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A Comparative Study of Enterprise Architecture Frameworks in the MSMEs' Logistics Sector

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Abstract: This study is intended to provide a detailed comparison of enterprise architecture (EA) frameworks tailored to the needs of micro, small, and medium-sized enterprises (MSMEs) in the logistics sector. EA frameworks are conventionally designed for larger organizations with plenty of resources in mind. In contrast, MSMEs lack the budget, skills, and immediate need for adoption, and they face rapid changes in operations, partners, and market stability. The following EA frameworks are compared in this paper: The Open Group Architecture Framework (TOGAF), Zachman, and the Department of Defense Architecture Framework (DODAF). The evaluation uses several criteria, including governance overhead, maintenance, long-term sustainability, tooling, and technology adoption. The paper includes an expanded domain-specific case mapping, an implementation roadmap, recommended patterns and technologies, detailed KPIs, a risk and mitigation matrix, and a training and capability-building plan. The findings suggest a lightweight pragmatic architecture for logistics MSMEs, capability-driven and iterative, drawing on concepts from heavyweight frameworks while keeping artifacts minimal, delivery-focused, and faster results.

Keywords **- Enterprise Architecture, MSMEs, Logistics, TOGAF, Zachman, DODAF, Lightweight Architecture, Governance**

I. INTRODUCTION

Enterprise Architecture (EA) serves as a strategic discipline that bridges the gap between business goals and information technology. It provides organizations with a structured approach to ensure that every technology investment supports long-term business objectives. By aligning business strategy with IT, EA enables consistent decision-making, minimizes redundancy, and lays a foundation for scalable, adaptive operations.

For logistics-based Micro, Small, and Medium Enterprises (MSMEs) engaged in warehousing, freight forwarding, last-mile delivery, or third-party logistics, EA holds the potential to transform efficiency and competitiveness. When effectively implemented, it enables consistent data models across multiple partners, ensures reliable integration with carriers and e-commerce marketplaces, and promotes standardized operational processes. These improvements translate into measurable gains in service quality, throughput, and accuracy, all of which are vital in an industry driven by real-time performance and customer satisfaction.

Despite these advantages, most existing EA frameworks, such as TOGAF, Zachman, or DODAF, were designed with large enterprises in mind. They assume the presence of specialized enterprise architects, governance boards, and dedicated transformation programs, resources that MSMEs often lack. As a result, smaller firms frequently perceive EA as overly complex or resource-intensive, leading them to operate with fragmented systems, brittle integrations, and increasing technical debt.

This paper aims to bridge that gap by conducting a detailed, comparative evaluation of major EA frameworks in relation to the operational realities of MSMEs. It proposes a lightweight, practical approach to enterprise architecture that retains essential principles such as standardization, scalability, and governance while simplifying adoption and maintenance. By aligning architectural discipline with the agility and constraints of MSMEs, this study seeks to make EA not only accessible but also an enabler of sustainable growth and digital resilience within the logistics sector.

II. METHODOLOGY

The analysis uses a mixed-method approach:

- Literature and standards review: TOGAF, Zachman, and DODAF.
- Domain mapping: typical logistics MSME processes (order, pick, pack, ship, deliver, return).

- Evaluation against domain-relevant criteria: cost, skills, time-to-value, operational fit, governance overhead, and scalability.
- Practical artifact design: minimal viable architecture (MVA) artifacts suited to the MSME.

III. Background and Related Work

Andry J. (2022) applies The Open Group Architecture Framework (TOGAF) in his study to develop an enterprise architecture model for Logistic Courier Services (LCS) Indonesia. The research aims to enhance key factors, such as efficiency, by integrating business processes and strengthening organizational performance through a standardized architectural approach guided by TOGAF. The study identifies existing system gaps and proposes a comprehensive blueprint to support sustainable improvement, helping minimize errors and improve service reliability. The implementation of the proposed enterprise architecture is expected to optimize system performance, support digital integration, and improve user satisfaction in Indonesia's evolving logistics sector.

Indra Ranggadara (2021) used the Zachman Framework to design logistics management for information systems, focusing on a part of shipping service companies. Still, the insights align with the design strategies in the taxonomy of architectural artifacts (What, How, Where, Who, When, Why) across stakeholder perspectives. This framework is conceptual and classification-focused; it requires a complementary process.

Dandashi F. (2003) explains the role and use of DoDAF as a framework for system integration efforts within the U.S. defense architecture domain, emphasizing its purpose of enabling descriptions across organizational and technical perspectives. It also explains some challenges in tailoring it further for specific use cases, such as service-oriented needs, ensuring product traceability to operational capabilities, and integrating architecture descriptions with system engineering processes. Dandashi's work is relevant to this study because it provides a structured implementation framework and explains structural governance.

IV. Logistics MSME Domain Mapping

As the study focuses on limited companies, it is vital to understand the core characteristics of the domain and the constraints these frameworks impose to evaluate and compare them theoretically.

The Operational priorities include the real-time tracking of parcel status, driver, or vehicle locations. Most MSMEs currently track via GPS when available or rely on driver updates through whatever medium the company adopted. For mid-level companies, inventory accuracy remains a bigger challenge across multiple sites, as most work in the last mile; there are constraints on integration with carriers, marketplaces, and customer portals. In the same vein, dealing with multiple third-party carriers would be essential, as would the billing and reconciliation process. And one common thing for every logistics company, regardless of size, is compliance and traceability in delivery proofs and regulatory reporting.

The Typical constraints of MSMEs start with technical adoption; they mostly cannot afford large IT teams and rely on third-party SaaS platforms, outsourced providers, or small IT teams. They usually hold limited budgets for expensive tooling and long consulting engagements. For investing companies, expect rapid time-to-value to justify their investment costs through savings or other benefits. While engaging different partner leads creates a heterogeneous ecosystem with varying technical maturity (partners may use EDI, APIs, spreadsheets, or manual vouchers, depending on their comfort zone).

Figure 1. Researcher-developed diagram illustrating evaluation criteria vs the domain needs of MSMEs

The enterprise architecture impact, as shown in Figure 1, must be direct, considering the organization's constraints and operational readiness, regardless of its size or operations. The EA should also cover the risk management support, basically the sound of the framework, in helping to identify, document, and mitigate the risks in early stages, and be open to expanding along with the organizational growth.

V. FRAMEWORK ANALYSIS

Framework	Strengths	Weaknesses for MSMEs	Operational Fit for Logistics	Practical Tailoring / Principles
TOGAF	• Comprehensive ADM provides a phased lifecycle for building and maintaining EA. • Strong governance and standardization capabilities. • Large community with extensive tooling and training options.	• High initial and ongoing investment in training and tooling. • ADM phases can be heavy; full adoption is often excessive for MSMEs. • Requires skilled architects to interpret and customize.	• Useful for multi-year platform modernization (e.g., Integrating carriers and warehouse systems). • Less applicable for incremental, small-team improvements.	• Apply selected ADM phases (Preliminary, Architecture Vision, Implementation Governance). • Focus on value-driving artifacts (capability map, roadmap, value streams) while skipping exhaustive deliverables.
Zachman Framework	• Provides comprehensive coverage through a matrix of perspectives. • Lightweight with no mandated lifecycle or methodology.	• Does not prescribe artifact creation but requires coupling with delivery processes (e.g., Agile, Scrum). • Can appear overly theoretical for fast-paced operational issues.	• Serves as an architectural completeness checklist ensuring consideration of Data (What), Process (How), Location (Where), People (Who), Time (When), and Motivation (Why).	• Use for gap analysis to identify missing views or artifacts and convert findings into actionable backlog items.
DODAF	• Provides structured viewpoints (operational, systems, services, capability) that promote traceability between mission objectives and system design. • Encourages consistency and integration across multiple domains and stakeholders.	• Complex documentation standards; requires significant modeling effort. • Heavy framework not naturally suited for MSME agility or small-scale operations.	• Useful for logistics MSMEs dealing with defense contracts, multi-stakeholder projects, or integration with government logistics systems.	• Simplify by adopting key DODAF viewpoints (Operational and Systems) to model core logistics processes and dependencies while omitting extensive compliance documentation.

Table 1. Researcher-developed table illustrating the consideration areas of different EA frameworks

IV. Comparative Summary

When MSMEs want to consider adopting enterprise architecture (EA) practices, the choice of framework can dramatically influence success. Each framework brings its own strengths, suited to different organizational contexts and maturity levels.

Comparing the major frameworks, TOGAF seems to be best suited for organizations which has strong and formal governance, can be adopted for those who look for rapid growth and communication with multiple stakeholders. The Architecture Development Method (ADM) is a structured process and lifecycle managed step by step but can be considered heavy for smaller companies that lack resources.

On the other hand, Zachman works best as a classification tool. It provides a checklist-based process that is structured and ensures all the necessary architectural aspects are being covered. But it cannot be considered as a full fledge delivery method and cannot guide implementation on its own.

DODAF is effective for modeling complex system interactions and dependencies by defining operational, system, and technical views, though it may seem over-engineered for small organizations. This framework is considered to some extent when companies bid for defense contracts, as it may be seen as a prerequisite. The Federal Enterprise Architecture Framework (FEAF) also shares

this view, as it aligns with MSMEs working with government agencies, where alignment to public-sector standards is often treated as mandatory.

VI. RESULTS AND DISCUSSION

Case Example: Regional Logistics MSME

As a hypothetical study, consider a regional logistics provider with about 120 employees, 4 warehouses, and 200–500 daily deliveries, and a small IT team of 3 developers and a product manager who supports several business users.

The key systems should include a warehouse management system (WMS), a third-party carrier portal, an accounting platform, and a driver mobile app. With this kind of system, the primary operational pain points are manual invoice reconciliation, which can lead to billing errors. Poor real-time visibility creates bottlenecks for customer services, Peak season scalability constraints, and onboarding multiple shipment identifiers across different partners.

To address these challenges, the company can implement a Minimal Viable Architecture (MVA), a pragmatic approach that delivers measurable benefits more quickly than major frameworks. Simple artifact mapping would involve creating capabilities such as Order Management, Inventory Control, Fulfillment, Transportation, Billing & Reconciliation, Customer Portal, and Reporting, with integration patterns including API gateways for internal APIs, Simplified cloud hosting, lightweight ETL for partner data, and a fallback mechanism for carrier updates.

As a practical implementation step, capability mapping and KPI baselines should be derived, followed by data modeling and integration, and finally by monitoring and iterative studies. Tools can be defined basically by the expertise of the team and cost-based free sources, with security considerations.

Key success of the implementations is measured by on-time delivery rate, minimal exceptions, accurate inventory management, average time to customer issue resolution, and reduced billing reconciliation errors, which eventually leads to reduced cost per delivery, reduced revenue leakage due to billing errors, and improved Customer Satisfaction Score (CSAT).

The governance system of the organization plays a key role in the stabilized framework, it is prescribed to have a small architecture review board with 2-3 key stakeholders to take care of the approval of any changes, meet periodically to define policies based on feedback, manage the decision records as logs, and train the team with mentorship and consulting.

Description	Alignment	Foundation	Integration	Stabilization & Governance	Maturation (Optional)
Timeline	2-4 weeks	1-2 months	3-4 months	Ongoing	Conditional
Desired Process	Capability mapping, Backlog refinement	Canonical data model, Monitoring setup, Integration planning	Carrier integrations with API gateways, driver tracking, and dashboards	Architecture review cadence, logs and registers, define scalability planning	Introduce formal TOGAF elements and move to matured framework implementation

Table 2. Researcher-developed table illustrating the implementation plan

As a result, a pragmatic, capability-driven EA tailored to MSMEs in logistics enables rapid operational improvements while maintaining a path toward greater architectural maturity as the organization grows. Heavy frameworks provide valuable concepts like governance, formal artifacts, and modeling languages, but must be used selectively. Zachman helps ensure coverage; TOGAF provides lifecycle guidance for larger transformations; ArchiMate gives consistent modeling notation. The lightweight approach embraces the best of these worlds: borrow concepts, keep artifacts minimal, automate, and measure.

Table 2 provides a high-level implementation plan for MSMEs to consider for their business. Lightweight and Applied Approaches Recent applied research advocates minimal viable architecture artifacts, prioritized capability maps, and iterative governance to enable constrained organizations to gain the benefits of EA without prohibitive overhead. These approaches emphasize outcomes (reduced delivery failures, improved traceability, API-first integration) rather than exhaustive documentation.

VII. CONCLUSION

Based on the factors considered, Logistics MSMEs require a pragmatic, minimum-viable architecture that balances operational impact and resource investment. Considering the growth factor in medium-level companies, following a basic technical adoption, TOGAF should be utilized with minimal layers, including a miniature ARB board, strong KPIs, Strong governance, and basic capabilities in the Data and Technology phases. The recommended path is iterative: start with capability and value stream mapping

and maintain lightweight governance using ADRs under the review board, reserve heavy framework adoption for when organizational scale and complexity justify its overhead.

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