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The Role of Artificial Intelligence in Supporting the Supply Chain, According to the Kingdom's Vision 2030

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ABSTRACT

One of the most important areas of application of artificial intelligence is the emerging supply chain management philosophy. It requires an understanding of complex and interrelated decision-making processes and the creation of intelligent knowledge bases necessary to solve common problems, such as synchronizing a series of interrelated but different stages of joint demand planning, forecasting processes in the supply chain, and predicting the final customer's request by exchanging information between multiple supply chain partners and learning from past prediction experience. This ultimately aims to develop the logistics sector so that the Kingdom becomes a global logistics centre in line with current trends. A rule in supply chain management in the Kingdom is to reach Vision 2030 and the importance of the current study is in revealing the most appropriate subfields of the most suitable artificial intelligence for supply chain management applications and identifying areas for the application of potential supply chain management that have not been explored, to serve the goals of the Kingdom's 2030 vision. This is aimed at making the Kingdom a global logistics centre in line with modern trends. In the management of supply chains in the Kingdom to reach Vision 2030, the current study aimed to identify sub-fields of artificial intelligence most suitable for supply chain management applications and then distinguish those sub-fields in terms of their usefulness to improve the efficiency of supply chains. Existing literature have dealt with applications of artificial intelligence to supply chain management with regard to its practical implications and technical advantages. The study reached a number of recommendations, the most important of which is the necessity of conducting workshops on the right foundations of supply chain management and the role of artificial intelligence in its follow-up and seminars between managers to encourage them to employ artificial intelligence to maximize supply chain management efficiency.

Key words : Artificial Intelligence, Supply Chain, Kingdom Vision 2030.

1. INTRODUCTION

In an era of increasing uncertainty of demand, high supply risk, and increased competitive intensity, excellence in the supply chain hinges on the ability of the organization to integrate and organize a full range of inclusive operations to acquire materials or components, and to provide the goods required in the form required, and deliver it to customers [1]. Since this capacity can be enhanced by increasing the clarity of permanent supply chain operations, many leading organizations have tried to enrich their own sources of information and share real-time information with their supply chain partners [2].

Thus, supply chain management has become more information intensive and has focused on replacing assets (e.g., inventory, warehouses and transport equipment) with information, and recognizing the increasing importance of information for the success of the supply chain, which specialists have explored to improve information management and make better business decisions [3]. One of these methods may include artificial intelligence, which has existed for decades, but has not been fully used in supply chain management. Artificial intelligence is generally referred to as the use of computers to think or learn about patterns or learn some behaviours; it also entails the acquisition of knowledge and retention and development of different types of inferences to solve problems in the realities of the solution that exist in the real world [4].

Simply put, the main goal here is to use artificial intelligence in the understanding of human intelligence and the design of computer systems that can simulate patterns of human behavior and create knowledge related to problem solving. Therefore, artificial intelligence must have the ability to learn and understand new concepts, and learn from experience ("subjectivity"), the performance of thinking, drawing conclusions, the implicit meaning, and the interpretation of symbols in context. As a result of this ability, artificial intelligence has been applied successfully in fields such as electronic games, semantic modelling, modelling of human performance, robots, machine learning, data, intelligence, and networks (data, networks) [4].

But one area of potential application of artificial intelligence that has not been explored is far beyond the philosophy of emerging management of the supply chain, which requires understanding complex, interrelated decision-making processes and the creation of intelligent knowledge bases necessary for solving common problems. For example, the use of codecs organizes the processes of collective consideration of requests with expertise and then develops an expert system based on the fundamentals of the selection path of choosing the optimal orders in the warehouse [5].

In an attempt to synchronize a series of interlocking phases with different processes of joint demand planning and forecasting in the supply chain, others have suggested a proxy forecasting system [6].

It has the ability to predict the ultimate client's demand, through the exchange of information between partners of the chain. Multiple supplies and learning from the past forecast experience, as shown in these examples can be some subfields of artificial intelligence such as expert systems and systems based on agents useful for dealing with different aspects of logistics [7] "such as storage, joint demand planning and inventory control" in the supply chain [8]. The objectives of the Kingdom's vision 2030 is evident in the past year from the Ministry of Transport, in the implementation of a strategic plan to make the Kingdom a global logistics platform and a hub, which will lead to an increase in GDP from non-oil resources and the rate of employment. This is an important opportunity to reach the best methods and the latest practices to improve the performance of supply chains and increase efficiency, and to develop the logistics sector, to become a global logistics center in line with modern trends in the management of supply chains in the Kingdom to reach vision 2030 [9].

2. PROBLEM STATEMENT

Classification of the Scope of the study problem was done by Hierarchical Classification of Artificial Intelligence Decision-making at three levels:
(1) Strategic decisions that address long-term issues at the operational level.
(2) Tactical decisions dealing with the medium term, and the mid-level issues of the manager.
(3) Operational decisions that deal with routine problems in the short term.
According to the classification of artificial intelligence literature:
(1) The scope of the problem is a criterion for measuring the extent of supply chain management problems while studying artificial intelligence.
(2) Methodology is a criterion for evaluating theoretical progress in artificial intelligence studies and suitability for specific areas of artificial intelligence for supply chain management applications.
(3) The status of implementation is a criterion for evaluating the practical application of artificial intelligence technology.

Study questions
The current study attempts to find answers to the following questions:
(1) How wide and deep are the supply chain management problems that AI attempted to address?
(2) What is the extent of theoretical progress of artificial intelligence studies and the appropriateness of specific subfields of artificial intelligence for supply chain management applications?
(3) What are the limits of practical application of artificial intelligence technology for supply chain management?

A. Importance of the study
The importance of the current study is summarized in revealing the most appropriate subfields of artificial intelligence most suitable for application in supply chain management and determining the fields of AI application suitable for managing potential supply chains of technology to explore what serves the goals of the Kingdom's vision 2030. On the basis that artificial intelligence is known for its ability to think like humans, to act like human beings, to think rationally, and to act rationally; therefore, with regard to these features, artificial intelligence can be classified in a number of subfields (Bansal: 306). These fields include:
(1) Artificial Neural Networks and Cohort Theory ("Human Thinking").
(2) Machine learning, expert systems, and ("human behavior").
(3) Mysterious Logic ("Rational Thinking").
(4) Proxy-based systems ("Rational behavior").

B. The Objectives
This research paper aimed to:
(1) Determine which subfields of artificial intelligence are most appropriate for applications to manage supply chains and then distinguish those subfields in terms of their usefulness for improving the efficiency of supply chains.
(2) Evaluate existing literature on applications of artificial intelligence to supply chain management with regard to its practical implications and technical advantages.
(3) Develop the current Hierarchical Classification of Artificial Intelligence and classify according to the fields of application, supply chain management, scope of problem, and methodology.
(4) Summarize trends in AI research and identify areas of application to manage potential supply chains for exploration.
(5) Discuss future prospects.

C. The Approach
The current study uses the descriptive approach through the survey study, so that information is gathered about the opinion of study sample members, on the role of artificial intelligence in supporting the supply chain, according to the Kingdom's Vision 2030.

3. THE CONCEPT OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is known as the ability of a digital computer or computer-controlled robot to perform tasks normally associated with intelligence [4] Artificial intelligence (AI) is known as a wide-ranging branch of computer science that is interested in building intelligent machines capable of performing tasks that require human intelligence [4].

In other words, artificial intelligence is a multidisciplinary science with multiple approaches, but developments in machine learning and deep learning have created a paradigm shift in almost every sector of the technology industry.

The term is frequently applied to projects to develop systems with distinct intellectual processes for humans, such as the ability to think, discover meaning, generalize or learn from past experience. Since the development of digital computers in the 1940s, it has been proven that computers can be programmed to do extremely complex tasks - for example, discovering clues to mathematical theories or playing chess - with great ingenuity. However, despite continuous progress, in the speed of computer processing and memory capacity, there are no programs that can conform to human flexibility in broader areas or tasks that require a lot of daily knowledge. On the other hand, some programs have achieved the performance of human and professional experts in conducting certain tasks, hence artificial intelligence is found in this limited sense in various applications such as diagnostics, engines search for computer and voice recognition or handwriting.

A. What is intelligence?

Each behavior of a human being described as simple is attributed to intelligence, while the behavior of complex insects is not considered an indication of intelligence, so what is the difference? When female wasps return to their burrow with food, they consider depositing them first on a threshold, verify if intruders are inside their burrows, and only then, do they carry their food inside. Here the true nature of the instinctive behavior of the wasp is revealed if the food is transported a few inches from the entrance to its hole in the interior, the situation here must express intelligence, but what is clearly absent from us here in the case of wasps is that it is not intelligence but the ability to adapt to new conditions [8].

Psychologists generally do not distinguish human intelligence with only one feature, but intelligence is distinguished by combining many diverse capabilities. Research in artificial intelligence has focused mainly on the following components of intelligence: learning, thinking, problem solving, cognition, and the use of language.

B. Problem solving

Problem solving, particularly in Artificial Intelligence, can be described as a systematic search through a range of possible actions to reach a predetermined goal or solution. Problem-solving methods are divided into 1) special purpose

and 2) general purpose. The specific purpose method is specifically designed for a particular problem, and often exploits very specific features of the situation that presents the problem. In contrast, the general method applies to a wide range of problems, and one of the general purposes used in artificial intelligence is final analysis of the means.

- It is to reduce the difference between the current situation and the final goal step by step, the program chooses actions from a list, until the goal is reached. Many different problems have been solved by artificial intelligence programs, some examples include finding a successful step (or sequence of moves) in a board game, eliciting mathematical guides and manipulating "virtual objects" in a computer-generated world [2].

C. How does artificial intelligence work?

What is artificial intelligence in essence? Artificial intelligence is an attempt to duplicate or simulate human intelligence in machines. The overall goal of artificial intelligence has raised many questions and discussions, to the point that there is no single definition of the field universally accepted [10]. The main limitation in defining artificial intelligence as just "smart building machines" is that it does not actually explain what artificial intelligence is?

D. What makes the device smart?

In the book "Artificial Intelligence: A Modern Approach", authors Stuart Russell and Peter Norvig addressed the question by unifying their work on the topic of smart factors in machines, with this in mind, artificial intelligence is "a study of factors that receive perceptions of the environment and perform actions", Norvig and Russell explored four different approaches that have historically defined the field of artificial intelligence [11].

1. Human thinking, 2. Rational Thinking, 3. Behaves Humanely, and 4. Behaves Rationally
The first two ideas relate to thought processes, while other ideas deal with behavior. Norvig and Russell focused specifically on logical factors that work to achieve the best results, noting that "all skills needed for the Turing test also allow the worker to act rationally" [11].

4. SUPPLY CHAIN

A supply chain is defined as a network between the company and its suppliers to produce and distribute a specific product to the final buyer, this network includes various activities, people, entities, information and resources. A supply chain also represents the steps it takes to deliver a product or service from its original condition to the customer [12].

Supply chains are developed by companies so that they can reduce costs and remain competitive in the commercial landscape, and supply chain management is an important process because an improved supply chain leads to lower costs and a faster production cycle [13].

A. Understanding supply chains

Supply chain includes a series of steps involved in obtaining a product or service for the customer. The steps include the transportation of raw materials and their transformation into finished products, the transportation of these products, and their distribution to the end user. The entities involved in a supply chain include producers, sellers, warehouses, transportation companies, distribution centers and retailers [14].

The elements of the supply chain include all jobs that begin by receiving an order to meet customer demand. These jobs include product development, marketing, operations, distribution networks, financing, and customer service.

As mentioned above, supply chain management is a very important part of the business process. There are many different links in this chain that require a lot of skill and experience, when the supply chain is managed effectively, it can reduce the company's overall costs and enhance profitability. If one of the links break, this will affect the rest of the chain and can be costly to the company.

B. Supply chain management versus business logistics management

The terms supply chain management and business logistics management - or simply logistics - are often used interchangeably. Logistics is one of the different links in the supply chain, and logistics specifically refers to the part of the supply chain that deals with planning and controlling the movement and storage of goods and services from its point of origin to its final destination. The Logistics Department begins with raw materials and ends with delivery of the final product [15].

Successful logistics management ensures that there is no delay in delivery at any time during the chain and that products and services are provided in good condition, which in turn helps reduce company costs [16,17].

C. Major supply chain characteristics

1. A supply chain is a network between a company and its suppliers to produce and distribute a specific product or service.
2. Supply chain entities include producers, sellers, warehouses, transportation companies, distribution centers, and retailers.
3. Jobs in the supply chain include product development, marketing, operations, distribution, finance, and customer service.
4. Supply chain management leads to lower costs and a faster production cycle [13,18].

D. How the flow of manufacturing costs works

Manufacturing cost flow refers to the process of using materials and labor to complete the final product that can be sold to a customer. The supply chain management system can reduce the cost and complexity of the manufacturing process, especially for a manufacturer that uses many parts [6].

For example, a garment manufacturer will first transfer raw materials to production, such as textiles, zippers, and other parts used in the garment industry, then the manufacturer will bear the labor costs of operating the machines and performing other business using the materials. Once the items are complete, they must be packaged and stored until they are sold to customers.

E. Trusted suppliers

Effective supply chain management process requires reliable suppliers, this means that it should produce a high-quality product that meets the manufacturer's needs, and the product is delivered on time [5].

F. Supply chain and deflation

The development and increased effectiveness of supply chains play an important role in curbing inflation, and with increased efficiency in transporting products from A to B, the costs of doing so decrease, thereby reducing the final cost to the consumer. While deflation is often considered negative, supply chain efficiencies are examples of the few cases where deflation is good, and as globalization continues, supply chain efficiencies are becoming more improved, keeping pressure on input prices [7,19].

5. METHDOLOGY

The researcher used the descriptive method to collect and classify data and facts. In addition to data analysis which also includes a degree of interpretation of these results, methods of measurement, classification and interpretation were used with the aim of extracting conclusions and significance. Thereafter, generalizations were made about the phenomenon and the study, in order to know the role of artificial intelligence in supporting supply chain, according to the kingdom's vision 2030 in line with the point of view of information technology experts in the city of Jeddah.

A. Research tools

The researcher designed a questionnaire in line with the point of view of experts in information technology in the city of Jeddah. It consisted of 12 paragraphs, and the answer to them was as follows: (always - sometimes - never). The researcher controlled the required adjustments, and was informed with the proofs of the questionnaire indicating that they are very stable.

B. Research community

The research sample consisted of (20) male IT experts, and they were chosen randomly.

C. Statistical methods

Data processing was done using the SPSS program.

6. RESULTS AND DISCUSSION

Based on the standard deviation and variance, it can be seen that there is homogeneity between the opinions of the sample about the extent of supply chain management problems that artificial intelligence can deal with.

It was found that 85% supported the observation that supply chain management problems can only be solved by AI programs and sometimes 10% rejected it, which shows that it is very important for AI to be used to solve the problems of the working environment in supply chains.

With regard to the extent of supply chain management problems that allow studying artificial intelligence (supported by 85%), it should be noted that there are problems with supply chain management that cannot be resolved through AI programs, 10%, while 1% outrightly rejected artificial intelligence. Table 1 and table 1 shows the results.

However, regarding international professional dealings, the importance of artificial intelligence for the professional performance of supply chain management in the global sample cannot be over emphasized. The overwhelming rate of 85% supported the realization of the effectiveness of forecasting and planning demand through artificial intelligence in the management of supply chains. This confirms the feelings of importance and effectiveness in forecasting and planning demand through artificial intelligence management. Figure 1 shows bar graph.

The use of artificial intelligence in logistics services to innovate and improve our business strategy by 30%, demonstrates the positive and effective impact of the uses of artificial intelligence in the effectiveness of business strategies in terms of supply chains.

Table 1: Statistics Results

Statistics					
		I use artificial intelligence software and applications to solve all supply chain management problems	The effectiveness of forecasting and demand planning can only be achieved through AI applications in supply chain management	International professional supply chains can be managed without any AI applications	I notice many supply chain management problems that can only be solved with artificial intelligence programs
N	Valid answer	20	20	20	20
	Missing	0	0	0	0
Standard deviation		.523	.550	.523	.510
Variance		.274	.303	.274	.261

Table 2: Statistics Results for Supply Chain

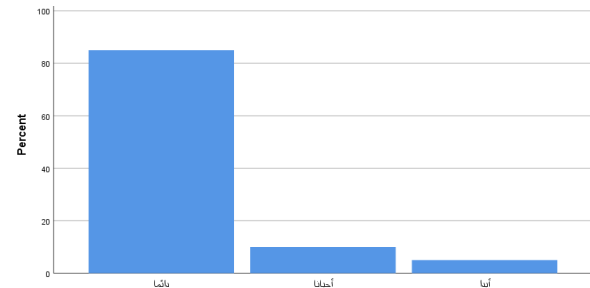| A valid answer	Always	17	85.0	85.0	85.0
	Sometimes	2	10.0	10.0	95.0
	Never	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Figure 1: Bar graph of results

7. CONLCUSIONS AND RECOMMENDATIONS

The first study question: what is the extent and depth of supply chain management problems that artificial intelligence study has tried to deal with? The researcher used percentages and to answer this question and the research reached a depth with clear and robust supply chain management problems that AI is useful in solving.

The second question states the extent of the theoretical progress in studies of artificial intelligence and the suitability of certain sub-fields of artificial intelligence for supply chain management applications. Applications of artificial intelligence meet the functions essential for supply chain management and evolution innovations in AI which cover the needs of changing supply chains and encourage the uses of AI in logistics innovation processes and improve working strategy. Smart database is considered as one of the most useful AI applications in the effectiveness of supply chain management.

The third question is: what are the limits of the practical application of artificial intelligence technology to supply chain management? The AI application was effective and of great benefit in the management of purchases within the organization. It was also emphasized that artificial intelligence facilitates and organizes product life cycle management as well as the benefit of artificial intelligence in positive supply chain planning and its effectiveness in order management.

The researcher has recommended conducting a number of future studies as follows:

1- Artificial intelligence innovations in inventory management.

2- Artificial Intelligence and its role in customer management.

3. How to develop the human element in its interaction with artificial intelligence in supply chain management.

4. Focus on the advantages and barriers of using AI in supply chain management and how to address them.

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