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Demystifying important issues concerning management of global IT resources in the Public Transit Sector in the US

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Abstract

The public transit industry has undergone a dramatic shift in its digital landscape, impacting its operations, infrastructure management, and stakeholder engagement in the United States. The effective management of global IT resources is now an imperative, with many transit systems now relying on technologies that are interconnected, including cloud, big data analytics, Internet of Things (IoT), artificial intelligence and advanced communication networks. But a host of governance, cyber security, data management, resource allocation, interoperability, workforce skills and vendor dependency challenges remain at the forefront of transit agency challenges. This article illuminates the key challenges confronting the management of global IT resources in the U.S. public transit sector by exploring the technological, organizational and operational challenges of digital transit ecosystems. The study investigates how IT governance ensures technology investments are in alignment with organizational goals and the importance of cybersecurity resiliency, enterprise data governance, and strategic sourcing practices. At the same time, the paper explores new issues which are associated with financial limitations, social justice of services, public-private cooperation, and digital innovation management. The article summarizes findings from previous studies and current practices, and suggests key recommendations for shaping more effective IT governance policies, developing digital skills, optimizing operations and fostering sustainable and resilient transport. The results support the academic body and policy makers in their actual and future efforts to effectively manage global IT resources to support the modernization and long-term sustainability of public transportation services in the U.S.

Keywords: Global IT Resource Management, Public Transit, Digital Transformation, IT Governance, Cybersecurity, Big Data Analytics, Internet of Things, Public Transportation, Smart Mobility, United States.

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Introduction

Public transportation is essential to the social inclusion and economic productivity of the United States, as well as to sustainable urban development. Transit agencies deliver mobility services to millions of people every day using buses, rail and transit, paratransit and newer shared mobility services. Public transportation is not only a mobility-enabling tool, it also plays a major role in reducing environmental impact, alleviating traffic issues, and promoting the access to jobs, schools, hospitals, and social services, among other benefits (Shaheen & Cohen, 2018; Wei et al., 2017). With the growing complexity of urban transportation networks, however, the demand for complex information technology (IT) infrastructures to support real-time operations, service optimization and strategic decision making has grown.

The public transport industry has been going through an unprecedented digital transformation, which has been called "the fourth wave of digitalization". Conventional transit operations are undergoing a transformation where advanced technologies like cloud computing, big data analytics, Internet of Things (IoT) devices, artificial intelligence (AI), machine learning and intelligent transportation systems are being integrated into these operations (Davidsson et al., 2016). Today's transit systems are more commonly utilizing multi-layered digital environments to track passengers, optimize routing, automate fare collection, monitor demand, and provide live travel data. New features like personal rapid

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transit systems and smart mobility are additional signs of the reliance of transportation organizations on globally distributed IT resources and collaborative technology infrastructures (Ghani et al., 2025).

Global IT resource management is thus a strategic priority for public transit systems. Global IT resource management involves the planning, procurement, deployment, control and optimization of the assets of technology, human skills, information and infrastructure in geographically distributed and interconnected settings (Lazar, 2019). Proper management of these resources can help organizations make technology investments that support business goals, optimize their operations, deliver better service, and build organizational resilience. Lazar (2019) argues that organisations with a strategic management of their global IT resources will be better equipped to adapt and react to changing environments, technology disruptions and stakeholder expectations. In the context of public transport, these capabilities are becoming more and more important, as public transport systems are embedded in complex socio-technical environments with a number of stakeholders, constraints and a variety of demands for service.

Although there are many opportunities tied to digital transformation, the management of global IT resources in public transportation is fraught with many challenges. The management and application of vast amounts of diverse data from fare systems, vehicle sensors, passenger applications, and operating platforms constitute one major challenge. Big data has the potential to help public organisations make better decisions, based on data-driven evidence and create predictions about their current and future needs; however, there are uncertainties about data quality, data governance, interoperability and institutional readiness (Klievink et al., 2017). In addition, the complexity of a big data ecosystem in development requires a strong governance framework that can maintain data integrity, data availability, and the value creation of the data as a strategic asset (Shin, 2016).

Another important issue for transit today is cybersecurity. The increasing number of devices, connected vehicles and cloud platforms in the Internet of Things (IoT) world has created an expanding attack surface for transit agencies vulnerable to cyber threats, operational disruptions, and privacy breaches. To achieve the interconnected transportation ecosystems, holistic solutions that involve device security, protecting edge computing, network security, and platform governance are needed (Cheruvu et al., 2020). As technologies are increasingly integrated from around the world and third parties, the management of cybersecurity becomes more difficult, and good risk management strategies gain in significance (Lazar, 2019).

Beyond technical issues, public transit agencies face managerial and organizational issues involving resource allocation, portfolio management, staff capabilities and organizational stakeholder partnerships. To ensure that technological investments are aligned with strategic transit goals, multiple digital transformation programmes and projects must be managed together using good portfolio and programme management practices (MacNicol et al., 2012). Additionally, service management issues such as service quality, accessibility, affordability, and sustainability are ongoing in the context of public transportation systems' technology adoption decisions (Bhuyan et al., 2024). In addition, successful implementation of large-scale IT projects is often reliant on partnerships among public agencies, private technology suppliers, and other stakeholders, highlighting the importance of public-private partnerships for transit modernization projects (Olatunji et al., 2016).

In addition, the last few years have seen significant progress in technologies specific to public transportation, like telecommunications networks, AI-based analytics, and natural language processing (NLP). New technologies in telecommunications enable ubiquitous connectivity and real-time communications for transit operations, while new NLP technologies are increasingly allowing for intelligent, more useful passenger information systems, automated customer support, and smart city integration (Ashok & Hallur, 2023; Tyagi & Bhushan, 2023). However, deployment of these technologies within existing transit systems has significant interoperability, governance, workforce training and organizational change management issues.

The operational and financial challenges faced during the COVID-19 pandemic also highlighted weaknesses in the U.S. public transportation sector, and underscored the need for resilient and adaptable digital infrastructure. In times of crisis, significant drop in ridership, changing travel habits and increased uncertainty of operations underscored the need to rely on data and flexible IT capabilities to maintain service continuity during crisis (Liu et al., 2020). Meanwhile, the transit sector is also working to be more efficient, accessible and effective in providing service to maximize value to the public while using resources efficiently (Verbich et al., 2017; Lee & Miller, 2018).

In this context, this study aims to explain the key issues related to the management of the IT resources of the world's public transportation sector in the United States. In particular, the article focuses on the strategic, technological, managerial and organizational issues that arise in the governance of IT resources spread across the globe in transit agencies. It further explores emerging opportunities arising from digital transformation and proposes recommendations for strengthening IT governance, enhancing cybersecurity resilience, improving data management practices, and fostering sustainable innovation in public transportation systems. By synthesizing insights from global IT management and transportation literature, the study contributes to a deeper understanding of how effective IT resource

management can support resilient, efficient, and citizen-centered public transit services in the United States.

Literature Review

The management of global information technology (IT) resources has emerged as a critical determinant of organizational competitiveness, operational efficiency, and service innovation across both private and public sectors. Within the public transit sector in the United States, rapid digital transformation, increased service complexity, and heightened customer expectations have intensified the need for effective management of IT resources. Public transit agencies increasingly depend on interconnected digital infrastructures, data analytics platforms, cloud services, intelligent transportation systems, and globally sourced technology solutions to deliver reliable and sustainable mobility services. Consequently, understanding the major issues associated with managing global IT resources in public transit has become essential.

Concept of Global IT Resource Management

Global IT resource management refers to the strategic planning, acquisition, deployment, governance, and optimization of information technology assets across geographically dispersed environments. According to Lazar (2019), effective global IT resource management encompasses IT governance, infrastructure management, sourcing strategies, portfolio management, human resource coordination, and risk mitigation. Organizations operating in globally interconnected environments must align IT resources with strategic objectives while balancing cost efficiency, technological innovation, security, and service quality.

Lazar (2019) further argues that globalization has transformed traditional IT management practices by necessitating cross-border collaboration, outsourcing, vendor coordination, and standardization of technological infrastructures. In public transit systems, these principles are particularly relevant because transit agencies increasingly rely on globally distributed cloud providers, international technology vendors, and integrated digital ecosystems to support fare collection, fleet management, passenger information systems, and predictive maintenance applications.

Portfolio and program management constitute another important dimension of global IT resource management. MacNicol, Reiss, and Rayner (2012) emphasize that managing multiple technology initiatives requires systematic prioritization, governance mechanisms, and continuous performance evaluation. In transit environments where numerous digital projects coexist, including smart ticketing, mobility-as-a-service platforms, and intelligent transportation systems, portfolio management ensures that scarce financial and technological resources are allocated efficiently.

Digital Transformation and Public Transit Modernization

The public transit sector has undergone profound transformation due to digitalization. Davidsson et al. (2016) describe this phenomenon as the "fourth wave of digitalization," characterized by extensive integration of cyber-physical systems, real-time data exchange, connected infrastructure, and intelligent decision support systems. This new digital paradigm offers significant opportunities for enhancing operational efficiency, passenger experience, and system sustainability.

Digital technologies enable transit agencies to optimize route planning, monitor vehicle performance, provide real-time travel information, and improve service responsiveness. According to Shaheen and Cohen (2018), technological innovations have contributed to what many scholars describe as a public transit renaissance, wherein digital platforms support more accessible, customer-centric, and sustainable mobility ecosystems.

However, digital transformation also introduces managerial complexities. Transit agencies frequently struggle with integrating legacy systems, ensuring interoperability among heterogeneous technologies, and managing rapidly evolving IT infrastructures (Davidsson et al., 2016). Furthermore, the increasing dependence on digital platforms necessitates substantial investments in IT governance, cybersecurity, workforce development, and organizational change management.

Recent developments in advanced transit modes further illustrate these complexities. Ghani et al. (2025) identify multiple technological, institutional, and stakeholder-related challenges associated with adopting personal rapid transit systems. Their findings reveal that successful deployment of advanced transit technologies requires coordinated management of technical resources, stakeholder expectations, regulatory requirements, and long-term sustainability objectives.

Big Data and Analytics in Public Transit

The proliferation of sensors, connected vehicles, mobile applications, and fare collection systems has generated unprecedented volumes of transit-related data. Big data analytics has consequently become an indispensable IT resource for transit agencies. Shin (2016) conceptualizes big data as a multidimensional phenomenon involving massive, diverse, and rapidly generated datasets that can support enhanced decision-making and organizational innovation.

Within public transportation, big data applications include demand forecasting, route optimization, congestion management, predictive maintenance, and passenger behavior analysis. Nevertheless, effective exploitation of big data remains challenging. Klievink et al. (2017) argue that public sector organizations often face significant uncertainties regarding data governance, organizational readiness, legal constraints, and analytical capabilities. Many

public agencies lack adequate data governance frameworks, skilled personnel, and institutional capacities necessary to transform data into actionable intelligence.

Moreover, the integration of multiple data sources across organizational boundaries introduces concerns related to data ownership, interoperability, privacy, and quality assurance. Public transit agencies must therefore establish comprehensive governance mechanisms to ensure that data assets are managed effectively and ethically (Klievink et al., 2017; Shin, 2016).

Emerging Technologies and Smart Transit Systems

The evolution toward smart cities has accelerated the adoption of emerging technologies in public transit systems. Among these technologies, the Internet of Things (IoT), artificial intelligence (AI), cloud computing, and natural language processing (NLP) have gained particular prominence.

IoT technologies facilitate continuous monitoring of vehicles, infrastructure, and passenger flows through interconnected sensors and edge devices. Cheruvu, Kumar, Smith, and Wheeler (2020) note that IoT architectures significantly enhance operational visibility and real-time decision-making. However, increased connectivity simultaneously expands the cyberattack surface, creating substantial security vulnerabilities. Transit agencies must therefore implement robust device authentication, encryption, access control, and threat detection mechanisms to protect critical infrastructure.

Natural language processing represents another emerging capability within smart transit ecosystems. Tyagi and Bhushan (2023) demonstrate that NLP applications can improve customer engagement, automate service requests, analyze passenger sentiment, and support multilingual communication within smart city environments. These capabilities are particularly relevant in large metropolitan transit systems where agencies must interact with diverse user populations and process substantial volumes of customer feedback.

In addition, telecommunications infrastructure plays a foundational role in supporting digital transit services. Ashok and Hallur (2023) emphasize that domain-specific technological drivers, including high-speed connectivity, network reliability, and communication interoperability, significantly influence the effectiveness of modern digital ecosystems. Public transit agencies therefore require resilient and scalable communication infrastructures to sustain real-time operational capabilities.

Service Management, Partnerships, and Sustainability Considerations

Effective service management remains central to public transportation performance. Bhuyan, Roy, and Srivastava (2024) argue that sustainable mobility systems depend on coordinated management of operational processes, stakeholder interactions, service quality, and technological resources. Inadequate service management often results in inefficiencies, reduced passenger satisfaction, and diminished sustainability outcomes.

Public-private partnerships (PPPs) have emerged as important mechanisms for acquiring and managing IT resources within public transportation systems. Olatunji, Olawumi, and Ogunsemi (2016) observe that PPP arrangements facilitate resource mobilization, risk sharing, and access to specialized technological expertise. Nevertheless, PPP initiatives may also introduce governance challenges related to accountability, contractual complexity, and strategic alignment.

The COVID-19 pandemic further exposed vulnerabilities within public transit systems. Liu, Miller, and Scheff (2020) report substantial declines in transit demand across the United States, emphasizing the need for resilient and adaptive digital infrastructures capable of supporting dynamic service adjustments during disruptions. Consequently, transit agencies increasingly recognize the importance of flexible IT architectures and data-driven decision-making capabilities.

Operational performance and equity considerations also remain critical in evaluating transit effectiveness. Verbich, Badami, and El-Geneidy (2017) emphasize the need for multidimensional assessment frameworks that consider cost efficiency, accessibility, and service quality simultaneously. Similarly, Wei et al. (2017) argue that operational efficiency and access equity should be treated as complementary objectives in transit planning. Lee and Miller (2018) further demonstrate that new transit services and system redesign initiatives can significantly improve accessibility outcomes when supported by appropriate technological and analytical capabilities.

Research Gap

Although substantial scholarship exists concerning digital transformation, smart mobility, big data, and transit performance, relatively limited research has specifically examined the management of global IT resources within the U.S. public transit sector from an integrated perspective. Existing studies frequently investigate individual technologies such as big data, IoT, or intelligent transportation systems in isolation. Furthermore, insufficient attention has been devoted to understanding how IT governance, global sourcing, cybersecurity, portfolio management, data governance, and service management collectively influence transit performance. This study addresses this gap by synthesizing these interrelated dimensions to demystify the major issues concerning management of global IT resources in the U.S. public transit sector.

Global IT Resources in the U.S. Public Transit Sector

The rapid digital transformation of public transportation systems in the United States has significantly increased

Table 1: Summary of Literature on Global IT Resource Management in Public Transit

Author(s)	*Research Focus*	*Major Findings*	*Implications for Public Transit*
Lazar (2019)	Global IT resource management	Effective governance, sourcing, and strategic alignment are essential for organizational success	Provides foundational framework for managing transit IT resources
Davidsson et al. (2016)	Digitalization in public transport	Digital transformation creates both opportunities and implementation challenges	Highlights need for integrated IT management strategies
Klievink et al. (2017)	Big data readiness in public sector	Public organizations face uncertainties regarding data governance and readiness	Emphasizes importance of data governance capabilities
Shin (2016)	Big data development processes	Big data supports innovation but requires organizational preparedness	Demonstrates value of analytics in transit operations
Cheruvu et al. (2020)	IoT security	Secure deployment of connected devices is critical	Underlines cybersecurity requirements in smart transit systems
Tyagi and Bhushan (2023)	NLP applications in smart cities	NLP improves citizen engagement and service delivery	Supports intelligent passenger communication systems
Bhuyan et al. (2024)	Service management in transportation	Sustainable mobility depends on effective service management	Reinforces operational and service quality considerations
Olatunji et al. (2016)	Public-private partnerships	PPPs facilitate resource mobilization and expertise sharing	Encourages collaborative IT investment strategies
Liu et al. (2020)	COVID-19 impacts on transit demand	Transit systems require resilient and adaptive infrastructures	Highlights importance of flexible digital architectures

reliance on global information technology (IT) resources. Public transit agencies increasingly deploy sophisticated digital infrastructures to enhance operational efficiency, improve passenger experiences, support strategic decision-making, and ensure sustainable mobility outcomes. According to Lazar (2019), global IT resources encompass not only technological assets such as hardware and software but also data resources, human expertise, communication networks, organizational capabilities, and externally sourced IT services. Within the U.S. public transit sector, these resources are becoming indispensable for managing increasingly complex and interconnected transit ecosystems.

3.1 Categories of IT Resources in Public Transit

Global IT resources in public transit can be broadly categorized into hardware infrastructure, software applications, data resources, communication networks, and human IT capabilities. Hardware resources include servers, onboard computing devices, sensors, fare collection terminals, and surveillance equipment deployed across transit networks. Software resources consist of enterprise applications, scheduling systems, customer relationship management platforms, asset management systems, and advanced analytics tools that support service delivery and operational management (Lazar, 2019).

Data resources have emerged as one of the most strategic assets in contemporary public transit organizations. Transit agencies generate enormous volumes of data from fare collection systems, automatic vehicle location systems, mobile applications, GPS devices, and passenger information platforms. The growing significance of big data has transformed transit agencies from traditional transportation providers into data-intensive organizations capable of making evidence-based operational and policy decisions (Klievink et al., 2017; Shin, 2016).

Communication infrastructure also constitutes a critical IT resource. Wireless communication technologies, broadband networks, cloud connectivity, and telecommunications systems enable real-time coordination among vehicles, control centers, passengers, and external stakeholders. The expansion of digital communication technologies has facilitated the emergence of intelligent transportation systems and integrated mobility services across urban regions (Ashok & Hallur, 2023; Davidsson et al., 2016).

Furthermore, human IT capabilities including technical expertise, project management competencies, cybersecurity skills, and data analytics proficiency represent essential strategic resources. Lazar (2019) emphasizes that organizations derive competitive and operational advantages not merely from technological assets but from their ability to effectively manage, integrate, and exploit these resources.

Emerging Technologies Transforming U.S. Public Transit

The ongoing digitalization of public transportation has accelerated the adoption of several emerging technologies. The fourth wave of digitalization has fundamentally reshaped transit operations through increased automation, connectivity, and intelligent service provision (Davidsson et al., 2016).

The Internet of Things (IoT) has become central to modern transit management. IoT-enabled sensors embedded in buses, rail systems, stations, and infrastructure continuously collect operational data concerning vehicle conditions, passenger flows, traffic patterns, and environmental conditions. These technologies support predictive maintenance, fleet optimization, and real-time service monitoring. However, increasing interconnectivity simultaneously introduces substantial cybersecurity vulnerabilities that necessitate robust security architectures and governance mechanisms (Cheruvu et al., 2020).

Cloud computing platforms are increasingly utilized by transit agencies to support scalable storage, data processing, and enterprise-wide information sharing. Cloud-based solutions enable transit organizations to integrate diverse operational systems while reducing infrastructure costs and improving organizational agility (Lazar, 2019). Similarly, big data analytics technologies facilitate demand forecasting, route optimization, and service performance assessment. Through advanced analytics, transit agencies can identify travel patterns, anticipate service disruptions, and optimize resource allocation to improve operational efficiency and accessibility outcomes (Klievink et al., 2017; Wei et al., 2017).

Artificial intelligence (AI) and Natural Language Processing (NLP) applications are also expanding across public transit systems. AI-driven algorithms support dynamic scheduling, predictive maintenance, and intelligent traffic management, while NLP technologies enhance customer engagement through conversational agents, automated passenger information systems, and multilingual service platforms (Tyagi & Bhushan, 2023). These technologies align with broader smart city initiatives aimed at improving urban mobility and enhancing citizen-centric service delivery.

Recent innovations such as Personal Rapid Transit (PRT) systems further demonstrate the increasing integration of intelligent technologies into urban transportation. Although adoption remains limited, PRT systems illustrate the growing importance of stakeholder coordination, technological interoperability, and adaptive governance in managing complex transit infrastructures (Ghani et al., 2025).

Global Sourcing, Outsourcing, and Public-Private Collaboration

Managing IT resources in public transit increasingly extends beyond organizational boundaries. Many U.S. transit agencies rely on global sourcing strategies, outsourcing arrangements, and public-private partnerships (PPPs) to acquire specialized technological capabilities and reduce operational costs. Lazar (2019) argues that global sourcing enables organizations to access specialized expertise, innovative technologies, and cost efficiencies unavailable internally.

Public-private partnerships have become particularly important in the transit sector, facilitating investments in intelligent transportation systems, digital ticketing platforms, and mobility-as-a-service solutions. PPP arrangements allow transit agencies to share risks, leverage private-sector innovation, and accelerate technological modernization initiatives (Olatunji et al., 2016). Nonetheless, effective governance mechanisms are essential to mitigate challenges associated with vendor dependence, contractual complexity, and strategic misalignment.

The increased adoption of outsourcing and collaborative service models also necessitates sophisticated portfolio and program management practices. Transit agencies frequently manage multiple concurrent IT initiatives, including infrastructure modernization projects, cybersecurity enhancements, data integration programs, and customer service innovations. Effective portfolio management enables organizations to prioritize investments, optimize resource utilization, and ensure strategic alignment across diverse initiatives (MacNicol et al., 2012).

Strategic Implications for Transit Service Delivery

The effective management of global IT resources directly influences service quality, accessibility, operational efficiency, and organizational resilience within public transit systems. Digital technologies support improved service reliability, enhanced passenger information, and more equitable access to transportation services (Lee & Miller, 2018; Wei et al., 2017). Moreover, growing calls for a public transit renaissance in the United States emphasize the necessity of leveraging digital technologies to create sustainable, resilient, and user-centered transportation systems (Shaheen & Cohen, 2018).

The COVID-19 pandemic further highlighted the strategic importance of digital capabilities. Transit agencies increasingly relied on digital platforms, real-time analytics, and remote operational technologies to respond to dramatic shifts in travel demand and maintain service continuity during periods of disruption (Liu et al., 2020). Consequently, investment in robust IT infrastructures has become a critical prerequisite for enhancing long-term resilience and sustainability across U.S. public transportation systems.

Important Issues Concerning Management of Global IT Resources in Public Transit

The increasing digitalization of public transportation systems in the United States has transformed the manner in which transit agencies manage infrastructure, service delivery, and operational decision-making. Modern transit systems increasingly depend on globally distributed information technology (IT) resources, including cloud platforms, Internet of Things (IoT) devices, big data analytics, communication networks, and intelligent transportation systems. While these technologies offer significant opportunities for improving operational efficiency, customer experience, and sustainability, their management presents numerous

Table 2: Major Global IT Resources and Their Applications in the U.S. Public Transit Sector

Global IT Resource	*Major Applications in Public Transit*	*Strategic Benefits*	*Key Challenges*
Cloud Computing	Data storage, fare management, enterprise integration	Scalability, flexibility, cost reduction	Vendor lock-in, security concerns
Big Data Analytics	Demand forecasting, route optimization, performance monitoring	Improved decision-making and efficiency	Data quality and governance issues
Internet of Things (IoT)	Fleet tracking, predictive maintenance, real-time monitoring	Enhanced operational visibility	Cybersecurity vulnerabilities
Artificial Intelligence and NLP	Passenger assistance, intelligent scheduling, predictive analytics	Service automation and personalization	Ethical and transparency concerns
Communication Networks	Vehicle-to-control center communication, passenger information dissemination	Real-time coordination and connectivity	Infrastructure investment requirements
Human IT Capabilities	System management, cybersecurity, analytics, project management	Effective technology utilization	Skills shortages and training needs

Source: Adapted from Lazar (2019); Davidsson et al. (2016); Klievink et al. (2017); Cheruvu et al. (2020); Tyagi and Bhushan (2023).

strategic, operational, and governance challenges. Effective management of global IT resources is therefore essential for ensuring reliable, secure, equitable, and resilient public transit services (Lazar, 2019; Davidsson et al., 2016).

IT Governance and Strategic Alignment

One of the foremost issues confronting public transit agencies is the establishment of effective IT governance structures. IT governance ensures that technology investments align with organizational objectives, regulatory requirements, and public service mandates. Lazar (2019) emphasizes that successful management of global IT resources requires clear governance frameworks that define decision rights, accountability mechanisms, and performance measurement systems.

In the U.S. public transit sector, agencies often operate under fragmented governance arrangements involving federal, state, regional, and municipal authorities. Such fragmentation can impede coordinated IT planning and hinder interoperability among transit systems. Moreover, strategic misalignment between technology initiatives and transportation objectives may result in underutilized investments, duplicated systems, and inefficient resource allocation. As public transit agencies increasingly adopt smart mobility solutions, robust governance mechanisms are needed to align digital transformation initiatives with long-term organizational strategies (Davidsson et al., 2016; Shaheen & Cohen, 2018).

Cybersecurity and Privacy Challenges

Cybersecurity represents one of the most critical concerns in managing global IT resources in public transit. Contemporary transit systems rely extensively on interconnected IoT devices, cloud infrastructures, fare collection systems, vehicle-to-infrastructure communications, and passenger information systems. Although these technologies improve service delivery, they simultaneously increase the attack surface for cyber threats.

According to Cheruvu et al. (2020), IoT-enabled environments are particularly vulnerable to unauthorized access, malware attacks, distributed denial-of-service attacks, and data breaches. Public transit agencies frequently manage sensitive information, including passenger travel records, payment information, and operational data. Compromise of these systems may disrupt transit operations, threaten passenger safety, and erode public trust.

The globalization of IT sourcing further complicates cybersecurity management because software development, cloud hosting, and data processing activities are often distributed across multiple vendors and geographical regions (Lazar, 2019). Consequently, transit agencies must adopt comprehensive cybersecurity strategies incorporating zero-trust architectures, continuous monitoring, encryption, identity management, and regular security audits to mitigate emerging threats (Cheruvu et al., 2020).

Big Data Governance, Quality, and Interoperability

The digital transformation of public transit has generated unprecedented volumes of operational and passenger-related data. Sources such as automated fare collection systems, GPS sensors, mobile applications, surveillance systems, and social media platforms continuously produce large datasets that can support evidence-based decision-making.

However, Klievink et al. (2017) argue that public sector organizations frequently experience uncertainties regarding data readiness, ownership, governance, and analytical capabilities. Similarly, Shin (2016) notes that extracting value from big data requires robust data governance structures, standardized data architectures, and effective analytical processes.

Many U.S. transit agencies encounter significant interoperability challenges because legacy systems often coexist with newly implemented digital platforms. Disparate technologies may use incompatible standards, thereby limiting seamless information exchange among agencies and reducing the effectiveness of integrated mobility services. Inadequate data quality, inconsistent metadata standards, and insufficient governance frameworks may further undermine decision quality and operational performance (Klievink et al., 2017; Shin, 2016).

Consequently, public transit organizations must establish enterprise-wide data governance frameworks that address data ownership, quality assurance, interoperability standards, privacy protection, and data lifecycle management.

Financial Constraints and IT Investment Prioritization

Public transit agencies in the United States often operate under substantial financial constraints. Declining ridership during and after the COVID-19 pandemic significantly affected fare revenues, thereby reducing available resources for technology modernization initiatives (Liu et al., 2020). Simultaneously, agencies face increasing pressure to upgrade aging infrastructure, deploy intelligent transportation technologies, and maintain cybersecurity resilience.

Lazar (2019) emphasizes that effective portfolio and program management is essential for optimizing global IT investments. MacNicol et al. (2012) similarly argue that organizations managing multiple technology projects must prioritize investments based on strategic value, risk, and resource availability.

In many transit agencies, inadequate funding results in delayed modernization efforts, deferred maintenance, and prolonged reliance on obsolete technologies. Such conditions increase operational vulnerabilities and reduce organizational agility. Therefore, systematic portfolio management approaches are required to ensure optimal allocation of scarce financial resources across competing IT initiatives (MacNicol et al., 2012; Lazar, 2019).

Human Resource and Digital Skills Deficiencies

The successful management of global IT resources depends significantly on human expertise. However, many public transit agencies face shortages of personnel possessing advanced competencies in cybersecurity, cloud computing, artificial intelligence, data analytics, and systems integration.

Table 3: Major Issues Concerning Management of Global IT Resources in U.S. Public Transit

Major Issue	*Description*	*Potential Consequences*	*Recommended Management Approach*
IT Governance and Strategic Alignment	Misalignment between IT initiatives and organizational goals	Inefficient investments and duplicated systems	Establish enterprise IT governance frameworks
Cybersecurity and Privacy	Increased exposure to cyber threats due to interconnected systems	Service disruption, data breaches, safety risks	Implement zero-trust security and continuous monitoring
Data Governance and Interoperability	Poor data quality and incompatible systems	Ineffective decision-making and reduced integration	Develop enterprise data governance standards
Financial Constraints	Limited funding for modernization projects	Aging infrastructure and delayed innovation	Apply portfolio and program management practices
Skills Gaps	Shortage of advanced IT competencies	Slow digital transformation and implementation failures	Invest in workforce development and reskilling
Vendor Dependency	Overreliance on external technology providers	Vendor lock-in and operational risks	Adopt multi-vendor sourcing strategies
PPP and Stakeholder Complexity	Multiple stakeholders with differing objectives	Coordination failures and project delays	Strengthen collaborative governance mechanisms
Equity and Accessibility	Unequal access to digital transit services	Social exclusion and reduced service effectiveness	Promote inclusive and accessible digital services

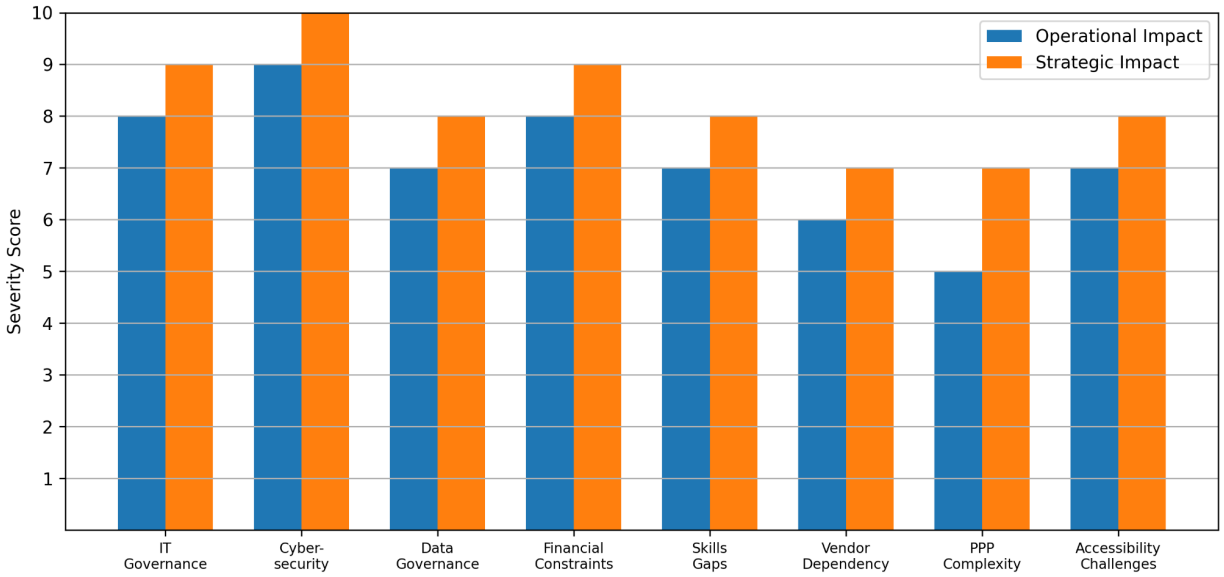

Figure 1*:* Severity scores are illustrative and are presented to demonstrate the relative operational and strategic impacts of major IT resource management challenges in U.S. public transit agencies.

Digital transformation initiatives frequently necessitate organizational change, cross-functional collaboration, and continuous workforce development. The emergence of advanced technologies such as natural language processing (NLP) and intelligent decision-support systems further intensifies demand for specialized skills (Tyagi & Bhushan, 2023).

Furthermore, resistance to organizational change may hinder successful implementation of digital innovations. Employees accustomed to traditional operational processes may perceive technological change as disruptive, thereby slowing adoption rates. Transit agencies must therefore invest in continuous training, reskilling programs, and change management initiatives to enhance workforce readiness and support sustainable digital transformation (Lazar, 2019; Tyagi & Bhushan, 2023).

Vendor Dependency and Global Sourcing Risks

Global sourcing practices enable transit agencies to access specialized technological expertise, reduce costs, and accelerate innovation. Nevertheless, excessive dependence on external vendors can expose organizations to significant risks, including vendor lock-in, contractual disputes, intellectual property concerns, and service disruptions (Lazar, 2019).

The increasing use of cloud services and outsourced software development introduces additional complexities related to jurisdictional regulations, data sovereignty, and cross-border data transfers. Transit agencies may experience difficulties switching providers due to proprietary technologies and incompatible system architectures.

Effective vendor management therefore requires comprehensive contractual frameworks, rigorous service-level agreements, risk assessment procedures, and contingency planning strategies. Multi-vendor sourcing models and standardized interoperability frameworks may further reduce dependency risks and improve organizational flexibility (Lazar, 2019).

Public-Private Partnerships and Stakeholder Complexity

Public-private partnerships (PPPs) have emerged as important mechanisms for financing and implementing transit-related technology projects. PPP arrangements facilitate access to private-sector expertise, innovation capabilities, and investment resources. However, managing partnerships involving multiple stakeholders often presents substantial governance and coordination challenges.

Olatunji et al. (2016) argue that unclear responsibilities, conflicting objectives, inadequate risk-sharing mechanisms, and weak contractual arrangements frequently undermine PPP effectiveness. Similarly, Ghani et al. (2025) highlight the complexity associated with coordinating diverse stakeholder interests during implementation of technologically advanced transit systems.

Successful management of global IT resources therefore requires collaborative governance mechanisms that foster transparency, stakeholder engagement, accountability, and shared strategic objectives among public agencies, private partners, technology providers, and citizens.

4.8 Equity, Accessibility, and Service Sustainability

Digital technologies can substantially improve operational

efficiency and passenger experiences; however, they may also exacerbate inequalities if not implemented inclusively. Public transit agencies must ensure that digital transformation initiatives support equitable access for diverse populations, including low-income communities, elderly individuals, and persons with disabilities.

Research indicates that operational efficiency and accessibility remain critical determinants of transit effectiveness (Wei et al., 2017; Lee & Miller, 2018). Furthermore, Bhuyan et al. (2024) emphasize that service management approaches should balance technological innovation with broader sustainability objectives.

As agencies increasingly deploy mobile ticketing applications, automated customer service platforms, and digital information systems, it is essential to preserve alternative service channels for digitally disadvantaged populations. Equitable and inclusive technology deployment is therefore fundamental to achieving sustainable public transit outcomes (Verbich et al., 2017; Bhuyan et al., 2024).

Discussion: Demystifying Strategic and Operational Complexities

The management of global IT resources within the U.S. public transit sector is characterized by substantial strategic and operational complexities arising from the convergence of digital transformation, evolving passenger expectations, cybersecurity concerns, resource constraints, and multi-stakeholder governance structures. While digital technologies have enhanced transit service delivery, they have simultaneously introduced new managerial challenges that require coordinated governance, robust technological infrastructures, and adaptive organizational capabilities. This discussion demystifies these complexities by examining the interrelationships among technology, governance, service delivery, and sustainability in the public transit ecosystem.

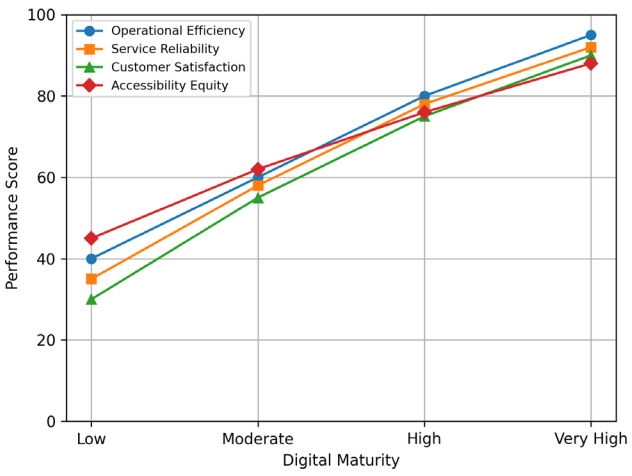

Figure 2*:* Performance scores are illustrative and depict the conceptual relationship between increasing digital maturity and improvements in operational efficiency, service reliability, customer satisfaction, and accessibility equity.

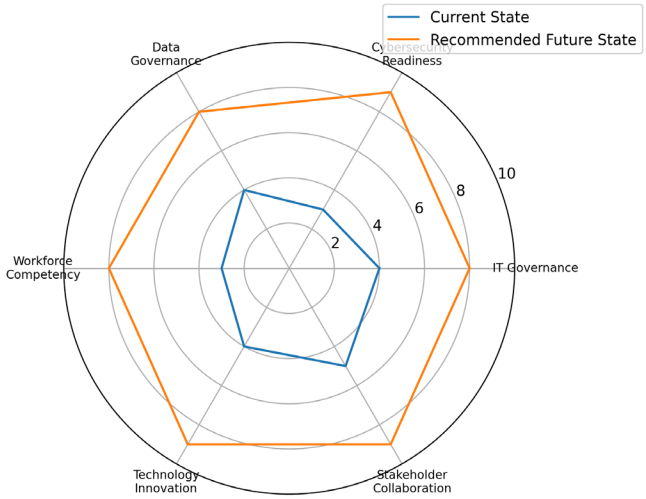

Figure 3*:* Capability scores are illustrative and compare the conceptual current state with the recommended future state across six strategic dimensions of IT resource management in U.S. public transit agencies.

Interrelationship Between Technology, Governance, and Service Delivery

Modern public transit systems increasingly rely on interconnected digital infrastructures comprising cloud computing platforms, intelligent transportation systems, Internet of Things (IoT) devices, big data analytics, and customer-facing applications. The fourth wave of digitalization has transformed public transportation from a predominantly infrastructure-centric service to a data-driven and user-oriented ecosystem (Davidsson et al., 2016). Consequently, effective management of global IT resources is no longer merely a technical function but a strategic necessity.

Lazar (2019) argues that global IT resource management must align technological investments with organizational objectives to maximize value creation. Within public transit agencies, strategic alignment ensures that investments in intelligent fare systems, fleet management platforms, and predictive analytics directly support operational efficiency, accessibility, and customer satisfaction goals. However, many transit organizations encounter difficulties in aligning technology initiatives with service priorities due to fragmented governance structures, legacy systems, and varying stakeholder expectations.

Service delivery outcomes are significantly influenced by governance quality. Agencies possessing mature IT governance frameworks tend to exhibit greater operational responsiveness, improved service reliability, and enhanced

passenger experiences. Conversely, weak governance can result in duplicated investments, inconsistent data standards, and inefficient utilization of technological assets. As public transit increasingly adopts smart city technologies, governance mechanisms that integrate technology planning, policy formulation, and operational management become essential for ensuring sustainable service provision (Tyagi & Bhushan, 2023).

Moreover, the effectiveness of digital technologies should ultimately be evaluated based on their contribution to public value. Studies demonstrate that improved digital capabilities positively influence transit accessibility, operational efficiency, and spatial equity, thereby strengthening public confidence in transit systems (Wei et al., 2017; Lee & Miller, 2018). Thus, strategic governance and service delivery must be viewed as mutually reinforcing components within the broader framework of global IT resource management.

Balancing Innovation and Risk

Digital innovation offers unprecedented opportunities for enhancing public transit operations, including predictive maintenance, real-time passenger information systems, demand-responsive services, and autonomous transit technologies. Nevertheless, innovation introduces significant risks that transit agencies must carefully manage.

Big data technologies exemplify this duality. The extensive collection and analysis of transit-related data facilitate evidence-based decision-making, service optimization, and passenger demand forecasting (Shin, 2016). However, Klievink et al. (2017) contend that public organizations frequently experience uncertainty regarding data quality, ownership, interoperability, and governance readiness. Inadequate data governance may compromise decision quality and diminish stakeholder trust.

Similarly, IoT-enabled transit infrastructures enhance operational visibility but substantially expand the attack surface for cyber threats. Connected sensors, edge devices, and communication networks are susceptible to unauthorized access, service disruption, and data breaches if appropriate security controls are absent (Cheruvu et al., 2020). Given the critical role of public transportation in national infrastructure, cybersecurity vulnerabilities may produce severe operational and societal consequences.

Emerging technologies such as personal rapid transit systems, artificial intelligence, and natural language processing further complicate innovation management. While these technologies promise greater efficiency and customer engagement, their implementation involves technological uncertainty, ethical considerations, interoperability challenges, and substantial investment requirements (Ghani et al., 2025; Tyagi & Bhushan, 2023).

Consequently, transit agencies must strike a balance between innovation and risk mitigation. Lazar (2019) emphasizes that portfolio management and risk assessment are fundamental components of global IT management. Agencies should therefore adopt phased implementation strategies, continuous risk monitoring, and enterprise-wide cybersecurity frameworks to ensure that innovation initiatives generate sustainable value without compromising operational resilience.

Public-Private Partnerships in IT Resource Management

Public-private partnerships (PPPs) have emerged as a strategic mechanism for overcoming resource limitations and accelerating technological modernization within public transit systems. Given the substantial financial and technical requirements associated with digital transformation, many transit agencies increasingly collaborate with private technology providers, cloud service vendors, telecommunications firms, and mobility platform operators.

According to Olatunji et al. (2016), PPP arrangements facilitate access to specialized expertise, innovation capabilities, and financial resources while distributing implementation risks among participating entities. Such collaborations can expedite deployment of intelligent ticketing systems, integrated mobility platforms, and real-time operational analytics.

Nevertheless, PPP-based IT initiatives are accompanied by significant governance challenges. Vendor dependence may lead to technological lock-in, reduced organizational flexibility, and diminished control over critical information assets. Lazar (2019) notes that global sourcing decisions require careful evaluation of contractual arrangements, governance structures, and performance management mechanisms to ensure strategic alignment and accountability.

Effective PPP governance should therefore encompass clearly defined service-level agreements, transparent performance indicators, cybersecurity obligations, and shared accountability mechanisms. Additionally, transit agencies must maintain internal competencies to oversee outsourced activities and safeguard institutional knowledge. Failure to establish appropriate governance mechanisms may result in cost overruns, fragmented systems, and compromised service quality.

Building Resilient and Sustainable Transit IT Ecosystems

Recent disruptions, particularly the COVID-19 pandemic, have highlighted the necessity for resilient and adaptive transit systems. The dramatic decline in transit demand during the pandemic exposed vulnerabilities in traditional operational models and underscored the importance of digital capabilities for sustaining service continuity (Liu et al., 2020).

Resilience within transit IT ecosystems extends beyond technological redundancy to include organizational adaptability, data-driven decision-making, and collaborative governance. Sustainable transit systems require integrated digital architectures capable of supporting real-time

monitoring, predictive analytics, remote management, and dynamic service adjustments (Bhuyan et al., 2024).

Portfolio and programme management practices provide valuable mechanisms for enhancing resilience by enabling organizations to prioritize investments, coordinate multiple initiatives, and align projects with long-term strategic objectives (MacNicol et al., 2012). Furthermore, infrastructure modernization initiatives should emphasize scalability, interoperability, and flexibility to accommodate future technological developments.

Sustainability considerations are equally important. Public transit agencies are increasingly expected to support broader societal objectives, including environmental sustainability, equitable mobility, and inclusive service provision. Research suggests that digitally enabled transit systems can significantly improve operational efficiency while promoting equitable access to transportation services (Verbich et al., 2017; Wei et al., 2017). Consequently, sustainable IT ecosystems should integrate technological innovation with social, environmental, and economic objectives.

Lessons from Smart City Initiatives

Smart city initiatives provide important lessons for managing global IT resources within public transit environments. Smart cities emphasize integrated governance, cross-sector collaboration, interoperability, citizen-centric service design, and data-driven decision-making. These principles are highly applicable to public transit modernization efforts.

Davidsson et al. (2016) observe that digital transformation in transportation increasingly depends on ecosystem-level coordination involving government agencies, technology providers, mobility operators, and citizens. Similarly, Ashok and Hallur (2023) highlight that domain-specific technological adoption is strongly influenced by contextual drivers, stakeholder readiness, and organizational capabilities.

One critical lesson from smart city initiatives is the importance of interoperability standards. Fragmented technological ecosystems impede information sharing, reduce operational efficiency, and increase implementation costs. Standardized architectures and integrated data platforms are therefore essential for maximizing the benefits of digital investments.

Another lesson concerns citizen engagement. Public transit systems exist primarily to serve societal needs; therefore, technology adoption strategies should prioritize user experiences, accessibility, transparency, and inclusiveness. Shaheen and Cohen (2018) argue that public transit revitalization depends not only on infrastructure investments but also on enhancing service attractiveness and user satisfaction.

Ultimately, demystifying the strategic and operational complexities of managing global IT resources in U.S. public transit requires recognizing that technology, governance, people, and public value are deeply interconnected. Transit agencies that successfully integrate these dimensions are more likely to achieve resilient, secure, and sustainable transportation ecosystems capable of meeting future mobility demands.

Recommendations and Future Directions

The effective management of global IT resources in the U.S. public transit sector requires a comprehensive strategic approach that integrates governance, cybersecurity, digital innovation, stakeholder collaboration, and sustainable service delivery. Given the increasing complexity of transit ecosystems and the growing dependence on interconnected digital infrastructures, transit agencies must adopt proactive measures to maximize the value derived from global IT resources while minimizing associated risks.

Strengthening IT Governance and Strategic Alignment

Public transit agencies should establish robust IT governance frameworks that ensure alignment between organizational goals, transportation policies, and technology investments. Effective governance structures facilitate accountability, strategic decision-making, and optimal allocation of IT resources across geographically dispersed transit systems. Lazar (2019) emphasized that successful management of global IT resources depends largely on governance mechanisms that coordinate technological assets, business objectives, and stakeholder expectations. Consequently, transit agencies should institutionalize enterprise-wide governance committees, standardized policies, and performance measurement systems to monitor IT investments and outcomes.

Moreover, portfolio and program management methodologies should be adopted to prioritize digital initiatives according to strategic importance, financial viability, and anticipated service benefits. Portfolio-based approaches enable transit authorities to balance innovation initiatives with operational stability while reducing project redundancies and implementation risks (MacNicol et al., 2012).

Enhancing Cybersecurity and Digital Resilience

As public transit increasingly relies on connected devices, cloud platforms, and Internet of Things (IoT) infrastructures, cybersecurity must become a strategic priority rather than a purely technical concern. The proliferation of smart ticketing systems, real-time vehicle tracking, and integrated passenger information platforms significantly expands the attack surface of transit systems (Cheruvu et al., 2020).

Transit agencies should adopt zero-trust security architectures, multi-factor authentication, continuous

network monitoring, and advanced threat detection mechanisms to safeguard critical infrastructures. Additionally, periodic vulnerability assessments, security audits, and incident response simulations should be institutionalized to improve organizational preparedness. Since transit operations constitute critical public infrastructure, cybersecurity strategies should also incorporate resilience planning to ensure service continuity during cyber incidents or operational disruptions (Cheruvu et al., 2020).

Future research should investigate cybersecurity governance models specifically designed for large-scale public transit ecosystems characterized by heterogeneous technologies and multiple stakeholders.

Establishing Comprehensive Data Governance Frameworks

Data has become strategic organizational assets in modern transit systems. The increasing deployment of sensors, mobile applications, automated fare collection systems, and passenger information services generates enormous volumes of structured and unstructured data. However, uncertainties regarding data ownership, interoperability, quality, and privacy continue to challenge effective utilization within the public sector (Klievink et al., 2017).

Transit agencies should establish enterprise data governance frameworks that clearly define data stewardship responsibilities, data-sharing protocols, quality standards, and privacy safeguards. Standardized metadata architectures and interoperable data platforms can significantly improve information exchange among transit operators, municipal authorities, and external service providers (Shin, 2016).

Future studies should explore scalable governance models for managing multimodal transit data across regional, national, and international transit networks while simultaneously addressing ethical and regulatory concerns.

Promoting Smart Digitalization and Emerging Technologies

The ongoing fourth wave of digitalization presents unprecedented opportunities for enhancing operational efficiency, passenger experience, and sustainability within public transportation systems (Davidsson et al., 2016). Therefore, transit agencies should strategically invest in emerging technologies such as artificial intelligence, natural language processing (NLP), edge computing, cloud computing, and predictive analytics.

Artificial intelligence can improve demand forecasting, predictive maintenance, and dynamic route optimization, while NLP applications can facilitate multilingual passenger communication, intelligent chatbots, and accessible transit information systems (Tyagi & Bhushan, 2023). Furthermore, advanced analytics platforms can support evidence-based planning and service optimization, thereby improving operational efficiency and transit accessibility (Wei et al., 2017).

Nevertheless, technology adoption should be guided by clearly defined organizational objectives and supported by rigorous cost-benefit analyses to avoid technological overinvestment or fragmented implementation. Research efforts should focus on evaluating the long-term impacts of artificial intelligence, NLP, and autonomous mobility technologies on transit performance and user satisfaction.

Expanding Public–Private Partnerships and Collaborative Ecosystems

Given persistent budgetary constraints facing many U.S. transit agencies, collaborative partnerships between public institutions and private organizations are increasingly essential for technology modernization. Public–private partnerships (PPPs) can facilitate access to financial resources, technical expertise, innovation capabilities, and global technology markets (Olatunji et al., 2016).

Transit agencies should establish transparent partnership frameworks that clearly define stakeholder responsibilities, risk-sharing arrangements, performance metrics, and accountability mechanisms. Such partnerships are particularly valuable for implementing advanced mobility solutions, smart fare systems, and integrated digital platforms. The successful deployment of emerging transit technologies, including personal rapid transit systems, also requires multi-stakeholder collaboration involving governments, technology vendors, operators, and users (Ghani et al., 2025).

Future research should investigate governance mechanisms that optimize collaboration among diverse stakeholders while ensuring public value creation and equitable service delivery.

Investing in Workforce Development and Change Management

Technological transformation within public transit organizations cannot succeed without adequately skilled personnel. The increasing sophistication of digital infrastructures necessitates continuous workforce development programs focusing on cybersecurity, data analytics, cloud management, artificial intelligence, and digital governance.

Transit agencies should establish comprehensive training programs, interdisciplinary learning initiatives, and professional certification pathways to strengthen organizational digital capabilities. Equally important is the implementation of structured change management strategies that facilitate employee adaptation to new technologies and operational processes. According to Lazar (2019), effective management of global IT resources depends not only on technological capabilities but also on human competencies and organizational readiness.

Future studies should examine the relationship

between workforce digital competencies and transit system performance outcomes.

Advancing Sustainable, Equitable, and Resilient Transit Systems

Future transit modernization initiatives should prioritize sustainability, service equity, and resilience. Digital technologies should be deployed in ways that enhance accessibility for underserved populations while supporting environmental sustainability goals. Studies have demonstrated that improved transit accessibility contributes significantly to operational efficiency and social inclusion (Lee & Miller, 2018; Wei et al., 2017).

Moreover, lessons learned from the COVID-19 pandemic underscore the importance of resilient transit systems capable of adapting to sudden disruptions in travel demand and operational conditions (Liu et al., 2020). Transit agencies should therefore develop adaptive service models supported by real-time analytics and flexible digital infrastructures.

Research should further explore how digital transformation can contribute to a renewed public transit renaissance characterized by improved service quality, accessibility, sustainability, and customer satisfaction (Shaheen & Cohen, 2018). Additionally, future investigations should assess how service management innovations can support sustainable mobility objectives within increasingly complex urban transportation ecosystems (Bhuyan et al., 2024; Verbich et al., 2017).

Overall, the future of global IT resource management in the U.S. public transit sector will depend on the ability of transit agencies to integrate governance, innovation, cybersecurity, human capital, and stakeholder collaboration into a cohesive and adaptive digital transformation strategy.

Conclusion

In the United States, managing global IT resources is a strategic need for public transit agencies as they deal with the growing digitalization of their operations, shifting passenger expectations, complexities, and new technologies that are disrupting the field. This study shed light on the key challenges public transit organizations face in managing global IT resources, as well as how governance structures, digital technologies, cyber security, data management, service delivery and organizational capabilities interact. The results show that in addition to technology acquisition, it is necessary to have a comprehensive alignment between IT strategies and the organization's objectives, adequate governance systems and foreseeable investments in human and infrastructural capacities for effective management of global IT resources (Lazar, 2019).

The analysis has shown that the world of public transportation is undergoing a digital transformation, and that this transformation opens up a number of opportunities to enhance the efficiency, reliability, accessibility, and passenger experience of the system (Davidsson et al., 2016; Tyagi & Bhushan, 2023). Such technologies can be used to enable smart transportation systems that can monitor, predict, schedule, and inform decisions based on evidence in real time. The growing reliance upon inter-connected digital infrastructures, however, presents significant interoperability, system integration, vendor dependency and technological complexity management challenges (Ghani et al., 2025; Ashok & Hallur, 2023).

Data governance and organizational readiness is one of the key problems found in this study. Public transit agencies collect tons of data about their operations and passengers, but many organizations still have data quality, ownership, integration and analytical readiness issues. The risks of big data adoption highlight the need for a governance framework at the enterprise level that allows for the accurate use of data, its accessibility, privacy and strategic use (Klievink et al., 2017; Shin, 2016). Likewise, security in the digital realm has become a major concern in the context of the growing number of Internet of Things (IoT) devices and digital platforms in transit environments. The security and resilience of these interconnected systems are critical to protecting the information of passengers, maintaining uninterrupted transport operations and protecting critical infrastructure (Cheruvu et al., 2020).

The study also confirmed that good portfolio and programme management can prioritise investments, optimise resource allocation and manage innovation and organisation risk, enabling the effective management of global IT resources, thus supporting sustainable management (MacNicol et al., 2012). Public-private partnerships are also significant financing and deployment mechanisms for advanced transit technologies, but they require transparent governance structures and well-defined roles, and equitable stakeholder engagement (Olatunji et al., 2016). Furthermore, sustainability aspects of mobility goals need to be aligned with service management considerations, such as operational efficiency, accessibility and equity, in order to make an impact for the achievement of sustainable mobility goals through technological innovation (Bhuyan et al., 2024; Wei et al., 2017).

The COVID-19 pandemic has exposed the fragilities of public transport facilities and the importance of resilient, adaptive and digitally enabled infrastructures that are able to serve evolving travel patterns and service needs in a timely fashion (Liu et al., 2020). Transit agencies must continue to adopt a comprehensive digital approach that facilitates service innovation, makes services more accessible, and increases the performance of the system – all while being cost-effective and delivering value to their public customers (Shaheen & Cohen, 2018; Verbich et al., 2017). Efforts to modernize transit technologies must be paired with robust governance regimes, training programs, and on-going organizational learning.

Ultimately, agencies' robust management of global IT resources in a dynamic and interdependent environment

will be crucial to the success of public transit in the United States. By strengthening IT governance, enhancing cybersecurity capabilities, promoting data-driven decision-making, fostering collaborative partnerships, and prioritizing equitable service delivery, transit agencies can build resilient and sustainable transportation ecosystems that improve mobility outcomes and support broader smart city objectives (Lee & Miller, 2018; Davidsson et al., 2016). Effective management of global IT resources is therefore not merely a technological necessity but a foundational requirement for achieving long-term public transit transformation and sustainable urban mobility.

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