

The impact of Emerging Technologies on Logistics: A Comprehensive Analysis

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Abstract. *Starting with the development that we had in previous years; we will look deeper into the benefits that emerging technologies have on logistics. We will explore specific applications and will use study cases as examples from companies that were successful in implementing this type of technology. Logistics management is being transformed by emerging technologies, bringing unprecedented efficiency, transparency, and sustainability. As global trade and supply chain complexities growth, logistics stakeholders are embracing cutting-edge technologies to optimize their operations. Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), Blockchain, and Autonomous Vehicles are leading the way as key drivers of this process. Highlighting these technologies, how they work, addressing their challenges and potential drawbacks, we will emphasize with a cause-and-effect projection for a better understanding of how the future will look into logistics. This paper analyses the consequences of these emerging technologies on logistics, emphasizing their capacity to redefine conventional paradigms and mold a future for the industry that is more resilient and adaptable.*

Keywords: technologies, logistics, autonomous vehicles, artificial intelligence.

Introduction

Given the dynamic nature of the industry, it is essential to understand that supply chain management is always changing and is influenced right now constantly by these emerging technologies. The field of logistics has a long history, and its roots can be traced back to ancient times, with etymology coming from Greek, which means "enabled in calculation". The modern concept of logistics, as applied in business and supply chain management, began to take shape in the middle of the 20th century. What brings together historical and modern logistics, is the process of computing, which is mainly the emphasis even in today's logistics studies. The improvements made in recent years are indeed very visible.

The logistics industry is going through numerous changes in the context of the ever-changing world of global trade. This transformation is driven by a wave of innovative technologies that are aimed at restructuring the traditional ways of doing business. As supply chains become more complex and interconnected, there is a urgency for efficiency, transparency and sustainability. The implementation of these recent technologies plays an important role in this development, offering logistics suppliers great opportunities to streamline operations, have better decision-making processes, and to be able to establish more resilient supply chains.

It is very clear, that with the innovation in the industry, all sectors will be affected, and all processes will be improved in time, nevertheless, it is important to understand that the structure is ever-changing and right now, the focus is on the adaptability of business to undergo the required changes. These emerging technologies started to appear in a lot of automotive companies, and with the study below we will see which were successful, how they did it, and of course the lesson learned with these implementations. We will firstly focus on highlighting improvements that were associated with the implementation of the emerging technologies, starting with a clear

understanding of these concepts. The main focus right now is split between the following aspects: digital transformation (continued shift towards digital transformation), E-commerce (focus on deliveries and innovative fulfillment), supply chain resilience (strategies to enhance resilience), sustainability initiatives (increasing awareness towards more eco-friendly strategies), technology integration (automation, robotics, autonomous vehicles), global trade challenges(focus on trade uncertainties), collaboration and visibility (collaboration end-to-end), labor shortages (driving automation and technology adoption).

Literature review

Overview emerging technologies

The logistics sector is known for its nature of constant change and has experienced many changes due to the emergence of new technologies. This review of literature aims to offer a deeper understanding of the transformation effects brought about by different technologies in the field of logistics. These technologies refer to Artificial Intelligence (AI) and Internet of Things (IoT) and Blockchain and Autonomous Vehicles. Through the analysis of the existing literature and this review purpose is to bring a closer understanding on how these technologies have influenced supply chain operations and efficiency and sustainability.

In their study and Chopra and Meindl (2020) have highlighted the significant impact of artificial intelligence in various domains and such as demand forecasting and route optimization and inventory management. Domains that are very focus in the actual market and due to the global uncertainty. The successful implementation of artificial intelligence here has led to better resource allocation and cost reduction. Furthermore and the utilization of machine learning algorithms has given to the logistics providers the ability to examine vast datasets and detect patterns and extract valuable real time data. This has played a crucial role in improving the flexibility and responsiveness of supply chains and as emphasized by Van Hoek et al. (2019). Machine learning algorithms enable logistics providers to analyze vast data and identify patterns and extract real time insights. This enhances supply chain flexibility and responsiveness (Van Hoek et al. and 2019). Internet of things (IoT) devices have significantly transformed logistics. They facilitate seamless connectivity and real time visibility throughout the supply chain. Asset tracking and condition monitoring and a predictive maintenance become possible with IoT technologies (Lee et al. and 2017). This empowers stakeholders to optimize asset utilization and minimize downtime. It also and give a lot more flexibility for logistic providers. Additionally and the integration of Internet of thing(IoT) sensors improves transparency in the supply chain and enables proactive risk management and ultimately leading to increased customer satisfaction and trust (Verma et al. and 2020).

The logistics industry has been greatly impacted by the emergence of blockchain technology. This innovative technology provides a secure and transparent transaction records and which in turn enhance trust and security within supply chains. According to Tapscott (2017) the blockchain has the potential to disrupt the industry by offering immutable records that cannot be tampered with. Additionally researchers like Lakhani (2017) highlight the ability of the blockchain to streamline cross border transactions and reduce paperwork and combat fraud in logistics operations. By utilizing decentralized ledgers and blockchain enables end to end traceability and verification of product provenance and effectively addressing challenges related to product authenticity and compliance. This technology has the potential to revolutionize the logistics industry and improve efficiency and security in supply chain operations (Chen et al. and 2020).

The emergence of self governing vehicles and encompassing unmanned aerial vehicles and autonomous trucks and holds the potential to transform the efficiency of last mile delivery and transportation. Researchers like Liu et al. (2018) delve into the consequences of autonomous vehicles on logistics and emphasizing their capacity to diminish delivery durations and decrease operational expenses and improve the overall resilience of the supply chain. Nevertheless and obstacles pertaining to regulatory structures and safety protocols and public acceptance continue to pose substantial challenges in achieving widespread implementation (Seurin' et al. and 2021). Emerging technologies are changing the logistics landscape and offering unseen opportunities for optimization innovation and sustainability. The integration of artificial intelligence (AI), Internet of Things (IoT), blockchain and autonomous vehicles promises to improve supply chain visibility and resilience and improve efficiency and driving competitive advantage in an increasingly volatile global market. However the successful implementation of these technologies needs strategic alignment and collaboration and of course the continuous adaptation to the evolving market dynamics. Future research endeavors should focus on addressing key challenges and exploring applications of emerging technologies to unlock the full potential of logistics in the digital age.

Methodology

Artificial Intelligence has an increasing trend lately, by 2022 the Artificial Intelligence hit the public ground and in 2023 it started to have roots into the business area worldwide, such as 2024 will be a pivotal year, as the awareness about AI is expanding. As seen in figure 1, by 2025 the topics where Artificial Intelligence will become critical is expected to increase with 27%, from the values from 2022.

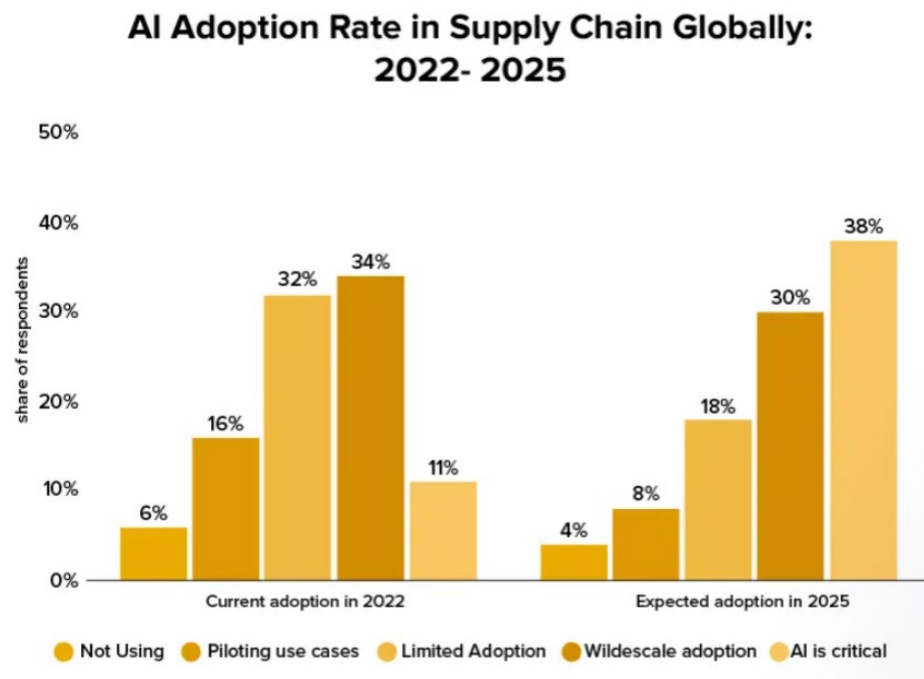


Figure 1. Artificial Intelligence Adoption rate

Source: <https://appinventiv.com/blog/ai-in-supply-chain-analytics/>.

In logistics there are a lot of areas where artificial intelligence is already used such as: demand forecasting and route optimizations. For the demand forecasting, we need to have first a

set of data to analyze, such as previously obtained data sets from sales. By analyzing such data sets by different methods such as moving averages, exponential smoothing, ARIMA (AutoRegressive Integrated Moving Average) and machine learning algorithms such as linear regression, decision trees, or neural networks, Artificial Intelligence can predict to a certain degree the outlook, nevertheless as a constrain it is not, yet fully capable to comprehend the variability determined by the bullwhip effect. Several companies are already using Artificial Intelligence in their demand forecasting for a better inventory management, optimized production and supply chain operations. Examples of companies that were successful in implementing these are: Amazon, Walmart, Procter&Gamble, Coca-Cola, Nike and from the automotive market Toyota,BMW, General Motors, Tesla, Volkswagen. When speaking about global companies in the automotive industry, with different production sites worldwide, the artificial can determinate in which location the demand is higher, and so the companies can allocate more resources to those locations in order to fulfill the demands with local production.

By starting to look over on autonomous vehicles and their benefits, one of the majeure improvement that it is promised with these implementations is the reduction of traffic accident. Autonomous vehicles in transportation. The deployment of autonomous trucks, drones, and delivery robots is on the rise, offering the potential to increase the speed and efficiency of transportation while reducing labor costs. However, regulatory challenges and safety concerns still need to be addressed for widespread adoption.

In present, a big percentage of car accidents are caused by human errors, which can be eliminated by the usage of autonomous vehicles. As we can see in table 1. Benefits of autonomous vehicles, the reduction of traffic accidents it is only one of the benefits promised by the introduction of this technology.

Table 1. Benefits of autonomous vehicles

Benefits of autonomous vehicles
Accident traffic congestions
Travel cost reduction
Eradicating human error
Independence for disabled people
More time and comfort
Smog and air quality
Safety Accessibility
Improved crash avoidance
Reduced CO2 emissions
Increased lane capacity
Quicker commute times
Optimized driving experience

Source: Authors' own research.

According to the World Health Organization, annually in the deaths of approximately 1.19 million people around the world, and among the main causes of these accidents are: speeding, driving under the influence of alcohol or other substances, distractions, non-use of safety devices (helmet, seat belt) and unsafe vehicles. In the European Union, the numbers of these events dropped, and according to data from CARE database, since 2011 where we had around 30.000 death by car accidents, in 2023, we had around 20.600 deaths in 2022, were according to European Commission news represented a 4% increase compared to 2021. In Romania, during the year 2022, 28,010 traffic accidents causing bodily injuries were registered, resulting in a number of 36,218 injured persons, of which 4.5% were

fatally injured. According to a study published by Institutul National de Statistica (ISN), in 2022 in Romania, most accidents happened in the Nord-Est region, followed by the accidents that happen in the capital, as saw in table 2. Even if over the years the number of accidents decreased for Romania, we are classified as number one in traffic accidents in Europe.

Table 2. Numbers of car accidents per region in Romania in 2022

Region	Number of accidents	Number of persons involved		
		Total	Deaths	Hurts
Total	28010	36218	1633	34585
Nord - West	3386	4441	184	4257
Centre	3235	4274	144	4130
Nord - Est	4594	5978	304	5674
Sud - Est	3625	4846	235	4611
Sud - Muntenia	3920	5175	274	4901
București - Ilfov	4401	5019	96	4923
Sud - West Oltenia	2676	3559	230	3329
West	2173	2926	166	2760

Source: <https://insse.ro/cms/ro/content/mijloace-de-transport-vehicule-%C3%AEnmatriculate-%C8%99i-accidente-de-circula%C8%9Bie-rutier%C4%83-0>.

Looking and compare the data from different countries around Europe, with the data from 2009 until 2021, as shown in figure 2, we can see that Romania has the most accidents compared to Nordic countries and with our neighbor Hungary. As shown in the graphic below, we can see that the Nordic countries have a low number of death provoked by traffic accidents occurring annually, and the trend is decreasing. Hungary is set in the middle, between Romania and the Nordic countries with a stable trend. Romania has a very fluctuating trend, but with an overall decrease of approximative 0.29% starting from approximative 2.700 deaths in 2009, to approximative 1.900 deaths by 2021.

Now, by understanding the need to reduce the number of traffic accidents we can delve into the necessity to achieve autonomous vehicles. As the autonomous vehicles are an innovation, is widely believed that the number of car accidents will decrease when technology is used to either partially or completely replace human drivers in maneuvering a vehicle from one place to another while avoiding hazards on the road and reacting to traffic conditions. However, the implementation of this technology requires a good road infrastructure. Right now there are ongoing a lot of project regarding the autonomous vehicles, most know are: Waymo, Tesla, Cruise, Argo AI, Zoox, Aurora, BMW, Aptiv. To the general public the most known autonomous cars right now are the Tesla models and Waymo, and as a result of the improving technology, as a support for logistics activities is the Aurora trucks.

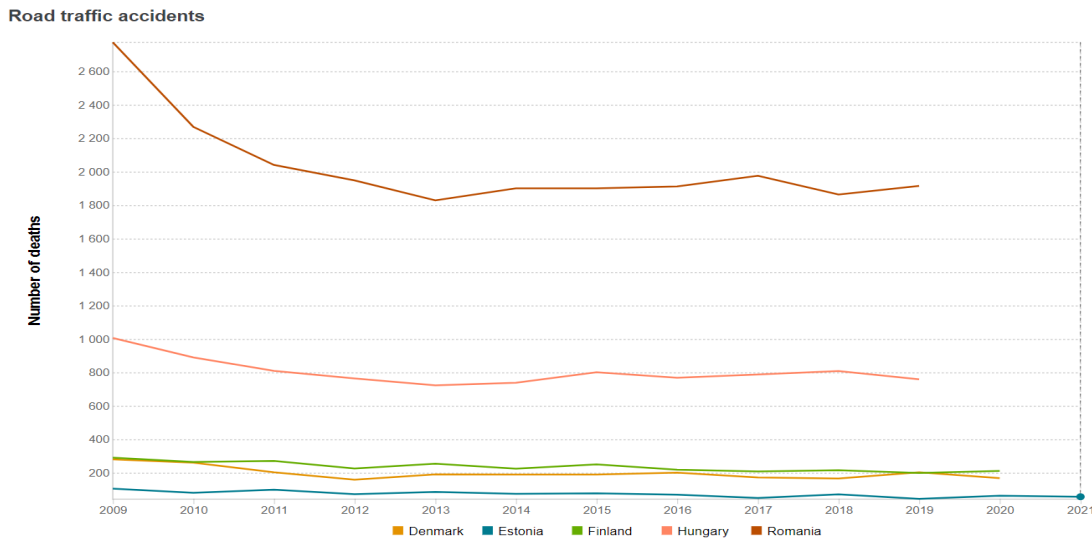


Figure 2. Number of deaths by road traffic accidents

Source: <https://platform.who.int/mortality/themes/theme-details/topics/indicator-groups/indicator-group-details/MDB/road-traffic-accidents>.

Tesla's Full Self-Driving was first made available to the public in beta form in October 2021. Even while the phrase isn't quite accurate and the vehicles can't drive themselves entirely, the technology is still a significant improvement above the autopilot mode that comes standard on the majority of Tesla's. Under its purview are features like smart summon, which enables you to park and unlock your Tesla while standing outside the car, and assisted steering on freeways and city streets. The technology, which can be accessed via the Tesla mobile app or key fob, lets you navigate around barriers and move the Tesla to whatever position you choose. It also controls traffic and stop signs and auto parks the vehicle (automatically parking in parallel or perpendicular slots). Eight cameras and twelve ultrasonic sensors, which gather data from the environment and transmit it into a potent computer integrated into the car, are standard equipment on all Tesla models. This data includes information about objects, people, traffic signals, signs, lanes, and other cars on the road. Using AI and machine learning, the built-in computer interprets this data and adjusts the car's navigation accordingly. The car is not autonomous even with the current Autopilot, Enhanced Autopilot, and Full Self-Driving functions activated; they still need active driver monitoring. Achieving reliability significantly greater than that of human drivers – as evidenced by billions of miles of experience – and gaining regulatory approval – which might take longer in some places – will be necessary for full autonomy. As Tesla's Autopilot, Enhanced Autopilot and Full Self-Driving capabilities evolve, the vehicles will be continuously be upgraded through over-the-air software updates. In the current status, the full self driving mode, still requires the full attention of the driver, the car is sending notifications on display, that the driver should always have his hands on the wheel. Even if, there is still a long way to go for a fully autonomous vehicle, Tesla is having a great start here, with a lot of features, already available for the public use.

Waymo, originally part of the Google autonomous vehicle project, has been in operation since 2009 and is currently a stand-alone subsidiary of Alphabet, the parent company of Google. Waymo intends to create a driver, not an automobile. Building technology that is equal to the most skilled driver on the road and one that is safe, careful, and proactive is Waymo's objective. In the long run, Waymo's technology will be a completely autonomous device that lets users ride along

as passengers throughout the entire journey. Unlike contemporary car technology like automated cruise control and lane-keeping mechanisms, which demand constant driver surveillance, Waymo is meant to function without a human driver. Waymo is capable of performing all aspects of dynamic driving within a given region and under specific guidelines. As seen in figure 3, Waymo technologies combines supplemental sensors with a vision system, a lidar system and a radar system. Before Waymo Driver starts working in a new region, Waymo meticulously maps the terrain, marking everything from curbs and pedestrian crossings to traffic signs and lane markings. The Waymo Driver thereafter employs these incredibly accurate personalized maps in combination with real-time data from sensors, rather than depending only on external data sources like GPS, which might lose signal strength, to always establish their precise geographical position.

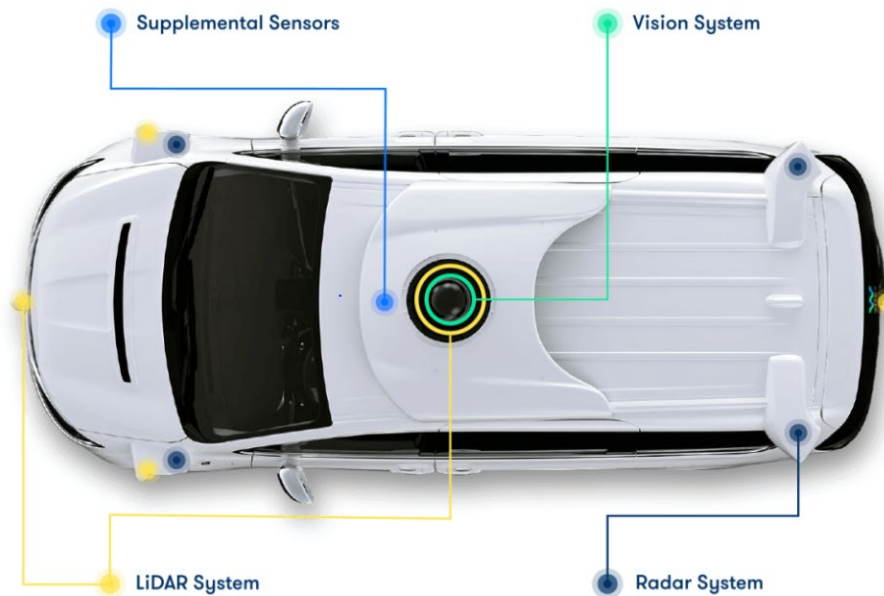


Figure 3. Waymo technology

Source: <https://waymo.community/about/how-autonomous-vehicles-work.html#watch>.

The technology of Waymo, is very complex, starting with the vision system, Waymo features an advanced camera system that is made to operate well in both bright and dimly lit environments at a distance. Waymo vehicles are capable of identifying traffic lights, areas of construction, school buses, and emergency vehicles' flashing lights because to its ability to sense color. Waymo's multi-layered sensor suite, which enables it to see in all directions, enables it to output a detailed three-dimensional representation of the surroundings which incorporates simultaneously moving and stationary elements. Day or night, Waymo's LiDAR (which stands for Light Detection and Ranging) technology calculates the period of time it takes for a laser pulse to bounce off a surface and return to the car by sending millions of pulses of laser light per second in a 360-degree array, view visible in figure 4.

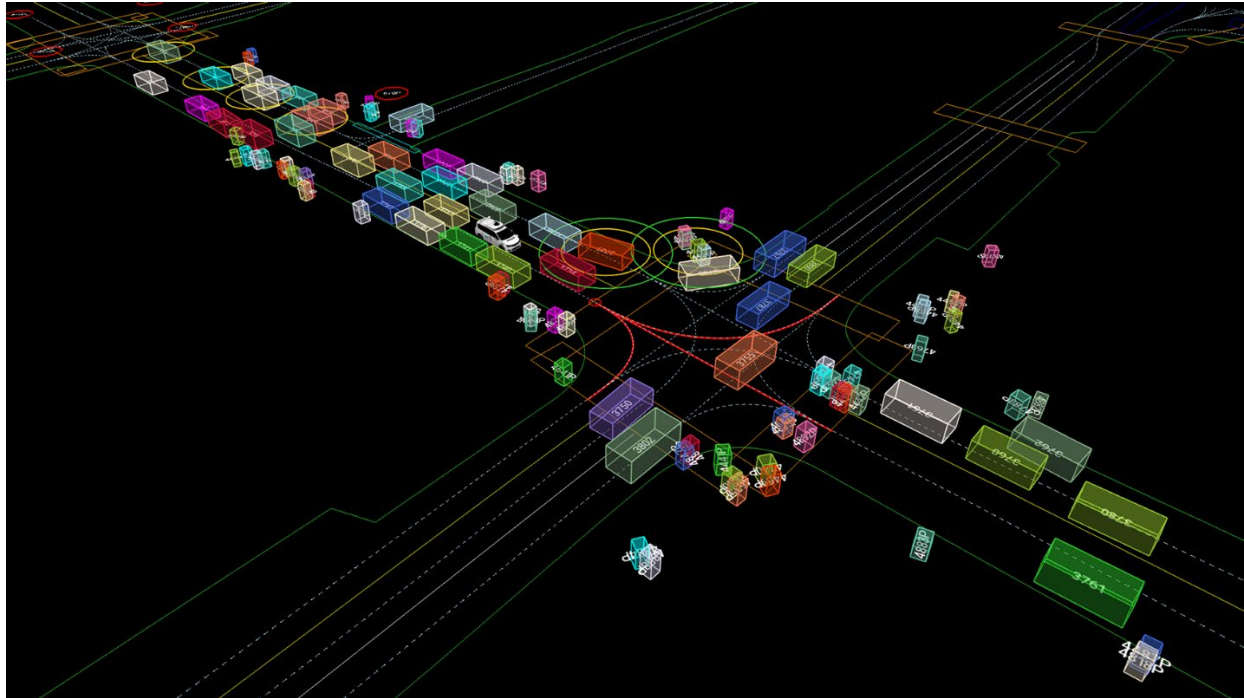


Figure 4. Overview from Waymo system

Source: <https://waymo.com/blog/2021/03/expanding-waymo-open-dataset-with-interactive-scenario-data-and-new-challenges/>.

In October 2020, Waymo became the first company to offer service to the public without safety drivers in the vehicle. Waymo currently operates commercial autonomous taxi services in Phoenix, Arizona and San Francisco, with new services planned in Los Angeles and Austin, Texas. Phoenix is the first city where Uber has publicly rolled out access to Waymo's cars. According to a study published by Waymo, in December 2023, based on the datasets analyzed in the location Waymo, is already used, for over 7 million rider-only miles, these cars are already outperforming humans comparable with less crash rate with any type of injuries and police-reported crash rate, as visible in figure 5.

As stated by their results they had the Waymo Driver's crash rate with any kind of injury was reduced by 85%, or 6.8 times, from minor to severe and fatal cases (0.41 incidence per million miles compared to 2.78 for the human benchmark), and the police-reported crash rate was reduced by 57%, or 2.3 times, from 2.1 incidence per million miles (2.1 for the Waymo Driver compared to 4.85 for the human benchmark). It is essential to take into account two major statistical bias concerns when comparing autonomous and human driving. The first factor is the underreporting of collisions involving people. Although statistics on human crashes that cause casualties or property damage are quite accurate, many low-severity events – such as seemingly insignificant "fender benders" or minor collisions with debris on the road – are not reported to the law enforcement. However, autonomous vehicle (AV) companies document even the most minor incidents in order to demonstrate the trustworthiness of AV driving on public roads. For example, just 21% of crashes that Waymo reports to the National Highway Traffic Safety Administration (US) ended up resulting in a police report being submitted, regardless of who was at fault. Disparities in driving circumstances and/or vehicle characteristics contribute to the second aspect. All kinds of highways, including freeways, where the Waymo Driver presently runs with an autonomous specialist present are included in the public data

on human crashes. It also incorporates a variety of vehicle types, such as motorbikes, passenger automobiles, and commercial heavy vehicles.

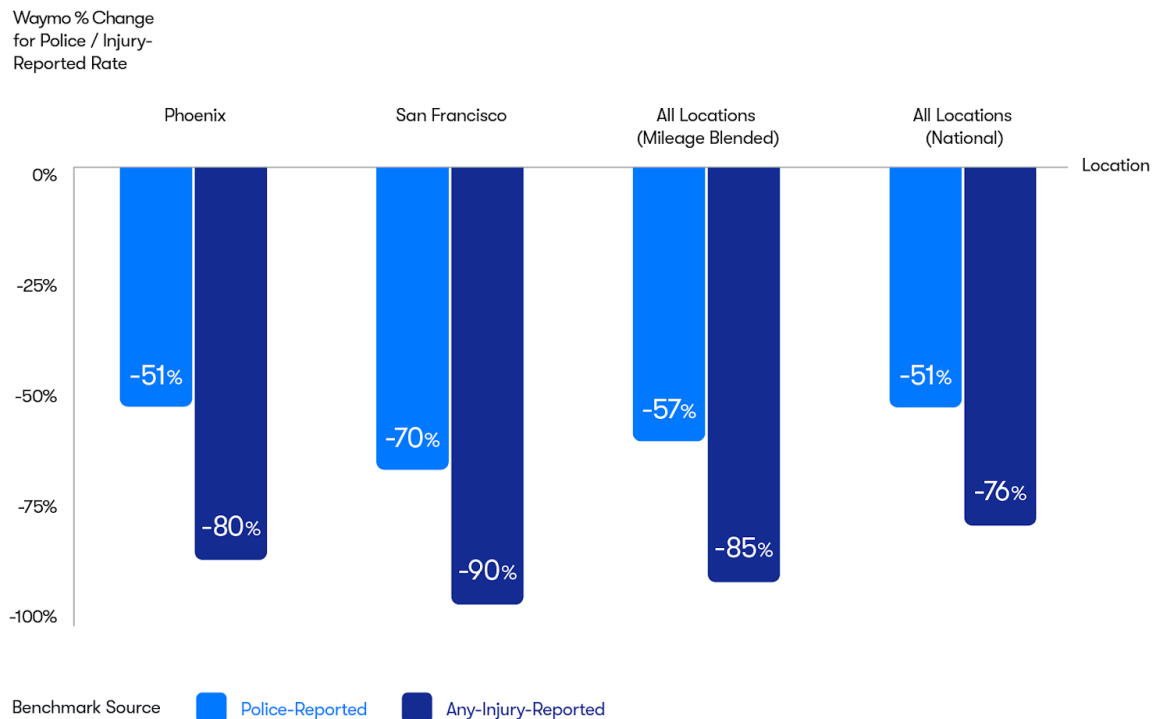


Figure 5. Decrease accidents for the Waymo Driver

Source: <https://waymo.com/blog/2023/12/waymo-significantly-outperforms-comparable-human-benchmarks-over-7-million/>.

Another globally issue persisting in the current logistic sector is the shortage for the truck drivers. The American Trucking Associations has estimated that the United States is currently facing a shortage of over 80,000 truck drivers. However, this issue is not exclusive to the United States alone. Similar shortages of truck drivers are being observed in other regions worldwide such as the European Union and China, indicating a global problem. The International Road Transport Union conducted a survey involving 800 transport companies across more than 20 countries, which revealed that approximately 20 percent of positions remained unfilled in Eurasia last year. It is important to note that this is not a recent problem, as analysts and industry groups have been warning about truck driver shortages for several years worldwide. Nevertheless, the ongoing pandemic and the subsequent disruptions in the supply chain, coupled with increased demand in countries like the United States, have exacerbated this long-standing crisis. The trucking workforce is aging globally, with the average age of truck drivers in the United States being 46, according to a report by the American Trucking Associations in 2019. Similarly, the average age in Europe is 44, while in the United Kingdom, heavy-goods vehicle drivers have an average age of 53. Many of these individuals are approaching retirement age, and the uncertainties and health risks associated with the pandemic have further accelerated their departure from the industry. Nevertheless, here we can have some improvements with the Aurora project.

Regarding the Aurora project regarding the new autonomous trucks they promise to improve the efficiency, they have a technology that is supporting the safety and focuses on costs reduction. Nevertheless, in today market, which is sensible regarding the workforce shortage

for drivers, the autonomous trucks delve into addressing this shortage. Aurora Innovation company has address the fact that they have finalized the design, architecture and hardware for its Aurora Driver, and that this technology will power the future of logistics, the driverless semi-trucks that are produced starting in 2027. In 2024, Aurora plans to launch Horizon. For scheduling cargoes with ease, Aurora Horizon will interface with a customer's transportation management system. Drop off trailers at a terminal equipped with audiovisual equipment so that they can undergo operational inspections before being launched independently to their destination terminal. The Aurora project is focused on four key areas: safety (using robust simulation and real-world data, the always-vigilant Aurora Driver is built to operate safely on its intended route while continuously learning and improving over time); designed to scale (offering a steady supply of drivers that fills the gap that businesses currently struggle with and grows with the increased demand); and fleet utilization. Semi-trucks that operate entirely autonomously are exempt from service hours regulations and only require stops for maintenance, loading, and fueling).The Internet of Things (IoT) ecosystem has been growing throughout the past few years,

and it will keep growing. The Internet of Things, or IoT, is a network of interconnected mechanical and digital devices, including robots, objects, animals, and people, that may transfer data over a network without requiring interaction between humans or between humans and computers. Fleet tracking is one of the main issues facing the logistics sector. IoT essentially increases the automation, economy, and efficiency of vehicle tracking solutions. There are several types of IoT asset tracking solutions available on the market. Many of them can be combined into hybrid systems for enhanced tracking capabilities and telematics. When it comes to vehicle tracking the best solution is Satellite and GPS, used for fleet management.

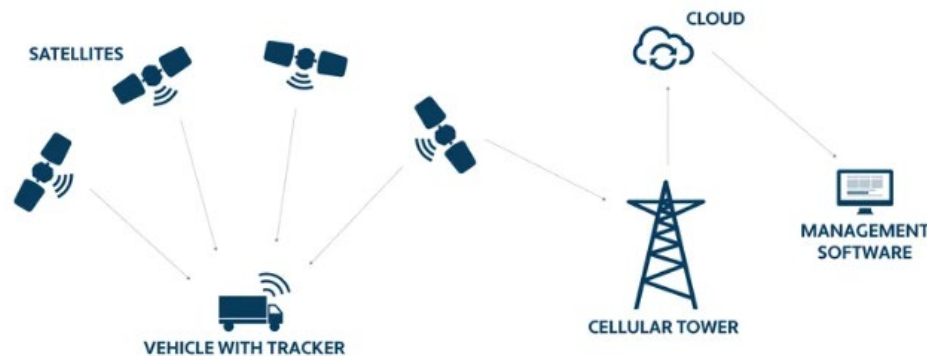


Figure 6.IOT satellite & GPS

Source: <https://info.velosiot.com/a-quick-guide-to-iot-asset-tracking>.

As seen in figure 6, the vehicle is equipped with a tracker and the satellites estimate the location of an asset by calculating the time it takes for it to send and receive a signal to a minimum of four satellites in range. This information is then sent to the data cloud and presented to the management system. Companies use the IoT for different purposes, such as enhanced operational efficiency, predictive maintenance, improved customer experience remote monitoring and management, all in order to drive innovation, improve efficiency and reduce costs. Globally a lot of companies already implemented IoT solutions, as seen in figure 7, the most influential companies in the global IoT ecosystem, according to [iotone.com](https://www.iotone.com) tracking.

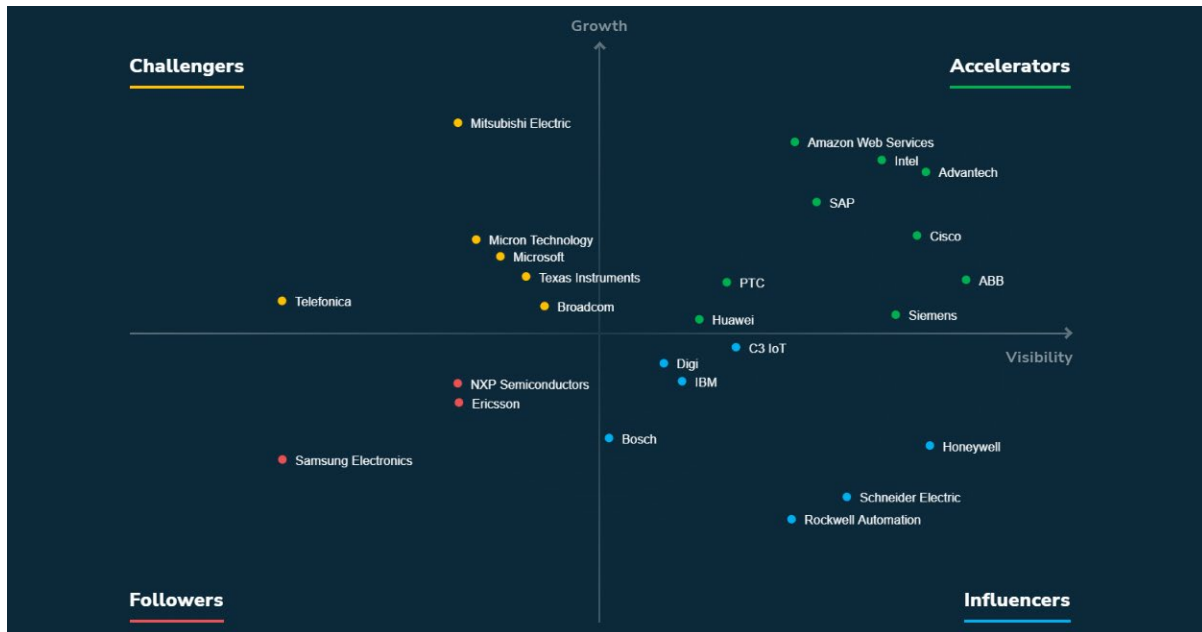


Figure 7. The most influential companies in the IoT ecosystem

Source: <https://www.iotone.com/iotone100>.

When it comes to the tracking fleet, most of the carriers now have real time tracking platformers for the users, that can be used to monitor the status of a shipment, each shipment having a unique identification number that will trigger a match in the data base and will give the details about the specific transport, as seen in figure 8.

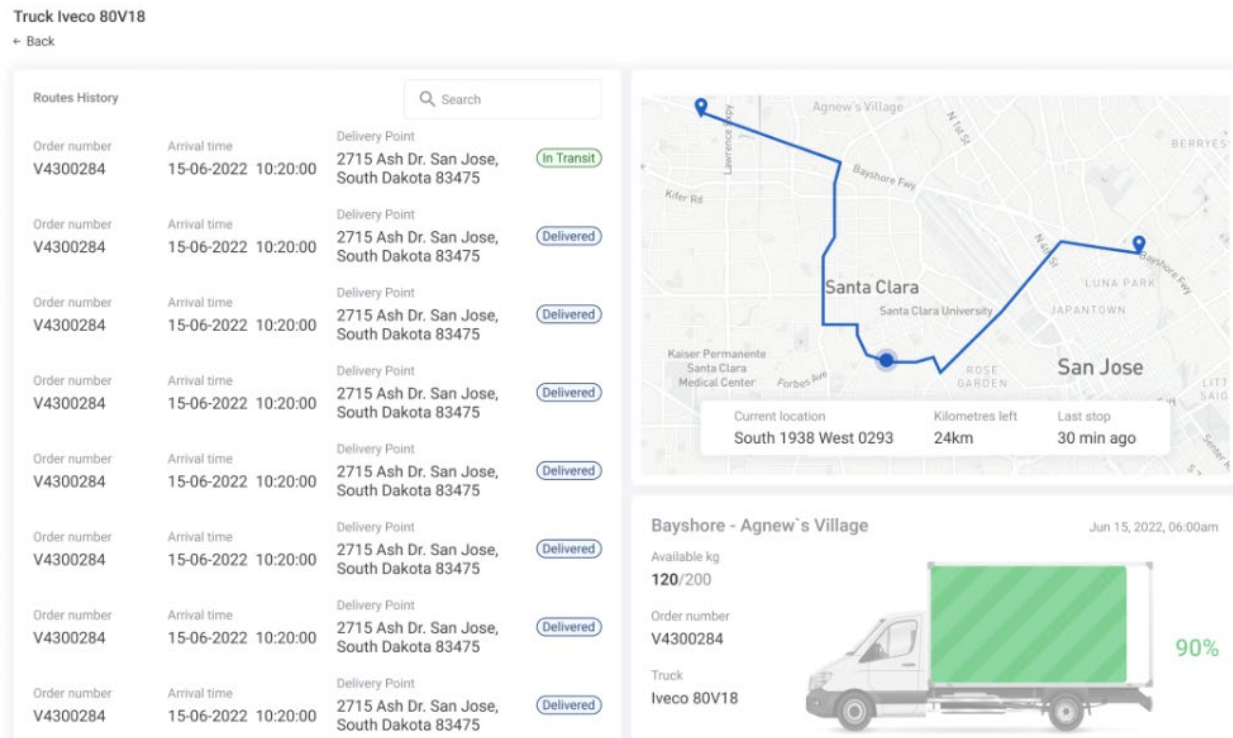


Figure 8. Shipments status with IoT

Source: <https://thingsboard.io/fleet-tracking/>.

When speaking about the emerging technologies, we need to take into consideration that we are facing a framework that works around the sustainability aspects while growing the outputs with ethical considerations. As visible in figure 9, we need to start working at the top being the ethical considerations(data privacy, security concerns, transparency) and by stating clear what criteria needs to be fulfilled, the emerging technologies further work towards sustainability practices (environmental impact, social, resource efficiency). One of the actual most discussed concerns regarding the ethical considerations is the privacy. By privacy we understand the action to protect individual privacy rights by implementing measures to safeguard personal data and ensure data protection, that will not be leaked to any third parties. Many people are questioning the ethical implications of using emerging technologies, particularly in cases where privacy rights may conflict with other interests such as security or convenience. They are calling for greater transparency, accountability, and ethical oversight in the development and deployment of technology. With great technology comes great responsibility, particularly in terms of cybersecurity. Tackling this involves not just advanced software but also a trained workforce that can manage these systems effectively. Overall, privacy concerns surrounding emerging technologies reflect broader societal anxieties about the balance between innovation and individual rights.

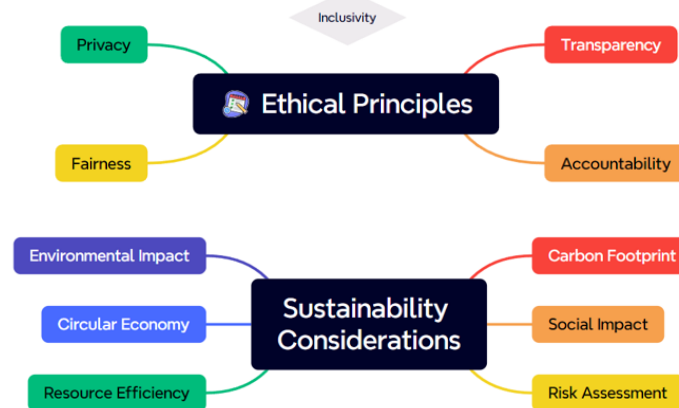


Figure 9. Ethical Principles and sustainability practices

Source: Authors own research.

About 74% of supply chain executives consider big data analytics as one of the most crucial supply chain and logistics technology. At its core, big data analytics examines large data amounts to discover hidden patterns and trends. Technological developments in artificial intelligence and machine learning have the greatest influence on e-commerce supply chains because they address some of the most challenging issues facing the sector. In table 3, is visible a comparative view for artificial intelligence, IoT and autonomous vehicles, for their short-term and long-term impact.

Table 3. Impacts of emerging technologies in logistics

Impact	AI in Logistics	Autonomous Vehicles in Logistics	IoT in Logistics
Immediate Impact	Enhanced predictive analytics for demand forecasting.	Improved route optimization for delivery vehicles.	Realtime tracking of assets and shipments for improved visibility.
	Automation of routine tasks such as inventory management.	Reduction of labor costs associated with transportation.	Optimization of warehouse operations through sensor data.

Impact	AI in Logistics	Autonomous Vehicles in Logistics	IoT in Logistics
	Optimization of supply chain operations through data analysis.	Increased efficiency in last mile delivery.	Improved fleet management with real time monitoring.
Long-term impact	Transformation of supply chain processes with Ai driven decision making.	Revolutionization of transportation networks with fully autonomous fleets.	Integration of IoT into supply chain networks for predictive maintenance.
	Integration of AI into warehouse robotics for automated sorting and fulfillment.	Shift towards on demand and shared mobility services.	Development of smart cities with IoT enabled infrastructure.
	Development of AI powered virtual assistants for customer service and logistics support.	Potential for urban planning and infrastructure changes to accommodate autonomous vehicles.	Enhanced sustainability through energy efficient IoT solutions.

Source: Authors own research

Results and discussions

The emerging technologies are evolving and this paper has the purpose of better understanding what those technologies are and how they are impacting the logistic sector, with focus on the autonomous vehicles. With the presentation of the actual technologies that are available on the market for the general use, and these technologies that are planned to be used sooner or later. It is well understood the fact that by embracing these technologies, improvements will follow, nevertheless there are still limitations that need to be overcome in order to successfully implement them and in order to be able to gain all the benefits. The automotive industry will change, and with those changes into the volatile market, logistics sector will need to follow along. The benefits that are listed from the autonomous vehicles that will improve the logistics sector are: cost reduction, number of traffic accidents reduction, supplement for the truck drivers shortage, reducing the transit time (as autonomous truck will not be requested to follow the break time implemented for truck drivers), and a slight transition to a more friendly environment. The main constrain that needs to be overcome to implement these is the infrastructure, as autonomous vehicles, require a certain level of infrastructure in order to function properly.

Conclusion

The emerging technologies will have a great impact on the logistics environment, which is nevertheless, very volatile. Every improvement brought by the emerging technologies will boost and develop further the logistic sector. With the view on how promising are this technologies to lighting the future in industry, with the promises of better efficiency, of cost reductions and better and safer environment, we can only look up at what the emerging technologies are going to bring into logistics. Referring to the addressed topic, mainly focusing in this paper, on the improvements brought by the autonomous vehicles, and looking into their benefits (accident traffic congestions, travel cost reduction, eradicating human error, optimized driving experience), we can assumed that the automotive market will drastically change in the long term. Another address term will be the reduction of the car accidents caused by the human errors (distractions or driving under the influence of alcohol or other substances), developing technologies and systems that are fully capable to extract data in real time, and act accordingly based on the fully developed 360-degree vision. With the developing of the autonomous trucks, another actual global issue, is going to be addressed-the shortage of truck drivers. Nevertheless, this is goinh to be a challenging process based on two assumption that required to be address. The first one, is regarding the infrastructure,

is the infrastructure develop enough in order to support the well-being function of the autonomous vehicles? If not, what is the minimum standard that needs to be achieved in order for the autonomous vehicles to be able to function properly. The second challenge will be regarding the public opinion regarding the safety of this technologies, as right now the opinion is divided between approving and on approving of these technologies, and the opposition for their implementation was addressed among the public.

As an expansion of this research will be delve in other emerging technologies, such as using augmented reality for warehouse management. The direction could focus on the development of advanced AR technologies and applications tailored specifically to the unique needs and challenges of modern warehouses.

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