"A study of Artificial Intelligence in Supply Chain Management"

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1.0 Introduction

1.1 Background

Artificial intelligence is developing rapidly in the field of supply chain management. According to the leaders of the supply chain sector, the industry is changing (Abdirad and Krishnan, 2020). With the development of technologies such as artificial intelligence and mechanical engineering, it is believed that new technologies will cause anxiety and innovation in these industries. Artificial intelligence is equipped with computer methods that support selecting large amounts of data from supply chains (Caiado et al., 2021). Individuals can use and analyse such methods to obtain results that can improve complex processes and operations. Its effectiveness can be monitored with the control of the artificial intelligence chain. It provides new and better elements that affect the same area.

By uncovering the variables and factors that influence the channel's impressive presentation, artificial intelligence combines several innovative possibilities that support learning, self-management and guidance (Plastino and Purdy, 2018). Artificial intelligence improves organisational planning and forecasting capabilities. Businesses are increasingly using practical tools to plan capacity and forecast demand. Market information is necessary to move vehicles quickly to high demand areas and also help to reduce operating costs. Artificial intelligence brings the right information to the supply chain, reducing operating costs and inventory management (Aryal et al., 2018). By combining artificial intelligence and machine learning, companies can gain new knowledge in various fields such as warehouse management, logistics and supply chain management.

A novelty in these parts is a visual inspection guided by artificial intelligence to detect damage and take action when special cameras are used to photograph products. With this article, people understand how artificial intelligence is changing the supply chain. Artificial intelligence makes it possible to measure and guide all components that can evolve towards the accuracy promised when requirements are determined (Barykin et al., 2021). Considering weather conditions, current business and other factors, it provides a stable assessment of deviations. With this information, one can help with automatic sorting, improved warehousing, inventory management, and forklifts (Roßmann et al., 2018). It is not difficult for AI to analyse creditor data such as audits, overall performance, credit ratings, ratings and future decisions, and this data can use that information (Esmaeilian et al., 2020). These steps help the company as a supplier make more informed decisions and improve the quality of service to its customers.

In times of increased demand uncertainty, increased supply risk, and increased competition, an excellent supply chain usually depends on the association's ability to integrate and coordinate all materials or components from one extreme to another and turn them into a finished product deliver product to customers (Chehbi-Gamoura et al., 2020). Because these actions can be enhanced by increasing the transparency of the SC career from start to finish, many leading organisations try to enrich their information disclosures and share information with

SC partners in real-time. Therefore, SC managers are educated and focus on exchanging assets (e.g. inventory, warehousing) for information (Wong et al., 2020).

Artificial intelligence has been implemented in games, semantic modelling, human performance, robotics, mechanical engineering, data processing, nervous systems, genetic algorithms (GA) and specialised systems (Baryannis, Dani and Antoniou, 2019). The idea of a

supply chain has a long history and is as old as the product itself. Today, supply chain networks are increasingly dispersed, more diverse, and transparent in business development, corporate goals, and stakeholders (Dubey et al., 2020). Therefore, supply chain management (SCM) aims at a digital business process, bringing together different stakeholders and assets to meet customer needs and gain an overall competitive advantage over the system. However, these disaggregated solutions are not transparent enough (i.e. cannot work reasonably according to the environment). Due to the powerful nature of the SCM supply chain, consumer demand is changing rapidly and unorganised; they are not adapted to today (Schniederjans, Curado and Khalajhedayati, 2020). In order to create a smart, fast and efficient response system for companies, it is necessary to work as well as possible in all the main business and business areas of the supply chain.

Therefore, more complex IT systems are needed to address the multifaceted and everchanging challenges facing industrial companies in the context of digitisation (Di Vaio et al., 2020). Due to the latest developments in deep nervous systems, developmental nervous systems, mathematical optimisation methods for action research, coercive programming and various numerical methods, artificial intelligence is a new area of computer science. This development has enabled computers to perform tasks that only humans could do before.

According to these studies, artificial intelligence aims to "create logical agents that can detect and act in a way that maximises certain objective actions" (Luthra et al., 2018). The Association for the Advancement of Artificial Intelligence (AAAI) defines artificial intelligence as "promoting the scientific understanding of intelligent thinking and behaviour methods and their use in machines". Artificial intelligence aims to understand intelligent units. From a

technical point of view, artificial intelligence capabilities can create new features for information systems that control operations (Grover, Kar and Dwivedi, 2020).

1.1.2 Overview of SCM

Successful companies have a clear and focused vision for value creation, from highquality products to customised services or traditional low-cost products. No matter how good their marketing is, if it is impossible to deliver a product or service to consumers in an affordable way, no one will buy it (Hartley and Sawaya, 2019). They realise that this is important for customers and external resellers, and with their help, they can further improve their business. The study describes SCM as a decision-making process that promotes various activities that create value for suppliers, retailers and customers.

A successful business plan can be profitable in production, purchasing, product development, solutions and the flow between all these activities. It can also be the process of optimising a collection of solutions (Bottani et al., 2019). It provides cost-effective solutions and effective action plans at many levels, taking into account all decision-making perspectives. Research shows that actions and SCM are necessary to educate everyone, regardless of their speciality (Dhamija and Bag, 2020). They pointed out that even if one is interested in finance and converting any value into any currency one chooses, one will understand that moving, storing and exchanging currencies.

1.1.3 Overview of AI

Research shows that in recent years, artificial intelligence has aroused curiosity in the field of microcontrollers. Since the late 1970s, the development of artificial intelligence has focused on improving the productivity of companies and their ability to understand business

models and phenomena (Shao et al., 2021). When an algorithm learns from data and analysis, robots and machine learning can perform common and time-consuming tasks. With their help, the customer management solution enables the company to understand customer service better. Research shows that in 2016, companies' investment in artificial intelligence was 2.6 to 39 billion US dollars (Giri et al., 2019). Artificial intelligence is defined as the ability of computers to solve problems on their own unless they are specifically programmed to perform certain tasks.

Modern artificial intelligence platforms can gather information about the environment. This type of artificial intelligence is based on logic and probability to make the decisions and actions that are most likely to succeed (Hofmann et al., 2019). Artificial intelligence uses large amounts of data, objects and sounds to function rationally and analyse them in detail. Artificial intelligence enables machines to perceive the environment in the same way that humans do. This basic form is difficult to calculate more complex algorithms and calculations, or when the user can not describe the rules. For example, in modern artificial intelligence, faces from different angles will use the nervous system to recover them (Wamba and Queiroz, 2020). Instead, this person creates rules for algorithms and calculations, and the machine writes the rules itself. In short, the definition of artificial intelligence can be used as a machine that uses big data to compare algorithms and calculations to explain and predict which outcome will be more successful.

1.1.4 Overview of AI in SCM

Artificial intelligence is scientifically developed and very practical. The pioneers of artificial intelligence have incorporated various applications into their day-to-day operations, but competitors are investing in new ideas (Pandian, 2019). However, some companies have not used or tried to implement such technology. According to research, artificial intelligence has had

a significant impact on production to maximise processes and assets (Baryannis et al., 2019). Artificial intelligence can plan and design the best solutions for robots and humans for high quality and reliable production. In addition, artificial intelligence can provide maintenance suspension. Automation, robotics and mechanical solutions have led to the advent of sophisticated technologies that can use camera-equipped robots to detect objects and materials and teach them to recognise shelf space (Di Vaio et al., 2020). Compared to conventional methods, this improves the speed of partial selection.

1.2 Research Aim

The research aims to study how artificial intelligence can be applied to Supply chain management and investigate the challenges faced after introducing AI.

1.3 Research Objectives

- To study the challenges that are faced with the introduction of AI.
- To determine various AI techniques that can be implemented for a better SCM.
- To examine the efficiency of the supply chain using AI.
- To study how AI can impact increasing warehouse operation efficiency.

1.4 Research Questions

- What are the challenges that are faced with the introduction of AI?
- What are the various AI techniques that can be implemented for a better SCM?
- How to increase the efficiency of the supply chain using AI?
- How can AI impact increasing warehouse operation efficiency?

1.5 Research Rationale

Over the years, the world has turned to the digital future and looked to industrial 4.0 technology as the way forward. With the growing importance of artificial intelligence in the industry, artificial intelligence increasingly appears in scientific discussions and has touched many areas, such as business research (Mohanta et al., 2020). These areas have solved this problem and are now increasingly being explored. From this point of view, microcontrollers are considered one of the areas where artificial intelligence applications are most useful.

In all transactions, the supply chain controls the flow of goods and services, funds or information from product creation to users (Min, Zacharia and Smith, 2019). With the development of new technology, the change in how companies exchange information and products in-house and with the chain members is also constantly changing. Artificial intelligence or artificial intelligence is one of the development technologies that are reshaping the supply chain of all industries, especially the automotive industry (Kilimci et al., 2019). It is a living word in any business, but it can be challenging to define due to the various interpretations used in industry today. According to IBM, artificial intelligence or artificial intelligence is called "a system that can truly understand, prove, learn and communicate" (Alzoubi, 2018). They use natural language processing and machine learning to find and analyse data and execute it at high speed and scale.

Artificial intelligence can be trained to connect this data and gain insight, thus improving the brightness of network operators. "Artificial intelligence is used in companies to analyse large amounts of data very quickly to draw conclusions that everyone can ignore (Borges et al., 2020). As artificial intelligence is increasingly used in companies, software continues to learn to adapt to its environment to gather additional data to make better decisions or deliver. These goals are

at the forefront of every company's strategy, helping companies save money in the manufacturing environment and keep customers happy, especially in the automotive industry used to learn, improve and simplify the automotive industry, the use and dissemination of data are essential in the manufacturing process (Holmström et al., 2019).

Many primary equipment companies or manufacturers of products for end-users in the automotive industry rely on internal data transfer and data transfer with other companies in the supply chain to produce products according to a pre-determined schedule (Dhanabalan and Sathish, 2018). Most original equipment manufacturers in the automotive industry use timeconsuming production processes (JITs), where production facilities keep inventory to a minimum and rely on suppliers for regular freight throughout the day. The original equipment manufacturer tells the supplier the number and order of each vehicle design they produce. The supplier can deliver precisely the number of parts needed to fulfil the production schedule in the correct order (Di Vaio and Varriale, 2020). This process is primarily data-driven, and artificial intelligence can be an excellent tool to help manufacturers manage inventory and improve the production process. Artificial intelligence can improve the JIT process, take into account suppliers' delays, delay production at the OEM (Original equipment manufacturer) level and provide customers (car dealers) with shipping information.

JIT production can participate in lean production or waste separation in various processes. Toyota is known for promoting lean manufacturing processes and has spread to other original equipment manufacturers. Fair production significantly reduces inventory, time, workforce and additional costs that AI can help limit (Garay-Rondero et al., 2019). Once JIT is in place, artificial intelligence can help identify congestion, improve efficiency, and use other cost-effective measures. At the supplier level, artificial intelligence can be used in various ways

to improve delivery performance, save on OEM shipments and predict more accurate product demand. The artificial intelligence capabilities that can be used at OEM and supplier levels overlap in many ways (Merkuryeva, Valberga and Smirnov, 2019). Still, it is essential that suppliers can constantly be on time, primarily through the JIT process. Chaos in the production company; however, thousands of different parts come in and go out every day. All orders must be completed accurately and on time; otherwise, the supplier should pay for prompt shipment to ensure timely receipt of OEM (Ivanov and Dolgui, 2020). Artificial intelligence helps streamline this process, analyse inefficient processes, plan production to maximise resource use, and improve demand forecasts.

Since the 1960s, the artificial intelligence community has been involved in decision support systems (DSS) and other methods of action management, such as planning and scheduling (Merlino and Sproǵe, 2017). The technical reason is that the development of mechanical engineering and smarter technology began with SCM. The business reason for introducing artificial intelligence in SCM is that artificial intelligence can increase chain visibility and transparency and improve consumer goods/services and customer satisfaction. For example, Eastman Kodak After planning the thought process of experienced order codes, a special periodic system was developed to select the best collection method in the warehouse (Lima-Junior and Carpinetti, 2017). In addition, to synchronise several reciprocal but independent collaborative planning and demand levels in SC, these studies provide an agentbased prediction system that can predict user performance by exchanging information between several SCs (Mashamba-Thompson and Crayton, 2020). As these examples show, certain subdomains of AI, such as dedicated systems and proxy systems, can help solve various aspects of SC (e.g. warehousing, organisational collaboration needs, inventory management).

2.0 Literature Review

According to research, artificial intelligence makes a forecast, demand and optimisation plan for SCM at the planning stage. These areas improve customer service and enable the better valuation of properties and processes (Klumpp, 2018). SCM's largest field of artificial intelligence can be seen as an agent system because it can work in many areas of SCM. Artificial intelligence can play a role in strategic, tactical and operational decision-making, but it primarily plays a role in the operational stage, such as forecasting, production and warehousing. With the advent of modern artificial intelligence technology, increased competitiveness, uncertainty about supply and supply risk, companies have been forced to invest huge sums in research and development and find the best artificial intelligence solutions (Núñez-Merino et al., 2020). However, companies cannot close their eyes when investing in artificial intelligence solutions but must pay close attention to the most sustainable and comprehensive service for them. In addition, they must consider the challenges that artificial intelligence may pose to the company in terms of ethics and data development.

Artificial intelligence based on SCM value creation can achieve almost perfect forecasts and reduce production costs. It also improves quality by optimising research and development, helping to identify customers and improving customer service (Al-Turjman, 2019). With accurate forecasting, companies can reduce waste and become more environmentally friendly. They can also reduce costs and maximise purchasing. Meteorological solutions can predict the best changes in supply and demand based on local weather forecasts. For example, this solution can be an important key for retailers to maximise sales. Artificial intelligence can predict

maintenance interruptions in a production environment and make production more reliable and high quality (Senthiil, Sirusshti and Sathish, 2019). Cameras equipped with cameras can detect objects and materials and increase the speed of collection. If supply and demand are the same, artificial intelligence will have a major impact on inventory. As a result, inventory levels decrease, and customers' needs are quickly met.

2.1 Global impact of AI

Computer intelligence can be a crazy change in the history of innovation. Allocations from the previous example can be transferred to a distributed computer: practical artificial intelligence and the successful environment of artificial intelligence innovative service providers (Weber and Schütte, 2019). The assets of artificial intelligence have increased significantly during the year. In 2019, artificial intelligence will "find the gap" in the main part. Computer intelligence is increasing at an alarming rate and different companies use various artificial intelligence programs.

The scope of artificial intelligence was then extended to all areas; organisations in the Asia-Pacific region are the most powerful in identifying artificial intelligence. More than twice as many companies have purchased AI today and fifth or tenth in North America in the AsiaPacific region (Priore et al., 2019). In the Asia-Pacific region, Chinese organisations are embracing artificial intelligence. The main centres are Beijing, Shanghai, Guangdong, Zhejiang and Jiangsu. In addition, one of the 14 organisations in the Asia Pacific that is not passionate about AI is the same as North America.

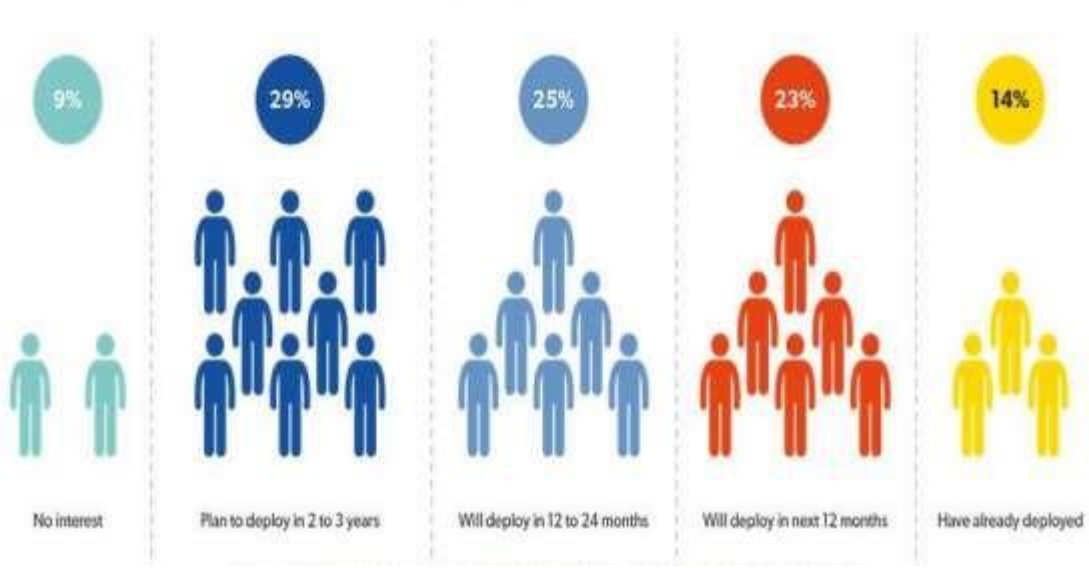

Figure 1 AI's enterprise plans

Source: (Ramirez-Peña et al., 2020).

Financial services, high technology and telecommunications, retail, healthcare and the media have a high adoption rate. Artificial intelligence offers great potential for value creation in these areas. The "first disciples" have found a front door. The "machine" quickly realised the growing opportunities and began to remove obstacles, such as obstacles in selecting a wide range of knowledge (Fu and Chien, 2019). Government agencies, education and charity rarely use artificial intelligence in various fields. The acceptance rate of insurance companies is higher than the service. There are far more payers in the healthcare sector than service providers. AI-based fraud analysis is less likely to detect fraud than traditional regular systems.

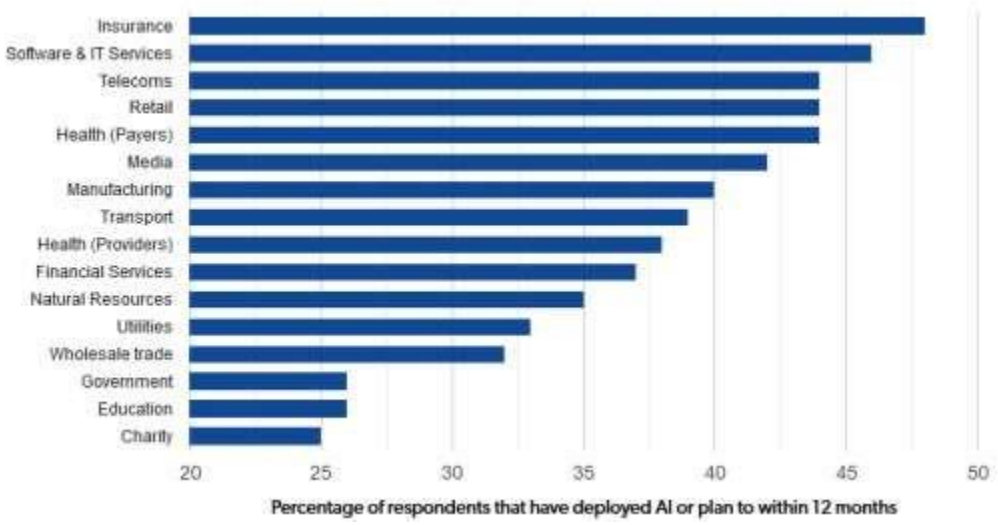

Figure 2 Adoption of AI across the sectors

Source: (Smith, 2018)

One thousand six hundred software companies in Europe are in the early stages of developing artificial intelligence. As a first step, an artificial intelligence company will be developed. In 2013, one in five start-up companies adopted artificial intelligence. Several European B2B providers provide services to various organisations (Ramirez-Peña et al., 2020). Many companies prefer to buy artificial intelligence rather than produce artificial intelligence. The company is proactively implementing artificial intelligence to increase modest profits. Nine out of ten pioneers of artificial intelligence increase their investment at the expense of artificial intelligence (Weber and Schütte, 2019). Two-thirds of companies have adopted artificial intelligence through technical research or testing; among companies that do not know artificial intelligence, the cost of artificial intelligence increases by one company. In April 2018, the European Commission launched a Communication on Artificial Intelligence to improve the EU's technical and industrial capacity and introduce artificial intelligence from the public and private

sectors (Al-Turjman, 2019). Europeans are ready for socio-economic change through new technologies and ensure appropriate ethical and legal frameworks.

New Code of Conduct for Artificial Intelligence covering Justice, Security and Transparency. The Committee will develop a harmonised artificial intelligence program with the Member States by the end of 2018 (Klumpp, 2018). Funding, development and acquisitions of new artificial intelligence companies and technologies will increase. Developed and growing economies have multiplied artificial intelligence business applications. Intelligent imitations can make it easier to plant objects in wells and improve efficiency, quality and production costs. Artificial intelligence can increase financial services and lending (Lima-Junior and Carpinetti, 2017). Despite redundancies in India and China, emerging markets have recently been given an indefinite share of GMOs in this powerful development, regardless of whether they profit more from law enforcement than from powerful frivolity.

2.2 Opportunities and challenges to Implement AI in SCM

Recent research has shown that SCM's built-in artificial intelligence equipment is limited to tactical and operational tasks (Ivanov and Dolgui, 2020). The organisation system has the greatest potential in SCM and can solve strategic challenges managing customer relationships, outsourcing relationships, business to business negotiations, strategic alliances between SCM partners and joint planning. Demand to eliminate the impact threatens. To understand the power behind new demand models, companies can use artificial intelligence to make decisions, plan practices, and implement them in SC. Demand planning is often ineffective in meeting unpredictable demand patterns (Garay-Rondero et al., 2019).

The development of artificial intelligence includes meteorological control, local market capability, identification of key demand variables, feedback on product quality and data

collection from production machines to a better plan. The genetic algorithm can analyse the objects involved in the planning and decision-making process of SC (Dhanabalan and Sathish, 2018). They direct orders and eliminate short-term delivery time. Genetic algorithms for batch analysis make it possible to identify internal costs and automatically obtain substitutes. The answer is, do not buy the latest design software from artificial intelligence companies. The artificial intelligence solution is a perfect ecosystem with the right algorithms, a combination of internal and external data and decision-making. Sustainable solutions lead to robust change management (Borges et al., 2020). To succeed in their business plan, companies must find new technology solutions to help them in a complex business environment.

Introduce artificial intelligence for robots, the Internet of Things, or use an intelligent agent who can enrich human experience to support decision-making. Failure to do so may result in bodily injury, economic damage and serious injuries, such as human prejudice and personal injury. These mistakes can lead to unreliability because they are strange and unpredictable, and new threats can lead to general discomfort and abandoned artificial intelligence (Kilimci et al., 2019). It is a very transformative and rapidly evolving technology that exists in everyone's lives. Artificial intelligence methods must be holistic and reflect many reasons why artificial intelligence can fail. The study pointed out that the main problem with the reliability of artificial intelligence is the reliability of artificial intelligence. Data and technology are not sophisticated enough to implement artificial intelligence solutions. According to the study, the problems with integrating artificial intelligence into SCM today are as follows: users lack free will, which leads to many computer programs, and if the programming is wrong, it can lead to bad decisions (Mohanta et al., 2020).

Cross-border and SC practical decision-making environment where artificial intelligence cannot perform as expected due to too much information. Artificial intelligence has changed

people's lives, but it must be implemented within appropriate and appropriate policies because it causes many problems (Baryannis et al., 2019). Due to an emergency, it can be difficult to do automatic driving in a crowded city. Artificial intelligence can become important for the health of millions of people, but only if it can win the trust of doctors, nurses and patients (Wamba and Queiroz, 2020). Quality education requires the active participation of teachers. If artificial intelligence is accepted and trained by teachers, it can be used effectively.

2.3 AI techniques for better SCM

The theory of ANN (Artificial neural networks) is based on the function of brain cells or neurons in living organs. Using interconnected computer memory systems, artificial nervous systems can learn from experience, analyse operations, known patterns, group objects, and process vague or abstract information (Giri et al., 2019). Create loops and set weights in a process called learning (Dhamija and Bag, 2020). Artificial nervous systems can learn to respond to different data models or explore hidden relationships in data as one wishes. When operating the network, the inductive learning algorithm can modify the ANN to improve its performance and be trained both under supervision and without supervision. It has been shown that artificial nervous systems can be useful in a semantic model, as they can learn pronunciation in English dictionaries.

ANN can be used for self-driving cars with image processing technology. The study uses an artificial nervous system to drive ground vehicles on the road and mimic the behaviour of human drivers (Hartley and Sawaya, 2019). Although the use of ANN in the independent driving of land vehicles is still limited to certain roads and traffic conditions, it has shown wide potential for independent navigation of vehicles. ANN is also suitable for traditional plot sizes. In a larger context, ANN has been used successfully to develop hierarchical SC planning, which

determines the time/energy required for adaptation, estimates the optimal plot size between continuous SC processes and links planning decisions to planning. Inventories with reduced production and demand (Luthra et al., 2018). Therefore, compared to conventional action research (OR) methods, ANN aims to reflect better the interconnection and reciprocity of the CS planning process. The latter is mainly used for less integrated sub-projects (e.g. inventory plan, production plan) SC plan.

As a branch of the evolution program, a genetic algorithm resembles the principle of natural evolution. It guides the rules of natural selection to create the organism that best suits the environment. GA's (Genetic algorithm) are commonly used to solve merger optimization problems, and a function can be constructed to assess the suitability of a particular agent (solution) for a particular environment (problem) (Schniederjans, Curado and Khalajhedayati, 2020).

Although GA aims to create the best solution worldwide, the size of its population cannot be unlimited. Due to the limited range of possible decisions, this may be their final objective decision. In addition, the efficiency of genetic algorithms may depend on specific hybridization and mutation rates (Baryannis, Dani and Antoniou, 2019). Therefore, GA can take an untimely approach. In addition, the population generally does not improve GA's performance in terms of speed of finding solutions. However, GA has been successfully applied to a variety of complex SC network design problems. These problems include the route and schedule of vehicles, minimum disability time; dissemination and collection; optimization of the bus system; and location issues (Wong et al., 2020). In addition, GA also participated in solving known supply chain problems related to factory design; pretty; Product Management, loading

containers, loading and unloading operations to ensure reliable supply chain, an amalgamation of assets, selection of suppliers, and express service.

One decentralized solution is the agent-based system. It divides the sub-task into subtasks and uses separate objects called agents to solve these sub-tasks. Each agent can use different methods, information and tools to perform assigned tasks. According to research, an agent refers to an independent entity that can take certain actions to achieve certain goals and can compete and work with other agents to achieve those personal goals (Esmaeilian et al., 2020). The characteristics of an agent are their ability to use a lot of domain knowledge, overcome errors, use symbols and extracts, learn in a decision-making environment, work in real-time and communicate with others.

Using these features, agent-based systems are commonly used to resolve various SC issues, including shop floor management; planning; air traffic control; plan and forecast aggregate demand; joint production schedule; development of new products; follow-up; business negotiations; exchange assessment; outsourcing relationship management; Customer Relationship Management (CRM); union-management SC; job evaluation in the UK; supply chain coordination; co-operation of the supervisory board in uncertain circumstances; information exchange between SC partners; trace information in SC; delivery and submissionoff; purchase of retail goods; electronic SC; strategic e-procurement; electronic supply chain; traffic accident management; and the purchase of maintenance, repair and use equipment (Aryal et al., 2018). Anticolonial optimization is a by-product of drug-based methods that can help solve complex SC problems.

Another feature of the analysis is the artificial intelligence technology used or reversed in the industry. Artificial intelligence technology refers to algorithms, architects, data or

information forms, and methodological methods described accurately and clearly (Caiado et al., 2021). They first analyse scientific sources for analysis, which provide a comprehensive list of artificial intelligence techniques in scientific practice and literature. The study shows a set of artificial intelligence technologies and their applications. More generally, research is an exhaustive store of artificial intelligence technology that can be used for various purposes. Name other references, regardless of their origin (Abdirad and Krishnan, 2020). The figure below shows the artificial intelligence methods used in literature in various fields, and the following figure shows the frequency of use of all artificial intelligence methods. The most widely used artificial intelligence technology is in production (Plastino and Purdy, 2018). Apart from the proliferation of disciplines, this is mainly due to the practical literature in this field, which usually involves experimental projects, case studies and real-life research. ANN, GA and ABS (Agent based systems) are the most widely used production methods.

With 12 technologies, marketing is in second place in terms of diversity, and the most used methods are ANN and GA, which each appear four times (Barykin et al., 2021). The third major area is the supply chain: 21 branches and 11 technologies for artificial intelligence. Artificial nervous systems, vague models and genetic algorithms are more common in this field. Finally, the smallest type of supply chain consists of eight technologies in seven parts. The figure below shows the general use of artificial intelligence technology in literature (Chehbi-Gamoura et al., 2020). Because some disciplines use more than one artificial intelligence method, artificial intelligence methods are greater than other disciplines. More specifically, 41 articles (64.1%) used one technical method, 13 articles (20.4%) used two technical methods, three articles (4.6%) used multi-technical methods, and seven articles (10, 9) % used a technical method (Roßmann et al., 2018).

In particular, these studies used two or more artificial intelligence methods in two ways: by combining them and creating a hybrid, and then applying them in turn. The most popular artificial intelligence technology is ANN (used 15 times), found in all fields (Dubey et al., 2020). Another common method is FL / copy (12 times), which can stretch a simple Bulgarian operator to the influence (Di Vaio et al., 2020). Intelligent agents in MAS and ABS are in third place (nine times), which can be due to their wide range. GA is the second most popular method (7 times), followed by data processing and CBR (4 times each), Search and Support Scales (3 times each) and automatic copying and programming (2 times). Other methods (association rules, tree models, escalation, k-tagging groups, specialised systems, heuristics, robot programming, stochastic models, Bayesian networks, RBIs, decision trees and Gaussian models) are used only once (Grover, Kar and Dwivedi, 2020).

Field	AI technique
Marketing	1.Artificial neural networks (4) 2. Genetic algorithm (4) 3. FL/modelling (3) 4. Agent-based/multi-agent systems (2) 5. Swarm intelligence (1) 6. Simulated annealing (1) 7.Association rule (1) 8.Tree-based models (1) 9.Support vector machines (1) 10.General forms of AI (1) 11.k-means clustering (1) 12. Hill climbing (1)
Logistics	1.Artificial neural networks (1) 2.Agent-based/multi-agent systems (1) 3.Data mining (1) 4.Simulated annealing (1) 5.Automated planning (1) 6. Robot programming (1) 7. General forms of AI (1) 8. Heuristics (1)
Production	1.Artificial neural networks (8) 2.FL/modelling (5) 3. Case-based reasoning (4) 4. Genetic algorithm (3) 5.Agent-based/multi-agent systems (2) 6. Data mining (2) 7.Decision trees (2) 8.General forms of AI (1) 9. Gaussian (1) 10. Rule-based reasoning (1) 11. Automated planning (1) 12.Swarm intelligence (1) 13.Expert systems (1)
Supply chain	1.Artificial neural networks (5) 2.FL/modelling (4) 3. Agent-based/multi-agent systems (4) 4. General forms of AI (4) 5.Physarum model (1) 6. Bayesian networks (1) 7.Swarm intelligence (1) 8.Data mining (1) 9.Support vector machines (1) 10. Stochastic simulation (1)

Figure 3 AI techniques based on different fields

Source: (Bottani et al., 2019)

The core of artificial intelligence, in addition to traditional regular programming, allows machines to define and train models, scripts or variables, change settings, restore models, and recycle and update models. Artificial intelligence technology is widely used to obtain useful information from data (Shao et al., 2021). It is important to understand that artificial intelligence training in data analysis, data-driven learning and information storage can be repeated (Hofmann et al., 2019). Use a lot of high-quality data to implement AI and implement training. In addition, the model must be a model with the right data source. Otherwise, one will not get good results / correct solutions.

2.3.1 Sources of data

As mentioned in the AI model, training, training, and exams should be collected and prepared for analysis. At both stages of data processing, one needs to understand what data needs to be collected and why. It is very important to gather relevant data and create the right database. SCM methods are generally based on quick and adaptable decisions based on potentially significant multidimensional data sources (Pandian, 2019). Thus, new types of data can create new opportunities and new uses. Sensor data: Sensor data can cover a wide range of applications, such as reducing consumer demand uncertainty caused by consumer behaviour, reducing transmission risk through real-time control of distribution centres, increasing transparency and trust between suppliers and digital dual-product improvements in industrial products (Holmström et al., 2019).

Unstructured data: Unorganised data include text documents, social media, and customer reviews (Di Vaio and Varriale, 2020). One can use social media information to analyse emotions and identify emotions, which are very important for managing customer relationships. Structured data: In general, one can find structured data in tables in standard software systems for use in traditional processes such as warehousing or order management. Machine data is also structured and can be dialled through standard or machine-connected ports (Merkuryeva, Valberga and Smirnov, 2019). With the development of automation, these processes are increasingly exposed to large amounts of data, which means that machines or control systems generate large amounts of data.

2.3.2 Infrastructure of technology

The data collection infrastructure is designed to collect central real-time and historical data for modelling. To support data and information exchange, various industrial information

systems, such as the SMEs, are integrated to provide powerful real-time monitoring and control of the entire production process; data acquisition and management system and programmable logic control PLC system directly controls machine response equipment and warehouse management system (WMS) which uses complex algorithms to manage staff from the warehouse

(Merlino and Sproǵe, 2017). Floors that enable remote sensors to communicate with the core network and even other products.

In addition, IoT systems must have special limiting capabilities and automatic detection capabilities (Mashamba-Thompson and Crayton, 2020). Therefore, data collection and calculation tasks are carried out in a distributed manner. Centralised and distributed data processing methods can reduce the burden of centralised data processing because training data requires a lot of processing energy (Núñez-Merino et al., 2020). Cloud computing is a key technology and it is used to centrally support the collection, selection and analysis of environmental data (Senthiil, Sirusshti and Sathish, 2019). Data centres that support AI must run on cloud servers. These discovery and computer systems store and process large amounts of highly heterogeneous data (including unorganised and unstructured data points) and require very fast processing.

Learning from training materials continuously can improve algorithms for machine learning and create a competitive advantage (Priore et al., 2019). The research underlines the importance of progressive learning and data learning for artificial intelligence rather than mastering artificial intelligence technology. However, this method is very complex as this requires good computer memory to maintain the knowledge gained from the training database and high demands on security, privacy, and resources related to computer architecture.

2.3.3 Training for AI

Many recent studies of machine learning and nervous system models to achieve business forecasting goals have shown that artificial intelligence can perform various intelligent business tasks (Fu and Chien, 2019). For example, different forecasting methods have been proposed for different projects, such as credit risk analysis, declining beef markets, inventory levels and consumer demand. The study aims to implement the choice of suppliers 'parties by identifying suppliers' risk profiles. On the other hand, research focuses on customer management. Research shows how to predict and manage risk in product portfolios and supply chains (Priore et al., 2019). On this basis, the model of teaching artificial intelligence in the general artificial intelligence learning process is summarised.

Other unorganised data such as text and documents will also be collected. The second step is to verify the original data, remove duplicates or inappropriate data entries, deal with missing data features and restore flags and actions by marking the necessary data in the training process/study (Núñez-Merino et al., 2020). It is very important to publish the data based on information about the business model (Lima-Junior and Carpinetti, 2017). Model training: This is where real learning takes place. Regardless of the size of the dataset, the machine can repeatedly obtain information through training and achieve acceptable forecast accuracy. Different training accounts are used in the training database (a subset of all training data). Learning objectives are used to create accurate mapping relationships based on available data and current algorithms (Merkuryeva, Valberga and Smirnov, 2019). The training database should contain all the features required by the model and be low noise. Repeat the steps to study the model and evaluate the results until the best prediction model used in real life is found.

Run-time model: The final stage is the test stage, where the model is implemented as part of an actual business process in an actual environment. The test data are used to confirm the accuracy of the model (Dhanabalan and Sathish, 2018). In some cases, the model may require additional functionality and is necessary before using a trained model to ensure safety and efficiency (Alzoubi, 2018). The first practice round requires much manual work to prepare and understand the business. However, in later cycles, computers are expected to automatically perform all tasks between physical Internet components (data sources) and the network (the Internet) (Mohanta et al., 2020). The recurrence rate depends on the needs of the company and the results of the calculations.

2.4 Efficiency of AI in the supply chain

To use SC technology to improve the efficiency of the supply chain of AI, the researcher has interviewed several experts working at the intersection of SCM and AI. A list of questions in an interview that briefly describes the expert's experience (Miranda Beltrán and Ortiz Bernal, 2020). The experts' answers and the literature and case studies that have been reviewed form the basis for a qualitative assessment. Influence refers to the extent to which artificial intelligence influences, complements or replaces traditional methods and processes.

Most analysts agree that SC planning is where AI forecasting is most useful. The planning process is based on data and analysis. However, traditional methods cannot accurately predict consumer demand and consumer cycles due to many influencing factors (Fraser and Pechenkina, 2017). As a study of SC's risk management shows, AI allows planners to analyse large amounts of historical data and near-real-time data to consider various factors that could disrupt demand (such as natural disasters, online emotions) (Jackson, 2018). In addition, SC's strategic experts pointed out that artificial intelligence can modify data from different

departments or factories, simplify the overall planning process and ensure full SC visibility. In general, planning methods based on artificial intelligence make it possible to predict demand faster and more accurately. Research estimates that these methods can reduce forecast errors by up to 50% (Azarova, Achkasova and Krivonosov, 2018).

Artificial intelligence forecasts help buyers choose and negotiate suppliers in a sensible way based on historical purchasing documents and foreign market information. In the same way that consumers are accustomed to asking for information and ordering products through Amazon Alexa, customer attendees can delegate communication with suppliers and order processing to virtual assistants (Fraser and Pechenkina, 2017). Purchases of Chabot were used to automate this process. However, an expert in artificial intelligence research said the impact could be negligible as human factors are still important in building and maintaining relationships with retailers (Jie, 2018).

Predictable artificial intelligence and mental robots can have a profound effect on production. The former uses the machine, sensory and visual data to predict and diagnose engine failure. This can reduce the annual result by up to 20% and the annual maintenance cost by 10% (Semigina, 2020). In addition, it is expected that human-robot collaboration will fundamentally change the production process. Production engineers attribute this to machine learning, computer vision, and technology, enabling robots to understand the environment better and work safely with humans. For example, robots can imitate them by following human actions. Artificial intelligence is generally expected to increase value in many aspects of manufacturing by improving products' efficiency, safety, and quality (Fraser and Pechenkina, 2017).

In terms of storage, artificial intelligence forecasts have a major impact on decisionmaking. This is because the warehousing process and inventory levels are highly

dependent on demand forecasts. The data researcher and prospective analyst pointed out that artificial intelligence to manage inventory allows some customers to reduce their inventory by up to 30% (Kim et al., 2020). In addition, artificial intelligence experts believe that storage can be considered an ideal platform for automating artificial intelligence due to the similarities between the environment and organised projects. The use of grey-orange shows how cognitive robots mostly take on the task of fulfilling the order (Jie, 2018).

The growth of e-commerce worldwide encourages customers to deliver products immediately. A planning expert from SC said that with the help of artificial intelligence, it would be possible to bridge the gap between growing customer demand and traditional delivery methods, first by streamlining supply chain routes and secondly by optimising new vehicles (Jie, 2018). Intelligent route optimisation is based on predictable artificial intelligence, which can consider many inputs such as historical driving data and real-time traffic data to point out the most efficient delivery route (Wollman, 2018). In addition, the use of stand-alone trucks and artificial intelligence drones has a significant impact on the flow of goods through SC and demand. In general, artificial intelligence can speed up the distribution time of SC but reduce the cost of transportation.

Strategic experts from SC said that artificial intelligence has the greatest impact on customers' challenges and the overall quality of customer service. In his opinion, the predictive capabilities of artificial intelligence are particularly useful as a large amount of consumer data, and closed issues need to be addressed, such as predicting what customers might buy next (Ling and Ling, 2017). For example, this is different from manufacturing, which involves many complex processes and tools, making automated decision-making difficult. In addition, customer

experiences, customised product suggestions and virtual assistants have become more personal and have significantly changed the way consumers interact with companies.

To evaluate the usefulness of artificial intelligence in computer matters, it is important to consider the usefulness of the technology. Artificial intelligence computing has flourished with large datasets from various sources, allowing machines to access unique information and perform tasks better and more efficiently than humans (Livingston, 2017). The network architecture of modern SCs and the large amount of data they create and import from connected devices and SC devices seem to provide a natural basis for scaling artificial intelligence. The potential impact of artificial intelligence in SC is greater than in almost all other areas of work. The study estimates that the company could receive $1.3 trillion in economic benefits from SC AI each year (Shaw, 2018). Most of this value is unused because previous SCM tools are overloaded with the amount, speed and variety of data in modern SC. In addition, they usually work in part, leading to a lack of data access and transparency in SC. At the same time, globalisation continues, growing market instability and growing consumer expectations complicate the economy (Das, 2019). To address this complexity and ensure the competitiveness of the future, SC must use available data to make decisions and sooner or later, it will embrace artificial intelligence.

Although artificial intelligence has been used in various industries, it is still in its infancy. This becomes clear when the potential economic impact of artificial intelligence is examined. The study predicts that due to increased productivity and consumer demand by 2030, artificial intelligence could increase GDP by 14% or almost 16 trillion dollars (Lew, 2017). However, it is impossible to measure the future impact of this technology from an economic point of view.

Since artificial intelligence is defined as a "machine that demonstrates human intelligence", technology development largely depends on the diversity and complexity of the tasks it can perform better than humans (Livingston, 2020). The study interviewed ten artificial intelligence researchers at Oxford University and Yale University to understand their predictions of when machines will excel in various tasks.

With an average plan, artificial intelligence will outperform humans' ability to play poker over the next ten years by assembling all Lego blocks and driving trucks according to instructions. The automation tasks of machines were primarily mechanical in the beginning but have become more complex and creative over time. After 50 years, artificial intelligence can take on very complex tasks, such as writing a best-selling book, performing calculations, or researching mathematical theorems. In addition, researchers predicted that by 2061, artificial intelligence would excel in all tasks; in 2136, all tasks will be automated, and in 2136, all tasks will be automated (Youhua, 2018). However, the study showed a significant difference in the researchers' ratings, and therefore, there was no clear consensus. This shows that the future of artificial intelligence is very uncertain.

2.5 Impact of AI on warehouse operation efficiency

It should be noted that the efficient and effective management of complex warehouses has become a challenge. Therefore, the important question is warehouse management as a collection of planning and management decisions and procedures to solve existing problems. Warehouse management involves the management and optimisation of multifaceted warehouses and marketing processes (Phothongsunan, 2019. The storage process must be careful and precise. This includes warehousing, on-site delivery of goods, warehousing, storage in order areas, ordering and delivery, ordering, value-added supply chain and packaging. Market activity

determines the pace of change in the external environment in which warehousing operates. One hopes that the additional registration projects will result in more versatile optimisation rules for planning and decorating the upcoming registration and execution (Joshi and Patel, 2019). The location and changes of the warehouse depending on the complexity of warehouse projects and market flow.

Traditional warehouse management is mainly based on automatic management or partial management. Storage conditions are generally relatively simple, without environmental monitoring equipment and necessary storage conditions such as temperature and humidity (IMAFUKU, 2019). Obsolete, deteriorated, damaged, and other products are manufactured from time to time that can easily cause economic damage to the company.

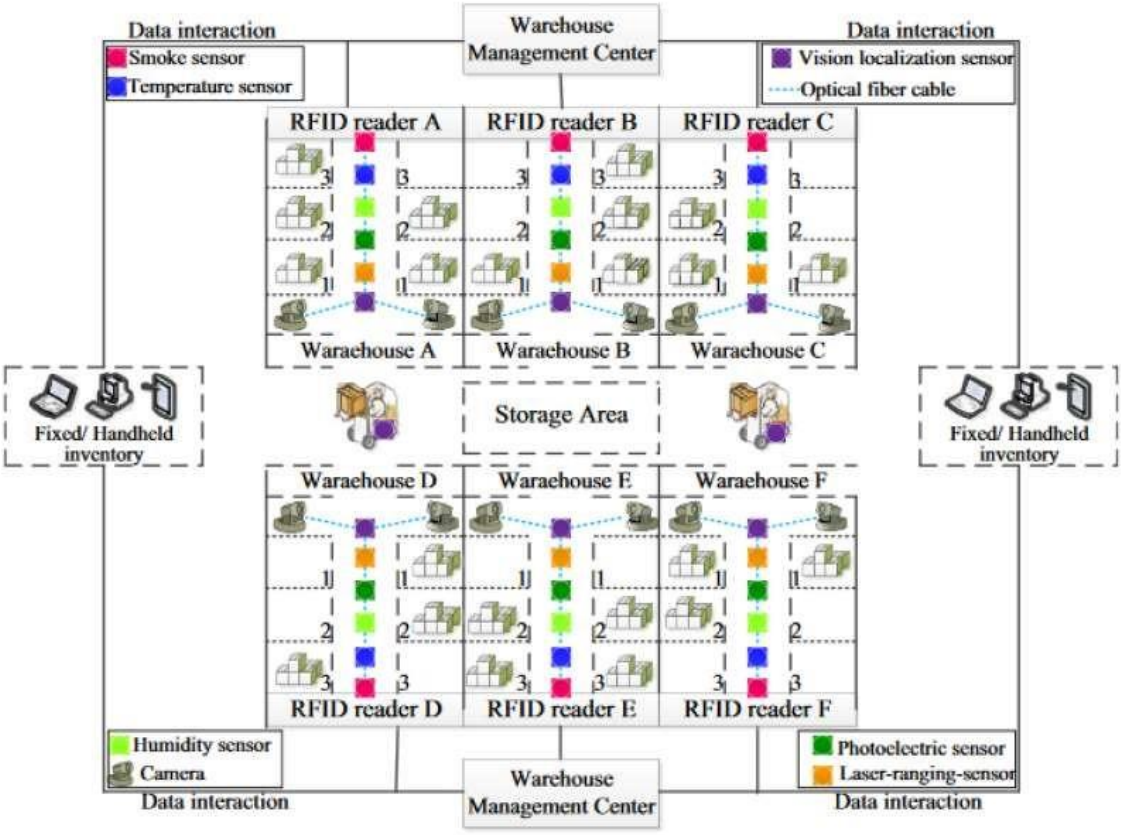

Figure 4 Operations business model of warehouse

Source: (Keemink, 2020).

A physical inspection of products and materials in stock can be performed. However, the basic principle of content management is that the flow of content and information must be precise. As a warehouse manager, one knows where their inventory is and other information about their expected time and location (Naz, Mazid and Khan, 2018). Personal maintenance and supplies are required to keep track of location and time. In planning, one makes a distinction at the planning and operational level. The warehouse has developed branding methods to use assets efficiently and meet market needs in terms of organisational solutions.

Despite the dense environment of many warehouses, strategy is only a matter of days or weeks, not months. Decision-making rules are used to simplify, record and improve proposed actions at the operational level. Warehouse management is an important part of a good supply chain and links between manufacturers, distributors, retailers and consumers (Keemink, 2020). Detailed product information is stored in the warehouse management file, including relevant inventory, delivery status and market flow. One plays an important leadership role in production, purchasing, sales and decision-making. It also affects the work, development and production of the company.

The main characteristic of supply chain is warehousing, which is increasingly important for the success or failure of organisations today. Warehouses are important because they act as intermediaries between different participants in the supply chain, which affects the costs and services of the supply chain (Joshi and Patel, 2019). In addition, many organisations have taken steps to centralise production facilities and warehouses to simplify and manage chain processes in recent years. As a result, it offers many larger distribution management houses for larger and more diverse customers in a larger area, leading to a more complex internal transfer process.

Because of their importance, this research focuses on SC and artificial intelligence. The use of traditional information and communication technologies (ICTs) plays a key role in supporting the transfer process and ensuring transparency in the supply chain (Youhua, 2018). The use of technology may reflect the organisation's willingness to continue to adopt new technologies. The warehouse is the core of the supply chain system, and many technologies are used in this environment to ensure product identification, measurement and traceability throughout the warehouse (Livingston, 2020). Therefore, supply chain information refers to methods aimed at improving supply chain operations to reduce uncertainty and risk.

The building agency's logical intelligence gathering has attracted a great deal of attention. Today's supply chain environment typically uses various ingenious technologies to make it easier for supply chain professionals to discover in real-time (Lew, 2017). For example, multimedia and radio frequency identification (RFID) technology are smart technologies that provide transparency and rationally manage innovations and cycles in real-time. Therefore, this technology plays an important role in simplifying the whole supply chain process, especially when members use similar technologies (such as RFID) (Shaw, 2018). Key technologies include warehouse management (WMS) systems needed to support warehousing and marketing processes.

WMS design must consider the physical characteristics of the equipment and the movement of the product to get the maximum benefit. Other major storage technologies that are widely used are automatic storage and retrieval systems (AS / RS), automatic sorting systems and automatic collection systems (Livingston, 2017). Although various technologies have been identified in the literature for ease of storage, usually only a small proportion of LSCMs focus solely on warehouse management. Researchers have focused on refining inventory management

theories and integrating new technologies into inventory management systems for the past two decades (Wollman, 2018). Bar code technology has been widely used in inventory management to manage inventory levels. Some researchers have suggested solutions that integrate warehouse management systems with automated inspection technology. Warehouse specialists demonstrated the most advanced warehousing and material handling systems and provided comprehensive theories and practical operations for industry and commerce.

For the past decade, artificial intelligence has played a role in the chain's management. However, the research area focuses on predicting customer needs, fulfilling orders, and approving specialised warehousing components. Since 2010, the use of manual supply chain management has made great strides (Fraser and Pechenkina, 2017). Many publications continue to focus on supply chain management, including order fulfilment and production planning. The research proposed a model based on web services. The steps to establish a complete automated identification system for loading and unloading are presented in detail. The research has completed a comprehensive framework that uses unattended machine learning to utilise genetic programming in warehouse management (Semigina, 2020). In addition, the model design focuses on a genetic planning system in bulk. The study has introduced a hybrid solution that uses a genetic algorithm to solve warehousing organisational problems. This article discusses reinforcement learning systems to plan and organise production in an intelligent warehouse system with multiple robots.

The study examined relevant artificial nervous systems and their applications in business, particularly in the wholesale industry, in 2016 (Azarova, Achkasova and Krivonosov, 2018). The author's methods include artificial nervous systems and models based on them. The researchers investigated the problem of optimising system resource synchronisation. Therefore,

the purchase course is always free, which requires further research from researchers in this field. Artificial intelligence technology is widely used in security and business fields, including warehousing. However, there is no artificial intelligence program to identify and calculate things in the recording stage of warehouse management (Miranda Beltrán and Ortiz Bernal, 2020). This chapter provides an overview of the latest literature on nervous systems to classify, identify and count objects. It describes basic theories, algorithms and structures that can be expanded in inventory management to guide future researchers.

3.0 Methodology

Research methods are set by definitions or research questions and methods on which research is based (Hicks, O'Dowd and Corbett, 2018). Therefore, different methods can be used to get answers to interesting questions. The methodology is a theory of how to start research. It contains the theoretical and philosophical models on which the analysis is based. For these studies, the application of artificial intelligence and its effect on the flexible anchor uses a conceptual research method (Laing, 2018). Conceptual methods are used for in-depth research. The aim is to look at artificial intelligence in a finer chain of leaders in a broader and more detailed way. Qualitative research is a term used to gather leading opinions and research methods to discover how people understand, experience, understand and create the social world. The value of this methodological arrangement is that it is adaptable and easy to implement changes in the research environment and usually requires little effort (Olenin, 2017). Although quantitative information is provided, subjective information is indicative.

3.1 Introduction

Research methodology is the third chapter of the dissertation and the main reason why this chapter is the most important and different from other chapters is that it contains all the methods and techniques that help researchers conduct this research is a powerful and effective way. Researchers will also use this section to understand the methods and techniques by which data should be collected effectively for this study (Alharahsheh and Pius, 2020). In addition, the research in this chapter focuses on the active participation of many chapters, including research design, research philosophy, research methods, research methods, data collection methods, data analysis, ethical perspectives, and exclusion and differentiation criteria.

This is part of active participation in these chapters, which can help researchers perform important analyses and determine simple, accurate, and reliable data collection methods (Tirkolaee et al., 2021). During the survey process, different people working in other organisations and institutions directly involved in the implementation of artificial intelligence asked different questions about the questionnaire. In addition, to conduct research, the researchers decided to collect research data by e-mail.

3.2 Research Philosophy

In research, there are different views regarding research philosophy as a method or line of attack that can help researchers conduct research effectively and efficiently. Researchers broadly apply three types of research philosophies in their research (Ghoreishi and Happonen, 2020). In addition, these three common research concepts help researchers understand the nature of research and explain how researchers collect data based on experience, observations or previous research. The first philosophy studied was "interpretivism". Interpretivism is considered a fundamental and pure form of qualitative methodology (Zhao, Chen and Ai, 2021). Researchers collect comprehensive data and observe the different objects and characteristics of people in society. In addition, the interpretivism approach collects data through interviews and collects data from previous research on related topics.

In addition, other research philosophies are "positivism". In positivism research philosophy, researchers continue to study society by doing various experiments based on previous research. Among the latter, the third research philosophy is "pragmatism." This research philosophy follows the method by which researchers evaluate different views and theories of social achievement but emphasise the real life of people in society (Agrawal and Narain, 2021). In addition, the researcher used the "pragmatism approach" in the research

philosophy of these studies because the researcher researched the basis of a "phenomenological research approach". The research method of phenomenology is firmly based on the life experiences of different people or groups.

3.3 Research Design

The researcher uses two different types of research to make his research unusual and effective. Researchers use research design in their research to obtain efficient, reliable and accurate research results. Researchers use two types of research design in their research; some are "deductive research approach", and others are inductive studies (Sharma, Adhikary and Borah, 2020). Researchers build a hypothesis based on existing literature that is largely incorporated into the research in the subtraction research method (Zarifis, Holland and Milne, 2019). In addition, the subtraction method is based on subtraction thinking, which depends on the current research past, and the researcher has to judge from previous research. In addition, it is stated that in the case of deduction research methods, researchers re-examine and test previous research and then evaluate it with the status quo and link the previous research to social status.

On the other hand, the other research method used by researchers is the "inductive research approach". Inductive research methods are also based on inductive reasoning; in this research method, researchers focus on the actual experiences of different people in society and society and then develop a research process based on previous research (Zarifis, Holland and Milne, 2019). In addition, the researchers used inductive research methods in conjunction with previous research on the subject and studied the personal life experiences of different people. In addition, the impulsive discussion focuses strongly and firmly on the lessons learned from real people (Hopkins, 2021). Furthermore, after researching the two research projects, the

researchers decided to use the inductive approach because all the data are collected based on artificial chain management.

3.4 Research Methods

There are three methods in a research and they are known as qualitative, quantitative and mix method. In this section, qualitative methods used in this study are presented. Interviews with experts in the supply chain are conducted in a high-quality manner. First method is the quantitative method, in which the focus of the study is related to human factors, which test people's opinions by asking questions. This method is valuable, but human factors can cause them to respond to things they need to respond to, or the interviewee may not have enough experience or knowledge in this area (Attaran, 2020). Scheduled interviews usually use Likert scales 1 to 5, while semi-structured interviews are more open and allow respondents to answer questions in words. Search methods are generally related to deduction methods for researching and describing research. The questionnaire is a popular management method (Rosunee, 2021) and his makes it possible to collect data with standard data and compare them easily. A specific relationship between variables and hypotheses about possible causes can be determined using research methods.

Second method is the qualitative method, in which the use of quality methods has been extended to various departments. It includes a variety of policies, data collection techniques and analytics. There is no right way to conduct qualitative research. As with regular surveys, one has a lot to do. Narrative research is a qualitative method used to describe generality or results. This approach focuses on gathering participants' experiences and analysing them as a whole (Pan et al., 2020). It seeks to maintain temporary relationships and a series of events to increase understanding of related areas. In narrative research, the participant is a narrator, he can be used

in different ways and he can be used with few participants. Because of the options, small, indepth storytelling interviews can be helpful (Cui, Li and Zhang, 2021). Due to the strength and nature of the time investment, this policy involves the use of small and specific samples.

The third is the mixed method in which research combines quantitative and qualitative approaches (Barclay, Preece and Taylor, 2018). It combines many forms, from simple designs to complex structures. According to the study, there are four methods that can combine qualitative and quantitative methods. First, quantitative results improve qualitative results. Second, quantitative results can be used to explain quantitative results. Third, qualitative methods can be used to make assumptions about quantitative methods (Pasonen, 2020). Fourth, the study uses the first quantitative method and on that basis the quantitative method creates the typography of qualitative methods. This approach may involve different sub-areas, which complement each other. Alternatively, research can find interesting results based on qualitative methods can be used for further research (Reyes, Visich and Jaska, 2020). The hybrid method uses qualitative and quantitative methods and they can be equal or different (Calatayud, Mangan and Christopher, 2019). If one method is dominant, their priorities and weight may be different. The composite method makes it possible to understand the generality of the study and ensure the reliability of the overall information.

In this particular study, the approach that has been selected for the research is qualitative method with a view of collecting data in a detailed manner for the topic of the research.

3.5 Data Collection Method

The method of data collection is considered one of the most important and mandatory parts of this chapter. The method of data collection determines the process and methods of monitoring the whole survey research method (Calatayud, Mangan and Christopher, 2019). It is

very important to choose the right data collection method that reflects the research policy. The study results are transferred to another method, so the researcher needs to choose the right and reliable method. Two data collection methods have been utilised as part of this study, one being secondary through research papers, case studies etc. and other being the primary qualitative through interviews with office/production staff only.

When collecting secondary data, all previous research data was collected by different researchers; compared to the first data collection method; the used data collection method is not called the direct data collection method. Another reason why the second method is not a direct method of data collection is that all the data in the second method are collected from reliable and reliable sources in previous studies and then evaluated based on studies conducted by previous researchers (Barclay, Preece and Taylor, 2018). In addition, the second data collection method is also considered the easiest because, in the second data collection method, researchers want to go nowhere and extract data directly from various reliable sources.

However, the "primary data collection method" is called a direct data collection method. The researcher directly contacts the interviewee and collects data based on their actual life experience in this method (Pan et al., 2020). They do not, and there is no contact with other sources. In addition, researchers use basic data collection methods to collect all data through interviews, surveys and questionnaires. The researchers also used "primary data collection methods" in this study, where the researchers collected all the data by e-mail surveys.

3.6 Sampling Technique

Sampling technique is an essential technique that will surely help researchers determine research results' accuracy, accuracy, and reliability. Three factors affect the sampling method: samples, sampling and population. The apartment is defined as a collection of different and

many factors that have similarities between these features. Sample is just a small part of the population and the sample helps to reflect the whole population. In addition, there are two sampling methods: one is the "probability technique of sampling", and the other is the "non-probability technique of sampling" (Attaran, 2020).

In light of these two sampling methods, researchers used probability sampling methods to select a large group of respondents at random. In sampling technique, everyone has an equal opportunity to choose and be part of the sampling model. However, with improbable sampling methods, researchers will not select respondents at random. In addition, in an unlikely sample, the researcher only selects a respondent in the required research area (Hopkins, 2021). In addition, the researchers used a sampling method which includes respondents who participated in the supply chain management work of the AI implementation process.

3.7 Sampling Size

Sampling is considered an important basic concept, closely related to sampling technique, which helps researchers measure individual samples. In research, the sample size is defined as the number of different observations made by the researcher on most of the respondents. Based on this large population, these figures are formulated for the entire population. In this case study, 20 active respondents participated without seals, as researchers only selected respondents who have worked for organisations that use artificial intelligence in supply chain management (Sharma, Adhikary and Borah, 2020). The sample size is also considered the most important part for the analysis of the researcher as they represent the population and the sample size would be the one to whom the questions would be asked for the analysis of the research.

3.8 Search Strategy

The search strategy is also considered an important part of the research. It can help researchers determine methods that will greatly help them conduct research and find researchrelated data. In this study, the researchers have used interviews, which helps researchers gather data for further research (Zhao, Chen and Ai, 2021). In this study, the researcher has used key words to search the past researches and select those articles which are related to the topic of the research.

Furthermore, keyword research is considered one of the most effective and efficient ways to help researchers collect powerful, decisive and reliable data from various research sources. In addition to conducting research, the researchers also used keyword techniques to gather reliable and relevant data in these studies (Ghoreishi and Happonen, 2020). Keywords research methods in these studies include "Artificial Intelligence", "Supply Chain Management", "Warehouse", "Supply chain activities", and "Technological advancement". These keywords help the researcher a lot in reviewing written material for the key research from the research source that is being researched.

3.9 Data Analysis

In this study, the researchers used effective qualitative methods, which means that all the data in this study were collected through the questionnaires and interviews. All the data in this study have been analysed from previous studies where the researchers have looked at those AI implementation processes that are being implemented in the supply chain management. The data collected from the interviews, case studies, research papers and document study would be analysed using the conceptualisation method. In addition, the researchers in this study has

analysed all data based on previous research and link it to research aimed at analysing and researching the supply chain using artificial intelligence.

3.10 Inclusion and Exclusion Criteria

Researchers strictly follow the intake and exclusion criteria for this study to determine the validity, validity and reliability of the studies conducted. For the convenience of readers, the researcher contains only answers to research questions related to the researcher's content, except for all answers that are not related to a specific research concept (Laing, 2018). Researchers do this only for readers because if they find only relevant answers and data in the study, it is easy to read and increases their interest (Hicks, O'Dowd and Corbett, 2018). In addition, the study indicated that the researchers only added references to studies conducted one year after 2016 and excluded all references to studies conducted before 2016. Magazines, articles and books are available online in a modern format. In addition, this research method or approach is very effective because it can help readers research only the latest data related to the nature of modern society.

3.11 Ethical Consideration

In these studies, ethical considerations have become enormous and important, and scholars adhere to strict ethical principles in these studies (Alharahsheh and Pius, 2020). In this study, the expert gives the interviewee the full right to leave the interview at any time or in the middle of the interview. Moreover, Researchers ensured that personal data of interviewees is kept confidential in the records. In addition, the questions asked by the interviewer were anything the limits of modesty and every individual had the choice not to answer any specific question.

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