Building Digital Twins to Produce Virtual Counterparts in Logistics

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Dr. K. Bhuvaneswari★

Professor & Head, Dept., of Management Studies, IFET College of Engineering, Gangarampalayam, Villupuram, TN, IND.

R. Anitha

Assistant Professor, Dept., of Management Studies, IFET College of Engineering, Gangarampalayam, Villupuram, TN, IND.

A R T I C L E I N F O	A B S T R A C T
	The world is becoming increasingly digital. This is the future's greatest potential. The anticipated trends in logistics for 2020 and the years after are more apparent. Large-scale changes are being brought about within businesses by the development of Logistics 4.0. According to many studies and businesses, the importance of networking, automation, and digitisation will increase inside the industry. End-to-end visibility is essential; full supply chain information could enable true demand-driven planning, enabling quick responses to shifts in capacity, demand, and supply. To lessen the difficulty and stress of examining technological trends, logistics also increasingly need methodological support and adequate data, given the quick rate of development and the variety of technical solutions available. Digital twins are used by businesses in the logistics industry to generate virtual versions of anything, including warehouses and distribution centres, packing and containers, individual shipments, and even entire supply chains. With the help of these digital twins, businesses will be able to foresee market volatility, spot current or projected supply chain bottlenecks, and plan logistics more effectively.

1.0 INTRODUCTION

Organisations from various sectors and industries may utilise digital twins to collect data from various sources using the most current breakthroughs in artificial intelligence and sophisticated analytics technologies. Afterwards, with these data, firms can make remarkably accurate performance predictions and provide insightful findings that enhance company strategies.

Although the concept of the digital twin was initially presented in 2002, recent developments have rendered the digital twins of the present almost unrecognisable from those of the past. Although

★ *Corresponding author's e-mail:* drbhuvaneswari.ifet.ac.in@gmail.com (Dr. K. Bhuvaneswari)

the idea of "digital twins" is still relatively new to the logistics sector, we may anticipate seeing them becoming commonplace in the following years, particularly since that internet giants like Google are working on supply chain-specific digital twin technology (Alshawi, 2001).

Although logistics service providers have traditionally adopted technology rather than development, it is nevertheless crucial for their plans and skills to be aware of the technical landscape in logistics (Brah and Lim, 2006). For instance, low-tech logistics service providers and businesses in the early stages of development can benefit from working with high-tech customer organisations to streamline knowledge and technology transfer. Even logistics service providers may be able to develop a new, technologically based business model with the help of this form of relationship (Hammant, 1995).

1.1 Literature Review

However, many scientific studies released prior to 2010 evaluated the potential effects of information-based technologies (such as EDI) on some areas of logistics and SCM, such as coordination processes or financial consequences, rather than delving thoroughly into any one particular technology. SCM and logistics are dynamic fields from which new subjects emerge, and scholars have acknowledged the necessity for methodological approaches and theories to continuously address their inherent complexity (Bowersox, 1991; Giunipero *et al.,* 2008; Nilsson and Gammelgaard, 2012).

1.2 Objectives of the Study
- To comprehend the underlying concept of route optimisation technology.
- To ascertain the function of connecting Cloud-Based Transportation Management Systems.
- To examine the Track-Inspection Drones used to supplement manual track inspections
- To study essentials of Digital Freight Matching.

2.0 RESEARCH METHODOLOGY OVERVIEW

The layout of conceptual pieces is divided into many subject flows. The material was acquired from a variety of researchers and research groups. Throughout the investigation, the bulk of the information acquired in research papers, articles, blogs, and online media provided insight into a good pool of analysed data that can be used to improve warehouse productivity, performance management, and examining technological trends, logistics also increasingly need methodological support and adequate data given the quick rate of development and the variety of technical solutions available.

3.0 ROUTE OPTIMISATION

The preferred technique for the trucking sector to cut emissions is having trucks drive less miles and spend less time on the road until electric semi-trucks (or some other equally sustainable option) become the standard. The fundamental idea behind route optimisation is that. Route optimisation technology is a more recent development in trucking, where it is already seeing extensive use, despite being quite ubiquitous in last-mile delivery operations. It has been shown that route optimisation may help trucking businesses save money by decreasing instances of unnecessary deadheading, improving insight into when freight is likely to arrive, and removing inefficiencies in the last leg of the delivery process.

3.1 Cloud-Based Transportation Management Systems

Transportation Management Systems (TMSes) are among the on-premise solutions that are increasingly migrating to the cloud. And it's simple to understand why an increasing number of transportation logistics companies are either investing in cloud-native TMS software or converting their current TMSes to the cloud:

Automate manual chores to create more efficient workflows and increase productivity. Reduce hardware and IT infrastructure capital and running costs.

They are accessible from almost anywhere in the world because they only need an internet connection to connect. Consolidate information from many internal and external sources to improve visibility. Analyse transportation data using advanced analytics to uncover crucial insights and business prospects. are simple to adopt and upgrade over time, allowing businesses to benefit from the most recent TMS capabilities are very scalable, allowing businesses to grow or shrink in response to shifting business requirements.

3.2 Track-Inspection Drones

Unmanned Aerial Vehicles (UAVs), sometimes called as drones, are being used to supplement manual track inspections carried out by people on trolleys or trucks with rail wheels. These UAVs have cameras and sensors that allow them to take pictures, record videos, collect LiDAR data, and relay that data in real-time to remote operators.

Since drone operators can efficiently conduct thorough inspections from far away while the track is still fully operating, there have been considerable productivity advantages and worker safety improvements thanks to this creative use of technology.

3.3 Digital Freight Matching

Companies are searching for innovative and imaginative ways to get cargo out the door and on the road as the truck driver shortage continues to put capacity limits on the domestic supply chain. One such technique is the matching of digital freight. Digital freight matching, sometimes referred to as load matching or "on-demand" trucking, is the process of "aligning shippers' available freight (loads) with carriers' available capacity (trucks) through the use of web- and mobile-based technology platforms."

The process is straightforward: On a load board, shippers or brokers publish facts about the freight they need to transfer, including load details like weight, pricing, distance, and pickup and delivery locations. By defining the type of freight they're looking for—truckload, partial truckload (PTL), or less-than-truckload—shippers can further narrow their search (LTL). After reviewing the posts, the carriers decide which loads to accept according on their capacity. Digital freight matching platforms and ride-sharing applications have a lot in common, so if they sound similar, it's because they do.

4.0 CONCLUSION

There is much potential upside for logistics companies, their corporate customers, and their end users in the IoT. Benefits accrue throughout logistics, from storage facilities to transportation to last-mile delivery. They also affect alternative company models, customer satisfaction, productivity, and security.

The largest firms utilise a lot of digital twin technology, which creates a virtual replica of an actual environment, to provide business process services. Digital twins can be modified and updated to find more productive manufacturing techniques that can subsequently be used in the real world. By fusing AI with digital twins, businesses may increase supply chain productivity to new heights and gain a competitive edge. The decentralisation-based tenets of the blockchain can aid in the transportation sector's transition to more transparency.

As it always has, the logistics sector will undoubtedly change to meet these diverse challenges. Innovative companies are already making investments in cutting-edge new technologies to deal with some of the most urgent problems now plaguing transportation and logistics companies. Technology in the logistics and transportation industries is developing at a fast pace to keep up with changes in the industry and address its most urgent problems.

"A virtual representation of an object or system that spans its lifecycle is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making."

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