enable trading of farm products, animal feed, and live cattle.

Modules:

- **Marketplace:** Farmers or Turmi list animal feeds and livestock.
- **Weekly Auction:** Scheduled listings for live cattle.
- **Transaction Management:** Bids, sales, payment confirmation.
- **Integration:** Payment gateway and mobile money APIs.

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5. Technical Architecture

Component	Technology
Frontend	React.js / Vue.js (PWA, responsive, offline-ready)
Backend	Node.js (Express) or Python (FastAPI)
Database	PostgreSQL with PostGIS / MongoDB
AI/ML	Python (TensorFlow, Scikit-learn, OpenCV)
Maps	Google Maps API / OpenStreetMap
Hosting	AWS / Firebase / DigitalOcean
Authentication	JWT + Role-based access control
Storage	AWS S3 or Firebase Storage for images/contracts

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6. Data Model Overview

Farmer Table

Field	Type	Description
farmer_id	String	Unique Farmer ID
name	String	Full name
address	JSON	Region, Zone, Woreda, Kebele

gps_boundary	GeoJSON	Farm polygon
id_number	String	Optional National ID
contact	String	Phone number
agent_id	String	Linked agent
created_at	Date	Registration date

Contract Table

Field	Type	Description
contract_id	String	Unique contract ID
farmer_id	String	Linked farmer
type	Enum	Feed Farming / Animal Husbandry
start_date	Date	Start of contract
end_date	Date	End of contract
financing_value	Decimal	ETB amount
repayment_method	Enum	Produce / Cash
signed_contract	File	PDF

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7. API Endpoints (Sample)

Method	Endpoint	Description
POST	/api/farmer/register	Register new farmer
GET	/api/farmer/:id	Retrieve farmer details
POST	/api/contract/create	Create new contract
POST	/api/loan/approve	Approve financing
POST	/api/repayment/log	Log repayment
GET	/api/analytics/yield	Predict yield using AI
GET	/api/analytics/risk	Risk scoring output

8. Security and Compliance

- **Encryption:** All sensitive data (IDs, location, finance) encrypted at rest and in transit.
- **Authentication:** JWT-based session control, multi-role hierarchy.
- **Data Localization:** Stored within Ethiopian or African-based cloud zones if possible.
- **Audit Trail:** Log all user actions.
- **Offline Mode:** Allow data caching for low-connectivity regions.

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9. Reporting and Analytics

- Farmer registration summary (region, crop type, total area).
- Loan disbursement and repayment dashboards.
- Yield and performance analytics by zone.
- Investor ROI and portfolio breakdown.
- Predictive analytics summaries from AI models.

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10. Phase Implementation Plan

Phase 1 (Week 1–2): MVP

- Admin & Agent login
- Farmer onboarding with GPS and KYC
- Contract generation & signature
- Input financing & repayment module
- Farm activity workflow tracking
- Dashboard for monitoring farms

Phase 2 (Week 3–4+): AI & Marketplace

- AI yield and risk models
- Satellite data visualization
- Price prediction engine
- E-commerce and cattle auction integration
- Investor analytics dashboard

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12. Future Extensions

- Mobile farmer app (Android) for self-onboarding
- Integration with microfinance institutions
- Integration with government KYC databases
- Voice interface for low-literacy users