



VIGILADA MINEDUCACIÓN

Application of artificial intelligence in the international transport of goods.

Mateo Flórez Gutiérrez

Juan José Briceño Gaitán

Esumer University Institution
Faculty of International Studies
Medellin, Colombia

2020



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Mateo Flórez Gutiérrez

Juan José Briceño Gaitán

Undergraduate work submitted to qualify for the degree of:

International Business Professional

Tutor:

Juan Gonzalo Arboleda

Geological Engineer

Esumer University

Institution Faculty of

International Studies

Medellin, Colombia

2020

THANKS AND DEDICATION.

Effort and dedication is the secret to achieve good results, even more when things are done with love, passion and discipline.

We first thank God for allowing us to live an unforgettable memory and to be able to complete our professional training; then, we extend our most sincere thanks to the teachers who were involved in this whole journey and who every day made an effort to reach us with their vast knowledge, for the excellence in the pedagogies and for the professional human quality.

Finally, we would like to thank our parents, family and friends who were involved and believed deeply in our dreams by giving their unconditional support.

We will remember all the efforts and we will be forever grateful with each one of you.

Summary

This research starts from a general framework to reach the specific, was carried out by reviewing documentary information, articles, publications, texts; through a fundamentally qualitative exercise with the aim of contextualizing the reader on the application of artificial intelligence in the international transport of goods, highlighting and identifying that it is a relatively new or little studied topic and seeking that this thesis serves as a pioneer or motivation for future research on the subject, Throughout the work it is possible to characterize the way the field under study has been evolving, the advances and developments, its application in international freight transport and the advantages and disadvantages, allowing to discover as a more relevant result that there are more positive aspects of such application and the benefits it can represent in everyday life.

Keywords:

Artificial Intelligence, International Freight, Goods, Logistics, Supply Chain

Resumen

La presente investigación parte de un marco general para llegar a lo específico, se llevó a cabo mediante la revisión de información documental, artículos, publicaciones, textos; mediante un ejercicio fundamentalmente cualitativo con el fin de contextualizar al lector sobre la aplicación de la inteligencia artificial en el transporte internacional de mercancías, resaltando e identificando que es un tema relativamente nuevo o poco estudiado y buscando que esta tesis sirva como pionero o motivación para futuras investigaciones sobre el tema, a lo largo del trabajo es posible caracterizar la manera como ha venido evolucionando el campo objeto de estudio, los avances y desarrollos, su aplicación en el transporte internacional de mercancías y las ventajas y desventajas, permitiendo descubrir como resultado más relevante que son más los aspectos positivos de dicha aplicación y los beneficios que puede representar en la vida cotidiana.

Palabras Clave:

Inteligencia Artificial, Transporte internacional, Mercancías, Logística, Cadena de Abastecimiento

Table of Contents

Summary.....	- 3 -
Abstract.....	- 4 -
Key Word:.....	- 4 -
Table of Contents.....	- 4 -
List of Tables:.....	- 5 -
Introduction	- 7 -
State of the art	- 9 -
Problem Statement.....	- 11 -
Objectives	- 13 -
General Objective:	- 14 -
Specific Objectives:	- 14 -
Justification	- 14 -
Framework of Reference	- 15 -
Theoretical Framework	- 15 -
Methodological Framework.....	- 23 -
Scope.....	- 24 -
Artificial Intelligence. Period 1990-2019	- 25 -
Artificial Intelligence and its application in transport.....	- 28 -
Main contributions of the artificial intelligence in the international transport of goods. -	31 -
Conclusions	- 33 -
Recommendations	- 34 -
Bibliography.....	- 35 -

List of Tables:

Table 1...	13
Table 2...	23
Table 3...	28

Introduction

The present work is elaborated to receive the title of Professional in International Business by the University Institution ESUMER, it is made with the purpose of deepening in the application of the artificial intelligence in the international transport of goods, mainly all the advances determined in a defined margin of time are presented, starting from an analysis of authors who have investigated on this topic and the interest to learn on the same one, that has been of little study in Colombia, because the lack of infrastructure, investment and investigation makes that this one in comparison with other countries is slower.

Artificial intelligence allows different programmed systems to have the ability to perform different activities automatically and provide accurate and quality results, executed through the combination of various algorithms, the creation of software and human intervention, resulting in a concept known as "intelligence of things" which is basically the capacity that a machine has to perform a function without human supervision.

Currently, most companies in the world are including the tools offered by artificial intelligence to streamline and automate processes and thus improve productivity rates and reduce costs in their production and value chain, representing a significant competitive advantage for their customers and users as the case may be, in international markets. Such inclusion throughout this research will focus on companies dedicated to the international transport of goods.

Artificial intelligence is the result of the mix between science and technology that brings together different tangible and intangible elements and the human capacity to create autonomous systems through it; mainly its relationship with the international transport of goods, understanding the latter as the action of transporting goods from a geographical point called origin, to a cross-border point called destination, through different means of transport and different modes of shipment. Its applicability has no limits and that is why, in this

research, there is interest in studying it because it will contribute a grain of sand to future research on this important topic.

The main motivation to carry out the research, as it will be shown during its development, is to expand the concept and perception of Artificial Intelligence applied to international freight transport, a concept that has been studied in Colombia, so it revolutionizes the way in which daily tasks, mostly work tasks, are performed through the constant integration of technology, machines, robotics and real-time communication.

Knowing this, the expectation emerges to understand the concept with its theories applicable to the subject of study, its evolution, its application to international transport of goods, its advantages and disadvantages, to create a theoretical basis for future research. This was done through a thesis that was elaborated through an applied study, of exploratory, descriptive character, developed from a documentary evaluation, analysis and interpretation of the information, to identify and contextualize different aspects of the application of the artificial intelligence in the international transport of goods.

It stands out as a relevant result that there are more positive aspects identified than negative ones and that these results depend on the correct use and application, taking into account that it can represent a great threat to the human labor force in the productive sector of each country and many people and companies can perceive it as a promoter of unemployment, however, not only depends on the ethical and responsible application by large and medium companies of the concepts understood throughout this work and the human quality of the employers who seek to contrast the human-machine relationship, but also of the future professionals who are called to be in constant search of knowledge so that the mixture generates optimal results and is not considered a threat to the work situation that has been experienced in recent years.

State of the art

Leyton, Rodriguez and Correa's research (2015) carried out under the methodology of interviews (qualitative) to eight (8) large organizations, showed that the motivation to be more optimal every day and the stress situations were factors that led people to make use of artificial intelligence in all its processes, to significantly improve their style and quality of life, because, through this it is possible to perform continuously activities that for humans are somewhat tedious.

The advance of international trade in the world economy, the phenomenon of globalization and the purpose of maintaining a competitive advantage was the trigger for Barragán Codina & Vela Quintero (2015) will carry out research, with the aim of discovering how ICTs influence, -according to Aparicio (2009), The TICS are a set of technologies that allow the acquisition, production, storage, processing, communication, recording and presentation of information, in the form of voice, images and data contained in signals of acoustic, optical or electromagnetic nature. Barragan & Vela, in summary, seek to answer questions about the way business evolves thanks to the incorporation of technological developments in the productive and daily processes; a relevant point for companies and the value chain is the transportation of goods, Lopez Garcia (2016) expresses that integrated transport systems (ITS) are quite important, including all land, air and sea means, since they allow the movement of people and the transport of goods from one place to another. The purpose of his study was to try to determine in time how to help take preventive measures to reduce noise, pollution and congestion, in urban environments and highways, to reduce the amount of gaseous pollutants emitted in the case of sea and air transport and to increase the efficiency and performance of transport systems, as well as to save on infrastructure by decongesting terminals and in order to maintain good operational fluidity. For all these reasons, early detection of congestion and other factors is a fundamental issue in the field of ITS research,

which is of great help for both general and freight transport.

Later Galindo Ramirez (2017), In his research, he emphasizes the artificial intelligence applied in organizations and companies, its contribution in the productivity and differentiating factor for the correct decision making that promotes the success and the development, was carried out under a qualitative methodology that allowed to give clarity to the investigation, concluding finally that the artificial intelligence influences directly in the strategic decision making of the companies, its contribution through intelligent machines and systematized processes facilitates the production, but being careful not to displace the human work force.

Making an approach to the article made by Abeledo (2018), "The disruption came to transport and could benefit emerging countries", he stresses that the success of transport companies in an era where a concept of "intelligent cities" is emerging, must focus on ITS (intelligent transport systems); the purpose is to use communication technologies and the combined application of information in the freight sector, which includes the incorporation of autonomous, electric and remotely controlled vehicles in the transport sector.

In addition, this same author Abeledo (2018), Puts in participation Professor Tony Seba, from Stanford University who in his book "Cleaning Disruption of Energy and Transportation", brings up the concept of "disruption" which, according to the RAE, means "sudden breakage or interruption". To give an example: "It happened at the beginning of the last century when the car replaced the horse- drawn carriage. Or the disruption generated by the appearance of the digital camera, the cell phone, the Airbnb hosting service or the Uber application".

For Professor Seba, topics such as batteries, electric cars, autonomous vehicles, carpooling and solar energy are important for the development of intelligent transport and allows us to understand, moreover, that once these five topics achieve convergence there will be a new disruption to what he calls "The disruption of transport 2020-2030".

Not less important and continuing the chronological order, it is decided to bring to the present work the investigation of Fajardo de Andara (2019) is based on analyzing the effective application of artificial intelligence to improve the competitiveness of companies, with emphasis on the economies of Asia, Europe, North America and Latin America, was carried out by collecting research that predict the impact of artificial intelligence cross with a data wrap analysis (DEA) to measure the effectiveness, this allowed to demonstrate that some

countries, including Colombia, are more effective in the application of artificial intelligence, while others, like USA, are less effective, it also showed that promoting innovation is key to economic growth.

Finally, Martínez Aguiló (2019) in his work he mentions the fourth industrial revolution and robotics for industry, he starts from some retrospectives and explains that with the evolution of technology processes are not replaced, they are improved and optimized, they contribute to improve production strategies and he acts as a facilitator for the functions of a company, the digital transformation and its contribution to learning as well as its impact on productivity. The research was conducted with the purpose of identifying the negative labor impacts of the application of expert systems and industrial robots in organizations, being these two, part of the most often used artificial intelligence devices and perceived as a possible threat to human labor.

Problem Statement

Over the years, brought together in the concept of "artificial" intelligence, technological developments, automation, wireless communication, robotics and innovation, have abruptly accelerated their participation in the business environment, a notable case of this is a company called MECALUX, a pioneer in the logistics sector worldwide, this company is based on integrating the most advanced technologies by creating automated warehouses through software which identifies Artificial Intelligence as

Artificial intelligence gives systems the capacity to make intelligent decisions and execute automated operations without any human intervention. It is based on a combination of three elements:

- *Algorithms, ordered sequences of operations that are applied to carry out a task in an optimal way according to the prevailing conditions.*
- *Software, which dictates the precise instructions for the execution of each task by the hardware.*
- *Machine Learning, that is, developments that allow the machines themselves, based on the recorded history and the repetition of operations, to learn and improve the processes gradually.*

Currently, most companies in the global framework are making use of the facilities and tools offered by artificial intelligence to optimize processes, improve productivity, the infrastructure of their management and information systems and be competent in markets that are naturally aggressive.

Being part of the global phenomenon that has emerged and is gaining strength, represents for all branches that are associated with this concept, including international transport, radical changes to submit to the trends that globalization imposes, hence the need to adopt the concept "artificial intelligence" and apply it to each stage of the value chain with emphasis on international transport.

For transportation companies, being at the forefront of developments can mean being willing

to assume changes and face situations that may arise. The greatest concern that artificial intelligence and its application brings is undoubtedly the replacement of human labor by automated processes in different industries; Another situation that arises from this phenomenon is an unbalanced competition thinking about those companies that are not able to invest in the necessary developments that make them as competent as those that are. Another additional situation that emerges is the fact of having to invest large amounts of money and that represent the risk of being lost because they do not achieve the expected objectives.

It seems inevitable to escape the wave of artificial intelligence, however, international transport companies could opt for this alternative and take the decision to enter into this innovative dynamic, the improvements in information systems and technological developments of the new revolution, in order to find a high point of efficiency, service and competitive advantage in the global transport environment, being responsible and attending to the variables and changes that may arise in the transition.

Based on the above, the question then arises: how has artificial intelligence been integrated into international freight transport over the last 30 years?

TABLE 1

CONCEPT	SUMMARY
ARTIFICIAL INTELLIGENCE	<ul style="list-style-type: none"> • Optimize processes, improve productivity, the infrastructure of their management and information systems and be competent in markets that are naturally aggressive.
	<ul style="list-style-type: none"> • Trend that globalization imposes.
	<ul style="list-style-type: none"> • Concern about the impersonation of human labor.

Source: own elaboration

Objectives

General Objective :

Characterize the evolution of the application of artificial intelligence in international freight transport.

Specific Objectives:

To observe the development of artificial intelligence for the period 1990-2019

Showing the application of artificial intelligence in international freight transport
1990-2019

To point out the advantages and disadvantages of the application of artificial intelligence in international freight transport.

Justification

The main motivation for the research is to expand the concept and perception of Artificial Intelligence applied to international freight transport. In theory, it is a concept that revolutionizes the way people and goods are transported, incorporating technology, machines, robotics and real-time communication, a necessary condition to adapt to the current process of globalization and be at the forefront to successfully respond to the demanding competition.

In addition to the above, the fourth industrial revolution has as its pillar technology and innovation, issues that are undoubtedly linked to artificial intelligence and that finally awaken the need for both people and companies to accept the changing world full of new challenges and thus try to respond to the challenge of reducing uncertainty about the way business, transport and companies evolve thanks to the application of this technology.

Framework of Reference

Theoretical Framework

For the development of this work, it is necessary to mention some sources, most of which are theories, in order to be able to obtain bases that support the object of study and that generate validity to what is intended to be exposed; these are directly related to artificial intelligence, machinery, communication and, again, artificial intelligence applied to the transport of goods and its relationship with the levels of competitiveness of a country.

Bearing this in mind, two theories and a model known as the Logistics Performance Index (LPI) are described. The first theory is recognized as the Theory of Constraints (TOC), which is based on the fact that it generates value, in this case focused on the logistics transport chain; the second theory, Theory of Competitiveness, is related to the "problem posed by the creation of the factors necessary for viable development processes in underdeveloped economies" Suñol (2006, p. 189) and the LPI (Logistics Performance Index) as a tool for consulting and analyzing global logistics performance. The relevant theories for the research work will then be defined.

The Theory of Constraints is a methodology at the service of management that allows to direct the company towards the achievement of results in a logical and systematic way, contributing to guarantee the principle of business continuity. TOC has its origin in programs based on linear programming, being used initially in the factory environment. It was developed by the Israeli physicist Eliyahu Goldratt, who began to analyze business problems almost by chance. Aguilera, C (2000, p. 53).

This theory considers that the technological systems, are interconnected and have a common objective or purpose, constitute the intentionality of achieving a goal, "from the study of minor parts (subsystems) that are interrelated with each other in the fulfillment of their objectives" Aguilera, C (2000, p. 54)

This theory is related to the efficiency and effectiveness that a company has, and under the object of study of this research, it corresponds to the competitiveness that countries present given their installed logistics infrastructure, "The idea of integration contained in the Theory of Constraints (TOC) is based on the fact that the value for the client is not generated in a certain place, but throughout the entire logistics chain" Portal Gestipolis (2016)

Under the previous statement, the competitiveness of countries is largely responsible of the entire supply chain that includes the production, transport and marketing of products imported and exported from the countries and because it is not in optimal conditions to offer the same service in the shortest time possible, the costs for idle time and transfers increase considerably.

An analysis in the synchronization of the components of logistics is required, which is provided by this theory, since the constraints involve the planning, organization, evaluation and control of complex systems to optimize the functioning of the business process.

TOC has been applied in major companies such as General Electric, General Motor, Ford Motor Company, Intel, CIA, the Israeli Air Force, the US Navy, among many others. In 1999 more than 5000 organizations had applied TOC, their turns have been industries, banks, universities, hospitals, etc. Goldratt (2005) quoted in Alfonso Arias (2015, p. 33). with which it has been possible to verify its application in different work environments and functions such as human resources, marketing, sales, production, finance, projects, distribution, etc. In every system there are restrictions, because there are not unlimited resources, but there are physical restrictions and those that are generated by policies or paradigms. In the case of the research study, these are physical restrictions.

At the national level, the prevailing idea is that a sustained increase in investment and trade liberalization is necessary for companies to become more competitive. The analysis of the concept of competitiveness from the perspective of different authors will show that it is much richer than commonly understood and that achieving real sustainable competitiveness over time requires the implementation of a variety of policies to overcome the obstacles to achieve it.

Understanding the concept of competitiveness in all its dimensions is important given its value in explaining and addressing the problems of creating the factors necessary for the development of viable growth processes, or at least in disadvantaged economies. Conducted by Porter (1990), The theory of competitiveness did not intend to study the internal conditions of underdevelopment, allows to analyze these limitations and propose strategies for their improvement. An example of this elaboration is found in the theory of competitiveness developed by the theorists of ECLAC, using a structural approach.

When the determinants of competitiveness are explained and the need to create productive factors is discussed, it points to a problem long discussed in the development literature, but only recognized by some trends. The theory of competitiveness makes the idea generally accepted that there is a need to create productive factors and skills in underdeveloped economies.

Furthermore, this task must be assumed by governments and all sectors interested in national development. The concept of competitiveness must be rescued in all its complexity, since its management in all its dimensions is especially important when designing inclusive development strategies with a positive impact on the social and economic processes of the countries.

According to Porter, there is a two-way relationship between productivity and the population's standard of living. In fact, productivity affects wages and profits, as well as income distribution, environmental quality, levels of political government, and the freedoms and rights of individuals. In turn, productivity defines wage levels and capital gains. When competitiveness is understood solely as sustained growth in investment, it is no longer important to raise the standard of living of the population and insert it into the development process.

For Porter (1990), Who was the first person to contribute and formulate a theory in relation to competitiveness described it as "the ability to sustain and increase participation in international markets, with a parallel increase in the population's standard of living. The only solid way to achieve this is based on increasing productivity. Quoted in Suñol (2006) Productivity is a term that includes many factors, such as efficiency among the productive systems of nations, which is directly related to the human factor, the net labor capital, the

investment made by the corresponding entity.

This theory contributes to research in its integral structure, that is, between countries, to be more competent, to have an organized infrastructure, to allow differentiation and economic growth, to receive income that, when redistributed in society, generates a higher per capita income than in neighboring countries, leading to a better quality of life. According to Suñol (2006, pág. 181), In the case of the United States, competitive capacity affects infrastructure, financial markets, consumer sophistication, the national productive structure, the rate and structure of investment, the scientific and technological infrastructure, and other no less important elements such as education, institutions and culture.

This is an important and representative factor for the development plans that are responsible of the national government, since its attention is focused on the improvement of the current logistic capacity, consequently, the country will have an advance in the internal processes and will be able to offer import and export services in shorter times. It can be more competitive compared to other countries.

Logistics, on the other hand, is understood as the supply chain that plans, implements and controls the flow of procedures for the effective and efficient storage and transportation of goods, including services and related information from the point of origin (production) to the final point (final customer) in order to meet consumer requirements. Mentzer, DeWitt, Keebler, & Min (2001) Therefore, it defines logistics as the process for a country to provide such inputs as processes in customs and infrastructure to meet the objectives proposed in national development plans and thus be able to have a more competitive position in the international market.

Logistics has been working for a long time, its beginnings were in the military context and after the Second World War, began to be taken into account in the business world and emphasize its importance throughout history, this has evolved from the management of the flow of materials to integrated logistics, but for the interest of this work, understanding the concept of logistics, it is necessary to reduce it to the logistics of international supply and its influence on the new globalized economy for the benefit of businesses.

For Ballou (2004) in its book Supply Chain Management Logistics defines supply logistics as a set of functional activities that are repeated many times along the flow channel, starting from the acquisition of raw materials, converting them into finished products and adding value for the final consumer. In general, a single company is not able to control its entire product flow channel, from the source of raw materials to the points of final consumption, an aid between local and international companies that translates into globalized cooperation with the purpose of finding benefits in the supply chain.

The Logistics Performance Index works with a series of analysis components that were chosen based on recent theoretical and empirical research and the practical experience of logistics experts involved in international trade. These components are:

- Customs, understood as the efficiency of the customs and border management office.
- Infrastructure, that is, the quality of the commercial and transport infrastructure. The ease of organization of shipments, with respect to the competitive prices handled by each nation and the time of management.
- The quality of logistics services, in relation to the competence and quality of transport logistics, shipping and customs agents.
- The tracking and tracing of shipments, the Just in Time or Opportunity, which is the frequency with which the shipments reach the recipients within the expected or planned delivery times.

The LPI uses standard statistical techniques to aggregate data into a single indicator that can be used for cross-country comparison. World Bank (2018), as explained below.

To determine the best logistics performance worldwide, the World Bank has been conducting an analysis since 2007 in which 160 nations are evaluated on six items and in eight significant markets to determine performance in the range of "very low" (1) to "very high" (5), customs, infrastructure, international shipments, quality and competence in logistics, tracking and just-in-time or opportunity, called the Logistics Performance Index that allows nations to see the opportunities and challenges they face in that area, World Bank Data (2018)

According to the Colombian Ministry of Transport (2018) The Integrated Transport Systems (ITS) are a wide range of information systems and electronic and communication technologies (wireless or wired) that improve road safety, mobility, quality of life of citizens, and increase productivity and competitiveness of the country, through the inclusion of advanced technologies in transport infrastructure and vehicles.

The three main components of STI are:

- Infrastructure: which includes all the development of the roads and which brings as a trend the modern sensor and signaling systems.
- Vehicles: autonomous, electric, remotely controlled
- People: as an important factor of mobility and that stimulate the interest in creating developments in transport, in order to achieve a more efficient, sustainable, accessible and safe circulation of goods.

Taking into account that the developments in the field are considered part of the artificial intelligence, it allows an applicability in different sectors, we see according to publication of the IDB (2017), Some applications of the ITS:

- Sustainable transport: electronic payment of transport services, information to the traveller about the status of his shipment in real time and availability in the reservations.
- Interurban transport: traffic control system, vehicle demand management.
- Cargo and Logistics: Fleet management, route design, remote control operations, tracking under GPS-Chip systems, border crossing automation.
- Road safety: Traffic and incident management, advanced vehicle safety systems.

In addition, it adds that the cost of implementing ITS applications is often relatively low compared to the cost of building additional infrastructure and has four benefits associated with such implementation:

- Environmental: Reduction in the emission of polluting gases.
- User satisfaction: efficient mobility management.
- Safety: reduction in the number of accidents and loss of goods.

- Economic: reduction of costs in the value chain, reduction of travel times and increase in productivity.

Although, taking the components, the different applications and the benefits of the integral systems of transport these affect in the improvement day by day of the positive changes that can be appreciated in the environmental scope and the security in the transit of the goods in the different means of transport, being more economic for the companies, additionally it generates that the final client feels more satisfied.

TABLE 2

CONCEPT	SUMMARY
THEORY OF CONSTRAINTS	Methodology that allows to direct the companies towards the achievement of results, guaranteeing the business continuity.
	Related to the efficiency and effectiveness that companies have.
	Generate value along the entire logistics chain.
	Synchronously analyzes the components of the logistics.
THEORY OF COMPETITIVENESS	Sustained increase in investment and trade liberalization
	It allows the analysis of the companies' limitations and proposes strategies for their improvement.
	There is a need to create productive factors and skills in underdeveloped economies
	The capacity to sustain and increase participation in international markets, with a parallel increase in the population's standard of living
LOGISTICS	Part of the supply chain that plans, implements and controls the flow of procedures for effective and efficient storage and transportation
	Supply logistics is a set of functional activities that are repeated many times along the flow channel, starting from the acquisition of raw materials, converting them into finished products and adding value for the final consumer
LOGISTICS PERFORMANCE INDEX	Analysis components chosen based on theoretical and empirical research and the experience of experts: Customs, infrastructure, shipment management, quality in transport logistics, Just in Time or Opportunity.
	It allows the identification of challenges and opportunities in the logistic aspects.
STIS	Integral transport systems.
	It integrates information, technology and communication systems to improve road safety and mobility, increasing the quality of life, productivity and competitiveness of the country.
	Main components: infrastructure, people, vehicles

	Associated benefits: environmental, user satisfaction, safety, economic.
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Source: own elaboration

Methodological Framework

Research Method

The development of the present work starts from a general framework to reach the specific, it reviews information from documents, articles, publications and texts about the origin and evolution of artificial intelligence, to later analyze its applicability in the international transport of goods, to finally highlight the contributions of this that mean advantages in the current context of international trade, in a fundamental component of logistics.

Research focus

The research exercise carried out was fundamentally qualitative, explained by the need to establish the conceptual bases for the application of artificial intelligence in international freight transport, since this is a subject that is in the initial stages of study both in the world and in Colombia.

Type of study

The work "Application of the artificial intelligence in the international transport of goods", is an applied study, of exploratory, descriptive character.

Research methodology

The project is developed from a documentary evaluation and performs an analysis and interpretation of information, to characterize the evolution of the application of artificial intelligence in international freight transport

Techniques and instruments for collecting information

The method of information and data collection consisted of a documentary review of articles, texts, publications and specialized reports, among others; thus allowing to deepen and collect high quality information. The review of scientific databases and information from recognized

authors in the field of study is highlighted. The antecedents and evolution of artificial intelligence, as a key element for the good performance in the development of research.

The analysis of the information is based on the fact that it is true and verifiable, in which value judgments are avoided as much as possible, always giving it a correct and objective use, highlighting some of them such as Google Scholar, Scielo, among others.

Scope.

This work aims to establish the importance of the integration of Artificial Intelligence with the international transport of goods in order to determine what are the most important contributions.

This research is intended to collect and provide a new source of information that will contribute to future research on this topic. The period of time on which this research will be based will be from its discovery in 1956 to 2019, starting with its description, followed by its progress through history and how it has evolved and taken on such importance, in addition to its main contributions to the international transport of goods.

Artificial Intelligence. Period 1990-2019

Artificial intelligence (AI) is a broad area of computing that makes machines work like a human brain. It is used to address problems that are difficult to clarify using traditional computer techniques. AI was first discovered in 1956 by John McCarthy, but did not achieve its goals (Sadek, 2007), and the lack of technological innovation made it less promising. From 1960 to 1970, researchers explored AI through the knowledge-based system (KBS) and artificial neural network systems (ANN) (Sadek, 2007). KBS systems are computers that provide advice using predetermined rules, according to the knowledge presented to them by humans. ANNs, on the other hand, are multi-layered neural connection systems modelled on the human brain that have been used in medicine, biology and engineering for language translation, law, manufacturing, etc. (Yegnanarayana, 1999, pág. 476). During that period of time, interest in AI decreased due to limited applications of NNA and lack of data until the 1980s (Minsky & Papert, 1969).

Since 1980, much research has been done to minimize predictive error through a method called gradient descent. This method is known as a retro propagation algorithm for NNA training and was applied to solve problems in different domains using few hidden layers. Data availability has introduced the concept of automatic learning as a subcategory of AI. Automatic learning involves coding computers to behave like a human brain rather than teaching them everything. Therefore, AI uses these uncertainties and models a relationship

between cause and effect of different real-life scenarios by combining available data with assumptions and probabilities for better analysis. Transportation problems become a challenge when system and user behavior is too difficult to model and predict travel patterns. Therefore, AI is considered a good option for transport systems to overcome the challenges of increasing travel demand, CO2 emissions, safety issues and environmental degradation. These challenges arise from the steady growth of international freight traffic due to the increasing number of emerging companies, especially in developing countries. For example: in Australia, the cost of congestion is expected to reach 53.3 billion, as the population will increase to 30 million by 2031. (Aguilera C. I., 2000) creating the need to discover new strategies to counteract this future problem.

AI does not refer to one technology, but to a broad set of diverse approaches, methods, and technologies, which to different degrees and in different ways exhibit intelligent behavior (such as logical reasoning, problem solving, and learning) in various contexts.

AI can be hardware based (for example, devices such as robots) or software based (for example, Google Maps). Some of the main AI technologies are described in recent EPRS (European Parliament Research Service) reports on "How Artificial Intelligence Works" and "Understanding Artificial Intelligence". These briefings group the key AI technologies into three sections: Symbolic AI, data-based AI and future technologies. Symbolic AI includes systems where a human creates a sequence of logical rules, transcribed into algorithms, that machines can follow to decide how to act in a given situation.

Data-based AI combines automatic learning techniques with technologies used to search and analyze large amounts of data. Future technologies include several developments where AI could show an even wider range of human capabilities (such as creativity and intuition), or where AI outperforms humans. AI is helping to make all modes of transport safer, cleaner, smarter and comfortable, and can be applied to vehicles, infrastructure, drivers or transport users, and the way they interact to provide a transport service. AI helps to detect market trends, identify risks, relieve traffic congestion, reduce emissions of greenhouse gases and air pollutants, design and manage transport, and analyse travel demand and pedestrian behaviour.

According to the EXPANSION magazine website (2018) Experts agree that 2019 will be the year of artificial intelligence, which promises to revolutionize all sectors and that is the key to extracting the potential of the hyperconnected world. The digital transformation is at the top of the agenda for 2019 of large companies. Although these processes go far beyond the adoption of technology, since they demand cultural and organizational changes, it is true that technology has a primary role as a lever for change. Artificial intelligence (AI), robotics, Internet, blockchain, cloud computing, and cyber security are some of the most relevant trends at the moment.

Table 3

CONCEPT	SUMMARY
Artificial Intelligence.	It is a broad area of computing that makes machines work like a human brain.
	First discovered in 1956 by John McCarthy
	Machine learning involves coding computers to behave like a human brain instead of teaching them everything.
The KBS systems.	Knowledge-based systems
	They are computers that provide advice using predetermined rules, according to the knowledge presented to them by humans
The NNAs.	Neural connection systems designed in several layers, modeled from the human brain that have been used in medicine, biology and engineering for language translation, law, manufacturing, etc.

Source: own elaboration

Artificial Intelligence and its application in transport.

Transport is one of the sectors where AI has been most successfully applied, opening up completely new levels of cooperation between various road users. Around the world, car manufacturers, technology companies and research groups are exploring artificial intelligence technologies to develop automated vehicles for use in commercial and personal transport. (Sadek, 2007)

These means of transport are based on a variety of sensors (such as GPS, cameras, radar), in combination with actuators (devices that transform an input signal into movement), control units and software. Some of these technologies only take over certain driving functions (such as parking or tracking), others are intended to completely replace the human driver.

Artificial intelligence technologies that take over certain driving functions are already widely available on the market, while fully automated vehicles are being tested (even for package delivery) in a limited number of situations and driving areas. In general, it is more complex to test automatic vehicles in urban areas, as there are many different actors, complicated road systems and infrastructure (intersections, traffic signs, etc.), where the vehicle needs to predict much more movement signals that are often unpredictable. (Aguilera C., 2000)

While the main driver is driven by a human, the following drivers can only be present in case of complex traffic situations (such as traffic circles) or unexpected incidents, instead of actively driving. In the future, it is expected that drivers' responsibilities to follow will be progressively reduced, until eventually they are no longer necessary. Although manufacturers of heavy goods vehicles are already testing the distribution of trucks in several European Union countries, more tests are still needed for the distribution of multi-brand trucks in more

complex traffic situations, to verify that safety requirements are met. In addition, AI algorithms are widely used on shared economy platforms offering road transport services.

The advance that will have the most impact would undoubtedly be the increase in safety on the roads and the reduction of accidents. AI is used to record the movements of drivers through the cameras installed in the vehicles, thus detecting the mood of the driver and for

example if he or she nods or is distracted by the cell phone. It is a step towards the intelligent tires that indicate the inflation pressure and internal temperature of the tires as presented by Toyota in 2018, on the other hand, there is the development of new applications such as the case of Truck GO, whose purpose is to establish a relationship between carriers and cargo generators to prevent trucks are traveling empty and thus reduce environmental impacts or the RoadTracer application that allows to trace routes with greater accuracy and make changes in real time due to traffic congestion or accidents on the road, without losing track of the monitored vehicle and finally the transport in autonomous vehicles for both goods and people.

For example, the Uber short-haul carpooling platform uses artificial intelligence techniques in all aspects of its services, from corridor/driver matching to route optimization. AI technologies are also applied in road traffic management, which helps to analyze traffic pattern, volume and other factors. These in turn can provide drivers with the fastest route information to relieve any traffic congestion that may have formed. Artificial intelligence technologies also help maintain traffic flow through traffic signals and traffic lights that turn in real time to meet traffic flow demands.

Artificial intelligence is not new to the aviation industry which, according to a 2018 International Air Transport Association (IATA) report, has already been using it in various parts of the business and throughout the value chain for decades. However, we are now entering a new era in which AI capabilities are reaching heights that will have a major impact on how aviation business is conducted. Bernal (2006). The use of AI in air traffic operations is in its infancy.

Progress in automation and computing power, using technologies associated with machine learning and data analysis models, are being used to improve the management of increasing air traffic volume.

The IATA report notes that the development of Unmanned Aerial Vehicle Systems (UAS) and UAS traffic management systems, using improved computer capabilities, will create new opportunities to improve existing traffic management systems, separation standards and airspace planning design. Galindo (2017). What is known as advanced business intelligence

can substantially change the way airlines conduct business in marketing and sales, distribution, pricing and fleet management.

A high-potential application of automatic learning is the translation of historical and real-time ideas about customer behavior into tactical changes in real time (by adjusting the content of the website presented to the customer). Other uses include sentiment analysis in social networks, which involves predicting customer needs based on their behavior in social networks.

Another area where AI can make a difference either in terms of process or speed is ground assistance. Examples of high potential use cases include security controls, aircraft movement operations (backhaul and towing), aircraft changeover operations (fuel supply, supply, loading and unloading, de-icing and anti-freezing) and ground transportation on the ramp (passengers, baggage, cargo and mail). The AI can also facilitate a change towards airport security without interruptions, since it can digest large amounts of data both in historical and real time and detect anomalies by implementing guide robots in the airports that attend to the doubts of the users, the use of facial recognition systems and biometric security, in addition, the user can have knowledge of his shipment through a system of cameras located in the hold of the aircraft that allows him to have control of the handling of his cargo and avoid looting or contamination of the shipments.

Over the last twenty years, maritime and inland waterway transport has undergone major developments. To name but a few of the trends that have shaped it, ship traffic has become more dense, raising the risks to maritime safety and calling for advances in maritime surveillance. The additional increase in container traffic has required adaptations to port terminals and better connections to their area of influence. Increasing ship sizes have amplified the pressure that ships exert on ports and their cities, Berzal (2017).

Awareness of environmental issues has forced adaptation to more ecological standards in the context of fierce international competition within the global maritime industry. In this scenario, technologies of digitization, internet of things, big data and automation include smart ports with the development of applications for sensors. Currently in Colombia a new system of seals is being implemented to the goods that leave the port to perform a Multimodal Transit Operation (MTO) that consists in monitoring the traffic and tracking the goods in real

time, even if the goods suffered some kind of movement during the journey, in addition to providing information on the status of the vehicle in another case of the motor vessel or vessels provides information as accurate as fuel levels, travel times, average speed and status of the crew, such control through sensors also contributes to avoid problems of congestion in maritime terminals, without leaving aside that development of autonomous motor vessels are a game changer. Having penetrated various parts of the industry to a varying degree, the common feature of these technologies is data generation. On the basis of this data, new tools, including artificial intelligence, make it possible to analyze the information and obtain information that facilitates decision-making, in particular by helping to improve safety, energy efficiency and optimize logistics.

Main contributions of the artificial intelligence in the international transport of goods.

The artificial intelligence has many fields of action that allows it to be very dynamic, practical and welcomed by most of the international transport companies of goods in their processes, some of them are

- **Prediction:** Prediction is based on Machine Learning which, as explained at the beginning, is based on collecting historical data in order to be incorporated into the machines to learn, identify and guide by means of algorithms the process assigned to it, carried out more efficiently.
- **Manage routes:** this application is for land transport, which provides real time information on traffic in different cities, allowing you to identify the range of hours when you can be more productive.
- **Automation:** Automation is one of the main and most important fields where AI is applied. It allows the transfer of repetitive functions that can be complex or

monotonous for humans, to a system of intelligent machines or robots, performing in a constant and effective way the same pre-established function.

The application of artificial intelligence in international transport offers many benefits, when AI is applied in international logistics processes it generates an added value which is reflected in the coordination and handling of the goods, providing real time location and knowing the status of the goods, making it easier for the customer to know the status of their goods, according to Gonzalez Correa (2015, p. 225) Coordination between shipments, vessels and trucks allows for the elimination of dead time in transit, more accurate cargo traceability and reduced storage time via shorter transit times. If synchronization reaches significant proportions, just in time operations can be reached and thus reduce inventory.

AI is designed to provide added value regardless of the type of technology and process in which it is applied, according to Leporati, Marcelo; Morales, Manuel (2019) It is important to establish what the needs are and to define which are the areas or activities in the chain that are potentially "quick wins", that is, which are the technologies within the AI that allow to obtain the maximum benefit with the least investment in costs, time, capacities and resources, so that the companies and processes can generate more income with less resources.

Although applying AI to a company requires a considerable investment, it tends to be an uncertainty that entrepreneurs want to avoid, since making the investment represents entering into an arduous study of the company's performance and productivity, it can mean success or failure and in the worst case scenario, bankruptcy of the companies.

In the case of Colombia, AI has not been sufficiently studied at present and therefore puts the nation at a disadvantage with the rest of the countries in many aspects, such as logistics, technological advancement, efficiency, and productivity. It is very important to start getting more involved with this issue because it is a key tool for the future, not only in the international transportation of goods but also in different aspects of life where the constant evolution of the human being motivates him to surround himself with technological, controlled, automated, robotic systems and find there a strength for everyday life.

Conclusions

Humanity is constantly evolving its daily activities, most of the processes become repetitive and tedious but fortunately the technological advances have allowed to transfer many of the daily tasks to the machines, robots and computerized systems, as a result of the evolution of artificial intelligence, in a wide period of time (1990-2019), the AI concept has extended its margin of application and quickly it has incursioned in what you do daily, it is a fact that people use intelligent devices every day, either the mobile device or remote control, over the years has increased the relationship between human and machine, resulting in a facilitator and a positive progress but depending on the perspective can be a threat, however, this study allowed to identify that there are more positive points and that the progress can be very helpful to society in general, that also includes the supply chains where it is included the international transport of goods and the production process of enterprises.

The international transport of goods is a key element for the development of companies and their growth, although the fact of a large company to globalize represents a competitive advantage, take advantage of each link in the supply chain can even increase that advantage, emphasis is placed on the transport of goods because much of the investment of companies is directed to the logistics coordination of operations, it is possible to identify that with proper

practice, relying on technological tools, it is possible to predict and project a good management of the processes, throughout the period covered by this study we note that it is increasingly easy to access such tools and that many of them are an integral part of the entire supply chain, which represents a significant benefit because in the long run the relationship will be closer between what comprises the artificial intelligence applied in international transport of goods and logistics processes of companies.

In short, it is inevitable to escape from artificial intelligence and the advances that it proposes, it is a fact that makes part of our lives and that depends on each person to apply it in his life in an appropriate way, we manage to determine multiple advantages that can be perceived in a positive way and to take refuge in search of the wished benefit, in conclusion the application of the artificial intelligence to the international transport of goods is not a threat and if it is a key advance for the development of this sector and the companies of our country.

Recommendations

Due to the lack of information, it is recommended that more research be done on the subject. It is a relatively new topic and an alternative to go deeper, starting with education in schools.

For older people it is more difficult to relate to this environment so a good alternative is that companies train their staff and make known the possibilities that artificial intelligence represents in their daily processes.

The lack of adequate infrastructure represents a delay for Colombia in technological advances, the absence of new generation roads significantly affects the application of artificial intelligence in the transportation of goods, an investment in the country's roads would significantly improve productivity, reduce costs, transit times, vehicle congestion and allow AI to be applied more widely.

Make use of the tools available in order to optimize work and achieve better results in the shortest time possible.

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