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Globle Logistic Services Using Artificial Intelligence Logistics Management: A Review

Juan Mark Deen [1,1], Marc Ruben Danny[2], Jessica Sarah Deen[3], Arien Maxwell Danny[4], Amisha Michelle Danny[5]
[1,4]*Department of Computer Science and Engineering and Bioinformatics*
Vellore Institute of Technology, Vellore Campus, Tiruvalam Rd, Katpadi, Vellore, Tamil Nadu 632014, India.
[1]*Email: [1]Email:juanmark0521@gmail.com,[4]Email: arien.danny@gmail.com*
[2]*Department of BBA in Logistics, Retailing & E-Commerce*
INDIAN MARITIME UNIVERSITY - [IMU-K] A central university.
South End Reclamation Area (Located on NH47- A), Near Alexander Parambithara Bridge, Matsyapuri P.O., Willingdon Island, Kochi- 682029, Kerala, India.
[2]*Email ID: marcruben.danny@gmail.com*
[3]*Department of Computer Science and Engineering*
Vellore Institute of Technology, Kotri Kalan, Ashta, Near, Indore Road, Bhopal, Madhya Pradesh 466114, India. 3Email ID: jessica.sarah2020@vitbhopal.ac.in
[5]*Department of Computer Science and Engineering*
Kalinga Institute of Industrial Technology, KIIT Road, Patia, Bhubaneswar, Odisha 751024, India. 5Email: amisha.danny@gmail.com

Abstract –
Most of the manufacturing sectors dealing their working operations and strategy to expand sustainable competitive benefits. In order to do those corporate sectors more focuses on their logistics as the core competency. With the ascend of globalization, logistics collaboration is
becoming one necessary way to cope with challenges such as global sourcing, cross country production, demand for rapid delivery, frequent order placement, reduced logistics cost and high service level, E-business model (Electronic business) has been made logistics relationship important more and more. The growing interest in logistics collaboration is fueled by the ever-increasing pressure on companies to operate more efficiently; the realization that shippers, carriers and even competitors can be potential collaborative partners in logistics; and the connectivity provided by the Internet. Global logistic service companies often report limitations and challenges to supply chain integration including decreased transportation efficiency, diminished information transparency, and reduced material, information and cash flows. However, many advance technologies create more feasibility environment for fast and very efficient way of logistics application on transportations, supply chain, and end to end delivery mechanism. The new concept of AI based logistic services is defined and developed to provide enterprises with improved, integrated, and comprehensive services worldwide. A multi-view process modeling approach is applied to construct the model and identify potential bottlenecks with existing logistics processes. The AI logistic management model is defined as a to-be improved logistic service framework with functions to enhance the flow of materials, products, information, and cash transactions for integrated supply chains.
Keywords: AI Logistic, Supply Chain and Management, Global Logistic Service, Logistics Autonomous Vehicles Warehouse logistic.

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I. INTRODUCTION

The growing interest in logistics collaboration is fueled by the ever-increasing pressure on companies to operate more efficiently; the realization that shippers, carriers and even competitors can be potential collaborative partners in logistics; and the connectivity provided by the Internet [1],[9]. Global logistic service companies often report limitations and challenges to supply chain integration including decreased transportation efficiency, diminished information transparency, and reduced material, information and cash flows.

However, many advance technologies create more feasibility environment for fast and very efficient way of logistics application on transportations, supply chain, and end to end delivery mechanism. The new concept of AI based logistic services is defined and developed to provide enterprises with improved, integrated, and comprehensive services worldwide. A multi-view process modeling approach is applied to construct the model and identify potential bottlenecks with existing logistics processes. The AI logistic management model is defined as a to-be improved logistic service framework with functions to enhance the flow of materials, products, information, and cash transactions for integrated supply chains. An author's Osterwalder and Pigneur [10] define the concept of a business model as "the rationale of how an organization creates, delivers, and captures value". They suggest that a business model can be described with nine basic building blocks, which cover the four main business areas: customers, offering, infrastructure, and financial viability. In the heart of the business model is the value proposition. In practice, it is a description of how to satisfy customer's needs or how to solve customer's problems with the help of products or services or a mixture of them [10].

The other elements of a business model describe how to deliver the value to the customer, while the value proposition describes the solution's value itself from the customer perspective. The other elements may also add value to the customer and thus be strongly connected to the value proposition. Carlson and Wilmot [11], define the components of the value proposition as NABCs, where the letters refer to an important customer Needs, a product or service Approach, Benefits, and prevailing Competition. These components define the value proposition required for a customer. In addition, value propositions are also required for other stakeholders in the supply chains, e.g., for logistic operators. Security management or disturbance management in logistic networks are businesses where technology and technological systems often play quite a remarkable. The interest towards solutions related to the management and analysis of disturbances in supply chains has increased, which has led to a pressure among technology and service providers to develop comprehensive business models to response customer needs. The aim of the study is to clarify the value elements of a business model for disturbance management and analysis in supply chains. Regarding to the elements of a business model, the paper concentrates on the analysis of customer segments, needs and demands related to the potential benefits for the customers. The research is done by the perspective of a solution provider developing a service entity to logistic intensive companies.

The article [11] study's findings and demonstrate the evident benefits and needs for the creation of solutions for disturbance analysis and management. Furthermore, a value proposition based on software as a service (SaaS) is presented for the novel supply chain disruption management and analysis solution. The value proposition is predicated on identifying the demands of the customer, the solution strategy, the advantages, and the level of competition that the new service entity faces. As the birthplace of logistic theory, the United States has led the globe in research on logistics, design, and technical development. This is reflected in the theory and practice of the current logistic industry in the country. There are rather mature logistic management skills and advanced modern logistic, especially those enterprises involving in commercial circulation and production manufacture all pay more attention to the development of modern logistic.

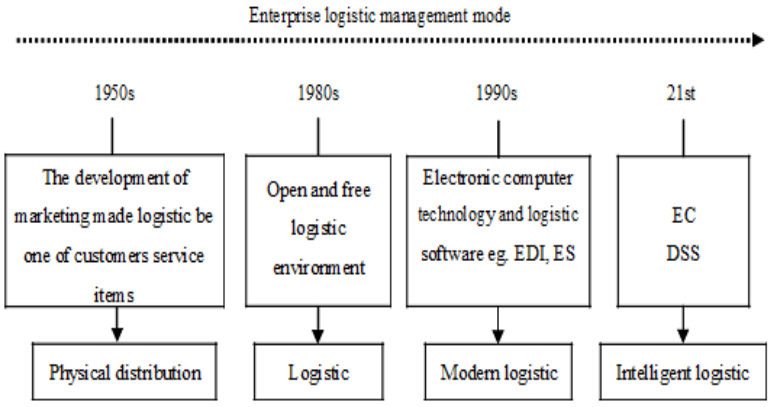


Figure 1. The sketch map of development course of American logistic practice

Japan logistic practice is different from American ones, which is closely related with the backgrounds of two countries developing logistic. America developed logistic after 1945 when the World War two ended, on the basis of advanced transportation network with the economic development (from the original physical distribution to later logistics). However, Japan developed logistic in 1960s when economy just began to rise while transportation network wasn't constructed and be limited by traffic supply and requirement conflict. Modern definitions of logistics state that it could advance contingent on technological feasibility until information technology matures. In actuality, Japan advanced to a modern logistical level in 1992, while America did so in 1988. Since production and distribution companies are known for viewing modern logistics as "the third profit source," modern logistics is essentially centered around one type of management thought: ideals and technology. As such, it gives careful consideration to the growth and adoption of modern logistic management in these sectors, as illustrated in Figures 1 and 2 [9]. The logistic industry is service industry in some environment, moreover, organization form and commercial mode are various, such as the third-party logistic enterprise involving mainly in transportation and storage, the fourth party logistic enterprise mainly providing logistic schematic design (SCM scheme: Supply Chain Management), as is of very important for global logistic to make good regional logistic development programming.

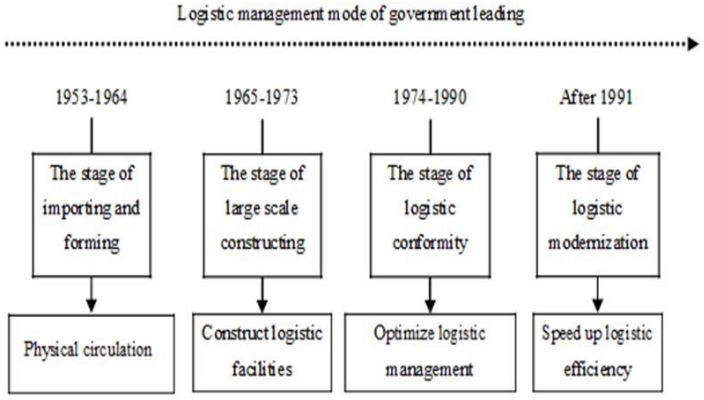


Figure. 2 The sketch map of development course of Japan logistic practice

During this past year, logistics has been featured on the cover of the Wall Street Journal, Forbes, Fortune, and Business Week magazines. It is no wonder. Logistics expenditures represent about 10 percent of the U.S. gross domestic product and are approximately $1 trillion annually [15] Author predicted in 2002 the next decade the global logistics expenditures exceed $3.5 trillion annually and represent nearly 20 percent of the sum total of the world's GDP. Now after 2 decades [15] studies and prediction the proven correctly. As latest report on 2023 on global logistic report [16] The global freight & logistics market is forecast to grow to $18.69 billion by 2026 at a compound annual growth rate (CAGR) of 4.4%. When looking solely at logistics, the global logistics market is expected to reach $6.55 trillion by 2027, growing at a CAGR of 4.7% between 2022 and 2027.Report says the freight & logistics market includes the sale of services by companies that transport goods and commodities via rail, air, roads, and water, using large vessels in the process of warehousing, management, transportation, delivery, consultation, packaging, and legal services. It is most commonly employed in sectors such as manufacturing & automotive, oil & gas, mining, agriculture, fishing, forestry, construction, distributive trade, and other end users. The most common types of logistics models are first-party logistics (1PL), second-party logistics (2PL), and third-party logistics (3PL). planning and executing the efficient transportation and storage of goods from point A to point B with the goal of meeting consumer needs in a timely and cost-effective manner. It includes Logistics has become an integral and growing part of the global economy as its worldwide applications enable businesses to mark their presence in the global market. The sector makes it possible for companies to store and transport resources such as equipment, inventory, food, and materials to the desired destination. It helps organizations create added value, save money, deliver a better customer experience, and improve brand standards. Currently, many companies around the world are looking for strategic logistics management to lower their transport expenses [16]. In order to do this the

manufacturing sector leads the global market share, as logistics help to improve efficiencies and production rates, cut costs, and boost customer satisfaction [47]. The Asia-Pacific region is the largest in the freight & logistics market, with North America looking to be the fastest-growing region between now and 2027[15].

II. LIMITATION OF CURRENT LOGISTICS

The logistics activities, including some basic aspects, such as storage, transport, loading and unloading, packaging, distribution, etc., in the actual operation of the logistics activities, will inevitably cause harm to the environment, mainly in terms of the following: The major reasons transportation has an adverse effect on the environment are noise pollution, fuel consumption during transportation, hazardous gas emissions, damage or leakage of transported goods, and an increase in road space due to the growth of the transportation industry, among other things. The environmental effects of distribution. Distribution describes the tiny groups' multi-frequency city transportation. Many businesses buy their own delivery trucks in order to ease the flow of goods, but this leads to a distributed delivery system that is problematic for municipal transportation. Consequently, businesses are unable to precisely, swiftly, and efficiently organize their distribution [15], [09]. Another crucial component of logistics management is storage techniques. The environmental effects of storage. In the custody process, non-green factors such as certain chemical conservation methods (such as spraying insecticides, antimicrobials), the use of refrigeration equipment and special commodities (such as flammable, explosive, dangerous chemicals, etc.) causes pollution and destruction to the surrounding environment due to improper custody. Environmental effects of loading and unloading. An improper operation will increase the risk of cargo damage, which will waste resources, produce trash, and eventually contaminate the soil and water.

The environmental effects of the packaging. The following elements may impact the ecological balance and pollute the environment during the packing process: Packaging that is resource-intensive and difficult to decompose, materials that aren't renewable, excessive or repetitive packing, and unconventional or non-standard packaging.

key issues: of Logistics and the supply chain are -

a) Structure and tiering
b) Material flow and information flow
c) Competitive criteria in the marketplace
d) Aligning capabilities across the supply chain.

III. RESEARCH METHODOLOGY

Global logistics is the flow of material, information, and money between countries.

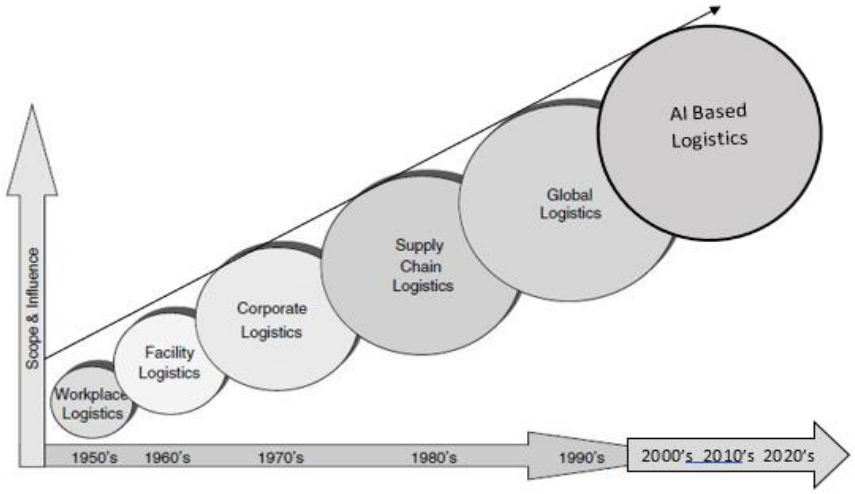


Figure 3. Evaluation of Global logistic [15]

The main phases of logistics development are workplace logistics, facility logistics, corporate logistics, supply chain logistics, and global logistics as shown in Figure 3.

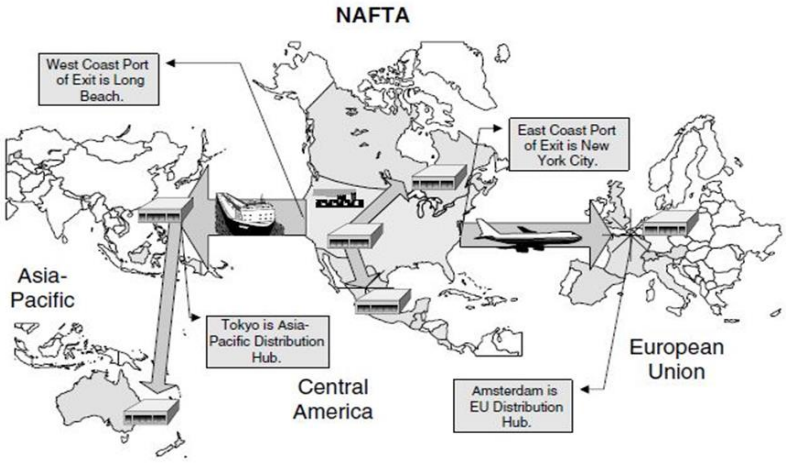


Figure.4 Global logistics

In this proposed methodology aim to study AI based logistics, in which this will be comprised of interdependent activities of customer response, inventory planning and management, supply, transportation, and warehousing as shown in Fig.4 and Fig.5.

Figure. 5 AI based Global logistics

IV. LITERATURE REVIEW

4.1 *Literature Survey*

logistics is actually a subset of supply chain management. Logistics is the task of managing using flows material flow of the physical goods from suppliers through the distribution centres to stores; and information flow of demand data from the end-customer back to purchasing and to suppliers, and supply data from suppliers to the retailer, so that material flow can be accurately planned and controlled. Thus, logistics can be seen as part of the overall supply chain challenge. Differentiating strategies, A supply chain, then, may choose to compete on different criteria. Such criteria need in turn to be recognized and form part of the business strategies of all the members of a given network. The choices so made have major implications for the operation of each member. Failure to recognize competitive criteria and their implications for a given product or service by any member means that the supply chain will compete less effectively.

Five principles of strategic positioning, related to

logistics strategy, are as follows (after Porter, 1984) [12]:

● A unique value proposition: determining what makes the product/service different from its competitors.

● A tailored supply chain: governed by consistent order winning and qualifying criteria.

● Identify the trade-offs: by choosing not just the priorities but also what not to do.

A responsive supply chain is not compatible with an efficient supply chain (Fisher, 1997) [13][14].

● Align logistics processes: so that processes are mutually reinforcing.

● Continuity: logistics processes are continually and consistently improved over time. To reinforce the issue of differentiating strategies, let us look at two commonly used strategies that have very different logistics implications. Consider products with different logistics priorities, such as shown in Fig.6.

● Cost: a high-volume product for which demand is relatively stable throughout the year. While subject to occasional enhancements, these are usually small scale: the life cycle is comparatively long.

Demand forecasts are usually pretty accurate.

● Time: a high-variability product that is entirely remade for the following season after being created for the current one. It is frequently impossible to forecast which color or design would be the most popular. The product life cycle is brief, but predicting demand is far more challenging. The effects of cost and time in logistics are very different. When responsiveness and speed are critical, the very cost-cutting measures—like sourcing from the Far East—are the incorrect course of action. Comparably, a company's capacity to provide variety and quick reaction times may be constrained by its investment in high volume, low variety industrial equipment, which may increase efficiency and lower costs. The ability to support another priority (time) is hampered by the development of the ability to sustain one priority (expense). In logistics, this is known as the trade-off principle: having more of one item means having less of another. Two distinct supply chains—one centered on cost and the other on timeliness—would be ideal. The requirement to keep a single European distribution center may make this impractical. Nonetheless, to prevent one product line from obstructing the flow of the other, logistical operations within the distributed center can very well be maintained apart. The same reasoning may also be used within a certain product range, where it may be necessary to keep promotional (or "surge") demand separate from every day (or "base") demand.

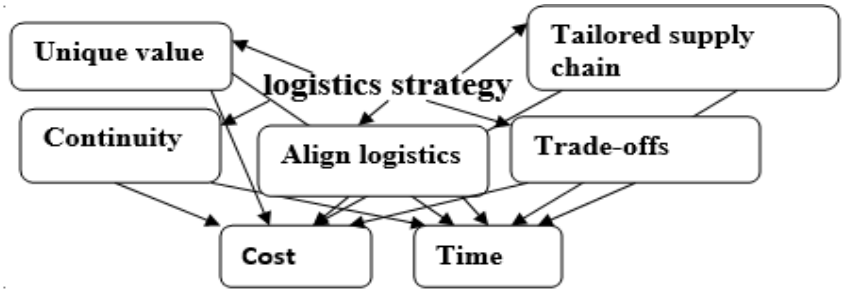


Figure.6 Supply Chain Logistics Strategy

4.2 Integration of Technologies

In article [17] discussing the integration of logistics information system and RFID (radio frequency identification) technology to improve the informatization level of logistics management. Based on analyzing the functional demand of logistics information system, a framework of logistics information system is constructed. The physical level, technical level, data layer, functional level, and service level are the five levels that make up the framework. Beginning with logistics information gathering, article [17] presents the fundamentals and benefits of RFID technology, as well as the viability and methods for implementing it to increase the effectiveness of logistics information gathering. Additionally, the logistics information system's dependability is increased by the inclusion of RFID technology. The use of barcode technology in warehouse operations and logistics is quickly becoming a must for modern logistics. The application of bar code technology in logistics and warehouses was covered in the article [18]. We then focused on how to employ barcode technology when items are entering, being stored, and leaving warehouses. Finally, we argue that using barcode technology in warehousing and logistics will result in enormous financial gains for logistics companies.

Zheng Wang and Guanyu L [19] discussed in their article today's intelligent era. Big data has emerged as one of the most potent tools in a variety of sectors. Smart logistics, which is based on big

data and related technologies, is the future direction of logistics since it offers significant benefits in terms of increasing user satisfaction, cutting costs, and increasing the efficiency of logistics. The information platform for intelligent logistics facilitates the effective operation of intelligent logistics. The platform operates supply chain logistics in an integrated manner, employing cutting edge information technology and intelligent technology and integrating all types of logistics resources and information. By integrating all kinds of logistics information and resources and applying artificial intelligence technology, the intelligent logistics information platform can provide high efficiency, low-cost and integrated logistics services, and promote the development of local economy.

The work of Yan Pang and Zhongwei Wang [20] illustrates how complex the establishment of a regional logistics information platform is. Their work demonstrates the development of a regional logistics information platform based on needs analysis. A multi-media database is created in order to handle the diverse media information during logistics operations. There are five tiers in the platform's hierarchy: physical, technical, data, functional, and service. Utilizing data mining and multi-media technologies ensures that the logistics information platform is fully utilized.

The complexity of the facilities structures and relationships in discrete manufacturing enterprises was covered in an article by Xiaoying Yang et al. [21]. It is very difficult for this type of enterprise to meet its growing demands when the facility layout method solely depends on the knowledge and tools of traditional systematic layout planning (SLP). This paper analyses the benefits and drawbacks of SLP and illustrates the nature of logistics simulation technology.

A new approach for enhancing the system layout process is provided by the authors [21]. The novel method for designing an enterprise's facility architecture combines logistics simulation technologies with SLP (Systematic architecture Panning). First and foremost, the SLP will be utilized for the system's plane layout and quantitative analysis. Subsequently, the 3D models for simulation and optimization will be constructed using the logistics simulation technologies. This approach can be used to visualize the layout of a facility, identify possible bottlenecks, and improve system performance.

A case is given to show that the application of this technology provides not only a high-efficiency, high-quality, visualization, flexible design tools for the factory layout, but also an effective communication means with decision-makers of enterprise. The research shows that the new approach has played a very important role in reducing losses, saving invest, and shortening the design cycle for enterprises. Describe in detail IoT-based technology in article [22]. As China's network economy grows at a rapid pace, there is a growing demand for customized logistics services that reflect the country's clear trend toward socialization and networking. In order to keep up with this trend, the integration of Internet of Things technology has led to the proposal in this article of a new intelligently networked logistical service mode called "cloud logistics" that may offer services on demand inside the context of IoT. They examine the idea, tenet, and characteristics of cloud logistics.

Then, the cloud logistics-based One-stop Service Platform for logistics center has been put forward. Through a unified, centralized, intelligent management and operation of cloud logistics platform, we can provide the supply chain users with comprehensive, fast and efficient logistics services. In addition, on the basis of research on the one-stop service platform architecture, a platform instance is also presented.

The latest technological advancements and trends in logistic management are enabled in Article [23]. They talked about how the creation and operation of third-party logistics management systems involves the use of enabling technologies for logistics, such as barcode technology, RFID, EPC, GPS, GIS, RS, GMS, EDI, and so forth. By combining these technologies, it is possible to manage storage, schedule, and control transportation, exchange information, and process logistics. In the meantime, the integration of CRM, DSS, SCM, and other cutting-edge enabling technologies with the third-party logistics management system allows for the effective improvement of informationization in third-party logistics enterprises, the creation of a more intelligent and flexible logistics chain, the sound and quick development of the logistics sector, the coordination of all facets of production for the benefit of society as a whole, and the provision of a comprehensive range of logistics services.

The author applies game theory to the logistics industry in [24]. It had a dynamic association with several businesses in the demand network system for the delivery of particular products or services. Under particular circumstances and with particular relationships, these systems cooperate and work together. The cornerstone of a successful, long-term cooperative network should be the logistics-dynamic alliance members' equitable profit allocation, and a sensible profit-sharing policy must be established among them. Their work reveals

that, in accordance with Nash equilibrium theory, the logistics industry's dynamic alliance members' optimal profit-sharing coefficient is determined on the basis of cooperation and collaboration, and a rational quantitative strategy for profit distribution might be put into practice.

4.3 *Artificial Intelligence-Based Optimal Control Method Supply Chain Logistics Transportation [28]*

In recent years, with the gradual improvement of the economic level and the rapid development of the logistics industry, the right energy-saving scheduling has become a key issue facing the management system [33]. Although logistics enterprises have rich experience in the long-term development process, due to the scheduling has not been properly solved, resulting in information feedback is not timely, resulting in high cost, which has affected the development of China's logistics enterprises to a large extent. Supply chain management is the network chain relationship surrounding the core enterprise, such as the relationship between the core enterprise and the supplier, the supplier's supplier and even the forward relationship, the relationship with the user, the user of the user, and the backward relationship.

The chain is around the core enterprise, through the control of information flow, logistics, and capital flow, starting from purchasing raw materials, making intermediate products and final products, and finally sending the products to consumers through the sales network, the suppliers, manufacturers, Distributors, retailers, and end users are connected into a whole functional network chain structure model [34],[35],[38]. Under the mode of supply chain, the competition between enterprises is no longer the competition between single enterprises, but the competition between supply chains in which enterprises belong. A well-functioning supply chain can not only bring value growth to the enterprises on the chain, but also can improve user service levels, reduce total transaction costs, or achieve a balance between the two [39].

V. AI IN WAREHOUSE LOGISTICS

Warehouse logistics, more specifically "intralogistics operations," is the art of integrating, automating, and managing the flow of products in fulfillment or distribution centers. GPU-powered AI solutions deliver a level of consciousness to the supply chain. With intelligent video analytics, robotics, automation, and management, operations become more efficient, process throughput accelerates, and warehouse robots deliver end-to-end visibility, increasing the accuracy of orders picked, packed, and shipped.

5.1 *Warehouse Simulation*

Many popular solutions based on a computing platform using 3D workflows with different applications. These are a cooperative platform that enables businesses to simulate their entire warehouse, run multiple scenarios such as increased demand during holidays or constrained time windows and optimize the results [17]. Retailers can utilize digital twins of their warehouses to discover how even small adjustments will impact operations before they make substantive investments. Case studies: In order to this demo video to see how PepsiCo is exploring_Omniverse_Enterprise>https://www.youtube.com/watch?v=MXJIEB6CVtE(Omnivers is a computing platform based on 3D workflows and applications)

5.2 *AI in Smart Warehouses*

Smart warehouses are using AI-at-the-edge technologies to automate inventory processes, simplify general package handling, and optimize real estate when receiving orders and sending packages to other distribution centers. Developers can leverage the different components of building, training, and deploying algorithms for inference at the edge. Artificial intelligence (AI) and cloud-native applications, IoT and its billions of sensors, and 5G networking now make large-scale AI at the edge possible. But, a scalable, accelerated platform is necessary to drive decisions in real time and allow every industry—including retail, manufacturing, healthcare, and smart cities—to deliver automated intelligence to the point of action.

This is what brings people, businesses, and accelerated services together, making the world a smaller, more connected place as shown in Fig.7.

Case studies: To bring agility and flexibility to distribution centers with AI > and Exploring AI computer vision applications at the edge for retail >

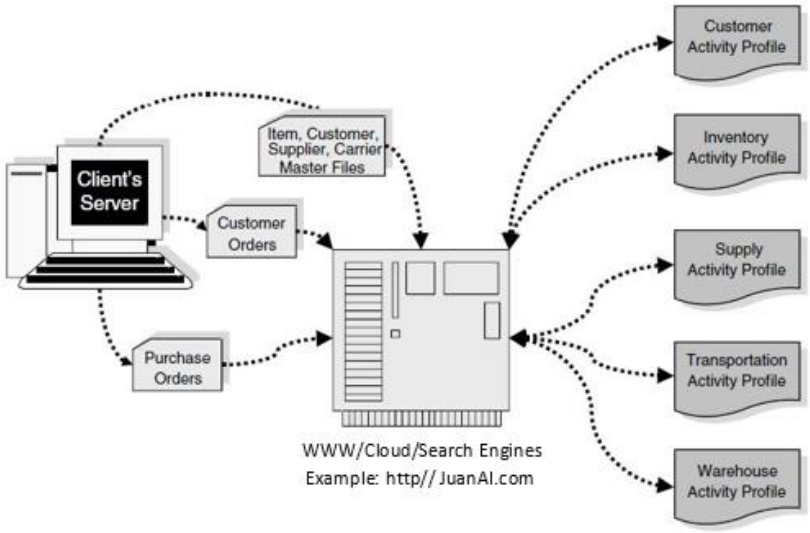


Figure.7 AI in Smart Warehouses

5.3 *Robots for Package Handling*

Store associates are the face of retail organizations. To maximize time with customers, retailers are working to reduce the time they spend on non-customer-facing tasks, such as inventory counts. Large retailers are using robotics technology to unload and sort items based on priority and department, check stock levels, correct shelf locations, and ensure price accuracy. To resolve throughput challenges from the scale and variety of products, companies are using edge computing to detect, classify, estimate the size of, and position packages, automatically adjust the speed of conveyors and optimize mechanical sorting. This helps to minimize product damage and machine down time. See Fig.8 shows working of robots for tracking inventory [49].

Figure.8 Robots are Tracking Inventory

5.4. *Accelerating and Enhancing Robotics*

From development to simulation and deployment from smart automation. In manufacturing to last-mile delivery, robots are becoming more ubiquitous in everyday life. However, industrial and commercial robotics development can be complex, time consuming, immensely challenging, and expensive. Unstructured environments across many use cases and scenarios are also common. The robotics platform as shown in Fig.9 addresses these challenges with an end-to-end solution to help decrease costs, simplify development, and accelerate time to market.

Figure 9. Robotics platform

5.5 *Route Optimization for Large Distribution Networks*

Warehouse and manufacturing centers are solving the enormous complexities of product flows with AI-powered robots. These robots utilize powerful deep neural networks for perception, segmentation, and pose estimation to perceive their environment, detect objects, navigate autonomously, and move objects. Market leaders are widening their competitive advantage with increased throughput, per-order customization, and differentiated customer experiences. Case Studies based on The NVIDIA Isaac™ robotics platform allows BMW Group to easily manage new models and configurations to meet customer demand, using AI technology to innovate factory logistics [25]. With this approach, they can produce high-quality, highly custom-configured cars more rapidly on the same production line as shown in Fig.10. 99 percent of BMW's customer orders are uniquely different from each other.

Figure 10. BMW Group is Redefining Factory Logistics

BMW Group's response is to use NVIDIA's Isaac robotics platform to develop five AI-enabled robots to improve their logistics workflow, powered by a variety of NVIDIA Jetson AGX Xavier and EGX edge computers [25].

5. 6 *Last-Mile Delivery Solutions*

Several factors can impact the last mile of a delivery, including traffic, construction, and weather. Using real-time data from a variety of sources from GPS data to weather forecasts routes can be optimized, which can significantly impact fuel, personnel, and other overhead costs. Beyond that, by using GPU powered smart solutions to optimize routes, carriers can provide more accurate delivery windows, improving the level of service provided to customers.

This in stills a higher degree of trust, which matters when customers have an array of options for sending and receiving important parcels. Many AI based solution empowers developers to leverage larger datasets and faster processing to optimize last-mile

delivery with new capabilities like dynamic rerouting, simulations, and sub-second response times in the warehouse and on the road. Global logistics is the most significant advancement basis on technology that has brought including warehouse automation, autonomous vehicles, predictive analytics, and smart roads. This powerful technology offers to automate and simplify numerous processes, thus helping companies save both time and money. It's no wonder giants like Amazon and Google have started investing in AI as sown in Fig.11. Modernization of the world business a warehouse that has already implemented various technologies to transform its business. The Amazon is one of the popular groups of logistic industries. It Founded in 1994, the company has become one of the biggest players within technology, web services, logistics and warehousing. With Amazon being one of the biggest companies globally, it has not limited the use of its AI to one business sector. The most important sector that AI and machine learning has been introduced into the delivery is highly dependent on a well-run warehouse operation. Amazon was the first company to introduce one-day shipping into their services. This involves various complexities within their fulfilment centers and these processes will continuously adapt and evolve to be more streamlined, automated, and sophisticated. There are between 1 to 5 million product bins in each Amazon Fulfilment Center.

Figure.11 Amazon AI Warehouse [43]

The team controls computer vision systems that examine images to track each item's position within the warehouse and allocate them into specific pods. Amazon makes use of AI to improve supply and make sense the data, automating the capability to forecast customer demand, assess product availability, optimize delivery routes, and personalize communication with customers while tracking the whole supply chain [43].

VI. ROLE OF AI IN THE LOGISTICS INDUSTRY

6.1 *Biggest Trends of AI in Logistics Autonomous Vehicles*

We have all heard about driverless cars Fig.12(a), but artificial intelligence in the logistics industry also allows automating other vehicles for transporting goods, such as vans, trucks, or buses. Autonomous vehicles can work on their own or with a human driver Fig.12(b). However, these vehicles are not fully autonomous yet. Current regulations and technology do not allow having autonomous vehicles on the roads without drivers [48]. According to many countries' laws, the driver still has to be behind the wheel to control the situation on the road and analyze potential risks, but that is expected to change in the future. This type of technology can bring lots of benefits to logistics. Automated vehicles bring changes to the supply chain and help save time and reduce costs. But more importantly, driverless technology could help reduce the number of accidents. Moreover, it helps the environment by reducing fuel usage [26].

Figure.12(a) Volvo Develops Autonomous Vehicle System for Logistics [26]

Figure 12(b). Autonomous Vehicles can work on their own or with a Human Driver[54]

In article [27] stated about the Autonomous driving is considered the future of road transport. Trucks that drive mostly autonomously and are controlled by the system are a development goal that appeals to many companies in logistics. The advantages of the technology seem too clear. Because autonomous trucks can:

i)compensate for the shortage of skilled workers
ii) drive around the clock
iii) be used more cheaply

These include liability issues as well as the safety of the systems and the technology of networking. One of the challenges is that autonomous commercial vehicles must first gain the trust of Germans.

6.2 AI *based autonomous driving for global logistics*

In order to be able to consider the advantages and disadvantages of a new mobility, it is important to first clarify the framework conditions: the automation of vehicles not clear about how independently can they move in traffic? Are they already suitable for use on public roads? In order to objectify this discussion, a division of development into different sub-areas has become established, according to which cars and trucks are classified.

The following levels apply:

(1) The driver drives himself
(2) There is driving assistance
(3) Partial automation (when parking, keeping in lane or braking)
(4) Conditional automation (when executing the indicator and changing lanes)
(5) High automation (the guidance of the vehicle is largely taken over by the system)
(6) Full automation (a system or programme controls the vehicle independently)

The categorization into these areas shows on the one hand that research into autonomous trucks has produced a number of valuable assistance systems in addition to the long-term goal of complete autonomy, such as emergency brake assist, distance cruise control with stop-and-go function, traffic jam assist, lane departure warning and lane feedback assist. However, it also reveals that important legal questions still need to be answered before fully automated trucks can be used in road traffic. This is because, according to current legal standards, the responsible party is determined in the event of traffic accidents in order to clarify the question of liability. To what extent this can also be implemented for system- or program-controlled vehicles and to whom the responsibility for a technological development is attributed is not yet

foreseeable. Not to mention ethical issues that may arise in the programming of the systems: Who do the systems prefer to protect when there will inevitably be a personal injury accident - children or the elderly? And how do they priorities when their driving manoeuvres can have varying degrees of severity, from minor injuries to certain death?

Figure 13. Autonomous Driving as a Path to the Future of Logistics.

6.3 *Benefit of autonomous driving for logistics*

Anyone who asks themselves the big safety questions surrounding driverless trucks quickly notices, away from the borderline cases, that they have the potential to increase road safety. Because the thought of a future with autonomous vehicles means at the same time that the effects of human weaknesses on traffic will decline: Misjudgments, wrong perception, emotions or bad form on the day and overtiredness. Once developed to operational maturity, the technology will always show consistently high performance.

A characteristic that makes autonomous driving enormously interesting, especially for logistics. Because it offers enormous efficiency potential for road freight transport. Today's framework conditions only allow vehicles to be used for around one third of the time of day, especially in long-distance transport. After all, there is usually one driver on the road alone who has to adhere to the applicable driving and rest times. Autonomous vehicles, on the other hand, have the potential to stay on the road around the clock and to carry out transports even at times when there is little traffic. This gives them the opportunity to significantly optimize their processes along the value chain by drastically extending the use of the vehicles.

Logistics service providers also benefit enormously from fully networked trucks, whose deployment they can control more easily because they receive comprehensive information from them. The autonomous driving affects the job of truck drivers. One important reason for working intensively on autonomous vehicles is the increasing shortage of skilled workers. Because there is a shortage of truck drivers in Germany and Europe.

Their working conditions, with high time pressure and at the same time increasingly dense road traffic, have become more and more of a burden on the profession as a whole. As a result, far fewer young people are learning the profession of truck driver than older colleagues retire each year. In North America, the driver shortage has already become an impediment to growth for the entire economy. Nevertheless, this deficit can at best be compensated for in the long term by autonomous trucks. It is not yet clear whether or by when autonomous trucks will be able to cope with the complexity of traffic in densely populated urban areas. In addition, the technology will entail a high initial investment for the deploying companies - which, according to estimates, will be offset by around 40 percent lower operating costs. According to forecasts, up to ten percent of road transport could be carried out by autonomous trucks by 2030 as shown in Fig.13.

6.4 *Artificial Intelligence in Warehouse Automation*

This year has brought new problems and solutions to look out for. Many large corporations require fast and advanced logistics solutions, which is why they are investing their resources in AI technology and robotics. Many routine tasks are facilitated thanks to warehouse automation. AI is transforming warehousing processes Fig.14, such as collecting and analyzing information and inventory processes, enabling companies to increase efficiency and boost revenues. In warehousing, AI is used to make demand predictions, modify orders, and re-route products in transit. You can adjust your orders according to these predictions and have the in-demand goods delivered to local warehouses as needed. In case there are multiple warehouses in the

chain, AI can connect them to find the best option for transporting the inventory. When you predict the demand for certain products and plan the logistics well in advance, you can improve your service, cut transportation costs, and save a lot of money.

Computer vision technology used in warehousing allows recognizing and organizing items. In the future, this type of technology will help perform quality control and eliminate the need for human supervision.

Figure 14. AI is Transforming Warehousing Processes

6.5 *Smart Roads*

Another application of artificial intelligence in the logistics industry is smart roads. Several companies are working on building them. Smart roads help improve road safety and reduce delays in the supply chain caused by unfavorable weather conditions, making deliveries faster.

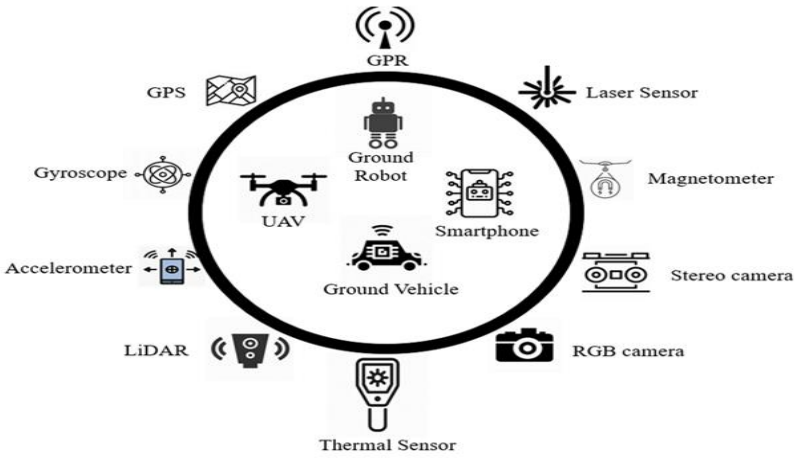


Figure.15 Road Condition Monitoring Using Smart Sensing and Artificial Intelligence [29]

Smart roads are equipped with solar panels and LED lights Fig.15. Solar panels are used to produce electricity and prevent roads from being slippery during winter months, as they have the ability to heat up. LED lights alert drivers about the changing road conditions. Smart roads provide highly valuable information for businesses that use them to transport their products. Roads with fiber optic sensors are connected to the internet and can sense traffic volumes and patterns and warn drivers of upcoming traffic jams Fig 16. They can also sense when vehicles leave the road or when an accident occurs and alarm emergency services.

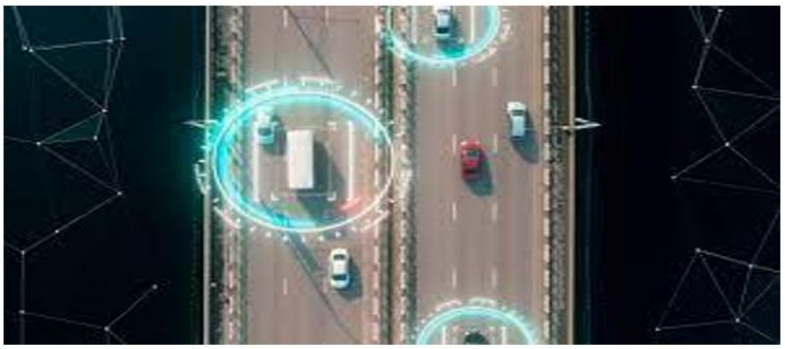


Figure.16 Smart Road Technology; Source: Digital Highways of The Future [30]

6.6 *Better Demand Prediction*

Predicting future needs regarding the number of goods and supplies is vital for running a successful company. When companies fail to make accurate predictions, and the amount of goods does not meet the high demand, they lose money, which is the last thing they want. If your predictions are inaccurate, you risk running short of inventory and losing sales. Your customers won't hesitate to turn to your competition unless you can meet their needs. Artificial intelligence offers algorithms that can predict these trends. Certain AI-based tools can make predictions even better than human specialists, which means lower inventory and simplified warehouse management and supply chain management as sown in Fig.17. Another benefit of AI in logistics is enhancing the customer experience. AI can ensure a better customer experience through personalization and product suggestions based on customers' buying habits and personal preferences. Customers will appreciate a more personalized experience and become more loyal to the company.

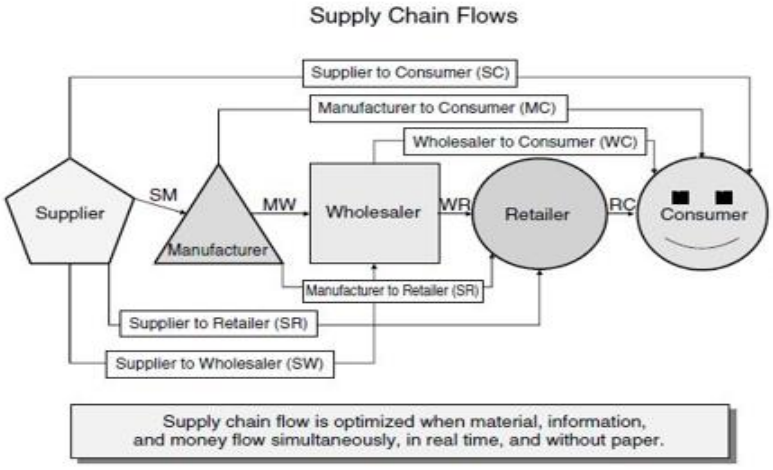


Figure. 17 Process of Supply Chain Management

6.7 Back *Office Operations*

Back-office operations are crucial for the logistics industry. AI plays a huge role in improving the speed and accuracy of many back-office operations. Combining AI with Robotic Process Automation (RPA) has created a technology called cognitive automation. In combination with RPA, AI enables employees to improve their performance by increasing productivity and accuracy. For example, some repetitive data-related tasks can be automated with the help of AI. This way, back-office automation helps companies with supply chains save both time and money. With this type of technology, some categories of employees, such as accountants and human resources specialists, can be replaced. Consequently, the probability of human error will be lower.

6.8 *Energy Saving Optimization Control Based on AI*

Decomposition of factors affecting energy consumption of logistics and transportation: Because the suppliers and demanders of people flow transportation have different purposes in the transaction process, the income is also different [6][9]. The logistics transportation supplier seeks to

meet the demand of the logistics transportation demander with the least cost, and the logistics transportation demander seeks to obtain the best logistics service from the logistics transportation supplier with the least input cost. Therefore, in the transaction process, the cost of information sharing should be considered, and the lost advantage of holding information should be considered after information sharing. Therefore, both parties are not willing to share with the other party. The information sharing mentioned above refers to the sharing of information related to the supply and demand of their own logistics transportation by using modern methods, so there is a game between them [7][8]. In order to make the game analysis between the supply side of logistics transportation and the demand side of logistics transportation closer to the inter-buying situation, and be more conducive to guiding practice, the game matrix between the supply side of logistics transportation and the demand side.

VII. RRSULT AND ANALYSIS

Most U.S. corporations spend between 8 percent and 15 percent of sales revenue on logistics activities as sown in Figure 18 Logistics is being recognized as perhaps the last frontier for major corporations to significantly increase shareholder and customer value. An excellent example is the Coca-Cola corporation. With the world's most recognized brand, Coke is the envy of the world in marketing. With a route driver or order taker appearing in nearly every customer location, nearly every day, Coke's customer service is outstanding. With a product made for over a century by the same mixing of sugar, water, carbonation, and flavoring, theoretical capacities for production quality and efficiency are being reached. The linking of those world-class marketing, customer service, and production processes, logistics, is the next great frontier for Coca-Cola and many other enterprises [15].

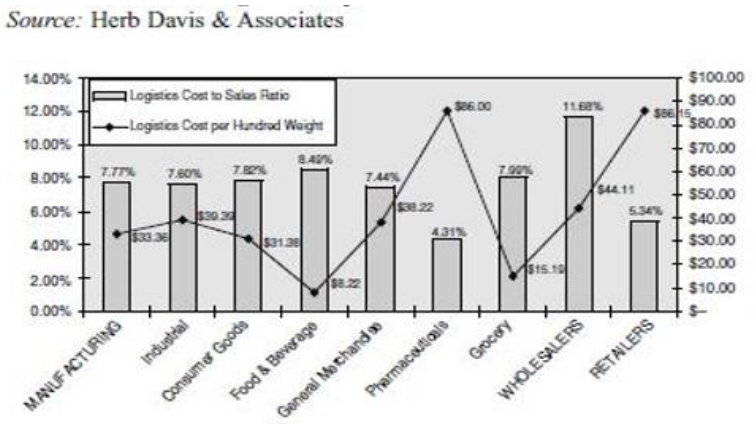


Figure. 18 Logistics Expenditures versus Sales for Various Industries

Logistics and supply chain management are new concepts in private industry Logistics and supply chain management cut across and draw from personnel in a multiplicity of disciplines. It is no wonder that confusion abounds and that a majority of logistics projects never reach their intended goals or wind up as catastrophic failures [15]. Add to this a marketplace that includes more than thousands of vendors of logistics software, more three thousand transportation providers, and many thousands are providers of third-party logistics, and we have a situation ripe for unmet promises and potential. The unmet potential is evidenced by the fact that less than 30 percent of all logistics projects ever achieve their intended goals and that logistics productivity in the United States in the last few years has remained flat due to covid19[52].

7.1 *Customer Response Analysis*

Customer response links logistics externally to the customer base and internally to sales and marketing. Customer response is optimized when the customer service policy (CSP) yielding the lowest cost of lost sales, inventory carrying, and distribution is identified and executed as shown in Fig 19.

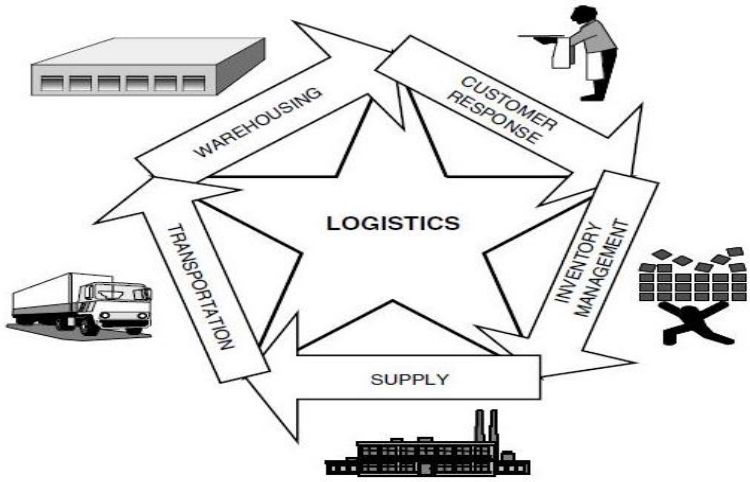


Figure. 19 Logistics of Customer Response and Activities

The logistics of customer response includes the activities of

• Developing and maintaining a customer service policy
• Monitoring customer satisfaction
• Order Entry (OE)
• Order Processing (OP)
• Invoicing and collections

7.2 *Results Based on Inventory Planning and Management Inventory*:

Block Fundamentals as shown in Fig.20 The inventory planning and management (IP&M) is to determine and maintain the lowest inventory levels possible that will meet the customer service policy requirements stipulated in the customer service policy.

The results analysis of logistics of inventory planning and management includes

• Forecasting
• Order quantity engineering
• Service level optimization
• Replenishment planning
• Inventory deployment

In the many cases, the optimal logistics policy is to provide 99.5 percent inventory availability and next-day response.

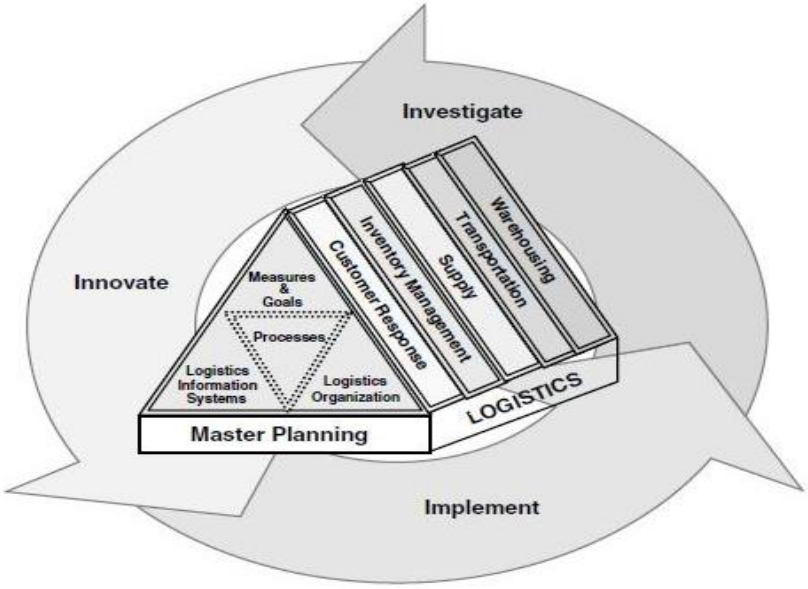


Figure.20 Inventory Master Planning Methodology

The analysis can and should be performed for individual products, product lines, customer groups, the overall product line, and/or any meaningful subset of the business as shown in Fig.21[15]

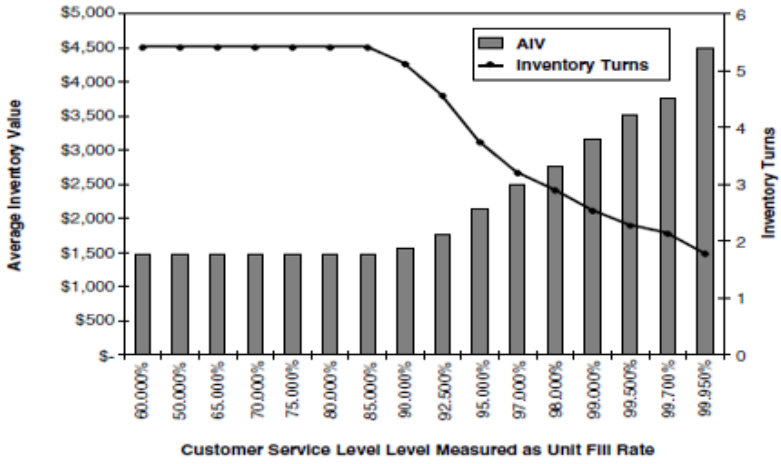


Figure. 21 The Result of Average Inventory value, Inventory turns, and Customer service levels.

Most major corporate and logistics decisions are based on the forecast including
• Capital investments
• Marketing campaigns
• Service level planning
• Warehouse sizing
• Staffing plans
• Manufacturing expansions
• Carrier negotiations
• Transportation network designs
• Supplier negotiations
Closed-loop forecasting is one of the forecast processes as shown in Fig.22

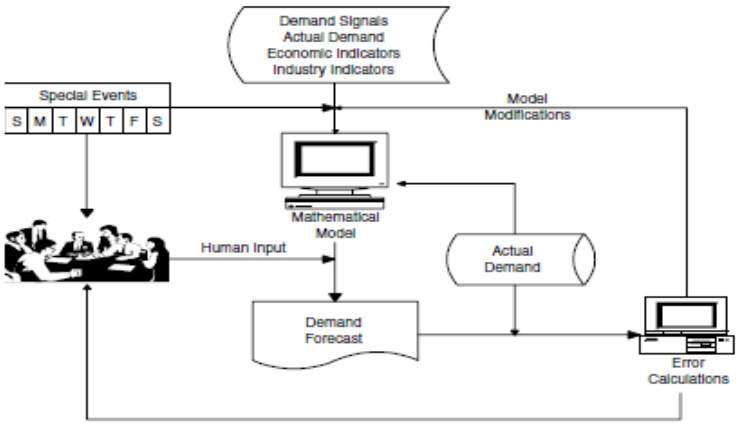


Figure. 22 Closed-loop Forecasting

This can be evaluated as given formulas: Efficient logistics quantity (ELQ). Efficient order quantities (EOQs) consider the purchase order cost (POC), the annual demand rate (AD), the inventory carrying rate (ICR), and unit inventory rate (UIV).

$$\text{EOQ} = [(2 \times \text{POC} \times \text{AD})/(\text{ICR} \times \text{UIV})]^{1/2}$$

$$\text{EOQ} = [(2 \times \text{POC} \times \text{AD})/(\text{ICR} \times \{1 - d\} \times \text{UIV})]^{1/2}$$

where d is the discounting rate (such as, 5 percent, 10 percent, 15 percent). An EOQ analysis is should be completed as a part of any inventory strategy.

7.3 Results *based on Supply*

Supply is the process of building inventory (through manufacturing and/or procurement) to the targets established in inventory planning [46]. The objective of supply management is to minimize the total acquisition cost (TAC) while meeting the availability, response time, and quality requirements

stipulated in the customer service policy and the inventory master plan.
The logistics of supply include
• Developing and maintaining a Supplier Service Policy (SSP)
• Sourcing
• Supplier integration
• Purchase order processing
• Buying and payment
The first sourcing decision for each item is whether to make it or buy it. The decision should take into account a long-term business strategy, core competencies, the capabilities of optional supply sources, total ownership cost, and quality implications associated with internal versus external sourcing. Internal sources should be held accountable to the same supplier certification criteria established in the supplier service policy. A common supplier sourcing review involves outsourcing component supply. The results presented in the figure are from an assessment of the cost per vehicle advantage related to component outsourcing among the Big Three auto makers. In this assessment, Chrysler maintains a $660 per vehicle cost advantage over General Motors and a $220 per vehicle cost advantage over Ford due to outsourcing major components. Outsourcing benefits practices for each of these supply activities presented in Fig.23[15]

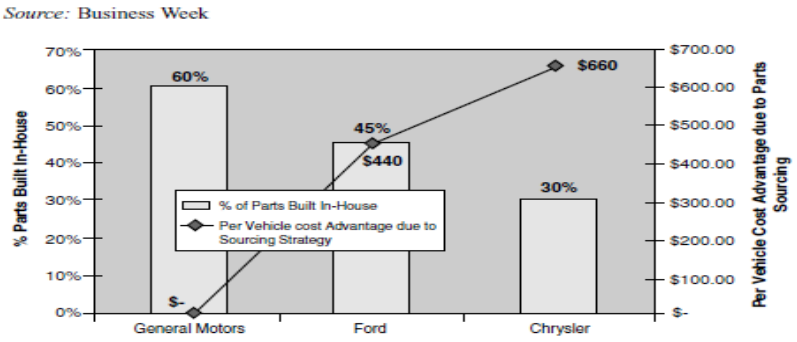


Figure 23 Outsourcing Benefits for Big-3 Automotive Companies

7.4 Results *and Analysis of Transportation*
Transportation is the most expensive logistics activity, representing over 40 percent of most corporations' logistics expense of 2004 as shown in Figure 24 and over $800 billion in annual expenses in the United States alone. Global transportation expenditures exceed $7.2 trillion annually (Michigan State University) [15]. International trade and global trends lead transportation is to link all pick-up and deliver-to points within the response time requirements of the customer service policy and the limitations of the transportation infrastructure at the lowest possible cost.
The logistics of transportation includes
• Network design and optimization
• Shipment management
• Fleet and container management
• Carrier management
• Freight management

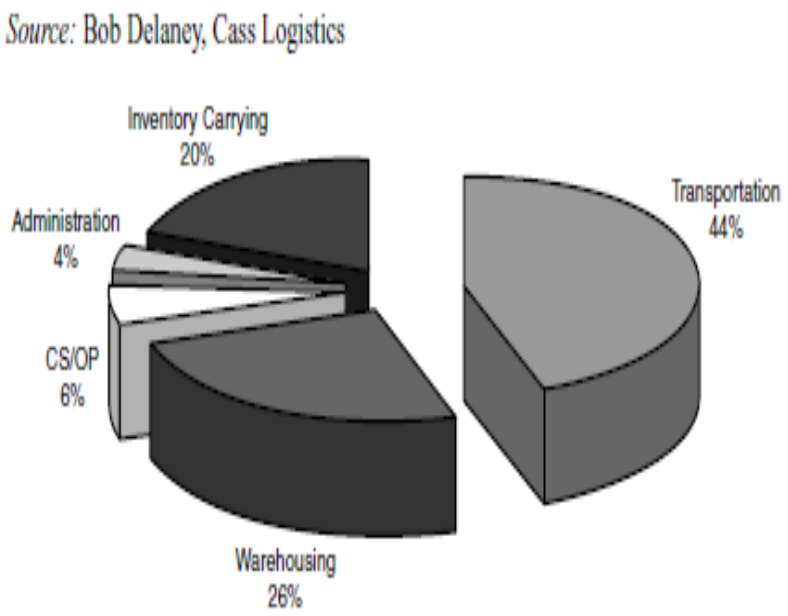


Figure.24 Transportation Expenses as a percentage of Total Logistics Expenses.

Web-based truck tracking: New AI and GPS systems permit transportation assets to be tracked physically within a few feet across the globe and functionally across a variety of activities including loading, unloading, traveling empty, traveling full, idling, and so on as see in Figure.25[45].

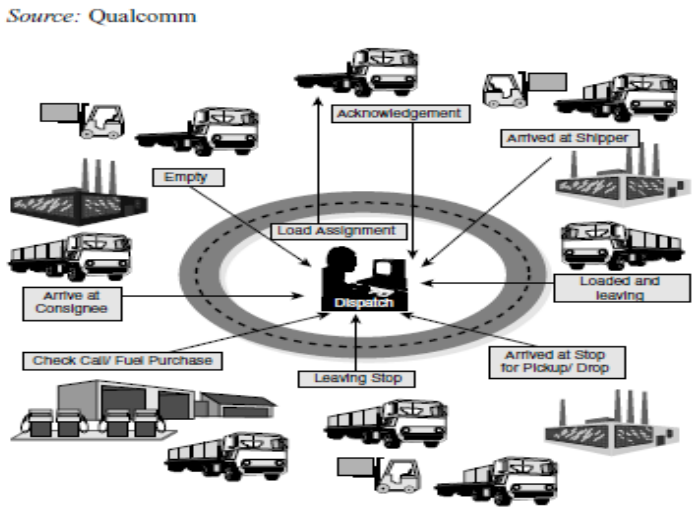


Figure.25 World Web-based Transportation Activities

7.5 *Results based on Warehousing*
The warehouse ultimately portrays the efficiency or inefficiency of the entire supply chain as shown in Fig 26.

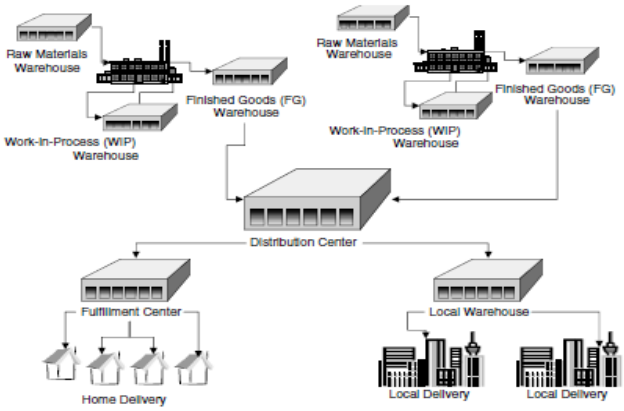


Figure.26 Roles of a Warehouse in the Logistics Chain

The objective of warehousing is to minimize the cost of labor, space, The objective of warehousing is to minimize the cost of labor, space, and equipment in the warehouse while meeting the cycle time and shipping accuracy requirements of the customer service policy and the storage capacity requirements of the inventory play. The logistics of warehousing includes

• Receiving /,• Putaway /,• Storage /,•Order picking /,• Shipping.

7.6 AI *based logistics*:

The AI based logistics has proven successful in a wide variety of industries around the world uses various decision based supported tools. As seen the growth of technology by the report of the Logistics Performance Index (LPI) India got the 38th position amongst 139 countries as seen in Fig.27. Artificial Intelligence (AI) and other emerging technologies have the capacity to make a substantial contribution to the digitalization of supply chains [53][55].

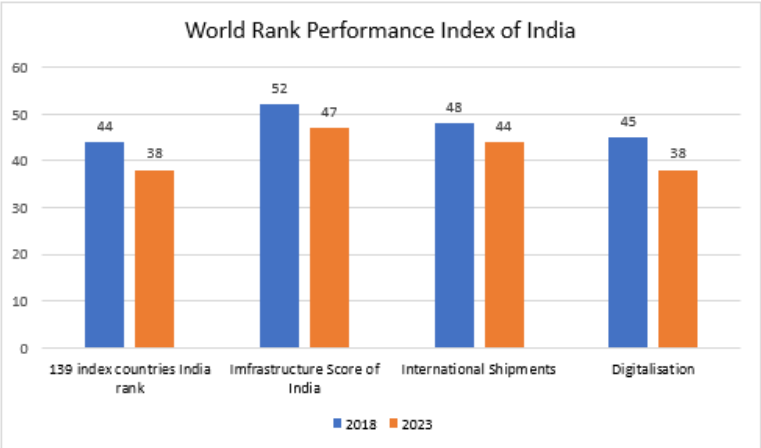


Figure.27 India's Rank based on Logistics Index [55]

Hence AI helps in logistics optimization and play role of a key ingredient in logistics planning methodology. many optimization techniques are applied but the innovation of technology force to global logistics and supply chain environment. It applied optimization of customer service policy optimization, computing optimal purchase order quantities, determining optimal product sources, choosing optimal locations for distribution centers, and optimizing the placement of products in a warehouse, transportation supply management and many more.

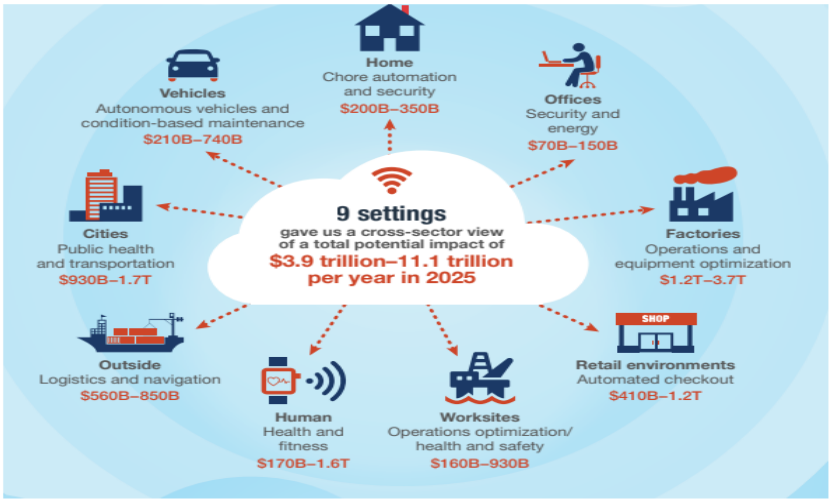
According the McKinsey Global Institute, operations and equipment optimization in the factory setting can generate up to $3.7 Trillion of value by 2025 (Manyika et al., 2015) [40]. More recently, Frank et al. (2019) [32] examine different economic and technological drivers for companies to adopt various Industry 4.0 technologies. Based on a survey of 92 manufacturing companies, they find that computerized (or smart) manufacturing is a key driver. The advancements of the communication technologies, sensor capabilities, and artificial intelligence are making robots smarter so that they

can work safely alongside human workers. Table 1 illustrated the AI based Global logistics platform.

Table. 1 AI based Global logistic platform

Sr.No.	Example	Illustration of work
1.	BMW	BMW has robots and human workers work alongside on its assembly line in its plant in South Carolina. Also, wearable robotics with exoskeletons can aid human workers to reduce repeated motion injuries due to lifting heavy boxes in the warehouse or harvesting fruits in the field.
2.	Caterpillar and GE	Companies such as Caterpillar and GE are exploring the adoption of wearable robotics to improve worker safety.
3	JD.com	JD.com, the largest online retailer in China, has adopted various advanced robots to stack products on shelves and pack merchandise in 500 warehouses (Marr, 2018)[41].
4.	Mujin Robots	By 2019, JD.com implemented the world's first automated warehouse in Shanghai equipped with Mujin robots (Hornyak, 2019)[42].
5.	Drones	Drones are unmanned aerial vehicles that can be controlled remotely. These drones can carry different sensors to record data (visual and audio) for monitoring and surveying operations, to carry certain devices including robotic arms for pick up and drop off operations, or automated sprays for farming operations.
6.	Internet of Things (IoT)	The internet of things a system of devices (e.g., sensors) that can communicate and interact with others over the internet, and this system can be remotely monitored and controlled.
7.	Processing speed of sensors	With drastic reduction in cost and increase in processing speed for these sensors and significant improvements in measurement and communication technologies, the adoption rate of internet of things is growing exponentially in recent years. Columbus (2018) reported that, by 2020[40-42].
8.	Logistics and Utilities industries	Discrete Manufacturing, Transportation & Logistics and Utilities industries are projected to spend $40B each on IoT platforms, systems, and services.
9.	Blockchain	A Blockchain is a distributed and secure ledger. As articulated by Olsen and Tomlin (2019), it is distributed because it can be written and accessed by different (possibly authorized) entities and its data is stored on a peer-to-peer network. Wang et al. (2019) conducted in-depth interviews with 14 supply chain experts to explore how blockchain technology may transform supply chain operations in the future.
10.	Cloud Computing	IBM Watson is an AI system that is capable of answering questions posed in natural language. Also, GE uses sensors to collect data from its gas turbines or windmills via its Predix Cloud (an online platform), and then use machine learning and deep learning algorithms to conduct preventive maintenance before a breakdown. Many firms are exploring different ways to exploit these exciting Industry 4.0 technologies.
11.	Industry 4.0	The manufacturing focus is reflected from a recent survey of 1600 C-level executives across 19 countries conducted by Deloitte: 73% of the respondents reported that they are currently developing Industry 4.0 based technology initiatives that focus on improving operations (mostly in manufacturing), and yet only 6% focus on logistics (Deloitte Insights, 2018) [32].
12.	Apache Hadoop	The company collects petabytes of manufacturing data from over 8.000 sources and over 500 servers worldwide. This data is sent to two environments of the open-source software program "Apache Hadoop" for data mining. Hadoop is designed for parallel processing of large data-sets, meaning that multiple datasets can be processed at the same

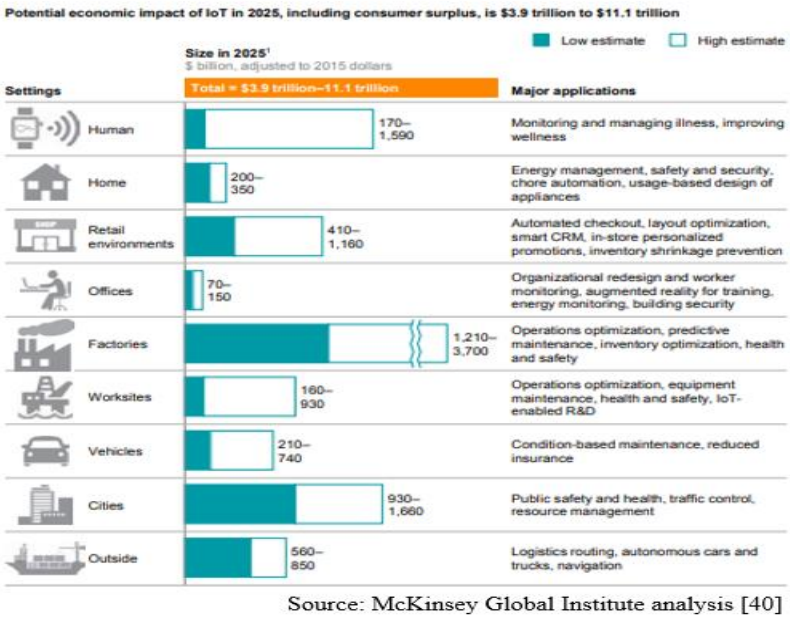
		time [36].
13.	GPU system	Machine Vision over 2.000.000 images are stored in the Hadoop environment. For Acoustic Listening, Micron sends the relevant data to a GPU system to handle the massive workload of the complex machine learning algorithm in a swift manner [36].



Source: McKinsey Global Institute [40]

Figure.28 The Strategic role of the AI Logistics Model

This observation implies that many firms undervalue of the strategic role of the logistics function as a competitive lever or as a business model as shown in Fig.28 and Fig.29. Based on World Bank projection of $99.5 trillion per year in global GDP in 2025[40**]**



Source: McKinsey Global Institute analysis [40]

Figure .29 The Strategic role of the AI Logistics Model

7.7 *Foreign Trade (NAFTA)*

FT (NAFTA) Division of the Department of Commerce deals with India's bilateral trade with United States of America, Canada and Mexico. Indian Trade Portal – www.indiantradeportal.in, on behalf of the Department of Commerce, Govt. of India. The Portal provides information on India's export and import policies, export benefits, Most

Favored Nation (MFN)/ preferential tariff, rules of origin, Sanitary and Phytosanitary Standards (SPS) / Technical Barriers to Trade (TBT) measures of 87 markets etc. at tariff line. It organizes many countries specific programs to prepare the exporters for various global markets. It exchanges business delegations, arranges exhibitions, organizes B2B meets with the members of trade from various countries. And lasted figures as shown in Fig.30 India's overall export Merchandise and services combined in March 2023estimated to be USD 66.11 Billion exhibiting a negative growth of (-)7.53percent over march 2022

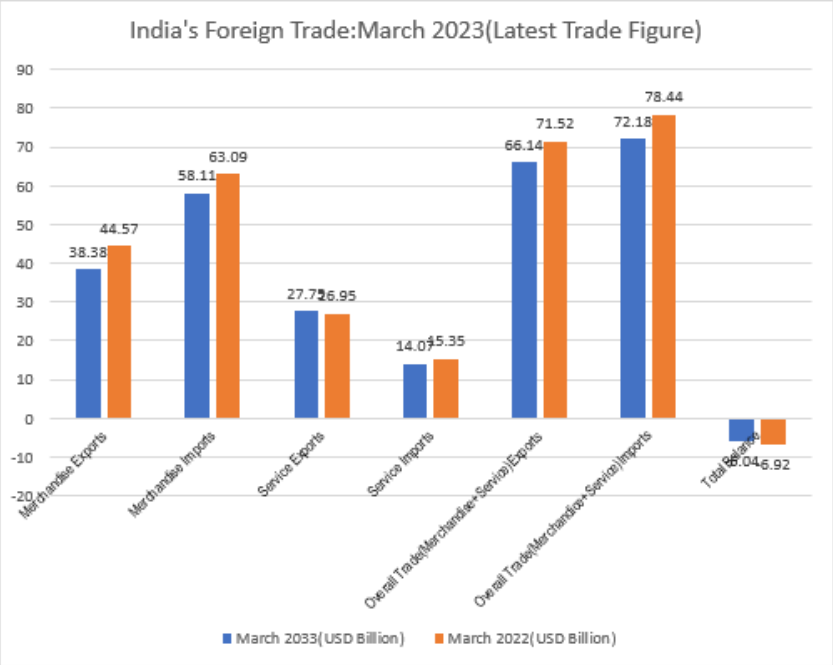


Figure.30 India's Latest Trade Figures: Source [44]

Table 2 Bilateral Trade Statistics in Respect of NAFTA Countries [44]

Country	Trade Indicators (in US$ mn)	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
USA	Exports	42, 464	40, 340	42, 217	47, 882	52, 406	53, 089	51, 630	76, 111
	Imports	21, 815	21, 781	22, 307	26, 611	35, 549	35, 820	28, 877	43, 314
	Total Trade	64, 279	62, 121	64, 524	74, 493	87, 956	88, 909	80, 507	119, 425
CANADA	Exports	2, 196	2, 019	2, 004	2, 506	2, 851	2, 852	2, 962	3, 764
	Imports	3,749	4, 234	4, 132	4, 729	3, 515	3, 880	2, 686	3, 060
	Total Trade	5,945	6, 253	6, 136	7, 235	6, 367	6, 732	5, 648	6, 824
MEXICO	Export	2, 862	2, 865	3, 461	3, 783	3, 842	3, 624	3, 087	4, 425
	Import	3, 393	2, 283	2, 944	3, 930	5, 577	4, 297	2, 846	4, 248
	Total Trade	6, 255	5, 148	6, 405	7, 713	9, 419	7, 921	5, 933	8, 673
Total Trade with NAFTA	Export	47, 522	45, 224	47, 682	54, 171	59, 099	59, 564	57, 679	84, 300
	Import	28, 957	28, 298	29, 383	35, 270	44, 642	43, 997	43, 997	50, 622
	Total Trade	76, 479	73, 522	77, 065	89, 441	1,03,741	1,03,561	92,087	1,34,922
Share of trade with NAFTA countries in India's total trade (%)		10.08	11.43	11.67	11.63	12.29	13.14	13.46	13.04
Share of Exports to NAFTA countries in India's total exports (%)		15.31	17.24	17.29	17.85	17.90	19.01	19.84	19.98

VIII. CONCLUSION

Generally, with economic development, logistic industry would be closer and closer with the life. Embracing new technologies is one of the best strategies to improve the supply chain. AI has numerous uses in the supply chain and the logistics sector. Companies all over the world are implementing this powerful technology into their everyday operations. Artificial intelligence helps speed up and simplify various essential processes. Automating routine tasks that otherwise take a lot of time improves efficiency and accuracy and reduces the probability of human error. As a result, the implementation of AI in the logistics industry can reduce expenses and increase customer satisfaction. The purpose of this study is to investigate the logistics framework of the current business model and its application to trusted data in the virtual world. In this study, we observed a suggested new technology-based supply chain management, self-driven transportation, smart management, and digitalization framework. Put special emphasis on the in-depthness of Indian foreign trade and logistics' index for this study to identify the future development sector of India and the need for their global development. In the future, artificial intelligence technology will have a wide range of applications. In the same way that new technologies improve financial services, they also improve the efficiency of financial services. Among them are banking, insurance, trading and investments, crowd-funding, the Internet of Things, manufacturing, such as on-demand manufacturing, smart diagnosis and maintenance, product certifications, asset and inventory record management, supply chain management, healthcare, governance and management education, and the energy sector.

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