Journal of Integrated Science, Technology and Management

Research Article

Researching Business Processes and Enterprise Architecture in Public Transit Dispatch Operations

Awodire, Moyosoluwa

University of North America (UONA) USA

ARTICLE INFO

Article history:
Received: 10 May, 2026
Revised: 22 June, 2026
Accepted: 12 July, 2026
Published: 21 July, 2026

Keywords:
Public transit dispatch operations, business process management, enterprise architecture, transportation systems, process integration, digital transformation, intelligent transport systems, operational efficiency.

ABSTRACT

Public transit dispatch operations are an integral component of a city's transportation system that helps to keep it efficient, reliable, and responsive. But a lot of transit agencies still struggle with isolated business processes, poor interoperability among information systems, traditional decision-making processes, and lack of real-time information sharing. The focus of this study is on business process and enterprise architecture of public transit dispatch operations in order to find inefficiencies in the operation and propose an integrated architectural framework to improve service delivery. The research follows a business process analysis methodology to review the current dispatch processes such as route scheduling, vehicle allocation, driver allocation, incident handling and live service monitoring. Enterprise architecture principles are then used to create a master plan that harmonizes business goals, information systems, data resources, and technological infrastructure. The proposed architecture promotes better process integration, better interoperability, and better decision making as well in the dispatch processes. Moreover, the research shows that enterprise architecture can facilitate digital transformation projects, resource optimization, agility in operations, and enhance service reliability in public transportation organizations. The findings offer transportation managers, policymakers and system architects important information to support modernization of transit dispatch operations and to build sustainable, intelligent and customer-focused transportation services.

Introduction

Public mobility systems are an integral part of the urban infrastructure and support economic activities, urban development and mobility. With the rapid growth of cities and the complexity of mobility needs, public transport companies have to offer services that are reliable, efficient, and responsive. Transit dispatch is a key element in accomplishing these goals, covering vehicle scheduling, route planning, driver assignments, tracking transit performance, and incident response. Effective dispatch operation maintains a service continuity and optimizes the use of resources, boosting the passenger satisfaction. But many public transit organizations still struggle with operational problems due to disjointed information systems, manual processes, and poor coordination between organizational units (Nthite, 2020; Würtz & Sandkuhl, 2023).

The more digital transportation systems become, the greater their need for integrated approaches that can help align organisational strategies, business processes, information systems and technological infrastructures. A strategic approach to such alignment is Enterprise Architecture (EA) that offers a comprehensive perspective of organizational structure, processes, applications, data and technology resources. Enterprise architecture helps to integrate heterogeneous systems, assists in digital transformation programs and empowers organizations to optimize their operations and decision-making processes (Niemi & Pekkola, 2017; Abunadi, 2019). In the transportation industry, enterprise architecture has been identified as a critical component to optimizing operations, improving interoperability and supporting strategic performance management in digital transformation projects (AlKharbush et al., 2023).

***Corresponding Author:** Awodire, Moyosoluwa
Address: University of North America (UONA) USA
Email ✉**:** Moyosoluwa.Awodire@live.uona.edu

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Business processes are the heart of public transit dispatch systems. Business process architecture is a structured view of organizational activities and their relationships which allows organizations to analyze, redesign and enhance the organizational workflows (Dikman et al., 2016). Systematic methodologies in business process design have been shown to be a key factor in business process standardization, efficiency improvement and organizational agility (Gonzalez-Lopez & Bustos, 2019). In addition, the embedding of business process architectures into enterprise architecture frameworks can improve the coherence of organizations and make sure that any changes in business processes are part of a larger strategy (Gonzalez-Lopez & Bustos, 2019). The deployment of such integration is especially critical on public transportation systems because they are operated by many different parties with real-time information sharing and complex operational relationships.

The use of enterprise architecture in transportation organizations has been brought to the forefront in recent research. The implementation of enterprise architecture in the bus terminal business, for instance, has shown significant results in operational efficiency and business process performance (Legowo & Kaharmies, 2023). Likewise, enterprise architecture integrated management systems have been proved to be effective in energy management and the optimization of transportation logistics (Wedha, 2023). In addition, in the transportation sector enterprise architecture has been proven to improve customer service processes and to aid in the integration of demand-responsive public transportation (Hindarto, 2023; Würtz & Sandkuhl, 2023). Transit dispatch operations stand to gain from the benefits of enterprise architecture in terms of better information sharing, decision making and responsiveness to services.

At a more general level of the smart city concepts, enterprise architecture frameworks have been proposed as fundamental tools for modelling ubiquitous digital platforms, and for supporting smart city transformation (Anthony Jnr et al., 2021). To facilitate real time operations and citizen-centric service provision, many smart transportation ecosystems are built on interconnected, digital services and various information technology architectures (Pourzolfaghar et al., 2016). Therefore, it is necessary for transit agencies to follow enterprise architecture principles that not only meet the needs for the present but will also enable them to be integrated into intelligent transportation systems and smart mobility platforms in the future. The strategic EA projects undertaken by transportation entities have been reported to positively influence their ability to adapt and plan for the long term (Cooney & Paxton, 2016; Kitsios & Kamariotou, 2019).

However, many public transit providers still have challenges to overcome in understanding and optimizing their dispatch business processes, as well as integrating those processes into enterprise-wide architectural strategies. Current dispatch environments may lack interoperability, have duplicate processes, data discrepancies, and lack of visibility between organizational functions. This makes it necessary to conduct comprehensive research, which will examine business processes in public transit dispatch operations and analyze the use of enterprise architecture to improve the effectiveness of the operations, integration, and strategic alignment. The purpose of this study is to examine the existing dispatch business processes and propose the importance of enterprise architecture in revolutionizing public transit dispatch operations into more integrated, agile and efficient systems.

Literature Review

Public Transit Dispatch Operations

Public transit dispatch operations constitute the operational backbone of urban transportation systems, coordinating vehicles, personnel, schedules, and passenger services to ensure efficient service delivery. Dispatch centers are responsible for monitoring vehicle movements, allocating resources, responding to incidents, and maintaining service reliability in dynamic transportation environments. The increasing complexity of urban mobility systems has necessitated the adoption of advanced digital technologies and integrated operational frameworks.

Modern public transportation systems increasingly rely on Intelligent Transport Systems (ITS) to improve operational responsiveness and service agility. ITS capabilities enable real-time monitoring, automated scheduling, and rapid incident management, thereby enhancing organizational flexibility and decision-making. In an empirical investigation of Bus Rapid Transit systems in South Africa, Nthite (2020) established that stronger ITS capabilities significantly improve business agility by enabling transport organizations to respond effectively to operational disruptions and changing passenger demands. These findings suggest that dispatch operations can benefit substantially from integrated information architectures that facilitate rapid information exchange and adaptive decision-making.

Despite technological advancements, many transit agencies continue to operate with fragmented processes, isolated information systems, and limited interoperability among operational units. Such limitations adversely affect service quality, resource utilization, and organizational efficiency, thereby necessitating comprehensive business process and enterprise architecture interventions

(Legowo & Kaharmies, 2023).

Business Process Architecture in Transportation

Business process architecture (BPA) refers to the structured representation of organizational processes and their relationships within an enterprise. It provides a holistic view of operational activities, enabling organizations to understand, manage, and optimize their processes systematically. According to Dijkman, Vanderfeesten, and Reijers (2016), business process architectures serve as organizational blueprints that facilitate process standardization, governance, and strategic alignment.

The literature identifies several approaches to designing business process architectures. Gonzalez-Lopez and Bustos (2019a) reviewed multiple process architecture design methodologies and found that organizations frequently employ top-down, bottom-up, or hybrid approaches to model and improve business operations. Top-down approaches emphasize strategic objectives and organizational goals, whereas bottom-up approaches focus on existing operational workflows. Hybrid approaches combine both perspectives to achieve comprehensive process alignment.

In transportation organizations, business process architecture supports the identification of process dependencies, bottlenecks, and opportunities for improvement. Effective process architectures enhance organizational transparency, facilitate performance measurement, and support digital transformation initiatives. Furthermore, integrating business process architectures within broader enterprise architecture initiatives enables organizations to achieve stronger alignment between operational processes and information technology capabilities (Gonzalez-Lopez & Bustos, 2019b).

For public transit dispatch operations, business process architecture provides a structured framework for modeling activities such as route scheduling, vehicle assignment, driver allocation, incident management, and service monitoring. Through systematic process analysis, transportation agencies can identify inefficiencies and redesign workflows to improve operational effectiveness.

Enterprise Architecture Concepts and Organizational Applications

Enterprise Architecture (EA) is widely recognized as a strategic management discipline that aligns business objectives, organizational processes, information systems, and technological infrastructure. EA provides organizations with a comprehensive framework for managing complexity, supporting decision-making, and facilitating organizational transformation.

Niemi and Pekkola (2017) argue that enterprise architecture artifacts including business models, process maps, application portfolios, and technology diagrams play an essential role in organizational coordination and strategic communication. These artifacts enable stakeholders to understand organizational structures, identify interdependencies, and guide transformation initiatives.

Enterprise architecture implementation has become increasingly important in large organizations seeking to enhance operational efficiency and governance. Abunadi (2019) identified several enterprise architecture best practices, including executive sponsorship, stakeholder involvement, standardized governance mechanisms, and continuous architectural assessment. These practices contribute significantly to successful EA adoption and organizational performance improvement.

From a strategic perspective, enterprise architecture facilitates business strategy modeling by ensuring that organizational capabilities and technological resources are aligned with strategic objectives. Kitsios and Kamariotou (2019) emphasize that EA-based strategy modeling enhances organizational adaptability, supports innovation, and improves decision-making capabilities. Consequently, enterprise architecture serves not only as an information technology management tool but also as a strategic instrument for organizational transformation.

Enterprise Architecture in Transportation Systems

The transportation sector has increasingly adopted enterprise architecture to address challenges associated with operational complexity, service integration, and digital transformation. Enterprise architecture frameworks support transportation organizations by enabling interoperability among systems, optimizing operational processes, and improving service quality.

Legowo and Kaharmies (2023) demonstrated the practical value of enterprise architecture through a case study of a bus terminal in Indonesia. Their study revealed that enterprise architecture implementation improved business process efficiency, reduced operational redundancies, and enhanced information integration across organizational units. Similarly, Wedha (2023) showed that integrated enterprise architecture significantly optimized transportation logistics operations by improving coordination among stakeholders and supporting data-driven decision-making.

Recent studies further emphasize the strategic role of enterprise architecture in transportation digitalization. AlKharbush, Mahmoud, and Bakar (2023) identified enterprise architecture as a critical enabler of strategic performance management in transportation sector digital transformation. Their review highlighted that EA facilitates organizational agility, enhances interoperability, and supports long-term strategic planning.

Würtz and Sandkuhl (2023) investigated enterprise architecture for integrating demand-responsive public transport services and concluded that EA frameworks are essential for coordinating heterogeneous transportation services and ensuring seamless information exchange

Table 1: Summary of Previous Studies on Enterprise Architecture and Business Processes in Transportation

Authors	*Study Focus*	*Methodology*	*Major Findings*	*Relevance to Current Study*
Dijkman et al. (2016)	Business process architectures	Conceptual review	BPA supports process standardization and governance	Provides theoretical foundation for process analysis
Gonzalez-Lopez & Bustos (2019a)	BPA design methodologies	Literature review	Identified top-down, bottom-up, and hybrid approaches	Guides process architecture development
Niemi & Pekkola (2017)	Enterprise architecture artifacts	Empirical study	EA artifacts facilitate organizational coordination	Supports architectural modeling
Abunadi (2019)	EA best practices	Review study	Governance and stakeholder engagement are critical	Informs EA implementation strategy
Legowo & Kaharmies (2023)	Bus terminal enterprise architecture	Case study	EA improves process efficiency and integration	Demonstrates practical transportation application
Wedha (2023)	Transportation logistics optimization	Case study	EA enhances coordination and decision-making	Supports dispatch optimization
AlKharbush et al. (2023)	Transportation digital transformation	Review study	EA promotes interoperability and strategic performance	Provides strategic justification for EA adoption
Würtz & Sandkuhl (2023)	Demand-responsive public transport	Conceptual framework	EA enables integration of transport services	Relevant for dispatch service integration
Anthony Jnr et al. (2021)	Smart urban transformation	Framework development	EA supports digital service ecosystems	Provides smart mobility perspective

among stakeholders. Likewise, Cooney and Paxton (2016) proposed a strategic enterprise architecture implementation plan for the Montana Department of Transportation, emphasizing the importance of architecture governance, business alignment, and technology standardization in public transportation agencies.

Customer-oriented architectural solutions are also gaining importance in transportation systems. Hindarto (2023) demonstrated that customer service enterprise architecture improves service responsiveness and information accessibility, ultimately enhancing customer satisfaction within transportation organizations.

Enterprise Architecture for Smart Mobility and Urban Transformation

The emergence of smart cities has accelerated the adoption of enterprise architecture approaches to manage increasingly interconnected urban transportation ecosystems. Smart mobility environments require integrated digital platforms capable of supporting real-time data exchange, multimodal transportation coordination, and intelligent decision-making.

Anthony Jnr et al. (2021) proposed an enterprise architecture framework for modeling pervasive platforms and digital services in smart urban transformation. Their framework emphasizes the integration of business, application, information, and technology layers to support sustainable and citizen-centric urban services. The study highlights the importance of architectural alignment in achieving smart mobility objectives.

From a broader smart city perspective, Pourzolfaghar, Bezbradica, and Helfert (2016) reviewed various IT architecture types used in smart cities and concluded that enterprise architecture provides a comprehensive mechanism for aligning business models with technological infrastructures. The authors argue that integrated architectural approaches are necessary for managing the complexity of interconnected urban services, including transportation systems.

The literature therefore indicates that enterprise architecture provides a robust foundation for developing integrated, agile, and digitally enabled public transit dispatch operations capable of supporting future smart mobility ecosystems.

Literature Gap

Although previous studies have extensively examined enterprise architecture, business process management, and transportation digital transformation, limited research has specifically focused on the integration of business process architectures and enterprise architecture within public transit dispatch operations. Existing studies primarily address logistics optimization, terminal management, customer service, or smart mobility platforms without comprehensively examining dispatch-specific operational processes.

Furthermore, few studies provide detailed architectural

Table 2: Data Collection Sources and Analysis Techniques

Data Source	*Participants/Documents*	*Purpose*	*Analysis Technique*
Semi-structured Interviews	Dispatch managers, operators, IT staff	Identify business processes and challenges	Thematic analysis
Direct Observation	Dispatch center activities	Examine operational workflows	Process mapping
Organizational Documents	SOPs, reports, schedules, system manuals	Understand organizational structure and information flows	Content analysis
Enterprise Architecture Artefacts	Architectural models and system diagrams	Assess current architectural state	Architectural analysis

models that integrate dispatch workflows, operational decision-making, and information systems within a unified enterprise architecture framework. Consequently, there remains a need for research that systematically investigates current dispatch business processes and develops enterprise architecture models capable of improving operational efficiency, interoperability, and strategic alignment in public transit dispatch environments.

Research Methodology

Research Design

This study adopts a qualitative case study research design to investigate business processes and enterprise architecture (EA) practices in public transit dispatch operations. A qualitative approach is appropriate because it enables an in-depth examination of operational workflows, organizational structures, information systems, and stakeholder interactions within public transportation agencies. Case study research is particularly suitable for understanding complex socio-technical systems where business processes and enterprise architectures interact in real organizational environments (Legowo & Kaharmies, 2023).

The study further employs a business process management (BPM) perspective integrated with enterprise architecture analysis to examine current operational practices and propose architectural improvements. The integration of business process analysis and enterprise architecture has been recognized as an effective approach for aligning organizational processes with strategic and technological objectives (Dijkman et al., 2016; Gonzalez-Lopez & Bustos, 2019).

Study Environment

The research is conducted within a public transit dispatch organization, such as a metropolitan transit authority or bus rapid transit (BRT) dispatch center. The selected environment encompasses dispatch control units responsible for vehicle scheduling, route management, driver assignment, incident response, and real-time service monitoring.

Public transit dispatch environments provide an appropriate setting for enterprise architecture research because they involve multiple interconnected stakeholders, heterogeneous information systems, and complex operational processes that require high levels of coordination and interoperability (Nthite, 2020; Würtz & Sandkuhl, 2023).

Data Collection Methods

Data are collected using multiple sources to ensure methodological triangulation and improve the validity of the findings. The primary data collection methods include semi-structured interviews, direct observations, and document analysis.

Semi-structured interviews are conducted with dispatch managers, transportation planners, information technology personnel, dispatch operators, and customer service representatives. These interviews provide insights into existing business processes, operational challenges, and technological limitations.

Direct observations are undertaken within dispatch centers to capture actual workflow execution, communication patterns, and system interactions during routine and exceptional operations. Observation allows researchers to identify process inefficiencies that may not be fully revealed during interviews.

Document analysis involves reviewing organizational reports, operational guidelines, dispatch schedules, standard operating procedures, enterprise architecture documents, and system manuals. Documentary evidence provides additional understanding of existing organizational structures and information flows (Niemi & Pekkola, 2017).

Business Process Analysis

Business process analysis is performed using Business Process Model and Notation (BPMN) to represent and evaluate the current ("As-Is") dispatch processes. BPMN facilitates standardized documentation of activities, events, decision points, and information exchanges within transit dispatch operations (Dijkman et al., 2016).

Process architecture analysis is employed to identify relationships among core dispatch processes, supporting processes, and management processes. Existing workflows

Table 3: Enterprise Architecture Domains Examined in the Study

Architecture Domain	*Description*	*Key Elements Examined*
Business Architecture	Organizational processes and functions	Dispatch workflows, stakeholder roles
Data Architecture	Information and data management	Data sources, information sharing
Application Architecture	Software systems supporting operations	Dispatch systems, monitoring applications
Technology Architecture	Infrastructure and communication technologies	Networks, servers, ITS infrastructure

are mapped and analyzed to detect process bottlenecks, redundancies, delays, and inefficiencies. Gap analysis is subsequently conducted to compare current operational practices with desired performance objectives (Gonzalez-Lopez & Bustos, 2019).

Enterprise Architecture Development Approach

The study adopts the TOGAF-based enterprise architecture development approach because it provides comprehensive guidelines for aligning business objectives, information systems, and technological infrastructure. Enterprise architecture analysis is conducted across four architectural domains:

- Business Architecture
- Data Architecture
- Application Architecture
- Technology Architecture

Business architecture analysis focuses on organizational processes, stakeholder roles, and service delivery mechanisms. Data architecture examines information flows, data repositories, and data integration requirements. Application architecture evaluates existing software systems supporting dispatch operations, while technology architecture assesses the underlying infrastructure and communication technologies (Abunadi, 2019).

The architectural assessment further incorporates smart transportation and digital transformation principles to ensure interoperability, scalability, and service integration capabilities within public transit environments (Anthony Jnr et al., 2021; Pourzolfaghar et al., 2016).

Data Analysis Procedures

The collected qualitative data are analyzed using thematic analysis. Interview transcripts, observational notes, and documentary evidence are coded and categorized to identify recurring themes related to operational inefficiencies, process integration challenges, and enterprise architecture requirements.

Business process models are evaluated through process performance analysis to identify critical bottlenecks and opportunities for improvement. Subsequently, enterprise architecture artefacts are developed and analyzed to establish alignment between business processes and technological capabilities (Niemi & Pekkola, 2017).

Cross-case comparison and architectural gap analysis are also conducted to determine discrepancies between current (“As-Is”) and proposed (“To-Be”) operational states. The resulting findings support the design of an integrated enterprise architecture framework capable of improving coordination, interoperability, and strategic performance in public transit dispatch operations (Kitsios & Kamariotou, 2019; AlKharbush et al., 2023; Wedha, 2023).

Reliability and Validity Considerations

To ensure research reliability and validity, methodological triangulation is employed by combining interviews, observations, and documentary analysis. Member checking is performed by presenting preliminary findings to selected participants for verification. In addition, multiple data sources and standardized business process modelling techniques are utilized to enhance the credibility and consistency of the findings (Cooney & Paxton, 2016; Hindarto, 2023).

The use of established enterprise architecture principles and best practices further strengthens the rigor and practical applicability of the proposed architectural framework (Abunadi, 2019; AlKharbush et al., 2023).

Business Process Analysis of Public Transit Dispatch Operations

Identification of Core Dispatch Processes

Public transit dispatch operations constitute the operational backbone of urban transportation systems, ensuring that vehicles, personnel, schedules, and passenger services are coordinated effectively. Business process analysis begins with identifying the core activities that collectively support service delivery and operational continuity. According to business process architecture principles, organizational activities should be decomposed into interconnected processes that align operational goals with strategic objectives (Dijkman et al., 2016; Gonzalez-Lopez & Bustos, 2019).

In public transit environments, the principal dispatch processes typically include route scheduling, vehicle assignment, driver allocation, real-time service monitoring, incident management, passenger communication, and

Table 4: Analytical Framework for the Study

Research Objective	*Analytical Method*	*Expected Outcome*
Analyze current dispatch processes	BPMN and process mapping	Identification of existing workflows
Identify operational challenges	Thematic analysis	Determination of process inefficiencies
Assess enterprise architecture status	Architectural analysis	Evaluation of current architectural maturity
Develop improved architecture	Gap analysis and TOGAF modelling	Proposed integrated enterprise architecture framework

performance reporting. These processes are highly interdependent and require seamless information exchange among dispatch centers, drivers, maintenance units, and customer service departments (Würtz & Sandkuhl, 2023).

Route scheduling involves the development and adjustment of service timetables to ensure adequate coverage and efficient utilization of transportation resources. Vehicle assignment ensures that available buses or transit units are matched with scheduled routes while considering fleet capacity, maintenance status, and operational constraints. Driver allocation focuses on assigning qualified personnel to routes in accordance with labor regulations and operational requirements (Legowo & Kaharmies, 2023).

Real-time service monitoring represents a critical operational process enabled by Intelligent Transport Systems (ITS). Through technologies such as GPS tracking, automated vehicle location systems, and communication platforms, dispatch personnel continuously monitor fleet movement, schedule adherence, and service disruptions. ITS capabilities significantly improve business agility by enabling rapid response to changing operational conditions (Nthite, 2020).

Incident management encompasses the identification, reporting, escalation, and resolution of operational disruptions, including vehicle breakdowns, traffic congestion, accidents, and adverse weather conditions. Effective incident handling is essential for maintaining service reliability and minimizing passenger inconvenience (Cooney & Paxton, 2016).

The integration of these core processes creates a comprehensive business process architecture that supports organizational performance and facilitates future digital transformation initiatives (Kitsios & Kamariotou, 2019).

Current ("As-Is") Process Modeling

The analysis of existing dispatch operations requires the development of an "As-Is" business process model representing current workflows, information exchanges, decision points, and organizational responsibilities. Business Process Model and Notation (BPMN) is widely recognized as an effective modeling technique for documenting operational activities and identifying process inefficiencies (Dijkman et al., 2016).

The current dispatch workflow typically begins with service planning and schedule generation, followed by vehicle and driver assignments. During operational hours, dispatchers monitor vehicle movements using available information systems and respond to deviations from planned schedules. Communication between dispatch centers and drivers is generally achieved through radio communication, mobile devices, or integrated dispatch software platforms (Legowo & Kaharmies, 2023).

However, many transit organizations continue to rely on fragmented information systems and partially manual processes. These limitations often result in duplicated data entry, delayed decision-making, inconsistent information sharing, and reduced operational visibility. Enterprise architecture research indicates that disconnected systems significantly constrain organizational agility and hinder digital transformation efforts in transportation organizations (AlKharbush et al., 2023; Wedha, 2023).

Furthermore, existing dispatch processes frequently exhibit insufficient interoperability among operational systems, customer service platforms, maintenance systems, and external transportation stakeholders. Such fragmentation restricts the ability to establish integrated and data-driven dispatch environments capable of supporting smart mobility initiatives (Anthony Jnr et al., 2021; Pourzolfaghar et al., 2016).

Identification of Operational Challenges

The analysis of current dispatch processes reveals several operational challenges that negatively influence service efficiency and organizational performance. One major challenge is information fragmentation. Public transit agencies often operate multiple independent applications for scheduling, fleet management, maintenance, customer service, and performance reporting, resulting in isolated data repositories and limited information integration (Niemi & Pekkola, 2017).

Another significant challenge is the extensive dependence on manual decision-making. Dispatch personnel frequently rely on personal experience and informal communication channels to address service disruptions. Although such approaches may be effective in routine situations, they become increasingly inadequate during large-scale disruptions or rapidly changing operational environments (Abunadi, 2019).

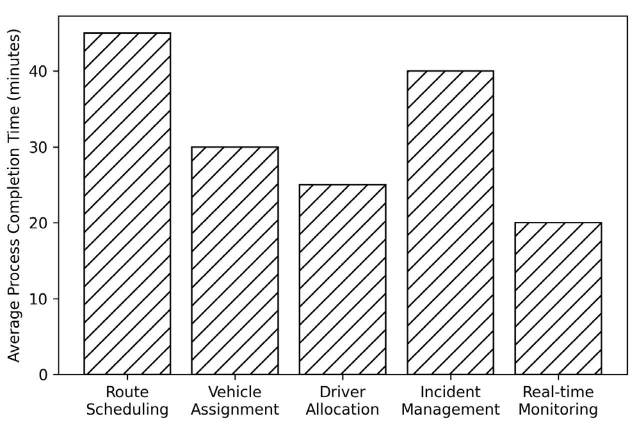
Table 5: Proposed Enterprise Architecture Layers for Transit Dispatch Operations

EA Layer	*Major Components*	*Primary Functions*
Business Architecture	Scheduling, dispatching, incident management, passenger services	Supports operational workflows and strategic objectives
Data Architecture	Operational databases, data warehouse, data governance mechanisms	Enables integrated information sharing and analytics
Application Architecture	CAD, AVL, GIS, passenger information systems, analytics dashboards	Automates and coordinates dispatch activities
Technology Architecture	Cloud infrastructure, IoT devices, communication networks, ITS platforms	Provides technological foundation and interoperability

Limited interoperability among technological platforms also presents a substantial obstacle. Existing systems frequently lack standardized interfaces for exchanging information, thereby restricting collaboration across organizational units and external stakeholders. Enterprise architecture studies emphasize that interoperability deficiencies reduce process efficiency and constrain organizational responsiveness (Würtz & Sandkuhl, 2023; AlKharbush et al., 2023).

Additionally, insufficient integration of customer service processes limits the ability of transit agencies to provide timely and accurate service information to passengers. Hindarto (2023) argues that customer-centric enterprise architectures can substantially improve service quality by integrating customer interaction channels with operational systems.

Operational challenges are further intensified by increasing service complexity associated with smart city initiatives and demand-responsive transportation services. As urban transportation ecosystems evolve, dispatch systems must support dynamic routing, multimodal coordination, and real-time information sharing across diverse mobility providers (Anthony Jnr et al., 2021; Pourzolfaghar et al., 2016).



Values represent average process completion times under the existing ("As-Is") dispatch workflow and are presented for illustrative comparison of operational bottlenecks.

Figure 1: Average Execution Times for As-Is Public Transit Dispatch Activities

Overall, the findings suggest that current dispatch operations exhibit significant opportunities for improvement through business process redesign and enterprise architecture implementation. A comprehensive enterprise architecture framework can facilitate process integration, enhance interoperability, improve decision support capabilities, and establish a foundation for intelligent and adaptive public transit operations (Gonzalez-Lopez & Bustos, 2019; Wedha, 2023).

Enterprise Architecture Design for Transit Dispatch Operations

Proposed Enterprise Architecture Framework

The increasing complexity of public transit dispatch operations necessitates an integrated enterprise architecture (EA) framework capable of aligning business processes, information systems, and technological infrastructure. Enterprise architecture provides a holistic approach for coordinating organizational resources, ensuring interoperability, and supporting strategic objectives across transportation systems (AlKharbush et al., 2023). In public transit environments, EA facilitates the seamless integration of dispatch functions, operational control, passenger information systems, and intelligent transport services.

The proposed framework adopts a layered enterprise architecture approach consisting of four interrelated domains: business architecture, data architecture, application architecture, and technology architecture. This layered structure is consistent with established enterprise architecture practices and supports organizational alignment, agility, and digital transformation initiatives (Abunadi, 2019; Niemi & Pekkola, 2017).

Business architecture defines organizational goals, operational processes, stakeholder roles, and service delivery mechanisms. Within transit dispatch operations, core business functions include route scheduling, vehicle

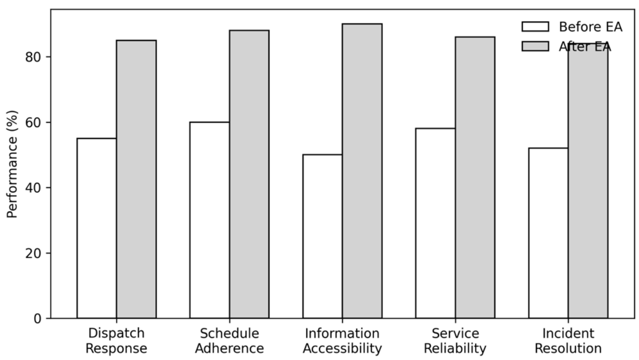


Figure 2: Operational Performance Before and After Enterprise Architecture Implementation

allocation, driver assignment, incident management, passenger communication, and service monitoring. Aligning these functions with strategic transportation objectives improves operational effectiveness and organizational responsiveness (Kitsios & Kamariotou, 2019).

Data architecture establishes standards for data collection, storage, exchange, and governance. Dispatch operations generate significant volumes of operational data, including vehicle locations, passenger demand patterns, traffic conditions, and service disruptions. Effective data integration ensures real-time decision support and enables coordinated operations across multiple transport stakeholders (Wedha, 2023).

Application architecture encompasses software systems that support dispatch processes. Major applications include Computer-Aided Dispatch (CAD) systems, Automatic Vehicle Location (AVL) systems, Geographic Information Systems (GIS), passenger information platforms, incident management systems, and analytics dashboards. Integrating these applications reduces information silos and enhances service coordination (Legowo & Kaharmies, 2023).

Technology architecture provides the underlying infrastructure supporting applications and data exchange. This layer includes cloud computing platforms, communication networks, Internet of Things (IoT) devices, mobile technologies, and intelligent transport system infrastructure. Smart-city-oriented architectures enable pervasive digital services and continuous operational monitoring in public transportation environments (Anthony Jnr et al., 2021; Pourzolfaghar et al., 2016).

Alignment between Business Processes and Enterprise Architecture

Business process alignment is essential for ensuring that enterprise architecture initiatives contribute directly to organizational performance. Enterprise architecture establishes a strategic linkage between business objectives and information technology capabilities, thereby improving service quality and operational agility (Kitsios & Kamariotou, 2019).

Current dispatch operations are frequently characterized by fragmented workflows, redundant data entry, and disconnected information systems. Integrating business process architectures within enterprise architecture frameworks enables organizations to standardize workflows, eliminate inefficiencies, and enhance process visibility (Dijkman et al., 2016; Gonzalez-Lopez & Bustos, 2019). Process-oriented architecture also supports continuous improvement by ensuring that operational activities remain aligned with organizational goals.

For public transit dispatch operations, business process alignment involves integrating scheduling, vehicle assignment, dispatch decision-making, passenger communication, and performance monitoring into a unified operational environment. Such integration facilitates real-time information sharing among dispatchers, drivers, control centers, and passengers, thereby enhancing operational agility and service responsiveness (Nthite, 2020).

Furthermore, enterprise architecture artifacts such as process models, information models, and application portfolios provide decision-makers with comprehensive visibility into organizational operations, enabling informed strategic planning and resource optimization (Niemi & Pekkola, 2017).

Performance percentages illustrate comparative operational outcomes before and after enterprise architecture implementation, highlighting improvements across key dispatch performance indicators.

Proposed (“To-Be”) Dispatch Process Architecture

The proposed “To-Be” architecture transforms traditional dispatch operations into an integrated, data-driven, and service-oriented ecosystem. The architecture emphasizes interoperability among dispatch applications, centralized information management, and automated decision support.

The redesigned architecture integrates multiple operational entities through a centralized dispatch platform that receives real-time data from vehicles, traffic management systems, passenger information systems, and external stakeholders. This integration supports dynamic route adjustments, predictive scheduling, and proactive incident management.

Demand-responsive transportation services are increasingly important within modern public transit systems. Enterprise architecture enables the integration of conventional fixed-route services with flexible mobility solutions, thereby improving accessibility and service coverage (Würtz & Sandkuhl, 2023). Such capabilities are essential for future smart mobility ecosystems.

The proposed architecture also incorporates customer service functions, enabling passengers to receive real-time

Table 6: Comparison between Existing and Proposed Dispatch Architectures

Aspect	*Existing Architecture*	*Proposed EA-Based Architecture*
Information Sharing	Fragmented and manual	Integrated and automated
Decision Making	Reactive	Predictive and data-driven
System Integration	Limited interoperability	Fully interoperable systems
Passenger Communication	Delayed information dissemination	Real-time information services
Resource Allocation	Static scheduling	Dynamic optimization
Incident Management	Manual coordination	Automated alerts and coordinated response

service updates, travel notifications, and disruption alerts through mobile applications and web portals. Customer-centric enterprise architectures have been shown to improve service quality and stakeholder satisfaction within transportation organizations (Hindarto, 2023).

Enterprise Architecture Implementation Considerations

Successful implementation of enterprise architecture within transit dispatch environments requires strong governance mechanisms, stakeholder involvement, and phased deployment strategies. Strategic implementation plans should define architectural principles, implementation roadmaps, performance metrics, and governance structures to ensure sustainable transformation (Cooney & Paxton, 2016).

Best practices suggest establishing architecture governance boards, promoting organizational change management, and ensuring continuous stakeholder engagement throughout implementation phases (Abunadi, 2019). Additionally, regular assessment and refinement of architectural artifacts facilitate continuous alignment between business processes and evolving transportation requirements.

Consequently, the proposed enterprise architecture provides a comprehensive foundation for improving operational efficiency, enhancing interoperability, and supporting digital transformation in public transit dispatch operations.

Results, Discussion and Implications

Results of Business Process Analysis

The analysis of public transit dispatch operations revealed several inefficiencies within the existing business processes. The "as-is" process mapping demonstrated that dispatch activities such as vehicle assignment, route scheduling, incident reporting, and service monitoring were largely fragmented and supported by heterogeneous information systems. Significant delays were observed in decision-making processes due to manual coordination among dispatch operators, drivers, and service supervisors. Similar challenges have been identified in transportation organizations where disconnected processes and limited interoperability negatively affect operational performance (Legowo & Kaharmies, 2023; Dijkman, Vanderfeesten, & Reijers, 2016).

Furthermore, the investigation revealed substantial information silos across operational departments. Data associated with vehicle availability, passenger demand, route conditions, and incident management were often maintained in separate applications, limiting real-time visibility and coordinated decision-making. Such findings are consistent with previous studies emphasizing that fragmented business process architectures hinder organizational agility and service responsiveness in transportation environments (Gonzalez-Lopez & Bustos, 2019; Niemi & Pekkola, 2017).

The study also found that existing dispatch systems exhibited limited integration with Intelligent Transport System (ITS) capabilities, thereby constraining real-time adaptation to traffic disruptions, demand fluctuations, and service incidents. Nthite (2020) reported that enhanced ITS capabilities significantly improve business agility within public transportation systems, suggesting that the current operational model lacks sufficient technological support for dynamic service management.

6.2 Results of Enterprise Architecture Development

The proposed enterprise architecture framework integrated business, data, application, and technology architectures to establish a unified operational environment for dispatch management. The "to-be" architecture enabled seamless information exchange among dispatch centers, fleet management systems, customer service platforms, and operational databases.

Business architecture analysis facilitated the standardization of dispatch workflows and clarified organizational roles and responsibilities. Data architecture established centralized repositories for operational information, while application architecture promoted interoperability among scheduling, monitoring, and communication systems. The technology architecture incorporated real-time communication infrastructures and digital platforms to support continuous service monitoring and decision-making. These findings align with enterprise architecture principles emphasizing strategic alignment, interoperability, and organizational integration (Kitsios & Kamariotou, 2019; Abunadi, 2019).

Previous research has similarly demonstrated that enterprise architecture implementations in transportation organizations improve business process efficiency, reduce operational redundancies, and strengthen

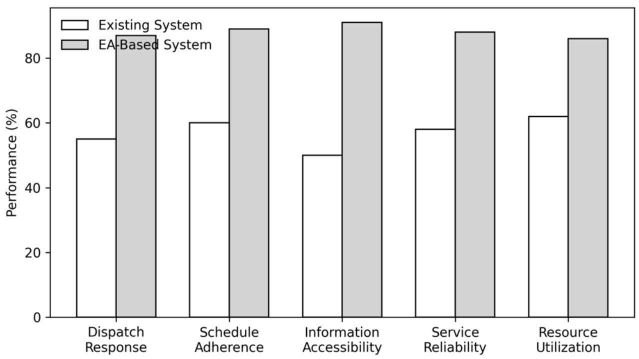


Figure 2: Operational Performance Before and After Enterprise Architecture Implementation

strategic performance management (Wedha, 2023; AlKharbush, Mahmoud, & Bakar, 2023). Moreover, the integration-oriented architectural approach supports the development of smart urban mobility ecosystems and digital transportation services (Anthony Jnr, Abbas Petersen, Helfert, Ahlers, & Krogstie, 2021).

Performance values compare the existing dispatch system with the enterprise architecture (EA)-based system, demonstrating the expected operational benefits of enterprise architecture adoption across major performance dimensions.

Discussion of Findings

The findings indicate that enterprise architecture provides an effective mechanism for addressing operational fragmentation in public transit dispatch systems. The integration of business process architectures with enterprise architecture artifacts facilitates greater process visibility, standardized workflows, and improved organizational coordination. This observation supports the argument of Gonzalez-Lopez and Bustos (2019) that business process architectures should be systematically embedded within enterprise architecture initiatives to achieve sustainable process improvements.

The study further demonstrates that enterprise architecture contributes significantly to digital transformation initiatives within transportation organizations. By aligning business objectives with information technology capabilities, transit agencies can improve operational agility, optimize resource utilization, and respond more effectively to changing service demands. Similar conclusions were reached by Cooney and Paxton (2016), who emphasized the strategic value of enterprise architecture in transportation agencies.

Additionally, the proposed architecture supports the integration of demand-responsive transportation services, enabling public transit organizations to adapt to evolving passenger mobility patterns. Würtz and Sandkuhl (2023) highlighted that enterprise architecture is essential for integrating flexible and demand-responsive transport services into existing public transportation ecosystems. The results also correspond with studies on smart city architectures, which emphasize pervasive digital platforms as foundational components for future urban transportation systems (Anthony Jnr et al., 2021; Pourzolfaghar, Bezbradica, & Helfert, 2016).

Practical and Managerial Implications

The practical implications of this study suggest that public transportation agencies should adopt enterprise architecture frameworks as strategic instruments for modernizing dispatch operations. Standardized business processes, integrated information systems, and interoperable technology infrastructures can substantially improve operational efficiency and service quality.

From a managerial perspective, decision-makers should prioritize enterprise architecture governance practices, including architecture documentation, stakeholder collaboration, and continuous process evaluation. The effective use of enterprise architecture artifacts can support evidence-based decision-making and ensure alignment between organizational objectives and technological investments (Niemi & Pekkola, 2017).

Moreover, customer-oriented architectural capabilities should be incorporated into dispatch systems to enhance passenger communication, service transparency, and user satisfaction. Hindarto (2023) emphasized that customer service enterprise architecture significantly contributes to improved service delivery within transportation organizations. Consequently, enterprise architecture adoption represents not only a technological initiative but also a strategic transformation approach for achieving sustainable and resilient public transportation operations.

Conclusion and Future Research

This study focused on business process and enterprise architecture (EA) in public transit dispatch operations and how important it is for them to have integrated and strategically aligned operational frameworks to maximize service efficiency, agility and organizational performance. The analysis revealed the following issues with public transit dispatch systems: Not all systems have sufficient interoperability; information flows are often disjointed; decision-making is still done manually; and there is limited real-time visibility. These constraints have a negative impact on the reliability of services, operational responsiveness and overall transit performance.

The results show that by implementing an enterprise architecture approach, business processes, information systems and technological infrastructures can be aligned to a great extent to enhance dispatch operations. Business process architectures offer a structured approach to understanding, modelling and optimizing the work-flows of businesses, thus enabling more process standardization and coordination within the transit sector (Dijkman et al., 2016; Gonzalez-Lopez & Bustos, 2019). Moreover, embedding business process architectures in enterprise architecture frameworks encourages enterprise strategic alignment, agility, and ongoing process improvement (Gonzalez-Lopez & Bustos, 2019; Kitsios & Kamariotou, 2019).

Additionally, the study underscores how enterprise architecture is pivotal in facilitating interoperability, resource optimization, and informed decision-making within the transportation industry, supporting digital transformation (AlKharbush et al., 2023). There is previous research that has shown that implementing enterprise architecture in transportation organizations can lead to more efficient operations, better customer service, and improved integration of transportation services (Legowo & Kaharmies, 2023; Hindarto, 2023; Wedha, 2023). Furthermore, enterprise architecture artifacts offer valuable communication, governance and strategic planning tools for organizations and enhance their capabilities and sustainability (Niemi & Pekkola, 2017; Abunadi, 2019).

The complexity of the urban mobility systems also requires the use of enterprise architecture frameworks to support smart city projects, pervasive digital platforms and integrated transport services (Anthony Jnr et al., 2021; Pourzolfaghar et al., 2016). The synergy between DRTS and ITS can be very useful to increase the agility and operational responsiveness of public transportation systems (Nthite, 2020; Würtz & Sandkuhl, 2023). Moreover, strategic enterprise architecture planning remains essential for ensuring successful implementation and alignment with organizational objectives in transportation agencies (Cooney & Paxton, 2016).

Future research should investigate the integration of emerging technologies such as artificial intelligence, machine learning, digital twins, and predictive analytics within enterprise architecture frameworks for transit dispatch operations. Additional studies may also examine the application of real-time data analytics and Internet of Things (IoT)-enabled architectures to improve dynamic dispatch decision-making. Comparative studies involving multiple transit agencies across different geographical contexts would provide deeper insights into best practices and implementation challenges. Finally, future research should explore governance models and performance measurement mechanisms that support sustainable enterprise architecture adoption in increasingly intelligent and interconnected public transportation ecosystems.

References

1. Anthony Jnr, B., Abbas Petersen, S., Helfert, M., Ahlers, D., & Krogstie, J. (2021). Modeling pervasive platforms and digital services for smart urban transformation using an enterprise architecture framework. *Information Technology & People*, *34*(4), 1285-1312.
2. Legowo, N., & Kaharmies, I. (2023). Enterprise architecture application and business process improvement: a case study of bus terminal in Indonesia. *Journal of System and Management Sciences*, *13*(5), 371-389.
3. Wedha, B. Y. (2023). Optimizing transportation logistics through enterprise architecture: A case study of integrated management systems. *Journal of Computer Networks, Architecture and High Performance Computing*, *5*(2), 693-702.
4. AlKharbush, M. M. S., Mahmoud, M. H. Z., & Bakar, N. A. A. (2023). A review of enterprise architecture for strategic performance management in the transportation sector digital transformation. *Open International Journal of Informatics*, *11*(1), 74-87.
5. Nthite, L. (2020). *Exploring the Relationship Between Intelligent Transport System Capability and Business Agility Within the Bus Rapid Transit in South Africa*. University of Johannesburg (South Africa).
6. Pourzolfaghar, Z., Bezbradica, M., & Helfert, M. (2016). Types of IT architectures in smart cities–a review from a business model and enterprise architecture perspective.
7. Würtz, M. O., & Sandkuhl, K. (2023). Enterprise architecture for integration of demand-responsive services in public transport. *Complex Systems Informatics and Modeling Quarterly*, (34), 62-83.
8. Cooney, R. C., & Paxton, M. C. (2016). Strategic Enterprise Architecture Design and Implementation Plan for the Montana Department of Transportation.
9. Hindarto, D. (2023). Application of customer service enterprise architecture in the transportation industry. *Journal of Computer Networks, Architecture and High Performance Computing*, *5*(2), 682-692.
10. Kitsios, F., & Kamariotou, M. (2019). Business strategy modelling based on enterprise architecture: a state of the art review. *Business Process Management Journal*, *25*(4), 606-624.
11. Khan, H. A. (2024). DATA-DRIVEN EPIDEMIOLOGICAL MODELING USING MACHINE LEARNING FOR DISEASE SPREAD FORECASTING AND PUBLIC HEALTH DECISION SUPPORT IN THE UNITED STATES. *International Journal of Applied Mathematics*, *37*(6s), 178-192.
12. Ferdus, M. Z., Monsur, M. H., Akhtar, M. J., & Islam, S. (2024). Secured Auto Encryption and Authentication Process for Cloud Computing Security. *Valley International Journal Digital Library*, 1040-1044.
13. Hossain, M. D., Kashem, M. A., Sadeq, M. J., Mustary, S., & Ferdus, M. Z. (2024, September). IoT Enabled Soil Fertilizer Monitoring and Recommendation System in the Context of Bangladeshi Agriculture. In *2024 IEEE International Conference on Power, Electrical, Electronics and Industrial Applications (PEEIACON)* (pp. 416-421). IEEE.
14. Ferdus, M. Z., Anjum, N., Nguyen, T. N., Jisan, A. H., & Raju, M. A. H. (2024). The influence of social media on stock market: A transformer-based stock price forecasting with external factors. *Journal of Computer Science and Technology Studies*, *6*(1), 189-194.
15. Arif, M. H. (2024). Optimizing Hospital Logistics and Healthcare Supply Chains Using Machine Learning and Artificial Intelligence Techniques. *J. Electrical Systems*, *20*(7s), 4209-4217.
16. Adepoju, S. A., & Adepoju, M. A. (2024). From Portals to Case Graphs: A Reference Architecture and Benchmark for Safety Investigation Operations with Agentic Orchestration.
17. Khan, H. A. (2024). DATA-DRIVEN EPIDEMIOLOGICAL MODELING USING MACHINE LEARNING FOR DISEASE SPREAD FORECASTING AND PUBLIC HEALTH DECISION SUPPORT IN THE UNITED STATES. *International Journal of Applied Mathematics*, *37*(6s), 178-192.
18. Kola, J. N. (2024). Longitudinal Cohort Intelligence for Self-Insured Employer Groups: A Predictive Framework for Healthcare Cost Trajectory Modeling and Proactive Risk Intervention. *Journal of Information Systems Engineering & Management*, *10*.
19. Isaac, P. (2024). Effect of Deep Margin Elevation on Periodontal Health and Gingival Microleakage: A Clinical and Microbiological Assessment. *Baltic Journal of Multidisciplinary Research*, *1*(4), 127-138.
20. Ezeagwuna, D. (2024). Enterprise Workflow Automation and Workforce Productivity: Evaluating the Economic Benefits of Service Now Adoption Across Industries. *International Journal of Technology, Management and Humanities*, *10*(04), 299-313.
21. Kola, J. N. (2024). Longitudinal Cohort Intelligence for Self-Insured Employer Groups: A Predictive Framework for Healthcare Cost

Trajectory Modeling and Proactive Risk Intervention. *Journal of Information Systems Engineering & Management*, *10*.
22. Ezeagwuna, D. (2025). Artificial Intelligence for IT Service Management: Developing a Framework for ROI Optimization Using Service Now and Machine Learning Technologies. *Well Testing Journal*, *34*(S4), 394-419.
23. Warren, Brandon. (2025). BUSINESS VALUE DRIVEN BY ENTERPRISE ARCHITECTURE TRANSFORMATION BRANDON WARREN. Journal of Tianjin University Science and Technology. 58. 10.5281/zenodo.20280991.
24. Dijkman, R., Vanderfeesten, I., & Reijers, H. A. (2016). Business process architectures: overview, comparison and framework. *Enterprise Information Systems*, *10*(2), 129-158.
25. Gonzalez-Lopez, F., & Bustos, G. (2019). Business process architecture design methodologies–a literature review. *Business Process Management Journal*, *25*(6), 1317-1334.
26. Gonzalez-Lopez, F., & Bustos, G. (2019). Integration of business process architectures within enterprise architecture approaches: a literature review. *Engineering Management Journal*, *31*(2), 127-140.
27. Niemi, E., & Pekkola, S. (2017). Using enterprise architecture artefacts in an organisation. *Enterprise information systems*, *11*(3), 313-338.
28. Abunadi, I. (2019). Enterprise architecture best practices in large corporations. *Information*, *10*(10), 293.

HOW TO CITE THIS ARTICLE: Moyosoluwa A. (2026). Researching Business Processes and Enterprise Architecture in Public Transit Dispatch Operations. *Journal of Integrated Science, Technology and Management*, 2(3), 1-13.