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Enterprise Architecture Design for an Integrated Inventory System Using TOGAF ADM at PT Media Selular Indonesia

Perancangan Enterprise Architecture Sistem Inventory Menggunakan TOGAF ADM pada PT Media Selular Indonesia

Apriansyah Rizqi Setiawan, Ichtiari Dayaguna Maulana Malik, Yohanes Michael Fouk Runa, Mesi Febima

Information Systems Study Program, Universitas Catur Insan Cendekia, Cirebon, 45133, Indonesia
apriansyah.setiawan.mi.19@cic.ac.id, ichtiar1221@gmail.com, yohanes.runa.si.23@cic.ac.id, mesi.febima@cic.ac.id

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Corresponding Author
Mesi Febima
mesi.febima@cic.ac.id

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ABSTRACT

Inventory management is a critical process for telecommunications product distributors because stock movement is fast, product variants are diverse, and sales decisions depend on accurate cross-location stock information. PT Media Selular Indonesia still faces inventory problems caused by semi-manual spreadsheet recording, fragmented warehouse and outlet data, lengthy stock-taking, and undocumented procurement requests. This study aims to design an enterprise architecture blueprint for an integrated inventory system using the TOGAF Architecture Development Method (ADM). The research applies a descriptive qualitative case study through observation, stakeholder interviews, and analysis of inventory documents. The design covers the Preliminary Phase, Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, and Migration Planning. The proposed blueprint consists of a TO-BE business architecture based on barcode scanning, real-time monitoring, and digital procurement approval; a data architecture with eight main entities; an application architecture with seven integrated modules connected through an API gateway and event-driven messaging; and a hybrid cloud technology architecture supported by security controls, backup, and disaster recovery. The migration roadmap is arranged in three stages over 12 months. The design targets inventory accuracy of at least 95%, stock-taking completion within one day, a procurement lead time of four days, stockout reduction of 60%, and system uptime of at least 99.5%. The study contributes a coherent architecture design that links operational inventory problems, architecture components, and measurable implementation targets.

Keywords:

Enterprise Architecture; TOGAF ADM; Inventory System; Telecommunications Distributor; Architecture Blueprint

ABSTRAK

Pengelolaan inventori menjadi proses kritis bagi perusahaan distributor produk telekomunikasi karena pergerakan stok berlangsung cepat, varian produk sangat beragam, dan keputusan penjualan bergantung pada akurasi informasi stok lintas lokasi. PT Media Selular Indonesia masih menghadapi masalah inventori berupa pencatatan semi-manual menggunakan spreadsheet, fragmentasi data gudang dan outlet, proses stock opname yang lama, serta permintaan pengadaan yang belum terdokumentasi secara sistematis. Penelitian ini bertujuan merancang blueprint enterprise architecture untuk sistem inventori terintegrasi menggunakan TOGAF Architecture Development Method (ADM). Metode penelitian menggunakan pendekatan kualitatif deskriptif dengan studi kasus melalui observasi, wawancara stakeholder, dan analisis dokumen inventori. Perancangan mencakup Preliminary Phase, Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, dan Migration Planning. Hasil penelitian berupa arsitektur bisnis TO-BE berbasis barcode scanning, monitoring real-time, dan workflow approval pengadaan; arsitektur data dengan delapan entitas utama; arsitektur aplikasi dengan tujuh modul terintegrasi melalui API gateway dan event-driven messaging; serta arsitektur teknologi hybrid cloud yang dilengkapi kontrol keamanan, backup, dan disaster recovery. Roadmap migrasi disusun dalam tiga fase selama 12 bulan. Rancangan menargetkan akurasi stok minimal 95%, stock opname maksimal satu hari, procurement lead time empat hari, pengurangan stockout 60%, dan uptime sistem minimal 99,5%. Penelitian ini memberikan rancangan arsitektur yang menghubungkan masalah operasional inventori, komponen arsitektur, dan target implementasi secara terukur.

Kata Kunci:

Enterprise Architecture; TOGAF ADM; Sistem Inventori; Distributor Telekomunikasi; Blueprint Arsitektur

1. INTRODUCTION

The rapid development of information technology has changed how distribution companies manage business processes, data, applications, and technology infrastructure. Organizations can no longer rely only on separate operational applications. They need to align business strategy with technological capability so that distribution processes become faster, more accurate, and easier to control [1], [2].

Enterprise Architecture provides a strategic approach for describing the relationship between business objectives, processes, data, applications, and technology infrastructure in a unified organizational blueprint [3]. EA helps organizations reduce system redundancy, improve data consistency, and direct information technology investment toward measurable business value [4], [5]. In inventory management, EA is relevant because inventory problems usually do not arise from a single application failure. They often result from fragmented processes, inconsistent master data, weak integration, and infrastructure limitations [1], [5].

PT Media Selular Indonesia is a telecommunications product distributor that manages mobile phones, accessories, prepaid vouchers, and SIM cards through warehouses and outlets in several regions. Product variety, a high number of stock keeping units, and rapid stock movement make inventory management a critical operational function. Inventory data must be available accurately and in real time because stock availability directly affects sales, procurement, warehouse control, and financial reporting.

Initial observation and stakeholder interviews identified several major problems. Stock is still recorded semi-manually using separate spreadsheets, data between the central warehouse and outlets is not integrated, stock-taking takes two to three days, procurement requests are often sent through WhatsApp or telephone, and procurement decisions are delayed because stock data is not accurate and not available in real time. These conditions create operational inefficiency, increase the risk of stockout and overstock, and reduce the reliability of managerial decisions [1], [2].

TOGAF Architecture Development Method was selected because it provides a systematic, iterative, and adaptable method for developing enterprise architecture [6], [7]. Previous studies have applied TOGAF ADM to logistics systems, warehouse management systems, retail distribution, and public service information systems [8]-[10]. However, research that specifically structures EA design for a telecommunications product distributor with fast stock movement, barcode-based control, API integration, event-driven architecture, and measurable migration KPIs remains limited. Therefore, this study aims to design an enterprise architecture blueprint for an integrated inventory system at PT Media Selular Indonesia using TOGAF ADM. The contribution of this study lies in the traceable linkage between operational problems, business requirements, architecture components, implementation roadmap, and target KPIs.

2. METHODS

2.1. Research Design

This study used a descriptive qualitative method with a case study approach [2], [10]. The research object was the inventory process of PT Media Selular Indonesia. The unit of analysis covered inbound goods, stock movement, outbound goods, stock-taking, procurement, reporting, and integration requirements between warehouses and outlets.

A qualitative approach was selected because the objective of this study was not to test a statistical hypothesis, but to design an enterprise architecture blueprint based on actual organizational problems [6], [9]. The research output is a set of design artifacts consisting of architecture principles, business architecture, data architecture, application architecture, technology architecture, migration roadmap, risk mitigation, and implementation KPIs.

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Table 1. Data Collection Techniques and Analytical Outputs

Data Collection Technique	Data Source	Analytical Purpose	Output
Process observation	Warehouse activities, outlets, receiving, issuing, and stock-taking	To identify the AS-IS flow, delay points, and possible human errors	AS-IS process map and operational problem list
Stakeholder interviews	Director, operations manager, IT manager, warehouse supervisor, warehouse staff, and finance manager	To explore business needs, system requirements, risks, and implementation priorities	Stakeholder concerns, functional requirements, and non-functional requirements
Document analysis	Inventory reports, stock-taking records, procurement documents, and spreadsheet samples	To examine data structure, reporting patterns, and data inconsistency	Data entities, baseline conditions, and architecture requirements

2.2. TOGAF ADM Stages

The design used six TOGAF ADM stages that were relevant to the research objective. Phases G and H were not included as the main scope because this study stops at the blueprint and migration planning stage, not at actual implementation and post-implementation governance. This scope adjustment follows the flexible nature of TOGAF ADM, which allows the method to be adapted to specific organizational needs and research boundaries, an approach frequently adopted in similar Indonesian information systems research [11], [12].

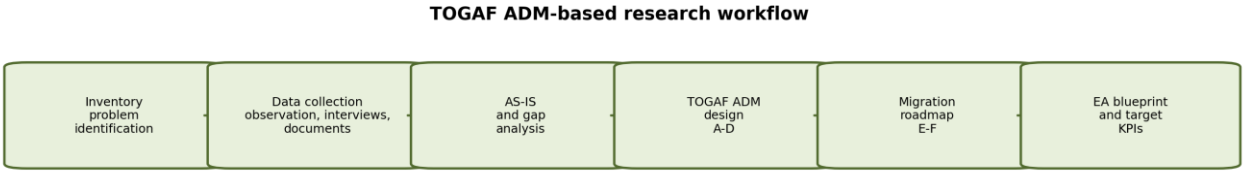

Figure 1. TOGAF ADM-Based Research Workflow

Table 2. Mapping of TOGAF ADM Phases and Research Artifacts

TOGAF ADM Phase	Analytical Focus	Research Artifact
Preliminary Phase	Identification of stakeholders, scope, architecture principles, and organizational readiness	Stakeholder list, architecture principles, and design boundaries
Phase A - Architecture Vision	Formulation of vision, strategic objectives, baseline problems, and target KPIs	Architecture vision, business goals, and performance targets
Phase B - Business Architecture	AS-IS process analysis, TO-BE process design, and gap analysis	Business gap map and integrated inventory process design
Phase C - Information Systems Architecture	Data architecture and application architecture design	Data entities, application modules, API integration, and event-driven flow
Phase D - Technology Architecture	Infrastructure, security, database, network, and backup design	Hybrid cloud technology blueprint and security controls
Phase E and F - Opportunities, Solutions, and Migration Planning	Solution prioritization, implementation phases, cost, risk, and KPI planning	12-month roadmap, investment estimate, and risk mitigation plan

2.3. Design Validation

The design was validated using traceability analysis, which examines the relationship between operational problems, business requirements, architecture components, and target KPIs [13], [14]. This approach ensures that each blueprint component has a clear problem-based rationale. Inventory

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accuracy, stock-taking duration, stockout reduction, procurement lead time, and uptime in this study are positioned as implementation targets, not as post-implementation measured results.

3. RESULTS

3.1. Preliminary Phase - Stakeholders and Architecture Principles

The Preliminary Phase produced the identification of key stakeholders and architecture principles. Stakeholders were identified to ensure that the design addresses not only technical requirements but also operational needs, supervision, budgeting, and daily use. The six main stakeholders are the Director, Operations Manager, IT Manager, Warehouse Supervisor, Warehouse Staff, and Finance Manager.

Table 3. Stakeholders and Architecture Concerns

Stakeholder	Role	Main Concern
Director	Sponsor and approver	Operational efficiency, data accuracy, business growth, and return on investment
Operations Manager	Key user and process validator	Service speed, stock availability, and process standardization
IT Manager	Technical lead	System integration, security, scalability, and infrastructure sustainability
Warehouse Supervisor	Subject matter expert	Stock balance accuracy, receiving control, issuing control, and stock-taking
Warehouse Staff	End user	Ease of input, barcode scanning, and reduction of duplicate recording
Finance Manager	Budget controller	Cost control, procurement approval, audit trail, and reporting

Table 4. Architecture Principles for the Inventory System

Architecture Principle	Description	Design Implication
Data Integration	Inventory data becomes a single source of truth across warehouses and outlets	Centralized database, API gateway, and real-time synchronization
Role-Based Access	System access follows user roles and authority levels	RBAC, multi-level approval, and audit trail
Scalability	The system can follow outlet and transaction growth	Modular architecture, cloud VM, caching, and message queue
Data Security	Transaction data and user access must be protected	TLS 1.3, AES-256, MFA, WAF, logging, and backup
User Experience	Warehouse users need a fast and simple interface	Mobile-first design, barcode scanning, and concise forms
Business Continuity	Inventory services must remain available during disruption	Replication, disaster recovery, RPO, and RTO

3.2. Phase A - Architecture Vision

The architecture vision is to establish an integrated inventory system that provides real-time stock visibility, automates procurement, accelerates stock-taking, and supports data-driven decision-making. This vision was translated into target KPIs so the architecture can be evaluated through measurable implementation objectives.

Table 5. Baseline Problems and Architecture Target KPIs

Indicator	AS-IS Condition	TO-BE Target	Improvement Meaning
Inventory accuracy	Around 70% based on inconsistencies between reports and physical stock	At least 95%	Reduces stock variance and improves report reliability
Stock-taking duration	2 to 3 days per warehouse	Maximum 1 day	Accelerates physical counting through mobile counting
Procurement lead	Around 7 days	4 days	Accelerates approval and purchase

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Indicator	AS-IS Condition	TO-BE Target	Improvement Meaning
time			order generation
Stockout	Often occurs because stock is not visible in real time	Reduced by 60%	Improves item availability at outlets
Warehouse staff productivity	Delayed by duplicate recording and manual corrections	Increased by 35%	Reduces re-entry and human error
System uptime	No formal target	At least 99.5%	Ensures inventory services remain available

3.3. Phase B - Business Architecture

Business Architecture maps the transformation from the AS-IS condition to the TO-BE condition. In the AS-IS condition, inbound goods are recorded in an expedition book and re-entered into spreadsheets. This process creates double-entry errors. In the TO-BE condition, goods are scanned through barcodes, transactions are stored directly in the central database, and stock balance changes can be monitored through a dashboard. Procurement also shifts from informal communication to a digital approval workflow that produces purchase order documents.

Table 6. Business Architecture Gap Analysis Between AS-IS and TO-BE

Aspect	AS-IS	TO-BE	Gap to be Closed
Recording	Separate manual spreadsheets per warehouse	Integrated barcode scanning	Barcode devices, SKU master data, and central database
Data integration	No real-time synchronization across locations	Synchronization through API gateway	Network infrastructure, APIs, and transaction mechanism
Monitoring	Physical checking and manual reconciliation	Stock dashboard and reorder point alert	Operational dashboard and stock threshold settings
Procurement	Requests through WhatsApp or telephone	Digital approval workflow and purchase order	Procurement module and multi-level approval
Stock-taking	Manual, paper-based, and error-prone	Mobile app for counting and variance analysis	Mobile application, barcode, and adjustment approval
Reporting	Reports are manually compiled from many files	Automated reports and BI dashboard	Reporting data mart and database replication

3.4. Phase C - Information Systems Architecture

A. Data Architecture

Data Architecture was designed to establish a single source of truth. The data structure must capture relationships among products, suppliers, warehouses, purchase orders, receipts, issues, stock cards, and stock-taking records. These eight main entities form the foundation for business process integration and operational reporting.

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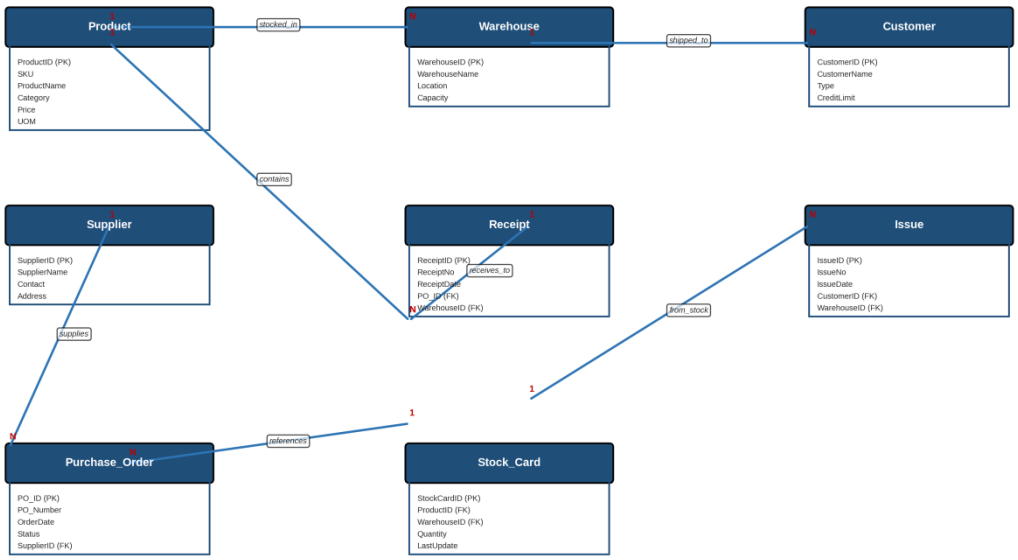

Figure 2. Entity Relationship Diagram (ERD) Sistem Inventory

Table 7. Main Entities of the Data Architecture

Data Entity	Key Attributes	Business Function
Product Master	SKU, product name, category, price, unit of measure, active status	Main reference for stock transactions
Supplier Master	Supplier ID, name, contact, address, transaction history	Manages suppliers and purchase relationships
Warehouse Master	Warehouse ID, location, capacity, person in charge	Manages storage and distribution locations
Purchase Order	PO number, supplier, item, quantity, price, approval status	Documents goods procurement
Receipt	Receipt number, PO, SKU, quantity, date, quality check	Records inbound goods into the warehouse
Issue	Issue number, SKU, quantity, destination outlet, approval	Records outbound goods to outlets or customers
Stock Card	SKU, warehouse, opening balance, inbound, outbound, closing balance	Provides real-time balance per product and location
Stock Taking	Period, SKU, system stock, physical stock, variance, adjustment	Manages reconciliation between physical and system stock

B. Application Architecture

Application Architecture uses a layered architecture approach. The Presentation Layer provides web admin, mobile scanner, and BI dashboard access. The API and Integration Layer manages API gateway, authentication, authorization, and event bus. The Application Layer contains seven business modules. The Data and Infrastructure Layer supports storage, caching, backup, and disaster recovery. Event-driven integration through Kafka is relevant for stock transactions that require fast updates, while REST APIs are used for data requests and external integration.

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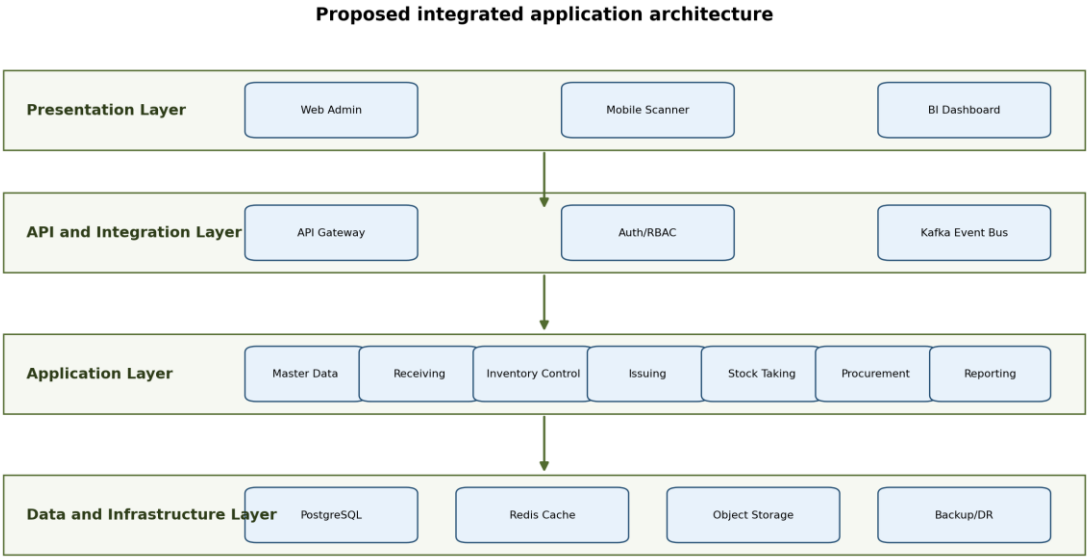

Figure 3. Proposed Integrated Application Architecture

Table 8. Application Modules, Functions, and Integration Protocols

Module	Main Function	Integration Protocol	Output
Master Data Management	Manages products, suppliers, warehouses, users, and roles	REST API	Single reference data
Receiving	Records inbound goods, barcode scanning, and quality check	Kafka event to Inventory Control	Inbound goods transaction
Inventory Control	Monitors real-time stock, stock card, and reorder point alerts	Receives events from Receiving and Issuing	Stock balance and alerts
Issuing	Manages outbound goods from warehouse to outlet or customer	Kafka event to Inventory Control	Outbound goods transaction
Stock Taking	Supports mobile counting, variance analysis, and adjustment approval	REST API to Inventory Control	Reconciliation report
Procurement	Manages purchase requisition, approval, and purchase order	Receives reorder alert from Inventory Control	Approved procurement document
Reporting	Generates operational reports and BI dashboard	Database replication and analytical queries	Management dashboard and reports

3.5. Phase D - Technology Architecture

Technology Architecture was designed using a hybrid cloud approach to balance scalability, cost, security, and service availability. PostgreSQL is used as the transactional database because it supports consistency and replication. Redis is used for frequently accessed data caching. The API gateway centralizes routing, rate limiting, and authentication. The network is protected with site-to-site VPN, while application security follows layered controls aligned with cybersecurity and application security guidance.

Table 9. Technology Component Specifications

Component	Technology or Specification	Description
Application Server	Cloud VM 4 vCPU, 16 GB RAM, auto-scaling up to 10 instances	Runs application services and APIs
Database Server	PostgreSQL 15.x master-replica, 8 vCPU, 32 GB RAM, daily backup	Maintains inventory transactions and data consistency [25]
Cache Server	Redis Cluster, 3 nodes, 8 GB each	Supports session data and frequently accessed data
API Gateway	Kong or AWS API Gateway	Centralizes routing, authentication, and rate limiting

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Component	Technology or Specification	Description
Message Queue	Apache Kafka	Processes receiving and issuing events in near real time [24]
Mobile Application	Flutter for Android and iOS	Supports barcode scanning and stock-taking
Frontend Web	React.js and TypeScript	Provides web admin and management dashboard
Network	Site-to-site VPN with AES-256 encryption and 100 Mbps dedicated connection	Connects warehouse, outlets, and cloud services
Security Control	MFA, RBAC, TLS 1.3, AES-256 at rest, WAF, and audit trail	Protects access, transactions, and traceability [22], [23]

The proposed disaster recovery plan uses database replication with a recovery point objective (RPO) of less than one hour and a recovery time objective (RTO) of less than two hours. The architecture is designed to support up to 50 outlets, 200 concurrent users, and target uptime of at least 99.5%.

3.6. Phase E and F - Migration Planning

Migration Planning was arranged in three phases over 12 months. A staged approach is used to control implementation risk. The first phase establishes data and core module foundations. The second phase conducts a limited pilot. The third phase performs full rollout and dashboard optimization. This strategy allows the company to validate processes before the system is used across all outlets.

Table 10. Three-Phase Implementation Roadmap Over 12 Months

Phase	Period	Main Activities	Deliverable
Phase 1 - Foundation	Month 1-3	Cloud setup, database design, core modules for MDM, Receiving, Inventory Control, data migration, and data cleansing	Core module alpha and migrated master data
Phase 2 - Pilot	Month 4-6	Issuing, Stock Taking, Procurement modules, barcode integration, mobile integration, pilot in six locations, and user training	Complete module, pilot go-live, and trained users
Phase 3 - Full Rollout	Month 7-12	Rollout to 50 outlets, Reporting and BI dashboard, integration with accounting, e-commerce, and optimization	All outlets live, BI dashboard, and ROI baseline

The estimated investment is IDR 2,002,000,000, consisting of human resources IDR 1,170,000,000, infrastructure IDR 340,000,000, training and documentation IDR 70,000,000, software licenses IDR 20,000,000, and contingency reserve IDR 182,000,000. This figure should be treated as a planning estimate and must be validated through actual vendor quotations and pilot implementation. The primary KPIs are inventory accuracy of at least 95%, stock-taking completion within one day, procurement lead time of four days, stockout reduction of 60%, system uptime of at least 99.5%, and ROI above 150% within two years.

3.7. Traceability of Problems, Solutions, and KPIs

The main strength of the proposed EA design is the traceability between initial problems and solution components. Table 11 shows that each inventory problem has a specific business requirement, architecture component, and target KPI. This traceability is important to ensure that the blueprint does not stop at technical diagrams but directly responds to operational problems.

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Table 11. Traceability of Problems, Requirements, Solutions, and KPIs

Main Problem	Business Requirement	Architecture Component	Target KPI
Inconsistent stock data across locations	Single source of truth and real-time synchronization	Central database, API gateway, and Stock Card	Inventory accuracy at least 95%
Stock-taking takes too long	Fast and documented physical counting	Mobile application, barcode scanning, and Stock Taking module	Stock-taking maximum 1 day
Procurement is not documented	Formal approval flow and purchase order traceability	Procurement module and approval workflow	Procurement lead time 4 days
Stockout is difficult to anticipate	Real-time stock visibility and reorder alert	Inventory Control, dashboard, and reorder point alert	Stockout reduced by 60%
Manual reports are slow	Automated operational and managerial reports	Reporting module and BI dashboard	Reports available in near real time

4. DISCUSSION

4.1. Relationship Between Business Architecture and Technology Architecture

The design results show that the inventory problems at PT Media Selular Indonesia cannot be solved simply by replacing spreadsheets with an application. Inconsistent stock records occur because business processes, master data, applications, and infrastructure have not been designed as one integrated architecture. TOGAF ADM helps structure the relationship among these domains, ensuring alignment between business strategy and information technology—a critical factor for organizational efficiency and sustainability [15]-[17]. This structured approach enables the transformation of business processes while ensuring that IT infrastructure effectively supports organizational goals, thereby reducing operational risks [18], [19]. The proposed solution thus becomes more coherent by mapping business needs directly to technological capabilities.

The TO-BE business architecture changes the main control point from manual recording to barcode-based transactions. This change affects the data architecture because each transaction must update the Stock Card. It also affects the application architecture because Receiving, Issuing, Inventory Control, Stock Taking, Procurement, and Reporting modules must exchange data consistently. At the technology level, API gateway, database replication, caching, and message queue support speed, integration, and service reliability.

4.2. Implementation Feasibility and Risks

From an implementation perspective, a 12-month roadmap is more feasible than a big bang approach. The foundation phase reduces failure risk because the company can clean master data and stabilize core modules before full deployment. The pilot phase provides space to test barcode flow, API integration, stock accuracy, and user adoption in a limited environment. The full rollout phase is conducted after key process and technical risks have been reduced.

The main implementation risks include poor master data quality, warehouse user resistance, limited outlet connectivity, failure of external system integration, and application security risks [20]. The recommended mitigation includes data cleansing before migration, role-based training, fallback procedures during connection disruption, API testing, monitoring, MFA, RBAC, WAF, audit trail, and regular backup [21], [22]. Employing a structured framework like TOGAF ADM in the design phase is crucial to managing these risks and enhancing the success rate of such projects within the Indonesian corporate environment [23].

Table 12. Implementation Risks and Mitigation

Risk	Impact	Mitigation
Unclean master data	Incorrect barcode mapping, inaccurate reports, and blocked migration	Data cleansing, SKU validation, and master data approval
User resistance	Low system adoption and return to manual processes	Training, concise SOPs, user champions, and

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Risk	Impact	Mitigation
		pilot assistance
Unstable outlet network	Delayed transaction synchronization	Offline mode, retry mechanism, and connection monitoring
Integration failure	Data mismatch between inventory, accounting, and e-commerce systems	API contract, integration testing, and event logging
Security weakness	Unauthorized access and transaction manipulation	MFA, RBAC, TLS, WAF, audit trail, and periodic security testing

4.3. Research Limitations

This study has several limitations. First, the research output is a blueprint and target KPI, rather than a measurement of impact after implementation, a common challenge in EA research where realizing benefits often requires significant time and organizational adaptation [24], [25]. Second, the data were obtained from a single case study, limiting statistical generalizability to other distributors [26]. Third, investment estimates and ROI targets remain initial planning values that must be revalidated through actual cost analysis, vendor quotations, and pilot implementation to ensure feasibility in the Indonesian context [27]. Fourth, while cybersecurity and disaster recovery aspects are designed at the architecture level, they require further technical testing and specific mitigation strategies to manage development risks before production deployment [20].

5. CONCLUSION

This study produced an enterprise architecture blueprint for the inventory system of PT Media Selular Indonesia using TOGAF ADM. The design addresses the main problems of semi-manual stock recording, fragmented warehouse and outlet data, lengthy stock-taking, undocumented procurement flow, and delayed decision-making caused by non-real-time data. The proposed architecture consists of a TO-BE business architecture based on barcode scanning, real-time dashboard, and approval workflow; a data architecture with eight main entities to support a single source of truth; an application architecture with seven integrated modules through API gateway and event-driven messaging; a hybrid cloud technology architecture with security, backup, and disaster recovery controls; and a 12-month migration roadmap with phased implementation. The proposed design targets inventory accuracy of at least 95%, stock-taking completion within one day, procurement lead time of four days, stockout reduction of 60%, and system uptime of at least 99.5%. Future research should proceed to pilot implementation, measure actual KPI achievement, deepen cybersecurity and disaster recovery testing, integrate the inventory system with finance, CRM, and e-commerce platforms, and compare TOGAF ADM with other EA frameworks such as Zachman or FEAF.

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