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AI-Enabled Communication Infrastructure for Enhancing Coordination Efficiency in U.S. Trucking and Freight Logistics

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ABSTRACT: The U.S. trucking and freight logistics industry plays a critical role in supporting economic activity and maintaining the efficient movement of goods across national supply chains. Despite its significance, there is a persistent challenge in communication and coordination in the sector that leads to operational inefficiencies, delays in shipments, high operating costs and lack of supply chain visibility. Recent developments in artificial intelligence (AI) have created new opportunities to improve communication processes and enhance coordination between key logistics stakeholders, including shippers, carriers, brokers, dispatchers and drivers.

This paper provides an overview of how AI-powered communication tools can improve the efficiency of coordination in U.S. trucking and freight logistics operations. The study explores current literature using a narrative literature review approach for Natural Language Processing, Machine Learning, Internet of Things (IoT) telematics, predictive analytics, automated dispatch systems, and digital freight communication platforms. The review assesses the role of these technologies in enabling real-time information exchange, enhancing the visibility of the operations, minimizing delays in communication and strengthening decision-making across freight networks.

The results suggest that AI-powered communication systems can have a significant impact on logistics operations by minimizing administrative tasks, improving load matching accuracy, boosting logistics visibility, and providing proactive solutions to disruptions. However, challenges related to data interoperability, cybersecurity, regulatory uncertainty, workforce adaptation and implementation costs continue to influence adoption outcomes. Overall, the paper finds that the U.S. freight sector has significant potential to gain from the use of AI-enabled communication infrastructure to enhance the efficiency of coordination and increase supply chain resilience. These benefits will take time to be realised and will need ongoing investment in digital infrastructure, industry partnerships, good governance structures, and human-centered systems design.

KEYWORDS: Freight logistics; Artificial intelligence; Communication infrastructure; Trucking coordination efficiency; Supply chain digital transformation

1. INTRODUCTION

The United States trucking industry has undergone a profound transformation over more than a century of evolution, moving from horse-drawn wagons and early motor vehicles in the early twentieth century to a sector that now serves as a critical component of the national economy and freight transportation system (ATA, 2023). The passage of the Federal Aid Road Act of 1916 established the federal-aid highway program and provided the foundation for the development of a national road network that supported the expansion of commercial trucking operations (Weingroff, 2017). By the mid-twentieth century, trucking had become the dominant mode of freight transportation for many forms of domestic cargo requiring flexible and time-sensitive delivery services.

A major turning point occurred with the passage of the Motor Carrier Act of 1980, which substantially deregulated the trucking industry by reducing entry barriers and increasing competition among carriers. Deregulation contributed to the growth of a highly fragmented carrier market structure and accelerated changes in freight pricing, service offerings, and market participation (Ellig, 2020). While these changes improved transportation efficiency and expanded service options for shippers, they also increased the complexity of communication and coordination across freight networks consisting of thousands of carriers, brokers, shippers, and logistics providers (ATA, 2023).

The 1990s and early 2000s witnessed the growing adoption of transportation management systems, electronic data interchange, and enterprise logistics software that improved freight planning, shipment management, and documentation processes (Speranza, 2018). However, many of these technologies operated in isolation and were not designed to support real-time information exchange across organizational boundaries, limiting end-to-end visibility throughout freight networks (Heinbach et al., 2022).

More recently, advances in artificial intelligence, machine learning, natural language processing, Internet of Things (IoT) technologies, and cloud computing have created new opportunities to improve communication, visibility, and coordination across freight operations. These technologies enable organizations to process large volumes of operational data, support faster decision-making, and enhance responsiveness to changing transportation conditions (Ben-Daya et al., 2019; Choi et al., 2018). As a result, AI-enabled communication systems are increasingly viewed as a potential solution to longstanding coordination and information-sharing challenges within the U.S. freight logistics industry.

Advances in artificial intelligence (AI) have created new opportunities for improving efficiency, visibility, and decision-making across supply chain and logistics operations. As the supply chain has become more complex and uncertain, organizations have started using AI-powered tools to help them better handle demand forecasting, route optimization, inventory management, and risk mitigation over the last decade (Baryannis et al., 2019; Choi et al., 2018). These developments have attracted considerable attention from both researchers and industry practitioners seeking more effective ways to manage large-scale logistics networks.

In the trucking and freight logistics industry, communication and coordination are one area where AI technologies are increasingly being incorporated. Incorporating technologies like natural language processing, machine learning, predictive analytics, and Internet of Things (IoT) in telematics allows organizations to capture, analyze, and share operational data in real-time (Queiroz et al., 2022). Consequently, freight stakeholders will be better prepared to act faster and more effectively in the event of disruption, to have more visibility of shipments, and to make more informed operational decisions.

These technologies are not intended to replace human decision makers, but are best suited to assist dispatchers, brokers, fleet managers and drivers in a more sophisticated logistics environment (Queiroz et al., 2022; Choi et al., 2018). AI tools can streamline repetitive data sharing, identify potential disruptions before they happen and enhance coordination results, ultimately ensuring that organizations make better use of their resources (Baryannis et al., 2019).

As AI technologies continue to be embraced, the focus has moved to the communication aspect of freight logistics, where the lack of timely information sharing often leads to operational inefficiencies and service disruptions (Heinbach et al., 2022; Choi et al., 2018). There has been significant research on the use of AI in transportation, supply chain management, route optimization, and inventory management, but few studies have specifically addressed the role of AI in communication infrastructure and how it can affect coordination among freight stakeholders (Baryannis et al., 2019). Efficient freight movement, reliable supply chains, and operational resilience in increasingly complex logistics remain dependent on effective communication.

The research on artificial intelligence applied to logistics and supply chain management has grown significantly in recent years, with considerable focus on demand forecasting, route optimization, warehouse automation, inventory management, and risk mitigation (Ben-Daya et al., 2019). However, less attention has been paid to how AI can support communication and coordination between the various stakeholders in freight transport. The communication processes among shippers, carriers, brokers, dispatchers, and drivers remain relatively under-researched, despite widespread recognition that communication delays and information gaps are primary drivers of inefficiency in freight operations (Heinbach et al., 2022).

Furthermore, the challenges of interoperability, data governance, cybersecurity, workforce adaptation, and regulatory compliance in the context of AI communication adoption are insufficiently addressed in the existing literature. This paper addresses that gap by examining how AI-powered communication systems can improve coordination efficiency in U.S. trucking and freight logistics. It explores key AI technologies applied to freight communication, their roles in coordination and operational performance, associated implementation challenges, and their implications for supply chain resilience and long-term competitiveness. The paper also provides targeted recommendations for practitioners and policymakers seeking to accelerate responsible AI communication adoption across the freight sector.

2. CORE AI TECHNOLOGIES TRANSFORMING FREIGHT COMMUNICATION

Artificial Intelligence is being widely used in freight transport and logistics to increase the efficiency of information flow in terms of its speed, accuracy, and quality. In contrast to conventional communication systems that merely convey information, AI-driven systems can process vast amounts of operational data, detect patterns, draw insights and offer recommendations, and facilitate timely decision-making (Baryannis et al., 2019). They are especially useful in freight logistics, where the information needed to coordinate logistics is continually changing and includes details about shipment status, available carrier capacity, traffic conditions, customer needs, and regulatory requirements.

Advances in machine learning, natural language processing, predictive analytics and Internet of Things (IoT) technology have expanded the ability for logistics organizations to automate communication processes and enhance operational transparency (Choi et al., 2018; Heinbach et al., 2022). These technologies are not designed to make decisions for drivers, but rather to aid dispatchers, brokers, fleet managers, and drivers by providing timely insights and alleviating administrative burdens (Queiroz et al., 2022).

2.1 Machine Learning and Predictive Analytics

Machine learning is among the most common AI applications in the logistics and transportation industry. Machine learning algorithms analyze historical and real-time operational data to detect patterns and predict future events, enabling more informed decisions about freight networks (Baryannis et al., 2019; Ivanov & Dolgui, 2020). In freight logistics, predictive analytics is applied to forecast shipment delays, estimate arrival times, identify capacity constraints, and detect potential disruptions before they escalate, allowing proactive rather than reactive communication among carriers, brokers, and shippers (Baryannis et al., 2019).

Machine learning models also help coordinate by assisting in better load planning and resource allocation. Predictive tools align freight demand with capacity, optimize routing decisions, and enhance scheduling efficiency, instead of relying on historical experience or manual judgment (Joerss et al., 2016). The practical effect is that communication among supply chain participants becomes timelier, data-driven, and responsive to operational realities. However, the impact of predictive analytics is critically dependent on data quality and availability. Poor data governance can degrade model performance and produce unreliable insights that undermine rather than support coordination (Heinbach et al., 2022).

2.2 Natural Language Processing and Automated Communication Systems

Natural language processing (NLP) enables AI systems to interpret, process, and generate human language, allowing organizations to automate communication tasks that traditionally require significant human effort (Jurafsky & Martin, 2023). In freight logistics, NLP applications include customer service communications, load tender processing, dispatch communications, shipment tracking inquiries, and freight documentation management. As digital freight platforms have expanded, NLP systems have become increasingly important for extracting relevant information from communication channels and converting unstructured data into actionable operational insights (Heinbach et al., 2022).

Conversational AI technologies such as chatbots and virtual assistants represent one of the most practical NLP applications in freight logistics. These systems can handle shipment tracking, routine carrier inquiries, appointment scheduling, and standard dispatch tasks with minimal human intervention, improving information visibility and reducing administrative workloads (Choi et al., 2018; Baryannis et al., 2019).

While NLP can streamline communication and support decision-making, successful implementation depends on addressing challenges related to language ambiguity, industry-specific terminology, data privacy, cybersecurity, and user trust (Jurafsky & Martin, 2023).

2.3 Internet of Things (IoT), Telematics, and Real-Time Visibility Systems

Ben-Daya et al. (2019) defined the IoT systems as a set of interconnected sensors, devices, and communication networks that allow people or physical assets to communicate with each other continuously, both with digital platforms and with physical assets. In freight transportation, these technologies support real-time tracking of vehicles, cargo conditions, fuel consumption, driver behavior, and route performance. By automatically transmitting shipment information, telematics systems reduce reliance on manual status reporting and improve visibility across freight networks.

Visibility is essential for effective supply chain coordination. Access to timely and accurate transportation data enables carriers, brokers, and shippers to make more informed decisions regarding scheduling, routing, and resource allocation, improving responsiveness to operational disruptions (Queiroz et al., 2022).

Realizing the full benefits of IoT-enabled visibility systems requires addressing several implementation barriers. Data security, system interoperability, and integration complexity continue to limit adoption (Ben-Daya et al., 2019). The growing connectivity of IoT-enabled logistics systems also increases cybersecurity and data governance concerns, particularly as telematics platforms become more deeply integrated into AI-enabled communication infrastructure (NIST, 2018; NIST, 2020).

2.4 Predictive Analytics and Prescriptive Communication

Predictive analytics enables freight stakeholders to anticipate disruptions before they occur, shifting communication from a reactive to a proactive process. AI systems can forecast arrival time deviations based on historical route performance, traffic conditions, weather forecasts, and shipment schedules, allowing downstream operations to adjust schedules and resource allocation in advance (Joerss et al., 2016). Prescriptive systems extend this capability by recommending operational responses such as rerouting drivers, rescheduling deliveries, and automatically notifying logistics partners of changing conditions (Choi et al., 2018). These capabilities improve coordination by ensuring that stakeholders receive actionable information before disruptions affect operations.

The effectiveness of these systems depends not only on technological capability but also on their integration into organizational processes. Technology investments deliver the greatest benefits when supported by appropriate workflows, information-sharing practices, and stakeholder collaboration (Christopher, 2016; Ivanov et al., 2019).

3. THE COMMUNICATION PROBLEM IN U.S. FREIGHT LOGISTICS

3.1 Structural Fragmentation and Legacy Systems

Efficient freight transportation depends on the timely exchange of information among shippers, carriers, brokers, warehouse operators, and drivers. However, communication across the freight sector remains highly fragmented. Many organizations still rely on a combination of phone calls, emails, spreadsheets, and legacy transportation management systems that operate in isolation from one another (Heinbach et al., 2022; Sheffi, 2015). As a result, operational information is often delayed, duplicated, or unavailable when needed.

This challenge is compounded by the structure of the U.S. trucking industry, which consists of a large number of carriers with varying fleet sizes and technological capabilities (ATA, 2023; U.S. DOT, 2020). Differences in software platforms, data standards, and communication protocols make seamless information exchange difficult and often require manual data transfers between systems.

Research consistently identifies information sharing and visibility as critical determinants of supply chain performance. Effective coordination depends not only on the movement of goods but also on the timely exchange of accurate information among supply chain participants (Ben-Daya et al., 2019). Fragmented communication systems therefore reduce operational agility and limit the ability of organizations to respond effectively to disruptions (Speranza, 2018; Samuels, 2025). These challenges demonstrate that communication inefficiencies in freight logistics are both technological and structural in nature.

3.2 Quantifiable Costs of Communication Failure

Communication inefficiencies in freight logistics have significant economic and operational consequences. Poor information sharing, information asymmetry, and fragmented communication can reduce coordination efficiency, increase operational uncertainty, and contribute to supply chain disruptions (Christopher, 2016; Sheffi, 2015). Because freight transportation depends on continuous information exchange among multiple stakeholders, communication failures often translate directly into higher costs and lower service quality (Heinbach et al., 2022).

One of the most visible consequences is reduced operational efficiency. Congestion-related delays, excess fuel consumption, and poor coordination of routing and scheduling continue to impose substantial costs on the trucking industry (Sheffi, 2015; Choi et al., 2018). As shown in Figure 1, congestion-related delay hours for U.S. trucking increased significantly over the past decade, highlighting the growing operational burden associated with inefficiencies in freight movement and coordination. Communication challenges also contribute to poor asset utilization. Industry analysis suggests that roughly one-third of truck miles in the United States are driven empty, partly due to limited visibility and difficulties matching freight demand with available carrier capacity (Kapadia, 2019).

Additional inefficiencies occur during freight pickup and delivery operations. Extended dwell times at warehouses and distribution centers reduce driver productivity, while persistent tender rejection rates indicate continuing supply-demand mismatches within freight markets (ATRI, 2021; Wingfield, 2025). Collectively, these findings suggest that communication failures affect not only information exchange but also asset utilization, labor productivity, transportation costs, and overall supply chain resilience (Christopher, 2016).

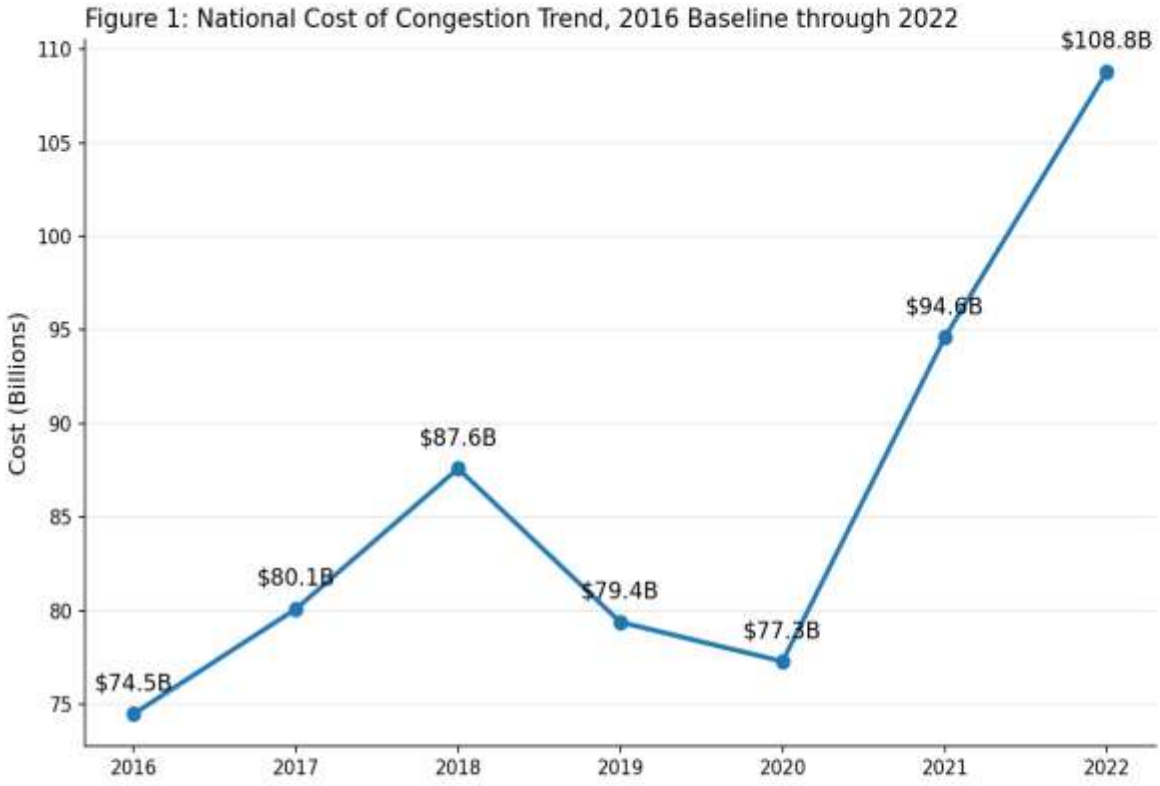

Figure 1: National Cost of Congestion Trend, 2016 Baseline through 2022. Adapted from ATRI (2024).

3.3 Information Asymmetry and Coordination Failure Dynamics

Information asymmetry occurs when freight stakeholders possess different levels of information regarding freight availability, transportation capacity, shipment status, delivery requirements, or operational constraints (Heinbach et al., 2022). Carriers, shippers, and brokers often have access to different pieces of operational information, making effective coordination dependent on timely communication and information sharing (Ben-Daya et al., 2019).

When information is incomplete, delayed, or unevenly distributed, coordination becomes more difficult and operational efficiency declines. Poor visibility of shipment status, capacity availability, and changing transportation conditions can lead to scheduling problems, inefficient routing decisions, missed delivery windows, and increased transaction costs (Heinbach et al., 2022; Speranza, 2018). These challenges are particularly significant in freight networks where decisions must be made rapidly under conditions of uncertainty.

Research consistently shows that greater visibility and timely communication improve supply chain coordination, resource utilization, and responsiveness to disruptions (Ben-Daya et al., 2019; Choi et al., 2018). As freight networks generate increasing volumes of operational data, organizations require communication systems capable of delivering accurate, timely, and actionable information to the appropriate stakeholders. The quality and visibility of information therefore remain central to improving coordination efficiency in modern freight logistics systems (Ben-Daya et al., 2019; Choi et al., 2018).

4. AI-ENABLED DISPATCH, BROKERAGE, AND COORDINATION PLATFORMS

4.1 Autonomous Dispatch Systems

Dispatch is one of the most communication-intensive functions in freight transportation, requiring continuous coordination among dispatchers, drivers, shippers, receivers, and warehouse personnel. Traditional dispatch operations rely heavily on phone calls, emails, and manual record-keeping, creating scalability challenges and increasing the risk of communication failures during high-volume periods. AI-enabled dispatch platforms address these limitations by using machine learning and optimization algorithms to automate load assignments, scheduling, and resource allocation. These systems can account for factors such as hours-of-service regulations, equipment compatibility, driver preferences, appointment schedules, and network-wide operational objectives (Heinbach et al., 2022; Ben-Daya et al., 2019).

AI-enabled dispatch systems have been shown to improve operational responsiveness by supporting faster information processing, optimized resource allocation, and real-time decision support (Ben-Daya et al., 2019). Similarly, Choi et al. (2018) reported that intelligent transportation systems improve responsiveness by reducing information-processing time and providing real-time operational recommendations. These technologies primarily function as decision-support tools, enabling dispatchers to manage increasingly complex transportation networks while maintaining human oversight of critical decisions.

The successful deployment of autonomous dispatch systems depends on data quality, system integration, workforce acceptance, and regulatory compliance (Ben-Daya et al., 2019; Ivanov et al., 2019). Organizations must therefore balance technological capability with human judgment to ensure that AI-generated recommendations align with operational requirements, safety considerations, and business objectives.

4.2 Digital Freight Brokerage Platforms

Freight brokerage is one of the most communication-intensive areas of the transportation industry, requiring continuous coordination between shippers and carriers in response to changing market conditions. Digital freight matching platforms use dynamic pricing algorithms, predictive matching models, and automated communication tools to streamline the load-booking process (Heinbach et al., 2022). By automating routine information exchanges, these platforms allow brokers to focus on exception management, customer relationships, and strategic decision-making. Platforms that learn from historical interactions can also improve match quality and reduce administrative inefficiencies over time (Heinbach et al., 2022).

Digital brokerage platforms enhance market transparency by aggregating information on freight demand, carrier availability, pricing, and service performance. However, technology alone does not guarantee improved outcomes. Quality management systems that support performance monitoring, communication accuracy, and continuous improvement are essential for sustaining efficiency gains from AI-enabled brokerage platforms (Christopher, 2016; Adjei et al., 2026).

As digital freight marketplaces continue to expand, issues related to data ownership, pricing transparency, platform governance, and competitive fairness are likely to become increasingly important. Addressing these concerns will help ensure that the benefits of AI-enabled brokerage systems are distributed more broadly across the freight ecosystem.

4.3 Multi-Party Visibility and Network Communication Platforms

Modern freight operations involve far more than bilateral communication between shippers and carriers. A single shipment may require coordinated information exchange among brokers, warehouse operators, third-party logistics providers, port authorities, customs brokers, and end consignees. Multi-party visibility platforms address this complexity by aggregating data from transportation management systems, telematics devices, freight marketplaces, warehouse systems, and customer platforms into a shared information environment (Heinbach et al., 2022). These platforms provide authorized stakeholders with role-specific information while maintaining a common operational view across the supply chain.

Enhanced visibility improves situational awareness, reduces information delays, and enables stakeholders to respond more effectively to changing operational conditions (Choi et al., 2018). Improved information sharing also supports better resource utilization and coordination across freight networks (Ben-Daya et al., 2019).

As transportation and warehousing systems become increasingly interconnected, multi-party visibility platforms create opportunities for predictive communication, automated decision support, and network-wide coordination. Consequently, they are emerging as an important foundation for AI-enabled freight communication systems (Ivanov et al., 2019; Ivanov, 2021).

5. REGULATORY FRAMEWORKS AND AI GOVERNANCE IN FREIGHT COMMUNICATION

5.1 The Current Regulatory Landscape

The regulatory landscape for AI-powered communication systems in U.S. freight logistics was largely developed before the emergence of semi-autonomous and autonomous decision-making technologies. Existing Federal Motor Carrier Safety Administration (FMCSA) regulations governing driver hours-of-service, vehicle safety, electronic logging devices, and carrier qualification increasingly intersect with AI-supported dispatch and communication systems, raising new questions regarding accountability and compliance (U.S. DOT, 2020). As AI assumes a greater role in operational planning, organizations must determine how existing regulatory requirements apply when algorithmic recommendations influence decisions traditionally made by human dispatchers and brokers.

The growing adoption of AI has increased attention on governance and compliance. AI systems should be designed with auditability, transparency, and compliance monitoring capabilities from the outset. Similar principles are reflected in the OECD Principles on Artificial Intelligence and the NIST AI Risk Management Framework, which emphasize accountability, transparency, and responsible stewardship throughout the AI lifecycle (OECD, 2019; NIST, 2023). The NIST Privacy Framework likewise highlights the importance of governance mechanisms for managing risks associated with increasingly data-driven technologies (NIST, 2020).

As AI becomes more deeply embedded in routing, scheduling, load assignment, and pricing decisions, governance mechanisms that support accountability, explainability, and regulatory compliance will become increasingly important (OECD, 2019). Human oversight, documentation practices, and transparent decision-support processes are therefore likely to remain essential components of responsible AI-enabled freight communication systems.

5.2 Data Privacy, Security, and Liability Frameworks

Data governance is a major challenge for AI-powered freight communication platforms because these systems rely on large volumes of operational data, including shipment information, carrier activity, driver performance, and pricing records. As organizations increasingly collect and share data across connected platforms, concerns relating to privacy, data ownership, and regulatory compliance become more significant. The NIST Privacy Framework emphasizes the importance of embedding privacy risk management into system design to ensure responsible data collection, processing, and sharing (NIST, 2020).

Cybersecurity and liability present additional governance concerns. The growing use of telematics devices, IoT sensors, cloud platforms, and AI tools increases exposure to cybersecurity risks, making system protection, threat detection, and incident response essential components of governance (NIST, 2018). Questions of accountability also arise when AI-supported decisions contribute to operational failures or safety incidents. In such situations, explainability becomes critical because stakeholders must understand how recommendations were generated. Doshi-Velez and Kim (2017) and Arrieta et al. (2020) identify explainability as a key requirement for accountability, transparency, and stakeholder trust in AI-enabled systems.

6. BARRIERS TO ADOPTION AND IMPLEMENTATION CHALLENGES

6.1 Technical Interoperability and Data Standardization

Technical interoperability remains one of the most significant barriers to widespread AI communication adoption in freight logistics. Carriers, brokers, shippers, and logistics providers have adopted digital technologies built on different data formats, communication protocols, and software architectures, making seamless information exchange across organizations difficult (Speranza, 2018). Transportation management systems, telematics platforms, and enterprise applications often operate in isolation, limiting the ability of AI communication systems to access consistent and reliable data.

Samuels (2025) identifies interoperability with legacy systems as a persistent barrier to digital supply chain transformation, arguing that progress requires industry-wide agreement on common data standards and communication structures. Achieving this goal will require not only technical standardization but also collaboration among logistics providers, technology vendors, and regulators to support data sharing across organizational boundaries.

6.2 Workforce Adaptation and Driver Experience

Workforce adaptation remains an important challenge for the successful implementation of AI-enabled communication systems in freight logistics. While these technologies can improve information sharing and reduce administrative burdens, their effectiveness ultimately depends on user acceptance. Drivers, dispatchers, and brokers may need to adjust established work practices and communication routines as AI becomes more integrated into daily operations (Sriwichien & Wisaeng, 2026).

Driver adoption is particularly important because AI-generated recommendations may not always align with real-world operating conditions. Transportation technologies are most effective when they support rather than replace human judgment (Sheffi, 2015). Recent studies also highlight workforce engagement, organizational readiness, and trust as important factors influencing technology adoption (Sriwichien & Wisaeng, 2026). Consequently, successful implementation requires training, employee engagement, and user-centered system design.

6.3 Capital Constraints, Small Carrier Exclusion, and Equity

Financial barriers continue to limit the adoption of AI-enabled communication systems across large segments of the U.S. trucking industry. Costs associated with telematics devices, in-cab technologies, software licensing, system integration, and workforce training can be substantial, particularly for small carriers operating with limited financial resources (ATRI, 2021; Speranza, 2018). While large carriers are often able to implement AI technologies at scale, smaller operators may lack the capital and technical expertise required to adopt and maintain advanced digital systems, creating disparities in access to efficiency-enhancing technologies (Christopher, 2016).

Software-as-a-service (SaaS) models have improved accessibility by reducing upfront investment requirements, but recurring subscription costs can still present challenges for owner-operators and small fleets. Collaborative approaches, including shared technology platforms and industry partnerships, can help expand access to digital freight technologies (U.S. DOT, 2020). Broader adoption among smaller carriers will be important to ensure that the benefits of AI-enabled communication systems are distributed across the freight sector rather than concentrated among a limited number of large operators.

6.4 Change Management, Trust, and Organizational Readiness

Technical and financial barriers are often compounded by organizational readiness challenges. Companies accustomed to established communication practices may lack the digital literacy, change management capabilities, and leadership support required to implement AI-enabled communication systems effectively. Digital logistics technologies generate the greatest value when integrated into routine business processes rather than deployed as standalone solutions (Ivanov et al., 2019). Successful adoption therefore requires workflow redesign, employee training, and organizational commitment.

Trust is also critical to adoption. Employees are more likely to embrace AI technologies when they understand their purpose, limitations, and value within existing operations. Recent research suggests that workforce engagement and organizational readiness are important determinants of successful technology adoption (Sriwichien & Wisaeng, 2026). As a result, AI communication adoption should be viewed not simply as a technology initiative but as an organizational transformation process combining technological change, workforce engagement, and effective leadership.

Table 1: Summary of Key Findings from the Review

Theme	Key Finding	Implication for U.S. Freight Logistics	Representative Sources
AI Communication Technologies	Machine learning, NLP, predictive analytics, and IoT enhance information flow and decision support.	Improves visibility, coordination, and operational responsiveness.	Ben-Daya et al. (2019); Jurafsky & Martin (2023); Choi et al. (2018)
Communication Inefficiencies	Fragmented systems and information asymmetry continue to hinder coordination.	Contributes to delays, empty miles, congestion, and poor asset utilization.	Christopher (2016); ATA (2023); ATRI (2021)
Autonomous Dispatch Systems	AI-supported dispatches improve scheduling, resource allocation, and real-time decision-making.	Enhances service reliability and operational efficiency.	Ben-Daya et al. (2019); Choi et al. (2018)
Digital Freight Matching	Digital brokerage platforms improve carrier-load matching and market transparency.	Reduces communication delays and improves capacity utilization.	Heinbach et al. (2022)

Governance and Compliance	AI adoption requires explainability, accountability, privacy protection, and cybersecurity safeguards.	Supports responsible deployment and regulatory compliance.	OECD (2019); NIST (2020, 2023); Arrieta et al. (2020)
Interoperability	Lack of common data standards remains a major barrier.	Limits network-wide benefits of AI communication systems.	Speranza (2018); Samuels (2025)
Workforce Adaptation	Successful implementation depends on user trust, training, and organizational readiness.	Improves workforce acceptance and technology utilization.	Sheffi (2015); Sriwichien & Wisaeng (2026)
Sustainability and Competitiveness	AI-enabled communication can reduce inefficiencies and support long-term resilience.	Strengthens competitiveness while supporting sustainability goals.	Christopher (2016); Sheffi (2015)

Source: Author's synthesis based on the reviewed literature.

7. DISCUSSION AND INDUSTRY IMPLICATIONS

7.1 Convergent Evidence for AI Communication Efficiency

Communication systems can significantly improve coordination and information flow within freight logistics networks. Improvements in shipment visibility, information exchange, predictive decision-making, and communication automation collectively address longstanding inefficiencies that contribute to delays, underutilized capacity, and service disruptions (Christopher, 2016; Choi et al., 2018). Taken together, the literature indicates that communication has evolved from an operational support function into a strategic capability underpinning modern freight systems.

Further evidence indicates that the primary value of AI lies not in replacing human involvement but in improving the quality and timeliness of operational decisions. By transforming large volumes of transportation data into actionable insights, AI systems enable organizations to respond more effectively to changing conditions and operational disruptions (Sheffi, 2015). This shift from reactive communication toward predictive and data-driven coordination may represent one of the most significant transformations currently occurring in freight logistics.

7.2 Distributional Dynamics, Equity, and Market Concentration

A recurring theme across literature is that the benefits of AI-enabled communication systems are unlikely to be distributed evenly across the freight sector. Larger carriers and logistics providers often possess greater financial resources, more extensive data assets, and stronger digital capabilities, allowing them to adopt and scale AI technologies more rapidly than smaller operators (ATA, 2023). As a result, disparities in technology adoption may contribute to differences in operational efficiency and competitive performance across the industry.

The literature also highlights the importance of considering workforce impacts alongside technological advancement. Sheffi (2015) emphasizes that digital logistics technologies should support users rather than replace their expertise. Similarly, Sriwichien and Wisaeng (2026) find that behavioral factors such as performance expectancy and organizational readiness jointly shape AI adoption outcomes across sectors and stakeholder groups. These findings suggest that efforts to expand access to digital infrastructure, support technology adoption among smaller carriers, and design systems that complement workforce capabilities will be important for ensuring that the benefits of AI-enabled communication systems are shared more broadly across the freight ecosystem.

7.3 The Interoperability Imperative and Standards Governance

The findings of this review suggest that interoperability remains a critical requirement for realizing the full benefits of AI-enabled communication in freight logistics. While individual organizations may achieve efficiency gains through AI adoption, broader network-level benefits depend on seamless information exchange among carriers, brokers, shippers, and logistics providers (Speranza, 2018). Persistent fragmentation across transportation management systems, telematics platforms, and enterprise applications continues to limit the effectiveness of AI-driven communication and decision-support tools (Christopher, 2016).

Samuels (2025) similarly finds that progress toward standardization requires governance structures capable of aligning the interests of diverse stakeholders rather than relying solely on technical solutions. Consequently, industry-wide collaboration on common data standards, interoperable platforms, and open communication frameworks will be essential for enabling network-scale AI communication capabilities (U.S. DOT, 2020). Continued engagement by industry associations, technology providers, and regulatory agencies will therefore play an important role in advancing interoperability across the freight sector.

7.4 Sustainability, Digital Transformation, and Long-Term Competitiveness

AI-enabled communication systems offer benefits that extend beyond operational efficiency. Improved information sharing, load matching, and routing decisions can reduce unnecessary freight movements and support more efficient use of transportation resources, creating opportunities for both economic and environmental gains across the freight sector (Christopher, 2016; Speranza, 2018).

The findings of this review suggest that AI-enabled communication systems are becoming an important component of the broader digital transformation of freight logistics. As digital platforms accumulate operational data and strengthen network connections, organizations can improve visibility, responsiveness, and decision-making capabilities (Heinbach et al., 2022). Over time, these capabilities may become an important source of long-term competitiveness within the freight industry.

8. PRACTICAL IMPLICATIONS AND RECOMMENDATIONS

Addressing the challenges identified in this review will require coordinated efforts from industry stakeholders, technology providers, and policymakers. First, freight operators should integrate AI communication tools into existing business processes through workforce training, change management programs, and workflow redesign rather than treating AI adoption solely as a technology investment (Christopher, 2016; Sheffi, 2015).

Second, industry stakeholders should support the development and adoption of common data standards and interoperable communication frameworks to reduce information fragmentation and improve system integration across freight networks (U.S. DOT, 2020). Improved interoperability would enhance the effectiveness of AI-enabled visibility, communication, and decision-support systems.

Third, organizations should incorporate explainability, accountability, privacy protection, and cybersecurity safeguards into AI communication platforms from the design stage. Strengthening governance mechanisms can improve stakeholder trust, support regulatory compliance, and reduce operational risks associated with AI-driven decision-making (OECD, 2019; NIST, 2018; NIST, 2020).

Finally, efforts to expand access to digital technologies among small and medium-sized carriers should be encouraged through collaborative platforms, industry partnerships, and scalable deployment models. Broader participation will help ensure that the benefits of AI-enabled communication systems are distributed more widely across the freight sector.

9. FUTURE RESEARCH DIRECTIONS

Several opportunities for future research emerge from this review. First, more longitudinal studies are needed to evaluate the long-term effects of AI-enabled communication systems across different segments of the freight industry, particularly among small and medium-sized carriers that remain underrepresented in existing research.

Second, future studies should examine driver-centered AI communication interfaces and their influence on user trust, technology adoption, and job satisfaction. Understanding how drivers interact with AI-enabled systems may provide valuable insights for improving workforce acceptance and retention.

Third, additional research is needed to quantify the environmental benefits of AI-enabled communication technologies. Studies evaluating the effects of improved load matching, route optimization, and reduced empty miles on fuel consumption and emissions would provide important evidence for sustainability-focused policy and investment decisions.

Fourth, the governance and liability implications of AI-supported dispatch and communication systems require further investigation. As AI assumes a greater role in operational decision-making, researchers should explore legal accountability, transparency, and regulatory compliance frameworks suitable for freight logistics environments.

Finally, emerging technologies such as large language models present new opportunities for freight communication and decision support. Future research should examine their practical applications, implementation challenges, and potential impact on logistics operations.

10. CONCLUSION

Effective communication is fundamental to the performance of freight logistics systems. As freight networks become more complex and data-driven, traditional communication methods are increasingly unable to support the speed, visibility, and coordination required across modern supply chains. The evidence reviewed in this paper demonstrates that AI-enabled communication technologies, including machine learning, predictive analytics, natural language processing, IoT-enabled telematics, and autonomous dispatch systems, can help address these challenges by improving information flow, supporting faster decision-making, and enhancing coordination among key logistics stakeholders.

Beyond improving operational efficiency, these technologies have the potential to strengthen supply chain resilience and contribute to more sustainable freight operations across the United States. However, technological capability alone is insufficient. Interoperability challenges, workforce adaptation, governance requirements, capital constraints, and organizational readiness remain critical factors influencing successful implementation. Addressing these barriers through coordinated technological, organizational, and policy efforts will be essential to realizing the full benefits of AI-enabled communication systems. Ultimately, AI-enabled communication infrastructure represents more than a technological innovation; it is a strategic enabler of a more connected, efficient, resilient, and competitive freight logistics sector in the United States.

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