TextileFlow ERP: Complete Features & Functionality Guide

Executive Summary

TextileFlow ERP is an **enterprise-grade, cloud-native SaaS platform** purpose-built for textile and apparel manufacturers managing $100K-$500K+ monthly order volumes. This document comprehensively details all **pre-built modules, enterprise features, 100+ connectors, APIs, mobile applications, and real-time capabilities**.

Platform Highlights:

- ✅ **100+ Pre-Built Connectors** (E-commerce, Logistics, Payment, Accounting, BI, CRM)
- ✅ **615+ Unit Tests** with 85% code coverage + Integration/E2E/Security testing
- ✅ **Modern APIs**: REST (100+ endpoints), GraphQL, WebSocket, Webhooks
- ✅ **Native Mobile Apps**: iOS/Android with full ERP functionality
- ✅ **Real-Time Capabilities**: Live dashboards, AI forecasting, instant notifications
- ✅ **Textile-Specific Features**: Dyebatch tracking, shrinkage allowance, export compliance, variant BOMs
- ✅ **Enterprise Architecture**: Multi-tenant, role-based access, audit trails, compliance-ready

---

PART 1: ENTERPRISE ERP MODULES

1.1 Sales & Customer Management

Sales Order Management

- **Create & manage sales quotations** with validity periods
- **Auto-convert quotes to sales orders** upon customer acceptance
- **Order variant management** (colors, sizes, finishes per SKU)
- **Multiple pricing models**: Fixed, tiered, cost-plus, percentage markup
- **Customer credit limit enforcement** with dynamic AR tracking
- **Backorder management** with automatic stock reservation
- **Order fulfillment workflow**: Draft → Approved → Released → Shipped → Invoiced
- **Shrinkage allowance calculation** per product type (textile-specific)
- **Delivery schedule optimization** across warehouses
- **Sales performance tracking** by customer, product, territory, salesperson
- **Commission management** with auto-calculation based on thresholds
- **Return & rework order tracking** with reason codes
- **Customer portal** for order status, invoices, payments, delivery tracking

Customer Relationship Management (CRM)

- **Customer master data** with hierarchical organization support
- **Contact management** (primary, secondary, backup contacts per customer)
- **Customer segmentation** (by revenue, geography, product category, risk profile)
- **Customer credit profiling** with automated risk scoring
- **Communication history** (calls, emails, meetings logged automatically)
- **Customer activity tracking** (last order, average order value, seasonality patterns)
- **Document storage** per customer (MOUs, price agreements, quality certifications)
- **Customer feedback & complaint tracking** with resolution workflow
- **Account receivable aging** and collection workflow
- **Customer survey & NPS tracking**
- **Sales pipeline management** with opportunity tracking
- **Lead source tracking** (direct, referral, marketing campaign, trade show)
- **Customer lifetime value (CLV) calculation** and analysis

1.2 Purchase & Vendor Management

Purchase Order Management

- **Create purchase orders** for raw materials, components, finished goods
- **Vendor selection** with vendor performance scoring
- **Blanket order management** (multiple line releases against framework PO)
- **MOQ (Minimum Order Quantity) enforcement** with warnings
- **Quantity Break pricing** configuration per vendor
- **Early payment discount terms** (e.g., 2/10 Net 30) with auto-calculation
- **Purchase order approval workflow** with multi-level authorization
- **Release-to-pay cycle integration** with goods receipt, invoicing
- **Purchase order variance tracking** (price, quantity, delivery time)
- **Vendor document attachment** (certificates, quality reports, certifications)
- **Purchase order amendments** with change tracking

Vendor Management

- **Vendor master data** (legal, operational, financial information)
- **Vendor performance scorecards** (on-time delivery %, quality score, cost variance)
- **Vendor categorization** (strategic, preferred, approved, development, restricted)
- **Vendor financial assessment** (credit rating, payment history, bank details)
- **Vendor communication & escalation** workflow
- **Vendor audit trail** with inspection records
- **Vendor documents** storage (quality certificates, GOTS, OEKO-TEX, ISO certifications)
- **Alternative vendor sourcing** with cost comparison
- **Subcontractor & job-work vendor management** with workflow
- **Vendor payment terms management** (Net 30, Net 60, 2/10, etc.)
- **Vendor compliance tracking** (environmental, labor, safety certifications)

1.3 Inventory & Warehouse Management

Inventory Management

- **Real-time stock tracking** across multiple warehouses/locations
- **Inventory valuation methods**: FIFO, LIFO, Weighted Average, Standard Cost
- **Multi-UOM (Unit of Measure) support** (pcs, kg, meters, rolls, dozen)
- **Item variant tracking** (color, size, weave, pattern, yarn count)
- **Shelf-life management** with expiry date tracking
- **Batch/Lot numbering** with lot traceability
- **Reorder point & safety stock automation**
- **ABC analysis** (Pareto principle for inventory categorization)
- **Slow-moving/dead stock identification** with aging analysis
- **Stock transfer** between warehouses with approval workflow
- **Physical inventory count** with variance analysis
- **Cycle counting** with automated scheduling
- **Scrap/waste tracking** per process
- **Returns management** (customer returns, vendor returns, rework returns)
- **Consignment inventory** management
- **Rental/loan equipment tracking**

Warehouse Management System (WMS)

- **Warehouse configuration** (multiple zones, aisles, rows, bins, shelves)
- **Goods Receipt workflow**: Inbound → Inspection → Putaway → Storage
- **Goods Issue workflow**: Pick → Pack → Weigh → QC → Dispatch
- **Bin management** with auto-suggestion of optimal bins
- **Wave picking** for order batching optimization
- **Cross-docking** functionality for direct transfers
- **Barcode scanning** for receiving, putaway, picking, and dispatch
- **RFID integration** for real-time location tracking (optional)
- **Picking list optimization** (by zone, by route, cluster picking)
- **Pack slip generation** with address labels
- **Dispatch gate management** with vehicle tracking
- **Warehouse performance dashboards** (pick accuracy, cycle time, throughput)
- **Staff productivity tracking** (picks per hour, accuracy rate)
- **Dock management** with appointment scheduling

1.4 Production & Manufacturing

Production Order Management

- **Production order creation** from sales orders or forecast demand
- **Multi-stage production workflow** (fiber → yarn → fabric → garment → finish)
- **Work order auto-generation** per production step
- **Production order status tracking**: Draft → Released → In-Progress → Completed → Closed
- **Actual output recording** with defect tracking
- **Yield calculation** (actual output vs expected, defect %)
- **Production cycle time tracking** (planned vs actual)
- **Work-in-process (WIP) inventory** management
- **Rework orders** creation for defective batches
- **Production scrap & waste tracking** by operation
- **Labor time recording** per work order (operator assignment, hours)

- **Machine utilization tracking** per production order

Production Planning & Scheduling

- **Master production schedule (MPS)** generation from sales forecast
- **Materials requirement planning (MRP)** with auto-explosion of BOMs
- **Capacity planning** considering machine constraints
- **Production sequence optimization** (minimize changeover time)
- **Resource leveling** (labor, machine, material availability)
- **Production bottleneck identification**
- **What-if scenario planning** (impact of delays, machine downtime)
- **Supply chain visibility** (supplier lead times, material availability)
- **Production schedule Gantt chart** visualization
- **Demand forecasting** (seasonal, trend-based, AI-assisted)
- **Safety stock calculation** based on demand variability
- **Constraint-based scheduling** (machine hours, labor hours, raw materials)
- **Forward/backward scheduling** options
- **Production plan vs actual variance** analysis

Bill of Materials (BOM) Management

- **BOM creation** per product, per version, per process
- **Multi-level BOMs** (parent items, sub-assemblies, components)
- **Variant BOM auto-generation** (1000+ variants from base BOM with colors × sizes)
- **Process loss inclusion** in BOM (3-5% typical for textile)
- **Shrinkage allowance per component** (fabric shrinks 2-3% after washing)
- **Scrap allowance** per operation (cutting loss, dyeing loss, etc.)
- **Alternative materials** per line item
- **Supersession tracking** (replace old BOM version with new)
- **BOM costing** with standard cost calculation
- **BOM audit trail** with change history
- **Engineering change order (ECO)** workflow
- **Effective dating** for BOM versions
- **Co-product & by-product handling** (main product + waste)
- **Recipe management** for process-based manufacturing (dyebatch formulations)

1.5 Quality Control & Compliance

Quality Control Management

- **AQL (Acceptable Quality Level) sampling plans** (ANSI/ASQ Z1.4)
- **Inline QC** (quality checks during production process)
- **Final QC** (quality checks before shipment)
- **Defect tracking** by type, location, operator, machine
- **Non-Conformance Report (NCR)** creation & tracking
- **Corrective action request (CAR)** workflow
- **Root cause analysis** (5-Why, Fishbone, Fault Tree)
- **QC hold & release** workflow for batches
- **Rework order generation** for defective lots
- **Quality test results recording** (dimensional, color, strength, durability)
- **Quality metrics dashboard** (defect rate by process, by operator)
- **Supplier quality audit trail** (inspection history)
- **Customer complaint tracking** with rework/credit workflow

- **Quality statistics & trend analysis** (SPC - Statistical Process Control)
- **ISO, OEKO-TEX, GOTS compliance** tracking & certification support

Dyebatch Tracking (Textile-Specific)

- **Dyebatch master data** creation with unique batch number
- **Yarn/fabric source tracking** (which raw material batch used)
- **Dyebath recipe management** (dye type, chemical name, qty, temperature, time)
- **Color specification lab values** (L*, a*, b* - CIE LAB measurement)
- **Dye date & completion date** recording
- **Dyebatch status workflow**: Created → In-Process → Dyeing Complete → QC Inspection → Approved/Rejected
- **Color matching** against customer approval (Delta E tolerance)
- **Shrinkage testing** (pre-wash vs post-wash dimensions)
- **Wash fastness testing** (resistance to color bleeding)
- **Traceability chain**: Dyebatch → Dyed Fabric → Production Order → Finished Garment → Customer
- **Auto-flag all garments** if dyebatch fails quality
- **Batch recall capability** for defective dyebatch
- **Dyebatch analytics** (defect rate, rework %, cost per batch)
- **Compliance documentation** (test certificates, lab reports)

1.6 General Ledger & Financial Management

General Ledger (GL)

- **Chart of accounts** with multi-level hierarchy (1000+ accounts typical)
- **Automatic GL posting** from all operational modules (SO, PO, Production, QC)
- **Journal entry creation** (manual adjustment entries)
- **Recurring journal entries** (monthly rent, depreciation, salaries)
- **Cost center allocation** (department-wise cost tracking)
- **Profit center management** (product line, geography, division profitability)
- **GL account reconciliation** workflow
- **Intercompany transactions** (multi-entity consolidation)
- **Trial balance** generation (must always balance)
- **Period close workflow** with check-lists
- **GL account change log** (audit trail of changes)
- **Consolidated financial statements** across entities
- **Subledger reconciliation** (AP, AR, Inventory, Fixed Assets)

Accounts Receivable (AR)

- **Customer invoice creation** from sales orders
- **Invoice tracking** (draft, posted, paid, overdue, written-off)
- **Invoice aging reports** (current, 30 days, 60 days, 90+ days)
- **Credit memo** issuance (returns, price adjustments)
- **Debit memo** issuance (shortages, damages)
- **Payment receipt recording** (bank transfer, check, cash, credit card)
- **Payment allocation** to specific invoices (open item or balance forward)
- **Partial payment handling** with remainder tracking
- **Late payment interest** calculation
- **Customer credit limit enforcement** (prevent over-credit sales)
- **Collection workflow** with escalation

- **Write-off management** for bad debts
- **AR aging dashboard** with customer-wise breakdown
- **Cash flow forecasting** based on expected collections
- **Days Sales Outstanding (DSO)** tracking

Accounts Payable (AP)

- **Vendor invoice creation** from purchase orders & goods receipt notes
- **Three-way matching** (PO ↔ GRN ↔ Vendor Invoice)
- **Invoice variance tolerance** (allow 2% variance, flag >2%)
- **Invoice approval workflow** (multiple authorization levels)
- **Early payment discount tracking** (2/10 Net 30 terms)
- **Payment scheduling** (due date, discount date, payment method)
- **Check/EFT payment processing**
- **Payment hold capability** (dispute resolution)
- **Vendor statement reconciliation**
- **AP aging reports** (current, 30 days, 60 days, 90+ days)
- **Vendor performance** (on-time payment %, invoice accuracy)
- **AP dashboard** with cash outflow forecast
- **Days Payable Outstanding (DPO)** tracking
- **1099/TDS reporting** (tax compliance)

Financial Reporting & Analysis

- **Profit & Loss statement** (P&L) with variance analysis
- **Balance Sheet** with comparative analysis
- **Cash Flow statement** (operating, investing, financing)
- **Departmental profitability** analysis
- **Product line profitability** (by product type, style, customer)
- **Cost of goods sold (COGS)** tracking and analysis
- **Gross margin** tracking by order, product, customer
- **Operating expense** analysis
- **EBITDA** calculation
- **Financial ratios** (current ratio, debt-to-equity, ROE, ROI, etc.)
- **Budget vs actual** variance analysis
- **Forecast vs actual** comparison
- **Key performance indicators (KPIs)** dashboard (profitability, margins, efficiency)
- **Quarterly & annual reporting** with consolidation
- **Tax compliance reporting** (GST, income tax, export duty)

PART 2: TEXTILE-SPECIFIC FEATURES

2.1 Textile Manufacturing Processes

Fiber & Yarn Management

- **Raw fiber master data** (cotton, polyester, silk, wool, blends)
- **Fiber sourcing** from suppliers with traceability
- **Fiber batch/lot tracking** with quality certificates
- **Yarn preparation** from fiber (spinning, twisting, winding)
- **Yarn specifications master** (count, twist, ply, fiber composition)
- **Yarn dyeing process** with dyebatch linking

- **Yarn quality testing** (strength, evenness, dye fastness)
- **Yarn inventory management** per batch, color, specification

Weaving & Knitting

- **Loom/knitting machine configuration** (machine type, capacity, speed)
- **Machine maintenance scheduling** (preventive, breakdown tracking)
- **Machine uptime/downtime tracking**
- **Production schedule** on each machine
- **Weave pattern management** (complex designs, CAD integration)
- **Knit pattern specifications**
- **Fabric specification master** (width, weight, construction, fiber content)
- **Fabric quality inspection** (consistency, defects, dimensions)
- **Batch numbering** per weaving/knitting lot

Dyeing & Finishing

- **Dyehouse master data** (dye vats, temperature capacity, chemical storage)
- **Dyebatch master** with complete recipe management
- **Color matching** (lab values Lab* with tolerance limits)
- **Shrinkage control** (heat setting, steaming, relaxation)
- **Finishing chemicals** inventory and application tracking
- **Shrinkage testing protocol** (wash multiple cycles, measure dimensional change)
- **Softness/hand feel** testing documentation
- **Dust/hairiness** control process
- **Anti-bacterial/antimicrobial treatment** tracking
- **Waterproofing/water-resistance** treatment tracking
- **Chemical compliance** (ZDHC, REACH, GOTS chemical restrictions)
- **Waste water treatment** and compliance

Cutting & Sewing

- **Lay planning optimization** (minimize fabric waste)
- **Cutting pattern management**
- **Marker making** (digital pattern optimization)
- **Cutting efficiency tracking** (fabric usage vs theoretical)
- **Sewing process workflow** (by assembly line or operator)
- **Sewing quality standards** (stitch consistency, seam strength)
- **Labor time tracking** (standard vs actual)
- **Operator skill assignment** (complex seams → experienced operators)
- **Rework tracking** (seam defects, fit issues)

2.2 Shrinkage & Allowance Management

Shrinkage Tracking

- **Shrinkage percentage by fiber type** (cotton 3-5%, polyester 1-2%, etc.)
- **Shrinkage allowance inclusion** in fabric/garment specifications
- **Shrinkage testing protocol**: Pre-wash dimensions → Wash cycle (ISO or customer specific) → Post-wash dimensions
- **Tolerance limits** for acceptable shrinkage
- **Shrinkage variance tracking** by dyebatch, fabric lot
- **Customer communication** of shrinkage (care label, shipping documentation)

- **Shrinkage credit/claim management** if exceeds limits
- **Material requirement calculation** with shrinkage factored in (order 100 units → need 103 units fabric due to 3% shrinkage)

Allowance Management

- **Process loss allowance** per operation (knitting 3%, dyeing 2%, cutting 4%, sewing 1%)
- **Scrap allowance** by operation type
- **Defect allowance** (2-5% expected defects, rework on 10% of defects)
- **Auto-adjustment** of material requirement based on process losses
- **Consumption variance** tracking (actual loss vs standard)
- **Waste tracking & cost attribution**
- **Yield optimization reports**

2.3 Variant Management & BOM

Variant BOM Auto-Generation

- **Base product definition** (e.g., T-Shirt style)
- **Variant dimensions**: 10 colors × 100 sizes = 1000 SKUs
- **Automatic BOM creation** for each variant (linking fabric color, thread color, trim size)
- **Variant pricing** (base price + color surcharge + size multiplier)
- **Variant inventory management** (track by color-size combination)
- **Bulk variant operations** (update price for all variants, copy BOM)
- **Variant grouping** (for sales reports, replenishment planning)
- **Master/variant relationship tracking**

2.4 Export Compliance & Documentation

HS Code Management

- **HS Code assignment** per product (6104.62.20 for cotton t-shirt)
- **HS Code database** with tariff information (280+ product categories)
- **Auto-assignment** based on fiber, construction, origin
- **Manual override** capability with audit trail
- **Country-specific duties** (USA 16.5%, EU 12%, etc.)
- **Export documentation generation** (commercial invoice, packing list, HS codes)

Country of Origin (COO) Management

- **COO determination** based on value addition rules (>35% value add = COO origin)
- **Multi-country components** tracking (yarn from India, fabric processing in Sri Lanka, final assembly in India)
- **COO calculation** based on percentage value addition per country
- **Made in [Country]** label compliance
- **Export certificate generation** with COO details
- **GSP/FTA eligibility** validation (for preferential trade agreements)

Export Invoice & Documentation

- **Export invoice generation** with HS codes, COO, duties
- **Packing list** with weight, dimensions, item details
- **Commercial invoice** with pricing, terms, payment details
- **Bill of lading (B/L)** integration with logistics provider
- **Customs declaration** document generation
- **IGST/CGST refund claim** support (for export goods)
- **Shipping marks** and packaging details
- **Compliance checklist** (quality certifications, chemical testing)

2.5 Certifications & Compliance

Certification Management

- **GOTS (Global Organic Textile Standard)** tracking
- **OEKO-TEX Standard 100** certification
- **OEKO-TEX SteP (Sustainable Textile Production)** compliance
- **ISO 9001:2015** (Quality Management System)
- **ISO 14001:2015** (Environmental Management System)
- **ISO 45001:2018** (Occupational Health & Safety)
- **SEDEX/SMETA audit** records
- **ZDHC Gateway** (chemical compliance)
- **Supplier compliance** documentation
- **Certificate expiry tracking** with renewal alerts
- **Certification documents** storage per product, lot, facility

Sustainability & Environmental Compliance

- **Water consumption** tracking (liters per kg of fabric)
- **Chemical inventory** with ZDHC restriction list validation
- **Waste water treatment** documentation and testing results
- **Emissions monitoring** (air quality, dust control)
- **Energy consumption** tracking (kWh per kg produced)
- **Renewable energy** usage percentage
- **Chemical restrictions** enforcement (banned dyes, heavy metals, formaldehyde)
- **Sustainability reporting** (carbon footprint, water usage, waste reduction)
- **Third-party audit** records and compliance status

PART 3: 100+ PRE-BUILT CONNECTORS

3.1 E-Commerce Connectors

B2C E-Commerce Platforms

- **Shopify** (product sync, order import, inventory sync, shipping)
- **WooCommerce** (inventory, order management, shipping labels)
- **Magento** (real-time inventory, order fulfillment, customer data)
- **BigCommerce** (multi-channel order management)
- **Amazon (Seller Central)** (inventory, orders, fulfillment, FBA sync)
- **Etsy** (product listings, orders, customer communication)
- **eBay** (inventory, order import, shipping integration)

- **Flipkart** (India-specific integration, order management)
- **Myntra** (India fashion platform, B2B orders)

B2B E-Commerce & Marketplaces

- **Alibaba** (supplier management, bulk orders)
- **Global Sources** (trade leads, product sourcing)
- **TradeKey** (B2B order management)
- **Exporters.in** (India B2B platform)
- **IndiaMART** (domestic B2B)

3.2 Logistics & Shipping Connectors

Shipping Providers

- **FedEx** (real-time rates, label generation, tracking)
- **UPS** (international shipping, ground delivery)
- **DHL** (express, ground, specialized services)
- **TNT** (international logistics)
- **Courier services** (India-specific: Blue Dart, Ecom Express, Delhivery, Shipyaari)
- **Last-mile logistics** (GoJavas, Shadowfax)
- **Port authorities** (port clearance, container tracking)
- **Customs brokers** (documentation, clearance tracking)
- **Freight forwarders** (LCL, FCL ocean freight)
- **Air freight** (IATA compliance, hazmat handling)

Shipping Aggregators

- **ShipStation** (multi-carrier shipping)
- **ShipRush** (shipping optimization)
- **Shippo** (real-time rate shopping)
- **EasyPost** (carrier agnostic)
- **Flexport** (international logistics platform)

3.3 Payment Gateway Connectors

Payment Processing

- **Stripe** (credit card, ACH, international payments)
- **PayPal** (checkout, invoicing, payment links)
- **Square** (card payments, cash, invoice)
- **Razorpay** (India-specific: credit card, debit card, UPI, wallet)
- **Paytm** (India digital payments)
- **PhonePe** (India UPI payments)
- **Google Pay** (mobile payments)
- **Apple Pay** (mobile wallet)
- **Amazon Pay** (login & pay)
- **2Checkout/Verifone** (multi-currency)
- **Worldpay** (international card payments)
- **Authorize.net** (USA credit card processing)

Bank Integrations

- **Direct bank feeds** (automatic statement import)
- **HDFC Bank** (India banking integration)
- **ICICI Bank** (India banking)
- **Axis Bank** (India banking)
- **NEFT/RTGS** (India fund transfer)
- **Wire transfer** (international)
- **Cheque processing** (digital cheque, reconciliation)

3.4 Accounting & Finance Connectors

Accounting Software

- **QuickBooks Online** (financials, payroll, tax)
- **QuickBooks Desktop** (local accounting)
- **Sage 50** (UK/European accounting)
- **Xero** (cloud accounting, multi-entity)
- **FreshBooks** (invoicing, time tracking)
- **Wave** (free accounting)
- **Zoho Books** (India-specific accounting)
- **Tally ERP** (India GST compliance)
- **SAP** (enterprise financials, consolidation)
- **Oracle NetSuite** (global accounting)

Invoicing & Billing

- **Invoice2Go** (mobile invoicing)
- **Zoho Invoice** (recurring invoices, client portal)
- **Billy** (subscription billing)
- **Chargebee** (recurring billing, SaaS)
- **Stripe Billing** (subscription management)

3.5 CRM & Sales Connectors

Customer Relationship Management

- **Salesforce** (CRM, sales pipeline, customer 360)
- **HubSpot** (marketing automation, CRM, sales)
- **Pipedrive** (sales pipeline, deal tracking)
- **Zoho CRM** (India-friendly CRM)
- **Microsoft Dynamics 365** (CRM, enterprise)
- **Freshsales** (sales CRM, email integration)
- **Copper** (CRM for Google Workspace users)
- **Close** (sales-focused CRM)

Marketing Automation

- **Mailchimp** (email campaigns, audience segmentation)
- **ActiveCampaign** (email marketing, automation)
- **HubSpot Marketing** (landing pages, lead scoring)
- **Klaviyo** (e-commerce email marketing)
- **SendGrid** (transactional email)
- **Drip** (e-commerce email marketing)

3.6 Business Intelligence & Analytics Connectors

BI & Analytics Platforms

- **Tableau** (data visualization, dashboards)
- **Power BI** (Microsoft analytics, real-time dashboards)
- **Looker** (data analytics, embedded analytics)
- **Qlik Sense** (associative analytics)
- **Google Data Studio** (free data visualization)
- **Metabase** (open-source analytics)
- **Sisense** (embedded analytics)

Data Warehousing

- **Snowflake** (cloud data warehouse)
- **BigQuery** (Google cloud data warehouse)
- **Amazon Redshift** (AWS data warehouse)
- **Azure Data Warehouse** (Microsoft cloud)
- **Databricks** (Delta Lake, unified analytics)

3.7 Human Resources & Payroll Connectors

HR Management

- **BambooHR** (HR management, performance)
- **Workday** (enterprise HR, payroll)
- **SAP SuccessFactors** (talent management)
- **ADP** (payroll, HR, benefits)
- **Paychex** (payroll, HR, compliance)
- **Guidepoint** (India HR, payroll)
- **Keka** (India HR platform)

Attendance & Time Tracking

- **Zoho People** (HR, attendance, leave)
- **AttendanceBot** (Slack-based attendance)
- **Time Doctor** (time tracking, productivity)
- **Toggl** (time tracking, project management)
- **Clockify** (free time tracking)

3.8 Supply Chain & Procurement Connectors

Supplier Management

- **Coupa** (supplier management, procurement)
- **Ariba** (SAP procurement network)
- **BravoSolution** (source-to-pay)
- **Jaggr** (supplier quality, compliance)
- **MetricStream** (supply chain risk)

Demand Forecasting

- **Blue Yonder** (AI demand planning)
- **Kinaxis** (supply chain planning)
- **o9 Solutions** (platform for integrated planning)
- **Anaplan** (integrated planning)
- **Demand365** (AI-driven demand planning)

3.9 Communication & Collaboration Connectors

Business Communication

- **Slack** (team messaging, notifications, approvals)
- **Microsoft Teams** (communication, video, chat)
- **Zoom** (video conferencing integration)
- **Google Meet** (video meetings)
- **WhatsApp Business API** (customer messaging, order updates)
- **Telegram Bot API** (notifications)

Email & Messaging

- **Gmail API** (email integration, calendar)
- **Office 365 Outlook** (email, calendar, contacts)
- **Twilio** (SMS, voice, email)
- **SendGrid** (email delivery)
- **MessageBird** (SMS, voice, chat)

3.10 IoT & Sensor Integrations

Manufacturing Sensors

- **MES (Manufacturing Execution System)** integration
- **Machine data collection** (loom speeds, knitting machine metrics)
- **Temperature/humidity sensors** (dyehouse monitoring)
- **Scale/weight sensors** (batch weighting)
- **RFID readers** (inventory tracking)
- **Barcode scanners** (WMS, quality control)
- **Camera systems** (quality inspection, facility monitoring)
- **Energy meters** (power consumption tracking)

IoT Platforms

- **Azure IoT Hub** (device management, data collection)
- **AWS IoT** (IoT device management)
- **Google Cloud IoT** (device connectivity)
- **Siemens MindSphere** (industrial IoT)
- **GE Predix** (industrial IoT, predictive maintenance)

3.11 Document Management Connectors

Cloud Storage & File Sharing

- **Google Drive** (file storage, document management)
- **Dropbox** (file sync, collaboration)
- **Microsoft OneDrive** (cloud storage)
- **Box** (enterprise content management)
- **AWS S3** (object storage, backup)

Document Generation & Management

- **DocuSign** (e-signatures, contract management)
- **PandaDoc** (document automation, e-signatures)
- **Adobe Sign** (e-signatures)
- **Formstack** (form generation, automation)

3.12 Compliance & Risk Management Connectors

Compliance Tools

- **Domo** (business intelligence, compliance)
- **Alteryx** (data governance, compliance)
- **Talend** (data governance, quality)
- **Collibra** (data governance)
- **Completeness360** (compliance automation)

Audit & Risk

- **Workiva** (enterprise data management, compliance)
- **AuditBoard** (audit management)
- **Anaplan** (risk and compliance planning)

3.13 Third-Party Services Connectors

Tax & Compliance

- **TaxJar** (sales tax, VAT compliance)
- **Avalara** (tax determination, compliance)
- **Customs brokers** (export documentation)
- **GST compliance** services (India)

Address Validation

- **Google Maps API** (address geocoding, validation)
- **HERE Maps** (location services)
- **PostalCodes.ai** (address validation)

PART 4: MODERN APIS & INTEGRATIONS

4.1 REST API (100+ Endpoints)

Sales API Endpoints

POST /api/v1/sales-orders → Create sales order
GET /api/v1/sales-orders/{id} → Retrieve order details
PUT /api/v1/sales-orders/{id} → Update order
DELETE /api/v1/sales-orders/{id} → Cancel order
GET /api/v1/sales-orders?filter=status → List with filters
POST /api/v1/sales-orders/{id}/approve → Approve workflow
POST /api/v1/sales-orders/{id}/release → Release for production
POST /api/v1/sales-orders/{id}/ship → Create shipment
POST /api/v1/sales-orders/{id}/invoice → Generate invoice
GET /api/v1/customers → List customers
POST /api/v1/customers → Create customer
GET /api/v1/quotes → List quotations
POST /api/v1/quotes → Create quote
POST /api/v1/quotes/{id}/convert → Auto-convert to SO

Purchase API Endpoints

POST /api/v1/purchase-orders → Create PO
GET /api/v1/purchase-orders/{id} → Retrieve PO
PUT /api/v1/purchase-orders/{id} → Update PO
POST /api/v1/purchase-orders/{id}/approve → Approve PO
POST /api/v1/grn → Create goods receipt
POST /api/v1/grn/{id}/inspect → QC inspection
POST /api/v1/grn/{id}/receive → Post to inventory
POST /api/v1/vendors → Create vendor
GET /api/v1/vendors → List vendors
GET /api/v1/vendor-performance → Vendor scorecards

Inventory API Endpoints

GET /api/v1/inventory/item-balance → Real-time stock
GET /api/v1/inventory/warehouse/{id} → Warehouse inventory
POST /api/v1/inventory/transfer → Stock transfer
POST /api/v1/inventory/adjust → Stock adjustment
GET /api/v1/inventory/reorder-points → Automatic replenishment
POST /api/v1/physical-count → Cycle count
GET /api/v1/inventory/aging → Slow-moving stock
POST /api/v1/warehouse/receive → Goods receipt
POST /api/v1/warehouse/dispatch → Goods issue

Production API Endpoints

POST /api/v1/production-orders → Create production order
GET /api/v1/production-orders/{id} → Retrieve order
POST /api/v1/work-orders → Create work order
PUT /api/v1/work-orders/{id}/complete → Record completion
POST /api/v1/bom → Create BOM

GET /api/v1/bom/{id} → Retrieve BOM
POST /api/v1/bom/variants → Auto-generate variants
POST /api/v1/production-orders/{id}/release → Release for mfg
GET /api/v1/production/dashboard → Real-time metrics

Quality Control API Endpoints

POST /api/v1/quality-checks → Record QC result
GET /api/v1/dyebatch → List dyebatches
POST /api/v1/dyebatch → Create dyebatch
PUT /api/v1/dyebatch/{id} → Update dye results
POST /api/v1/ncr → Create non-conformance
POST /api/v1/car → Corrective action
GET /api/v1/quality/defects → Defect analysis
POST /api/v1/quality/aql-check → AQL sampling decision

Financial API Endpoints

POST /api/v1/invoices → Create invoice
GET /api/v1/invoices/{id} → Retrieve invoice
POST /api/v1/payments → Record payment
GET /api/v1/ar-aging → AR aging report
GET /api/v1/ap-aging → AP aging report
POST /api/v1/gl/entries → Journal entry
GET /api/v1/gl/trial-balance → Trial balance
POST /api/v1/gl/period-close → Period closing
GET /api/v1/financials/profitability → Profit analysis

Reporting API Endpoints

GET /api/v1/reports/sales-analysis → Sales analytics
GET /api/v1/reports/production-metrics → Production KPIs
GET /api/v1/reports/inventory-turnover → Inventory metrics
GET /api/v1/reports/quality-metrics → QC statistics
GET /api/v1/dashboard/kpis → Executive dashboard
GET /api/v1/export/pdf → Export as PDF
GET /api/v1/export/excel → Export as Excel

Total REST Endpoints: 130+

4.2 GraphQL API

Example GraphQL queries for flexible data fetching

query GetSalesOrderWithDetails {
salesOrder(id: "SO/2026-01/0015") {
id
customer {
id
name

```graphql
creditLimit
currentAR
}
lines {
lineNo
item {
code
name
variant { color size }
}
quantity
rate
total
}
status
total
createdAt
}
}

query GetProductionMetrics {
productionOrders(
filter: { status: "in_progress", createdDate: "2026-01-01" }
) {
id
product { code name }
qty
actualQty
defectQty
yield
workOrders {
operation
status
completionTime
defectRate
}
}
}

query GetInventoryBySKU {
inventoryItems(
filter: { warehouse: "WH001", status: "active" }
) {
sku
itemMaster { code name }
quantity
availableQty
reservedQty
warehouseLocation {
zone aisle bin
}
```

```
lastMovedAt
}
}

mutation CreateSalesOrder {
createSalesOrder(input: {
customerId: "CUST001"
lines: [
{ itemCode: "GAR001", quantity: 1000, rate: 8.50 }
]
}) {
id
status
total
message
}
}

mutation CompleteWorkOrder {
completeWorkOrder(input: {
workOrderId: "WO/2026-01/0001"
outputQty: 600
defectQty: 5
actualTime: 380
}) {
id
status
yield
message
}
}
```

GraphQL Features:

- Flexible query structure (request only needed fields)
- Nested relationships (customer → orders → items)
- Real-time subscriptions for data changes
- Mutations for create/update/delete operations
- Batch operations support
- Custom resolvers for business logic

4.3 WebSocket Real-Time API

// WebSocket subscriptions for live updates

```
// Subscribe to production order status changes
ws://api.textileflow.com/ws?token=auth_token
{
"type": "subscribe",
"channel": "production_order:SO/2026-01/0015",
"events": ["status_changed", "work_order_completed", "defect_detected"]
}
```

```
// Real-time dyebatch color matching updates
{
"type": "subscribe",
"channel": "dyebatch:DY0615-001",
"events": ["color_lab_updated", "shrinkage_tested", "qc_passed"]
}

// Live inventory level updates
{
"type": "subscribe",
"channel": "inventory:YRN001:WH001",
"events": ["quantity_changed", "reorder_triggered", "stock_low"]
}

// Receive updates
{
"type": "update",
"channel": "production_order:SO/2026-01/0015",
"event": "work_order_completed",
"data": {
"workOrderId": "WO/2026-01/0001",
"operation": "Knitting",
"actualQty": 600,
"defectQty": 3,
"yield": 99.5,
"completedAt": "2026-01-15T14:30:00Z"
}
}
```

WebSocket Features:

- Real-time order status updates
- Live production metrics
- Inventory alerts
- QC result notifications
- Payment confirmations
- System alerts & warnings

4.4 Webhook Integrations

// Outgoing webhooks triggered by system events

```
// Example: Sales Order Created Webhook
POST https://customer-system.com/webhooks/sales-order
{
"event": "sales_order.created",
"timestamp": "2026-01-15T14:30:00Z",
"data": {
"orderId": "SO/2026-01/0015",
"customerId": "CUST001",
"customerName": "Customer XYZ",
"totalAmount": 8500,
```

```
"lines": [
{ "itemCode": "GAR001", "quantity": 1000, "rate": 8.50 }
]
}
}

// Production Order Released Webhook
POST https://warehouse-system.com/webhooks/production
{
"event": "production_order.released",
"timestamp": "2026-01-15T15:00:00Z",
"data": {
"productionOrderId": "PROD-2026-001",
"salesOrderId": "SO/2026-01/0015",
"warehouseId": "WH001",
"materialsIssued": [
{ "itemCode": "YRN001", "qty": 618, "status": "issued" }
]
}
}

// Goods Receipt Completed Webhook
POST https://supplier-system.com/webhooks/receipt
{
"event": "goods_receipt.completed",
"timestamp": "2026-01-15T16:00:00Z",
"data": {
"grnId": "GRN/2026-01/0001",
"poId": "PO/2026-01/0001",
"vendorId": "VEND001",
"itemsReceived": [
{ "itemCode": "YRN001", "qty": 100, "inspectionResult": "passed" }
]
}
}

// Invoice Created Webhook
POST https://accounting-system.com/webhooks/invoice
{
"event": "invoice.created",
"timestamp": "2026-01-15T17:00:00Z",
"data": {
"invoiceId": "INV/2026-01/0001",
"type": "sales",
"customerId": "CUST001",
"totalAmount": 8500,
"dueDate": "2026-02-15"
}
}

// Payment Received Webhook
POST https://bank-system.com/webhooks/payment
```

```
{
"event": "payment.received",
"timestamp": "2026-01-20T10:00:00Z",
"data": {
"paymentId": "PAY/2026-01/0001",
"invoiceId": "INV/2026-01/0001",
"amount": 8500,
"method": "bank_transfer",
"status": "completed"
}
}
```

Webhook Features:

- 50+ event types (creation, update, status changes)
- Automatic retry logic (exponential backoff)
- Webhook signature verification (HMAC)
- Event filtering & customization
- Webhook test endpoint
- Event delivery logs & troubleshooting

PART 5: MOBILE APPLICATIONS

5.1 Native iOS App

Platform: iOS 14.0+
Framework: SwiftUI + Swift async/await
Storage: Core Data (local), Keychain (secure credentials)

Key Features

- **Secure authentication** (Face ID, Touch ID, 2FA)
- **Offline-first architecture** (sync when online)
- **Real-time notifications** (push notifications)
- **Dark mode support** (iOS-native dark theme)
- **Accessibility features** (VoiceOver, Dynamic Type)

Core Modules

1. **Dashboard** (KPIs, top metrics, quick actions)
   - Sales pipeline value
   - Production yield %
   - Inventory levels
   - QC pass rate
   - AR aging
2. **Sales Order Management**
   - Create SO from mobile
   - View order details, status
   - Approve/release orders
   - Attach photos/documents
   - Customer contact info
   - Send order confirmation via email/WhatsApp

3. **Production Tracking**
   - View production orders
   - Record work order completion
   - Log defects with photos
   - Real-time yield tracking
   - Dyebatch color matching (camera integration)
4. **Inventory Management**
   - Barcode/QR code scanning
   - Quick stock check
   - Physical count (cycle counting)
   - Stock transfer approval
   - Goods receipt inspection (photo evidence)
5. **Quality Control**
   - QC test recording
   - Defect documentation (photo + description)
   - Non-conformance report creation
   - Shrinkage measurement entry
   - AQL sampling decision
6. **Financial Dashboard**
   - AR aging summary
   - Top customers by AR balance
   - Payment tracking
   - Invoice details
   - Collection status
7. **Vendor Management**
   - Vendor contact details
   - Performance scorecards
   - PO list per vendor
   - GRN inspection
   - Invoice approval
8. **Reporting & Analytics**
   - Sales trend charts
   - Production metrics
   - Quality dashboards
   - Inventory aging
   - Financial summaries
   - PDF export capability

5.2 Native Android App

Platform: Android 10.0+
Framework: Jetpack Compose + Kotlin Flow
Storage: Room Database (local), EncryptedSharedPreferences (secure)

Key Features

- **Material Design 3** UI
- **Biometric authentication** (fingerprint, face)
- **Offline sync** with conflict resolution
- **Background workers** (sync, notifications)
- **Adaptive layout** (phone, tablet, foldable)

Core Modules

[Same 8 core modules as iOS]

5.3 Cross-Platform Features

Authentication

- Single Sign-On (SSO) with enterprise systems
- Multi-factor authentication (MFA)
- Session management
- Automatic logout after inactivity
- Secure token storage

Push Notifications

- **Sales**: New order received, order approval required, shipment delayed
- **Production**: Work order ready, defect detected, production delayed
- **Inventory**: Stock low alert, goods receipt pending inspection
- **Quality**: QC failed batch, shrinkage out of tolerance
- **Finance**: Payment received, invoice overdue, AR limit exceeded
- **Admin**: System alerts, user login from new device

Offline Capabilities

- Draft order creation (sync when online)
- QC defect logging offline (sync later)
- Inventory count offline (reconcile on sync)
- View cached data (last 30 days)
- Automatic sync on network reconnection
- Conflict resolution (server version wins)

File Management

- Photo capture (camera integration)
- Document upload (PDF, image, Excel)
- Barcode/QR scanning
- Signature capture
- File viewer (PDF, images, documents)
- Document download for offline access

Location Services

- GPS tracking for deliveries
- Warehouse location mapping
- Store locator (find nearest warehouse)
- Delivery route optimization
- Geofencing alerts

Biometric Security

- Face ID / Face Unlock
- Fingerprint authentication
- Iris recognition (Samsung devices)
- Transaction signing (sensitive operations)

PART 6: REAL-TIME CAPABILITIES

6.1 Live Dashboards

Executive Dashboard

- **KPI Cards** (updated every 30 seconds)
    - Total sales (YTD, MTD, Weekly)
    - Production output (units, %)
    - Inventory value
    - AR outstanding
    - Gross margin
    - Cash position
- **Sales Pipeline Chart**
    - Real-time order count by status
    - Pipeline value breakdown
    - Month-wise comparison
    - Color-coded status indicators
- **Production Metrics**
    - Current production orders in progress
    - Yield % by product
    - Top defects (real-time)
    - Machine utilization
    - Next bottleneck alert
- **Quality Dashboard**
    - Pass/fail ratio (real-time)
    - Defect trend (last 7 days)
    - Top 5 defect types
    - AQL sampling status
    - Dyebatch status
- **Financial Summary**
    - Revenue vs target
    - Gross margin trend
    - Cash flow forecast
    - AR/AP aging
    - Top customers by revenue

Department-Specific Dashboards

Sales Team Dashboard

- My quota vs actual
- Top customers
- Pipeline opportunities
- Conversion rate

- Discount utilization
- Commission tracking

Production Dashboard

- Live production orders
- Work order status (Gantt chart)
- Machine status & utilization
- Quality pass rate
- Yield trending
- Shift performance

Quality Team Dashboard

- Real-time QC results
- Defect trending
- AQL sampling queue
- NCR status
- Corrective actions
- Rework orders

Finance Dashboard

- AR aging (waterfall chart)
- AP aging
- Cash flow forecast
- Expense vs budget
- Profitability by product
- Bank balance

Mobile Dashboard

- Simplified version for mobile screens
- Swipeable card layout
- Touch-optimized charts
- Auto-refresh every 60 seconds
- Offline mode with cached data

6.2 AI-Assisted Forecasting

Demand Forecasting

- **Historical data analysis**: 3-year sales history
- **Trend analysis**: Seasonal patterns, growth rates
- **Machine learning model**: ARIMA, Prophet, XGBoost
- **Forecast accuracy**: 85-95% for seasonal products
- **Forecast by**: Product, customer, region, sales channel
- **Confidence intervals**: 80%, 90%, 95% confidence levels
- **What-if scenarios**: Impact of price increase, new customer
- **Automatic model retraining**: Weekly (monthly best practice)

Supply Chain Forecasting

- **Lead time prediction**: Supplier delays, customs delays
- **Stock-out risk**: Alert 2 weeks before stock-out
- **Reorder point optimization**: Based on demand forecast
- **Demand variability**: Coefficient of variation alerts
- **Supplier performance**: On-time delivery %, quality score

Production Capacity Forecasting

- **Machine downtime prediction**: Preventive maintenance alerts
- **Labor capacity**: Shift-wise availability, skill-based allocation
- **Material availability**: Shortage alerts
- **Changeover time**: Minimized by intelligent scheduling
- **Bottleneck prediction**: Alert 1 week ahead

6.3 Instant Notifications

In-App Notifications

- **High priority** (red): System down, payment failed, batch recalled
- **Medium priority** (orange): AR limit exceeded, stock below reorder point
- **Low priority** (blue): New quote received, order shipped
- **Auto-dismiss**: Low priority after 24 hours
- **Notification center**: View history (30 days)
- **Mark as read**: Individual or bulk

Email Notifications

- **Daily digest**: Morning summary of pending actions
- **Urgent alerts**: Real-time for critical issues
- **Scheduled reports**: Weekly, monthly summaries
- **Customer communication**: Order confirmations, shipment status
- **Vendor communication**: PO confirmation, payment notifications
- **Finance alerts**: Large AR, payment reminders

SMS Notifications (India-specific)

- **Transactional SMS**: Order confirmation (1-2 rupee per SMS)
- **OTP delivery**: Login verification
- **Alert SMS**: Stock alert, payment due, AR reminder
- **Customer SMS**: Delivery notification, payment status (optional premium)
- **DND compliance**: Respect national do-not-call registry

WhatsApp Business API Integration

- **Order confirmations**: Customer receives SO confirmation
- **Shipment tracking**: Real-time delivery updates
- **Payment reminders**: AR overdue alerts
- **QC notifications**: Batch pass/fail status
- **Customer support**: Chatbot for FAQ, ticket creation
- **Media sharing**: Photos of products, invoices, shipping labels

6.4 Real-Time Sync

Cloud Sync Architecture

- **Bidirectional sync**: Changes on mobile sync to cloud
- **Conflict resolution**: Last-write-wins (with audit trail)
- **Incremental sync**: Only changed records (delta sync)
- **Background sync**: No UI blocking
- **Bandwidth optimization**: Compress before upload
- **Retry mechanism**: Exponential backoff (3 retries)

Data Sync Triggers

- **On-demand**: Manual refresh button
- **Periodic**: Every 5 minutes (configurable)
- **On change**: Immediately after local edit
- **Network aware**: Sync only on WiFi if configured
- **Battery aware**: Pause sync if battery <20%

Sync Priority

1. Financial data (highest priority)
2. Production data
3. Quality data
4. Inventory data
5. Sales data (lower priority due to non-critical nature)

Real-Time Inventory Level Sync

- **Warehouse terminal** updates stock → **Server** processes → **Mobile apps** receive update
- **Latency target**: <2 seconds (99th percentile)
- **Broadcast to relevant users**: All warehouse staff see updated stock
- **Reserve logic**: Prevent over-allocation during sync delay

Real-Time Production Status Sync

- **Production floor terminal** logs completion → **Server** updates → **Dashboard refreshes**
- **Cascade triggers**: Next work order auto-queued
- **Defect impact**: Flag related garments automatically
- **Alert generation**: Supervisors notified of delays

PART 7: ENTERPRISE TESTING & QUALITY ASSURANCE

7.1 Testing Coverage

Unit Testing

- **Framework**: Jest + React Testing Library (frontend), Jest + Supertest (backend)
- **Coverage**: 85% overall, 98%+ for critical paths
- **Tests**: 615 unit tests across all modules
- **Execution**: Real-time on save (~2-3 seconds)
- **Targets**:

- Item Master: 45 tests
- BOM & Variants: 65 tests
- Purchase Order: 50 tests
- Sales Order: 55 tests
- Production Order: 60 tests
- Costing: 80 tests
- Dyebatch Tracking: 70 tests
- QC & Defects: 60 tests
- GL & Accounting: 75 tests
- Inventory: 55 tests

Integration Testing

- **Framework**: Jest + Test Database (PostgreSQL)
- **Coverage**: 60% business flows
- **Tests**: 120+ integration tests
- **P2P Cycle**: PO → GRN → Invoice → Payment (complete cycle)
- **Q2C Cycle**: Quote → SO → Production → Invoice → Payment
- **Production Workflow**: SO → Production → WO Cascade → Completion
- **Multi-tenancy**: Strict isolation between organizations

End-to-End Testing

- **Framework**: Cypress for UI automation
- **Coverage**: 40 critical user journeys
- **Duration**: Full test suite runs in 30-40 minutes
- **Execution**: Daily at 2 AM, on-demand pre-release
- **Journeys**:
    - Complete sales order creation to invoice
    - Full purchase to payment cycle
    - Production order workflow
    - Quality control process
    - Inventory management
    - Financial closing

Performance Testing

- **Framework**: Artillery (load testing)
- **Target metrics**:
    - P95 latency: <100ms
    - P99 latency: <200ms
    - Error rate: <0.5%
    - Throughput: 10,000 req/sec
- **Load scenarios**:
    - Ramp-up: 10 users/sec for 60 seconds
    - Sustain: 100 concurrent users for 5 minutes
    - Spike: 500 concurrent users
- **Key endpoints tested**:
    - Sales order creation
    - Inventory query (10K+ items)
    - Production dashboard
    - GL trial balance (100K+ transactions)
    - AR aging report

Security Testing

- **OWASP Top 10** coverage
- **Penetration testing**: Quarterly by certified firm
- **Vulnerability scanning**: Continuous (Snyk, OWASP ZAP)
- **Threat modeling**: Monthly review
- **Security audit trail**: All data access logged
- **Compliance testing**: GDPR, HIPAA, SOC 2, ISO 27001

Database Testing

- **Schema validation**: Constraint testing, referential integrity
- **Data consistency**: Multi-table transactions, cascade operations
- **Concurrent updates**: Lock testing, deadlock scenarios
- **Query performance**: Slow query monitoring
- **Backup & recovery**: Monthly full restore test

7.2 Quality Metrics

Metric	Target	Current	Status
Unit Test Coverage	85%	82%	⚠
Integration Test Coverage	60%	58%	⚠
Critical Path Coverage	98%	97%	✓
API Endpoint Coverage	95%	93%	⚠
P99 API Response Time	<200ms	185ms	✓
Error Rate	<0.5%	0.3%	✓
Security Vulnerabilities	0	0	✓
Test Execution Time	<30min	28min	✓
Defect Escape Rate	<0.1%	0.08%	✓
Uptime SLA	99.9%	99.92%	✓

7.3 CI/CD Pipeline

Continuous Integration

- **Trigger**: Every commit to develop/main branch
- **Steps**:
    1. Code lint & format check (2 min)
    2. Unit tests (5 min)
    3. Integration tests (15 min)
    4. Security scan (5 min)
    5. Build artifact (3 min)

- **Parallel execution**: Lint + Unit tests run simultaneously
- **Artifact**: Docker image pushed to registry
- **Failure notification**: Slack alert to developer

Continuous Deployment

- **Dev environment**: Auto-deploy on passing CI
- **Staging environment**: Manual approval required
- **Production environment**:
  - Blue-green deployment
  - Canary roll-out (5% → 25% → 50% → 100%)
  - Automatic rollback on error rate >0.5%

Staging Testing

- **Smoke tests**: 10 critical scenarios (5 min)
- **Performance test**: Load testing (30 min)
- **Security scan**: OWASP ZAP (20 min)
- **E2E tests**: Full suite (40 min)
- **Manual QA**: Exploratory testing (2 hours)

Deployment Frequency

- Development: Continuous
- Staging: Daily at 6 PM IST
- Production: Weekly on Tuesday (2 AM UTC)
- Hotfixes: On-demand with approval

PART 8: ENTERPRISE ARCHITECTURE & INFRASTRUCTURE

8.1 System Architecture

Frontend

- **Framework**: React 18 + Next.js
- **State Management**: Redux Toolkit + RTK Query
- **UI Components**: Custom design system (Material-UI based)
- **Styling**: Tailwind CSS
- **Forms**: React Hook Form + Zod validation
- **Deployment**: Vercel CDN (global edge caching)
- **Performance**: Next.js image optimization, dynamic imports

Backend

- **Runtime**: Node.js 18+ (LTS)
- **Framework**: Express.js + Custom middleware
- **Language**: TypeScript (type safety)
- **API**: REST + GraphQL + WebSocket
- **Database**: PostgreSQL (primary), Redis (caching)
- **Deployment**: Docker containers on Kubernetes
- **Scalability**: Horizontal scaling with load balancer

Mobile

- **iOS**: SwiftUI + Swift async/await
- **Android**: Jetpack Compose + Kotlin Flow
- **Shared Code**: Business logic in shared Kotlin/Swift modules
- **Local Storage**: SQLite (iOS/Android)
- **Sync Engine**: Custom delta sync implementation

Deployment Infrastructure

- **Cloud**: AWS (us-east-1, ap-south-1)
- **Container Orchestration**: Kubernetes (EKS)
- **Load Balancer**: Application Load Balancer (ALB)
- **CDN**: CloudFront
- **Database**: RDS PostgreSQL (Multi-AZ)
- **Caching**: ElastiCache Redis
- **Object Storage**: S3
- **Email**: SES
- **SMS/WhatsApp**: Twilio

8.2 Data Security

Encryption

- **In Transit**: TLS 1.3 for all connections
- **At Rest**: AES-256 encryption for sensitive data (customer info, payment data)
- **Database**: Native PostgreSQL encryption
- **Backup**: Encrypted S3 storage

Access Control

- **RBAC** (Role-Based Access Control)
  - Super Admin
  - Organization Admin
  - Department Head (Sales, Production, Finance)
  - Manager
  - Staff
  - External (Customers, Vendors, Logistics)
- **ABAC** (Attribute-Based Access Control)
  - By organization
  - By warehouse
  - By customer
  - By product category
- **Row-Level Security**: PostgreSQL RLS policies

Data Privacy

- **PII Protection**: SSN, phone, email encrypted
- **Customer Data**: Separate encryption keys per organization
- **Audit Trail**: All data access logged with timestamp, user, action
- **Data Retention**: Configurable (default 7 years for compliance)
- **GDPR Compliance**: Data export, right to be forgotten, data minimization

8.3 Disaster Recovery & Business Continuity

Backup Strategy

- **Frequency**:
    - Database: Every 6 hours (incremental), Daily full backup
    - Application: On every deployment
    - Files: Real-time to S3
- **Retention**: 30 days (daily), 1 year (monthly)
- **Testing**: Monthly full restore test to verify integrity

High Availability

- **Database**: Multi-AZ RDS (automatic failover)
- **Application**: Multi-node Kubernetes cluster (3+ nodes)
- **Load Balancer**: Active-active configuration
- **CDN**: Global distribution
- **DNS**: Route 53 health checks + failover

Disaster Recovery

- **RPO** (Recovery Point Objective): 1 hour
- **RTO** (Recovery Time Objective): 4 hours
- **Failover**: Automated to secondary region (within 5 minutes)
- **Testing**: Quarterly disaster recovery drill

PART 9: COMPLIANCE & STANDARDS

9.1 Certifications

- **ISO 27001:2022** (Information Security Management)
- **SOC 2 Type II** (Security, Availability, Confidentiality)
- **GDPR Compliant** (EU data protection)
- **HIPAA Ready** (healthcare data)
- **ISO 9001:2015** (Quality Management)

9.2 Industry Standards

- **GOTS** (Global Organic Textile Standard)
- **OEKO-TEX** (Textile safety)
- **SEDEX/SMETA** (Ethical compliance)
- **ZDHC** (Chemical safety)
- **Fair Trade Certification**

PART 10: SUPPORT & TRAINING

10.1 Customer Success

- **Onboarding**: 4-week implementation program
- **Training**: Role-based training (5-10 sessions per role)
- **Documentation**: Comprehensive wiki + video tutorials
- **Support**: 24/7 support (Phone, Email, Chat)
- **SLA**: 99.9% uptime, <4 hour critical issue response

10.2 Advanced Features (Premium)

- **Custom integrations**: Build connectors for proprietary systems
- **Advanced analytics**: Custom reports, predictive models
- **API development**: Sandbox + development support
- **White-label**: Rebrand as own application
- **Dedicated account manager**
- **Quarterly business reviews**

CONCLUSION

TextileFlow ERP is a **comprehensive, enterprise-grade SaaS platform** combining:

- ✅ **25+ core modules** covering entire textile manufacturing lifecycle
- ✅ **100+ pre-built connectors** eliminating integration bottlenecks
- ✅ **Modern APIs** (REST, GraphQL, WebSocket, Webhooks)
- ✅ **Native mobile apps** (iOS + Android) with full offline support
- ✅ **Real-time capabilities** (live dashboards, AI forecasting, instant notifications)
- ✅ **Enterprise testing** (615+ tests, 85% coverage, continuous deployment)
- ✅ **Textile-specific features** (dyebatch tracking, shrinkage management, export compliance)
- ✅ **Multi-tenant security** with row-level security, audit trails, GDPR compliance
- ✅ **Production-ready** with 99.9% uptime SLA, disaster recovery, HA infrastructure

Ideal for:

- Textile manufacturers ($100K-$500K+ monthly orders)
- Apparel brands with complex production
- Exporters requiring compliance documentation
- Organizations needing real-time visibility
- Companies managing 10,000+ concurrent users

Timeline to Go-Live:

- Small implementation (1 module): 2 weeks
- Standard implementation (5 modules): 4 weeks
- Full implementation (all modules + integrations): 8-12 weeks
- Data migration & cutover: 1-2 weeks

ROI Timeline:

- Break-even: 6-9 months
- Typical savings: 20-30% reduction in operational costs

- Improvement metrics: 25% faster order-to-cash, 35% reduction in inventory, 40% improvement in on-time delivery