SELINUS UNIVERSITY
OF SCIENCES AND LITERATURE

Artificial Intelligence and its Effects on Supply Chain

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Acknowledgement

I would like to dedicate my dissertation to my wonderful family. Without their love and support this would not be possible.

Abstract

Artificial Intelligence has the potential to revolutionize the supply chain. It will allow organizations to improve both decision making and become more efficient. Companies can also leverage their AI tools to be able to process huge amounts of real time data and improve their forecasting ability. While artificial intelligence can improve the areas of the supply chain that include inventory management, customer service, financial optimization,, and reduce costs, it will also have a trickle-down effect that has yet to be fully understood.

Research has clearly shown us the benefits of artificial intelligence. While implementation can be a daunting ordeal for some companies, the benefits far outweigh the concerns. AI can assist companies with planning, production, inventory management, cost reduction, customer satisfaction, and financial management. It can also provide a much better path of communication with the suppliers and vendors.

Current data on the use of artificial intelligence is not unsurprisingly good news for the supply chain industry. Noeth America continues to dominate the world with AI implementation. Key players in the market are showing that there are huge cost savings to be made, as well as improvements to the supply chain operations.

Research conducted in 2024 shows that companies with mature supply chains are about 23% more profitable than their counterparts. When looking at the top 1,000 companies it was found that the top ten companies that have invested in AI platforms achieved a 24% higher margin than those companies that have yet to invest in AI technology.

When it comes to AI technology there are a lot of risks and costs associated with its implementation. There are a lot of elements that need to be considered and protected. Security is

of extreme importance when it comes to AI technology. Large companies such as Walmart and Amazon have seen these issues firsthand. AI is a huge investment and undertaking. There can also be at times unintended consequences of the implementation.

As artificial intelligence relates to myself and my current position as the Vice President of Operations, I can only say I am extremely excited to see this implemented. I will be able to see it firsthand as it manages the maintenance department, applies its safety technology, and handles the management of the yard. AI's ability to predict future events based on the collection of data is truly amazing.

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Chapter 1

Introduction

Background

Artificial intelligence will revolutionize the supply chain management process by making internal operations much more efficient. It will enable organizations to manage end-to-end processes and help alleviate many of an organization's biggest challenges (Consumer, 2023). Over the next ten years, supply chains will become highly autonomous , with most of their systems managing the processes from start to finish. The disruptions of the past will get a much more rapid response. But at the same time, there will be trickle down effects that yet might be unseen. Artificial intelligence will allow companies to monitor global events in real time, therefore identifying the potential risks before they can impact the supply chain. AI based tools will have the ability to collect, analyze, and generate alerts of any sort of abnormal activity from demand changes to product issues (Georgetown, 2022).

Statement of problem

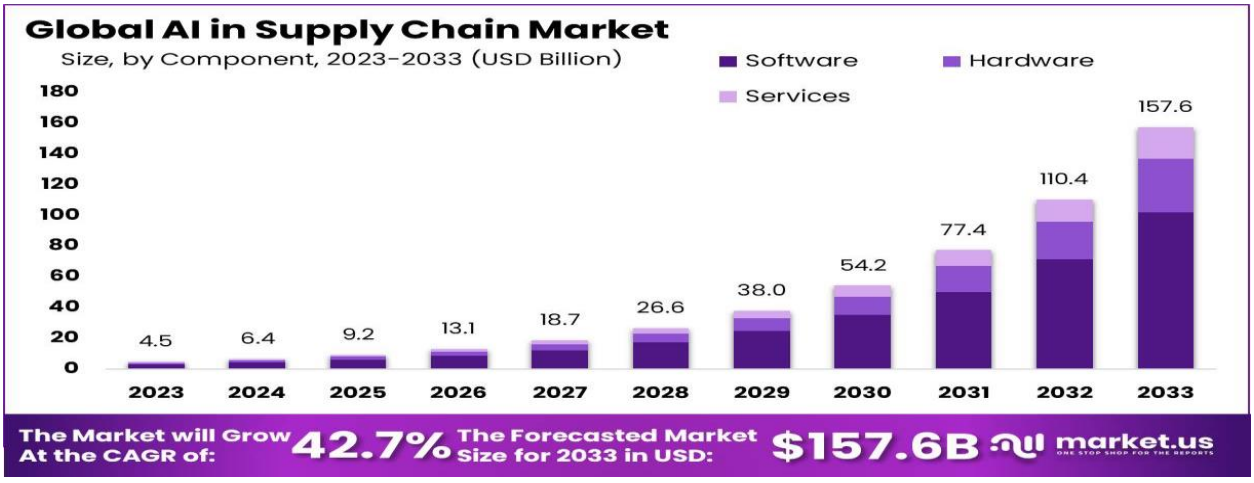
Resilience is the supply chain key. The term "supply chain management" which was termed in the 1980's was somewhat overlooked until the world found itself in the throes of the Covid pandemic (Georgetown, 2024). As a result, the number of companies turning to artificial intelligence (AI) to assist in the management of their supply chain is increasing each day. Some of the questions that need to be answered when taking this approach are: Can the supply chain become more resilient, and how will it affect the employment of those working in the supply chain management group? However, before questions such as these can be answered we need to look at what exactly the definition of supply chain is. It is the journey that connects raw materials and components, through their assembly, and progresses to the sale to the customer as a finished good

(Mckinsey, 2022). When a link in the supply chain is not working, a disruption occurs. This disruption then forces the labor market to begin to worry about operational issues. Based on research, supply chain disruptions that last longer than thirty days occur on average every 3.7 years (Mckinsey, 2022). One key factor to take note of is that the result is an organization experiencing a 45 percent decrease in profits over the next decade.

Objectives

The aim of this research is to examine the ways in which artificial intelligence will impact the supply chain. All businesses need to avoid what is termed stock outs. The key to solving this issue is to have better control on inventory management and optimization. Artificial intelligence can transform the inventory management process by leveraging advanced algorithms to process data on an unparalleled scale. There will no longer be the need to input data and then analyze that data (Takyar, 2024). Artificial intelligence will be able to detect patterns and trends while also scrutinizing historical data, customer behavior, and other pertinent factors. This will allow an organization to have a much more proactive approach and be able to improve its operational efficiency. Also, since AI is adaptable it will stay engaged and be responsive to the changing environment.

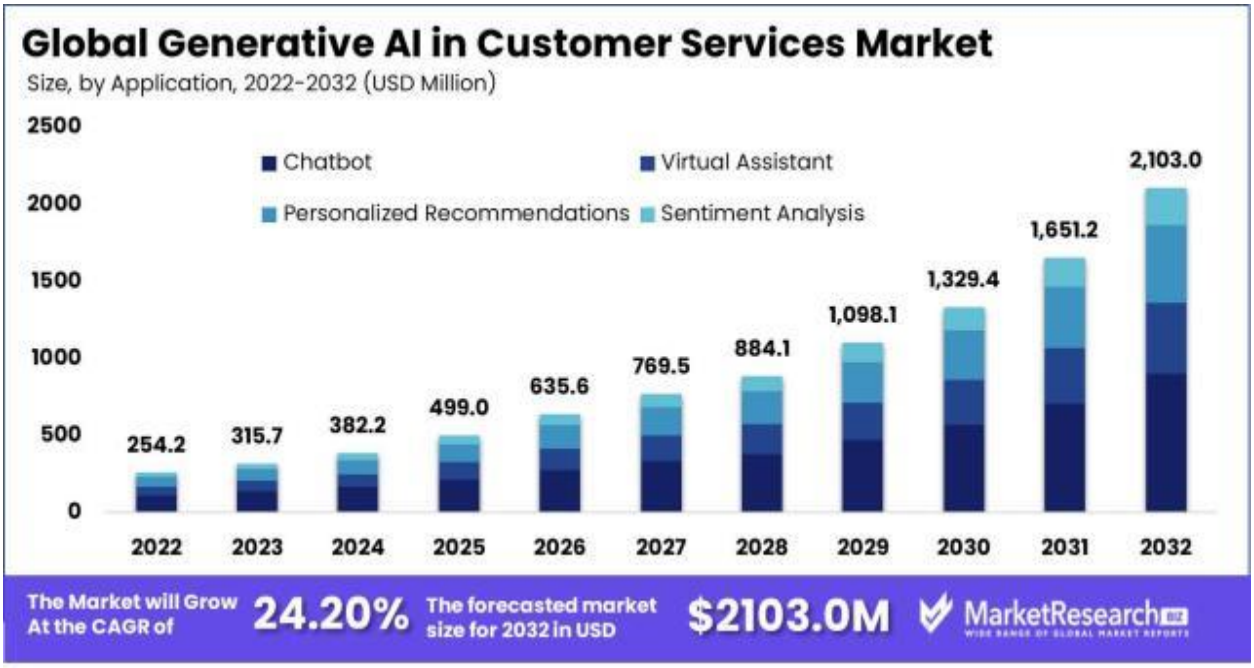
Figure 1.1



When it comes to customer service, artificial intelligence can enhance the customer's experience by its use of chatbots and virtual assistants (Gabani, 2024). This will allow an organization to provide 24/7 support. It can also drastically reduce the response times needed to achieve good customer service. Natural language processing or NLP will allow artificial intelligence systems to have a better understanding of the questions being asked of it, therefore improving overall customer satisfaction. Again, algorithms will play an important role. These can monitor customer sentiment, thus getting a better understanding of customer feedback. This can lead to identifying areas for improvement and setting up personalized recommendations.

Following along with customer experience is the concept of customer relationship management or CRM. This is the process in which a business or organization administers its interactions with its customers (Wiki, 2024). Artificial intelligence transforms a basic data management system into a more dynamic platform (Designs, 2024). Managing this relationship with AI offers the ability to anticipate the customers' needs and tailer services accordingly. This takes the process and moves it ahead of even the traditional practice approach. The use of artificial intelligence will redefine how a company looks at customer engagement. As these types of systems develop over the next several years, they will become more advanced and more adaptive, therefore allowing for continual improvement and higher customer satisfaction. This type of integration will be a necessity when it comes to an organization staying competitive in their marketplace. As you can see by the figure below, the global generative market in relations to the customer service market is expected to quadruple by the year 2032. The use of chatbots and virtual assistants is something that we will be seeing take off in smaller companies soon.

Figure 1.2

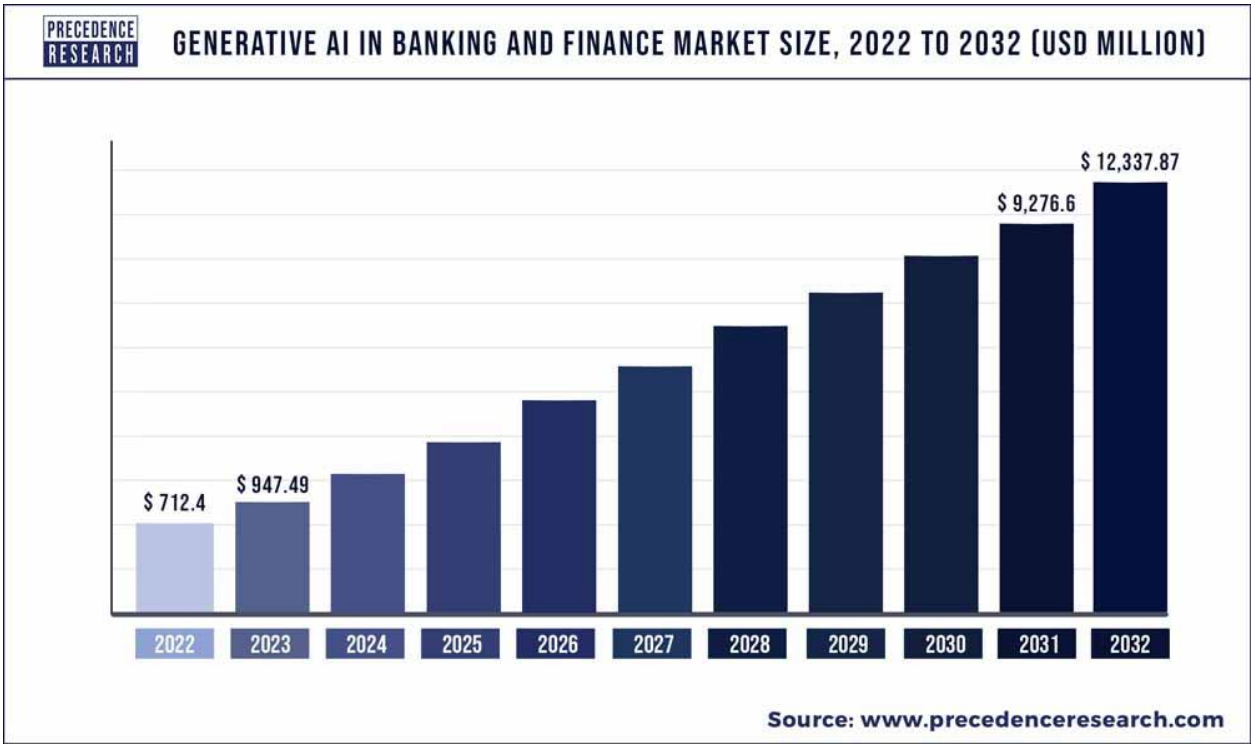


Another area artificial intelligence will affect the supply chain can fall under the category of financial optimization. Many different layers within an organization fall within this category. One being that of financial optimization. One of the key functions that artificial intelligence can help solve is the idea of repetitive tasks. Those repetitive tasks such as data collection, anomaly detection, and transaction matching will all become automated. AI will create an environment where the data is organized, analyzed, and reconciled much more efficiently and accurately. Artificial intelligence is much more accurate at identifying errors in a spreadsheet for example, than the human being who has stared at the same sheet all day (*Kluwer, 2024*). Using predictive analytics, forecasts become more accurate using artificial intelligence. This means when calculating a company's financials, they will become more accurate and dependable.

When it comes to looking at the use of artificial intelligence as it relates to finance, there are three points that should always be considered. These are explainable outcomes, human control,

and data governance (*Kluwer, 2024*). It is recommending that any AI-powered system uses what is called, “glass box approach”. This allows the finance department to not simply go by what is spit out by AI, but it also allows them to look deeper into the systems logic as why that decision was made (*Kluwer, 2024*). This approach allows the organization to see the rational used and look at both the strength and weaknesses of that logic. This means the organization can anticipate how the system will make determinations in the future. A company can then have full confidence in how decisions are being reached. Human control refers to how much of a role a human being still needs to play in the process. This needs to be answered because the decision-making capability between a Human and artificial intelligence is quite different. This technological transformation will still have been issued when it comes to the biases that human beings possess (*Kluwer, 2024*). It is important to note that human beings are still needed when it comes to addressing issues at the strategic level, it is also true at the functional level as well. The third point of dealing with artificial intelligence as it relates to finance is data governance. This has always been a challenge since there are always changes to rules. Artificial intelligence will allow for the data which may take years to analyze by a human to be gone through in a matter of seconds. The old process of analyzing data was very cost prohibitive. Now a company can get information at supersonic speeds and have access to levels of data that were previously inaccessible because it was buried in a mass of unstructured data. Due to its effectiveness, artificial intelligence as far as being used as a financial tool is expected to take a big leap forward in the coming years. You will notice in figure 3 that the AI market in relation to finance will more than double by the year 2032. This success will clearly be recognized and utilized by the supply chain market as well.

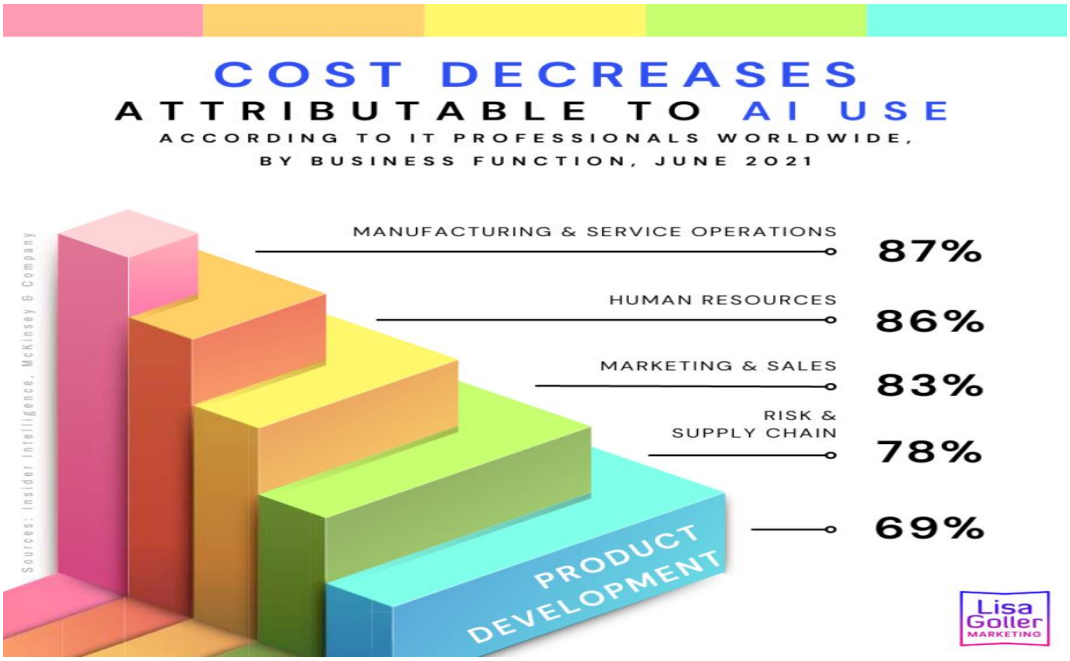
Figure 1.3



Also correlating to the financial aspect artificial intelligence will have on the supply chain comes the ability to reduce costs. This is an aspect of AI that nobody can ignore. Every company and organization is seeking ways of reducing their operating costs. Everything from the warehouse work and customer service can work more error free for longer periods of time (*ThroughPut, 2024*). Since humans will be needed less, the number of human oversight errors will be drastically reduced. There will be higher productivity and a higher accuracy rate. This will most certainly correlate to a cost reduction within the operations of an organization. According to the 2022 study by Mckinsey, it was found that of all the markets, it was the supply chain market that would have the most reduction in costs due to artificial intelligence implementation. Those supply chain companies that have already made an investment in AI have seen a 15% reduction in costs (*ThroughPut, 2024*). Inventory levels have improved by 35% and service levels have increased by 65%. AI is a huge

investment for most companies, however of the 150 companies that were surveyed, 70% have stated there was a huge return on the investment. It is also believed that when it comes to AI use in the supply chain, it will not reduce the need for management level personnel. In fact, it is more likely to create more opportunities since companies will always still need to mitigate the risks of all new technology (Georgetown, 2022).

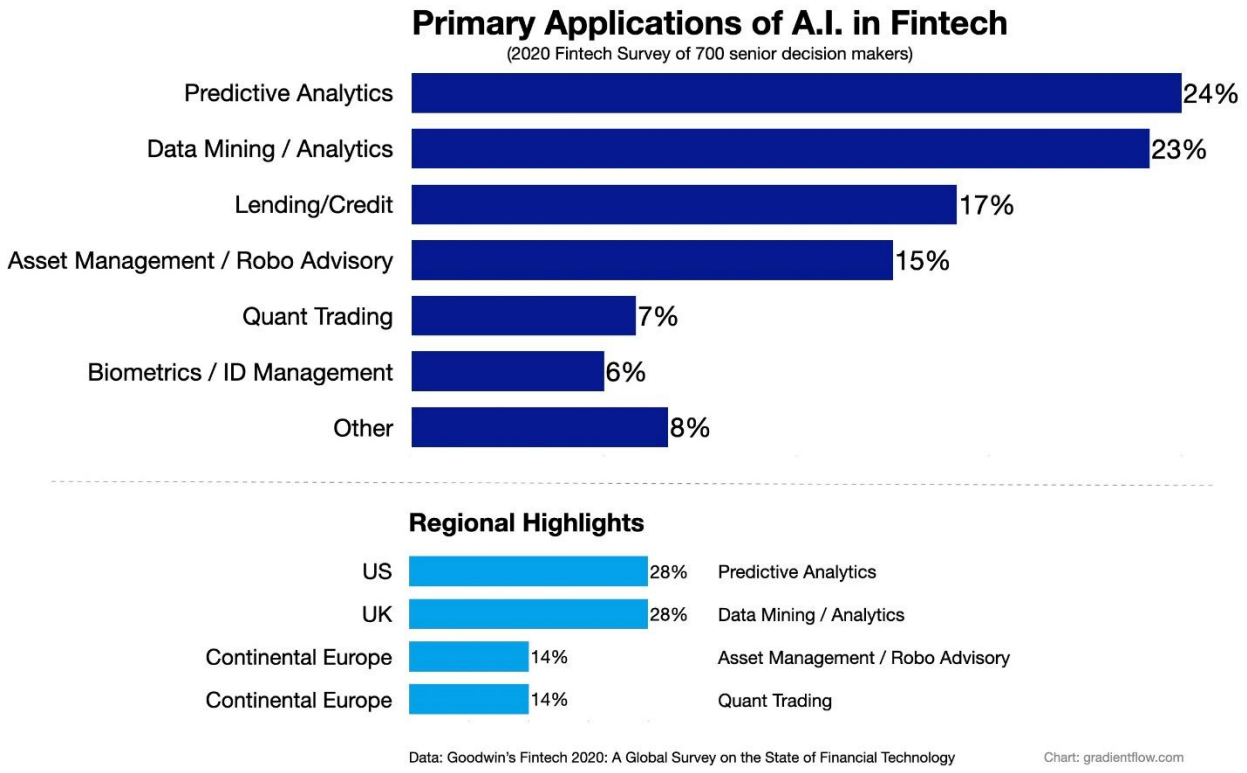
Figure 1.4



One of the largest expenses that occur alongside the supply chain would be that of warehousing and distribution efficiency. Warehouse facilities have been making great leaps forward, they are no longer just considered to be dusty storage locations. Because of technology including artificial intelligence they have become very large, busy facilities filled with many employees (Hart, 2024). A great number of them have added machinery to assist in the daily operations. The people and machines work together to get out the orders that come in, meaning this assist in having less chaos as orders increase and more items need to be picked up and shipped. Artificial intelligence can help these environments better manage the ebbs and flows of the

warehouse cycle. In the past a warehouse could have volumes so large it created issues, then later because of the season find its racks empty of product. Artificial intelligence can use real time data to tackle these volume issues allowing for adjustments to be made on the fly. As you can see in figure 5, more companies are increasingly focused on automating their facilities.

Figure 1.5

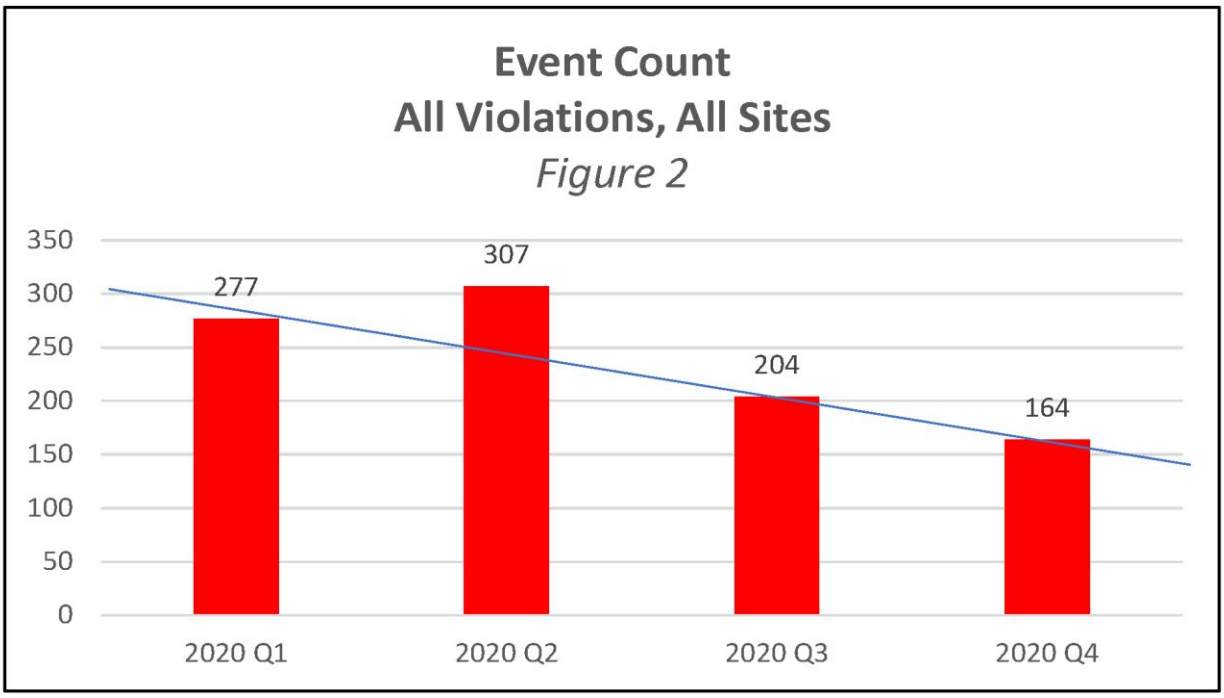


Artificial intelligence and automation puts an end to the common warehouse structure of people running round, forklifts whizzing by and creating an organized and structured environment. There are AI-powered robots that can and will in the future continue to navigate this environment like a pro (Hart, 2024). This means the company will have less collisions involving human beings, all while maintaining a fast-paced working environment.

With artificial intelligence controlling warehouse movements, warehouse safety will see improvement. AI will understand the safest and most productive path to be taken. Safety figures for the organization should see a drastic drop. AI will allow for issues such as traffic jams and

maneuvering to be more flexible and safer. You can see by figure 6, which covers the four quarters of 2020 that each quarter safety instances have decreased. It can be assumed that this data would be able to translate year over year. A decrease in safety occurrences will also save an organization a lot of money over a year's time.

Figure 1.6



When it comes to warehouses and distribution, artificial intelligence can also enhance the order filling process. Artificial intelligence can create more efficient routes for the pickers by factoring in variables such as product attributes, picking frequency, and real time ordering priorities (Element, 2024). With this use of AI, the results show there would be an improvement as far as error accuracy, increased throughput, and a reduction in overall labor costs. Robotics being incorporated into warehouse operations can also boost productivity and reduce the human error factor (Element, 2024). AI combined with robotics will be able to navigate through aisles, locate specific items, perform specific tasks such as picking, sorting, and packing.

Once again, the use of artificial intelligence in the supply chain wis ushering in a new era. It is creating an unparalleled environment for better efficiency, accuracy and optimization. Specifically, AI adds value on multiple fronts such as planning, production, inventory management, and product distribution (Georgetown, 2024). Early use of AI in the supply chain has shown that there is a verifiable cost reduction of 15%, along with an increase in inventory management of 35%. A survey conducted looked at 70 companies and 70% of the CEO's surveyed agreed that AI is showing a strong return on investment (Georgetown, 2024).

Research Questions

The main question I would like to address is how AI in the supply chain will work. The supply chain has become a complicated network and requires constant monitoring. They are expensive and require thorough oversight to avoid any disruptions (Downie, 2024). Is artificial intelligence the assistance the supply chain requires when it comes to forecasting and Planning? Can it be transparent with its valuable data and protect the stakeholders at the same time. We will examine if AI can lower operating costs, assist with real-time decisions, cut down on waste and errors, better manage inventory, and improve efficiency in the operation.

Significance of study

The significance of the study can be far-reaching. For myself alone it can alter the course of business I have been engaged in for the past thirty years. With the supply chains ever increasing interlinked physical flows of products, market volatility, and the COVID-19 pandemic, it's imperative that the supply chain remain resilient (McKinsey, 2022). If AI proves to be a potent instrument in solidifying the supply chain against disruptions, the impact could be felt worldwide.

Scope of study

I intend to dive into the multiple aspects of artificial intelligence as it relates to the supply chain. I wish to dive into the data that has been collected and determine if AI is the fix the supply chain expects it to be. We will examine and dive into all the data associated with the questions of inventory management, financial reporting, lower costs, labor management, safety, and preventive equipment maintenance. We look at examples of how algorithms are currently being used to answer these questions and analyze the data that has been collected.

Organization of study

I will begin as previously seen in chapter one with the basic claims being made of what artificial intelligence can do to better the supply chain. Once we have established what the claims and needs are, we will investigate what the research shows. We will look at the data and how current companies are using this data in the day-to-day operations of their supply chains. The results will be analyzed and broken down to its smallest components to verify its success. It's important to note that the risks and costs involved with AI implementation also need to be addressed. As well as the security and ethical questions that surround a company collecting that much data.

Chapter 2

Research has clearly shown that artificial intelligence has the potential to revolutionize supply chain operations. (Georgetown, 2024). Its implementation can have a huge impact on decision making and a company's efficiency. There is value using AI when it comes to Planning, production, inventory management, cost reduction, financial management and customer relationships. The first step to implement artificial intelligence is a crucial one, that's mapping your supply chain (Georgetown, 2024). It is this crucial step that will enhance a company's resilience along its supply chain. Using the tools of AI an organization can gather records, create customs documentation, and book freight transactions. Using AI algorithms, you can extract relevant data and map out the different tiers within the supply chain. Generative AI can use both private and public data to assist in the process of mapping the supply chain. You can also add an LLM or large language model assistant that can respond to employees' questions using plain language. Within this system you can also employ a document processing system that can capture, analyze, and share documents such as bills of lading, and invoices (Georgetown, 2024). All of this will result in better communication with all business partners.

AI will help a company gauge market demand and manage its changes. It can also track customer sentiment. Scanning data that can be utilized at the point of sale can be analyzed and combined with the information obtained on blogs and social media, can be very useful. AI can enable companies to create an end-to-end dashboard capable of generating alerts for abnormal behavior as well as demand changes. One key issue is that it can detect panic buying and can assist in finding out the reasons behind it. Also, contained within the vast amounts of data are clues to detecting disruptions within the supply chain, worker issues, factory shutdowns, and shipping delays (Georgetown, 2024). Collecting this type of data assisted the US department of

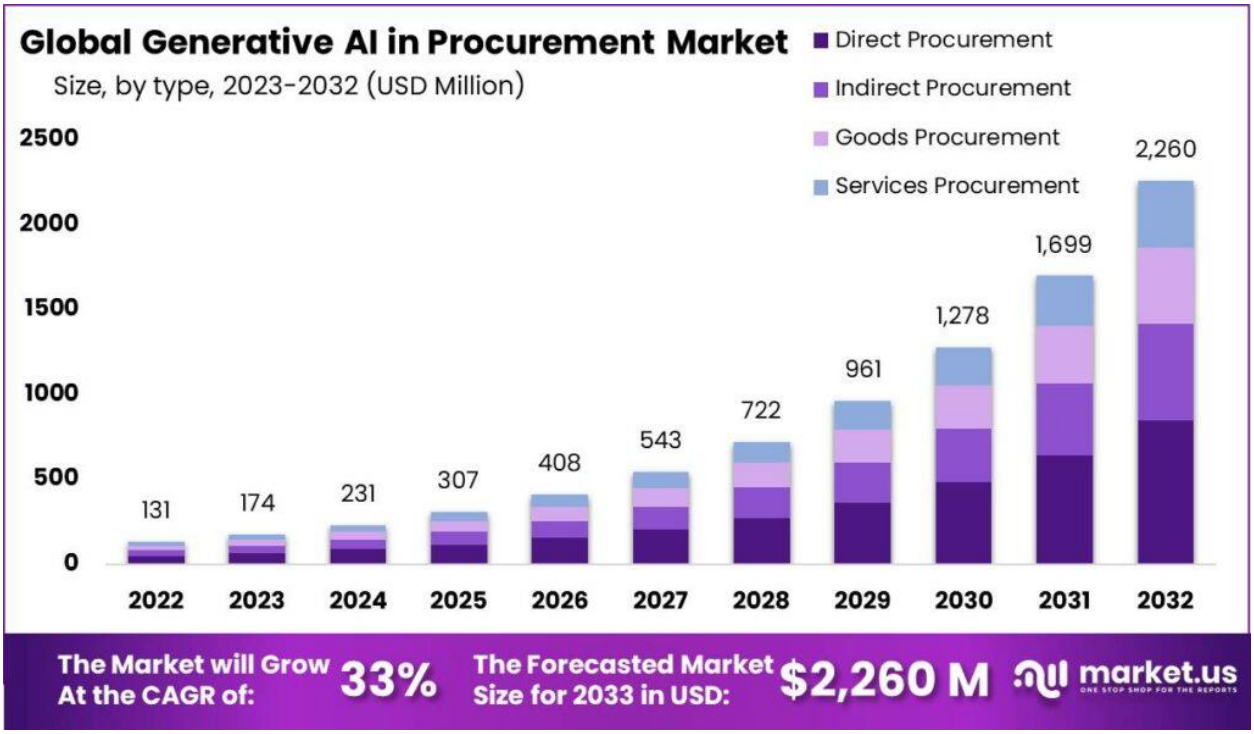
Transportation in 2021 when the west coast saw unprecedented delays regarding ocean containers. It allowed them to create a dashboard that tracked the goods moving from the ports to the retail stores. This allowed them to have a better handle on any future anomalies (Georgetown, 2024).

Let's begin by breaking down the main aspects of artificial intelligence and how it relates to the supply chain. While this is still a somewhat new subject that is constantly changing, a lot of research is being done on how this will all affect the overall process. The first topic I would like to dive into is how AI can and will affect the planning and procurement stages for companies and organizations. AI's predictive powers can facilitate more accurate demand schedules as well as more accurate sales forecasts (Online, 2024). This allows a company to have a better understanding of their orders and the quantities of products it will need from their suppliers. This falls right in line with the concept of lean management. Companies can mitigate waste and take full advantage of their resources. Thus, creating a more efficient planning process. AI can create a flexible inventory process and estimate the costs associated with the overstocking and understocking of goods. Just-in-time inventory strategies are now a viable option. This in turn will reduce storage costs, which can also enhance better cash flow (Online).

Research shows that AI can use historical data and predictive analytics to help companies get what items they need without paying excessive costs (Business, 2024). Procurement and planning staff are able to quickly identify the products they need and be better aligned with what the company goals are. AI can help when it comes to time sensitive procurement and planning. Finance teams now have a greater insight into what is being spent and what the expected future costs might be. AI can help those visualize alternative scenarios and ensure the procurement and planning aspects are operating efficiently. AI can also be used to extract information from documents such as invoices. This can speed up the company's workflow and lead to significate

time savings. Of course, along with time savings come lower overall costs. Also, this would free up staff to pursue other company tasks. Overall, AI would put less pressure on the planning and procurement teams and would allow for the employees to feel more productive (Business, 2024). As you can see from figure 2.0 below, the procurement market using AI is expected to grow over the next several years.

Figure 2.0

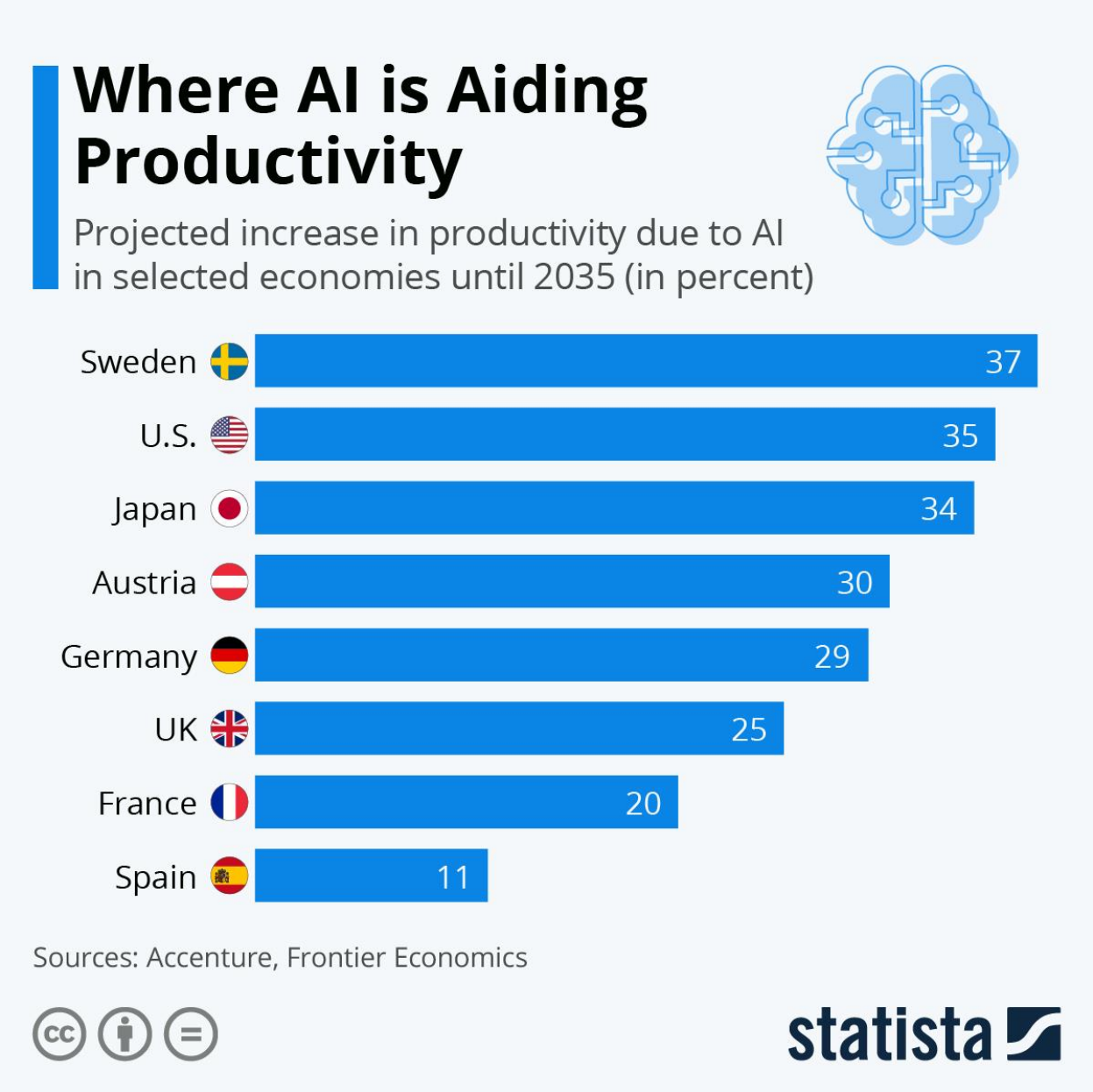


AI in Supply chain presents the opportunity for companies to access training models on their own data sets. They can then ask the AI system to assist in finding ways to increase productivity and efficiency (EY). With predictive maintenance, AI can help determine if specific areas in the production process may have a breakdown. It can also give the company a timeframe when an incident may occur. If a company's equipment effectiveness is maximized then their

productivity will also increase. Maintenance can then be scheduled to occur at a time when productivity will be less affected and extend the life of the equipment. All of this plans a role in operating costs, and the reduction of down time. The use of artificial intelligence can also help in the production palling stage because it will consider factors such as customer changes, production capabilities, and the resources available (EY). Using a company's own data, AI can maximize production plans and allocate resources much better than the traditional way. It can make daily production plans as well as minimize the bottle necks that occur when it comes to productivity.

Another use of artificial intelligence as far as productivity is concerned lies in its algorithms. A smart AI warehouse, for example, can enhance the efficiency of its order picking routes by factoring in factors that may not have been previously discussed. This would include factors such as product attributes, picking frequency, and real time order priorities (Element, 2024). With intelligent pick sequencing and travel path optimization, a company would have improved order accuracy, increased throughput, and reduced labor costs. AI's ability to conduct ongoing data analysis allows for more correlation when it comes to KPI's or key performance indicators. This continuous improvement aspect of AI results in a streamlined workflow and a drive for a company to focus on a cultural shift of continuous improvement. As you can see in figure 2.1 the United Staes is near the top when it comes to countries seeing improved productivity due to artificial intelligence.

Figure 2.1

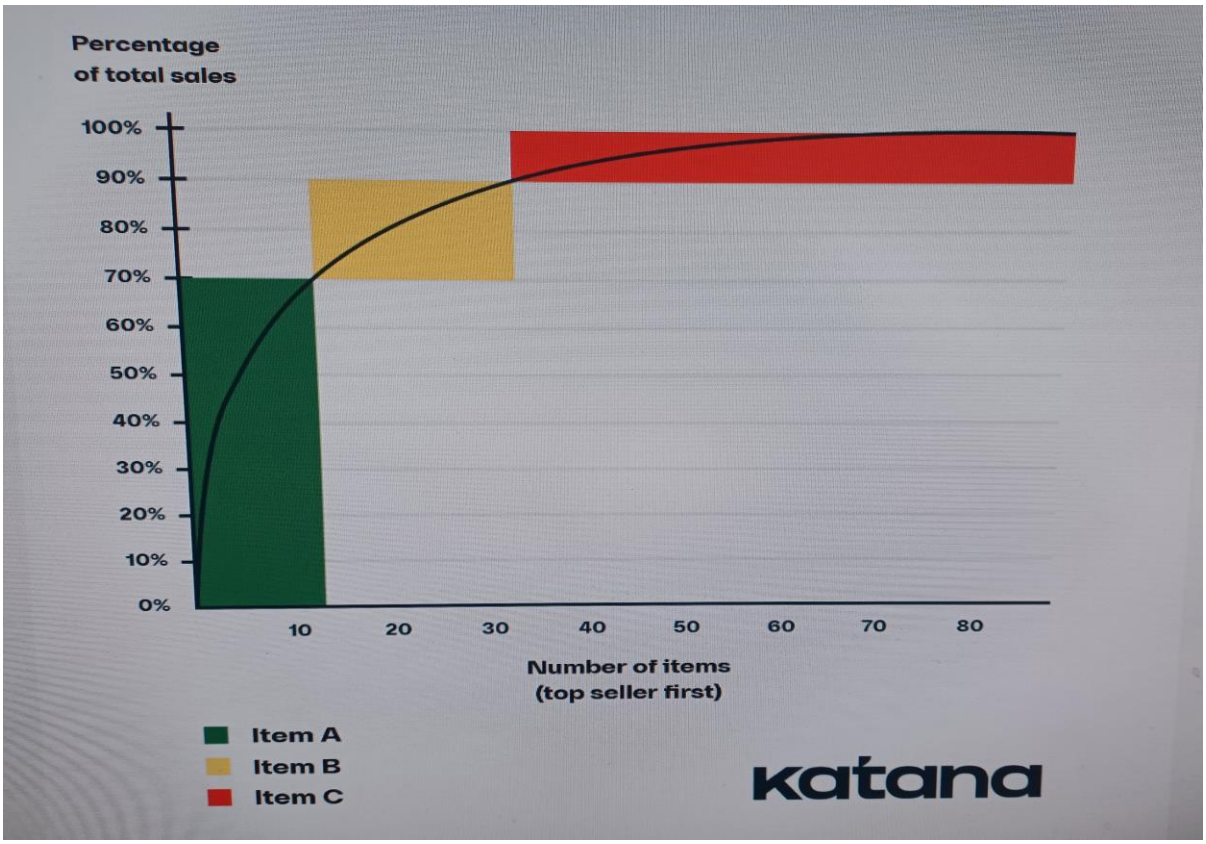


One of the most impressive uses of artificial intelligence can be seen when it comes to an organization's ability to manage inventory. Efficient inventory is the cornerstone for any company that deals with physical goods (Kivimaa, 2024). It can ensure that products are in stock when needed, it minimizes costs and assists with customer satisfaction. Inventory management as well

as forecasting has plagued most companies at one time or another. Companies are always looking for new ways to gain an edge and improve their operations. Artificial intelligence is not a single monolithic technology, but it does allow machines to mimic human intelligence. It can learn from data, make predictions, and help automate certain tasks.

Research shows that AI can be applied to a wide range of activities within the supply chain realm. They include the end of the supply chain or retail services, manufacturing, as well as logistics. Using AI to manage inventory can make processes better and lead to better accuracy, real-time data analysis, automation, cost reduction, and enhanced customer satisfaction (Katana). One of the most significate aspects of AI in inventory management is that of inventory forecasting. AI learning models can use the collected data, customer trends, and other outside factors to predict future demand with remarkable accuracy. The algorithms used can adapt and improve over time, making the data collected even more accurate. This results in a company minimizing its overstocks, or stock outs, this in turn saves the company money. AI combined with inventory strategies such as ABC, allow companies to categorize their products based on things like self-life, demand, and profitability. AI can assure that the right products receive the correct classification and attention, saving time and resources (Kivimaa, 2024). Using AI in combination with other inventory management techniques will result in a more dynamic and adaptable system of inventory management. A worldwide business research study showed that AI and user-friendly inventory management software will be pivotal strategies for a large share of companies moving into 2025. 94% of the companies surveyed plan to incorporate some form of artificial intelligence into their inventory management. 30% have stated that the two most significant focus areas are inventory management and new automation. Overall, some 97% of the respondents will be implementing

some form of artificial intelligence in the future. As you can see in figure 2.2, AI combined with other inventory management strategies can be very effective.



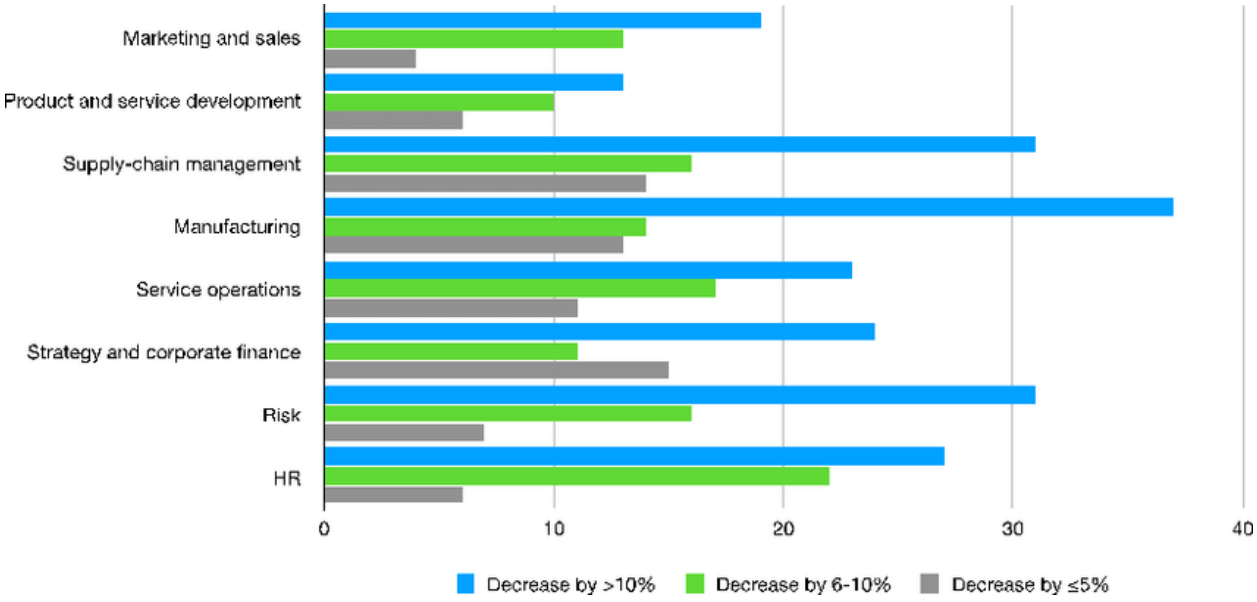
Supply chain leaders face multiple challenges daily, however, the never-ending challenges they face is how to cut costs in today's environment. Artificial intelligence can provide game changing opportunities for a company when it comes to cost savings (Marketing, 2024). AI allows for execution in areas such as network design, transportation, forecasting, planning, inventory management and warehouse operations. These are all very important areas when it comes to a company's desire to reduce costs. One of the key aspects in which AI can assist in cost reduction lies within a company's transportation system. AI algorithms will analyze factors such as delivery locations, modes of transportation, vehicle capabilities, traffic conditions, and delivery times. They

will then be able to optimize the delivery routes. AI allows for the minimizing of travel distances, fuel reduction, and makes better utilization of the company's resources. An AI driven route optimization plan can significantly reduce transportation costs and improve delivery efficiency, Therefore, adding to customer satisfaction. Costs can also be reduced by using the AI algorithms to identify the most strategic locations for warehouses, distribution centers, and production facilities within the entire supply chain network (Marketing, 2024). Using data such as supplier locations, customer data, transportation infrastructure, labor availability, real estate costs and regulatory considerations, AI can pick the optimal facility location. This again can prove to be a great money-saving tool for the supply chain network. Once the company's objectives have been established, AI can find solutions that balance competing objectives more efficiently.

Another significant cost saving initiative can be found when using AI to drive warehouse functions. Significant cost savings can be found with labor performance, automation and robotics, slotting optimization, continuous improvement, layout and better space utilization (Marketing, 2024). There are endless tactical opportunities when it comes to leveraging Artificial intelligence. If a company can look at the beginning of their supply chain and follow it through completion, they can learn the best places to begin their cost saving initiatives. Labor analytics with AI allows for continuous updates and forecasts when it comes to labor. It can create labor profiles and labor standards as well. AI's ability to mimic human thought can determine areas of improvement and reduce labor costs. AI can also power a company's robotics or automation strategic plan. These are great tools that can be used in conjunction with AI to supplement the existing labor needs. This can free up labor resources to be able to achieve other tasks within the organization. When dealing with warehouse standards, AI can organize and slot items with more efficiency and productivity than previously envisioned. This can save production costs by minimizing picking and packing

times, as well as reducing travel distance. Thus, creating a more cost centered operation. AI also can continuously analyze operational data to identify bottle necks and other opportunities for improvement. AI offers companies a continuous improvement program that takes less attention away from the other processes. This is a huge improvement over what companies have had to do to create and maintain a continuous improvement program. You can see in figure 2.3 below that supply chain cost savings are ranking towards the top for most organizations.

Figure 2.3

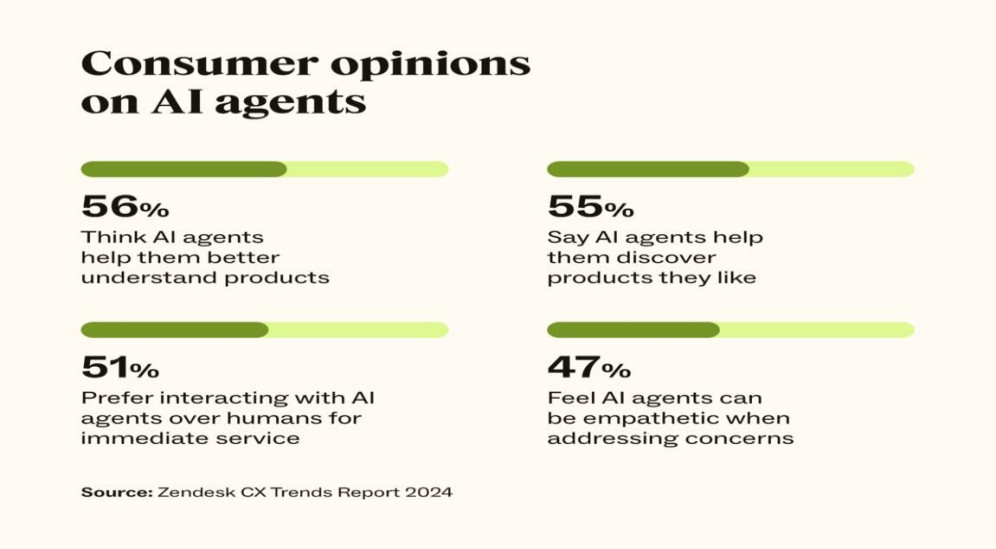


One of the more critical aspects of using artificial intelligence in the supply chain falls on the issue of customer relations, and customer satisfaction. AI can improve the overall customer experience and brings with it significant business benefits. Some of AI's top advantages include decreased costs, improved satisfaction, efficiency, personalized experiences, and the ability to handle a high volume of customer demands (Zendesk, 2024). Research has shown that AI can automate 80% of all customer interactions. This gives other agents free time to focus on a higher value workload. In a study conducted by Unity a development platform company, AI agents deflected over 8,000 calls. This resulted in $1.3 million in savings. AI as far as customer service

is concerned is proactive and can help resolve issues faster, easier, and offer a response tailored to each customer. AI allows for an automated workflow which is faster and more efficient. Questions can get assigned to the correct agent, content can be analyzed, and suggestions or responses can be generated.

AI can also optimize the workforce by analyzing historical data and can therefore predict future staffing needs. These needs will include the ability to create work plans by week, day, month , year, and by season (Zendesk, 2024). AI will speed up the ability to respond correctly to a customer's needs. By continuously analyzing the ongoing data, AI can provide instant insights to assist the support functions. AI could write after-called summaries to speed up wrap-up times. It can also transcribe voice interactions for agent training. Some research has shown that AI can be a revenue generator for some companies. What has traditionally been a standard cost, can now generate revenue. AI can recommend items to a customer based on their personalized data points. It can review what is in a customer's cart, as well as their purchase history. Having this information will allow the AI platform to send out targeted messages based on user events and historical data. This can boost sales and lead to a more proactive approach. The more data AI can have access to, the more effectively it can send messages that can drive revenue. As you can see in Figure 2.4, AI can assist with customer satisfaction.

Figure 2.4



The last aspect of artificial intelligence I would like to briefly touch on is the topic of financial management. AI integration within the financial sphere of an organization is not just an incremental change, it is a huge leap into the future (Onestream, 2024). Learning from historical data, AI can help with fraud detection and prevention. It allows the company to predict potential fraud scenarios and alert the finance teams of suspicious behavior. It also enhances the cash flow analysis process by analyzing factors that could potentially affect that flow. It can track market trends, seasonal effects, and make better investment decisions. Having a better knowledge of your company's cash flow will allow CFOs to make better informed decisions about a company's liquidity.

With artificial intelligence a company can expect to see more of an environment that has automated reporting. Financial reports such as balance sheets and income statements will become automated saving both time and money. AI also offers an ability to establish a credit risk analysis element. It can predict the odds of someone defaulting on a loan by analyzing their past historical financial data. Including within all of this is AI's ability to also analyze a person's social media behavior and their transaction patterns

Chapter 3

As the artificial intelligence data begins to roll in, many people are beginning to feel as if there is a new fortune teller in town (Wifi, 2024). 95% of supply chain leaders are predicting we will see AI play a key role in the future. From its ability to reduce forecasting errors by over 50% to its generating $1.3 trillion in value by the year 2030. AI is here to stay, and a new cost saving era is in the making.

Reducing Operational Cost in Supply Chain (Wifi, 2024):

- 70% of supply chain professionals are using AI to identify cost-saving opportunities.
- AI-enabled predictive maintenance can optimize equipment performance and reduce maintenance costs by 15-20%.
- AI can optimize supply chain labor allocation and reduce labor costs by 10-15%.

Artificial intelligence is no longer a thing of science fiction. It is a real time tool that will shape the future of supply chain operations. It comes as no surprise that 70% of supply chain professionals are using some form of AI to help uncover cost savings within their chain. It is being used to predict equipment failures as well as fine tuning a company's labor resources (Wifi, 2024). AI is offering the supply chain community a chance to focus on productivity and cost savings without the trappings of the past. Demand forecasting with AI has been shown to reduce forecast errors by 30-5-%. With AI as their tool, demand forecasting can be done with newfound precision and with confidence. As you can see from the bullet points listed below, AI can assist in every aspect of supply chain operations. It can assist at the beginning with planning and procurement and follow and assist all the way through the chain until the product reaches the retail establishment or the customers' hands.

AI's Impact on Supply Chain management (Wifi, 2024):

- AI in supply chain management is estimated to generate more than $1.3 trillion in value by 2030.
- AI can reduce supply chain forecasting errors by up to 50%.
- AI can help reduce supply chain operational costs by up to 30%.
- AI-driven supply chain models can lead to a 5-10% reduction in overall supply chain costs.
- 90% of supply chain professionals say that AI has the potential to significantly enhance supply chain efficiency.
- AI-powered predictive analytics can reduce inventory holdings by up to 20%.
- AI can increase supply chain transparency by up to 50%.
- AI can reduce transportation and logistics costs by up to 30%.
- AI can help detect and prevent supply chain disruptions up to 5 days in advance.
- AI-powered supply chain analytics can lead to a 15% increase in on-time deliveries.
- 78% of supply chain professionals believe that AI can enhance supply chain visibility.
- AI can optimize warehouse operations and labor utilization by up to 40%.
- 60% of companies are planning to increase their investments in AI for supply chain optimization.
- AI can improve order fulfillment accuracy by up to 50%.
- AI adoption in supply chain and logistics is expected to increase by 47% over the next two to three years.
- AI can improve supply chain visibility by 41% and reduce supply chain disruptions by 40%.
- AI-powered supply chain solutions can increase forecast accuracy by 25%.
- By 2024, it is estimated that global spending on AI systems in supply chain and logistics will reach $7.8 billion.
- AI can help reduce supply chain lead times by up to 63%.
- 55% of supply chain professionals say that AI enhances supply chain risk management.
- AI-driven predictive maintenance can reduce equipment downtime in the supply chain by up to 40%.
- AI can help optimize supply chain routing and reduce transportation costs by up to 25%.

- 73% of supply chain professionals believe that AI can enhance demand forecasting accuracy.
- AI can help improve supplier performance by up to 60% in the supply chain.
- 85% of executives state that AI improves decision-making in supply chain operations.
- AI can reduce supply chain inventory levels by up to 20% while maintaining service levels.
- AI-driven supply chain optimization can lead to a 35% reduction in order processing time.
- AI-enabled supply chain networks can increase labor productivity by 20%.
- AI can help reduce supply chain network complexity by up to 45%.
- AI-powered data analytics can help reduce supply chain risks by up to 30%.
- AI can help reduce supply chain paperwork by up to 70% through automation.
- AI-powered supply chain monitoring can improve compliance by 35%.
- By 2025, it is estimated that AI will be a standard technology in 95% of supply chain organizations.
- AI can help reduce supply chain costs by 10-20% and improve efficiency by 20-50%.
- AI can reduce supply chain disruptions by up to 65% through predictive analytics.
- AI can improve supply chain sustainability by 10-15% through optimized resource utilization.
- AI-driven supply chain optimization can lead to a 25% reduction in excess inventory.
- 45% of supply chain professionals are implementing AI to enhance order fulfillment speed.
- AI can reduce supply chain lead times by up to 50% through dynamic routing optimization.
- AI-powered chatbots can enhance customer service and reduce response times in supply chain interactions by 30%.
- AI can enhance supply chain collaboration and communication by 40% through real-time data sharing.
- AI can help improve warehouse utilization rates by 15-20% through smart inventory management.
- 65% of supply chain professionals believe that AI can enhance the accuracy of delivery time estimates.
- AI-powered supply chain risk management can reduce financial losses from risks by 25-30%.
- AI can help reduce supplier lead times by up to 40% through predictive supplier performance analysis.
- AI can enhance supply chain agility and responsiveness by 30-40% through real-time data analytics.

- AI can reduce supply chain planning time by up to 50%.
- AI can help decrease supply chain process errors by 25-30%.
- AI can improve supplier risk management by up to 45% through predictive analytics.
- AI-powered supply chain optimization can lead to a 20% reduction in out-of-stock situations.
- AI can help increase supply chain capacity utilization by up to 25%.
- AI can enhance supply chain decision-making speed by 30-40% through real-time insights.
- 53% of supply chain professionals believe that AI can optimize inventory levels and reduce carrying costs.
- AI can improve supply chain process efficiency by 15-20% through automation.
- AI can help reduce supply chain order cycle times by up to 30%.
- AI-driven supply chain visibility can improve on-time deliveries by 20-25%.
- 66% of supply chain professionals anticipate increased supply chain reliability with AI adoption.
- AI can enhance supply chain capacity planning accuracy by 35%.
- AI-powered supply chain predictive analytics can help reduce excess inventory by 20-30%.
- AI can optimize supply chain asset utilization by up to 30%.
- AI can reduce supply chain project lead times by 20-25% through predictive planning.
- 60% of supply chain professionals are leveraging AI to enhance supply chain sustainability efforts.
- AI can help optimize supply chain resource allocation and reduce waste by 15-20%.

Artificial intelligence is emerging as that silent partner whose voice stands way above all others. AI has the potential to add $1.3 trillion in value by the year 2030. 90% of supply chain professionals believe AI will enhance its company's services and another 78% believe it gives the company a visibility it has never seen before. This is not simply a trend; AI is here to stay. It is projected that 95% of companies will use some form of AI in their supply chain by the end of 2025 (Wifi, 2024). Ai is expected to transform the supply chain landscape by adding value to inventory management, better decision-making data, reduced costs, better lead times, and less errors

throughout the supply chain. Below are two bullet points expressing how supply chain executives rate AI as far as importance is concerned (Wifi, 2024).

- 64% of supply chain executives rate AI as highly important for their company's strategic objectives.
- 62% of supply chain executives see AI as a key enabler of customization and personalization strategies

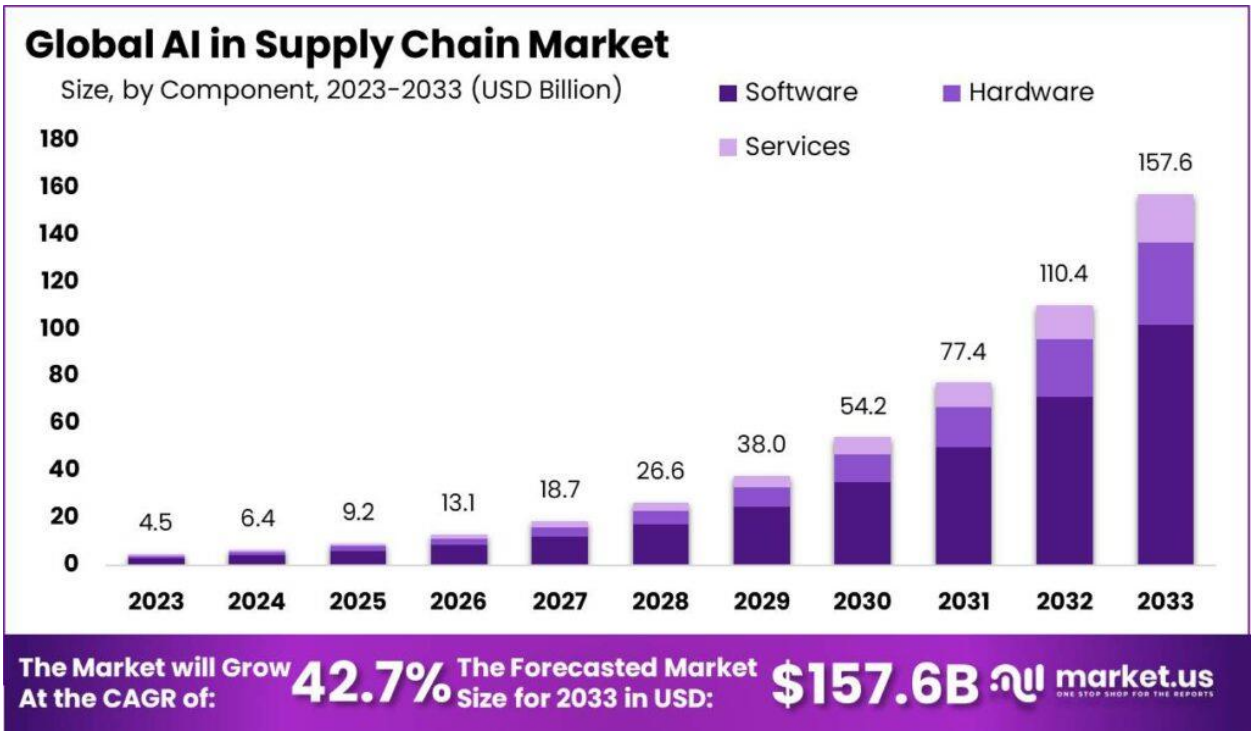
A staggering 64% of top professionals recognize the importance of AI, it is now the secret weapon, or as some say, the not so secret anymore weapon for supply chain. 62% of those who believe in AI's power to revolutionize customization strategies throughout the entire supply chain. These strategies can AI to be personalized based on each organization's needs. AI is not a trend, it's a game changer for the supply chain operation professionals. Some of the beliefs expressed by supply chain professionals are listed below (Wifi, 2024).

- 95% of supply chain leaders believe that AI and Machine Learning are key technologies for supply chain success by 2023.
- 85% of supply chain leaders believe that AI will provide a competitive edge in the future.
- 54% of supply chain professionals are investing in AI to enhance their supply chain resilience.
- 57% of supply chain executives believe that AI will improve demand forecasting accuracy.
- 68% of supply chain executives believe that AI can increase process automation in the supply chain.
- 80% of supply chain executives believe AI will lead to new revenue streams within three years.
- 70% of supply chain leaders believe that AI is crucial for managing supply chain complexity.
- 75% of supply chain executives see AI as a driver of operational excellence in the supply chain.
- 50% of companies are investing in AI to improve their supply chain sustainability and reduce their carbon footprint.

- 58% of supply chain professionals believe that AI can help optimize warehouse layout and space utilization.
- 48% of supply chain executives believe AI can enhance supply chain resilience against disruptions.

In this new world of AI being used in supply chains, professionals of the industry are predicting there will soon be a golden age for the supply chain network. It is abundantly clear that embracing artificial intelligence is no longer a simple luxury, it is now a necessity if one wants to keep up within the marketplace. AI can make the supply chain more resilient, as well as unlock potential for more revenue streams (Wifi, 2024). It is no longer a secret; AI is something companies will need to use to remain relevant. AI is the new sheriff in town.

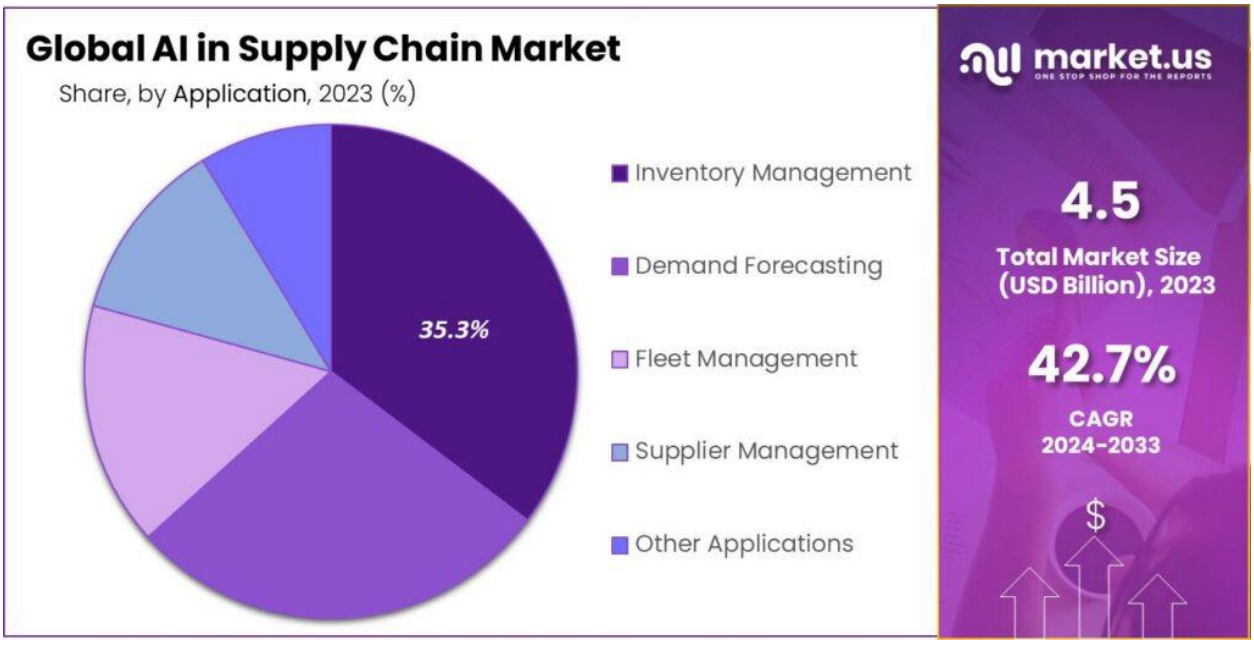
Let's look at what some of the other supply chain professionals have to say about artificial intelligence and how it relates to the supply chain network. The market for AI in the supply chain is growing rapidly and so has its need for automation (Markets, 2024). Businesses are investing in AI solutions because they believe it will give them a competitive edge over their competition. As this market grows, this expansion will be supported by further advancements in AI technology. We will begin to see AI as becoming increasingly available to even the smallest of companies. While other aspects of AI will see more of a structure that will be tailored to specific supply chain challenges. Figure 3.1 below shows the expected increase in AI over the years ending with 2033.



According to a study by Capgemini, 68% of supply chain organizations are adopting some form of enabled traceability and visibility AI solution (Markets, 2024). This technology will enable a significate boost in transparency throughout the supply chain. It should be noted that the expectation is that they will see a 22% increase in efficiency. It should also be noted that in 2024 there are approximately 70% of those supply chain companies that use some form of maintenance AI solution. Another 82% of organizations have implemented some form of AI to help management its quality control and inspection programs. The companies that have been using this type of AI technology have need an 18% decrease when it comes to product defects. This can all be traced to the company reducing its operational costs. Some companies have reported a 25% decrease in logistics costs and an outstanding 35% reduction in their inventory levels due to using an AI solution. As well as cost savings, 65% of those companies have also stated that it has drastically improved their service levels.

When it comes to artificial intelligence and supply chain some have stated that there are five key takeaways to improving business. They include the software component, the technology component, demand forecasting, the retail industry, and North America (Markets, 2024). The software component of AI held a dominant position in 2024. It holds a 65% share of the AI driven implementations. The machine learning technology component has dominated the market with a 44% share due to its speed and precision. AI driven demand forecasting has a current share of 35.3% because of its ability to control inventory management while optimizing inventory levels and stockouts. The retail industry, which tends to be the end of the supply chain for a lot of companies held a 24.1% market share. AI has allowed for the streamlining of processes, as well as improving customer experience. Lastly, North America has dominated the market with a 37.9% share due to its substantial investments in AI. Figure 3.2 below shows a breakdown and the relationship between the AI applications.

Figure 3.2



With regards to end-use analysis, the retail segment has held its dominant market position. This is mostly due to its extensive adaptation of AI technologies which have streamlined operations and reduced costs. Through AI's predictive analytics, retailers can anticipate market trends and adjust to them. This means there are far less supply chain interruptions. Decisions can now be made proactively. Retails use of AI also has a trickledown effect which can help logistics. Order fulfillment operations get better information which leads to better delivery systems, more productive order picking, and better shipping accuracy rates.

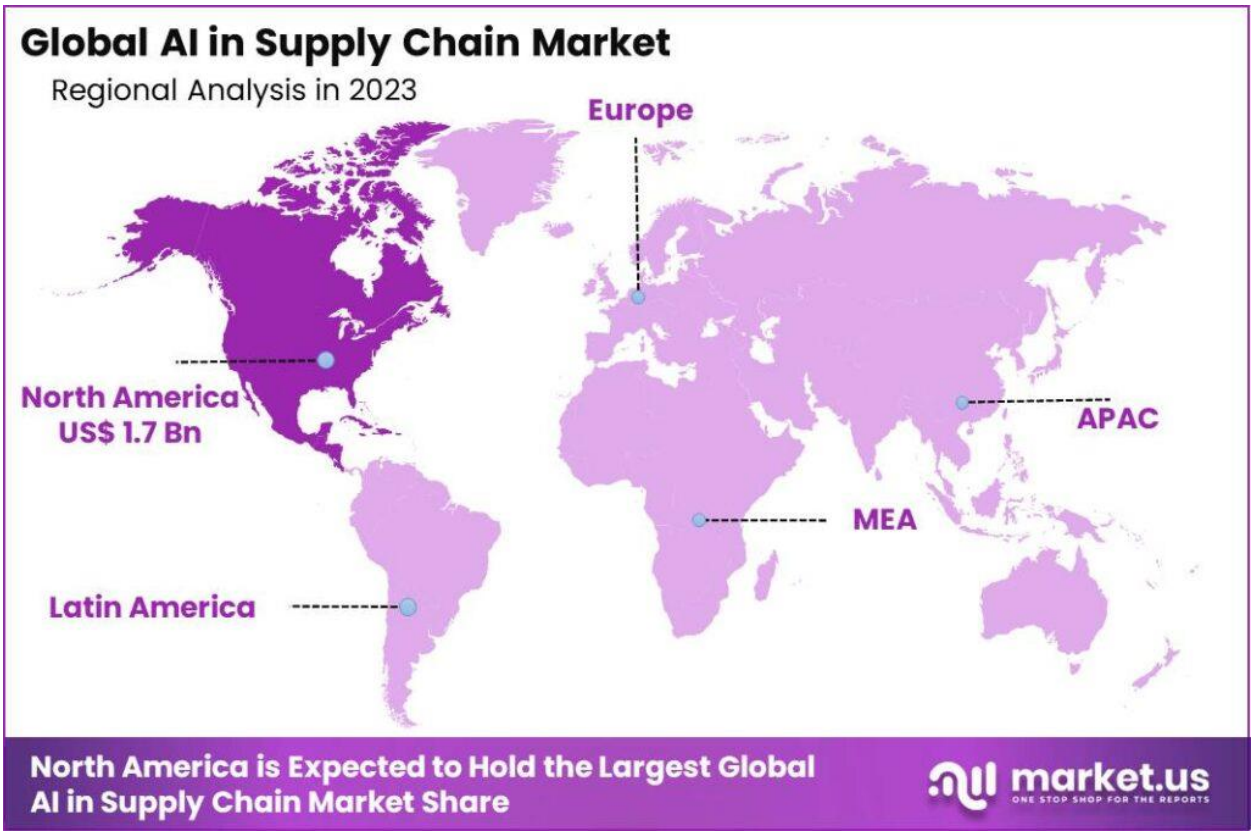
As with any technology it will always be improving. Some of the emerging trends include actionable AI, smart operations, mobile assist optimization, industry cloud platforms, and cyber resilient supply chains (Markets, 2024). Actionable AI refers to the trend that emphasizes AI's ability to enhance its decision-making ability. It can do this by learning from its past decisions and adapting to the changes. This will be a crucial step in supply chain operations moving forward. Smart operations means using AI technology to expand away from the manufacturing sector and integrating with other aspects along the supply chain. This is especially important when it comes to logistics and global trade initiatives. Mobile asset optimization fucuses on using sensory technologies to maximize the utilization and monitoring of an organization's mobile assets. These assets are what would be found within the transportation and warehouse portions of the supply chain. Cloud platforms are evolving into concepts that can provide industry specific capabilities. These capabilities allow for a more modular and agile way to manage. This means management teams have much more flexibility in their operations. Lastly is cyber resilient supply chains. This aspect incorporates cybersecurity with the supply chain operations. It maintains an interconnecting network.

Growth factors are another concept that should be addressed when dealing with artificial intelligence. There are five key growth factors that should be looked at. These include increased data utilization, a focus on sustainability, resilience and risk management, e-commerce growth, and technological integration (market us). The ability to leverage AI ability to analyze big data remains one of the most fundamentals of all the drivers of AI growth. With the world being ever more concerned with the environment, sustainability has become a big issue for companies. AI can meet all regulatory requirements at the same time as helping to maintain a company's reputation. After the issues the supply chain has faced over the last several years, resilience and risk management has become a hot topic. Building a resilient supply chain that can withstand disruptions is now a focus. The use of AI can assist and help by monitoring trends and world events. Another key area of growth lies in the e-commerce market. The surge of online shopping options has created a necessity for companies to incorporate AI to be able to handle the increased customer demands. Th fifth and last area to be discussed regarding the growth of AI is that of technological integration (Markets, 2024). The adaptation of new technologies such as blockchain and AI driven automation is crucial when it comes to modernizing the world's suppl chain. This allows for competitiveness to remain within the global market.

In 2023 North America is a dominant market position with it capturing more than 37.9% of the market share (Markets, 2024). This is mainly because AI is supported by major technology leaders and innovators. The current demand in North America for AI in the supply chain industry is valued at nearly 2 billion US dollars. AI integration is supported through huge investments in AI research and development. North America also has a very large technological infrastructure. North American companies have let it be known that they support complete supply chain transparency. They are using the new AI technology to predict and isolate any supply chain

disruptions. This proactive response has proven to be a huge cost savings for North American companies. AI also helps when it comes to the regulatory issues that face the supply chain network. It allows the organizations to remain consistent and compliant with any new regulations. It has been seen that educational institutions have begun to collaborate with the AI industry. This helps in nurturing those through the AI process and creates a more talented workforce pool (Markets, 2024). The synergy between technology, expertise, and the AI industry demonstrates why North America leads the world in AI implementation. It also shows that the potential for growth is limitless. In Figure 3.3 you can see that North America is expected to hold the largest Global AI share with regards to AI.

Figure 3.3



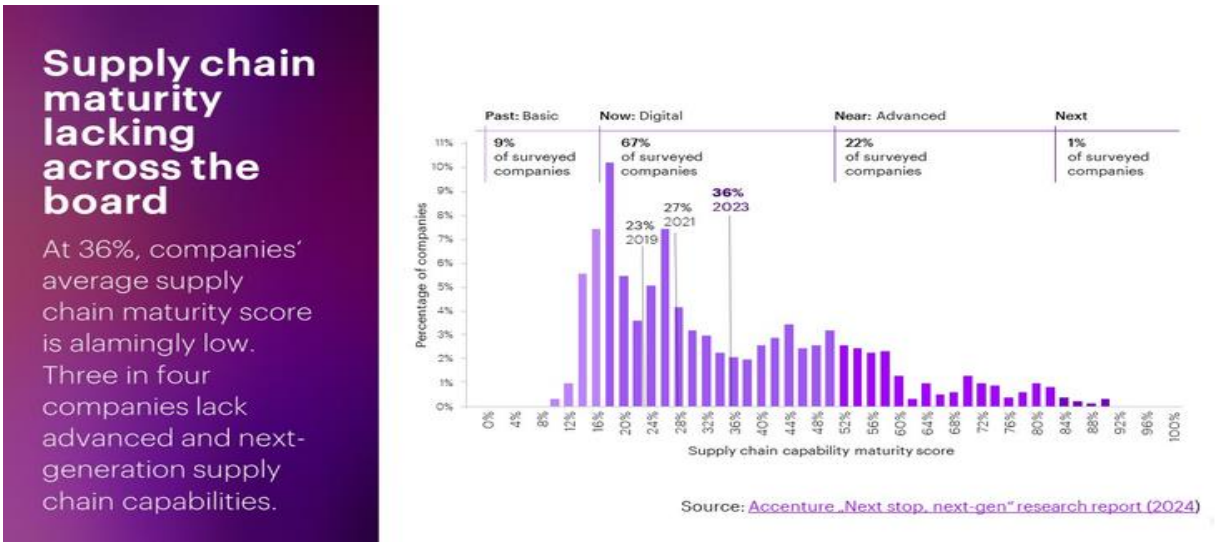
Since artificial intelligence in the supply chain continues to evolve, some key players have merged (Markets, 2024). These key players are shaping the industry through its technological advancements, and its strategic partnerships. These key players include Microsoft, NVIDIA Corporation, Oracle, and IBM. These companies have been instrumental in the development of solutions that enhance supply chain operations by improving the industry's ability to forecast and optimize its logistics standing.

Chapter 4

New research conducted in 2024 from Accenture shows that companies with the most mature supply chains are 23% more profitable than other supply chain networks (Newsroom, 2024). These companies are also 6 times more likely to use AI as part of their network solution. Accenture looked at over 1,000 companies in 15 countries and it was determined that those using AI technology performed better with autonomous decision-making and continuous improvement. The report also shows that the top 10% of these companies achieved a 24% higher margin in their operations as did those companies without an AI solution. At the same time, these companies were able to deliver to the stakeholders a 15% higher return on their investment (Newsroom, 2024).

However, when looking at the bigger picture of this survey, it was found that only 9% of companies use AI throughout their supply chain network. While the average supply chain maturity score jumped up more than 50% from the years 2019 – 2023, the average score of all companies remained at about 36%. Figure 4.1 shows supply chain maturity and how it is still lacking across the board.

Figure 4.1



According to the Accenture report, supply chain capabilities need to be more competitive in today's economic climate. Today's companies no longer operate in an environment with stable economic growth. This would mean that the old way supply chain networks used to operate no longer work. Reinventing the supply chain network is what is needed. This will require organizations to be able to monitor suppliers in real time to evaluate risks. (Newsroom, 2024). They will need the ability to change production schedules on short notice and simulate the entire lifestyle of their product. Next generation supply chain that use AI will be able to adapt to these changes and therefore be more sustainable. Companies that do not make an investment in AI technology have a real risk of not surviving in today's marketplace. Author Max Blanchet stated, "Reinventing supply chains requires the ability to, for example, monitor supplies up to the fourth and fifth tier in near-real-time to anticipate risks, change production on short notice and stimulate the entire lifestyle of the product. Next generation supply chains will autonomously adapt to change and be sustainable by design. Companies with supply chain maturity scores of 25% or lower- almost one in three companies- must act fast to catch up. Otherwise, there is a real risk they won't survive (Newsroom, 2024).

A 2017 study showed that most businesses lose an average of 6,500 hours a year doing what is called busy work. This work could easily be done more efficiently and effectively if done using an AI platform (Built In, 2024). AI in the supply chain has virtually unlimited applications. Its use can impact all realms of operational situations. One company that has been able to make a huge return on their investment in AI technology is Echo Global Logistics (Glasscock, 2023). Echo Global Logistics is a top provider of technology-related supply chain management services provider. Echo only rejects the idea of one size fits all when it comes to supply chain technology and AI use. They have be able to figure out how to leverage their wide variety of intelligence

capabilities to provide those in the supply chain with the solutions they need. Echo Global logistics' AI capabilities have enabled them to provide larger shippers and carriers with access to the huge integration capabilities of artificial intelligence. Zach Jecklin the current CEO states their applications can provide supply chain companies with systems to assist with their ability to quote, book, track, document, and invoice with greater success (Glasscock, 2023). As the industry is always volatile, Echo Global Logistics can provide an AI platform that leverages data science and can confidently predict future costs and returns on investment. All day-to-day mundane tasks can be eliminated due to data science and using AI as it's intended, as a leaning machine.

Let's look at some of the world's leading corporations and see how well artificial intelligence has worked out for their operations. What was originally founded as a book selling company in 1994 by Jeff Bezos in Bellevue Washington, has turned into a worldwide phenonium and industry disruptor. Amazon.com Inc is now considered to be one of the top five American technology companies. Its supply chain and distribution network is unmatched (Wikimedia, 2024). Amazons has been able to ship millions of packages a day due to its sophisticated supply chain operations. These operations leverage both AI and robotics to maintain it competitive edge over the e-commerce and retail markets.

Over the years Amazon experienced its continued growth, it also experienced many operational and supply chain issues. These issues include managing the increasing volumes, maintaining an efficient warehouse and inventory process, a need to reduce human error, reduce physical strain on order pickers, and keeping all costs in check. The only solution as Amazon saw it was to implement AI-powered robotics and AI-powered inventory and management software. Its key focus was operations within its fulfillment division which was responsible for all of their fulfillment centers (Digital, 2024). Amazon came up with several ideas to incorporate AI in their

upgrade. The deployed over 200,000 robotic units assist in moving goods and sorting packages within its fulfillment centers. It also used AI's ability to employ machine learning algorithms to optimize their warehouse layouts to create more efficient paths for both the robots and employees. This implementation of AI systems allowed Amazon to have a better grip on demand forecasting. This aids in waste reduction and enhances their team's ability to better manage inventory. Their integration of AI with computer vision enabled them to enhance their order picking accuracy, as well as reduce errors. Lastly, by leveraging its AI system, they could monitor safety conditions and predict possible hazards prior to having an incident. This improvement in worker safety was game changing (Digital,2024). All these changes and implementations has led to huge improvements for Amazon. They now have faster processing times, better ability to pick and sort products, and ship to ship millions of packages a day with unprecedented efficiency. By pioneering the use of AI in operations management, Amazon has solidified its position as the global leader in e-commerce and logistics. As you can see, Amazon has a huge market share advantage over its competition.

Figure 4.2

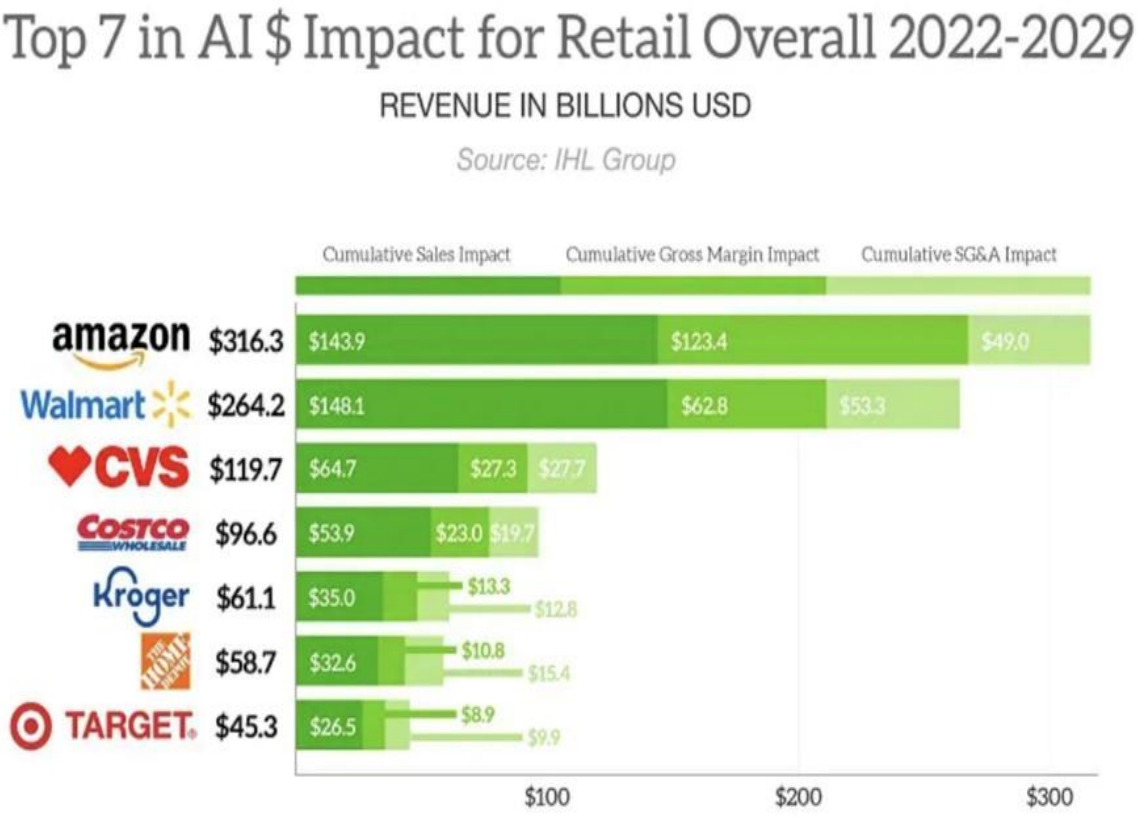
One cannot approach the subject of AI use with regards to supply chain without discussing Wal-Mart Stores, Inc. Founded in 1962 in Bentonville Arkansas by Sam Walton, Walmart has become a global retail giant (Wikipedia, 2024). Walmart now has a presence in 27 countries and has over 11,000 stores. One thing that stands out about Walmart is its dedication to innovative practices, its ability to utilize technology, and its complete devotion to cost savings. Due to its enormous size, Walmart's vast logistics network and supply chain are crucial when it comes to managing the enormous volumes the company must deal with (Digital, 2024).

To maintain its competitive edge Walmart began to look at several key factors regarding its supply chain. Th first factor that needed to be addressed was enhancing the efficiency and responsiveness of its global supply chain. Next comes their need to enhance inventory management and minimize the amount of waste. This is a need that extends not only to the retail stores but also includes their distribution centers. Shipping costs also need to be looked at. Optimizing its logistics to reduce shipping times and costs has a direct effect on the company's bottom line. Another key factor needing improvement that AI could certainly help with is that of demand forecasting. Walmart needed a way to shift its patterns and evolve more into a demand pattern focused on customer preferences. The last factor was to incorporate sustainability into its supply chain operations (Digital, 2024). Walmart needed a way to create a sustainability program without having to compromise the supply chain efficiency.

Walmart took several major steps to tackle the challenges they had to remain competitive, and implementing an AI-driven solution across their networks is what was determined to be needed. Walmart first introduced an advanced AI platform to be able to forecast demand more accurately. This allows them to better control stock levels and thus reduce waste. Also, by deploying machines learning algorithms they have been able to optimize the routing and delivery schedules. This results

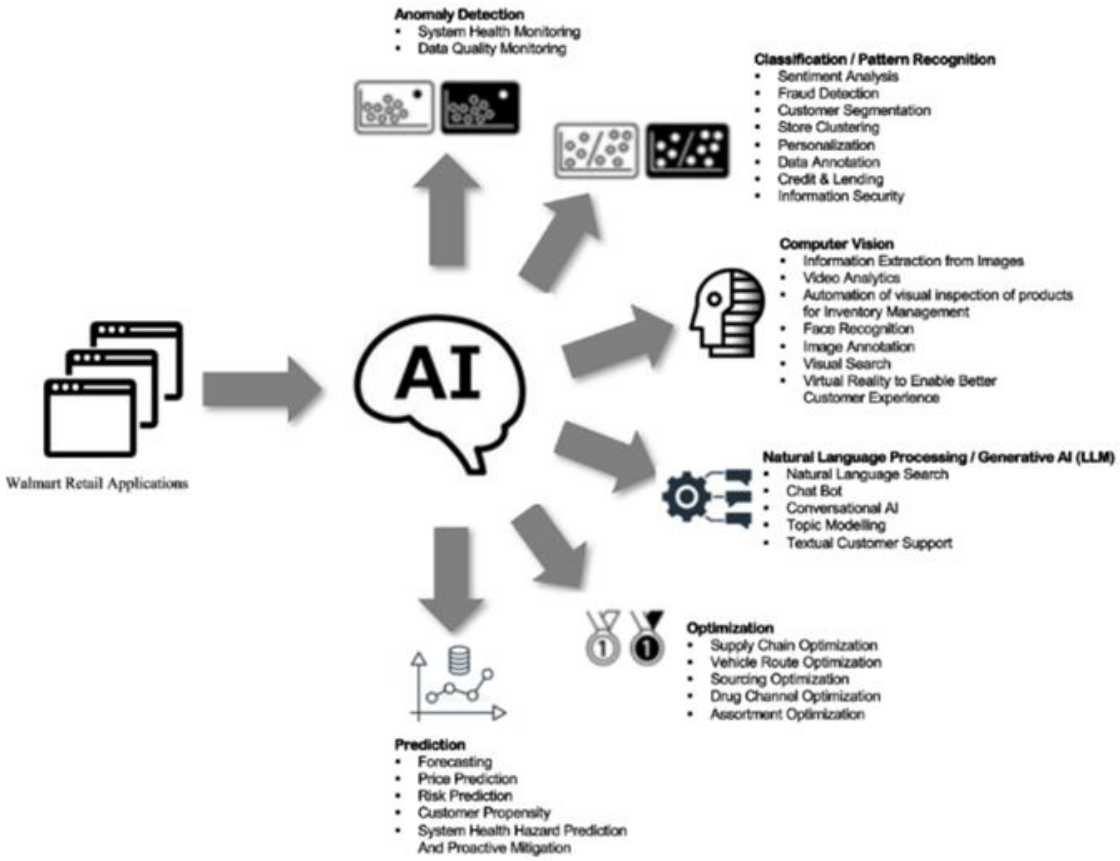
in fuel cost savings and higher customer service due to better delivery times. AI has also assisted Walmart with its warehouse automation. This includes things such as autonomous vehicles and drones. These are used to better manage inventory and the company's delivery of its items. The implementation of their AI-powered system for real-time inventory tracking and management has assured that their products are being handled and stocked more efficiently (Digital, 2024). The last solution Walmart implemented to face their concern over remaining competitive is that of leveraging its AI systems to analyze customer data. This allows them to better understand the trends and for a more personalized shopping experience for their customers. As you can see in figure 4.3, Amazon and Walmart could see $580 Billion impact from AI by the year 2029.

Figure 4.3



Walmart's adaptation of AI has yielded huge benefits to its supply chain operations. The company has seen a marked improvement in its supply chain efficiency, it have more accurate demand forecasting and has reduced overstock and understock issues dramatically. This optimization of logistics has not only reduced costs but also decreased their carbon footprint. This of course aligns well with its sustainability program. AI has enabled them to enhance their inventory management which has resulted in higher customer satisfaction and customer loyalty (Digital, 2024). Walmart has proven that using AI to remain competitive proves its commitment as it has always stated it has for its customers.

Figure 4.4



As you can see from the previous figure 4.3 Walmart uses AI in a wide range of areas including supply chain. AI has allowed Walmart to better address issues when it comes to factors

such as anomaly detection, pattern recognition, computer vision, generative AI, optimization, and prediction (Vengal, 2023).

Artificial intelligence serves as the catalyst for revolutionizing operations management as it relates to supply chain. There is a transformation that is taking place due to how this new environment can address the issues of customers, employees, and the environment. AI will no doubt be the key when it is determined which companies will remain relevant, and which ones will not be able to keep pace and move forward.

Let's look at one more company and how its implementation of an AI solution has improved and changed its operation with regards to supply chain. Deutsche Bahn AG is a prominent German railway company that is headquartered in berlin. It was founded after a merger between Deutsche Bundesbahn and the East German company Deutsche Reichsbahn in 1994 after the unification of Germany took place in 1994 (Wikipedia, 2024). Now one of the world's leading mobility and logistics companies, they manage a complex network of railway and train operations. This type of management requires a certain amount of precision and efficiency. To remain reliable with the ever-increasing demand for the delivery of goods, DB needed to make some decisions on its future.

Deutsche Bahn faced several challenges that needed to be addressed if it was going to optimize its railway operations. First, they need the ability to predict and mitigate delays. They also needed to effectively manage their maintenance schedules to ensure the safe arrival of its goods and reduce any downtime. Improving energy consumption across its network also became a priority. Lastly, they needed to have access to real-time data analysis for a better understanding of its decision-making process (Digital, 2024).

Like the previous two companies we have discussed, Deutsche Bahn also implemented an AI-solution to be able to address the challenges it faces. Using AI, they developed a predictive model to forecast delays and adjust their rail schedules. They also implemented an AI-driven predictive maintenance tool that could preemptively identify and rectify potential issues. Routes were also now being driven by AI technology. Using algorithms routes were optimized and energy consumption declined. Additionally, DB used AI-powered systems that were designed to offer better product delivery services. This led to better customer satisfaction. Overall DB has embraced the new AI technology, and it has assisted them in tackling all its major issues. These changes has allowed DB to strengthen its market position as well.

Since artificial intelligence (AI) and machine learning (ML) have transformed supply chain operations, let's look at some of the top companies that supply these platforms. Amazon web services (AWS) is the world's most comprehensive service available. In 2017 Amazon launched SageMaker which is a machine-learning platform that enables developers to create, train, and deploy leaning models to the cloud (Ashcroft, 2023) . Built along with this is AWS Supply Chain, this is a cloud-based application that can unify data and provide actionable insights. It also has built in contextual collaboration and demand planning features. This platform can connect to existing enterprise resource systems without having to re-platform which would increase costs such as licensing fees. Also, with this AWS Supply Chain platform, there is no need to have a long-term commitment.

Another big player in the AI for supply chain market is Googles's Vertex AI platform (Ashcroft, 2023). With this platform, users can build and deploy their models much faster and fully manage the tools associated with it. Google brings together its vertex AI platform with their cloud services and puts them both under one unified user interface. This means that users can easily train

because everything is being stored together. Companies that use Google's platform can build a digital copy of their entire supply chain. This gives them end-to-end visibility to understand its event management, analytics, and allows for collaboration among all their teams.

Figure 4.5

Source: Introspective Market Research

The next company to look at is Microsoft. In November of 2022, Microsoft announced its new Supply Chain Platform. This platform is built on Azure which helps companies maximize their data estate investment (Ashcroft, 2023). This platform brings with it the ability for AI collaboration, low-code, security and SaaS applications in a composable platform (Ashcroft, 2023). Microsoft Azure (ML) lets data scientists and developers build and manage a high quality and faster model. It increases the time to value ratio with its integrated tools. This platform is specifically designed to be a responsible player in the machine-learning market.

The last key player to discuss is IBM Watson. This is a machine-learning model which is cloud based and allows for easy training and the deployment of its tools (Ashcroft, 2023). It is

based on an open-source platform and first gained attention in 2011. IBM Watson aids in the end-to-end visibility of the supply chain by the usage of intelligent dashboards. It was in 2011 that IBM's platform was set up against two human opponents for a game of Jeopardy. IBM's systems won the match.

Chapter 5

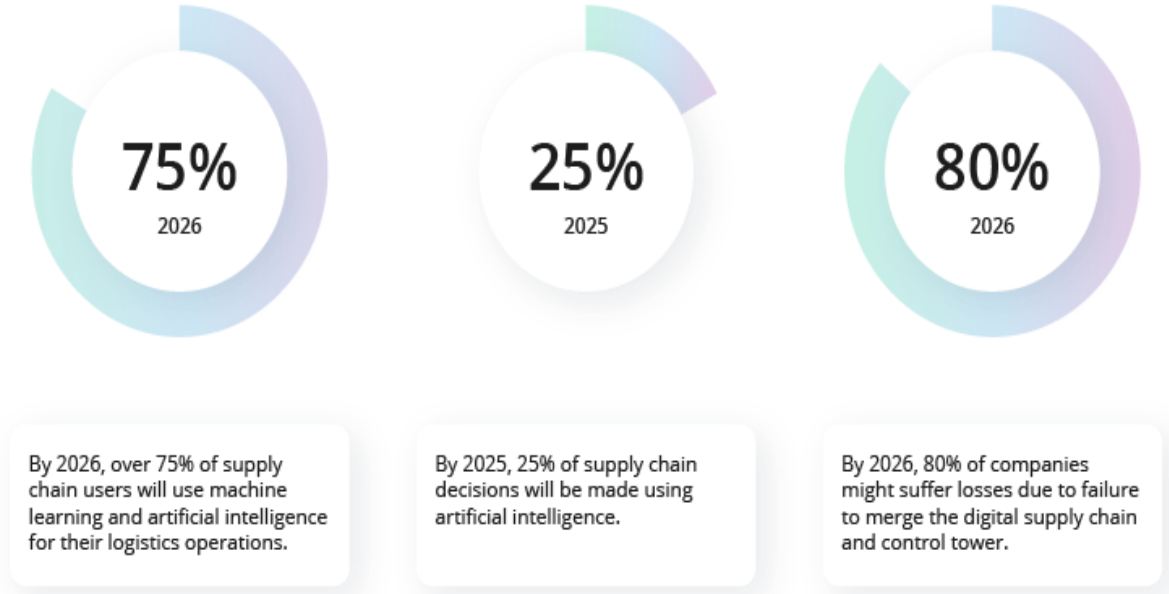
Now that we have examined all the aspects of just how artificial intelligence platforms can benefit the supply chain, let's look at some of the potential challenges and risks companies face when it comes to this new platform. Implementation of an AI platform is not something that can be done overnight. While technology offers tremendous potential to reduce costs and better manage operations, it can at times be expensive and be a very time-consuming affair. Some of the challenges that companies face include training costs, startup and operational costs, and the complexity of all the systems working together (Oracle, 2024).

Training costs as well as any new implementation requires a lot of training for those team members that will be interacting with the new technology. This can also be very intimidating for some employees. A company will need to make sure they properly train their employees and at the same time overcome people's tendency to resist change. Like any new system, there will be employees that will not be able to adjust to the new environment and will leave the company. All this needs to be taken into consideration before the final rollout begins (Oracle, 2024). This means because of the nature of training that down time needs to be scheduled. This of course comes with a cost and most companies fear downtime at any level. Before the training process begins and a schedule of down time is developed, the company needs to make sure and partner up with AI team and develop the process together. This will limit the down time and be more constructive and affordable (Oracle, 2024). It should be noted that training costs can only be limited, there will always be a cost associated with the training of the team.

Next comes the cost associated with the startup and the overall operations. These costs go beyond the basics of procuring and integrating the hardware and software. While not all machine-learning algorithms need to be built from scratch and some platforms have prebuilt

models available, there are still a lot of tweaks that will need to take place before any sort of rollout can begin. For a company to get the maximum benefit they should train the models on their own data. Collecting, validating, and transforming large amounts of data can make a big difference.

Figure 5.0

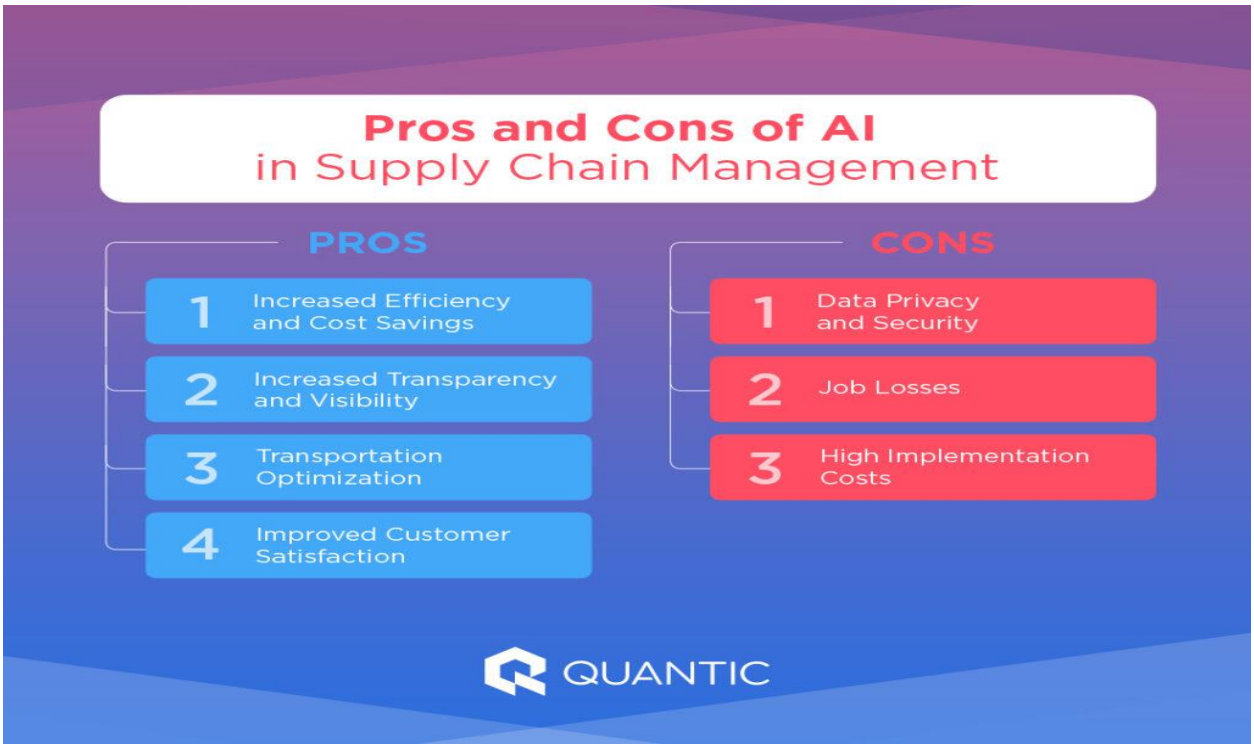


If businesses don't properly prepare a high-quality data set, then they may risk the old maxim: garbage in, garbage out (Oracle, 2024). Training with machine learning with the correct data in an intense phase of the implementation and requires server and cloud demands that were not previously seen. This is not a one and done program, it is an on-going process that will require a lot of attention. Cloud-based platforms are, however, making this much more accessible and affordable as time goes on. There are some cloud infrastructure companies that offer managed data science platforms. These types of platforms can simplify the building of the

machine-learning platforms and fine tune their performance (Oracle, 2024). It can also help to identify and fix any glitch or situation that may arise.

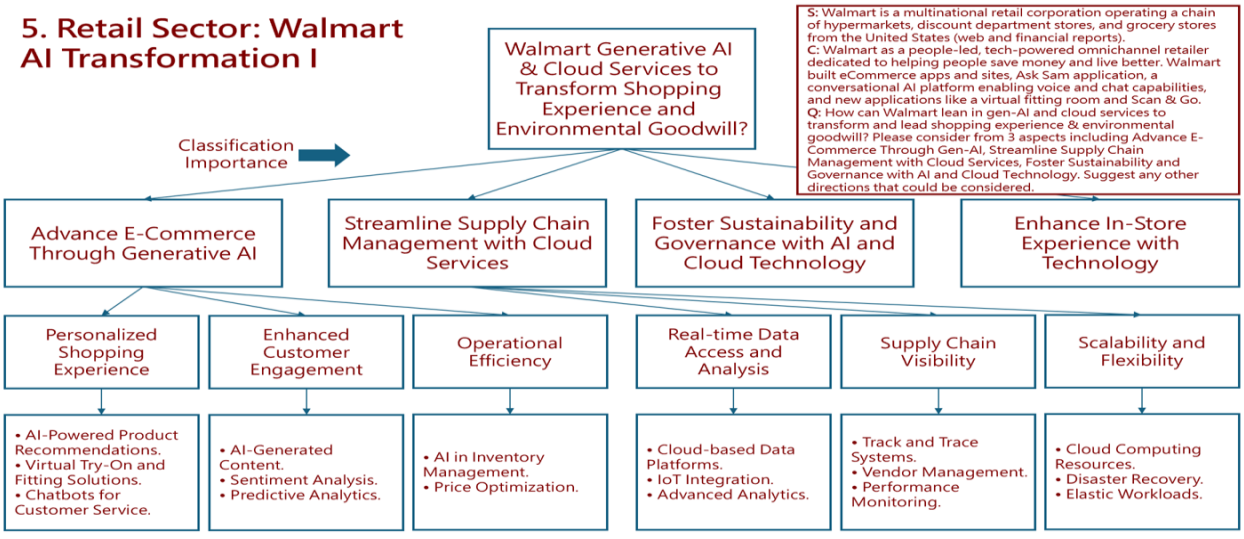
There is also the issue of complex systems. Artificial intelligence systems have a lot of moving parts. These include devices that are used to stream real-time data, GPU servers used for the initial and later training modules, edge and cloud servers, and applications that will act on the patterns that are being established. All these elements must integrate to have a successful supply chain implementation. They will also need to consistently monitor and fine tune the new technologies' performance. This will allow for continuous improvements as glitches and issues are identified. As you can see in figure 5.1 below, there are several pros and cons with AI that will need to be addressed.

Figure 5.1



Walmart, which has previously come up in discussion, is a company that is known for its industry disruption. While it is one of the top companies using artificial intelligence, it is not without its challenges. Walmart uses its AI platform to be able to forecast demand and optimize its inventory levels. It uses its data to analyze in real time to assure them that they have the correct products available, and that stock levels at the same time are minimized. This is not without its challenges. Walmart has found that even with AI there is still a need for more accurate and consistent data (Visconsult, 2024). There are also issues with maintaining data protection and making sure that sensitive materials are secure. Along with any implementation and Walmart is no different, there are issues with integrating with existing systems. AI is also a huge investment, not only for large players like Walmart, but for smaller companies as well. Walmart also found it challenging to make sure that cybersecurity and data protection was accruing in real-time. One last issue Walmart and other companies as well will face is the lack of skilled experts in AI (Visconsult, 2024). This is still a new and evolving aspect of technology; experts are hard to come by. As you can see, in figure 5.2 Walmart is attempting to transform its retail sector with the use of AI.

Figure 5.2



AI companies themselves face significate challenges as this new technology begins to grow and become more ingrained in the marketplace. While the cash appears to be rolling in for these AO technology companies, there are still issues with market growth, market timing, and management (Oracle, 2024). Investors ae flocking to this new opportunity and they have begun to shift to the marketplace. However, along with this new technology comes regulatory concerns and competition for computing capacity. Some of the main issues that AI companies face include, Security, data volume, computing capacity, cloud costs, efficiency, data quality, KPI's and measurement, funding, and sales and marketing.

Security and Privacy responsibilities need to go beyond what they used to be in the corporate environment. Some of the old measures such as the zero-trust model will remain the same. While others will change. The zero-trust model is great for detecting malicious activity and are also able to send out electronic alerts. But there are now new challenges. AI models can potentially leak information to those that are being trained to use them (Oracle, 2024). This information could contain terabytes worth of data sets. It's extremely important that the AI companies minimize these risks and regulate the information. Investors need to know that these types of issues have been and are currently under control.

Data volume is another concern. AI companies deploy large language models (LLMs) with extensive data sets and billions of parameters for all sorts of use. This include the use of natural language processors (NLP) and image creation. There are also models for the development of computer vision, forecasting and prediction, and anomaly detection (Oracle, 2024) All of these require huge amounts of data, and it all must be managed to be accurate and consistent. For an AI company, data management sits at the core of its business. The key challenge is to use the right data sets to suit the AI training needs and upload them into a massive

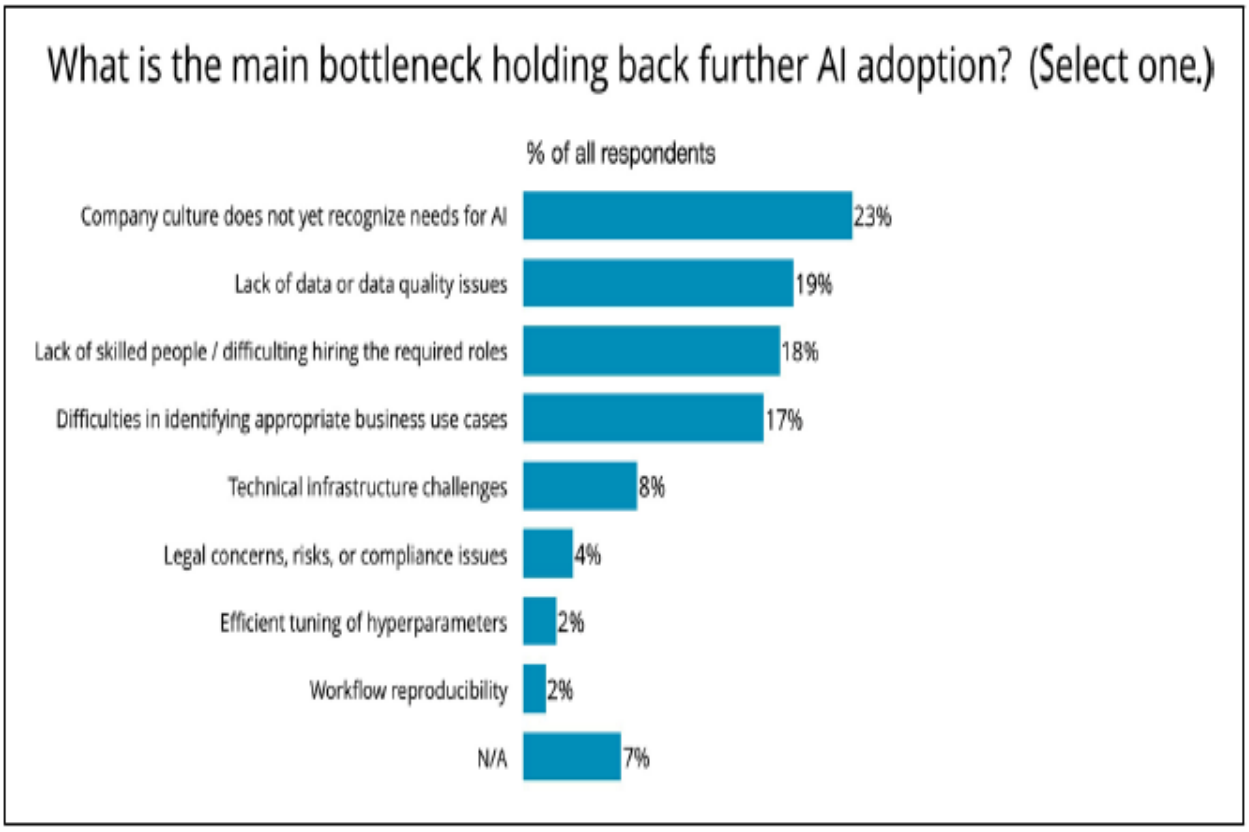
data warehouse. The data must flow securely from neutral networks and AI platforms using superclusters and GPU servers.

Customization is another issue that faces companies and their AI technology. In most cases it is more efficient to build your AI model off the work of existing models (Oracle, 2024). There are two approaches which are most common for customization. These are fine-tuning and retrieval augmented generation (RAG). To fine-tune the AI system means to train it on large amounts of data. This data needs to be specific to the issue and then instruct AI to give that information more weight in overall responses (Oracle, 2024). The next option for customization is RAG or retrieval-augmented generation. This involves embedding highly important documents in a database and then giving the AI system context to be written, or verbal responses when prompted. This allows for technical details to be part of the output, and it can even cite how the information was gathered. Each method will have its own challenges such as speed, quality and cost (Oracle, 2024). This is the reason why it is so important that serious consideration be given to the issues before the customization process begins.

Cloud costs are something all industries find challenging. When companies are looking to implement an AI model it is hard to say no to a ready-made cloud infrastructure. Cloud providers tend to provide the training needed to customize large language models including a high bandwidth and high-performance file system. Since these systems tend to be consumption based, it’s often that these can be found to be less expensive. They are usually faster as well (Oracle, 2024). This means it’s a better option than setting up an on-site infrastructure. However, this speed and efficiency must also be weighed against the cost. A budget calculation should be established and then a cloud infrastructure should be picked that can handle the expectations. As with most industries, the faster the system works, the less overall cost and wasted time there is.

Energy consumption and efficiency is another challenge. It will take many gigawatt hours of energy to train an AI model. It's been stated that the amount of energy it would take can power 874,00 homes for a year. This means that using their money wisely is very important (Oracle, 2024). Some AI models don't need the same level of efficiency as others. Companies such as OpenAI, Cohere, and Anthropic can offer the system with different variants and different sizes. Once the model and data sets have been decided, then comes the infrastructure selection. This should include parallel processing and dynamic scaling to avoid paying for resources you won't be using. Investors will always want to see that there is a balance between the system's performance and its affordability (Oracle, 2024). As you can see in Figure 5.3 there are several issues that can cause a bottleneck for companies when it comes to AI adoption.

Figure 5.3



When it comes to scaling for learning machines, there are three main techniques that can be applied to increase their quality and speed. These include increasing the amount of training data, using a larger and more complex model, or adding more computing capacity (Oracle,2024). A larger model will increase the number of layers within the network. This gives it a higher capacity to learn. As a result, you will get more detailed answers and data. In either case, an expense model needs to be developed to be able to maintain the model's performance.

Whenever the issue of quality is mentioned, the old statement of garbage equals garbage comes to mind. Quality is not specific to the AI industry or the supply chain industry. Quality has always been a part of doing business. A part that has had most companies struggling with at one time or another. AI companies face the challenge of needing to tap into the expertise of data scientists and subject matter experts. This allows them to deal with and remove redundant information, irrelevant content, and other noise that might cause an issue (Oracle,2024).

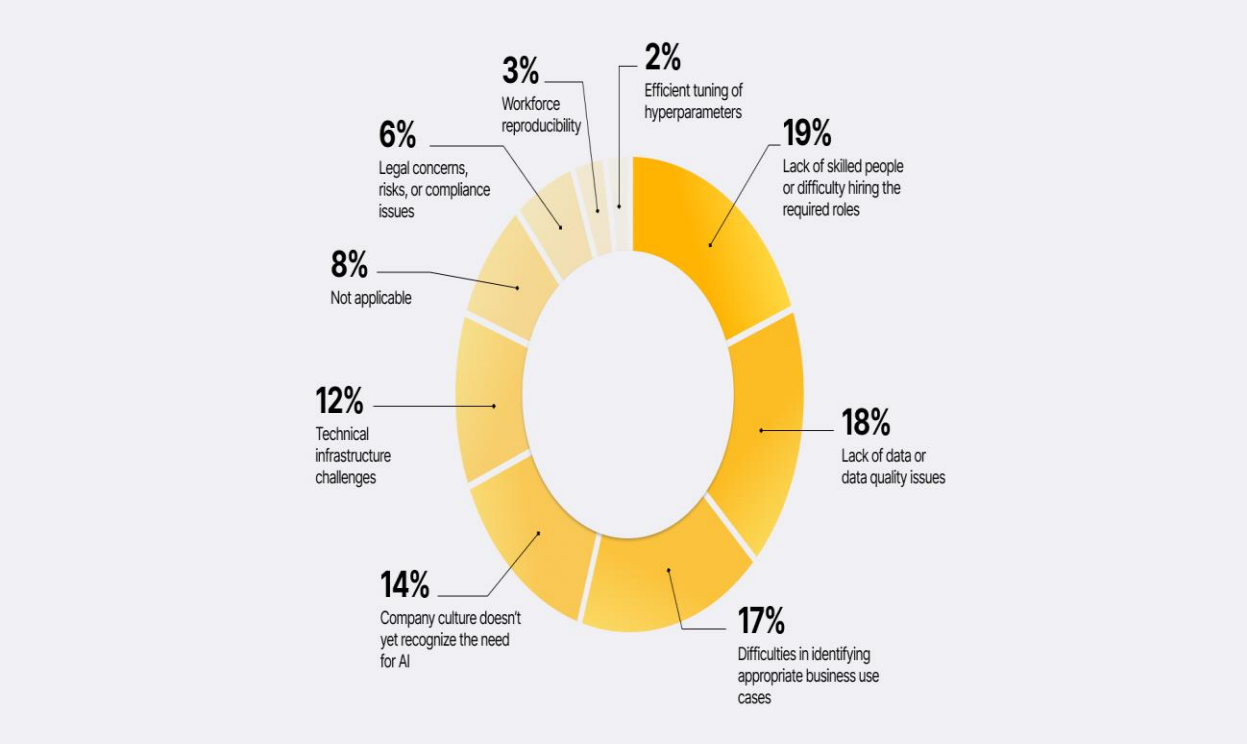
Key performance indicators is a topic that is also not new to most companies. Those in the supply chain industry live and die from this data. For AI technology companies it's very important that they establish both a quantitative and qualitative measure of their success. Quantitative measures would include their return on investment, and their technical performance indicators. This would include mean squared error (MSE) which can identify any outlier results. Qualitative results would be those that show how well the model performs with unseen data, and how relevant that data is when it compares to the target audience (Oracle, 2024).

AI companies also have the challenge of obtaining funding. Surge AI for example has taken its time to build up its customer base without taking in any investment money. However, most AI system companies cannot wait to get into the use of investor funds. There are investors, accelerators, and incubators all looking for a company with good ideas. The benefit of incubators

and accelerators is that they can assist with relationships, access the market opportunities better, offer advice, and even offer other platforms for AI development.

The last big challenge that AI technology companies face is that of sales and marketing. AI can use detailed data to map and track product movement and offer services personalized to each potential customer (Oracle, 2024). AI can then generate upselling and cross-selling opportunities that could nudge customers in a specific direction. These types of tactics have proven themselves to increase the conversation rates and prove to be very appealing to investors (Oracle, 2024). Seeing how these AI services can help a company benchmark the offering.

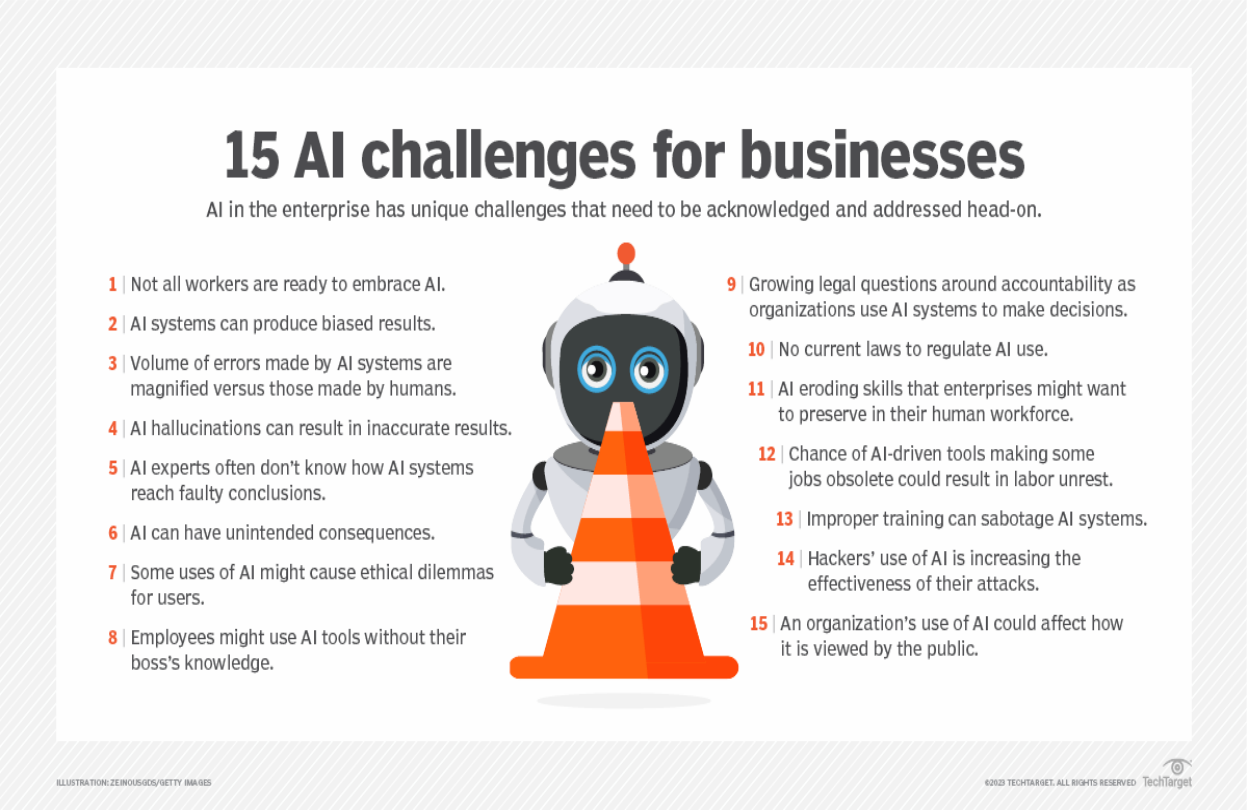
Figure 5.4



Some of the risks associated with artificial intelligence implementation are the same as with any new system. Companies have always had to manage these risks and be able to adapt (Pratt, 2024). However, with AI companies are finding that there are several unique risks that

need to be addressed, and those are what we will explore. We will briefly touch on 15 areas of risk that companies will need to address when it comes to artificial intelligence. Figure 5.5 below shows these risks (Pratt, 2024).

Figure 5.5



1- Not all workers are ready to embrace AI. A lack of employee trust can make AI implementation a very unpleasant process. A study done by the University of Queensland in Australia shows that 54% of the employees surveyed did not trust the data that AI was supplying (Pratt, 2024).

2- AI systems can produce biased results. AI takes large amounts of data and by using algorithms identifies patterns. However, if the data is biased, AI will

produce bad results. This comes from the fact that problematic algorithms tend to reflect the biases of the programmers.

3- The volume of errors are magnified compared to those made by humans. This is based on simple math. Humans make dozens of mistakes each day, but AI, which is handling missions of transactions a day can magnify by millions of errors.

4- AI might be delusional. AI systems are stochastic or probabilistic. This would mean they contrast with a deterministic environment which has behavior being able to be predicted. This means that most AI systems are not 100% accurate. This means the information would still need to be vetted as accurate.

5- AI can damage trust by creating unexplainable results. It is extremely important that the results given by AI are validated. This is even more important as the system is continuously learning. Information that is inaccurate and not validated will be referred to as AI hallucinations.

6- The use of AI can have unintended consequences. Some systems can be so focused on profits that they worsen the inequality of the workforce, therefore having an unintended social impact.

7- AI does have the ability to act unethically and illegally. This means there is always a risk for the stakeholders that they could be held accountable for the actions of an AI system.

8- Employees can use the AI system without their boss's permission. The use of ChatGPT has skyrocketed in the workplace. This leaves some companies being forced to create controls around the employee's use of AI.

9- There are legal issues. Questions have come up regarding the accountability of organizations as more and more of them use AI technology. Who is liable for the legal issues?

10- No current laws regulate the use of AI technology. Governments all around the world are looking at when and how to regulate the use of AI technology. As laws and regulations come into being, the AI systems and the organizations can find themselves in a situation where they are not in compliance.

11- Key employee skills might be at risk of being eroded. Regardless of the use of AI technology there needs to still be a focus on skills that could and should only be done by a human. One example of a skill would be that of a human's ability to fly an airplane.

12- There could be social unrest. A study by Microsoft shows that 61% of the respondents believe that AI and its tools will eliminate most jobs done by a human.

13- AI systems can be sabotaged. These AI systems can be hacked and taught specific ideas such as being a racist or misogynistic. This means the results that it sends out will not be correct and can cause a great deal of harm.

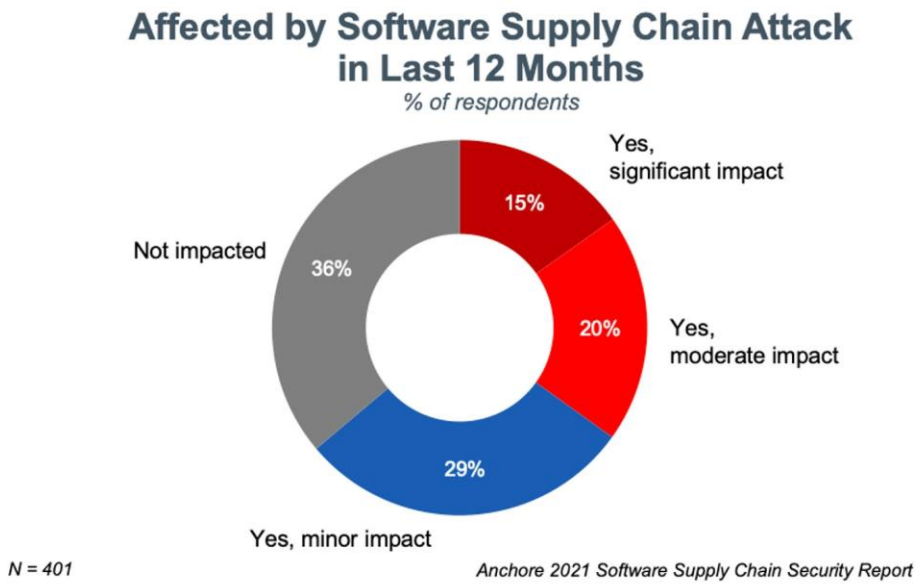
14- Hackers can use AI to create even more sophisticated attacks. In other words, hackers can use AI to their advantage and speed up the effectiveness of their bad intentions. In its current form, all someone must do is to be able to ask the right questions and they could get information that they could use to hack into someone's network.

15- Damaged reputations could be a result of poor decisions. If the data being collected is biased, then the results could turn out to be very manipulative or unethical. Therefore, damaging the reputation of the organization (Pratt, 2024)

To manage these risks organizations must first realize and understand that these risks are real. They need to have policies in place and make sure there are monitors in place to prevent these events from happening (Pratt, 2024). Monitoring AI technology is something that will always be ongoing. These risks are not just an IT issue, they are an organization issue.

As artificial intelligence continues to grow and reshape how we all live and do business, it is critical that the security of our supply chains remain intact. Companies need to make sure they keep intact the integrity and reliability of these chains. This will require enhanced security measures. AI supply chains encompass the entire lifecycle from data collection to training, and maintenance of the supply chain (AppSOC, 2024). At risk along the supply chain are the stakeholders, data providers, developers, hardware manufacturers, and the end-users. This is a very complex new technology, and it can have vulnerabilities as it interconnects its systems through its many networks. It is important that security gets addressed at each link within the supply chain. Let’s look at some of the key security challenges of AI along the supply chain. These challenges include data integrity and privacy, new roles driving AI outside of AppSec, widespread availability of open-source LLM’s, model theft and tampering, third-party dependencies, adversarial attacks, and regulatory compliance (AppSOC, 2024). As you can see in figure 5.6, a survey of large organizations show that 64% have been affected by a software supply chain attack in the last year. There are 7 key challenges to supply chain security (AppSOC, 2024).

Figure 5.6



1 -Data integrity and privacy. Data is the key attribute of artificial intelligence technology. It needs to be ensured that this data's integrity is secure throughout its lifespan. Any unauthorized access, tampering, or data breaches can lead to some serious consequences. Thes actions can lead to the AI model learning malicious and biased actions. There will need to be a robust encryption method implemented, it must have system controls, and it must also have secure data handling practices in place. The data obtained is very sensitive and needs to be protected.

2- New roles driving AI outside of AppSec. New AI projects which have initially been driven by data scientists have begun to move outside security application software. By doing this, it means that there are less guardrails to protect these projects. Until these projects get

security professionals involved, there will be a significant risk of accidents, breaches, or instances of having data stolen.

3- Widespread availability of open-source LLM's. There are many sites available that can provide hundreds of thousands of datasets for free download with very little government oversight. While many people love experimenting with these models, they have already been shown to be a gateway for malware practices.

4- Model theft and tampering. These AI models that have been developed are intellectual property and have been created with an expensive amount of time, research and resources. Protecting these models from theft is extremely important. Adversaries can attempt to reverse engineer these models if they are stolen. They can then modify these models to extract proprietary algorithms and introduce vulnerabilities into the model. These models can become safer if watermarking and secure distribution methods are done correctly.

5- Third-Party dependencies. Many AI systems rely on the use of third-party libraries, frameworks, and components. These dependencies mean that there are more places where someone can introduce vulnerabilities. To stop this the components, need to be verified and updated regularly. Each organization needs to conduct a thorough security assessment of all third-party vendors to enhance their security.

6- Adversarial attacks. All computer systems are susceptible to attacks and AI technology is no exception. Attacks can be severe and cause significant consequences, especially if they involve something as critical as healthcare. Organizations need to implement adversarial training, anomaly detection, and have a robust model to validate these actions are being one.

7- Regulatory compliance. The regulatory environment for AI technology is still ongoing and is ever changing. As AI grows more governments and organizations will be introducing

guidelines and standards that must be followed. It is important to incorporate these compliance issues into the AI model. It is also important that there are checks put in place to verify the guidelines are being followed.

Figure 5.7

There are five main strategies that can be used to enhance AI supply chain security. These include secure development practices, model verification and validation, supply chain transparency, collaborative security efforts, and education and awareness (AppSOC, 2024).

1- Secure Development practices. Supply chain and AI technology needs to adopt secure coding policies, make sure to conduct reviews of all programs, and institute vulnerability assessments to make sure they secure the fundamental AI software. One way in which I can enhance security is by implementing

DevSecOps principles. Integrating this into each step of the process will significantly enhance the security of the network.

2- Model verification and Validation. It is crucial that all AI models are validated and verified before they are deployed to ensure the integrity of the system. There are a couple of techniques that can be used including formal verification, testing against examples of known adversarial examples, and to continuously monitoring of the system. All these techniques will help mitigate the possibility of becoming vulnerable.

3- Supply Chain Transparency. Having a program that is transparent and traceable is something that shows there is accountability and trust. However, this does require that data is continuously monitored, it's also important to provide model training when seeking to have a transparent and trustworthy supply chain.

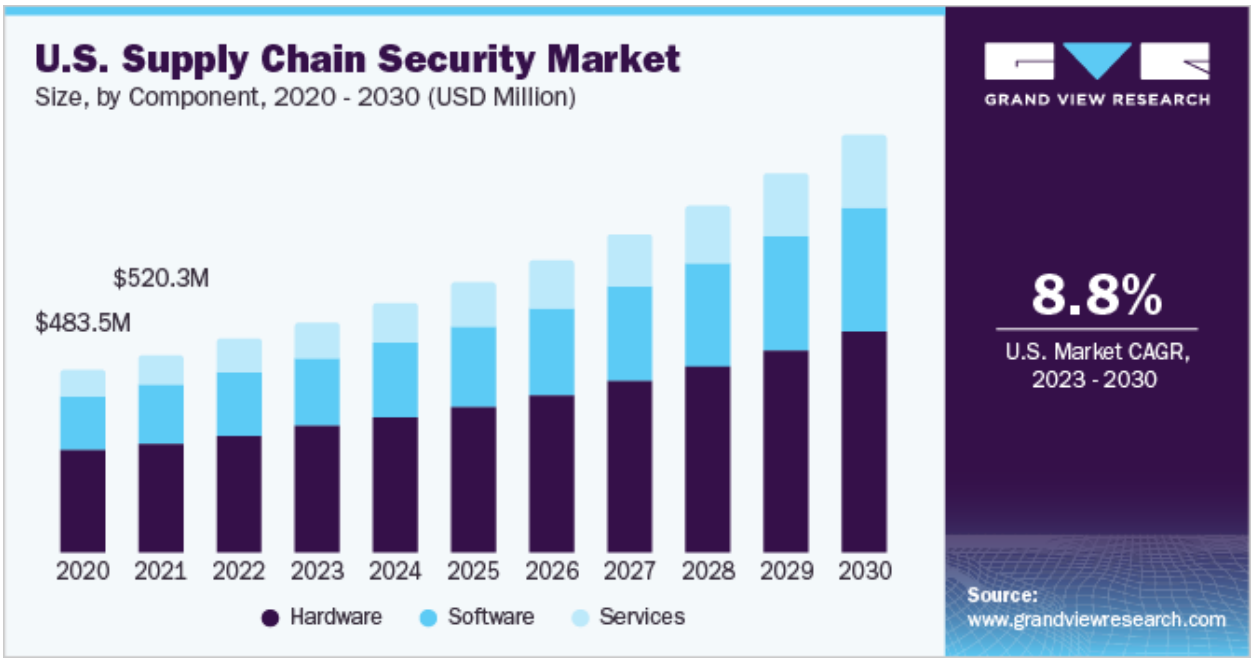
4- Collaborative Security Efforts. To enhance the security of AI technology it's important to collaborate with the stakeholders, researchers, developers, policy makers, and other industry leaders. The sharing of threat concerns, best practices, and security standards can only strengthen the security of the AI systems.

5- Education and Awareness. Education and awareness are key issues when it comes to establishing a secure system. There needs to be a consistent and reliable security driven culture in place. Training developers, data scientists and end users on secure practices will reduce the overall concern of security matters, and thus reduce the likelihood of a security breach taking place.

AI is going to be important to various aspects of all our lives in the future. This means that its security will always be of the utmost importance. The complexities and

infrastructure that need to be created with AI need to be safeguarded and protected. This security is not just a technical requirement but also an imperative strategic move (AppSOC, 2024).

Figure 5.8



Chapter 6

Artificall intelligence will be the one new technology that will continue to revolutionize the supply chain industry. From end-to-end its use will effectively allow organizations to address these issues (Consumer, 2023). It has been stated that over the next decade or so AI technology will be completely autonomous, and operations will be managed from start to finish. A great deal of knowledge was gained when the Covid pandemic hit the world, and the supply chain suffered. These disruptions can be better managed and predicted with the use of AI technology. AI technology has the tools necessary to collect, analyze, and generate alerts when any sort of abnormal activity is seen.

In the aftermath of the supply chain disruption due to the Covid outbreak, a survey found organizations believe that the only way to avoid this in the future was to make the supply chain more resilient, sustainable, and more collaborative with suppliers and stakeholders (Author, 2024). It comes as no surprise that only 2% of companies were prepared for the supply chain disruption. As you see from figure 6.1, serious disruptions affected 57% and 72% reported a negative effect.

Figure 6.1

Usually during uncertain economic times companies reduce their investments in new technology. However, during the Covid pandemic 92% of the companies surveyed continued to move forward with their investments (Author, 2024). This is due to the importance the supply chain plays in the overall world economy. There were some positive things that came out of the Covid pandemic as it relates to the supply chain. It forced supply chains to develop a more agile organization. It made them change their operation to be able to adjust to any unforeseen event.

It is important to understand that supply chain management is a journey that consists of raw materials and components, then travels through the process until it becomes a finished good for sale to a customer (Mckinsey, 2022). The use of artificial intelligence can make this supply chain more resilient by being able to detect patterns, analyze historical data, and interpret customer behavior. This technology allows companies to make the transition from a reactive organization to a proactive one.

AI technology also assists companies with better financial optimization and customer service. Financial AI can help eliminate those mundane repeatable tasks and therefore save the company money. It also offers better customer experience by being able to b foresee what the customers' past expectations were and attempt to meet those criteria in the future. It can use both new and historical data that can target the customer based on their wants and needs. This means a company can better manage its customer service and get repeat customers.

Research has clearly shown that AI technology can revolutionize supply chain operations (Georgetown, 2024). A company's implementation of artificial intelligence can make a huge difference in the company's decision-making process. It has been shown that AI technology can benefit a company in many ways including planning and procurement, production, inventory management, cost reduction, financial management, and customer relationships. Using

algorithms that can learn and grow over time, the process can only get better and more efficient. AI technology allows for a more dynamic and adaptable operation. Research shows that 94% of supply chain companies that have been surveyed plan to incorporate some form of AI technology in their future operations (Kivimaa, 2024). AI also offers companies a built-in continuous improvement program. This is a key element because the issue of continuous improvement has always been an issue most companies face.

Now that artificial intelligence is gaining ground more data is beginning to come out about its use. Below is just a small fraction of what current research shows.

- AI in supply chain management is estimated to generate more than $1.3 trillion in value by 2030.
- AI can reduce supply chain forecasting errors by up to 50%.
- AI can help reduce supply chain operational costs by up to 30%.
- AI-driven supply chain models can lead to a 5-10% reduction in overall supply chain costs.
- AI can improve order fulfillment accuracy by up to 50%.
- AI adoption in supply chain and logistics is expected to increase by 47% over the next two to three years.
- AI can improve supply chain visibility by 41% and reduce supply chain disruptions by 40%.
- AI-powered supply chain solutions can increase forecast accuracy by 25%.

AI has the potential to add $1.3 trillion in value by the year 2030 and most supply chain professionals believe it can enhance their company’s services by up to 78%.. It should also be noted that 64% of supply chain professionals also believe that AI should be a strategic part of their objectives. As AI continuously evolves in the marketplace some key players have begun to stand out. These include Microsoft, Oracle, and IBM. These are some of the companies that have been instrumental when it comes to the development of AI technology. Companies such as Amazon and Walmart have already seen the benefits of the AI boom. However, this does not

come without risks. There are substantial challenges that these companies face when implementing an AI solution including training costs, operational costs, and infrastructure costs due to systems needing to communicate with each other.

While many of the risks involved are the same as a company would face with any new technology, some variations come with AI technology. One key issue is that errors are magnified when made by an AI system versus those made by a human (Pratt, 2024). Also, the old saying of garbage in equals garbage out could not be truer. If the data for AI technology gets tainted, the results could be biased. AI would not be doing the job it is expected to do if it contained some of the biases that human beings possess. It's also important to note that the security of the data is of utmost importance. Since AI depends on collecting and analyzing huge amounts of data, a security breach could cause a great deal of harm. Not only could it affect the customer base, but it could also ruin the company's reputation and adversely affect the stakeholders.

Now that we have looked at all the benefits of AI technology and what the most current research shows, let's look at what the future holds for AI. While AI might not be a cure for all the aliments of the supply chain, it does hold great potential and can alleviate most of the supply chain's biggest challenges. Companies need the ability to adapt to the world we live in, a world in which people what more to happen faster. Companies will not be able to survive if they are not willing to make the necessary changes in this environment (Consumer, 2023). Processes need to be automated and converted from manual processes to ones which machines can do. These machines will however still need to be overseen by humans.

When it comes to the future of AI in the supply chain it needs to be understood that companies that may possess unlimited resources can use artificial intelligence in every link of the supply chain (Consumer). While there cannot be an exact definition of what AI will look like in

the future there can be some pretty accurate guesses as to what the future holds. One of the things we can expect to see is the rise of digital twins. These are virtual replications of processes, systems, and products which companies can use to identify in advance if a supply chain disruption is imminent (Consumer, 2023). This is particularly valuable to supply chains because they can proactively pinpoint a disruption and therefore reduce the risk associated with it. When companies were asked about their future regarding innovation, most stated they have already implemented digital twins while the others have plans to do so.

Another key component of AI that we will see in the future is that of robotic process automation or RPA. This automaton expects that AI powered systems will increasingly be used to validate and dispatch product orders, track shipments, and gather customer feedback (Consumer, 2023). Over time with the ability to learn from data sets AI enhanced automation will be able to reduce errors once committed by humans and allow an organization to operate at peak efficiency.

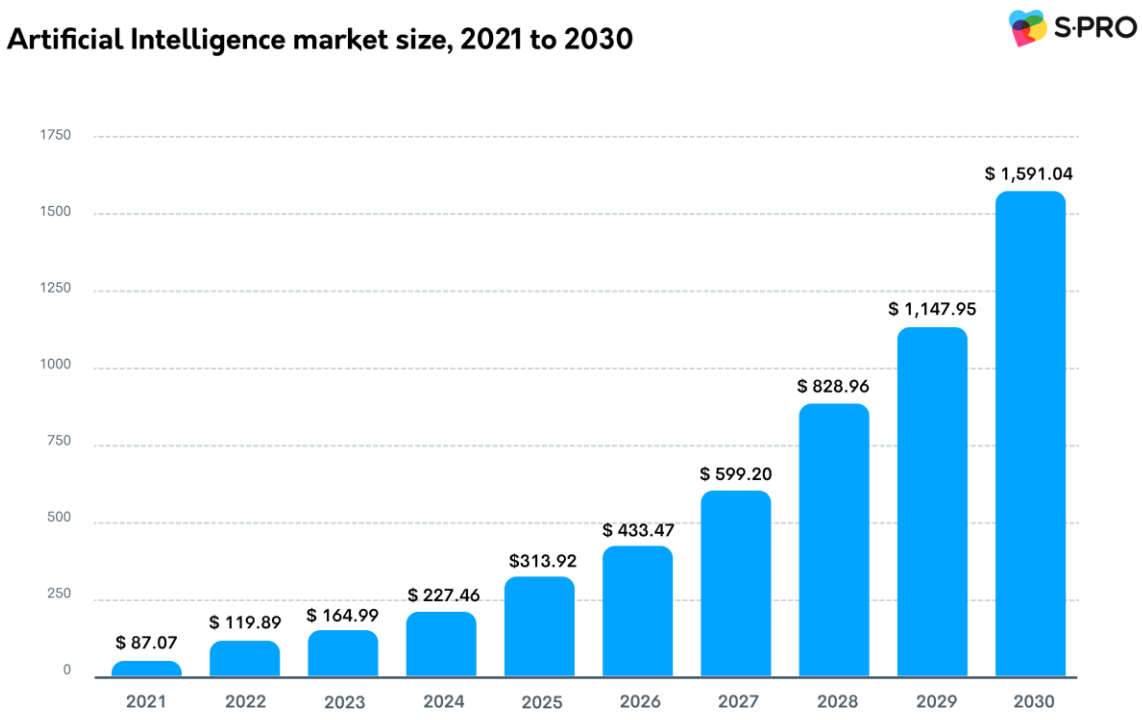
A third aspect of AI and how it looks in the future is the internet of things (IoT). This is not a new concept, but it is something that companies can leverage as it applies to the supply chain. This technology has had many key advancements and continues to move forward. There has been a massive leap towards miniaturization and precision that has resulted in big increases in the amount of data that can be generated to monitor and track items as they move throughout the supply chain (Consumer, 2023).

One of the emerging technologies we are seeing in the Supply Chain is that of generative AI. This technology is more geared to impacting certain tasks as opposed to specific occupations or aspects of the supply chain. Generative AI can transform and optimize tasks, manage data, create faster insights, augment workers, and communicate with customers (Consumer, 2023).

With increasing computing power and its continuous learning abilities generative AI can scan and query data much faster, making the data available on demand. With the popularity of ChatGPT it's easy to see how this technology would eventually be extended to the supply chain.

Artificial intelligence at this point is not going to replace everything we do in the workplace. When it comes to supply chains, many tasks such as merchandizing are still done mostly using spreadsheets. It appears very unlikely that all these tasks that require a manual process will end over the next decade. The supply chain is still a human network that supplies, stores, moves, and communicates with others. AI is a great tool and an augmenting force, but it is not a replacing tool (Consumer, 2024).

Figure 6.2



As far as AI technology goes and its relationship to my current position, I can only say I am looking forward to its advancement and use. I am currently the Vice President of a logistic company located on the east cost of the United States. My current employer Pioneer Cold Logistic Services was founded in 1947 by Joeseph Deliso, and to this day remains a family owned and operated company (Pioneer, 2024)

Figure 6.3

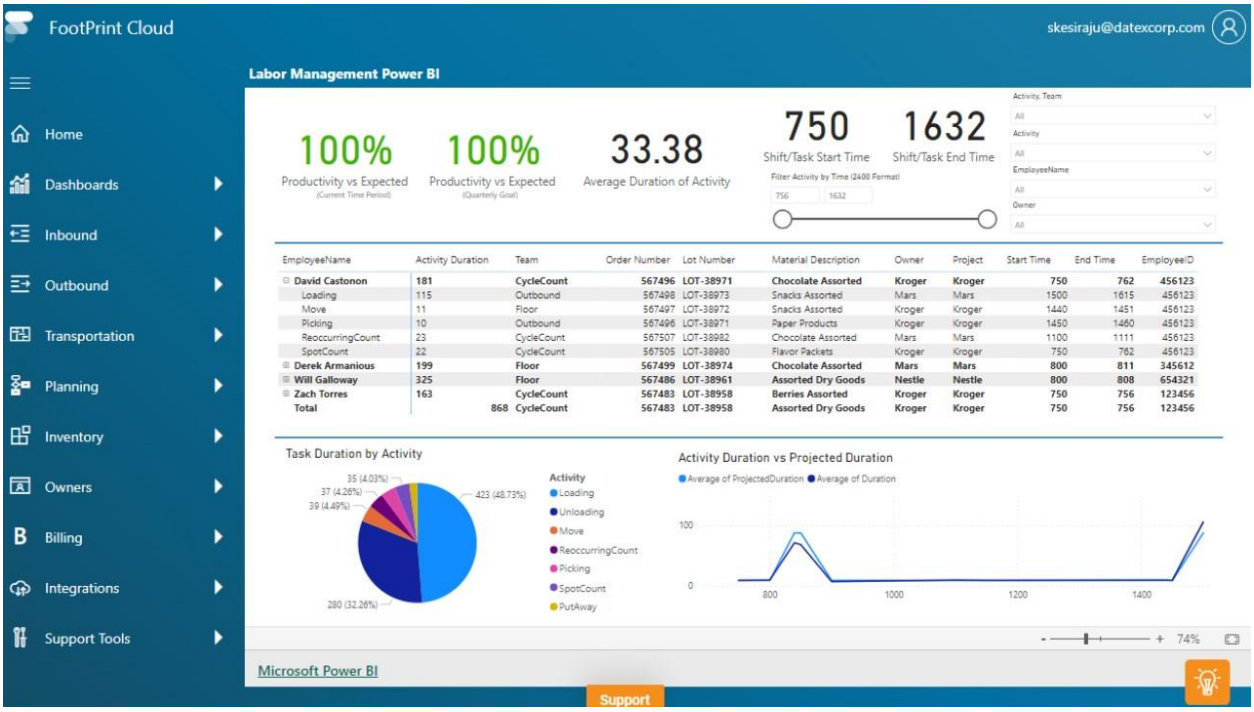
OUR MISSION

- To provide comprehensive warehousing and distribution services
- To achieve the highest levels of customer satisfaction
- To enjoy our work and provide our customers with a positive experience
- To add value for our customers and to our community
- Highly qualified warehousing and transportation specialists who are committed to Excellence in Service

Part of my main job duties includes bringing the company up to a level of technology that has been missing over some 74 years. To do that, myself as well as the board of directors have made the decision to invest in new operations technology. To accomplish our goals, we have reached an agreement with Datex corporation for the implementation of their WMS system. Datex Footprint was chosen due to its advanced database design which enables precise control over

complex logistic operations that are unique to cold storage (Mustafa, 2024). As you can see in figure 6.4, Datex Footprint offers visibility of projected production versus expected production.

Figure 6.4



Datex Footprint is the premier SaaS application for cold storage warehouse operations. Its systems are hosted by Microsoft Azure and are fully integrated, composed, published, and managed within their Wavelength platform (Datex, 2024). What makes this the state-of-the-art warehouse management system is its expansive capability and its approachable package. A case study presentation done in Clearwater Florida in September of 2024 demonstrates the impact of AI in advanced warehouse management systems. This is exactly the type of study we at Pioneer Cold Logistic Services finds fascinating. Our goal as a company has always been to modernize the technology used by our company. We are due to go live with Datex Footprint at the end of 2024. By the end of 2025 we intend on having the next step in our revolution mapped out to add AI technology to the Datex Footprint system. The presentation showcased how data, collected

directly and via integration with advanced warehouse systems management software can transform cold storage operations (Chau, 2024) The cases study showed how AI technology brought insight to labor management and optimization. It also showed how it could recognize and resolve labor issue with throughput on an hourly, daily, and weekly basis. With its learning abilities, Datex and combined with AI technology can constantly use new data that is collected to predict and improve productivity across the board.

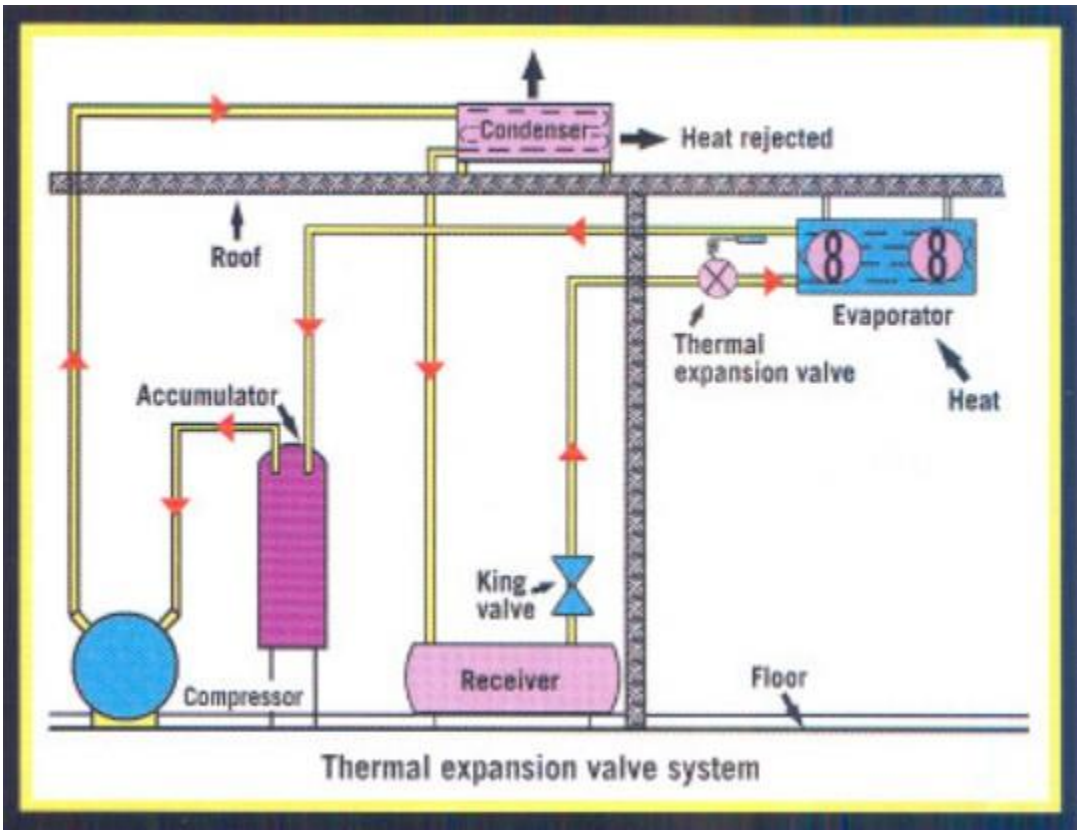
The approach being used by Datex Footprint involves understanding each employees individual picking and loading time, taking the sum, then removing those outliers (Chau, 2024). Using this model will allow us to explain over half of the variation in shipment requirements. Due to the vast amounts of historical data that can be migrated over to the Datex Footprint system, we will be able to develop a predictive model that will turn labor management from reactive to proactive. This will help our management team set a clear roadmap for the future of our labor management.

One key goal of mine as far as artificial intelligence and its use at Pioneer Cold Logistics is concerned is to make it part of our maintenance program. We are an ammonia refrigeration cold storage facility. With that comes a lot of cost associated with its maintenance, as well as a lot of safety concerns. Any type of ammonia release can have serious consequences due to its toxic nature. This makes it even more important that proper research is conducted before any changes including the addition of an AI model take place.

A group of Italian researchers conducted a study and presented their findings after looking at 19 refrigeration facilities in which artificial intelligence algorithms were being used. It was determined that AI and its subgroups including machine learning (ML), artificial neural

networks (ANN), and deep learning (DL) all showed there was significate benefits to the operations and its maintenance departments (Agudelo, 2024).

Figure 6.5



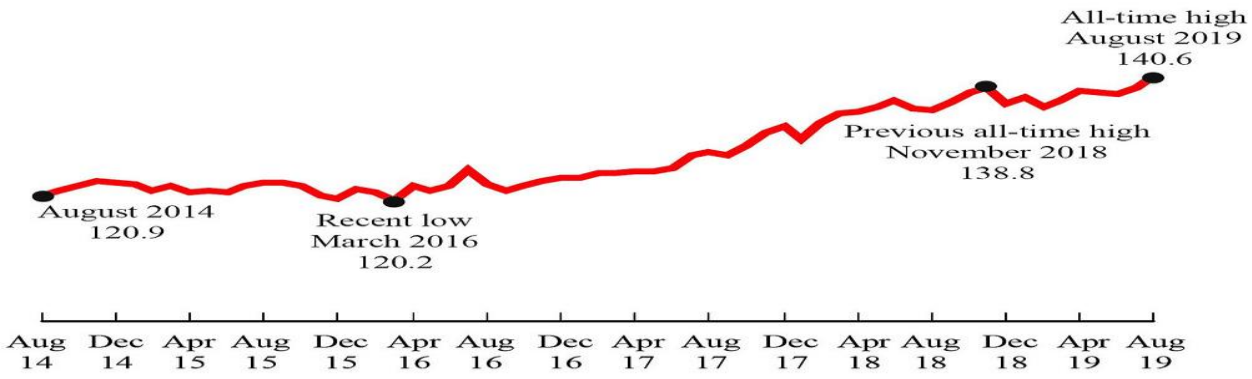
In the area of refrigeration and AI use, fault detection and diagnosis (FDD) for preventive maintenance are two of the most studied aspects. Predictable failures is what the main goal of these studies are focused on. The use of artificial intelligence models allow for better understanding and the ability to find proactively any refrigerate charge defects, any heat exchange failures, any issue with fluid mass flow, and if there is any reduction in heat transfer (Agudelo, 2024) . AI enables companies to better understand the scheduling of its maintenance programs and avoid any serious failures. This can limit costs as well as avoid any potential injuries due to an ammonia release. Due to its reduced computing time algorithms can be implemented on the main control boards of the operating systems in real time. This can push the

boundary of the PID controls and provide a shorter response time, achieving significant cost savings (Agudelo, 2024).

The study's authors used as an example the modeling of a 4-cooler plant with a two-level algorithm to minimize its operating costs (Agudelo, 2024) . At the first level an algorithm was used to predict the on/off status based on the system’s cooling charge. At the second level, particle swarm optimization was used to minimize the system's energy consumption using its cooling capacity, water temperature, and enthalpy as the main inputs (Agudelo, 2024). After two days of monitoring the operation, it was found that there was 14% energy savings. It was also determined that due to the system's high calculation rate, it was possible to implement the algorithm to control the entire plant.

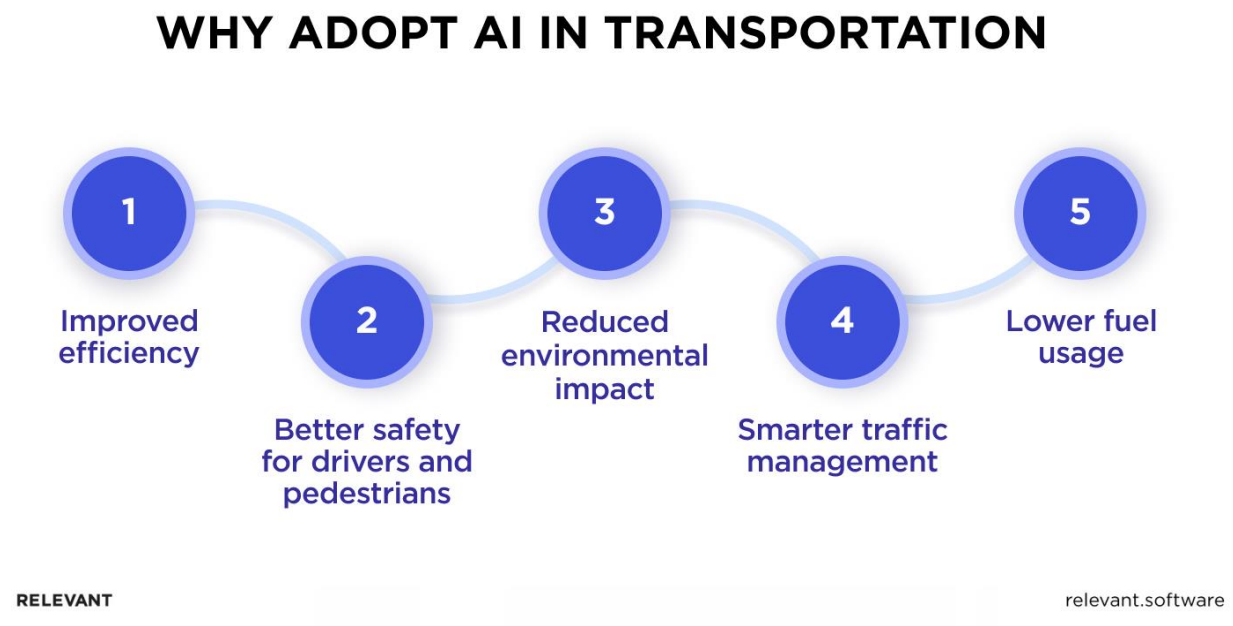
Another key initiative I would like to address with Pioneer Cold Logistics is introducing AI into our transportation department. For years now we have avoided expanding the transportation aspect of our business. With a high trailer lease rate and low margins, it appeared to be more of a problem than it was worth. Supply transportation of goods also brings with it financial responsibility for the timely delivery of the materials. Over, short, and damage claims facing the transportation industry can be a make-or-break deal when it comes to the financial stability of the company.

Figure 6.6



When it comes to the implementation of artificial intelligence as it relates to transportation at Pioneer Cold Logistics, route planning, and traffic management are key. AI can be used to analyze data that is associated with road closures, weather, road construction, and other traffic conditions (Relevant, 2024).

Figure 6.7



By optimizing delivery routes and reducing idle time, AI can make sure Pioneer Cold Logistic vehicles are always on the most efficient path. These intelligent systems can predict traffic patterns and make on-the-fly changes to schedules (Relevant, 2024). This will minimize delays and increase throughput. But what stands out is the cost savings associated with late deliveries. Not only is this an issue for the customer service teams when they need to address late shipments, but there is also a cost associated with it that gets passed on to the shipper. With AI managing the delivery schedule, there will be fewer late shipments, lower overall costs, and a better customer satisfaction rating (Relevant, 2024).

One other key aspect of utilizing AI with transportation lies within the yard management function of the system. AI systems can use algorithms to assist with smart parking management, automated license plate and seal recognition, and autonomous vehicles (Relevant, 2024). AI can assign truck drivers to doors or parking locations based on the product location within the facility with little to no intervention from a human. AI can also allow for truck check-in to be completely done by AI. Due to advancements in AI and its relationships with cameras, seals, truck numbers, and license plates can be verified without a driver having to stop at a truck gate. The system could then check the driver using the appointment function and notify the warehouse (Relevant, 2024). While self-driving cars are the most thrilling aspect of AI and transportation, it is also becoming more popular with trailer movements and yard management. When it comes to supply chains at the warehouse level, many organizations utilize what is referred to as a drop trailer program. What this means is trailers are stored at the facility until such a time as they are needed for outbound shipments. With AI technology, the system could select the trailer needed and automatically assign it to the door which would make the loading process the most efficient. AI would know the staging location of the product, analyze the shortest path to the dock, and assign the dock door accordingly (Relevant, 2024).

However, there are some limitations of AI as it relates to yard management. The exceptions include exception handling, high initial costs, dependence on quality data, and data privacy concerns (Yard, 2024). AI is outstanding when processing normal day-to-day operations. However, there is an issue when it comes to addressing the outliers. Unexpected events and anomalies are an aspect of AI and yard management that still needs some advancement. There is also a very high cost associated with the implementation of AI as it relates to yard management. Companies need to weigh the long-term benefits versus the overall cost. Having quality data is

also a key issue with AI and yard management. Since a lot of companies didn't track yard movement at all before implementation, there is little historical data for the AI technology to learn from. This means the system will need to learn as it goes on and make adjustments on a day-to-day basis. The last and one of the key issues is that of data privacy. With AI and its integration into a camera system able to collect important data, this data must remain private. A company using this technology may have access to a driver's license information, company name, driver name, cell phone numbers, seal numbers, etc. This data, if not kept private, could jeopardize the reputation of the company as well as that of others (Yard, 2024).

We have examined how the use of artificial intelligence in the supply chain will revolutionize this vast industry. By processing vast amounts of data, it will optimize all supply chain activities. Activities include planning, production, inventory management, financial management, and labor management. Artificial intelligence allows for better decision-making and can also improve the overall operation efficiency of an organization. Combined with machine learning (ML) technology learning from the new data it collects, the limits of AI technology in the supply chain are endless. It is important that companies and organizations begin to embrace this new technology if they wish to keep their competitive edge. They need to fully understand all the benefits as well as the challenges of this new technology. Manufacturers as well as logistics providers should take steps to prepare their supply chains for the future of AI technology. They need to understand that optimization of this magnitude can take a lot of time and resources. Start-up costs can be high, so each company needs to weigh its options before deciding on a technology of this magnitude. Each company must also understand that with artificial intelligence technology comes the risks of security and ethical risks. This technology

contains and has access to vast amounts of data, and if that data is not secure, reputations and people's lives can be adversely affected.

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