VAASAN AMMATTIKORKEAKOULU
UNIVERSITY OF APPLIED SCIENCES

Shamas Pervaiz

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SUPPLY CHAIN MANAGEMENT

Unit. Business Economics

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VAASAN AMMATTIKORKEAKOULU
UNIVERSITY OF APPLIED SCIENCES
INTERNATIONAL BUSINESS

ABSTRACT

Author	Shamas Pervaiz
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The point of thesis was to exhibit how man-made reasoning is functioning in the cutting edge world and particularly in the field of supply chain management. The hypothetical system of the postulation indicated how man-made consciousness began through its types. There are three fundamental kinds of AI which are managed learning, unaided learning and fortification learning and they are portrayed in the hypothetical piece of this thesis. Deep learning has significant impact on supply chain management. This research focused on the overview of supply chain management and explained the terms inventory management, warehouse management and logistics. This study illustrated that artificial intelligence is beneficial for the supply chain management and its present state in the world and Finland.

The utilization of the computerized reasoning in supply chain management exhibited more subtleties with common sense models from Amazon and Amer Sports. Amazon is utilizing computerized reasoning procedures for web based shopping and it has automated its warehouse. As the smart warehouses are more advanced in the operations of daily routine. Amazon has used the artificial intelligence to provide the customers with the better satisfaction. Amer Sports is using machine learning successfully to improve the management and predictability of their supply chain. The qualitative research methodology (Document Analysis) was used in this thesis. Twenty electronic documents and publications regarding artificial intelligence in supply chain management were evaluated by the researcher.

This thesis found that the two organizations have been profiting incredibly by actualizing distinctive man-made brainpower applications. This study illustrates that augmentation and automation process are being improved with the help of artificial intelligence. Automation is replacing the human involvement with great efficiency. This research concludes that speed, accuracy and profitability of the company can be enhanced with the use of artificial intelligence.

Keywords: Artificial Intelligence, Machine learning, Supply chain management, Deep learning, Warehouse management, Logistics, Inventory management.

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
ML	Machine Learning
GDP	Gross Domestic Product
SCM	Supply Chain Management

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1 INTRODUCTION

Artificial intelligence is growing at a fast pace when it denotes to global logistics and supply chain management. According to the executives from the transportation industry, fields go through significant transformation. As evolution is happening in technologies like artificial intelligence, machine learning, and alike new technologies is said to hold the potential to bring in disturbance and lead innovation inside these industries**.** Artificial intelligence has been equipped with computing techniques that support selecting large quantities of data from logistics and supply chain. A person can put such methods to use, and they can be analyzed to get results that can pledge processes and complex functions. It is possible to examine its performance by using AI in supply chain management. It comes up with new and better factors that impact the same area. By finding the variables and issues which influence the presentation of the gracefully chain, AI coops the capacities of various innovations the same support learning, unaided learning, and directed learning.

Man-made intelligence abilities are improving the capabilities of the organization in the zones of system arranging and prescient interest. Companies are becoming more practical using tools that can help with capacity planning and demand forecasting. Market knowledge is essential that can quickly move the vehicles to the areas where demand is high, and it can help to bring down operational costs. AI brings the supply chain with an appropriate intellect, which can reduce the operating costs and manage inventory. By the combination of AI and machine learning, companies are getting new insights into different areas, which comprise warehouse management, logistics, and supply chain management. The innovations utilized in these parts are AI-controlled Visual Inspection to perceive harm and do needed remedy by taking photographs of the load by utilizing exceptional cameras. Through this thesis, people will understand how AI is revolutionizing the supply chain.

Man-made intelligence makes it conceivable to gauge and way all the components which can progress in the direction of commitment precision in demand determining. In view of the climate, constant deals, and extra factors, it gives persistent estimates in a contort. By making use of the information, it can aid with automated sorting, improving warehouse management, self-management of inventory systems, and self-driving forklifts. It is not difficult for AI to analyze the data relating to the suppliers like audits, in-full delivery performance, credit

scoring, evaluations, and future decision can use that delivered information. These kinds of steps assist the company make better decisions as a supplier and work to refining customer service.

My research focuses on the issue of whether man-made consciousness applications have entered the commercial, particularly in the field of supply chain management. The point of the thesis is to illuminate how much essential impact artificial intelligence has on supply chain management. This study likewise presents which sort of computerized reasoning procedures are used today in supply chain management. Besides, artificial intelligence has not only played an essential role in enhancing customer service for the company in the supply chain but also helped improve their yearly profit. In addition, the thesis likewise centers around how Finnish organizations have offered an explanation to the ascent of man-made reasoning and what Finland will accomplish for man-made brainpower later on.

Factory scheduling and production planning can proceed with the introduction of AI. The companies can work on to analyse the issues and then solve them. AI has the power to balance the restrictions that can work well for the build to order situations automatically. Issues in transportation emerge once framework conduct is difficult to shape dependent on the anticipated example that is influenced by people mistakes, traffic, or mishaps. In such circumstances, AI can be a handful to rescue. AI envisages decisions based on data analysis.

This thesis is structured in the following way. Chapter 2 starts with the introduction of artificial intelligence and puts lights on the types of artificial intelligence, machine learning and deep learning. Chapter 3 deals with the overview of the supply chain management which includes logistics, inventory management and warehouse management. Chapter 4 and 5 continue with the information relating to the artificial intelligence global impact and artificial intelligence in Finland. The Research method has been described in chapter 6. Document analysis has been used for this research. The results are analysed in chapter 7, artificial intelligence in supply chain management. Chapter 8 is mainly based upon the conclusion of the thesis.

2 ARTIFICIAL INTELLIGENCE

While the beginning of AI can be followed over fifty years back, its potentials have really climbed these days. This has incited the arrangement of a diversity of its rational requests, in the deftly attach section in adding to various zones of concentration.

In this part, we start by presenting the possibility of Artificial Intelligence and a succinct conversation round its subfields.ML and deep learning will also be discussed.

2.1 Introduction to Artificial Intelligence

In 1956, John McCarthy introduced the articulation computerized reasoning. He welcomed a get together of specialists from an assortment of controls, for example, great neuron nets, language reenactment, and intricacy hypothesis also. The examiners rose calm to elucidate and progress the thoughts around "rational machines," which, up 'til now, had been exceptionally uncommon. (Bernard Marr 2018)

Artificial Intelligence (AI) is a novel technology and science. This studies theories, devices, growths, and applications. It pretends human intelligence through image recognition, computerized robots, voice recognition, expert systems and natural language processing. With the assistance of Artificial Intelligence and linked computer technologies, Machine Translation (MT) denotes the change of and translation from one natural language to another natural language. (Lili li 2013)

PCs primarily work by adhering to gatherings of programming directions. Man-made consciousness is a field that is serving transmute this procedure into something considerably more unique. It is a process that programs can sift out ways to study on their particular deprived of having to receive new directions all the time. Artificial Intelligence (AI) is a generic period used to define computerized approaches, which service knowledge, reasoning, self-learning, and decision creation to make machines act smarter. In overall, AI might be divided into two classes: the first is Symbolic Intelligence, which includes Expert systems, Knowledge-based systems, Case-based reasoning, etc. (Kesheng Wang 2001)

Man-made brainpower moreover has applications in the budgetary business, where it is utilized to notice and banner movement in banking and fund, for instance, bizarre charge card use and large account deposits—all the assistance a bank's fraud department. Applications for AI are being utilized to help smooth out and make brand exchanging simpler. This is finished by get together gracefully, request, and evaluating of protections simpler to appraise. (Jake FrankenField 2020)

Simulated intelligence frameworks will traditionally uncover as a base a portion of the accompanying practices related with human insight: thinking, critical thinking, arranging, learning, information portrayal, observation, control and movement, and, less significantly, innovativeness and social knowledge. (Heath 2018)

Subsequently Artificial Intelligence (AI) is a part of software engineering which is concentrating on making frameworks that can work astutely and freely like people. Computer based intelligence depends on the human insight forms by machines. The insight forms contain getting the hang of, thinking, and self-remedy. Explicit AI applications like machine vision, discourse acknowledgment, and master frameworks. (Takyar 2020)

2.2 Types of Artificial Intelligence

There are particular types of AI under which extended categories of AI falls. There are many terms and definitions of AI, which make it intensive to explore different groups, subsets, or variety, which come with different ideas. A few subsets of AI which fuse ML, huge information, and NLP. In any case, in this portion, we will cover the four essential kinds of AI: open machines, quelled memory, mind speculation, and care.

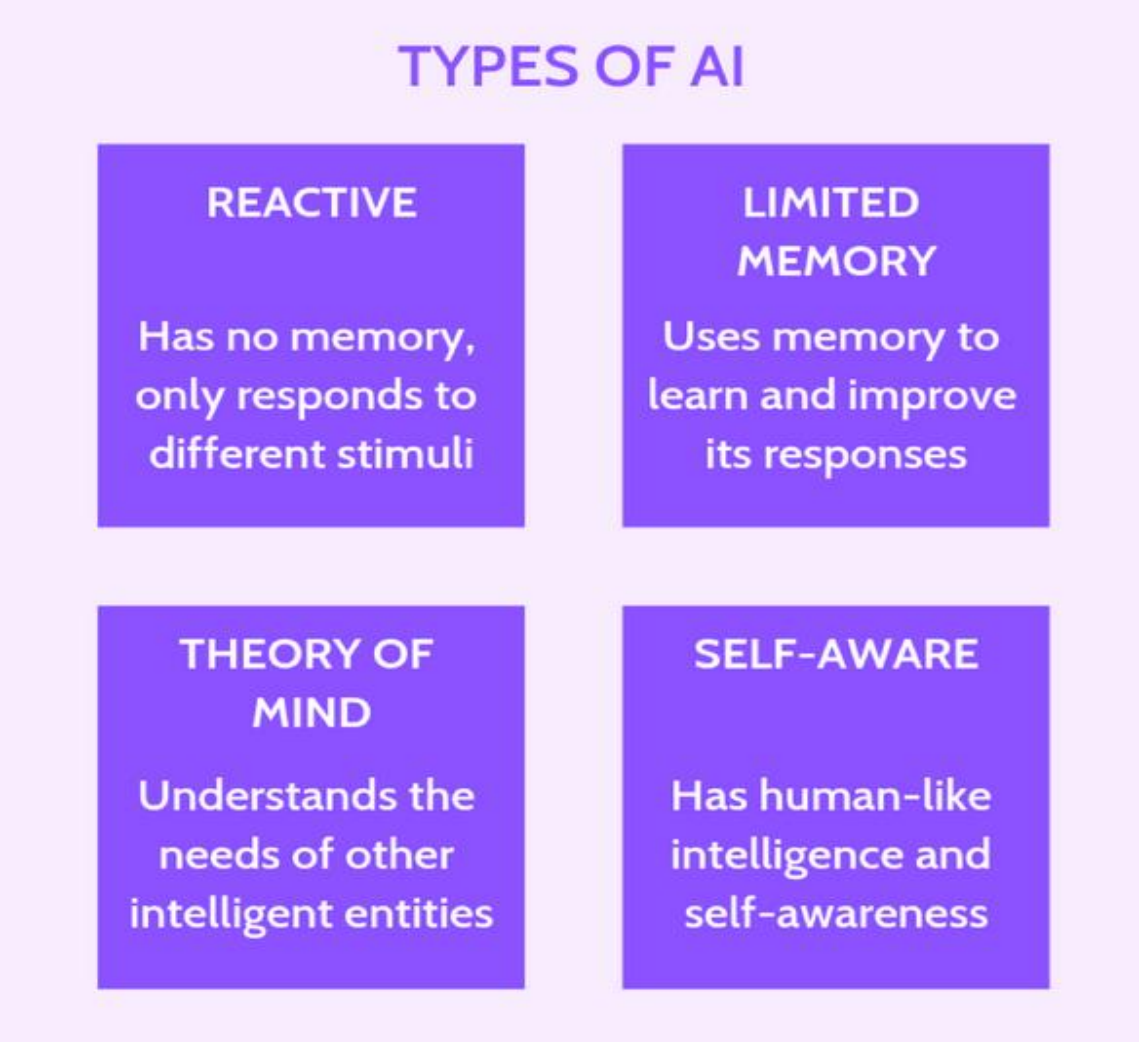

Figure 1. Types of AI (Adapted from Forbes 2019)

These four sorts of AI comprise slighter facets of the universal area of AI.

Constrained memory machines will be machines that, in collection to having the capacities of uprightly responsive machines, are additionally cultivated in gaining from recorded information to settle on decisions. Almost all current applications that we are aware of start from this class of AI. All present-day AI frameworks, for example, those utilizing profound learning, are practiced by huge sizes of preparing information, which they stock in their memory toward system a reference model for taking care of future issues. For instance, a picture acknowledgment AI is prepared to use a huge number of pictures and their marks to instruct it to name questions its pictures. (Joshi 2019)

Hypothesis of Mind scientist's certainty to fabricate PCs that recreate our psychological models, by establishing portrayals about the world, and about included operators and elements in it. One objective of these specialists is to manufacture PCs that describe to people and notice

human knowledge and how individuals' feelings are affected by occasions and the earth. While a lot of PC utilization models, a PC with a 'mind' doesn't yet exist. (Ray 2018)

A mindful machine can mark portrayals about itself. They are aware of their internal states, can front cast the feelings of others, and can deliver thoughts and derivations. They are the group of people yet to come of the machine: hyper-genius, estimation, and cognizant. The topic of whether a gadget can act naturally cognizant or "mindful" is smarter to control for scholars. (Yaninen 2017.)

2.3 Machine Learning

As we realize that AI is a use of man-made consciousness (AI) that conveys frameworks the capacity to take in and advance as a matter of fact without being expressly customized. The point of AI is to create PC agendas that can associate information and use it to read. The essential point is to let the PCs to adapt naturally wanting humanoid association or help and change activities subsequently. (Expert System 2017)

Machine learning is a device for turning information into knowledge. There has been an explosion of data in the past 50 years. This mass of data is unusable unless we analyse it and find the patterns hidden within. Machine learning inevitably the valuable underlying patterns within multifaceted data that we would otherwise struggle to discover. The unseen patterns and information about a problem can foresee future events. It can do all kinds of multifaceted decision making. (Edwards 2018)

AI today is very exceptional from the AI of the past. As it came in to see from design acknowledgment and the hypothesis. PCs can learn denied of being customized to do exact undertakings. Scientists focussed in man-made reasoning looked to check whether PCs could gain from information. The iterative aspect of AI is significant on the grounds that, as models can adjust freely, are recognizable to new data. (SAS 2020)

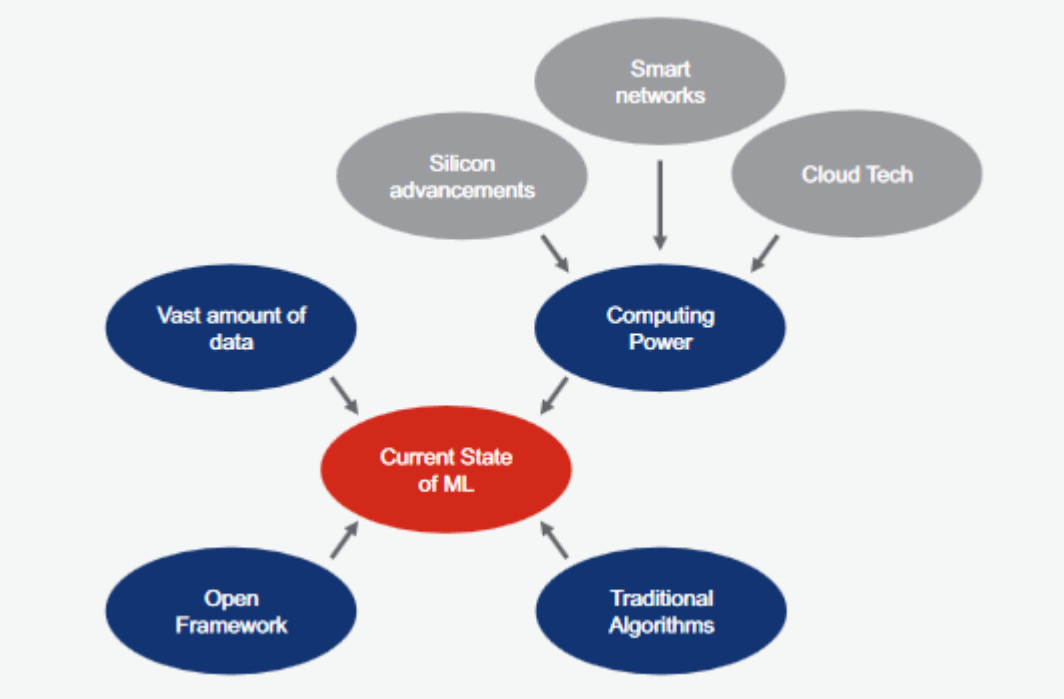

Figure 2. Enablers of Machine Learning (Adapted from Anastassia Lauterbach 2017)

Machine learning extents a broad usual of algorithms which extract useful models from raw data. These models, in turn, are cast-off in a variety of withdrawal tasks (where we quotation one or more examples of a specific model from enormous amounts of environmental data, for example finding a person's face happening in a large number of picture frames at various resolutions, lightings, and so on) in addition to synthesis tasks (where we concept new instances of the models, allowing predictive what-if scenarios or prominent the model in new environments). (Jeffers 2016)

It is clear that Machine learning is a subfield of Artificial Intelligence (AI) and has changed from pattern recognition, used to sightsee the structure of the data, and fit interested in the models that can be tacit and utilized by users. Its responses the question as to how to concept a computer program employing historical data, to solve a given problem, and automatically progress the efficiency of the program, with experience. (Shobha 2018)

Machine learning is a field of learning that looks at using computational algorithms to turn experiential data into usable models. The machine learning field nurtured out of traditional statistics and artificial bits of intelligence communities. Due to the exertions of big companies for example Amazon, Microsoft, Google and Facebook, machine learning has become one of the progressive computer science topics in the last decade. (Edgar 2017)

2.4 Supervised and Unsupervised Learning

Machine learning has two main types of learning to solve problems or reach goals: supervised and unsupervised.

In regulated learning, the PC is giving delineation inputs that are portrayed by their ideal yields. The assurance of this strategy is for the calculation to have the option to "learn" by partner its genuine creation with the "instructed" yields to discover blunders and alter the model in like manner. Directed learning, subsequently, utilizes examples to anticipate mark esteems on extra unlabelled information. (Tagliaferri 2017)

Input data is furnished in the examples in unsupervised learning. There are no considered example outputs to aim. But it may be astonishing to understand that it is still likely to find many stimulating and composite designs concealed within data without any labels. Unsupervised learning can be more robust than supervised learning, as the exclusion of supervision means the problem has become less defined. The algorithm has a less intensive idea of what patterns to look for. (Edwards 2018)

2.5 Reinforcement learning

It is an additional type of machine learning, According to Akerkar (2019, 79), it is a form of machine learning wherever the system interacts with an altering, dynamic environment and is offered with (positive and negative) feedback as it receipts actions in response to this environment. There is no predefined concept of a correct answer to a given stimulus, but there are no pre-set notions of better or worse ones that can be stated mathematically in some way.

Akerkar remains by saying that reinforcement learning is a computational tactic. That can be used to considerate mechanising goal-focused and decision making. It is learning what to do and how to plan circumstances to movements. The outcome is to maximize the digital reward signal. The learner is not communicated which action to take but, in its place, must discover which effort will yield the maximum reward.

2.6 Deep Learning

Deep learning is a set of machine learning techniques that feat many coatings of nonlinear information dispensation for supervised or unsupervised feature withdrawal and transformation, as well as for pattern investigation and cataloguing. (Akerkar 2019, 33)

The shallow artificial neural networks cannot handle significant amount of complex data. That can be seen in many monotonous applications such as natural speech, images information recovery, and other humans like information dispensation applications. Such requests are suggested by deep learning. It is possible to classify, categorize patterns and recognize in data for a machine with comparatively less efforts with the help of deep learninig. (Akerkar 2019, 33)

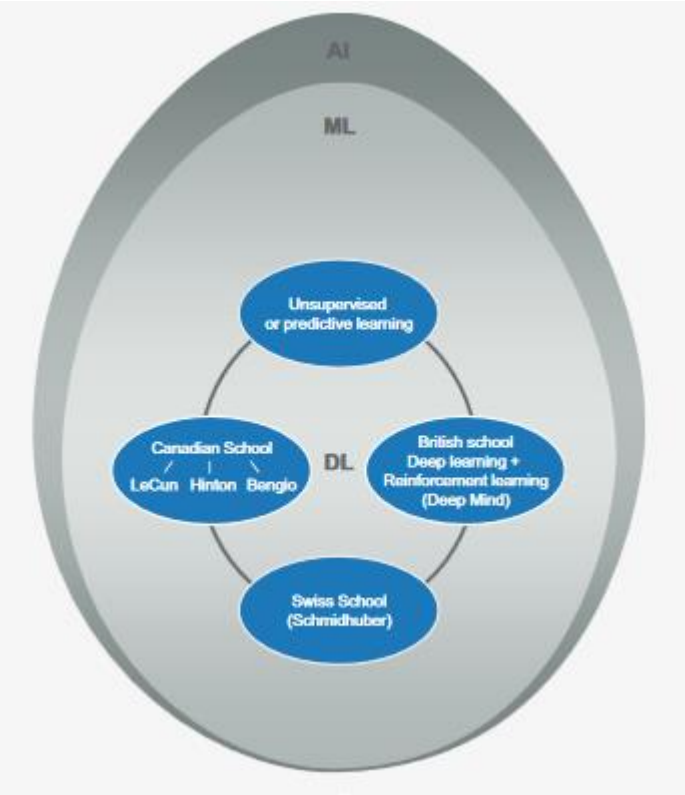

Figure 3. Deep Learning within AI (Adapted from Anastassia Lauterbach 2017)

Deep learning suggests human-like multi-layered dispensation in contrast with the shallow architecture. By using various layers of architecture, the basic cognizance of deep learning is to service hierarchical processing. The layers of the architecture are decided hierarchically. As each layer input is providing to its together layer after pre-training. Such pre-training of a certain layer is done in an unsupervised way. Deep learning trails a distributed tactic to managing big data. The method assumes that data are generated considering numerous factors, different time, and various levels. Deep learning facilitates the arrangement and processing of

the data into different layers according to its time (occurrence), its standard, or nature. Deep learning is related with artificial neural networks. (Akerkar 2019, 33)

3 An Overview of Supply Chain Management

According to Vitasek (2013), supply chain management is defined as:

Supply chain management comprises the preparation and control which persuade obtain, procurement, all logistics activities and adaptation. Basically, it additionally incorporates bearing and relationship with channel accomplices, which can be providers, mediators, outsider specialist organizations, and clients. In focal, flexibly chain the board coordinates gracefully and request the board inside and across firms.

The description of supply chain management has been useful to comprehend the prearrangements and it is essential in one-to-one care of things and data brooks with the logistics operations. The data streams both inside and outside crosswise a group and between firms. (Cooper Lambert & Pagh 1997b)

Although the SCM concept initially occurred at the beginning of the 1980s, right after the 1990s, it started to hasten and gain more attention. For decades, the growing interesting SCM can be assigned to, first, deepened globalization that has recognized operational SCM potentials, comparable worldwide distribution and global manufacture for organizations, and has armoured business struggles on a global rate. Hence, the propensity around time and excellence-based rivalry, which weights a closer communication and reconciliation among the company and its suppliers. Third, an enormous uncertainty of surroundings under technological variances, unbalanced economic situation, and substantial business scuffles that requests for vast quickness in the supply chain. (Mentzer, DeWitt, Keebler, Min, Nix, Smith & Zacharia 2001)

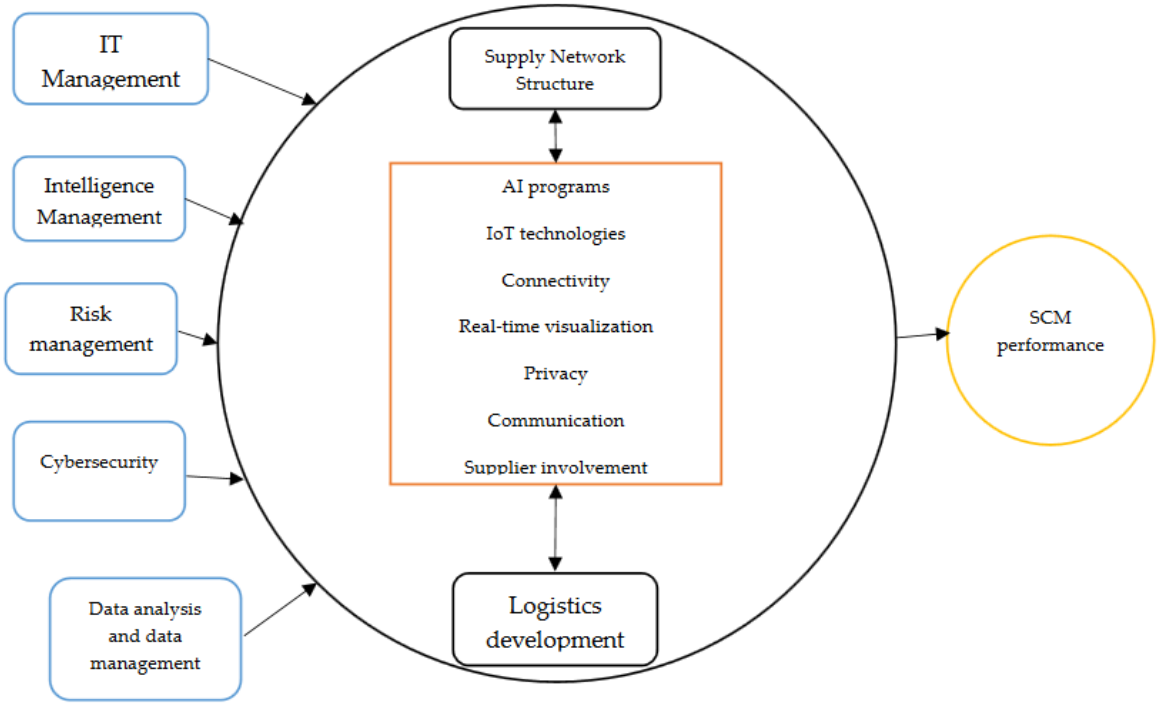

Figure 4. A framework of supply chain management structure with integrated AI and IoT technologies (adapted from Chen& Paulraj 2004)

There is a variety of choices like purchasing and procurement, shipping and logistics, misuse control, commerce, organizational theory, information technology systems, and hazard management have enabled the rapid growth of SCM research. (Chen&& Paulraj2004)

According to Anderson and Katz (1998), SCM utilizes rationally internal and external facilities to bring efficiency. However, the idea begins a logically expressed supply chain, which persuades to performance and competitive advantage of the organization.

The degree to which a set of defined characteristics of a product or service accomplishes known requirements. The shared element of the business definitions is that the quality of a product or service refers to the insight of the degree to which the product or service meets the customer's prospects. Class has no precise meaning unless related to explicit function and object. Quality is a perceptual, conditional, and somewhat individual attribute. (CSCMP, 2013)

The well-organized management of the end- to- end process of designing, planning, and forecasting, sourcing still complex supplier networks, manufacturing, and allocating products

from raw material to the end customer, and the ultimate removal of the merchandise by the customer. (Chan and Lee, 2005, p. 31)

SCM is the viewpoint of management that contains the management and integration of a set of selected essential business systems from end-client through unique providers, that manages items, administrations, and data that supplement an incentive for clients and other stakeholders through the cooperative efforts of supply chain members. (Ho et al., 2002, p. 4422)

The supply chain is usually abstracted as a network of companies from suppliers to end- users, which have the intention of assimilating supply/demand via coordinated company efforts. The source of the term "supply chain management" is thought to exist in the work of consultants during the primary 1980s. (Oliver and Webber, 1982)

The hazard in supply chains can be brave as the possible hindrances for the unique goal that, hence, influence their duct ion of profitable operations at many stages. The primary activities may be considered by the size and excellence of outputs at various positions and time in the supply network. In case of a breakdown of service at any stage of Supply Chain can affect other operations. Therefore, by way of taking tenacious lucrative actions, risk evaluation has been found as one of the indispensable components of the supply chain -planning model. Risk evaluation consists of characteristics, assessment, and uncovering of risks and hazards in supply chains and deciding problems to lessen the collateral damage. (Kumar2010)

3.1 Logistic Management

Supply chain management and logistics are not novel ideas; evidence of values of logistics and supply chains date as far back by way of the building of the pyramids. Though, it is only in the past few decades that logistics and supply chain management were resolutely established as critical business concerns and thereby as business disciplines. (Christopher, 2016)

The procedure of strategically dealing with the picking up, embraced and capacity of assets, parts and completed stock. Also, the associated data developments over the affiliation and its showcasing divert so that current and future achievement is amplified through the productive execution of requests. (Gattorna 1991)

The problem for both practitioners and researchers is that supply chain performance is relatively hard to measure. This study includes an established measure of logistics performance

as a replacement for supply chain performance. Logistics is a supply chain function in that it links manufacturers and customers while those customers may not be the final customers in the supply chain. (Green, k 2008)

According to (Gattorna 1991), Logistics management is anxious with the analysis, planning, and control of that level of product availability suitable to the needs of the marketplace and the resources of the company. Only a thorough analysis of demand in terms of standard, location, and timing can offer a starting point — and even then, when secure facilities are involved, a forecast is also required.

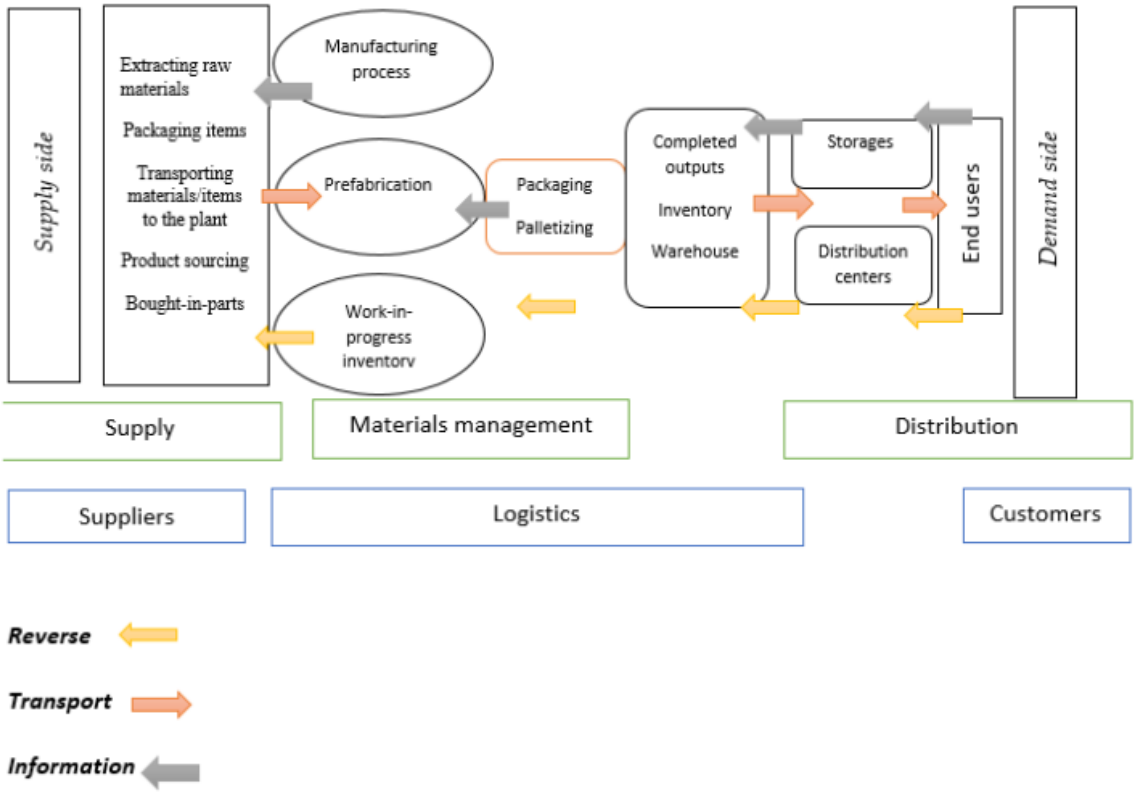

Figure 5. Logistics flow and some of the logistics terminologies (adapted from Farahani et al. 2011).

Logistics signifies the arriving and outbound drive and storing of things, services, and info inside and among establishments. As a managerial activity, early outsets of logistics-intensive on its role in the supply of products and to backing an organization's business strategy and to provide time and place value. (Gregory T 2006)

The framework of Forslund and Jonsson (2007, 2010) is more comprehensive. It contains five happenings, and besides, it is precisely advanced for logistics performance management. Hence, the explanation of the performance management process is based on the assembly of this framework, while added by several other authors. The activities in this process are: selecting metrics, defining metrics, setting targets, measuring, and analysing/acting. (Veronica 2015)

Srivastava (2006) explored the state of logistics and supply chain practices in India. He originates that, while Indian managers are aware of the need to develop supplier partnerships, integrate and organize the flow of goods from supplier's supplier to the final customer, and share information among supply chain partners, the infrastructure essential to ease such seamless addition is as yet inaccessible. There is pressure in developing markets to quickly implement logistics and supply chain combination practices to contest globally. (Inman, R 2008)

The current state of logistics research echoes its evolution from an importance on operational and useful areas to an emphasis on the competencies that can be gained through the integration and interface(s) between different regions and other functional departments within the organization plus manufacturing, human resources, finance/accounting, etc. Logistics research is responding to current demands for determining the performance of the logistics system and sub- systems. Its inferences for entire company performance, chiefly with an importance on the efficacies that can be gained from encompassing this functional integration over collaboration athwart the entire supply chain. (Gregory T 2006)

3.2 Inventory Management

Inventory management in Supply Chain is studied by most of the academic papers from a fine viewpoint. The point to note that imitation of inventory management is exceedingly difficult for scholars to device. Hereafter, to discover inventory management, the proper paradigm is practical by scholars. However, there are two elements that are included by the Supply Chain, which is the interconnection network between these elements and expense breakdown that consists of two components. Afterward, the influence of dimensional inventory characters and outputs on capacity are reflected inside these stylized settings. (Ganeshan, Boone and Stenger 2001)

Nearly every company is aware with the manifestation of inventory error. According to Raman, DeHoratiusand Ton (2001), In retail stores, stock keeping units are more than 65%, where inventory management network was incorrect on data on a stock count, and physical inventory was distinct by the information system inventory.

The information system inclines to be at a progressive level than physical inventory. In physical inventory, stock availability is decreased if units are stolen. There is possibility that units become unsold. However, Information system inventory does not affect due to these factors. Despite this tendency, physical inventory can be information system inventory under certain conditions. In the procurement, papers demonstration up fewer units by accident by the provider. The physical inventory system outcome can be affected; in that case, an added considerable number of products will be written in information system inventory. (Fleisch &Tellkamp2005)

Due to internal and external theft, errors can be occurred in the information network, unsaleable products such as wrongly delivered, misplaced goods, as well as low demand goods (Ramanet al.2001)

According to Fleisch and Tellkamp (2005), SC replication research outcomes, supply chain costs can be decreased by the refinement of inventory errors. The degree of unavailable items can be lowered. However, the degree of operation excellence, stolen, and unsaleable units continue to constant. To enhance supply chain efficiency, inventory error should be reduced. Inventory error can be abridged by the acceptance of better strategies and the modern technologies.

3.3 Warehouse Management

As a significance, managing complex warehouses effectively and efficiently has become an intensive task. An important question, therefore, is how warehouse management, as a cluster of planning and control decisions and procedures, is planned to meet today's challenges. Warehouse management includes the control and optimization of multifaceted warehouse and distribution processes. (Ten Hompel and Schmidt, 2006)

Warehouse processes that vital to be deliberate and precise. These contain incoming flow handling, product- to- location task, product storage, order- to- stock location-distribution,

order batching and issue, order selection, shipment, worth- added logistics activities, and packing. (Frazelle 2002)

Market dynamics events the rate of change of the external environment in which a warehouse operates. We expect that an added difficult warehouse task fallout in more multifaceted optimal rules for scheduling and ornamental inbound, storage, and outbound doings. Warehouse arrangement and switch is depending both on the difficulty of the warehouse task and on the undercurrents of the market. We test these plans in our study. (Van Assen, 2005)

Traditional warehouse management is chiefly contingent on guide management or partial-automatic management. Generally, warehouse circumstances are comparatively simple, lacking accomplished environmental monitoring equipment and storage environment for example temperature and humidity, which cannot be certain. Expired, worsened, damaged, and other conditions of goods occur from time to time, which can easily cause economic losses to enterprises. (Liu, H 2019)

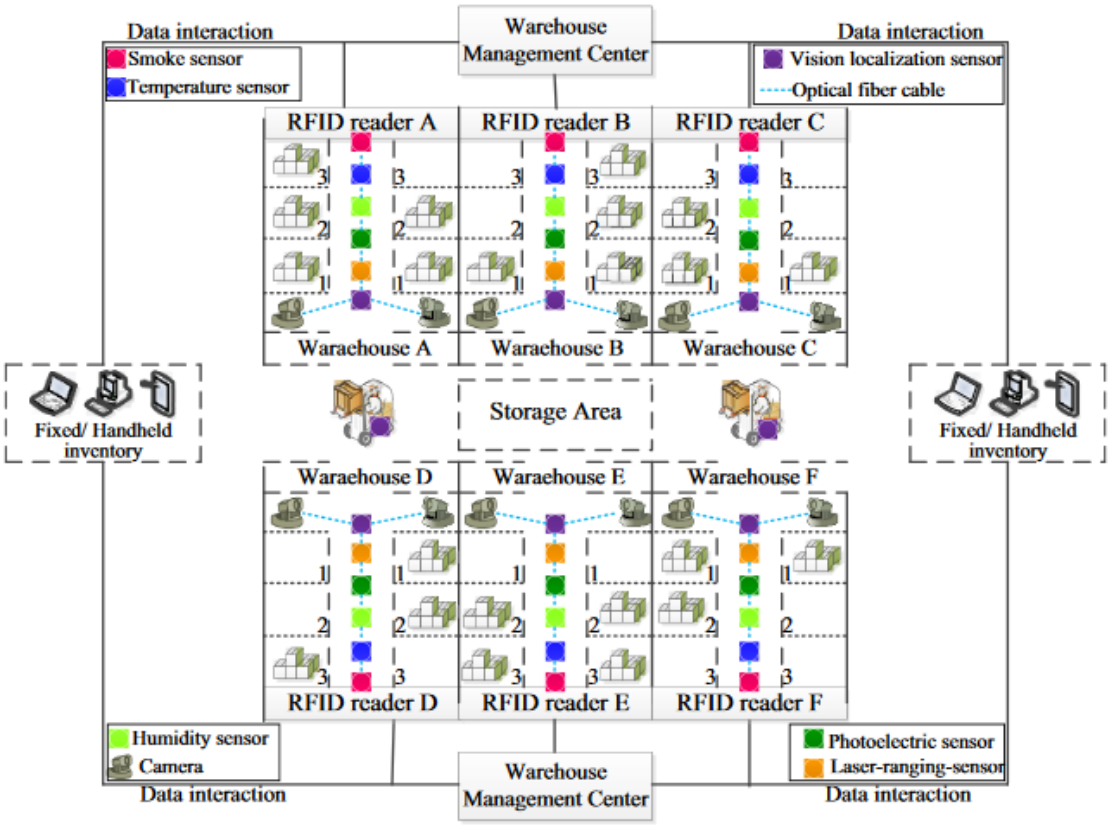

Figure 6. Operation business model of warehouse centre (Adapted from Hao Liu 2019).

Physical control of the goods and materials is possible with warehousing. Though, an essential principle of materials management is that material flow and information flow must go

precisely. As warehouse manager has not only knowledge about a piece of stock where that is, but he or she knows about the other things at an assumed point in time and place. The one-to-one care and extent of stock essential to take account of both physical location and time. (Ballard, R 1996)

Planning is, therefore, proactive, and control is reactive. Together, plans and controls regulate outputs. Within planning, we differentiate a planned and an operational level. At the planned decision level, warehouses draw up tactics to brand effective use of possessions and to fulfil market demand. Though, due to the very lively environment, for numerous warehouses, the strategic planning prospect is only days or weeks slightly than months. Decision rules are used to order, list and enhance planned activities at operational level. (Slack et al., 2001)

Warehouse management is a crucial part of the supply of a good chain, which in turn is a meaningful connection to connect manufacturers, distributors, retailers, and consumers. Warehouse management records detailed stored information of products, including stock status, shipping status, market flow, and other related information. It plays an essential guiding role in the production, supply, sales, and decision-making. It also affects enterprises operation, development and production. (Liu, H 2019)

4 ARTIFICIAL INTELLIGENCE GLOBAL IMPACT

Computer based intelligence might be the careless change in outlook in innovation history. Appropriation has been allowed by the earlier example move to distributed computing. The comfort of fitting and-play AI civilities from global innovation sellers, and a flourishing environment of AI-drove programming providers. The appropriation of AI has significantly increased in a year. In 2019, AI 'denotes the gap' to the essential dominant part. Computer based intelligence is progressing at an incredible range. Numerous kinds of AI applications are utilized by endeavours. (MMC Ventures2019a)

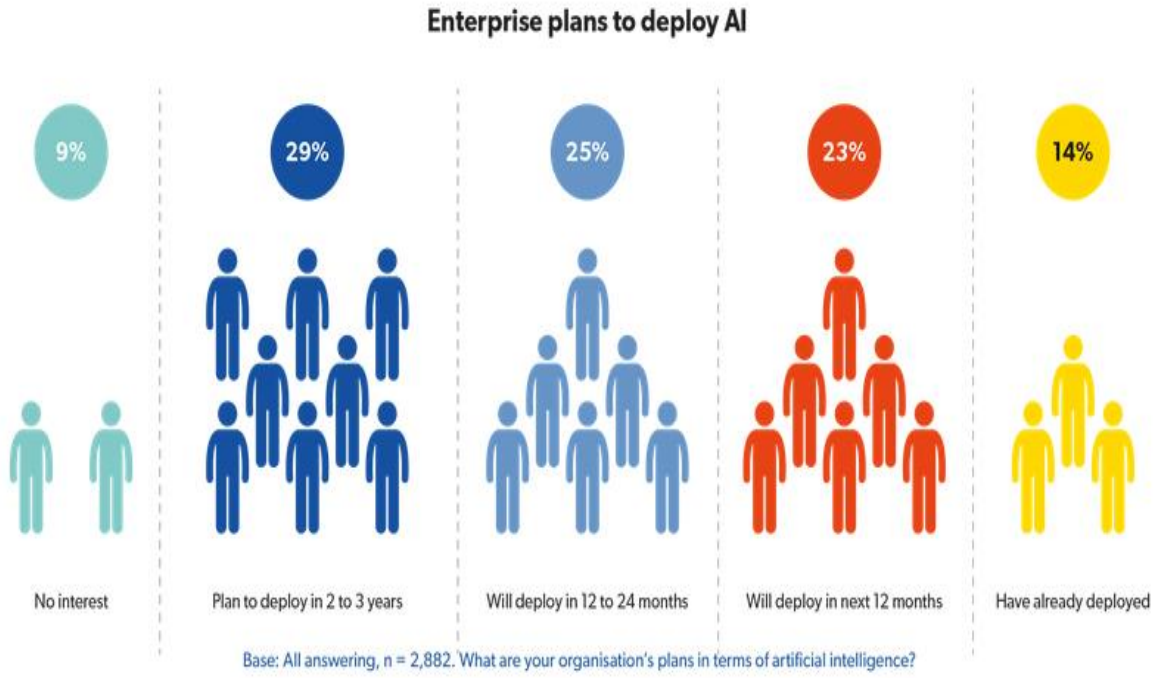

Figure 7. Initiative strategies to organise AI as of 2019 (Adapted from MMC Ventures 2019a.)

Subsequently the selection of AI has expanded in all locales; organizations in Asia/Pacific have been the most dynamic in acknowledgment of AI. There are twice the same number of undertakings in Asia/Pacific – one out of five – that have received AI today, identified with one of every ten organizations in North America. Inside Asia/Pacific, Chinese organizations lead to AI reception. Beijing, Shanghai, Guangdong, Zhejiang, and Jiangsu are the fundamental center points. Further, the piece of organizations in Asia/Pacific with no enthusiasm for sorting out AI – one out of 14 – is semi that of North America. (MMC Ventures 2019a)

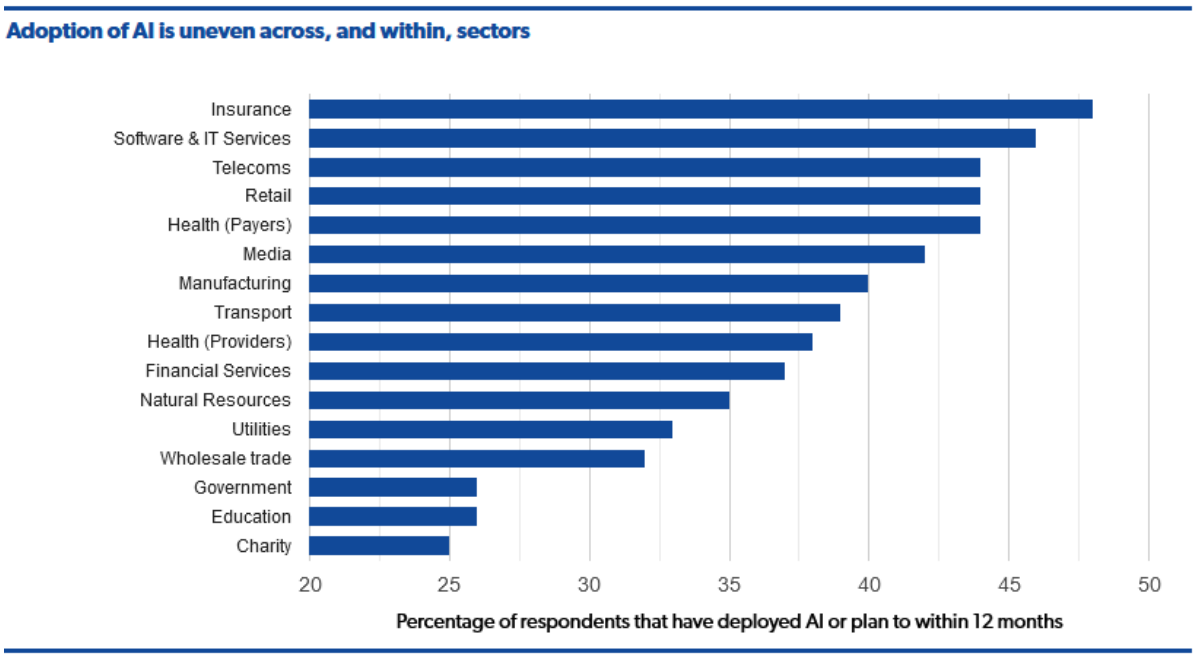

Figure 8. Sector adoption of AI as of 2019 (Adapted from MMC Ventures 2019.)

Financial services, high tech and telco, retail, healthcare and media show high adoption rate. Huge potential is offered by the AI for value creation in these sectors. 'Early adopters' met open door with vision. 'Movers' have quickly perceived rising chance – and started to handle hindrances to selection, for example, broad, siloed information domains. (MMC Ventures 2019a.)

Government offices, education, and charitable organizations have a lower rate of AI adoption among the sectors. The percentage of insurance firms has a higher adoption rate as compared to the services. There are great numbers of payers in the health industry than the suppliers. AI-based fraud analysis is more counterproductive in the detection of fraudulent activity by contrasting with the traditional, rules-based system.

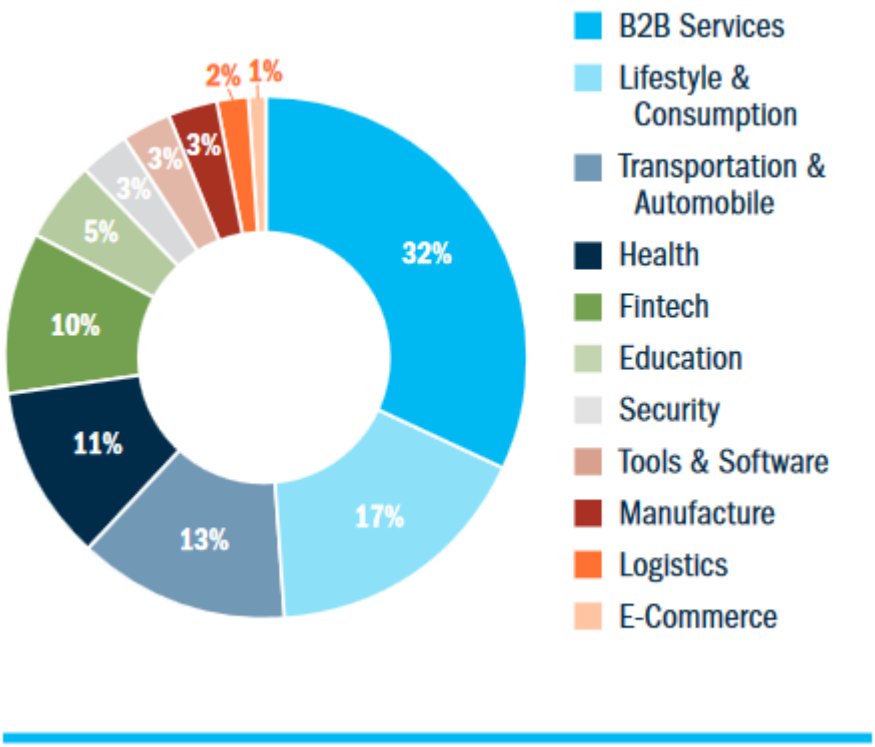

Figure 9. China AI Investment by Subsector (Adapted from Mou 2019)

One thousand six hundred software companies are in the early stage of AI in Europe. Enterprise on AI is developing initially. One out of fifty new companies received AI in 2013. B2B merchants are in great numbers in Europe, which is offering services for different organizations. Numerous associations like to purchase AI as opposed to manufacture. (MMC Ventures2019b.)

Businesses are growing their modest benefit by deploying the AI proactively. Nine out of ten AI pioneers are enhancing their investment by using AI. Two-thirds of companies have adopted AI which investigate or experiment with technology. Among businesses without much understanding of AI, spending on AI has been expanded by every fifth company. (MMC Ventures2019b.)

In April 2018, the European Commission launched its “Communication on AI” aiming at increasing the EU’s technological and industrial volume and AI uptake by the public and private sectors, preparing Europeans for the socio-economic changes triggered by new technologies; and ensuring that an appropriate ethical and legal framework is in place. A new set of AI ethics guidelines to discourse issues such as fairness, safety, and transparency.

Commission is working with member states to advance a coordinated plan on AI by the end of 2018. (Anastassia Lauterbach 2019)

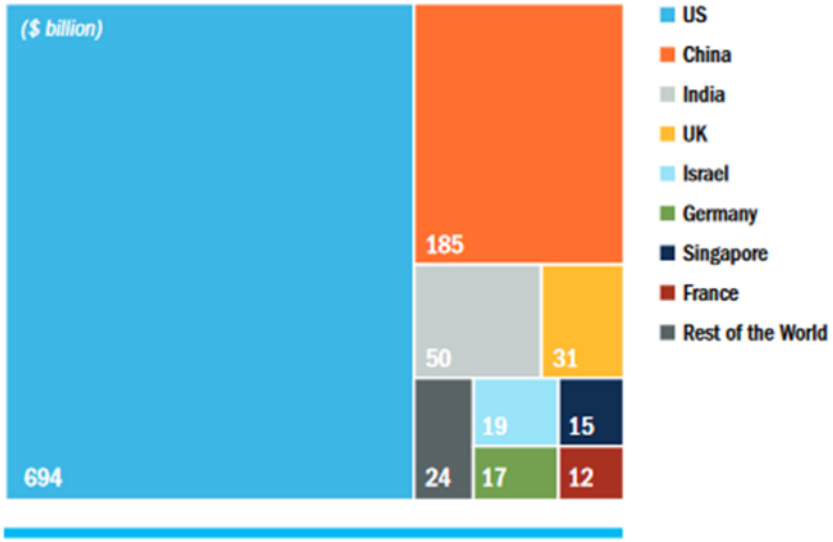

Figure 10. Global VC Investment 2008-2017(Adapted from Mou 2019)

There is increase in the funding, development and acquisition of start-ups and artificial intelligence technologies. Advanced and evolving economies has increased the use of AI commercially. Simulated intelligence can comfort grow well items and improve functionality, quality and cost in terms of manufacturing. It can improve analytical maintenance. Credit and financial services can be extended with the help of AI. In any case, with the dismissals of India and China, making markets have gotten recently uncertain segment of overall undertaking in this powerful development, whether or not they may benefit more from AI execution than dynamic frugalities. (Mou 2019)

5 ARTIFICIAL INTELLIGENCE IN FINLAND

In May 2017, Finland is Minister of Economic Affairs Mika Lintilä selected a steering group to examine how Finland can progress one of the world's topmost countries at the application of AI technologies. However, by looking for Finland's strengths and weaknesses in AI, there were eight recommendations given to make Finland one of the top countries in AI usage. Top activities include the creation of an AI accelerator pilot program, Finnish Centre for AI, and AI was integrated with public service. (Anastassia Lauterbach 2019)

A €160 million AI investment program has been launched by the Finnish Government. Finland wants to become one of the top AI realms. There is need to attract additional investment to make Finland one of the finest places for development, research and better application of AI. Agility and innovativeness to be used to compete with other nations of the world by considering that other countries are spending at higher rate. There are many factors that can be enhanced if Finland's AI program becomes successful, which are workforce productivity, improved service, and product quality. In 2023, Finnish GDP (Gross domestic product) can increase by €20billion. (PWC & Microsoft 2018)

There are high numbers of nations that have acknowledged the importance of AI. All the respective countries have developed a national plan for AI. Finland is viewed as a developed country as far as utilizing the advances and perceived as one of seven countries with a hearty monetary impact on innovation. (Microsoft and PwC 2018)

Helsinki University and Reaktor are providing a free online course "Elements of AI." Helsinki University cooperated with Reaktor to develop a free online course for meeting the increasing interest in the field of AI. The course comprises 2 ECTS, and it has not any specific requirements and free access worldwide. The Helsinki University and Technology Company give the course expecting to make Finland the most socialized nation on the planet as far as AI. (Yle 2018)

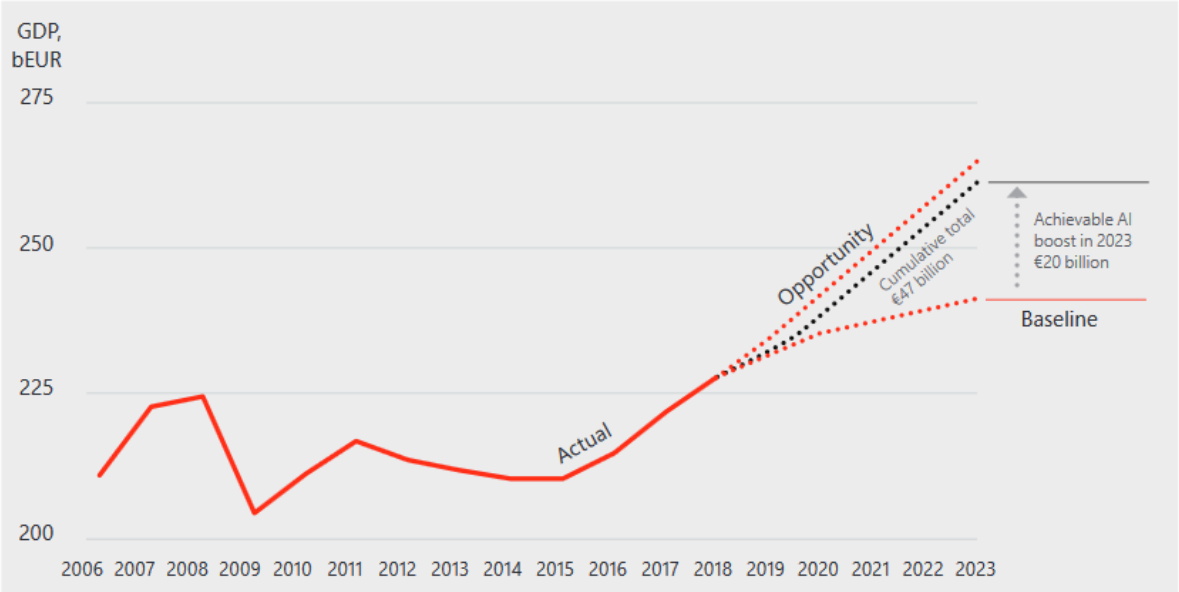

Figure 11. Finnish GDP estimates in various AI adoption states (Adapted from Microsoft and PwC 2018)

VTT Technical Research Centre and University of Helsinki launched Finnish Centre for Artificial Intelligence (FCAI). The research is grounded on top-tier expertise in machine learning, especially probabilistic modelling and in-depth knowledge, and on multidisciplinary collaboration with specialists from other fields. (Finnish Centre for Artificial Intelligence 2020)

6 RESEARCH PROCESS

Research is defined as a systematic, self-effacing inquiry. The inquiry is pointed at understanding a thing or phenomenon or solving a problem. When a query is led at thoughtful, it is termed as basic or central research, which follows knowledge, and may or may not have practical or commercial use. When the inquiry is pointed at put on the available expertise for useful or commercial purpose, or for solving a problem tackled in practice, it is termed as applied research. (Krishnaswamy 2006)

The manual for exploration is portrayed by the methodology of the assessment and sees the central activities that the pollster is locked in with during the examination. The objective of this investigation is to perceive the things of Artificial Intelligence on supply chain management.

6.1 Research Methodology

As research methodology is the assembly of investigation of a determination or problem and strategy on which research is depend on. So, answers to the desired question are got by applying different techniques. Methodology is the theory of how research can be commenced. It comprises the theoretical and philosophical moulds upon which analysis is founded. The insinuations of these for the method or methods adopted (Saunders. M et al., 2007)

The subjective exploration technique was utilized for this examination by inspecting the application and effect of AI in the flexibly anchor notwithstanding researching how man-made consciousness is changing the supply chain. The subjective technique was utilized as things to be surveyed with more detail. This strategy expects to consider AI in gracefully chain the executives in a more extensive and itemized way.

Qualitative research is a term for a collection of attitudes towards and strategies for leading inquiry that are pointed at discovering how human beings comprehend, experience, understand, and produce the social world. (Sandelowski 2004: 893). The value of this arrangement of techniques is that it is adaptable and simple to acquaint with varieties in the exploration condition and frequently requiring little to no effort. While quantitative information expresses, the subjective information is characterized.

Qualitative research is a realistic process that endeavours to an in-depth understanding of social phenomena within their natural situation. Qualitative research efforts further on questions, for example, ‘why’ rather than ‘what’ and depend on the straight experiences of human beings in their everyday lives. For the study of social phenomena, multiple systems are used by qualitative researchers. Researchers can study selected issues in depth by using qualitative methods. Qualitative researchers choose logical and statistical approaches such as case study, biography, discourse analysis, historical analysis, ethnography, grounded theory, and phenomenology. Flexibility and openness are valued by using qualitative research. (University of Utah 2018)

6.2 Document Analysis

Document analysis is an organized process that refers to the examination and evaluation of the documents. The type of documents can be both printed and electronic (PC based and web way) material. (Bowen 2009). In the event that we select report examination as a strategy for research, it very well may be furnishing us with numerous advantages: it supports the researcher in reaching "unreachable persons or subjects. Specialists set up the materials in open space which incorporate important data and instincts. Narrative sources are open to the central qualities and exceptionally modest. Also, such records can be a massively reliable wellspring of information; therefore, they are progressed for national or global purposes. (Amonashvili 2011)

Document analysis was the method of research used for the qualitative process of collecting data. As it uses systematic procedure to analyse the documentary evidence. Document analysis needs repeated review, examination, and understanding of the data to gain meaning and experiential knowledge of the construct being studied. Data collected by professional groups can be evaluated by using this kind of research method, which is not possible by using another type of research method. Document analysis makes it possible to access the data.

6.3 The articles and publications used in the study

Several online documents were explored by research under the accompanying catchphrases: "man-made intelligence and Gracefully Chain Management," "Impact of AI in Supply Chain Management," "Usage of AI in Supply Chain Management," “Imminent of Supply Chain

Management." It was taken into thought that dependable data must be explored during the research. The articles and publications used in the study are listed below:

Table 1. List of articles and publications used for the research

1	Artificial Intelligence for Business. Akerkar, R., 2019. Springer. Cham
2	Supply chain management: more than a novel name for logistics. Cooper, M.C., Lambert, D.M. & Pagh, J.D. (1997b).
3	Defining Supply Chain Management. Nix, N.W., Smith, C.D. & Zacharia, Z.G. (2001).
4	Understanding supply chain management: critical research and a theoretical framework. Chen, I.J. & Paulraj, A. (2004).
5	Strategic sourcing. Anderson, M.G. & Katz, P.B. (1998)
6	Minimization of supply chain cost with fixed risk using computational intelligence approaches. Kumar, S.K., Tiwari, M.K & Babiceanu, R.F. (2010).
7	Effective Logistics Management. Gattorna, J., Day, A., & Hargreaves, J. (1991).
8	The impact of inventory and flow planning parameters on supply chain performance: An exploratory study. Ganeshan, R., Boone, T., & Stenger, A.
9	Execution: The missing link in retail operations. Raman, A., DeHoratius, N. & Ton, Z. (2001).
10	Uncovering AI in Finland. Microsoft and PwC. 2018.
11	The State of AI 2019: Divergence. MMC Ventures. 2019.
12	"An RFID and sensor technology-based warehouse center: assessment of new model on a superstore in China" Liu, H., Yao, Z., Zeng, L. and Luan, J.
13	Organizing warehouse management. Faber, N., de Koster, M., and Smidts, A. (2013).
14	Management Research Methodology: Addition of Principles, Methods, and Techniques. Krishnaswamy, K. N.; Appa Iyer Sivakumar; Mathirajan, M.
15	The rise of Industrial AI. Tracy, Suzanne. 2019.
16	Future Supply chains with Artificial Intelligence. BIC. 2018.
17	Applications of Artificial Intelligence in Supply Chain Management and Logistics. Hellingrath, B., & Lechtenberg, S. (2019)
18	Step by step instructions to Develop a Personal Shopper App Based on AI 2017
19	The Role of Artificial Intelligence in Logistics. GoodWorkLabs 2018.
20	Methods of inventory monitoring and measurement. Ballard, R. 1996

7 RESULTS OF THE STUDY- ARTIFICIAL INTELLIGENCE IN SUPPLY CHAIN MANAGEMENT

As globalization stays, organizations are looking forward to improve flexibly chain efficiencies, which thus keeps the weight on business sectors to ascend just as on organizations that are not observing of embracing AI. Numerous in the assembling division are as of now expound in the AI wonder, and others are keen on applying it.

This section talks about how AI is affecting flexibly chain the executives because of record examination subjective exploration strategies.

7.1 Application of artificial intelligence in supply chain management

Numerous organizations are applying computerized reasoning in flexibly chain the board. Organizations like Siemens and Amazon are as of now utilizing AI in their flexibly chain frameworks through savvy automatons and AI mechanical autonomy. A high number of AI is fundamentally mechanical autonomy, and programming dealing with the start to finish procedure of gracefully chains is being created. Despite the fact that the possibilities with AI are regularly talked about, there is little direction on commonsense parts of applying AI. As we realize that all the organizations are not equipped for progressing with the innovation. The challenges of overseeing various exercises of flexibly chain the board can't be overlooked while applying AI simultaneously.

7.1.1 More supply chain transparency is needed

Despite the fact that flexibly chain the executives is the administration of the exercises to improve cost and boost client esteem. Flexibly chain exercises incorporate the things from item improvement, sourcing, and creation coordinations to data frameworks planning these exercises. (BIC 2018)

7.1.2 Focus and supply chain management disciplines evolve over time

In the event that we glance back at the advancement of gracefully chain the board, client centered corporate vision was at the center to convince the varieties and cause a progressively productive flexibly chain the executives strategy. With the point of client fulfillment, gracefully chain the executives changes all through an association's inner and outside connections. It additionally synopses the communication of between utilitarian and between hierarchical joining just as coordination. In this unique circumstance, the meaning of incorporation signifies not just the consolidation and procurement of the responsibility for associations yet in addition to finish and very much associated connections to the full flexibly chain process. (Schlege, 1999)

Evolution Stage	Time	Philosophy	Key Driver	Key Performance Metric
I	Early 1980s	Product-driven	Quality	• Inventory turns • Production cost
II	Late 1980s	Volume-driven	Cost	• Throughput • Production capacity
III	Early 1990s	Market-driven	Product availability	• Market share • Order fill rate
IV	Late 1990s	Customer-driven	Lead time	• Customer satisfaction • Value-added • Response time
V	Early 21st century	Knowledge-driven	Information	• Real-time communication • Business intelligence
VI	The present, and future	Customer-driven	Technology (Artificial Intelligence, IoT, and Blockchain)	• Actual orders vs Forecast • Actual production vs Planned

Figure 12. The evolution of supply chain management disciplines (adapted from Hokey, 2015)

7.1.3 Physical and information flows are enabled by AI

Data stream expresses the development of data among individuals and frameworks. Productive and secure data stream is a focal part of the presentation of dynamic, advancements, and correspondences. (John 2017)

7.1.4 Augmentation and automation implementation

By virtue of Understanding of Artificial Intelligence programs, Automation and Augmentation is gigantic for its application in nimbly chain works out. Figure 13 denotes the from beginning to end commercial process overhaul practices and the latent key Artificial Intelligence contraptions that can be useful to the exercises. There are various focal points of utilizing AI

in indicated regular deftly chain procedures that can overhaul effortlessly chain the board. (BIC 2018)

Robotization gear decreases the intermittent or manual activities and establishes the programmed working conditions. Utilizing the computerized machines and gear, human association to control the procedures in a matter of seconds falls. This decreases the venture on the work cost from now on the creation cost. (Elprocus 2020)

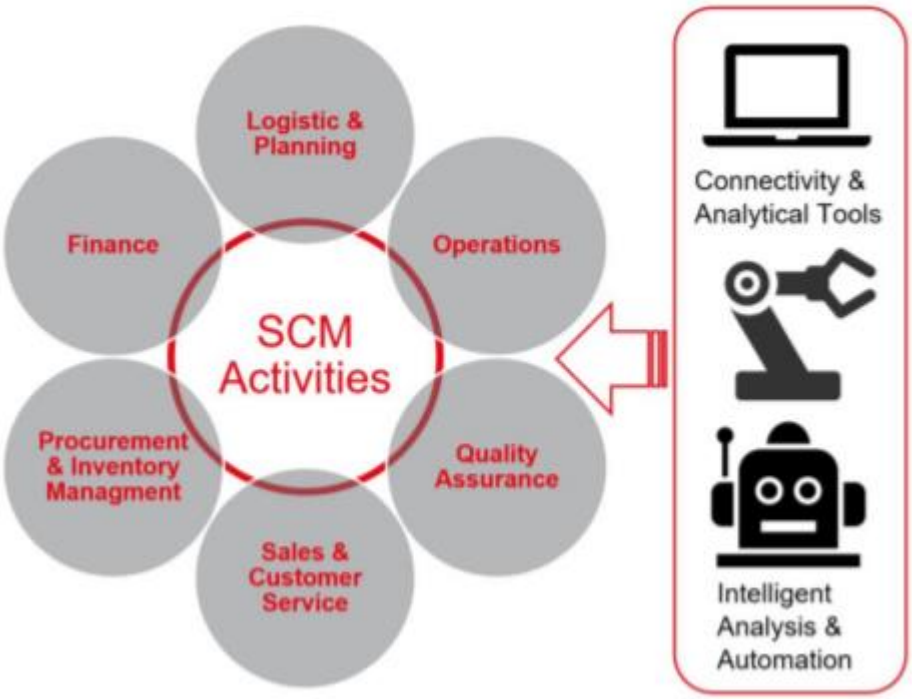

Figure 13. End-to-end supply chain management activities with the possible AI Tools (Adapted from BIC 2018).

7.1.5 AI impact on important aspects

AI enhances the crucial elements of supply chain management. Figure 14 describes the advantages provided by the AI for points. AI can streamline every aspect from demand to inventory to supply with minimal human input. It saves time and reduce error. Having AI access to and analysing the infinite source of data at once will be more comfortable. In less time, it will examine information like weather, traffic, etc., to improve demand and supply. Easier access to data records, along with future predictions and feedback from customers. AI can also help in designing and promoting products. AI can also catalyse the mechanical

process, including transport and logistics. To improve accuracy, reduce human labour cost, and decrease lead times. (Arkieva 2018)

Figure 14. Advantages of AI in supply chain management (Adapted from BIC 2018).

7.1.6 Pre-requisites for AI in supply chain management

To viably actualize AI into flexibly chain the board and for undertaking to attain perfect outcomes, it is central to have these pre-essentials. The flexibly chain will give standard outcomes if pre-requisites are missed during implementation. Undertaking list seven models that are mandatory for Artificial Intelligence achievement, as beneath. (BIC 2018)

1. Admittance to constant information
2. Admittance to multi-basis information

3. Sustenance shopper driven targets
4. The dynamic procedure to think about the expense of progress
5. Incessant, identity-checked and identity-erudition process
6. Interacted dynamic and Accessible devices
7. Operator-Artificial Intelligence collaboration chance

7.2 The impact of artificial intelligence in supply chain management

Man-made reasoning has been created and executed in various zones, particularly in supply chain management. As artificial intelligence has impressed everybody in the field of supply chain management. Amazon and Amer Sports have achieved a lot of benefits with the adoption of Artificial intelligence in supply chain management.

This chapter will compare the data of two companies, Amazon and Amer Sports, using artificial intelligence in supply chain management. Amazon is an e-commerce giant, and Amer Sports is a sporting goods company.

7.2.1 Amazon

The improvement of man-made reasoning is by and by expanding essentially, and this development has improved flexibly chain the executives with new headways. Amazon.com is effectual in by man-made consciousness in e-retail deals of gadgets and different items. The organization additionally introduced figuring administrations, client gadgets, computerized text, and nearby administrations in goods and day by day purchasing. As indicated by statics entryway (FIGURE 15), in 2019, net deals of Amazon.com were close

to 280 billion dollars.

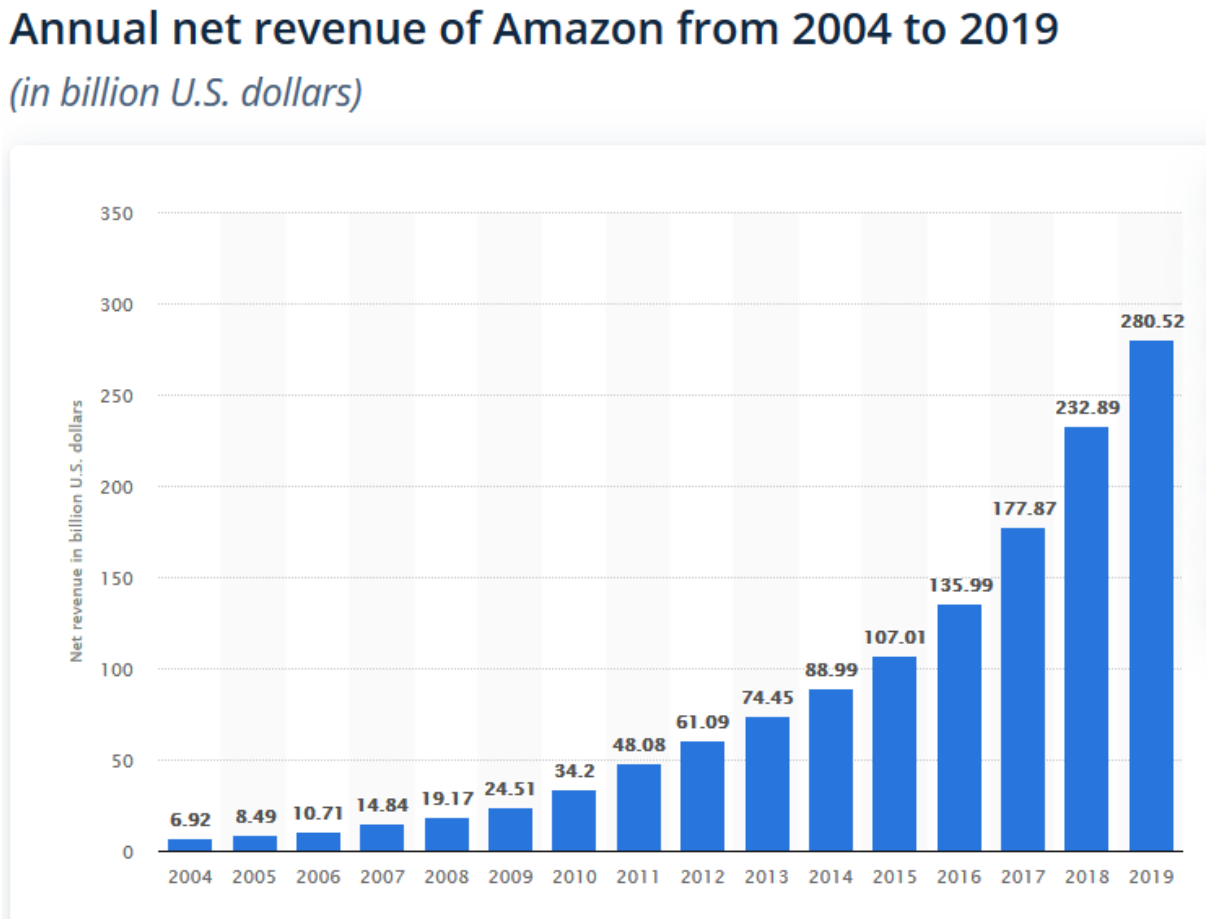

Figure 15. Net sales of Amazon between 2004 and 2019 (Adapted from Statista 2019).

7.2.1.1 Warehouse automation

We can see that eventual fate of Amazon's coordinations will certainly contain man-made reasoning and apply autonomy, however it is an uncovered inquiry when. Computer based intelligence fueled machines will do the vast majority of the work. Scott Anderson, the chief of apply autonomy satisfaction expressed that the start to finish automation of the Amazon distribution center is at any rate ten years away. (The Verge 2019)

A large portion of the organizations are as of now coordinating over to dealing with their distribution center tasks, improving proficiency and decreasing expenses. These robotized distribution centers are increasingly productive, versatile, speedy and strong too. They grant to manage up and accomplish the warehousing items spread and, to keep up best material stream,

with such system it is basic on limit, move the product and recoup the data normally. (Magneto 2019)

The association has quite recently found another strategy for using robots in labour assignments once accomplished by workforces. In 2014, Amazon started captivating off robots to its transport places using machineries from the outset made by Kiva Systems, an affiliation Amazon bought for $775 million and give new name Amazon Robotics. Amazon at the moment has about 100,000 robots in real life around the world. (Wingfield 2017)

Warehouse automation is one of the exceedingly researched fields for the application of AI recognition approaches. Not only research but especially industry is concerned in using advances in AI as well as robotics to mechanise typical warehouse operations such as bin picking. Amazon even has organized a “bin picking challenge” to inspire teams from different universities etc. (Hellingrath 2019)

Figure 16. Robots are working on Amazon automation warehouse. (The Verge 2019).

7.2.1.2 Virtual Assistant

Amazon Echo is a virtual shopping associate apparatus as known as Alexa and can provide the buyers with up-to-date shopping entertainers and encounters. It just needs to distinguish clients' voice to movement the request. As indicated by Statistic Portal, clients are increasingly fulfilled by utilizing Alexa. Shopping on the web and the aptitudes of Alexa have created from just 130 abilities to upon more than 80000 abilities from 2016 to the furthest limit of 2018. (Statista 2018)

Mona is the utmost predominant shopping partner application. To make the application utmost supportive the team combined AI, big data, and human expertise. To make them even more pertinent, the app needs access to a user's email to look at e-commerce receipts and learn partialities, style, size and other details. If a customer doesn't like a firm brand, colour or anything else, there is the choice to offer further feedback. (Masters blog 2017)

The virtual assistant is an element occur in programming that associates with the interface to associate human in a human manner. It is where this product specialist does assignments or administrations for a person. These menial helpers are much of the time known with the name Chatbots. That is are exceptionally proposed for client backing through online visit. (Magneto 2019)

7.2.2 Amer Sports

Amer Sports is a sporting goods company. Its brands are internationally recognized and popular brands and include Salomon, Arc'teryx, Atomic, Peak Performance, Wilson, Suunto and Precor. The organization's dynamic athletic gear, footwear, attire and embellishments upgrade execution and flood the pleasure in sports and open air exercises. Amer Sports' business is steady by its items and expansive arrangement of sports and an event in every single primary market. The proposing of athletic gear, embellishments, attire and footwear protects a wide assortment of sports, including tennis, badminton, American football, golf, b-ball, soccer, crosscountry skiing, baseball, snowboarding, elevated skiing, wellness preparing, cycling, running, climbing, and jumping. Amer Sports methodology stresses splendor in customer driven item creation. Through relentless investigation and improvement, Amer Sports seeks after to progress new and better outdoor supplies that pull in to shoppers and its exchange clients. Items are proposed to improve the presentation of competitors, help them accomplish

their objectives, and offer them with additional pleasure from their development of decision. In 2018, Amer Sports net deals totalled EUR 2,678.2 million. Toward the year's end, the organization employed 9,489 individuals. (Amer Sports 2020)

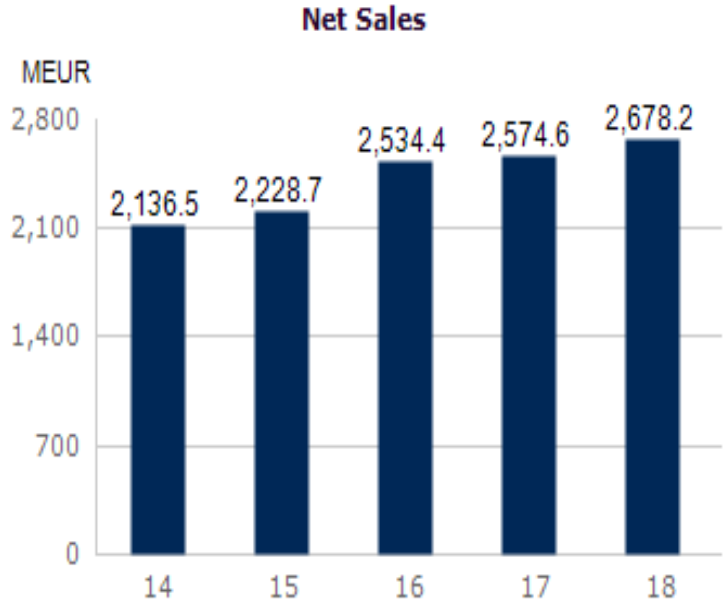

Figure 17. Net sales of Amer Sports 2014-2018 (Amer Sports 2020)

7.2.2.1 Demand prediction for supply chain

Machine learning is used by Amer Sports to enhance the management and predictability of their supply chain. The applied data platform syndicates customer data with sales data and makes it easy to study, envisage and share the vision through the supply chain. Amer Sports tested initial hypotheses prediction of demand is possible to automate through the combination of customer data with sales data from ERP system. Amer Sports is able to trace back the product route by the supply chain, once customers registers the products they bought online. The data also approximations for instance how many items of each product is left in each store and when the stock will be traded. Demand forecasts resultant from the system empowers Amer Sports to be more informations driven from procurement to production to shipping and sale. (Microsoft and PwC 2018)

For instance, if the sports watches provided by Amer Sports are selling mainly well in a sports shop in a specific area, sellers and suppliers will be conversant of this by the data platform. A seller is contacted with the store at the right time and offer more products. This persuades to

the creation of additional sales and confirms the availability of products, which considerably surges net sales. (Microsoft and PwC 2018)

7.2.3 Future of Amazon and Amer Sports

Amazon has gotten one of the most regarded, dreaded and ground-breaking organizations in tech. It has flourished over the last decade. It got the apex position in the field of web based business by really doing what different organizations state they do. Amazon is concentrating diligently on clients and being eager to try, come up short and learn. Current situation of the organization will assist it with conquering the 2020s. (Rosoff 2019)

Amazon will open eight Amazon Go stores in two different cities of USA, company announced in 2019. Checkout is not required in Amazon Go as it is a physical store. Amazon Go stores use deep learning and sensor fusion and computer vision to observe what has been put in to the clients' shopping bag. (Forsdick 2018)

The Company has set heartless focuses for Amer Sports. The brands under Amer Sports have just made exceptionally vigorous market acknowledgment all around. Amer Sports is ranked top three amongst global sports gear brands in various market segments. (Hong 2019)

8 CONCLUSION

The aim of the thesis was to examine the influence of AI in the modern world, particularly in the field of supply chain management. This thesis was also aimed to identify how AI can be applied in supply chain management. The qualitative research method (document analysis) was used for the research.

As a result of research, it is certain that AI has been moving at glance in recent years. AI has created the value chain for the supply chain management. AI is persuading the corporate revenue growth and cost savings in current industries. Companies are using multiple kind of applications in their daily operations. Use of Chat-bots has been found highly effective in procurement. Predictive capabilities are enhancing the demand forecasting. Operational costs are reduced with the use of it. In this modern era, smart warehouses are becoming the special need for the effective supply chain management activities. The companies are increasing revenue due to automated warehouses. Data collection and inventory process is being improved with the adoption of AI technologies. For strengthening the logistics process, genetic algorithms can be used which are improving delivery times and reducing costs. AI is helpful in the identification and solving of big problems in supply chain management. The study shows that the embracing of other AI technologies and machine learning offers new perceptions into a wide range of aspects, comprising warehouse management and logistics, collaboration, and supply chain management. Intelligent robotic sorting and AI-powered visual inspection have brought great facilities in supply chain management.

AI can streamline every aspect from demand to inventory to supply with minimal human involvement. It is also effective in precision planning which will make the supply chain management processes reliable. The role of AI is admirable in logistics, as it is making the transport faster than before. The use of autonomous vehicles in logistics process is saving the money and time. AI provides access to real- time data and multi- source data which can be precisely used by the business organization to revolutionize the process of supply chain management. The studies shows that Amazon has been benefiting a lot due to the advancement of warehouses. Amazon is at zenith position nowadays due to the use of artificial intelligence in the system. The automation of warehouses is the key to the success for the effectiveness of supply chain management. The impact of machine learning and deep learning is quite high in this modern era. Amer Sports is using machine learning to enhance the management and

predictability of their supply chain. Amazon is leading the ways in e-commerce industry. However Amer sports is currently exploring artificial intelligence to increase the revenue and reach at heights. The future of both companies Amazon and Amer Sports looks bright. Overall, it can be concluded that artificial intelligence role is fundamental in development of better supply chain management.

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