

Intelligent Transportation Systems - A tool for enhancing Supply Chain for Quick Commerce Businesses

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Abstract— The concept of Integrated Intelligent Transportation System (ITS) or Smart Traffic Management System operating within a Connected Digital Ecosystem (such as Digital Twins) represents the zenith of modern ITS and smart city planning - moving from standalone, reactive traffic control to a unified, urban predictive ecosystem, that is proactive. This article explains how a single pane of glass for urban mobility, created by leveraging digital infrastructure and systems engineering, effectively address critical challenges of rapid urbanization including growing congestion, environmental and safety issues to benefit quick commerce and e-commerce businesses whose supply chains, earnings and margins are heavily affected by their last-mile logistical efficiencies. The article shows that ITS reduces urban travel times by 25 and congestion by 30%, while increasing intersection efficiency by 40% and cutting unnecessary stops by 20%. By integrating AI and IoT, these systems optimize logistical operations and reduce company costs by 10–30%. This study offers practical insights for traffic regulators and e-commerce professionals aiming to optimize last-mile logistics, accelerate business growth, and secure customer loyalty by elevating the delivery experience.

Keywords— Intelligent Traffic Systems, Supply Chain, Smart Cities, Smart Traffic, logistics, management, Digital Infrastructure, IoT, Digital Twin.

1. Introduction

The past few decades have witnessed digital technology and e-commerce transforming global retail. Starting as a small part of the internet, e-commerce has now become an indispensable part of modern urban life, influencing the habits of retail consumer, strategies of business, and ongoing

market trends. People, across the globe, are drawn towards e-commerce for the convenience it provides in terms of time and place of shopping, along with lower prices, broader product ranges on offer, simplified payment options, and the convenience of receiving the delivery of the products purchased to their doorsteps whenever they want [1, 2]. A variation of this e-commerce is quick commerce that offers very fast delivery of the products, typically within 10–30 minutes. Efficient supply chain management especially logistics and transport part of it is central to the success of quick commerce businesses[3]. ITS acts as crucial tools that enable enhancement of quick commerce (Q-commerce) supply chain (SC) of businesses, enabling delivery at lightning speed – often within 10–30 minutes. In so doing it leverages real-time data, AI-driven algorithms, and IoT (Internet of Things) connectivity.

This article scrutinizes the potential of digital infrastructure in enhancing traffic management, improving incident response, providing public transportation oversight, and ensuring parking availability. It evaluates the utility of a unified, comprehensive, real-time visual interface for monitoring and controlling urban mobility integrating multiple data sources by leveraging digital infrastructure and systems engineering. The article would be helpful for quick commerce professionals, logistics providers and the researchers on the topic as it provides useful insights into last-mile logistical efficiency and sets the background for further research on the discipline.

2. Literature Review

Rapid urbanization has worked as one of the key catalysts driving the exponential expansion of online businesses across the world, aided by greater internet penetration, larger disposable incomes, and the growing demand for shopping convenience among the urban consumers [4]. The linkages amongst urbanization and policies pertaining to digital technology offer a reference for modern cities that are aiming to undergo urban transformation by way of upgradation of their digital economies [5]. Urbanization, driven by the rapid development of digital economy, does not involve the mere expansion of cities and application of information technology (IT) but is heavily influenced by the co-action and interaction of knowledge, industrial structures and resource allocation [5].

The second half of the twentieth century witnessed the initial breakthroughs in electronic data interchange (EDI) and creation of online catalogs that were responsible for the emergence and gradual expansion of E-commerce. Global giants such as Alibaba, eBay, and Amazon have scalable platforms that have been instrumental in connecting buyers and sellers across the world, changing the primary nature or line of the business. Today in the e-commerce space, these 3 are giant offering unique features that cater to various different markets [6]. Worldwide adoption of e-commerce was further boosted by the emergence of cutting-edge digital marketing tools, sophisticated logistics networks, and safe and advanced online payment systems.

Developments in technology, shifting consumer preferences, and the growing need for convenience in our fast-paced society have all contributed to the recent rapid evolution of the retail scene. With time the cities keep densifying, an outcome of which is significant changes in lifestyles of urban dwellers – such as busy schedules and lack of time which further lead to the consumers shifting from traditional, brick-and-mortar format for retail to digital platforms for purchasing merchandizes, services, and food delivery [7]. The COVID-19 pandemic was another factor that led to the emergence and expansion of quick commerce. The lockdowns and other prevention measures to stop the rapid spread of COVID-19 caused worldwide supply chain disruptions which forced businesses all over the world to create a novel and exclusive business model that makes no-contact doorstep delivery of goods and services possible within 10-30 minutes of placing the order. The emergence of quick commerce (q-commerce), thus, was the direct result of the global pandemic [8].

Q-commerce being a unique kind of business concept in which the delivery of goods and services occurs within the shortest possible time, needs a set of infrastructures that will facilitate this rapid movement of delivery vehicles. In general, quick commerce concentrates on micro to small or fewer commodities, like over-the-counter pharmaceuticals products, stationery, personal hygiene products, and food, which makes carriage easy as the boxes or packets to be delivered are neither too heavy to carry nor too difficult – what matters here is the swiftness or the speed and the accuracy. Hence the need for efficient and quick navigation [9].

2.2 Uniqueness of Q-commerce SC

In the very dynamic world of urban e-commerce, the key differentiator is speed with accuracy - the ability to deliver the correct product at the correct time to the door-step of the correct customer. Hence, quick commerce is gaining traction and is remodeling the landscape of urban retail, driven further by the demand for convenience, along with reliability. The efficient integration of advanced last mile delivery systems determines the efficiency of addressing the urban logistics challenges [10].

Q-commerce has modified conventional SC through the replacement of traditional, centralized, and lagging logistical models with an extremely contained, technology-driven method invented specifically for delivering goods in less than half an hour. It demands tremendous logistical efficiency which in turn demands application of smart transport systems. This model is unique due to its ability to bring a product into outermost proximity to its consumers within a very short span of time, meeting immediate, small-quantity needs which fuels impulse buying. Technological developments provide the solid foundation on which Q-commerce stands, and at the same time, it enhances the operational efficiency through the application of artificial intelligence, real-time analytics, while ensuring well-improved logistics [11].

2.3 Importance for Transport Management in Q-commerce Growth

Modern supply chains are much more complex than before [12]. Rapid urbanization has been both a boon and a bane for the quick commerce businesses. While it provided significant boost on the demand side, it also resulted in the need for significant control over route planning, parking and navigation. That will ensure products get delivered on time. This

is particularly relevant in today's smart cities. These cities utilize intelligent traffic management systems (ITMS) that are powered by AI, IoT, sensors and cameras to optimize traffic flows, bring down congestion, and enhance road safety on a real time basis. Being dynamically adjusted systems, ITMS is able to adjust traffic signals as per the traffic density in the vicinity. This also ensures automated law enforcement that significantly reduces the time required for commutation.

In this era of speed and technology, what matter more than anything else are efficiency and reliability. They are the key drivers behind the rapid expansion of global e-commerce. Seamless movement of goods across cities, regions, and international borders are absolute necessity for trade to flourish. Intelligent Transportation Systems (ITS) are, therefore, playing a progressively critical role in manipulating trade practices. To optimize traffic flows and reduce congestion ITS integrates advanced communication, control, and information technologies into transportation networks, thus enhancing supply chain logistics [13].

Urban areas are infamous for traffic congestion, which is a key cause behind significant delays in deliveries and can disrupt schedules. Congested roads result in delay in deliveries due to longer travel times, lead to higher fuel consumption, and cause greater stress on delivery personnel. Success of quick commerce businesses hinge on their abilities to equip themselves with advanced solutions for last mile delivery that apply AI technology to optimize routes and minimize delays that result from urban traffic movement. An increasing number of smart cities are adopting ITS for effective management of traffic congestions [14]. These systems leverage technology to optimize traffic flow, reduce congestion, and enhance urban mobility. High speed deliveries to meet the promise of delivery within few minutes often make enterprises incur higher operational costs that is the consequence of the need for additional labor, vehicles, and resources. Since last-mile logistics costs alone account for more than half of total supply chain expenses, balancing speed and efficiency with economy continues to a crucial challenge for enterprises as direct impact of congestion-induced delays is the increase in fuel consumption, labor costs, and operational inefficiencies [10]. This acts as an important blockage for the q-commerce supply chain that can disrupt the promise of 10-to-30 minutes deliveries while looming large on operational

profitability. It, therefore, becomes critical that enterprises navigate these issues to maintain delivery promises - specifically the ones who are involved in hyperlocal deliveries. [15].

2.4 Challenges of Transport Management

Transport management faces such issues as traffic congestion, that result in inefficiency, higher costs, and safety concerns, necessitating the application of ITS that can effectively apply advanced technologies (sensors, data analytics) to find real-time solutions. Urbanization brings with it rapid population growth and its direct impact is on the number of vehicles which keeps increasing every day. Add to this the increasing number of delivery vehicles which keeps adding to the traffic, further slowing down the traffic and resulting in travel delays and increasing fuel use. The outcome is cost escalation and lower profit margin. Poor route planning, underutilized vehicle capacity, and difficulty in tracking shipments lead to wasted resources. Excessive idling is also a major concern. All these lead to lower operational efficiency. Fuel, maintenance, and labor costs keep rising. The cost pressure dents profitability. Infrastructure bottlenecks also present significant challenges. Outdated infrastructure finds it hard to cope with today's demands.

Problems of Getting Real Time Traffic Data: One of the key problems in traffic management and navigation is the lack of availability of real-time data especially in developing and emerging nations where traffic management remains largely manual. Where ever data is available, a key challenge faced by existing traffic management systems is the quality of the available data.

3. Data Indicates Need for Efficient Transport Management

3.2 Increased Urbanization – Rise of Smart Cities – Need for online businesses

According to the data acquired by the United Nations (UN) people division from the World Bank, in 2020, over 4 billion people had been estimated to live in urban areas [16, 17]. This accounted for more than half of the world population. Similar, estimates show that by 2050, another 2.5 billion people would be added to the world's urban population [18, 19]. The data

indicates that by 2050 the ratio of people living in urban areas would constitute more than 66% of the world population [19, 20, 21]. According to UN Department of Economic and Social Affairs, by 2030, an estimated 68% of the world's population is anticipated to live in urban areas [16]. This transference is expected to be a key driver behind the increased demand for prompter and more reliable delivery systems. Urbanization is responsible for increase in population density, which augments the possibility and viability of quick commerce through the reduction in delivery travel distances.

3.3 Growth in Online Commerce & Quick Commerce

The quick commerce market is set to grow from \$25 billion in 2021 to \$72 billion by 2025, a compound annual growth rate (CAGR) of 27%. This growth is fueled by increased internet penetration, higher disposable incomes, and a surge in online shopping trends [10].

According to the UNCTAD 2020 report, 14% of global trade has increased due to ICT usage since it facilitated globalization along with enabling businesses to gain foothold in newer markets and customers both nationally and internationally [22]. The global e-commerce market size (Figure 1) that was estimated at US\$ 25.93 trillion in 2023, is projected to grow at a CAGR of 18.9% from 2024 to 2030, to reach US\$ 83.26 trillion by 2030 [23].

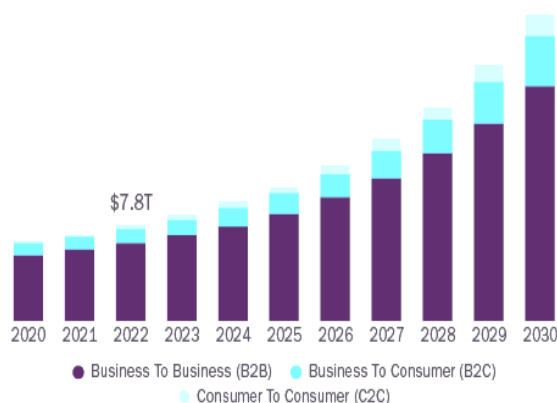


Figure 1: Global e-commerce market 2020-30 (US\$ Trillion) [23]

Modern cities need to improve road safety while handling the challenges of growing traffic congestion, and emissions. These are also the reasons for slowdown in vehicle movement that takes a toll on the very fundamentals of quick commerce and online businesses – the on-time delivery without compromising on product quality. The solution to these problems is the use of AI and IoT in smart traffic management [23].

According to Market Research Future analysis, the Quick Commerce Market Size (Figure 2) is estimated to be worth US\$ 8.841 Billion in 2024. The Quick Commerce industry is forecasted to grow to US\$ 228.88 Billion by 2035 from US\$11.88 Billion in 2025, reflecting a CAGR of 34.42% during 2025 – 2035 [25].

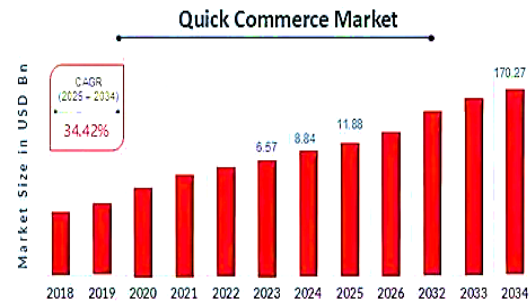


Figure 2: Global Q-commerce Market Growth [25]

The global last mile delivery market size (Figure 3) has reached to US\$184.2 billion in 2025 as is expected to reach \$277.76 billion in 2030 growing at a CAGR of 8.6% [26].

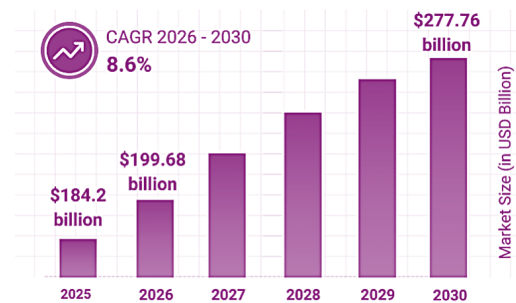


Figure 3: Global Last Mile Delivery Market Growth [26].

Despite short distances to be covered, deliveries often slow down as they enter the city. Urban traffic continues to remain a key reason behind late shipments, elevated delivery costs, and increasing number of customer complaints. Presently, the impact of urban traffic on delivery is greater than ever. Peak-hour congestion is now capable of increasing travel time by nearly 25–40% in major urban locations in Asian countries [27]. Slow-moving lanes, limited parking availabilities, random diversions, and extremely crowded streets are factors that create serious delivery logistics challenges.

4. The relevance of Smart Traffic Management

ITS has an extensive scope, covering a broad array of applications, that includes smart systems for traffic signal, dynamic route planning, autonomous vehicle technology, real-time public transit tracking and electronic toll collection. Besides enhancing day-to-day transportation for individuals, these advancements also contribute to the broader social objectives that include energy conservation, emission reduction, and better urban planning [28].

Integration of multiple data sources for controlling mobility within the urban areas involves leveraging advanced digital infrastructure including IoT, 5G, and Artificial Intelligence. This must be guided by systems engineering principles that will allow building, simulating, as also managing urban transportation networks on a real-time basis. Generally, this data-driven approach is implemented using Urban Digital Twins (UDTs). This puts together heterogeneous data, such as traffic sensors, public transit information as well as GPS data, to improve traffic flow, bring down congestion by up to 25%, and decrease emissions.

A crucial aspect of urban infrastructure management is the integration of a large number of data sources into a real-time visual interface that can be used for monitoring and controlling urban mobility. This approach leverages digital infrastructure and systems engineering to create a dynamic and responsive urban environment [29]

5. Discussion

The key hurdle in q-commerce supply chain in the contemporary urban regions is the traffic congestions caused by the overburden of motorists. Add to that the problems related to crashes, on-road vehicle breakdowns and other traffic disruptions where slow response time can worsen the congestion problem. Quick commerce delivery executives need to be updated with such information on a real-time basis as it allows better route planning that can minimize delays in movement of goods and enhance efficiency of last-mile logistics.

Urban data platforms enable real-time traffic management solutions, that equip smart cities with advanced tools for optimizing traffic flow, reduce congestion, and improve safety. ITMS utilize sensors, cameras, and communication networks for gathering traffic data continuously. Sensors, cameras, GPS and various other sources provide

huge volumes of data that is crucial for making informed decisions pertaining to efficient traffic management and swifter incident response. This data is integrated by these platforms, which makes it possible for the traffic managers to respond to conditions on a real time basis and allows dynamic adjustment of the signals. [30].

5.2 Intelligent Transportation Systems

The term “Intelligent Transportation Systems” (ITS) refers to the myriad of applications, encompassing traffic management, reactive traffic control, and autonomous vehicles, that aim to enhance and improve mobility experiences while dealing with the challenges of urbanization [31]. Such technologies as sensors, artificial intelligence (AI), and communication networks are utilized to enhance public transit, ensure swifter, better efficient and safer travel, using efficient traffic management, and to provide real-time info to travelers. Key components for the system include vehicle-to-everything (V2X) communication, smart traffic signals, automated fleet management, integrated passenger information systems, and automatic tolling, all working towards reducing the congestion, enhancing safety, and speeding up traffic movement. All of these will work in tandem towards enhancing SC efficiency in a sustainable manner across all modes of transport.

ITS integrates road traffic infrastructure (such as traffic lights, roads) with vehicles and users, to enhance safety, speed and safety while reducing emissions through smart and more efficient signal control, connected vehicles, and better logistics, benefiting everyone from commuters to fleet operators [32]. Such systems are expanding rapidly to fulfil the increasing demand for sustainable transportation solutions that would also be safer, and more efficient. These systems incorporate diverse applications, spanning across traffic management and control to electric vehicles and autonomous vehicles, that aim to augment mobility experiences while tackling the challenges of urbanization. ITS also includes Vehicular AD-HOC Networks, intelligent traffic Lights, virtual traffic Lights, accompanied by mobility prediction, emphasis on their role in improving transportation efficiency, safety, and sustainability [32]. In essence, ICT acts as the central nervous system, connecting disparate parts of multimodal transport into a cohesive, intelligent network, making it a fundamental tool for modern logistics success.

5.3 Rationale

The scope of ITS is extensive, covering a wide range of applications, including intelligent traffic

signal systems, autonomous vehicle technology, dynamic route planning, electronic toll collection, and real-time public transit tracking. These advancements, besides enhancing everyday transportation for individuals, also contribute towards such broader social objectives as conservation of energy, lower emissions of pollutants, and superior urban planning [32].

With the ongoing acceleration of urbanization and increasing demand for efficient transportation, ITS plays a crucial role in determining the future of mobility. Global governments, corporations, and researchers are allocating resources toward implementing ITS technologies to establish more intelligent, interconnected, and environmentally friendly transportation ecosystems.

The advent of technologies such as the Internet of Things (IoT), used for sensing and tracking, and 5 G communications in recent years has accelerated the adoption of ITS [32]. IoT refers to a network of physical objects that are embedded with actuators and sensors, connected using wireless and wired networks, and are able to carry out seamless interaction and information exchange amongst objects in the physical and virtual world. Intelligent Traffic Lights (ITL), Virtual Traffic Lights (VTL), Vehicular Ad-hoc Networks (VANETs) and Mobility Prediction are prominent ITS applications. These are intended to improve traffic flow and reduce congestion [31]. In urban areas ITS solutions report 25% reductions in average travel time along with 30% lower traffic congestion and typically 40% improvement in intersection efficiency while unnecessary stops reduce by 20% [34]. Through the integration of AI, IoT, and real-time data, ITS allows companies to cut down operational costs by 10–30% while improving delivery efficiency.

While live data can help adjust signals, manage incidents, and lessen bottlenecks, connected vehicles and smart infrastructure can warn of hazards, thereby reducing accidents. Through the application of AI and data analytics routes can be optimized, which improves fleet utilization, and reduces fuel consumption. Personalized travel information together with efficient public transport improves accessibility and convenience thus enhancing user experience. Lower congestion and optimized energy consumption lead to greener cities.

Predictive analytics and AI-driven systems can also play a defining role in anticipating congestion and accidents while optimizing routes in real-time. AI-driven analytics can be employed to predict traffic patterns, allowing businesses to adjust routes dynamically which helps to avoid jams. While enhancing delivery efficiency, this also reduces

fuel consumption, leading to lower overall operational costs. Singapore, London, Barcelona, and other cities have successfully implemented real-time traffic management systems, which resulted in more seamless traffic flow and lower emissions [29]. Applying predictive algorithms can help agencies predict incident clearance times – an important information that supports execution of superior traffic management strategies besides providing accurate traveler information [30].

5.4 Need for Efficient Transport Management

With the passing of time, the intricacies of logistics management are also growing. It is also becoming an increasingly important economic activity that is widening the scope and enhancing the profile of information and communication technology (ICT) as the means to better the degree of visibility, receptiveness, response time and efficiency in SC that relies on multimodal transport operations [35, 36, 22]. As quick commerce deliveries often occur within minutes of placing the order, it becomes an absolute necessity for the delivery executives to be well aware of the traffic conditions of the route decided and its alternatives, as well as the shortest uncongested route to the delivery destination in order to be able to fulfil the order on time. Beyond a doubt, the information and communication technology functions can be considered to be like the nerve system of a multimodal transport chain. ICT brings a plethora of benefits to business organizations across industries by providing visibility on a real-time basis, allowing efficient exchange of data, and superior flexibility to respond to unforeseen modifications in circumstances during shipment [36, 22].

Advanced solutions provided by ITS can streamline SC management and ensure smooth operations. Within e-commerce SC management, real-time freight tracking has emerged as a transformative capability that can substantially enhance coordination and improve delivery performance [37]. Real-time freight tracking refers to the constant monitoring of shipments during the process of transportation, employing such technologies as GPS, RFID (Radio-Frequency Identification), IoT sensors, and cloud platforms. These tools are able to provide real-time location, condition, and status updates, which ensures that every stakeholder, including shippers, carriers, and customers, is updated on the freight's present position, its progress and any disruptions that may have happened [37]. Live tracking systems make it possible for the businesses to monitor shipments,

thus reducing the uncertainties while improving the coordination between suppliers, manufacturers, and retailers.

To create an urban environment that is not just superior in quality but is also sustainable, today's smart cities have become increasingly reliant on the integration of advanced technology and green infrastructure. While the smart cities are striving to better the quality of public transport and trying to diminish the dependence on individual vehicles, these modern cities witness the dual challenges of managing transportation systems that are growing in complexity and handling massive volumes of data generated by transport management systems. Real-time tracking and monitoring of urban traffic and transportation infrastructures like surface public transport fleets and subways generate these data. Data is also generated from innovative Mobility-as-a-Service (MaaS) schemes. All these represent true big data circumstances [38].

Due to the rapid integration of Internet of Things or IoT technologies, urban mobility is going through a phase of significant transformation. Modern cities are grappling with growing congestion, pollution, and inefficiencies in conventional transportation systems. Smart cities are growing in number as the concept is becoming increasingly popular due to its relevance and ability to electronically connect infrastructure [39]. They have the ability to integrate several diverse technological solutions and handle a broad range of city assets, including schools, hospitals, libraries, power plants, transportation systems, law enforcement, local government information systems, and other services in that community [40]. IoT-enabled solutions are emerging as promising path towards effective implementation of intelligent transport systems [41]. In recent years, transport systems are becoming more intelligent and automated due to real-time monitoring and prediction. Transport data automation, process feedback, and visualization have now become critical to effective monitoring and improvement in the performance of transport systems [42].

5.5 Digital Twin Technology

A real-time visual interface leveraging digital infrastructure and systems engineering is commonly realized through Digital Twin (DT) technology. This approach integrates physical infrastructure with cyber-physical systems that allows continuous, two-way data synchronization thus making monitoring, simulation, and predictive analysis possible. In simple terms DT technology enables the synchronization of a physical asset, system, or process with a virtual model, allowing

for live monitoring, analysis, simulation, and predictive maintenance

The Digital Twin refers to a reciprocally connected and synchronized representation of a physical asset so-called Physical Twin – a dynamic virtual replica of its physical twin which could be a physical object, a system, or a process [43]. As the name suggests, in a Digital Twin System (DT System), the digital twin is the fundamental component, that connects and interacts with its the Physical Twin, using various

components, and carries out the essential functions including data exchange, data processing and data storage. The engineering behind a DT System is a lengthy and intricate process which is often lacking formal and systematic methodological approaches notwithstanding the application of a wide array of techniques and technologies by the practitioners. Systems Engineering (SE) provides the correct frameworks, methodological tools, processes, and principles, for the engineering of such complex systems [44]. By providing insight into how an object functions in the present—and projecting how it might behave in future scenarios—digital twins help organizations improve efficiency, accelerate innovation and make data-driven, informed decisions [43]. Virtual, real-time representations of physical transportation infrastructure (digital twins) are used to simulate and optimize network conditions.

Visibility offers the complete picture or the big picture of the overall movement of the products-in-transit. It provides visibility through real-time tracking or the incessant live monitoring and updating of the location and status of vehicles, personnel, assets, or consignments. GPS, RFID, and IoT sensors provide constant location and condition updates for goods.

5.6 Key Advantages of Applying the Technology

Implementation of ITS using the DT technology, a variation of IoT technology are the following -

- **Data Integration & Data-Driven Decisions:** Platforms pool data from all transport modes, producing a single, transparent view. Analyzing data pertaining to logistics helps to optimize routes, inventory, and resource allocation.
- **Responsiveness (Reacting Quickly):** Wireless networks (like vehicular networks) enable instant communication between vehicles, infrastructure, and systems. AI and data analytics anticipate disruptions (weather, traffic) and suggest proactive solutions.
- **Efficiency (Optimizing Operations):** Automation, an outcome of the digital

processes, reduces manual errors as least human intervention is required, thus improving speed and accuracy of the tasks.

5.7 Challenges of ITS Implementation

Implementation of ITS comes with its own share of hurdles. It includes high costs, data privacy, security risks, and integration complexities, especially in developing nations. Urban mobility systems create a massive volume of real-time data, offering an excellent opportunity to comprehend and optimize transportation networks [45].

As already discussed, application of DT has become inevitable to maintain a complex system, since it can be employed to address certain needs for control and supervision, creation of parameters, testing and optimization, and even as a provision for training of operators. However, both PTs and DTs being complex systems, which results in accumulation of an extensive assortment of concerns pertaining to performance, safety, environment and / or maintainability. Both need application of correct methodologies for their engineering, operations, maintenance and dismantling [44].

Urban data platforms are able to process vast datasets, converting raw data into actionable insights for traffic managers, while also providing for sustainability through the reduction of vehicle idling and drop in pollution levels. However, their implementation comes with several challenges, including concerns regarding data privacy, high costs, and the need to amalgamate with legacy systems. [29].

- **High Costs:** Substantial investment are required for sensors, communication networks, and control systems, which becomes prohibitive for small and medium players
- **Data Privacy & Security:** ITS implementation involves constant handling and collection of a vast volume of data. Such huge amount of collected data needs to be protected from breaches and misuse.
- **Integration & Interoperability:** Implementation of ITS involves coordination and cooperation of more than one technology. Getting diverse systems and technologies to collaborate seamlessly is not just complex but extremely difficult.
- **Technical & Workforce Gaps:** For the entire system to run properly and without glitches it is necessary that a skilled team of professionals is in place that will take care of the technical anomalies and other difficulties that may occur from time to time. A robust

telecom infrastructure must also be in place, especially in developing regions.

- **Time & Obsolescence:** Long planning and deployment cycles are likely to make systems outdated before completion adding to the cost of maintenance and replenishment.

6. Conclusion & Future Work

Increasing environmental problems, rising fuel price and congestion on several road networks demand novel solutions pertaining to freight transport operations. Integrated multimodal transport network could prove crucial for companies striving to successfully execute their SC processes both domestically and internationally. The future of traffic management is expected to witness further advancements with the coming on stream of autonomous vehicles and smart infrastructure, which are heavily reliant on real-time data as well as predictive technologies to ensure efficient urban mobility and sustainable development of smart cities. The establishment of ITS has all-round benefits as it helps in both creation of a system that can help enhance last-mile delivery and at the same time lead to sustainable development of cities and businesses. Application of DT technology can provide the much-needed interactive interface that can, while ensuring complex technology integration, enhance traffic management, incident response, public transportation oversight, and parking availability, through a unified comprehensive, real-time visual interface for monitoring and controlling urban mobility integrating multiple data sources by leveraging digital infrastructure and systems engineering.

This article advances current knowledge in ICT by presenting overview of existing and emerging ICT applications to multimodal transport. It also presents a sustainable solution to the problem of traffic management that is essential to improve the SC of quick commerce businesses. It also presents the pros and cons of implementation of the suggested cutting-edge DT technology. This article will prove useful to both traffic controllers and the e-commerce practitioners who strive to enhance the efficiency of their last-mile efficiency to boost business expansion and user loyalty through heightened user experience. It also lays the foundation for further research. The article also established a bright future for urban data platforms. AI, Big Data and other technologies offer massive potential for creating efficient transportation systems. Despite several benefits, mobility data platforms face challenges. Data confidentiality is a key issue, as high security standards are necessary

for user trust. The technical complexity of building and operating such platforms demand significant resources commitment along with experienced collaborators.

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