

# Requirement Analysis Document

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## **Development of a Computerized Maintenance Management System (CMMS)**

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# Requirement Analysis Document

## Computerized Maintenance Management System (CMMS) for Bole Lemi Special Economic Zone (BLSEZ)

Prepared for: GIZ & Industrial Parks Development Corporation (IPDC)

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### 1. Executive Summary

This requirement analysis document defines the scope, objectives, current-state challenges, and detailed functional and non-functional requirements for a CMMS tailored to BLSEZ. It consolidates inputs from BLSEZ stakeholders (engineering, electrical, water supply, wastewater, inventory/store, operations, IT, and tenants), structured questionnaires, existing SOPs/forms, and technical guidelines. The CMMS will digitize work requests, work orders, asset and inventory management, preventive maintenance, field mobility, tenant feedback, and reporting, with future integrations to utility metering, wastewater treatment, and SCADA.

#### Core outcomes

- End-to-end maintenance lifecycle digitized (request → triage → execution → verification → close-out → feedback).
  - Asset registry with hierarchy, QR/barcode, geo-location, and complete history.
  - Inventory and store management linked to work orders and procurement.
  - Preventive maintenance schedules and inspection checklists enforced in the workflow.
  - Tenant portal/app for transparent service requests and feedback.
  - Role-based dashboards, Key Performance Indicators (KPIs), and automated monthly/annual reporting.
  - Wastewater treatment plant monitoring, billing, and compliance integrated.
  - Phase 2: data ingestion from meters and SCADA; extended billing support for utilities and waste.
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## 2. Methodology

### 2.1 Activities

- **Document review:** ToR; corrective maintenance SOP; operational forms (maintenance history, downtime, time record, Lockout/Tagout (LOTO)); sanitary/plumbing preventive checklists; wastewater procedures; technical guidelines for shed modifications; tendering annexes.
- **Stakeholder interviews:** Maintenance division head; senior electrical & mechanical engineers; maintenance technicians (electrical, mechanical, HVAC/plumbing); wastewater department head and deputy manager; facility coordinator; utility maintenance supervisor; asset/property officer; infrastructure engineer; civil engineer; storekeeper and inventory controller; IT officers; operations and compliance; tenant liaison.
- **Workshops:** Process mapping (as-is / to-be), risk and Service Level Agreement (SLA) alignment, KPI definition.
- **Questionnaires:** Structured requirement questionnaires administered to departments (organizational context; asset; work order; preventive maintenance; inventory; roles; integrations; mobile; notifications; reporting; feedback; training & adoption).

### 2.2 Interviews Conducted

Interviews were conducted with key stakeholders to capture their requirements and pain points. The following positions were engaged:

- Maintenance Division Head / Supervisor
- Senior Electrical Engineer
- Electrical Maintenance Technician
- HVAC/Plumbing Technician
- Waste Water Department Head
- Deputy Manager
- Additional engineers, technicians, storekeepers, Supply and Chain, IT staff, and tenant liaisons as listed in the stakeholder plan.

These interviews provided direct input that shaped the requirement analysis, summarized later in section 4.3.

### 2.3 Deliverables from Analysis Phase

- Finalized requirement specification and acceptance criteria.
- As-is → to-be process maps by department.
- Stakeholder RACI (Responsible, Accountable, Consulted, Informed) and access matrix.
- Data dictionary and form-to-field mapping.

### 3. Stakeholders & Roles

| Group                   | Roles  | Interests in CMMS  |
|-------------------------|--|--|
| Maintenance & Technical | Division head, senior engineers, technicians (electrical, mechanical, HVAC/plumbing), facility coordinator, utility supervisor | Faster request intake, clear assignments, SLA tracking, checklists, history, mobile app                      |
| Infrastructure & Assets | Infrastructure/civil engineers, property/asset officer, documentation officer  | Asset registry & hierarchy, location mapping, drawings & manuals linkage, tamper/modification approvals      |
| Inventory & Stores      | Storekeeper, inventory controller  | Stock levels, reservations, issues/returns, shelf life and reorder alerts, linkage to work orders            |
| Water Supply            | Water technicians  | Meter readings, distribution grid assets, preventive tasks, leak/outage response, billing support            |
| Waste Water Department  | Department head, deputy manager  | Maintain wastewater treatment plant, collect revenue, track tenant waste, generate bills and revenue records |
| Operations & Compliance | Zone operations manager, internal audit, legal/compliance, safety  | Dashboards, audit trails, approvals, incident logging, safety (LOTO) recording                               |
| IT & Admin              | IT/system/network admins   | Hosting, security, SSO, backup/DR, API/integrations, device management                                       |
| Tenants (Investors)     | Facility liaison / maintenance contact   | Simple request portal/app, status transparency, feedback, billing visibility                                 |

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## 4. Current-State (As-Is) Analysis

### 4.1 Cross-cutting Pain Points

- Manual, paper-based reporting and logbooks; limited visibility for management.
- No standard triage or Service Level Agreement (SLA); requests not prioritized, leading to delays.
- Communication gaps between technicians, engineers, stores, and administration.
- Weak feedback loop from tenants; satisfaction not measured consistently.
- Maintenance history fragmented; difficult to detect recurring failures.
- Inventory requests and reservations not connected to work orders; frequent stock-outs and shelf-life blind spots.
- Utility and wastewater billing processes are manual; late/non-payment follow-ups are ad-hoc.

### 4.2 Departmental Observations

- **Engineering & Electrical:** Requests arrive by memos/phone; task status shared informally; technicians keep notebooks; preventive maintenance reminders are calendar-based; completion evidence is not standardized.
- **Water Supply:** Multi-party approvals using letters; delays in authorization; meter readings and flow data on spreadsheets; limited analytics; inspection logistics and transport planning are manual.
- **Waste Water Department:** Plant operations monitored manually; revenue collection and billing done via spreadsheets; waste discharge tracking is inconsistent.
- **Inventory/Store:** No real-time visibility into tools/spares availability; issuance/returns tracked manually; reorder thresholds not enforced.
- **Compliance & Safety:** Corrective maintenance SOP exists, including flow, approvals, KPIs, and Lockout/Tagout (LOTO) requirements; record formats exist but are not digitized.

### 4.3 Interview & Input Log

#### Maintenance Division Head / Supervisor

- Needs end-to-end visibility on requests, assignments, and SLA adherence.
- Wants standardized approval gates and close-out QA before sign-off.

### **Senior Electrical Engineer**

- Emphasized formalizing Lockout/Tagout (LOTO) within work orders and capturing test results before returning equipment to service.
- Highlighted recurring issues in utility substations and need for spare part critical lists.

### **Electrical Maintenance Technician**

- Asked for mobile checklists, photo upload, QR scanning, and simple time logging.
- Wants transport/route planning for multi-site calls.

### **HVAC/Plumbing Technician**

- Stressed seasonal PM campaigns (roof/gutter cleaning before heavy rain).
- Requested easy access to manuals and previous fixes on the mobile app.

### **Water Supply Technicians / Team**

- Reported meter reading is manual and slow; wants photo-backed readings and exception flags.
- Seeks automated reminders to tenants for unpaid utility bills and structured disconnection workflow when required.

### **Waste Water Department Head & Deputy Manager**

- Responsible for operation and maintenance of the wastewater treatment plant.
- Need digital tools to track tenant industrial waste discharges, generate billing, and monitor payments.
- Seek dashboards for revenue collection, overdue accounts, and plant performance.
- Want integration of environmental compliance checks with maintenance workflows.

### **Storekeeper / Inventory Controller**

- Needs reservation against Work Orders, kitting, and stock-out prevention with min/max.
- Wants shelf-life tracking and supplier lead-time visibility.

### **Asset/Property & Infrastructure Engineers**

- Want structured asset hierarchy, geo-mapping for networks, and linkage to modification approvals with inspections.

## IT / System Admin

- Prefers Single Sign-On (SSO), robust role-based access, API-first for future integrations, and backup/disaster recovery clarity.

## Operations, Compliance & Audit

- Need dashboards, immutable audit logs, incident logging, and linkage to SOPs.

## Tenants (Company Facility Liaisons)

- Want a simple, transparent request portal/app with status notifications and an easy feedback mechanism.
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## 5. Target-State (To-Be) Vision

A centralized CMMS with mobile apps enables tenants and staff to submit and track requests; engineering triages with SLA policies; supervisors assign to technicians; wastewater and water departments record discharges and bills; inventory is reserved from store; technicians execute with guided checklists and safety gates; QA verifies; tenants provide feedback; KPIs and costs roll up to dashboards. Phase 2 integrates meter/SCADA signals, wastewater plant data, and billing notifications.

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## 6. Functional Requirements

### 6.1 Asset & Location Management

- Maintain a centralized asset registry covering all equipment, infrastructure, vehicles, utility assets, and wastewater treatment plant components.
- Support asset hierarchies (park > zone > building/shed > system > equipment > component).
- Capture full lifecycle data: commissioning date, warranty, maintenance history, modifications, inspections, decommissioning.
- Enable asset tagging with QR codes/barcodes for quick identification and mobile scanning.
- Store associated documents and drawings (manuals, warranties, compliance certificates).
- Geo-mapping of assets and infrastructure networks (electrical, water, wastewater).

## 6.2 Work Requests & Work Orders

- Allow tenants, staff, or supervisors to submit maintenance requests via web portal, mobile app, or helpdesk.
- Requests include tenant details, location, description, severity, attachments (photos, videos, documents).
- Auto-routing of requests to the right department (electrical, plumbing, wastewater, civil).
- SLA (Service Level Agreement) timers start on submission; configurable by request type.
- Supervisors convert requests into work orders with prioritization and assignment to technicians.
- Work orders include scope, tasks, checklists, required materials, estimated cost, and timeline.
- Technicians update progress, capture time spent, upload photos, and complete checklists on mobile.
- Supervisors and QA verify completion with digital sign-off before closure.
- Wastewater-specific WOs track industrial discharge inspections, treatment plant tasks, and compliance audits.

## 6.3 Preventive Maintenance

- Support calendar-based, usage-based, and condition-based scheduling.
- Auto-generate preventive maintenance work orders according to schedules.
- Templates/checklists for sanitary systems, plumbing, HVAC, wastewater plant filters and pumps, and electrical inspections.
- Seasonal preventive tasks (e.g., gutter/roof cleaning before rainy season).
- Ability to group tasks by location for efficient technician routing.
- Track compliance percentage and generate overdue task alerts.

## 6.4 Inventory & Stores

- Maintain a digital inventory of spare parts, consumables, tools, and safety equipment.
- Integrate existing shelf organization and tagging system; technicians can locate items by code and shelf.
- Real-time stock visibility; alerts for low stock and expired/expiring items.
- Reserve items directly against work orders; automatic deduction upon issue.
- Manage issuance and returns of tools; record calibration and custody.
- Integration with procurement: generate requisitions for out-of-stock items.

## 6.5 Utility & Wastewater Billing

- Capture water and electricity meter readings with mobile devices and photo verification.
- Track tenant wastewater discharge volumes, link to billing rules.
- Generate bills for water, electricity, and wastewater services; apply tariffs and rates.
- Record payments, flag overdue accounts, and trigger reminders.
- Provide dashboards for revenue monitoring and collections.

## 6.6 Notifications & Communications

- Multi-channel notifications (in-app, SMS, email).
- Configurable triggers: new assignment, SLA breaches, task delays, completion, billing reminders, feedback requests.
- Multilingual templates (English, Amharic).
- Tenants receive updates on their requests in real time.

## 6.7 Reporting & Dashboards

- Role-based dashboards (technicians, supervisors, managers, compliance, finance).
- Real-time KPIs: SLA compliance, downtime, MTTR (Mean Time to Repair), MTBF (Mean Time Between Failures), PM compliance.
- Wastewater KPIs: plant throughput, compliance results, discharge levels.
- Revenue reports: collections vs. outstanding bills.
- Exportable reports (Excel/PDF); automated monthly/annual reports.

## 6.8 Feedback

- Tenants provide ratings and comments after service completion.
  - Feedback collected through portal, mobile app, or SMS link.
  - Negative ratings trigger alerts for supervisors.
  - Feedback data integrated into dashboards for service quality improvement.
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## 7. Non-Functional Requirements

The CMMS must not only deliver features but also operate reliably, securely, and in line with the broader needs of IPDC and GIZ. The following non-functional requirements ensure the system's quality and sustainability:

### **Security and Compliance**

The system shall enforce role-based access control (RBAC) with Single Sign-On (SSO) options. All data in transit and at rest must be encrypted. Comprehensive audit logs must be maintained and exportable for compliance.

### **Availability and Performance**

The system is expected to provide reliable access during business hours, with any planned maintenance clearly communicated in advance. Performance should be sufficient to allow smooth navigation of dashboards and timely generation of reports without noticeable delays. Mobile app access will ensure that technicians and supervisors can continue to interact with the system even when not at their desks.

### **Scalability and Extensibility**

The solution shall support growth to cover additional tenants(investors) . It must handle thousands of assets, users, and work orders without performance degradation. Integration APIs should be built in to allow future linkage with ERP, SCADA, or billing systems.

### **Usability and Accessibility**

Interfaces must be intuitive for technicians with limited digital literacy, offering clear navigation, QR scanning, photo uploads, and simplified forms. Accessibility should include responsive design for desktops, tablets, and mobiles, with multilingual support (English and Amharic).

### **Data Protection and Recovery**

Daily backups are required with at least 30 days of retention. Disaster recovery plans must include quarterly restoration tests. The system shall offer configurable alerts for backup failures and ensure continuity of operations in case of outages.

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## 8. Implementation Plan & Milestones

The requirement analysis phase has already been completed, and this document reflects the outcomes of that stage. It now serves as the foundation for ongoing implementation activities.

- **Phase 0:** Initiation and setup.
  - **Phase 1:** Requirement analysis (already conducted and documented here as proof).
  - **Phase 2:** Build (assets, WR/WO, PM, inventory, billing, mobile) ← **Current phase (in progress).**
  - **Phase 3:** Training and pilot.
  - **Phase 4:** Go-live & hypercare.
  - **Phase 5:** Extension (wastewater SCADA integration).
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## 9. Acceptance Criteria

The system will be considered acceptable and ready for handover when the following detailed criteria are fully met:

### Asset & Location Management

- All critical assets (including water, electrical, and wastewater treatment components) are registered in the system with unique IDs, QR/barcodes, and geo-location.
- Asset hierarchies are correctly structured (park > zone > building/shed > system > equipment).

### Work Requests & Work Orders

- Tenants and staff can submit requests through web, mobile, and helpdesk channels.
- SLA timers are automatically triggered and monitored for each request type.
- Supervisors can convert requests into work orders, assign technicians, and attach materials/tools.
- Technicians can update progress via mobile, including photos, time spent, and checklist completion.
- QA officers can verify and digitally sign off before closure.

### Preventive Maintenance

- Preventive maintenance schedules are created for all major systems (electrical, sanitary, plumbing, wastewater, civil).
- At least 10 PM templates and checklists are configured and in use.
- Automated work order generation is functioning with compliance tracking and overdue alerts.

### Inventory & Stores

- Store organization and tagging are fully digitized in the CMMS.
- Real-time visibility of stock is available; low stock alerts are functioning.
- Reservations, issues, returns, and tool custody are linked directly to work orders.
- Integration with procurement workflows is tested and functional.

### **Utility & Wastewater Billing**

- Water and electricity meter readings are captured digitally
- Wastewater discharges are tracked per tenant and linked to billing.
- Bills for utilities and wastewater are automatically generated and distributed.
- Revenue dashboards and overdue alerts are functioning.

### **Notifications & Communications**

- Notifications (in-app, SMS, email) are triggered for assignments, SLA breaches, delays, and completions.
- Multilingual templates (English and Amharic) are active.
- Tenants receive updates for every stage of their requests.

### **Reporting & Dashboards**

- Dashboards display SLA compliance, downtime, PM compliance, and revenue.
- Wastewater plant KPIs and tenant satisfaction ratings are included.
- Reports are exportable to Excel/PDF and auto-generated monthly/annually.

### **Feedback Module**

- Tenant feedback is collected after every tenant-initiated request.
- Negative ratings generate alerts for supervisors.
- Feedback trends are visible in management dashboards.

### **System Reliability & Compliance**

- Security features (RBAC, SSO, audit logs) are active and tested.
- Backup and restore procedures have been validated.

- The system demonstrates availability during pilot.
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## 10. Risks & Mitigations

The following risks have been identified along with mitigation measures to reduce their impact on successful CMMS implementation:

### Data Migration and Quality

- *Risk:* Legacy maintenance data, downtime logs, and billing records may be inconsistent or incomplete.
- *Mitigation:* Structured data cleansing workshops, validation through pilot loads, staged imports with departmental verification.

### User Adoption and Change Resistance

- *Risk:* Staff and technicians accustomed to manual logbooks and memos may resist using the digital system.
- *Mitigation:* Phased rollouts, role-based training, and designation of internal champions. Benefits communicated clearly to users.

### Connectivity and Infrastructure Limitations

- *Risk:* Field staff may encounter low connectivity, leading to delayed updates.
- *Mitigation:* mobile capability with auto-sync, backup connectivity solutions in critical areas.

### Integration with Other Systems

- *Risk:* Complexities in linking CMMS with ERP, procurement, and future SCADA systems.
- *Mitigation:* API-first design, phased integration after stabilization, sample dataset testing before rollout.

### Inventory Accuracy and Supply Chain

- *Risk:* Inaccurate stock data may lead to shortages or delays.
- *Mitigation:* Cycle counts, barcode scanning, and enforcement of min/max thresholds with procurement linkage.

### Training and Support (CRC Helpdesk)

- *Risk:* Users may face difficulties without consistent support.
- *Mitigation:* A dedicated helpdesk (CRC) has been created to provide ongoing assistance. Staff can sign up via the CRC platform ([https://crc.et/signup\\_user\\_complete/?id=sjoa87fbnb8efpsqf8jqki7q3o&md=link&sbr=fa](https://crc.et/signup_user_complete/?id=sjoa87fbnb8efpsqf8jqki7q3o&md=link&sbr=fa)). CRC will manage support tickets, user queries, and training follow-up.

### **Financial and Budget Risks**

- *Risk:* Costs may exceed projections if scope expands.
- *Mitigation:* Modular implementation, milestone-based cost monitoring, scope change approvals with justification.

### **Operational Continuity**

- *Risk:* System downtime or technical issues could halt operations.
- *Mitigation:* Target 99% uptime, disaster recovery plans, quarterly fallback procedure testing.

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This requirement analysis document consolidates the needs of Bole Lemi SEZ and its stakeholders into a detailed blueprint for CMMS implementation. The analysis confirms that the requirement phase has been completed and that the project is currently in the build phase. The outlined functional and non-functional requirements, acceptance criteria, and mitigation strategies ensure that the system will meet operational, financial, and compliance objectives. The presence of the CRC helpdesk provides an ongoing support mechanism to sustain adoption and ensure smooth usage. In addition, a dedicated progress tracking portal has been made available at <https://ipdclemi.crc.et/> so stakeholders can monitor implementation milestones and project status in real time.

This document also serves as the baseline reference for monitoring project delivery and alignment with GIZ and IPDC expectations.

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