OmniaScience

Journal of Industrial Engineering and Management
JIEM, 2022 – 15(4): 566-586 – Online ISSN: 2013-0953 – Print ISSN: 2013-8423
https://doi.org/10.3926/jiem.3410

Determinant Factors for the Strategic Management of the Supply Chain of the Angolan Cement Industry

Pedro Campos[1], Carina Pimentel[2], José Lopes[3]

[1]*DEGEIT, Aveiro University (Portugal)*
[2]*DEGEIT, GOVCOPP, Aveiro University (Portugal)*
[3]*ISEG, Lisbon University (Portugal)*

pecampos001@yahoo.com.br, carina.pimentel@ua.pt, diaslopes@iseg.ulisboa.pt

Received: November 2020
Accepted: June 2022

Abstract:

Purpose: Considerable portion of the countries' income is invested in the construction and reconstruction of houses, shopping centers, schools, universities, research centers, pavements, bridges, dams, among other infrastructures. Cement is, therefore, a priority consumer good in all modern societies. Given its importance, it becomes relevant to understand, the way its distribution takes place and the determinant factors that influence the supply chain management, because only with this knowledge can appropriate management strategies be developed that support the operation of the cement industry and ensure an agile and/or efficient structure that facilitates the distribution of the products from this industrial sector.

Design/methodology/approach: This article presents the results of qualitative research, based on a narrative literature review and interviews, which aimed to identify the determinant factors and barriers in the management of the Supply Chain of the Angolan cement industry.

Findings: The main outputs of this research are the identification of a set of determining factors of the strategic supply chain management, and a set of determining factors of the strategic supply chain management of the Angolan cement industry, as well as some barriers that have hindered the supply of cement in the Angolan market.

Research limitations/implications: This research has been among the first to identify the determinant factors and barriers to the strategic management of the Angolan Cement Industry Supply Chain. Besides the contribution of this research, some limitations are identified, to be addressed as future research. Since this study is grounded in interviews to some of the Angolan professionals linked to the Cement Supply Chain, the results present their perspectives and might lack generalizations. Also, because the research is focused on a particular geography, its findings may not apply to other Cement Supply Chain belonging to other geographies.

Originality/value: The identification of determining factors and barriers that have hampered the strategic management of the supply chain of the Angolan cement industry is a fundamental step that can help public and private entities in making decisions that aim to improve the supply chain of the Angolan cement industry.

Keywords: cement, supply chain management, strategic management, determinant factors, barriers, Angolan cement industry

To cite this article:

Campos, P., Pimentel, C., & Lopes, J. (2022). Determinant factors for the strategic management of the supply chain of the Angolan cement industry. *Journal of Industrial Engineering and Management*, 15(4), 566-586. https://doi.org/10.3926/jiem.3410

1. Introduction

Different authors approach the concepts of the supply chain (SC) and SC management in different ways, but they all coincide on viewing their objective as satisfying the needs of customers. According to Fahimnia, Luong and Marian (2008) and Lambiase, Mastrocinque, Miranda and Lambiase (2013), SC is a network composed of suppliers and customers that involves material and financial resources, workforce and information and communication technology (ICT) to convert raw materials into finished products and later distribute them to final customers. Typically, a SC consists of several levels and business functions/process represented by suppliers, factories, warehouses, retailers, marketing, planning, purchasing, production, distributors, customers and reverse logistics. Generally, suppliers have different options to purchase raw materials, as there are different production options, different distribution options and different modes of transport to allocate products to consumer markets.

According to Ballou (2001), logistics is vital for all companies. The mission of logistics is to allocate goods and services in the right place, at the right time and in the desired condition. The configuration of a company's logistical network involves levels of customer service, location of facilities, number of warehouses, selection of modes of transport, and usually focuses on three main objectives related to each other: minimizing costs, maximizing profit and ensuring an adequate level of service to the customer. According to Mishra, Patnaik and Mishra (2019), these aspects are all closely related and mutually dependent on each other in the SC. However, during the execution of activities some instability may occur due to natural or man-made factors. Thus, resilience of the human factor is fundamental to restore balance.

Usually, the objectives that are pre-established when setting up a logistical network may not be achieved at the same time. During the execution, conflicts arise that negatively interfere with the process. For example, minimizing costs while maximizing service levels are conflicting goals. Distribution isn't an easy task. It can increase the trade-off between the activities to be managed. Some authors disagree with the idea that supplying the customer with minimum cost is a logistical goal for companies. For example, Kotler and Armstrong (2012) report that no logistics system can maximize customer service and at the same time minimize distribution costs. To maximize service, it is necessary to have high levels of stock, speed, flexibility and many other services that increase the distribution costs. According to Gambardella, Rizzoli and Zaffalon (1998), sales require the ability to predict customers demand by and to plan carefully the distribution of products to consumers.

In the same line, Lestari, Kurniawan, Ismail, Mawardi, Nurainun and Hariadi (2022) refers that the SC strategy involves several business units that interact to achieve the organizations' objectives. Currently, the competition in the global market encourages business units to collaborate in carrying out business processes. Modibbo, Singh, Hassan and Mijinyawa (2021) states that most real-life decision-making problems involves multiple objectives, demanding multiple solutions to achieve the objectives.

Whereas according to Singh and Modgil (2020), the most crucial aspect in selecting suppliers for a cement plant is selecting the right criteria which may vary from company to company and industry to industry. The increasingly dynamic market environment has put cement architectural plants under pressure to improve quality. However, this is only possible by getting it from the right supplier.

In the past several authors in different sectors have used different criteria in their research. For example, Nteta and Mushonga (2021) by observing the backwardness of the South African cement industry regarding green supply chain management, conducted a study to identify the barriers and significant factors of implementing a green chain in their cement industry using the analytical hierarchy process. The authors identified financial performance,

competition and organizational style as limiting factors and high capital costs with the main barrier of green management implementation in that industry.

Thus, given the great importance that the cement distribution problem in Angola assumes, both as a determining element of the context and as a factor for cost reduction and profitability recovery, it is fundamental to understand the strategic management of the supply chain of the Angolan cement industry (ACI), as well as the strategic management of the cement industry supply chain in general.

This study was driven by which factors are most important for the strategic management of the SC of the Angolan cement industry (ACI), by understanding their nature and the relationship between them. Thus, the research questions that guide the study are as follows:

1. What are the determining factors in the strategic management of the SC of the ACI?
2. What is their nature and how do they relate to each other?
3. What barriers can undermine the strategic management of the SC of the cement industry (CI)?

Therefore, to achieve this objective, this research was focused on a qualitative approach, based on a literature review and data collection through semi structured interviews conducted with entities linked to the SC of the ACI (applied between October and November of 2019). To this end, an interview protocol was developed and applied, which aimed to identify the perception of the respondents on the determinants and barriers in the strategic management of the SC of the ACI.

The main discovery of this study is that it is the first articles to address and identify a set of determining factors and barriers that have hindered the strategic management of the SC of the cement industry. Likewise, it is the first study on SCM in the ACI.

There are few articles addressing the management of the cement SC and the deficit of more literature renders the understanding of the problem more difficult. After Newmark (1998), who addressed the issue of transportation in the management of the CI, the most complete and focused work in the management of the cement industry supply chain (CISC) is the one from Agudelo's (2009). Agudelo (2009) acknowledged that there are still contributions that can be made in this area. In their study on the SC management in the German CI, Noche and Elhasia (2013) mention that in the 21st century, improvements in the construction of infrastructures forced the CI to focus more on the management of its SC. Due to the existence of few articles that deal with the management of this SC, Noche and Elhasia (2013) identified Agudelo (2009) as the first author to deal extensively with this problem. Subsequent studies were based on Agudelo (2009), Noche and Elhasia (2013) and Elhasia, Noche and Zhao (2013).

Based on the result of their studies, it was noted that the management of the CISC presents complexities that must be carefully studied to clearly understand their nature. Thus, this qualitative research focuses on four fundamental pillars (see Figure 1) to understand the strategic management of the CISC.

Figure 1. Research structure

This article is organized into seven sections. In section 1, an introduction to the topic under study is made, the study's objectives and research questions are presented, and the need for the research carried out is explained. Section 2 introduces the theme of strategic SC management. Section 3 presents the research methodology. In section 4, based on the bibliographic in which the research based on, the determining factors in the strategic management of the SC are presented. Section 5 presents the determining factors in the strategic management of the CISC. Section 6 presents the results of the interviews conducted with the entities of the SC of the ACI. Finally, Section 7 presents the final considerations.

2. Strategic Management in Supply Chains

According to Caris, Macharis and Janssens (2008), each decision-maker faces planning problems in different time horizons. In the long run, strategic planning involves the highest level of management and requires capital investments over time horizons. Decisions at this level of planning affect the network design and infrastructure. In the medium term, tactical planning aims to ensure efficient and rational distribution of existing resources to improve the performance of the system. In the short term, operational planning is carried out by local management in a dynamic environment, where the time factor plays an important role. Liu and Papageorgiou (2013) consider that the performance of the SC depends essentially on the production capacity, distribution, costs, responsiveness and level of customer service.

Papageorgiou (2009) refers that the management of the SC is a complex task, mainly due to the size of the SC and the uncertainties. According to the same author, in a competitive environment, depending on the strategic, tactical or operational level, more than one of the following decisions are made: 1) number, size, and location of production sites and warehouses; 2) decisions on production planning and scheduling; 3) network connectivity (suppliers, factories, warehouses and markets); 4) management of stock levels and their replacement; and 5) modes and types of transport to be used. According to Cohen and Roussell (2005), strategic management generates innovations in the configuration of the SC. The authors identify five critical components (problems) in SCs strategic management: operations strategy; outsourcing strategy; distribution channels strategy; customer service strategy; and asset network. These five critical components will be addressed in the subsections below.

2.1. Supply Chain Operations Strategy

In a SC, there are at least a set of suppliers, a set of manufacturing companies and a set of consumers. Companies adapt their strategies according to the market environment and circumstances. According to Cohen and Roussell (2005), decisions on how to produce goods and services form operation strategies that incorporate stock orders, outsourcing, installation and implementation of low-cost production strategies. These critical decisions influence the entire SC. According to Wieland (2021), most theories that have dominated supply chain management (SCM) take a reductionist and static view of the SC and its management, promoting a constant search for resources and cheap labour. As a result, the supply chains tend to be operated without much concern for this wider environment. Cohen, Cui, Ernst, Huchzermeier, Kouvelis, Lee et al. (2018) refer that global strategies have become extremely important to dynamic changes in economies. Currently, labour costs no longer dominate production site decisions; instead, the companies make decisions based on trade-offs combining a variety of factors.

2.2. Outsourcing Strategy

According to Meng, Yao, Nie and Zhao (2018), the decision to outsource depends on some key factors, such as economies of scale, capacity, market-entry, product substitution, demand risk, among others. The question arises: when should a company outsource and when should it carry out its activities or processes itself? According to Oláh, Sadaf, Máté and Popp (2018), the key factors are trust, technology development, choice of strategies, service portfolio and diversification based on profitability. Companies outsource some activities to improve the efficiency of their core functions. According to Cohen and Roussell (2005), outsourcing decisions start with an analysis of the company's key competencies and SC knowledge. For example, what is the company really good at? What areas of expertise can make the company strategically distinguishable?

2.3. Distribution Channel Strategy

According to Cohen and Roussel (2005), the channel strategy deals with decisions on how to distribute products in market segments. Buijs, Danhof and Wortmann (2016) emphasize that cross-docking is a distribution strategy in which products are transported from suppliers to customers without long-term storage. It aims to reduce stock levels and distribution times by creating a "continuous" flow of products from suppliers to customers. According to Langevin and Riopel (2005), it is up to the management team to decide which channels to use to distribute products to consumers. However, the effective management of the logistical activity requires serious decisions by managers because the organizational nature of logistics is broad and complex. According to Vieira, Veloso, Dias,

Pereira, Oliveira, Carvalho et al. (2019), supply chains are complex and dynamic networks, connecting different businesses and dealing with activities such as production, shipping and delivery. Therefore, the use of distribution channels to better serve customers presupposes the existence of good infrastructure that goes according to the three types of communication lines or routes by which customers can obtain the products of the cement industry: railways, roads and by sea.

2.4. Customer Service Strategy

Concerning customer service, currently and due to the use of ICT, the customer is getting better informed about the products offered on the markets, their characteristics and prices. With this information, the customer becomes more demanding and easily impatient. For the customer, logistics should add value, especially speed.

According to Cohen and Roussell (2005); Chan, Ngai and Moon (2017) and Nuševa and Maric (2017), the customer service strategy must be based on the volume of business, its profitability and the understanding of what customers need. It is important to explore the main antecedents and consequences of agility at the strategic and operational levels of the SC. Organizational flexibility is a critical aspect for the agility of the SC.

2.5. Asset Network

The network determines the location, number and capacity of the facilities, as well as the product flow through it. The configuration of the logistics network cannot be changed in the short term due to the construction costs.

According to Cohen and Roussel (2005), based on factors such as business volume, customer service, tax advantages, supplier base, local rules and labor costs, companies choose one of the following three network models: 1) global model – production is done in one place for the global market; 2) regional model – production is done mainly in the region where the products are sold; 3) country model – production takes place in the country where the market is located.

According to Sarkis and Talluri (2002), Papageorgiou (2009) and Gunasekaran, Yusuf, Adeleye and Papadopoulos (2018), the network and the planning determine how to produce, distribute and store to respond to requests and forecasts efficiently. Globalization and technological advances have connected companies and countries like never before, providing an opportunity to improve management. Decision-making requires ensuring that long-term issues are covered with strategies even if short-term risks can cause barriers.

3. Research Methodology and Method

According to Green, Johnson and Adams (2006) and Ferrari (2015), there are three types of literature review: unsystematic/narrative review (NR), systematic review (SR) and systematic review (meta-analyzes). SR has guidelines (for example, PRISMA statement). NR has no recognized guidelines. The quality of an NR can be improved with SR methodologies, aiming to reduce bias in the selection of articles. According to Yuan and Hunt (2009) and Hochrein and Gloch (2012), the NR mix opinions and theories hence, they do not follow a systematic procedure of selection and evaluation of the literature. It addresses several questions on a topic, selects the literature and provides a qualitative summary. According to Green et al. (2006), NR is based on a short review, selected and focused on only a few articles. The author summarizes the results of the research in an article. However, the first step in writing an NR is to conduct a preliminary literature search to see what other works in the area of interest have already been published.

According to Gasparyan, Ayvazyan, Blackmore, and Kitas (2011), it is important to provide information about the databases accessed, terms, inclusion and exclusion criteria. According to Green et al. (2006), it is difficult to review all articles related to the topic of study. Thus, keywords must be defined that find synonyms in the databases. According to Ferrari (2015), the keywords and inclusion and exclusion criteria must be defined comprehensively so that they select related articles and exclude unrelated ones.

Based on these approaches, searches were carried out on Scopus, Web of Science, Science Direct, and Google Scholar, using the following keywords: "logistics and distribution", "supply chain management", "strategic supply chain management", "cement supply chain" and "determinant factors in the management of the cement industry".

The following filtering criteria were used: (1) publication years: 1990-2020; (2) document type: articles; (3) source type: journal; (4) language: English. All extracted articles were manually analyzed in the light of the following inclusion and exclusion criteria: analysis of the title, research area, keywords used, and abstract including the contributions and main results.

In order to answer the research questions identified in this research, the focus of this work was centered on interviews with entities in the SC of the ACI. NR aimed to identify factors that the literature considers determinants for the supply chain management (SCM) and for the CISC management. From the four databases, 676 articles were extracted, 117 duplicates were organized and excluded. The remaining 559 articles were analyzed and 360 were excluded because they are not focused on the strategic management of the SC/CISC. The remaining 199 articles were again subjected to a more in-depth analysis which resulted in the selection of only 65 articles.

Gill, Stewart, Treasure and Chadwick (2008) state that there are three fundamental types of interviews (structured, semi-structured and unstructured) that can be made in an in-depth approach to the problem, given that these types of interview allow the researcher to ask questions that are not included in the interview protocol. According to Alshenqeeti (2014), qualitative data can be collected through surveys or interviews. However, in comparison with the survey, the interview has the advantages of resulting in a deeper understanding of the problem under study, of searching in detail for the causes of the problem, and of allowing the interviewee to have a more realistic and in-depth view of the problem.

To conduct the interviews, an interview protocol (see annex A) was prepared, indicating the questions that are specifically to some particular entities. The interview protocol was prepared based on the SC approaches and on the determining factors set out in Tables 1 and 2. As for the sample, only entities that are directly linked to the SC of the ACI were selected. The interviews took place between October 30 and November 29, 2019, were recorded with the consent from the interviewees and were subsequently analyzed.

The analysis of the interviews took place as follows: after collecting the data, the entire material was reviewed and prepared for due analysis. To that end, the entities were grouped according to their nature (with the ministries in one group and the cement industries and the retailers in another), the interviews were summarized, classified and transcribed to the Word format without eliminating valuable information. Then, the responses of each entity were analyzed following the interview protocol, in order to identify the determining factors and barriers.

4. Determining Factors in Strategic Supply Chain Management

In some markets, the difficulties the industries face are due to the little collaboration, integration and communication among them. Without union, it is difficult for companies to achieve agility, efficiency and effectiveness. The current management paradigms are guided by innovations that help the infrastructure, organizational integration and information sharing.

According to Liu, Zhang and Hu (2005), the main success factors of the SC are the management of strategic alliances, the capacity of data management and the organizational information system. These elements provide up-to-date information and allow accurate responses to the inventory to adjust demand and the appropriate stock levels. According to Kotler and Armstrong (2012), to better distribute products and create value for customers, companies create bonds between them. The agents that are part of the distribution channels add value by creating a bridge between the time, place and possession gaps that separate goods and services from those who consume them.

According to Flynn, Huo and Zhao (2010), the integration of a SC is related to the degree in which a manufacturer collaborates strategically with its partners, coordinating the process inside and outside the organization to streamline the flow of products, services, information, money and decisions in order to provide customer value. According to Silva and Teixeira (2013), competitive economies have common characteristics: good infrastructures, good transport and telephone networks, good quality roads, railways, ports and electricity supply. The impact and importance of having quality infrastructures is measured by the logistical advantages that these confer on companies in the economy. Infrastructures are a mechanism that brings together the poles of economic activities that joins together stakeholders in a given region that would not otherwise exist.

A real problem that can be identified in SCM, especially in developing countries, is production efficiency and agility in distribution. Charging for agility when transport infrastructures lack good capacity and quality is a challenge. Several authors identified different determining factors that affect the strategic SCM. These factors are mentioned in Table 1. To organize them, the same filtering methodology mentioned above was used, that is, several articles were analyzed and only those that referred certain elements as determining factors that significantly influence the strategic management of the SC were extracted. The filtering consisted of transcribing the determining factor, the author and the year of publication in a spreadsheet.

Determinant factors	Authors
Training of human capital	Cohen et al. (2018)
Innovation, technology, agility and efficiency	Cohen et al. (2018), Gunasekaran et al. (2018), Nuševa & Maric (2017), Sabri, Micheli & Nuur (2018), Gajšek, Kovač & Hazen (2018), Oláh et al. (2018), Kazancoglu, Kazancoglu & Sagnak (2018)
Quality, flexibility, delivery and delivery time	Sarkis & Talluri (2002), Cohen & Roussell (2005), Chan et al. (2017), Oláh et al. (2018), Zhu, Shah & Sarkis (2018)
Selection of suppliers	Sarkis & Talluri (2002), Santis, Golliat & Aguiar (2017), Ismail & Mahardika (2017)
Communication between companies	Gajšek et al. (2018), Qi, Huo, Wang & Yeung (2017), Souza & Haddud (2017)
Cost of labor, production, transportation and unloading	Cohen et al. (2018), Gunasekaran et al. (2018), Cohen & Roussell (2005), Tosarkani & Amin (2018), Meyer & Erasmus (2017), Zhu et al. (2018)
Coordination, internaland external integration	Gajšek et al. (2018), Jajja, Chatha & Farooq (2018), Qi et al. (2017), Meyer & Erasmus (2017), Sabri et al. (2018)
Geographic location	Gajšek et al. (2018), Sabri et al. (2018), Cohen & Roussell (2005)
Confidence	Oláh et al. (2018)
Market demand	Tosarkani & Amin (2018)
Road, railway, port, airport infrastructure	Santis et al. (2017), Cao, Shen, Liu & Zhong (2016)
SC performance	Um (2017), Sabri et al. (2018), Jajja et al. (2018)
Differentiation	Um (2017)
Collaboration	Kotler & Armstrong (2012)
Stock of raw materials	Cohen & Roussell (2005), Nuševa & Maric (2017)
Economies of scale, supplier capacity, market entry, demand risk	Meng et al. (2018), Oláh et al. (2018), Sabri et al. (2018)
Profits	Cohen & Roussell (2005), Oláh et al. (2018)
Asset network	Ballou (2001), Owen & Daskin (1998)
Logistics and distribution	Sarkis & Talluri (2002), Kazancoglu et al. (2018)

Table 1. Determinant factors in the strategic supply chain management

5. Cement Industry Supply Chain

SCM has become a very important element for the success of modern industry. The cement industry is one of the main manufacturing sectors affecting the growth of modern societies. However, as this industry faces many problems and challenges, its SC has been transformed over time. Among these problems and challenges are logistics and transportation costs, reduction in delivery time and reduction in production costs (Taak & Kumar, 2019). In the CISC, integration, collaboration, communication, agility, efficiency and effectiveness play key roles. For example, according to Dikos and Spyropoulou (2013), the Heracles Cement developed a platform in 2005 for the optimization and planning of its SC. Currently, operation responses to fluctuations in demand and production are in place, medium and long-term planning is carried out, hypothetical scenarios are evaluated, network

optimization problems are solved and the best policies for implementing strategic decisions are identified. According to Agudelo (2009), Noche and Elhasia (2013) and Elhasia et al. (2013), the CISC essentially depends on five aspects (see Figure 2): location of raw materials, exploration license, assembly of production lines, cement distribution plan and analysis of the quality of the cement to avoid its return by the customers.

Cement factories are usually located in regions with good limestone reserves in order to avoid unscheduled breaks in the cement production and distribution process. Limestone is the main raw material used for the production of clinker. According to Newmark (1998), the structure of the CI has been influenced in the past by two forces: high costs and economies of scale.

Figure 2. Characteristics of the cement supply chain (Agudelo, 2009)

5.1. Cement Distribution

According to Prochnik, Perez and Silva (1998), the distribution of cement depends on the development of transport. For small consumers, cement is transported from the factory to warehouses located close to local markets. Civil construction companies receive cement directly from factories. According to Kibria (2015), cement is a heavy product, so transporting it over long distances may not be economic. The CI essentially adopts three modes of transportation: road, rail and water. According to Newmark (1998), Prochnik et al. (1998), Agudelo (2009), Elhasia et al. (2013) and Noche and Elhasia (2013), the transport of cement by road shouldn't exceed 300 km or 500 km in areas with a low population density. In terms of costs, transporting cement by river is less expensive than transporting it by rail, and both are less expensive than transporting it by road.

Agudelo (2009) developed a structure that he called "Build-to-Stock" (Figure 3). In this structure, the cement is delivered from the warehouse with the consumer's waiting time being only the period in transport from the warehouse to his/her door. In this structure, the push and pull strategies represent the driving force of supply and demand converging to the completion of market fluctuation transactions.

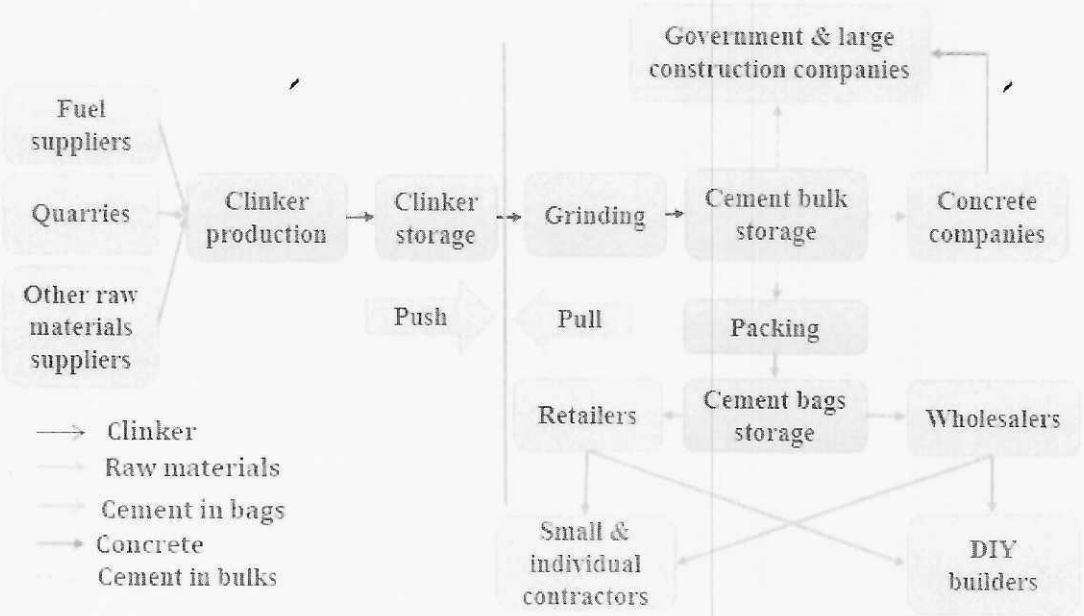


Figure 3. Build-to-Stock model (Agudelo, 2009)

5.2. Determining Factors in the Strategic Management of the Cement Industry Supply Chain

It is not just the lack of raw materials that can cause impasses in the cement production and distribution process. Studies carried out in the first two decades of the 21st century have shown that weak development of infrastructures, weak development of logistics, poor qualification of the human capital employed in this sector, weak use of the ICT and little collaboration and integration among the entities of this same sector are also key elements that can cause impasses in the strategic management of the CISC.

According to Palei (2015), the level of institutional development and good infrastructure (roads, railways, air, sea and electricity supply) help to improve industrial policy and boost national competitiveness. Noche and Elhasia (2013) hold that the level of development of the CISC depends on the development of logistics and transport infrastructures and can facilitate or restrict the economy of a country. According to Wolf (2017), investments in the Angolan cement sector reflect the dynamics of the political economy underlying the diversification process. According to Schmidt, Ngassam, Breitschaft and Virchow (2018), cement factories are growing in Africa at a good pace, but their density is still low. The related transport costs cause high local prices for cement. According to Olendo and Kavale (2016), the way the customers relate to suppliers plays a determining role. In the study done to improve the performance of the Bamburi cement supply chain, it was stressed that collaborating with suppliers is a strategy that brings competitive advantages over competitors.

Different determining factors that affect the management of the CISC have been identified by several authors. For the creation of Table 2, the same procedure used in Table 1 was used.

Determinant factors	Reference
Public investment, GDP per capita, population, growth rate, urbanization	Cao et al. (2016), Maity, Suresh & Baidya (2019)
Supplier management	Maity (2014), Ismail & Mahardika (2017)
Ability to manage the CI	Placet, Anderson, Fowler, Placet, Anderson & Fowler (2015), Ismail & Mahardika (2017), Jamali, Asl, Zolfani & Šaparauskas (2017), Sharma & Khanna (2020)
Integration and communication between companies	Jajja et al. (2018), Souza & Haddud (2017), Sharma & Khanna (2020), Nteta & Mushonga (2021)
Cement quality, production and transport costs, flexibility, agility, efficiency, effectiveness, collaboration	Newmark (1998), Agudelo (2009), Upadhyay & Pandey (2015), Walther (2018), Meyer & Erasmus (2017), Zhu et al. (2018), Sharma & Khanna (2020)
Reliability and response time	Meyer & Erasmus (2017), Sharma & Khanna (2020)
Economic development, labor	Lonita, Wurtenberger, Mikunda & Coninck (2013), Maity et al. (2019)
Transport infrastructures	Lonita et al. (2013), Noche & Elhasia (2013), Aniki, Mbohwa & Akinlabi (2014), Gajšek et al. (2018), Nuševa & Maric (2017)
Control of the cement production process	Mahdavi, Shirazi, Ghorbani & Sahebjamnia (2013)
Geographical location, market competition, exchange rate fluctuations	Meyer & Erasmus (2017), Gajšek et al. (2018), Sabri et al. (2018), Sharma & Khanna (2020), Nteta & Mushonga (2021)
Economic sustainability	Elhasia et al. (2013), Maity et al. (2019)
Technologies, coordination	Macedo, Fonseca, Alves, Oliveira, Carvalho & Pereira (2018), Sharma & Khanna (2020), Singh, Dadhich, Chouhan & Sharma (2021)

Table 2. Determinants of the cement industry supply chain

Figure 5 shows the number of studies, the countries where they were conducted and the respective percentage of the global average. India is the country with the most articles on supply chain management in the cement industry.

In numerical terms, the 29 articles on the cement industry supply chain identified in a 31 years period show that there are still many contributions that can be added to this sector. In this sense, the research agrees with Agudelo (2009) when the author elucidated this fact.

Figure 4. Research on the supply chain of the cement industry between 1990 and 2021

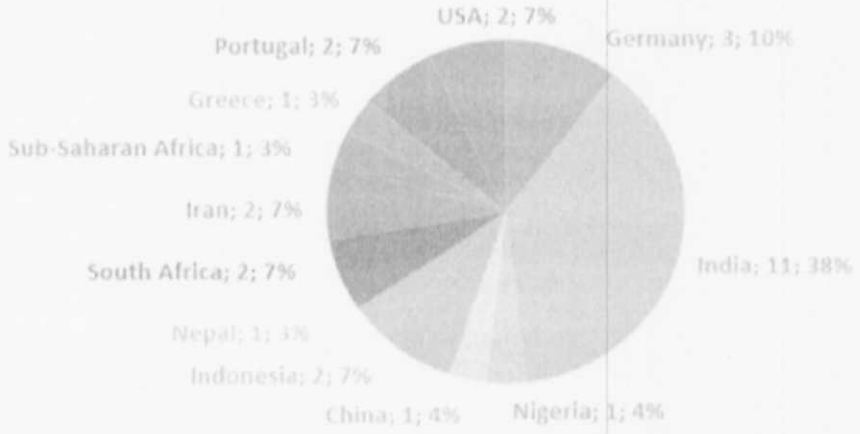


Figure 5. Articles on strategic supply chain management in the cement industry

6. Determining Factors and Barriers in the Strategic Management of the Angolan Cement Industry Supply Chain – Interview Results and Discussion

Based on the bibliographic research carried out, to identify the determining factors and possible barriers in the strategic management of the SC of the ACI, the perceptions of a group of ACI stakeholders were collected through interviews. Twenty interviews were conducted, all in Portuguese: five with members of the ministries, five with cement companies (CC) and ten with retailers. The interviewees have more than fifteen years of professional experience, including one specialist from Portugal, two from Brazil and seven Angolans. The ten retailers interviewed are considered experienced because they have accumulated more than ten years of experience in the sale of cement and other construction materials. However, one of the entities interviewed did not wish to be recorded for confidentiality reasons. Each interview lasted between 40 minutes and 2 hours. The profile of the interviewees is presented in Table 3.

Company	Code	Department	Job position	Education level
Ministry of Commerce	i_1	Planning & Statistics	Head Dept.	Higher
Minist. of Public Works	i_2	Planning & Purchasing	National director	Higher
Ministry of Industry	i_3	Planning & Statistics	Senior Manager	Higher
Railway Trans. Inst.	i_4	Planning & Statistics	National director	Higher
Road Trans. Inst.	i_5	Planning & Statistics	National director	Master
Cimenfort	i_6	Planning & Statistics	Head Dept.	Master
FCKS	i_7	Production & Sales	Head Dept.	Master
CIF Luanda	i_8	Planning & Statistics	Head Dept.	Master
Nova Cimangola	i_9	Production & Sales	Head Dept.	Master
Secil Lobito	i_{10}	Production & Sales	Company director	Higher
Retailers (10)	i_{11}	Warehouse	Merchant	High School

Table 3. Profiles of interviewees

The objective of this study is to collect information about the Angolan cement supply chain that will make it possible to develop management strategies that enable an efficient and effective supply of cement in the Angolan market.

In general, the entities indicated several determining factors and barriers that have mainly hampered the management of cement distribution in Angola. Besides, after analyzing the interviews, it was concluded that the determining factors, in general, are related to those already mentioned in Table 1 and 2.

The factors and barriers in the Angolan CISC registered bellow are mostly associated with the weak development of infrastructure and logistics. According to Deloitte (2018), the weak evolution of the logistics sector in Angola has limited the efficient movement of people and goods, thus compromising the development of the country.

In the following sections, the research questions will be discussed based on the result of the analysis of the interviews and some excerpts from the respondents' original responses will be included.

Determinant factors
Cement production capacity and quality
Supply levels and channels
Infrastructure capacity and quality
Capacity and quality of transport modes
Existence of cement distribution strategies
Collaboration, integration, agility, effectiveness and efficiency in the SC
Availability of qualified labor
The geographic location of markets
Competitiveness factors (price, quality, response time, flexibility, agility, services, reliability, process variability, differentiation)
Barriers
Weak Ministries strategic action
Poor management skills
Lack of institutions that train staff for the CI
The poor state of the country's road and rail infrastructures

Lack of tax incentives and government support
Low use of information technologies
Manual loading and unloading of cement in factories
Lack of collaboration, integration, flexibility, business effectiveness, poor job security and poor communication between CC
Lack of rail and maritime transport network
Cement price
Rising fuel price
Existence of dumping and influence management in SC
High freight cost
Lack of foreign exchange in the country
Extension of Angolan territory

Table 4. Determining factors and barriers mentioned by the Angolan entities

6.1. Ministry of Commerce, Industry and Public Works

Interviews with ministerial entities showed that in Angola not all Ministries have Institutes that can carry out their strategic plans, given that the ministerial network is centralized. This particularity also covers the Ministry of Commerce, Industry and Public Works, that is, these ministries lack competency to interfere in matters relating to the production, distribution and sale of cement in Angola. Therefore, these ministries have little information about the strategic management of the SC of the ACI. Even so, the i_2 entity mentioned that the aspects mentioned in the interview guide are really determining factors and that this study will certainly help to improve the SCM of the ACI. Also, the entity i_3 underlined that the aspects addressed in the interview guide are all determinant factors for the effective SCM, likewise states that according to the data contained in its databases, the installed production capacity of the ACI is almost 9 million tons of cement per annum, while consumption in 2015 was 6 million tons and in 2019 was around 2.5 million. However, it fails to accurately characterize the degree of application of the factors in the SCM of the ACI.

6.2. Cement Companies, Retailers and the Ministry of Transport

Regarding the installed production capacity of the ACI, the entities converge by admitting that capacity and quality are determining factors for the effective management of the ACI. But, they differ as to its sufficiency. Some say that the installed capacity is not enough to cover the country's reconstruction needs, others say that the installed production capacity is sufficient to cover market demand. Each of these entities justified its position by presenting the following arguments:

> *"Isn't permissible for Angola, as a country with so many mineral resources to have adobe/mud houses on the outskirts of the capital, isn't permissible that considerable part of the Angola population doesn't have a block house"* [i_9].

> *"In the interior of the country, we spent months without cement and for that reason the price tends to increase. Normally only cement from FCKS and Cimenfort appears here, our colleagues in Luanda say that even there in the capital of the country, cement isn't always available in informal markets"* [i_{11}].

> *"Cement is fundamental for the reconstruction of the country steeped in 27 years of civil war, it is a pivot for the development of Angolan society. The government can design several programs, but if it isn't proactive in the CI, there will be no reconstruction in Angola. The national cement production capacity is still not enough to cover the reconstruction of Angolan infrastructure, in addition to the fact that the population is growing. In addition, the Angolan road network still has no concrete bridges, and the improvised metal bridges that were used as a supplement in the past don't support much weight"* [i_5].

> *"All Angolan CC have 50% idle capacity, although there are provinces without a large cement market due to the poor quality of roads"* [i_6], [i_8].

"Angola only needs good management and collaboration, the installed capacity is almost 9 million tons of cement per year, while current consumption is around 2.5 million tons" [i_6], [i_8], [i_{10}].

As for the SCs, Angolan CC used the direct channel to supply the construction companies and the indirect channel to supply the retailers. However, the poor quality of the infrastructures, the manual loading and unloading of the cement practiced in the factories and warehouses represent the main problems and risks faced.

For the SC of the ACI to be efficient and effective, public entities need to adopt a more proactive action in the construction and repair of infrastructures. CC also need to be more proactive. The more united they are, the more efficient and effective they will be. According to Sharma and Khanna (2020), CISC is limited by time, location and the lack of use of technologies. Achieving success in the SC depends on coordination, communication and collaboration between channel partners. For example, during the interview the entities underlined the following:

"The SC of the ACI practically does not exist. Each cement company in Angola saves itself as much as possible, each forms its own SC, this behavior has made the process of production and distribution of cement in Angola very difficult, the lack of an integrated logistics system, the lack of collaboration between the entities of the SC in the Angola industry has hampered the SC activities. For example, if a given cement company wants to take a cement container from Benguela to Huambo, it will have to pay the rental of the round-trip transport, although, if there were collaboration and integration, maybe another producer needed to take his product from Huambo to Benguela and would pay the return costs" [i_{10}].

"Due to the lack of integration and collaboration in the Angola market, the trucks start from the loaded origins and return empty, this represents a great failure on the part of the managers, because, on the return, there are only costs with fuel and wear of the rolling material" [i_8].

Analyzing the nature of the determining factors identified, it appears that they essentially depend on two distinct entities. On the one hand, the factors that depend on the government as the ultimate entity responsible for their development (training of human capital, requalification and construction of road, rail, port, airport infrastructures, restructuring and monitoring of the country's financial system so that there is foreign exchange, investment in telecommunications, market development, etc.) and, on the other hand, elements that depend on the relationship between public and private SC entities (collaboration, integration between stakeholders and competitiveness factors). Zaile and Gitau (2016) assessed the competitiveness and sustainability of the Kenyan CI through the analysis of qualitative and quantitative data. The authors concluded that the development of SC determines the profits of CC. The greater the development of the infrastructure, the greater the performance of the CISC.

Regarding collaboration, integration, agility, efficiency and effectiveness, Angolan companies say that the lack of collaboration and integration made them less efficient, effective, agile and also damaged the structure of the market. The market shouldn't be predatory, but collaborative and integrative.

"Without collaboration and integration, it is difficult to organize the market" [i_{10}].

"If CC with greater financial capacity continue to sell cement below the production price in cement markets with less financial capacity, they will be gaining marketing, but CC with less financial capacity until a certain moment will start to strangle and will not be able to sell, thus causing the dismissal of workers, closure of factories, loss of investments and tax collection by the State. Collaboration is needed so that there is balance, so that there is healthy competition and the consumer buys cement at a low price. If it is a predatory competition, in the long run all CC will lose out. When it comes to integration with the State, CC need conditions, road and public safety" [i_8].

"Unfair competition, influence traffic, the existence of dumping and the practice of some prices well below the cost of production represent free trade attitudes. If the market doesn't allow the combination of prices, then it must also not combine marketing or selling below the cost of production" [i_6].

The relationship between determining factors is so intrinsic that the poor performance of one of them automatically influences the remaining factors. For example, if the quality and capacity of the infrastructures are not good, the distribution management will be limited and this automatically limits production, which in turn limits the ability to respond to customers. Likewise, if credit availability has no agility, the CC may not be able to buy raw materials on the international market. If the human capital used in factories is not well qualified, the CC may

produce low quality cement, which will be returned by the clients and consequently, increase the company's risk of losing clients.

> *"CC to distribute cement to the interior of the country use trains whose railway paths have many limitations. If a cement company orders two wagons to transport the goods within two days, it will only be granted wagons within 15 days. There is a lot of demand for cement in the Angolan market, but Angola's rail transport doesn't have enough capacity to transport cement when needed. Entrepreneurs demand a lot of rail transport services, but they don't have the capacity to respond"* [i_{10}].

> *"In Angola, there are only three railway lines, all in the parallel direction, without connection between them in the North-South direction. However, in the future there will be a connection in this direction through an ongoing project"* [i_4].

Managing the SC requires planning, organizing, coordinating and controlling production and distribution activities, always ensuring that products are available at the right time and in the right place when necessary. CC can restructure their supply networks, but if the infrastructures aren't good there will always be factors or barriers that will make it difficult to supply the communities with cement. For example, an entity stressed the following during the interview:

> *"If Angola had a rail network it would facilitate the distribution process and reduce risks. In Angola the greatest risk comes from road infrastructures, interprovincial roads have only one narrow lane in each direction, without separators, without signs, causing many accidents and insecurity in mobility. The quality and capacity of Angolan infrastructures are still precarious. Angola needs a railway network, the railways that Angola has aren't connected. Without infrastructures, it isn't possible to distribute cement throughout Angola. Good infrastructures reduce travel time and minimize costs. The sale price of cement in the Angolan market is fundamental, it must not be exaggerated, there must be flexibility and mechanisms that help the country to grow"* [i_5].

For CC, geographic location is a factor of competition between them in the Angolan market. According to them, cement plant must be installed near the port or near the limestone mine and must be connected by a road and rail network. Tseng, Yue and Taylor (2005) hold that without well-developed transport systems, logistics would not contribute significantly to society. A good transport system provides logistical efficiency, reduces operating costs and promotes quality of service. In this regard, during the interviews conducted, several entities reported that:

> *"The capacity and quality of the infrastructures and the modes of transport are the determining elements, as they constitute majority of the problems of the Angolan SC. The country's roads are bad, the peripheral neighborhoods aren't paved, thus making it difficult to supply small traders"* [i_8].

> *"There is no structural link between road infrastructures in urban and rural areas, farms and industrial centers, especially in the North, the railway line does not work"* [i_9].

> *"A rail network is sorely missed in the Angolan market"* [i_6].

> *"Angolan infrastructures lack qualities required by SADC, the geometry of Angolan roads still follows colonial times when there was not much flow of people and goods. Currently, roads must be made to international standards. The curvature of Angolan's roads doesn't allow the mobility of traffic; the angles must be widened to allow trucks to maneuver"* [i_3].

The development of the SC for the ACI depends heavily on the development of logistics and transport infrastructure. Unlike civil construction companies that receive cement directly from factories, small consumers in different and remote regions cannot always have the possibility to have cement in their communities due to the lack of adequate transport, the long distances to be covered and the prices charged. Therefore, given the importance of cement for the construction of housing for the population, CC must urgently adopt strategies that allow the cement to flow more easily and be supplied to communities in a more proactive and agile way. Among those strategies, the installation of warehouses close to local markets should be highlighted.

> *"Warehouses are very important to serve the end consumer, making them not travel long distances"* [i_7].

> *"Warehouses are very important; some will be installed on the railway lines to assist industrial hubs"* [i_4].

> *"Cement in Angola can be allocated to road transport over 400 Km, but 1.000 Km is a distance well above the average, so it is necessary to install warehouses"* [i_6].

"The SC of the ACI is managed within what is possible, the country is very large, 1.200 Km wide and access to the interior is difficult, generating aggressive costs, the factories were installed on the Angolan coast because limestone is in the coast" [i_{10}].

According to Owen and Daskin (1998) and Onstein, Tavasszy and Damme (2018), to face the challenges of transporting goods to the right place, at the right time and the right price, companies must create effective distribution structures, systems that allow the flow of goods and the easy movement of populations to warehouses.

Regarding the importance of ICT and its application in the ACI, all the interviewed entities consider ICT a determining factor for SCM of the ACI. According to the interviewee's, currently without ICT it is not possible to work proactively. CC are only efficient if they have full control and, good control isn't done manually. Companies can only improve what they master and can measure. Currently, in the ACI, even the mills are monitored on a computer basis from a centralized control room.

"ICT's are important. Between 2010 and 2015, the Institute tried to equip the locomotives with GPS, unfortunately it was unable to follow the train's trajectory from origin to destination due to the lack of antennas along the railway lines, in certain locations the communication signal drops" [i_4].

"ICT's are essential. The current needs are infrastructures, warehouses, human capital formation for the CI, ICT and distribution capacity. Unlike us, others CC haven't constant communication with customers, they depend on the reaction of customers, this factor leads them to lose many customers. We go looking for customers, we make constant visits to customers and teach them sales techniques, we train local young people and put them to work with us here at the factory" [i_6].

As for the price, quality, response time, flexibility, agility, services, process variability and differentiation, the entities interviewed consider that all these elements are determining factors, but differ in the order of importance. For some, price and quality reflect a greater impact on achieving competitive advantages in the competing market. Other entities consider that the reliability, price and variability of the process interfere in the production cost, but agility is the most important determining factor.

In general, CC and retailers pointed out that the main factors in the sale of cement in the Angolan market are price and quality. Builders watch over quality, while retailers watch over price. However, the entities [i_1] and [i_2] emphasizes that the Angolan government does not interfere in the stipulation of the price for the sale of cement practiced in the Angolan market.

7. Conclusion and Future Work

The CI is a fundamental pillar for modern societies since it produces cement, the main raw material used in the construction of housing and other infrastructures. Its SC presents complex and hermetic trade-offs, especially in developing societies, as is the case of Angola, torn by 27 years of civil war. In general, it seems restricted to construction professionals and logistics. However, SCs that are not very efficient or effective should be managed with great caution. And this is only possible if the factors that determine their strategic management are identified and their nature and complexities are understood so that the impasses that arise when distributing cement to communities are more clearly resolved.

The study, in addition to allowing the identification of the determining factors, also made it possible to understand that the barriers that hinder the distribution of cement in the Angolan market are strongly interconnected to each other and are also mainly associated with the poor development of the infrastructures, the poor development of the logistics, the lack of communication and integration and the poor qualification of human capital. Without good infrastructures, it is difficult to distribute cement to communities, instead of minimizing costs, you risk increasing them. Thus, this study can help decision-makers to develop strategies that make it possible to have an efficient and effective supply of cement in the Angolan market in the short, medium, and long term.

This study contributes significantly to the improvement of the decision-making processes related to the strategic management of the supply chain of the cement industry, identifying the determinants to the distribution of cement and barriers that have limited the distribution of cement, as well as the growth of companies linked to this sector. The identification of the existing gap in this sector, the determining factors and the barriers constitute the main finding of this study, while the main advantage consists in the fact that this is the first study carried out exhaustively

in the context of the Angolan cement market, which in a way brings contributions or elucidations that can help improve the performance of the supply chain of the Angolan cement industry.

However, the greater the number of entities interviewed, the greater the knowledge about the required approaches and strategies to help to improve the performance of the CISC. Thus, in order to have a broader view on the determining factors and barriers of this sector, in future research, entities linked to the CISC on other African countries could also be interviewed. Also, a cross case study deployment, including entities belong to several echelons of the Angolan CISC, grounded on the results achieved in the present research.

Still regarding the future, the authors of this research intend to develop a work that aims to identify the marketing channels and the distribution channels strategies that best fit the Angolan cement market context, to be subsequently developed and thus enable in the short, medium and long term an efficient and effective supply of cement in the Angolan market.

Acknowlegments

The authors would like to thank the public and private entities in the SC of the ACI for the time they have taken, for the interviews and contacts established.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

One of the authors would like to acknowledge financial support from Fundação para à Ciência e Tecnologia (Grant: UIDB/04058/2020).

References

Agudelo, I. (2009). *Supply chain management in the Cement Industry*. Master Thesis in Logistics. Massachusetts Institute of Technology.

Alshenqeeti, H. (2014). Interviewing as a data collection method: a critical review. *English Linguistics Research*, 3(1), 39-45. https://doi.org/10.5430/elr.v3n1p39

Aniki, A.O., Mbohwa, C., & Akinlabi, E.T. (2014). Improvement of logistics and supply chain management in the Cement Industry in Nigeria. *Proceedings of the World Congress on Engineering*, II(7), 1-5.

Ballou, R.H. (2001). Unresolved issues in supply chain network design. *Information Systems Frontiers*, 3(4), 417-426. https://doi.org/10.1023/A:1012872704057

Buijs, P., Danhof, H.W., & Wortmann, J.H. C. (2016). Just-in-Time retail distribution: a systems perspective on cross-docking. *Journal of Business Logistics*, 37(3), 213-230. https://doi.org/10.1111/jbl.12135

Cao, Z., Shen, L., Liu, L., & Zhong, S. (2016). Analysis on major drivers of cement consumption during the urbanization process in China. *Journal of Cleaner Production*, 133, 304-313. https://doi.org/10.1016/j.jclepro.2016.05.130

Caris, A., Macharis, C., & Janssens, G.K. (2008). Planning problems in intermodal freight transport: accomplishments and prospects. *Transportation Planning and Technology*, 31(3), 277-302. https://doi.org/10.1080/03081060802086397

Chan, A.T.L., Ngai, E.W.T., & Moon, K.K.L. (2017). The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry. *European Journal of Operational Research*, 259(2), 486-499. https://doi.org/10.1016/j.ejor.2016.11.006

Cohen, M.A., Cui, S., Ernst, R., Huchzermeier, A., Kouvelis, P., Lee, H.L. et al. (2018). OM Forum - Benchmarking global production sourcing decisions: where and why firms offshore and reshore. *Manufacturing & Service Operations Management*. https://doi.org/10.1287/msom.2017.0666

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management. The five disciplines for top performance*. McGraw-Hill

Deloitte (2018). Governance da Banca Angolana Desafios e Oportunidades. *Banca Em Análise. Entrevistas a Líderes Do Sector Bancário Angolano.* Luanda, Angola.

Dikos, G., & Spyropoulou, S. (2013). Supply chain optimization and planning in Heracles General Cement Company. *Interfaces*, 43(4), 297-312. https://doi.org/10.1287/inte.2013.0689

Elhasia, T., Noche, B., & Zhao, L. (2013). Simulation of a sustainable cement supply chain; Proposal Model Review. *World Academy of Science, Engineering and Technology. International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering*, 75(3), 562-570.

Fahimnia, B., Luong, L., & Marian, R. (2008). An integrated model for the optimisation of a two-echelon supply network. *Journal of Achievements in Materials and Manufacturing Engineering*, 31(2), 477-484.

Ferrari, R. (2015). Writing narrative style literature reviews. *Medical Writing*, 24(4), 230-235. https://doi.org/10.1179/2047480615Z.000000000329

Flynn, B.B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *Journal of Operations Management*, 28(1), 58-71. https://doi.org/10.1016/j.jom.2009.06.001

Gajšek, B., Kovač, J., & Hazen, B.T. (2018). An organizational framework for logistic platform and its subtypes in a search for more logistically attractive regions. *De gruyter Open*, 51(1). https://doi.org/10.2478/orga-2018-0002

Gambardella, L.M., Rizzoli, A.E., & Zaffalon, M. (1998). Simulation and planning of an Intermodal Container Terminal. *Simulation*, 71(2), 107-116. https://doi.org/10.1177/003754979807100205

Gasparyan, A.Y., Ayvazyan, L., Blackmore, H., & Kitas, G.D. (2011). Writing a narrative biomedical review: considerations for authors, peer reviewers, and editors. *Rheumatology International*, 31, 1409-1417. https://doi.org/10.1007/s00296-011-1999-3

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), 291-295. https://doi.org/10.1038/bdj.2008.192

Gunasekaran, A., Yusuf, Y.Y., Adeleye, E.O., & Papadopoulos, T. (2018). Agile manufacturing practices: the role of big data and business analytics with multiple case studies. *International Journal of Production Research*, 7543, 1-13. https://doi.org/10.1080/00207543.2017.1395488

Green, B.N., Johnson, C.D., & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal of Chiropractic Medicine*, 5(3), 101-117. https://doi.org/10.1016/S0899-3467(07)60142-6

Hochrein, S., & Glock, C.H. (2012). Systematic literature reviews in purchasing and supply management research: a tertiary study. *International Journal of Integrated Supply Management*, 7(4), 215-245. https://doi.org/10.1504/IJISM.2012.052773

Ismail, A.H., & Mahardika, R.Z.Z. (2017). Supplier selection in supply chain management using analytical network process for Indonesian Cement Industry. *Series: Materials Science and Engineering*. https://doi.org/10.1088/1757-899X/277/1/012063

Jajja, M.S.S., Chatha, K.A., & Farooq, S. (2018). Impact of supply chain risk on agility performance: mediating role of supply chain integration. *Intern. Journal of Production Economics*, 205(9), 118-138. https://doi.org/10.1016/j.ijpe.2018.08.032

Jamali, G., Asl, E.K., Zolfani, S.H., & Šaparauskas, J. (2017). Analysing LARG supply chain management competitive strategies in Iranian cement industries. *Ekonomie a Management*, 20(3), 70-83. https://doi.org/10.15240/tul/001/2017-3-005

Kazancoglu, Y., Kazancoglu, I., & Sagnak, M. (2018). Fuzzy dematel-based green supply chain management performance: application in cement industry. *Industrial Management & Data Systems*, 118(2), 412-431. https://doi.org/10.1108/IMDS-03-2017-0121

Kibria, G. (2015). Exploring the most efficient transportation mode for cement industries: a case study from Bangladesh perspective. *European Journal of Business and Management*, 7(4), 277-280.

Kotler, P., & Armstrong, G. (2012). Principles of marketing. *World Wide Web Internet And Web Information Systems*, 785. https://doi.org/10.2307/1250103

Lambiase, A., Mastrocinque, E., Miranda, S., & Lambiase, A. (2013). Strategic planning and design of supply chains: a literature review. *International Journal of Engineering Business Management*, 5(1), 1-11. https://doi.org/10.5772/56858

Langevin, A., & Riopel, D. (2005). *Logistic systems: design and optimizaton*. G. and E.P. de Montreal & Springer.. https://doi.org/10.1007/b106452

Lestari, F., Kurniawan, R., Ismail, K., Mawardi, M., Nurainun, T., & Hariadi, I. (2022). Business unit utilization in supply chain of distribution channel. *International of Industrial Engineering and Management*, 15(2), 143-154. https://doi.org/10.3926/jiem.3546

Liu, J., Zhang, S., & Hu, J. (2005). A case study of an inter-enterprise workflow-supported supply chain management system. *Information and Management*, 42(3), 441-454. https://doi.org/10.1016/j.im.2004.01.010

Liu, S., & Papageorgiou, L.G. (2013). Multiobjective optimisation of production , distribution and capacity planning of global supply chains in the process industry. *Omega*, 41(2), 369-382. https://doi.org/10.1016/j.omega.2012.03.007

Lonita, R., Wurtenberger, L., Mikunda, T., & Coninck, H. (2013). Energy efficiency and GHG reduction in the cement industry: case study of Sub-Saharan Africa. *Climate Technology and Development*. University of Sussex.

Macedo, A.R., Fonseca, J., Alves, R., Oliveira, J.A., Carvalho, M.S., & Pereira, G. (2018). The impact of industry 4.0 to the environment in the cement industry supply chain. *Proceedings of ECOS 2018 - the 31st International Conference on Efficiency Cost, Optimization, Simulation and Environmental impact of energy systems*. Guimarães, Portugal.

Mahdavi, I., Shirazi, B., Ghorbani, N., & Sahebjamnia, N. (2013). IMAQCS: design and implementation of an intelligent multi-agent system for monitoring and controlling quality of cement production processes. *Computers in Industry*, 64(3), 290-298. https://doi.org/10.1016/j.compind.2012.11.005

Maity, A. (2014). Impact of external influencer recommendation in purchase behavior process of selection of cement for construction. *International Journal of Business and Management Invention ISSN*, 3(8), 2319-8028.

Maity, B., Suresh, V., & Baidya, M.K. (2019). Performance of indian cement industry: drivers, models and empiries. *World Scientific Publishing Company*, 19(2), 1-19. https://doi.org/10.1142/S219456591950009X

Meng, X., Yao, Z., Nie, J., & Zhao, Y. (2018). Make or buy? It is the question: a study in the presence of carbon tax. *International Journal of Production Economics*, 195, 328-337. https://doi.org/10.1016/j.ijpe.2017.10.029

Meyer, J.A.M., & Erasmus, L. (2017). An analysis on the marketing of engineering services for the cement manufacturing industry in Sub-Saharan Africa. *IEEE Africon 2017 Proceedings* (776-781). https://doi.org/10.1109/AFRCON.2017.8095581

Mishra, U.S., Patnaik, S., & Mishra, B.B. (2019). Role of resilience in cement supply chain points. *International Journal of Supply Chain Management*, 8(6), 153-160.

Modibbo, U.M. Singh, R.Y., Hassan, M., & Mijinyawa, M. (2021). A critical review on the applications of optimization techniques in the un sustainable development goals. Paper presented at the *Proceedings of 2021 2nd International Conference on Intelligent Engineering and Management, ICIEM 2021* (572-576). https://doi.org/10.1109/ICIEM51511.2021.9445349

Newmark, C.M. (1998). Price and seller concentration in cement: effective oligopoly or misspecified transportation cost? *Economics Letters*, 60, 243-250. https://doi.org/10.1016/S0165-1765(98)00109-8

Noche, B., & Elhasia, T. (2013). Approach to innovative supply chain strategies in cement industry; Analysis and Model Simulation. *Procedia - Social and Behavioral Sciences*, 75, 359-369. https://doi.org/10.1016/j.sbspro.2013.04.041

Nteta, A., & Mushonga, J. (2021). Drivers and barriers to green supply chain management in the South African cement industry. *Journal of Transport and Supply Chain Management*, 15(0), a571. https://doi.org/10.4102/jtscm.v15i0.571

Nuševa, D., & Marić, R. (2017). Quick response logistics in retailing as an information technology based Concept. *Strategic management*, 22(4), 32-38.

Oláh, J., Sadaf, R., Máté, D., & Popp, J. (2018). The influence of the management sucess factors of logistics service providers on firms competitiveness. *Polish Journal of Management Studies*, 17(1), 175-193. https://doi.org/10.17512/pjms.2018.17.1.15

Olendo, J.A., & Kavale, S. (2016). Effects of supplier relationship management on supply chain performance at Bamburi Cement Mombasa, Kenya. *The international Journal of Business & Management*, 4(7), 436-452.

Onstein, S., Tavasszy, L., & Damme, D. Van. (2018). Factors determining distribution structure decisions in logistics: A literature review and research agenda. *Transport Reviews*, 1-18. https://doi.org/10.1080/01441647.2018.1459929

Owen, S.H., & Daskin, M.S. (1998). Strategic facility location: a review. *European Journal of Operational Research*, 111(3), 423-447. https://doi.org/10.1016/S0377-2217(98)00186-6

Palei, T. (2015). Assessing the impact of infrastructure on economic growth and global competitiveness. *Procedia Economics and Finance*, 23, 168-175. https://doi.org/10.1016/S2212-5671(15)00322-6

Papageorgiou, L.G. (2009). Supply chain optimisation for the process industries: advances and opportunities. *Computers and Chemical Engineering*, 33, 1931-1938. https://doi.org/10.1016/j.compchemeng.2009.06.014

Placet, M., Anderson, R., Fowler, K.M., Placet, M., Anderson, R., & Fowler, K.M. (2005). Strategies for Sustainability. *Research-Technology Management*, 48(5), 32-41. https://doi.org/10.1080/08956308.2005.11657336

Prochnik, V., Perez, A., & Silva, C.M. (1998). *A globalização na indústria de cimento* (1-91). U.F. do R. de Janeiro

Qi, Y., Huo, B., Wang, Z., & Yeung, H.Y.J. (2017). The impact of operations and supply chain strategies on integration and performance. *Intern. Journal of Production Economics*, 185, 162-174. https://doi.org/10.1016/j.ijpe.2016.12.028

Sabri, Y., Micheli, G.J L., & Nuur, C. (2018). Exploring the impact of innovation implementation on supply chain configuration. *Journal of Engineering and Technology Management*. https://doi.org/10.1016/j.jengtecman.2018.06.001

Santis, R.B. De, Golliat, L., & Aguiar, E.P. De (2017). Multi-criteria supplier selection using fuzzy analytic hierarchy process: case study from a Brazilian railway operator. *Brazilian Journal of Operation & Production Management*, 14(3), 428-437. https://doi.org/10.14488/BJOPM.2017.v14.n3.a15

Sarkis, J., & Talluri, S. (2002). A model for strategic supplier selection. *The Journal of Supply Chain Management*, 18-28. https://doi.org/10.1111/j.1745-493X.2002.tb00117.x

Schmidt, W., Ngassam, I.L.T., Breitschaft, G., & Virchow, S. (2018). Challenges of the growing African cement market - environmental issues, regulative framework and quality infrastructure requirements. *Published by EDP Sciences*, 01014, 1-8. https://doi.org/10.1051/matecconf/201814901014

Sharma, A., & Khanna, P. (2020). Relevance of adopting emerging technologies in outbound supply chain: new paradigm for cement industry. *Operations and Supply Chain Management*, 13(2), 210-221. https://doi.org/10.31387/oscm0410263

Silva, R.V. da, & Teixeira, N. (2013). *A competitividade das nações no século XXI - um roadmap para a economia portuguesa.* Caleidoscópio.

Singh, R.K., & Modgil, S. (2020). Supplier selection using SWARA and WASPAS - a case study of Indian cement industry. *Measuring Business Excellence*, 24(2), 243-265. https://doi.org/10.1108/MBE-07-2018-0041

Singh, G.K., Dadhich, M., Chouhan, V., & Sharma, A. (2021). Impact of Big Data Analytics & Capabilities on Supply Chain Management (SCM) - An Analysis of Indian Cement Industry. *3rd International Conference on Advances in Computing, Communication Control and Networking*. https://doi.org/10.1109/ICAC3N53548.2021.9725531

Souza, A. De, & Haddud, A. (2017). Supply Chain Management Integration in Maintenance and Repair Services Sector. *Operations and Supply Chain Management*, 10(4). https://doi.org/10.31387/oscm0290191

Taak, A., & Kumar, R. (2019). Suppler chain issues and challenges for cement industries of India: a case study. *Advances in Industrial and Production Engineering, Lecture Notes in Mechanical Engineering*. https://doi.org/10.1007/978-981-13-6412-9_27

Tosarkani, B.M., & Amin, S.H. (2018). A possibilistic solution to configure a battery closed-loop supply chain: multi-objective approach. *Expert Systems With Applications*, 92, 12-26. https://doi.org/10.1016/j.eswa.2017.09.039

Tseng, Y., Yue, W.L., & Taylor, M.A.P. (2005). The role of transportation in logistics chain. *Eastern Asia Society for Transportation Studies*, 5, 1657-1672. https://doi.org/10.1017/CBO9781107415324.004

Um, J. (2017). The impact of supply chain agility on business performance in a high level customization environment. *Springer Science Business Media*, 10, 10-19. https://doi.org/10.1007/s12063-016-0120-1

Upadhyay, M.K., & Pandey, M. (2015). SWOT analysis of cement industries in Chhattisgarh (comparison between international brand and local brand). *International Journal of Science, Engineering and Technology Research (IJSETR)*, 4(10), 3555-3563.

Walther, T. (2018). Digital transformation of the global cement industry. *Cement Industry Conference (IAS/PCA)*, Siemens AG, Germany. https://doi.org/10.1109/CITCON.2018.8373101

Wieland, A. (2021). Dancing the supply chain: toward transformative supply chain management. *Journal of Supply Chain Management*, 57(1), 58-73. https://doi.org/10.1111/jscm.12248

Wolf, C. (2017). Industrialization in times of China: domestic-market formation in Anggola. *African Affairs. Published by Oxford University Press on Behalf of Royal African Society*, 4, 435-461. https://doi.org/10.1093/afraf/adx015

Yuan, Y., & Hunt, R.H. (2009). Systematic reviews: the good, the bad, and the ugly. *The American Journal of Gastroenterology*, 104(5), 1086-1092. https://doi.org/10.1038/ajg.2009.118

Vieira, A.C.A., Veloso, H., Dias, L.M.S., Pereira, G.A.B., Oliveira, J.A., Carvalho, M. S. et al. (2019): Using simulation to model the logistic operations of a company of the cement industry. *FME Transactions*, 47(683-690), 683

Zaile, N.S., & Gitau, R. (2016). Effects of strategic responses on competitiveness and sustainability in Cement Manufacturing Firms in Kenya. *International Academic Journal of Human Resource and Business Administration*, 2(2), 177-194.

Zhu, Q., Shah, P., & Sarkis, J. (2018). Integrating product deletion with lean and sustainable supply chain management. *Intern. Journal of Production Economics*, 205, 201-214. https://doi.org/10.1016/j.ijpe.2018.08.035

Annex A

Interview protocol

Nº	Questions for the entities
1	Do you consider the capacity and quality of the production in the Angolan cement industry as determining factors for the effective management of the supply chain? Why?
2	What other factors do you consider determinant for the effective management of the Angolan cement supply chain?
3	Do you consider the current cement production capacity sufficient to cover national consumption? (except the Ministry of Transport)
4	How many supply levels are there in the supply chain of the Angolan cement/cement industry and how are they organized?
5	What are the types of distribution channels normally used in the Angolan goods/cement and services supply chain and how are they organized?
6	In the management of the Angolan supply chain, what risks do you consider to be decisive in the allocation of cement to communities? What crucial problems do companies face, especially when transporting cement?
7	Do you consider the capacity and quality of the infrastructures and modes of transport in Angola as key factors for the management of the supply chain for the Angolan industry/cement industry? Why?
8	How do you rate the quality of Angola's infrastructure? What is the degree of connection between urban, rural, farms and industrial centers?
9	What mechanisms does your organization use to promote/ensure the distribution of cement/goods to the provinces in the interior? Is supply centralized or decentralized?

10	Do you consider collaboration, integration, agility, effectiveness and efficiency in the supply chain of Angolan cement companies to be determinant factors in the management of this chain? Why?
11	What is the degree of application/ development of these factors in the supply chain management of the Angolan cement industry? What are the benefits of mergers and acquisitions in the Angolan industrial sector?
12	Do you consider the warehousing as a determining factor for increasing agility and efficiency in the management of the distribution of cement/goods in the Angolan market? Why?
13	Do you consider information technologies to be decisive factors in the management of the Angolan cement industry supply chain? What is the degree of their implementation in your sector?
14	Do you consider raw material and labor as fundamental factors for the management of the Angolan cement industry supply chain? What is the level of development of these factors in the Angolan market?
15	How easy is it to acquire and transport the necessary raw materials in the Angolan market?
16	Do you consider the geographic location of consumer markets as a determining factor for competition between cement companies/entities in the Angolan industry? Why?
17	In the following list, what factors of competitiveness do you consider determinant for the achievement of competitive advantages for the (your organization)/ industries vis-à vis the competing market? Price ☐ quality ☐ response time ☐ flexibility ☐ agility ☐ service ☐ reliability ☐ process variability ☐ differentiation ☐
18	How reliable is the Angolan cement industry supply chain?
19	How do you describe the demand for the products you produce/sell? Is it seasonal/variable? (only for cement companies and retailers)
20	How is the cement distribution planned in the Angolan market? What modes of transport do the cement companies prefer? Why?
21	Is it common to have returns from the products that you produce and /or sell from customers? (cement and retailers only)
22	How big is the supplier base of your organization and how important is it for an effective and efficient SC management? That is how many suppliers does your organization collaborate with? What are the criteria for selecting suppliers? (only for cement companies and retailers)
23	What is the perspective of implementing the production of other products derived directly from cement and inherent to the urbanization of Angolan cities?

European Journal of Economic and Financial Research
ISSN: 2501-9430
ISSN-L: 2501-9430
Available on-line at: http://www.oapub.org/soc

DOI: 10.46827/ejefr.v7i1.1428

Volume 7 | Issue 1 | 2023

ANGOLAN PORT INFRASTRUCTURE AND THE COMPETITIVENESS IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

Pedro Manuel Campos[i]
Lisbon School of Economics & Management,
Lisbon University,
Portugal

Abstract:
Africa has nine transit corridors, two intra-regional corridors and two main east-west corridors. Africa accounts for about 13% of the world's population and includes 54 countries, of which 38 have coastline access along the continent's 30,490 Km of coastline and 16 are landlocked. However, 90% of the volume of cargo between Africa and the world is transported by sea, which typifies the importance of port infrastructure in economic development. This research presents a comparative analysis of the port infrastructures in the Southern African Development Community (SADC) based on the weight capacity that the ports support, waiting time for ships in ports, the connection of infrastructure networks, the growth of GDP per capita and the entry of ships in the country during the year by type of cargo. Similarly, determinant factors of port infrastructure management were identified. The objective is to characterize the competitive position of Angolan's port infrastructure in the SADC context. The results show that Angola's port infrastructure is not the worst in SADC. However, the lack of good roads and railroads reduce its competitiveness in relation to Namibian and South African port infrastructure.

JEL: R40; R41

Keywords: Angolan port infrastructure; port infrastructure in Africa; competitiveness; economic growth and development, determinants factors

1. Introduction

Studies on the competitiveness of port infrastructure have grown significantly since the 1960s (Woo *et al.*, 2011) and (Munim & Saeed, 2019). The increasing competition between ports is focused on the logistical performance of terminals. The changing conditions of

[i] Correspondence: email pecampos001@yahoo.com.br

competition raise questions about port management policies and strategies. The term competitiveness stands for strategic development, innovation and progress in port logistics (Munim & Saeed, 2019).

Angola is located in the western region of southern Africa, south of the equator. It has an area of 1.246.700 km², its coastline extends for 1.650 km and has a land border of 4.837 km (ANEME, 2016). Its length from north to south is 1.277 km and its width from west to east is 1.236 km. it is bordered to the North by the Republic of Congo and Democratic Republic of Congo (DRC), to the East by the Republic of Zambia and the DRC, to the South by Namibia and to the West by the Atlantic Ocean (Portugal & Angola, 2016). The country is the seventh largest in Africa. Despite its long continental border of 84.837 km, its connections are limited by poor transport infrastructure (Haddad *et al.*, 2020). Along the coast, the lack of good port infrastructure has hindered the distribution of cement, which is one of the main components for the rebuilding of infrastructure destroyed during the civil war (Campos *et al.*, 2022) and (Campos *et al.*, 2023).

The war devastated the country and destroyed most of its economic infrastructure (Pushak & Foster, 2011). The ports of Luanda, Lobito, Cabinda, Namibe and Soyo serve the highly import-dependent economy following the collapse of domestic industry and agriculture (Porto & Clover, 2003). The reconstruction of port infrastructure began after the civil war (Jensen, 2018). However, in terms of infrastructure and logistics Angola still faces serious difficulties in achieving the levels of service delivery desired by customers. The Angolan logistics chain is composed of small players with a poor supply of customs and road transport services (Deloitte, 2014). Despite investment in transport infrastructure, the levels achieved are still far below what is needed to close the gap. The most important seaports are Luanda, Lobito, Namibe and Soyo (ANEME, 2016) and (Haddad *et al.*, 2020).

Given the importance that port infrastructure in Angola has assumed, both as a determining element in the commercial context and as the country's window to the world, it is essential to identify its competitive position in the context of SADC port infrastructure, as well as the factors that determine its competitiveness. To this end, the following questions were raised:

1) What factors determine the management of port infrastructure?
2) How competitive is Angola's port infrastructure in the SADC context?

There are very few scientific articles that address the state of Angola's port infrastructure and its competitiveness in the SADC context. The existence of little literature signals a deficit that somewhat hinders the understanding of this situation.

This paper is organized in six sections. Section 1 presents the objectives, research questions, and the justification of the need for this research. Section 2 presents the literature review, addressing the nature of port infrastructure, its classification, and the types of terminals. Section 3 presents the research methodology. Section 4 presents the state of African port infrastructure management, and the main trans-African corridors. Section 5 presents the analysis and discussion of the results, and section 6 presents the final considerations.

2. Literature review

2.1. Port infrastructure

Port infrastructure is crucial for trade. However, its development is quite costly (Aerts *et al.*, 2014). More than 80% of international trade by volume is carried out by sea (Mokhtari *et al.*, 2011). Port activity is related to the movement of goods from port to terminals and from terminals to different destinations (Montwill, 2016).

Port are critically important nodes in the global supply chain, port authorities focus on increasing their efficiency and effectiveness (Nuzzolo *et al.*, 2013) and (Caldeirinha *et al.*, 2020). A port is a deep-water geographic area where ships dock to load and unload goods (Dwarakish & Salim, 2015) and (Alrukaibi *et al.*, 2020). The economic relevance of ports stems from the fact that most of a country's foreign trade is conducted by sea (González & Trujillo, 2008).

2.2. Classification of ports

Ports are built based on the characteristics of the soil and the depth of the water. The quay and breakwater are artificial structure erected to protect the harbor area from the waves. The breakwaters are made up of large stones to stop the sea waves. Berths, on the other hand, are structures intended directly for attracting ships and are equipped with appropriate equipment. Berths are divided into fixed and floating. Berths can be for cargo, passengers, or ship repair. In general, ports are classified as seaports and dry ports. Ports positively impact the regions in which they are located and in adjacent regions. A seaport allows landlocked regions to better engage in regional and international export and import activities (Yudhistira & Sofiyand, 2017). Seaports provide services to shipping companies and cargo owners. Ports are involved with governments, port administrations, carriers, agencies, shipping companies, and unions (Esmer *et al.*, 2016).

Dry ports, on the other hand, are based on seaports and are classified as: distant, medium, and near. This classification helps shift road freight to rail traffic modes, reduces congestion around the port, and facilitates improved logistics solutions for carriers operating within the port (Roso *et al.*, 2009). Dry ports are inland terminals that are strongly connected to seaports by road and rail. Dry ports function as extension of seaports to facilitate the movement of cargo between seaports and inland (Nguyen & Notteboom, 2016) and (Rodrigue & Notteboom, 2012). The decision where to locate a dry port requires analyzing the entire supply chain (Awad-Núñez *et al.*, 2016).

The factors that influence the location of a dry port can be economic or no-economic, quantitative or qualitative (Nguyen & Notteboom, 2016). But, are necessary:

- quality of port infrastructure and port development;
- institutions that regulate the development of infrastructure/superstructure; and
- division of tasks between the public and private sectors (Jacobs & Hall, 2007).

2.3. Types of freight terminals

Terminals are operations stations that handle two or more modes of transportation. Terminals have equipment for loading and unloading containers, the length of the port and the depth of the channels determine the size of the vessels that can operate in it (Cosco, 2017). Each port has several terminals and they are operated by one or several operators. Container terminal operators are companies that operate one or several container terminals in a port. There are two types of private investors in container terminals: pure stevedores such as, HPH, PSA and DP *World* and global shipping companies that want to integrate the terminal operation into their business activities (Yip *et al.*, 2011) and (Yeo, 2015).

The following three types of cargo terminals are distinguished: Satellite terminals (A), cargo centers (B), and transfer centers (C). For inbound or outbound cargo flows, the land terminal is the first level of a functional hierarchy that defines its fundamental (activities it serves directly) and extended (activities it serves indirectly) hinterlands. Satellite terminals tend to be set up within 100 Km of the port (Rodrigue & Notteboom, 2012). Terminal operators deal with a number of logistical problems. One such problems is the scheduling of quay cranes, which are the port's most valuable resources. Marine container terminals are major infrastructures in global supply chains (Castilla-Rodríguez *et al.*, 2020).

Container terminals are derived into three main areas quay, yard, and gate (Ries *et al.*, 2014). One of the biggest challenges for container terminals is the modernization of cranes. As the size of ships increases, it is necessary to invest in larger cranes that can reach out to pick up the container farther from the quay. Ports are pressured by shipping companies to invest in the equipment or be excluded from major east-west trade routes (Yeo, 2015). Accessibility to seaports can be measured by the distance to the nearest port and the number of ports within a distance of no less than 200 km or more than 400 km. the hinterland is a location where a terminal offers its services to customers. The location of the dry become a strategic issue to assist the logistic system of the dry port becomes a strategic to assist the logistics system of a country or region (Awad-Núñez *et al.*, 2016).

Pier length, yard area, type of operating system, yard cranes, geographic location, connection with rail lines and road network are key elements to promote the efficiency of a port or container terminal (Fancello *et al.*, 2014) and (Ghiara & Caminati, 2017). In general, there are many factors that affect cargo flows in ports such as: (1) economic factors, (2) politics factors, (3) geographic factors, (4) industrial production factors, (5) supply chains and logistics factors, (6) port organizational factor, (7) port service factors, and (8) port competition and hinterland factors e *hinterland* (Othman *et al.*, 2020).

Containers are not commodities, they are standard-sized boxes that facilities the organization and transportation of goods to other modes of transport (González & Trujillo, 2008). The capacity of the port determines its choice by shippers. The volume of containers handled by cranes/hour in the port has grater relevance for shipping companies over geographic location (Kawasaki *et al.*, 2021). Terminal customers value

reliability, flexibility, availability, time, cost, control, and after-sales support (Wiegmans *et al.*, 2015).

2.4. The impact of port infrastructure on the economy

There is a high synergy between the port economy and the regional economy. On the one hand, the port economy has an overall effect and can effectively drive the development of the regional economy, on the other hand, the regional economy promotes the development of the port economy through its labor and resources that the port economy needs to move.

The benefits of the economic impact of a port are manifold (Wilmsmeier *et al.*, 2006) and (Wilmsmeier & Sanchez, 2017). Ports add value and generate jobs directly and indirectly. The economic benefits of port infrastructure are used by port authorities to justify raising financial resources to invest in port expansion projects. The types of port impacts are assessed in terms of output, employment, income, and value added. In general, the direct impacts correspond to the economic impacts generated by the construction and operation of the port. Indirect impacts correspond to the effects on suppliers of goods and services (Santos *et al.*, 2016) and (Jouili & Allouche, 2016).

Seaports are the main entry and exit points for bulk products (coal, ores, and crude oil) to non-bulk items (vehicles) (Michal *et al.*, 2017). With the development of international trade, more than 80% of trade in volume and more than 70% of trade in value are managed at seaports worldwide (Chenhao *et al.*, 2020). In the past the transportation of packed cargo took months to reach the destination, nowadays it takes only a few weeks (Ghiara & Caminati, 2017). Due to the loading and unloading equipment already involved in other activities at terminals, the average waiting time it takes a ship to be unloaded can range from hours to days (Rusu, 2015).

Thus, although port efficiency varies from port to port, the services required at terminal are crucial for commercial transactions. For example, according to Clark *et al.* (2004), until 2004 the most efficient ports in the world were Singapore and Hong Kong, while the most inefficient were located in Africa (Ethiopia, Nigeria, Malawi) and Latin America (Colombia, Venezuela, Ecuador). Today, seaports still face high challenges, especially in managing container ships (Hsu *et al.*, 2020).

The efficiency and effectiveness of port infrastructure significantly impacts the circulation of the economy, boosts the country's economic growth and development, and promotes the port's image. Port terminals handle hundreds of container units during the year, if the terminals are not well equipped, the volume of transacted flow can negatively affect the management services of these terminals.

3. Material and Methods

The present study used the unsystematic literature review based on the approach of Green *et al.* (2006), Yuan & Hunt (2009), Gasparyan *et al.* (2011), Hochrein & Glock (2012) and Ferrari (2016). Searches were conducted in Scopus, Web of Science, Science Direct

and Google Scholar, using the following keywords: *"Angolan port infrastructure"*, *"port infrastructure"*, and *"African port infrastructure"*. The following filtering criteria were used: (1) *publication years: 1990 – 2020; (2) document type: article; (3) source type: journal; (4) language: English.* All extracted articles were manually analyzed in light of the following inclusion and exclusion criteria: title analysis, research area, keywords used, contributions, and main results.

Regarding the method, in this work was used the qualitative comparative analysis, which is an analytic technique which combines quantitative and qualitative methodologies. The technique originally focused on small samples but further development has allowed its application to broader contexts (Ragin & Rihoux, 2004) and (Roig-Tierno, 2017). The drawback to the method is the impossibility of generalizing the results to other similar cases. However, currently, in addition to being based on case studies qualitative comparative analysis of empirical data for the generalization of analyses considering possible replication in subsequent studies, and constructing logical propositions as a result of the qualitative study of the phenomenon in question (Ragin, 2008), (Woodside & Zhang, 2012) and (Roig-Tierno, 2017).

4. The development of African port infrastructure

Analyzing the efficiency and effectiveness of port terminals is key to raising port performance (Othman *et al.*, 2020). A port's operational reputation is based on objective factors (infrastructure and supply chain efficiency) as well as subjective factors (reliability and level of corruption). Currently, 80% of African trade transits via ports (Caschili & Medda, 2015). Thus, the larger the port, the higher its level of competitiveness. In general, the characteristics to be evaluated are those with depth water, berth and terminal length. Ports with better infrastructure are these with deep water, long berths and terminals (Dyck & Ismael, 2015).

4.1. The Angolan port infrastructure

There are seven seaports in Angolan, four of which are deep water (Luanda, Lobito, Amboim and Namibe) and three are shallower (Malongo, Soyo and Cabinda). According to Muzima (2019), Luanda, Cabinda, Lobito and Namibe are ports that make the country a regional transportation hub for neighboring landlocked countries.

Luanda with 11 berths is the most important port and receives 80% of imports, especially container trade. The second most important port in the country is the port of Lobito. Most of Angola's port are limited by factors such as, poor management, low container flow and poor connection with rail lines (Golub & Prasad, 2016). The capacity of the port of Lobito has been expanded, but its utilization rate is still less than 25% due to the lack of roads and railroads that would allow it to be connected to neighboring landlocked countries (in particular Zambian mining companies) (Muzima, 2019). The port of Malongo is most used for the provision of services to the *offshore* (oil and gas).

The port of Luanda is the country's main international trade route. It has 2.738 meters of quays (six berths)), 19 warehouses of 55.500 m^2, a land area of 792.219 m^2 and allows for the berthing of 17 vessels. Until 2011, the draught of the port was 10,5 meters, considerable for ship of about 30.000 deadweight tons. But the depth in Luanda Bay exceeds 20 meters, potentially allowing ships with more than 150.000 tons of deadweight to enter the day. The port is protected by the large Luanda Bay. In addition to container, bulk and general cargo berths, the national oil company Sonangol operates an oil terminal adjacent to the port (Bank, 2005) and (Pushak & Foster, 2011). In order to maintain control of container flows, the port of Luanda is assisted by the dry port of km 30 and they are connected by road and rail.

The port of Lobito was modernized and expanded with a container terminal, a mineral terminal, and an oil terminal. By 2014 the port had the capacity to handle 3.7 million tons which would be expanded to 4.1 million when the Benguela railway was operating at its full potential (Duarte *et al.*, 2014). The port of Cabinda has severe operational limitations for large ships and dredging and major rehabilitation works on berthing facilities, warehouses and sidewalks. The port of Malongo, on the other hand, supports the export of oil *offshore* Cabinda (Bank, 2005).

4.2. Competitiveness in the African port sector

Given the importance of the port of Luanda for goods from Angola, DRC, Zambia and Zimbabwe, the port of Luanda has become one of the fastest growing ports in Africa. The growth in demand in the first decade of the 21st century has generated serious congestion at the Luanda ports general cargo terminals and container traffic, with traffic volumes increasing from 30,000 to 346,000 (Pushak & Foster, 2011).

The entire Atlantic coast up to Cape Town in South African is characterized by a back of indentation, with only a few natural harbors at Dakar, Freetown, Lagos, Lobito and Walvis Bay. Modern seaports on the Atlantic coast of African can be classified into natural and man-made ports. Natural ports were dredged and expanded to accommodate larger ships, while artificial ports were built for strategic reasons. Port development was aligned with the construction of railroads and highways (Olukoju, 2020). For example, the Autonomous port of Cotonou has been the lifeblood of Benin's economy since 1910, it is a pillar of socio-economic development. Benin occupies a strategic position among the coastal countries of West Africa. It is a natural corridor for the transport of goods to and from Niger, Burkina Faso, Mali, Chad, Togo and Nigeria through the Port of Cotonou. Until 19th century, Benin's maritime trade was conducted at two points on the coast: Grande Popo and Ouida. After the record of many losses of materials and human lives, the wharf was built in Cotonou in 1891 (Alexis *et al.*, n.d.).

Dyck & Ismael (2015) evaluated the competitiveness of major West African ports (Abidjan, Cotonou, Dakar, Lagos, Lomé and Tema), using the Analytic Hierarchy Process. The results show that the port of Abidjan is the most competitive due to its efficiency and performance, infrastructure and political stability. The Lagos Port Complex, the largest port in West Africa in terms of Scale and throughput, ranked fifth

behind the ports of Lomé, Tema and Dakar due to political instability. The port of Cotonou in Benin, on the other hand, was the least competitive because port competitive in West Africa excels in door-to-door delivery. According Malchow & Kanafani (2004), location, port characteristics and ship characteristics determine the selection of a port in port competitiveness.

The port of Luanda had long delays and poor performance relative to other African ports. Container dwell time (12 days) was twice as long as Durban, the best performing port in Africa and rivaled only the underperforming ports of Mozambique. Truck delays (14 hours) were more than twice as long as other SADC ports. Crane productivity was lower than other Southern African ports. The handling rate at the port of Luanda was among the higher than that charged at the port of Mombasa (Kenya) and 25% higher than that charged at Durban (South Africa). The bulk cargo handling fee was also high compared to other African ports (Pushak & Foster, 2011). But after some years, Caschili & Medda (2015) analyzed the attractiveness Index of 41 container ports in 23 African countries with data from the period 2006 to 2010. Their results show that the port of Luanda is not among the worst on the African continent.

Namibia has two ports (Walvis Bay and Lüderitz) which handle over 6.5 million metric tons of cargo. Walvis Bay is Namibia's main port and the only deep-water port, its depth is 12.8 meters and can accommodate container ships with a maximum capacity of 2.400 tons. Walvis Bay Harbor has a new cargo and container quay wall that is 500 meters long and the channel has a draft of 8.15 meters, which can accommodate ships up to 150 meters long. This port handles over five million tonnids of cargo per year, 20% of which is containerized. The port of Walvis Bay is one of the preferred entries into SADC because of its accessibility and agility, it offers less time. Namibia is connected to Botswana, Angola, South Africa, Zambia, Zimbabwe and DRC (Namakalu *et al.*, 2014). Dyck & Ismael (2015) when conducting their study of the port sector on the west coast of Africa, observed that competition and port selection are closely related to port location and throughput, which in turn affects the direct port calls of shipping lines. According to Clark *et al.* (2004), the African ports that had severe delays at las until 2004 were: Ethiopia (30 days), Kenya, Tanzania and Uganda (14 days each), Cameroon (20 days), Nigeria (18 days) and Malawi (17 days).

Cargo dwell time (the time between the arrival of the ship and the container leaving the port facility) exceeds 20 days on average for ports on the African continent, making them the most time inefficient. Companies that rely on just-in-time shipments are less likely to development in this environment (Refas & Cantens, 2018).

The time delays in African ports are due to the lack of modern equipment capable of handling cargo quickly and the lack of administrative efficiency. Bureaucracy in the handling of customs documents generates high transaction costs for companies and wastes time. Thus, the more red tape there is at customs, the less competitive they become for shipping companies.

According to Cullinane *et al.* (2005), the efficiency of port is characterized by quay length, ship turnaround time, ship stowage, crane throughput, and yard operations.

These authors evaluated the efficiency of the world's most important ports and container terminal throughput is a determining factor in the contemporary global economy.

Omoke & Onwuegbuchunam (2018) analyzed costs per ship time in port, ship turnaround time, crane efficiency, and frequency of ship call as determinants of port competition in West Africa. The authors concluded that ports operating in the same geographic range compete with each other, leading the less efficient ones to lose customers to the more efficient ones. In the same vein, Kaliszewski *et al.* (2020) analyzed the global competitiveness factors of container ports and highlighted three factors: quality of container terminal service, manpower, and adequate nautical accessibility. This corresponds to the increasing size of container ships, which require Deepwater container terminals and reliable port services. The shipping lines need high standard services and low risk of labor-related disruptions to maintain the high level of service quality.

Today, ports can lose important customers if they have inefficient port infrastructure (Notteboom & Winkelmans, 2001a). The market environment in the port sphere is changing significantly (Notteboom & Winkelmans, 2001b). In this vein, Goss (1990) identified five distinct forms of port competition: between port clusters; between ports in different countries; between ports within a country; between terminals within a port; and between modes of transport.

Currently, research on port competition is focused on these five categories (Munim & Saeed, 2019). Research indicates that the most important elements in port selection are the number of trips, internal transportation rates, the port's internal intermodal connectivity, and the existence of container terminal (Dyck & Ismael, 2015). The determinants in the port industry can be qualitative and quantitative (D'Este & Meyrick, 1992). Quantitative factors include route and cost factors and service factors, while qualitative factors include flexibility and ease of use, port management, contacts, and the level of cooperation between the shipper and the port (Rimmer, 1998).

Analyzed the competitiveness of port infrastructure necessarily implies charactering the main competitiveness factors, since the relevance of a port depends on its location, the market situation, and is perceived different by stakeholders (shippers, forwarders, shipping companies, shipping agents, carriers, and logistics operators). The stakeholders exert influence on the choice of the terminal and are guided by the different competitiveness factors (Kaliszewski *et al.*, 2020).

4.3. Determinant factors in port competitiveness

Ship waiting time, container dwell time in port, ship turnaround time, and crane productivity are factors that represent a port's efficiency and directly influence the efficiency of shipping companies and other ports users (Dyck & Ismael, 2015). Three factors characterize the productivity of port terminals (Trujillo *et al.*, 2018):

- the berths needed to berth the ships (measured in linear meters);
- the cranes used to load and unload the containers; and
- the surface area of the terminal which is measured in m^2.

Cargo volume is also a determining factor, it measures the actual amount of cargo handled at a port (Hales *et al.*, 2017). As a rule, cargo volume is measured by the movement of containers in Twenty-foot Equivalent Units (TEUs). In turn, the input factors (the terminal's quay cranes) affect the efficiency of the container terminal. Thus, a terminal is efficient if it moves high amounts of cargo (container traffic in TEUs) in the terminal. As a rule, the efficiency of port terminals is measured in TEUs per crane. But, this measure does not evaluate the overall efficiency of the terminal, as it focuses only on a specific aspect of the terminal (Notteboom *et al.*, 2000).

Several authors have identified different determinants factors that affect port competitiveness. To organize them, a filtering methodology was used, that is, several articles were analyzed and only those that cited certain elements as determining factors in port competitiveness were extracted. Subsequently, the determining factor, author and year of publication were transcribed in Table 1.

Table 1: Determining factors of port competitiveness

Determining factors	Authors
Geographic location of the port	Starr (1994), Ha (2003), Song & Yeo (2004), Yuen *et al.* (2012), Malchow & Kanafani (2004), Dyck & Ismael (2015), Hales *et al.* (2017)
Connection between transport infrastructures	Starr (1994), Yuen *et al.* (2012), Parola *et al.* (2017), Tongzon & Heng (2005)
Development of port infrastructure	Starr (1994), Ha (2003), Song & Yeo (2004), Yuen *et al.*(2012), Dyck & Ismael (2015), Parola *et al.* (2017)
Workforce stability	Starr (1994), Yuen *et al.* (2012)
Port handling charges and/or fees (costs)	Song & Yeo (2004), Yuen *et al.* (2012), Dyck & Ismael (2015), Hales *et al.* (2017)
Volume of the load handled safely	Song & Yeo (2004), Yuen *et al.* (2012), Dyck & Ismael (2015)
Efficiency and effectiveness in the delivery of port services (transit time, frankness, capacity and reliability), strategic management of the port	Bennett & Gabriel (2001), Ha (2003), Malchow & Kanafani (2004), Song & Yeo (2004), Teng *et al.* (2004), Tongzon & Heng (2005), Yuen *et al.* (2012), Dyck & Ismael (2015), Hales *et al.* (2017)
Wharf depth	Tongzon & Heng (2005), Yuen *et al.* (2012)
Adapting the port to the current market	Tongzon & Heng (2005)
Product differentiation	Tongzon & Heng (2005)
Capacity and size availability	Yuen *et al.* (2012)
Connectivity with the interior	Yuen *et al.* (2012)
Maritime transport services	Yuen *et al.* (2012)
Terminal operators	Yuen *et al.* (2012)
Personalized service	Yuen *et al.* (2012)
Document simplification at the port	Yuen *et al.* (2012)
Damage to cargo and port skills	Yuen *et al.* (2012)
Port Information Systems	Yuen *et al.* (2012)
Government policies	Teng *et al.* (2004), Yuen *et al.* (2012)
Information about the port's activities	Ha (2003), Yuen *et al.* (2012)
Port response time	Ha (2003), Hales *et al.* (2017)
Vessel characteristics	Malchow & Kanafani (2004)

Sustainability policy	Dyck & Ismael (2015)

Source: Elaborated by the author.

Port facilities refer to all tangible assets used to serve maritime cargo (Hales *et al.*, 2017). In this context, the capacity and efficiency of port infrastructure, the quality of roads, railroads, cost, services, geographical location, and easy access to the interior of the country or continent play an important role in making decisions regarding the choice of port (Cullinane *et al.*, 2005) and (Guy & Urli, 2006).

4.4. Africa's main ports corridors

African ports are vital to the African economy, they facilitate Africa's integration into the international trade arena, enabling over 90% of the continent's imports and exports (Refas & Cantens, 2018). A report on transport corridors in West Africa identified nine transit corridors (Figure 1), two intra-regional corridors (Bamako, Mali-Ouagadougou, Burkina Faso and Ouagadougou-Niamey, Niger) and two main east-west corridors (Dakar-Niamey) and (Abidjan- Lagos) (Olukoju, 2020).

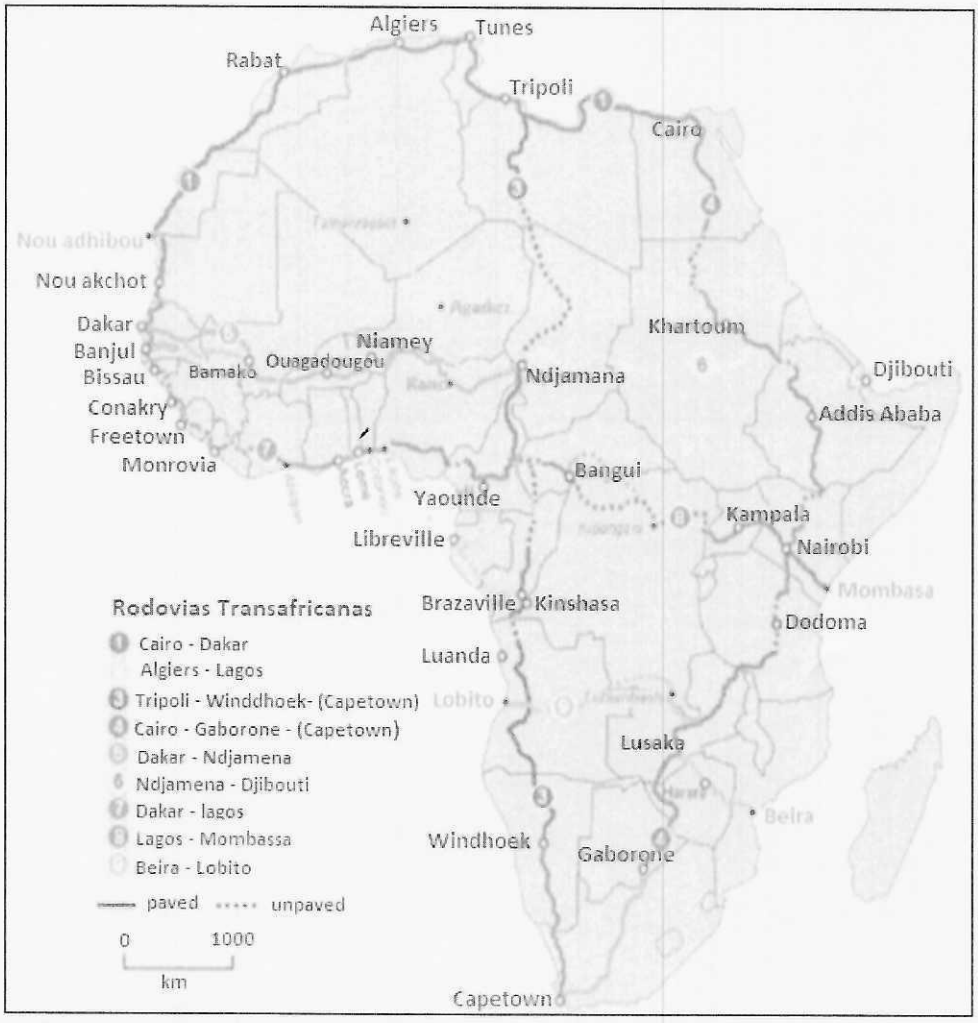


Figure 1: Trans-African corridors. Source: adapted from Olukoju (2020).

Africa accounts for about 13% of the world's population, 38 countries have access to the coast along the continent's 30.490 km of coastline and 15 are landlocked. 33 African countries are classified as least developed, 21 of them have access to the sea and 12 have no access to the sea. The GDP of African countries is relatively low (Trujillo *et al.*, 2013). West Africa is characterized by a number of relatively small ports that spread along the Atlantic coast of West Africa and compete fiercely for cargo destined for the landlocked West African hinterland (Dyck & Ismael, 2015).

Opened in 1866, the port of Dakar was the main port in French West Africa, its annual throughput in 2006 was 9,9 million tons. The port was served by a major railway line opened in 1885, running north to the port of Saint Louis and east to Bamako in Mali. After the completion of the Cana Vridi in 1951, the Porto of Abidjan became the main seaport on the Côte d'Ivoire, leading to the closure of the canals at Porto-Bouet and Grand Bassam. A one-meter narrow gauge railway line from Abidjan a Azaguié was opened in 1905 over a distance of about 70 km (Olukoju, 1992) and (Olukoju, 2020).

In the same vein, Ghana´s first major seaport was opened in 1928. It was proceeded by an eastern railroad built in 1923 to move minerals and cocoa from the interior. After independence, a new port was built in Tema as an outlet for the country´s aluminum smelting plant. In the Republic of Benin, the port of Cotonou was inaugurated in 1965. It has been operational since the era of French colonial rule. A railway line was inaugurated in 1906 to connect Cotonou in Ouidah to the capital of the pre-colonial Kingdom of Daomé (Olukoju, 2020).

In Nigeria, seaport and railroad construction began in the 1890s. the Lagos railroad had reached Ibada in 1901 and Minna in 1911. Meanwhile, the Baro-Kano railroad was built by the northern Nigerian government between 1907 and 1911. Both lines were integrated when northern and southern Nigeria unified in 1914 (Olukoju, 1992; Olukoju, 2020). The port of Douala, on the other landlocked countries to the north since the 19h century. Construction of the railroad and port occurred during German colonial rule until 1914 (Olukoju, 2020).

The port of Dakar has the best crane productivity and one of the cheapest handling costs, its main disadvantage being the distance from the port to the landlocked West African hinterland. Its port technical efficiency is also quite low, with a rather average throughput for a port of its scale. Lagos is the largest port in West Africa, serving Africa´s largest economy (Nigeria). In terms of port infrastructure, Lagos port's quay has the largest berth and terminal area, which is comfortable to accommodate larger ships and more containers, but the water depth of the port is comparatively the most (9m), which leads the port to accommodate only ships of up 2.000 TEUs. That is its major disadvantage. The port changes the lowest handling cost, but has the worst crane productivity compared to the port of Abidjan, Lomé, Tema, Dakar and Cotonou (Dyck & Ismael, 2015).

The most important corridors from the point of view of seaport-hinterland development are Lagos-Kano-Jibiya, Cotonou-Niamey, Lomé-Ouagadougou, Tema-Ouagadougou, Abidjan- Ouagadougou, Abidjan-Bamako and Dakar-Bamako. These

transit corridors are differentiated by certain characteristics. First of all, two of them (Dakar-Bamako and Abidjan-Ouagadougou) have dual rail and road connections. Others are based on road transport services. Second, Dakar and Abidjan serve multiple corridors with Bamako and Ouagadougou being the inland terminals of these links. Third, Dakar, Abidjan and Lomé, unlike Lagos and Tema, profit from their common affiliation with the extinct French empire in west Africa and with rail links across their modern borders (Olukoju, 2020).

In the Gulf of Africa, the port of Lomé is the smallest port in terms of all, but it can accommodate large ships due to its large draught (14m). The port's efficiency and performance in vessel handling is good, but handling cost are relatively high. Its crane productivity is also relatively high (Dyck & Ismael, 2015). In recent decades, due to port costs, shipping companies are choosing efficient and less expensive ports (Munim & Saeed, 2019).

In the same vein, the port of Abidjan is the best in West Africa, offers the best level of service to shipping lines, provides quick access to berths upon ship arrival and a fast ship response time. This allows container ships to spent little time in port and reduce their operating costs. However, the productivity of its crane is relatively very poor, compared only to the one in Lagos. Relatively the average distance from the port of Abidjan to landlocked West African countries is the second best after Tema port. The productivity of the Tema is high and compares only favorably with Dakar. In terms of location, Tema is best suited to serve landlocked West African countries (Dyck & Ismael, 2015).

The Cotonou-Niamey corridor is the busiest in West Africa. A portion of this corridor passes through northern Nigeria, thus diminishing the advantages of Lagos which is Nigeria's main seaport. Cotonou's competitiveness over Lagos can be attributed to two factors (Olukoju, 2020):

- it is the least expensive corridor in West Africa at $3.938 compared to $4.552 for Lagos-Jibiya or $5.095 for the Abidjan-Ouagadougou corridor.
- delays at border checkpoints averaging 98 minutes, were the shortest in the region.

Walvis Bay, Namibia's largest port, was built in 1840. Originally developed by the Germans, it came under South African control as a League of Nations territory that South Africa annexed before Namibia became independent. The Germans began construction of the railroad from Swakopmund to Windhoek in 1897. The Walvis Bay railroad was completed in 1899 (Olukoju, 2020). The port of Luanda, on the other hand, was opened in 1844, but railroad construction did not begin until 1887. However, deterred by the long delays and high prices, Angolan traffic began to use the port of Walvis Bay more as the main gateway to the sea. Walvis Bay is located 2.100 km south of Luanda, but improvements in road rail infrastructure connecting the two cities have made the port more accessible to the Angolan market (Pushak & Foster, 2011).

In general, the quality of port infrastructure differs from country to country and region within the same country and terminal to terminal within the same port, these differences significantly affect logistics performance (Munim & Schramm, 2018).

In addition to the corridors in Figure 1, SADC has other internal corridors that facilities the movement of goods (Figure 2). Despite the differences between gauges, the SADC region has a strong connectivity between different rail lines and road lines, which together connect the ports on the Atlantic coast to the ports on the Indian coast. Among them, the following multimodal (road-rail) corridors can be distinguished:

A. Lobito Corridor – constitutes the shortest route from mineral-rich areas of DRC and Zambia to a port (Duarte *et al.*, 2014). It is estimated that in Katanga alone the copper and cobalt deposits account for 40% and 50% respectively, of the world's total reserves. The need to allocated these resources to the coast makes the Lobito corridor a very important line, as it represents the shortest and fastest line to the European and American markets from the Port of Lobito. However, the inefficiency of the rail and road infrastructure causes these resources to be transported to South African ports (Mouzinho, 2016).

The railway infrastructure is a major component in the Lobito corridor. It runs from the port of Lobito to the Luau-Dilolo border crossing between Angola and the DRC, over a stretch of 1.344 km, includes rails, locomotives, wagons, 70 railway stations and warehouses. Until 2014 the railroad was not operational in the DRC. Zambia had started planning work on a new railway from the copper belt crossing the border post of Jimbe and connecting to the CFB at Luena (Duarte, 2014).

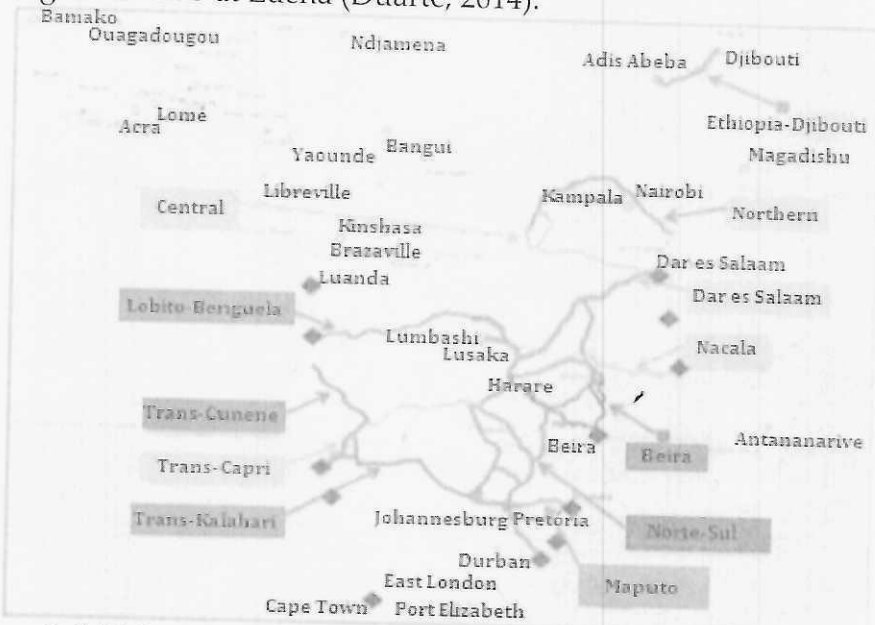


Figure 2: SADC multimodal corridors and major ports. Source: Parida (2014).

B. Trans-Kalahari Corridor – officially opened in 1998, is a paved road that stretches more than 1900 km from the port of Walvis Bay through Botswana to Johannesburg. Together with the Maputo corridor, it connects east to west in four countries (Namibia, Botswana, South Africa and Mozambique). The railway line along the corridor runs from port of Walvis Bay to Gobabis (via Windhoek) and continues on from Lobatse in Botswana. Currently, cargo from the Port of Walvis Bay is mainly transported by road from the Port of Walvis Bay to Gaborone and Gauteng. Cargo can also be transported by rail from the port of Walvis Bay to Gobabis and then offloaded from the train onto a truck,

with the remainder of the trip made by road to Gaborone or Gauteng, as the rail link ends at Gobabis. Okahandja, Gobabis, Karibib, Usakos, Walvis Bay and Swakopmund are some of the tows located along the Trans-Kalahari corridor (Parida, 2014).

The Trans-Kalahari highway connects the port of Walvis Bay with Botswana and the province of Gauteng (South Africa's industrial heartland). Similarly, the Trans-Caprivi highway connects Namibia (Zambia and Zimbabwe) to the port of Walvis Bay. The Trans-Cunene also connects the port of Walvis Bay to neighboring Angola (Namakalu *et al.*, 2014).

C. Beira-Harare Corridor – Mozambique is the gateway for international trade to landlocked countries such as Zimbabwe, Zambia, DRC, Malawi and Botswana, it has the shortest distance to the seaports of Beira, Nacala and Maputo. In this corridor, the Sena railway line (575 Km) is the only existing export corridor, connecting the city of Moatize to the port of Beira. On this line, the section from Beira to Dondo is in poor condition, leading to a single line speed restriction of 20 Km/h (Parida, 2014).

5. Results and discussion

Africa's port infrastructure, particularly that of SADC is developing. For example, the port of Dar es Salaam is one of the largest in Africa with a presence in the global arena. According to Trujillo *et al.* (2013), only East African ports are characterized by first generation port systems, in most African countries port are management by Ministries of Transport. Until 2013 the largest ports in Africa were in Egypt, Morocco, Algeria, Djibouti, Mauritius, Togo and South African. These countries have implemented port reforms.

For years poor management and investment in transport infrastructure have elevated the port of Luanda to the status of the most expensive and inefficient port in SADC, with has negatively influence the port's image and the flow of goods between landlocked SADC countries and the port of Luanda. In general, shipping companies find it attractive to move to a particular port if it offers lower costs, cargo handling efficiency, and routes for the allocation of goods.

The comparative evaluation of terminals and cranes is increasingly pronounced. Thus, to identify the competitiveness of Angola's port infrastructure in SADC, we proceeded to analyze the growth of GDP per capita of each SADC country that has access to the sea (Figure 3). GDP data (total and per capita, current and constant prices, annual) are taken from UNCTADState.

Analyzing the growth dynamics of GDP per capita of the SADC countries that have access to the sea, it is observed that during the period from 2000 to 2021 South Africa showed the highest economic growth, which may mean that South Africa invests heavily in its port infrastructure, because the greater the investment in transport infrastructure, the higher the GDP per capita. Angola's GDP per capita, on the other hand, began growing in 2001, peaking in 2014.

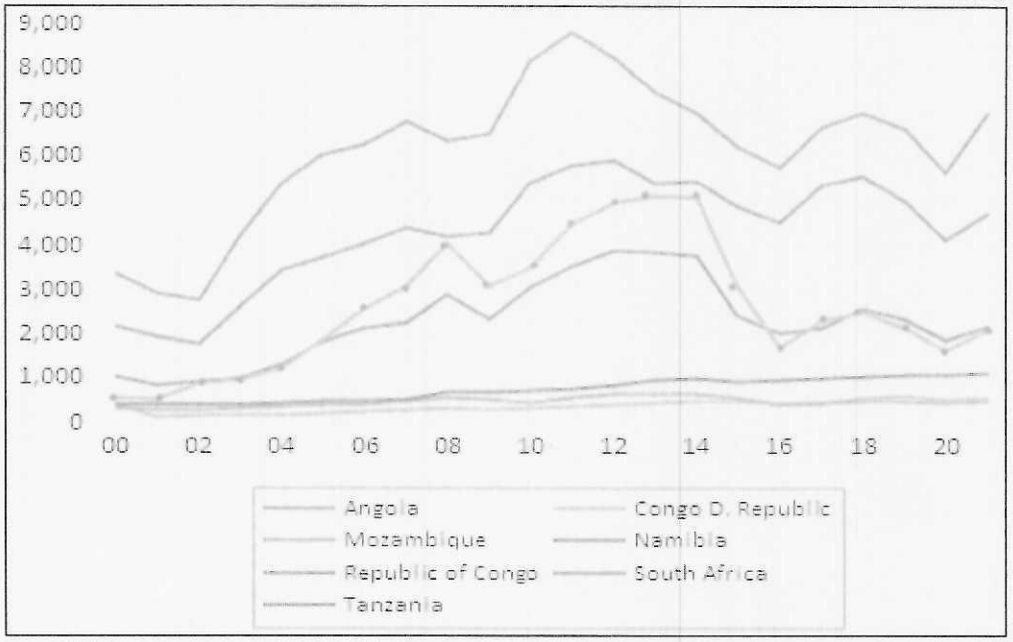


Figure 3: GDP per capita of the SADC countries with access to the sea between 2000 – 2021. (Source: the authors)

This growth reflects investment in transportation infrastructure and the oil boom in the international market. In general, South Africa, Namibia, Angola and the Republic of Congo show the same growth trend. Similarly, the Democratic Republic of Congo, Mozambique and Tanzania show the same growth trend.

Regarding the entry of ships in SADC between 2018 and 2021, the results in Figure 4 illustrate that Angola was on equal footing with Mozambique and Tanzania and they all only below South Africa which had the highest number of registrations in the region.

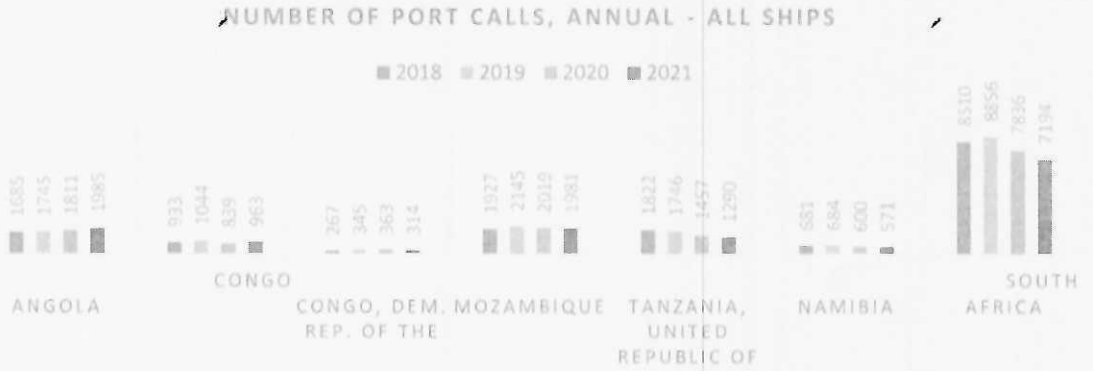


Figure 4: Port calls recorded in the SADC countries between 2018 and 2021 (Source: the authors)

Regarding the number of port calls of liquid bulk carriers among SADC countries, the results in Figure 5 illustrate that Angola was below only South Africa which has the best developed port infrastructure in the region.

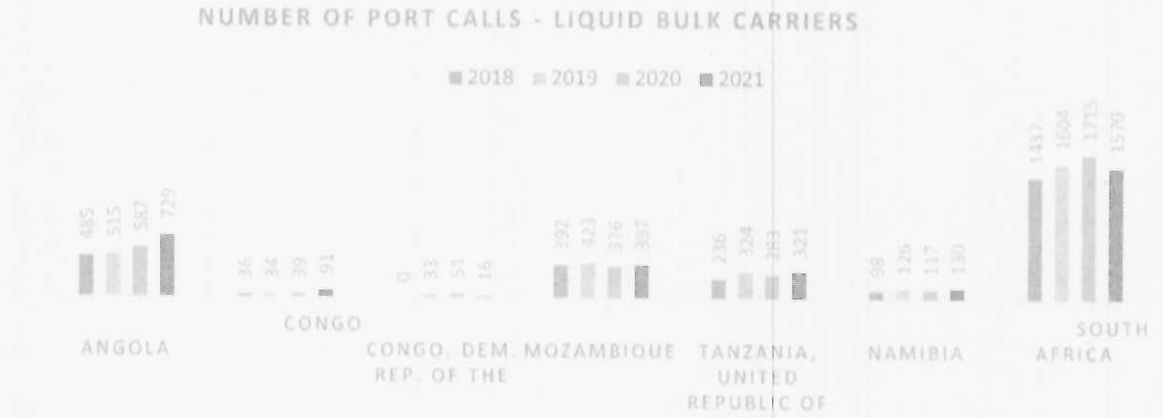


Figure Error! No text of specified style in document.: Number of port calls – liquid bulk carriers between 2018 – 2021
(Source: the authors)

Regarding the number of dry bulk carriers registered in SADC countries between 2018 and 2021, the results in Figure 6 illustrate that Angola had the worst results. Only South Africa and Mozambique had a good result.

Figure 6: Number of port calls – dry bulk carriers between 2018 – 2021
(Source: the authors)

Regarding the number of dry breakbulk carriers registered in SADC countries between 2018 and 2021, the results in Figure 7 illustrate that Angola performed better relative to Namibia, Tanzania, Mozambique, and the DRC.

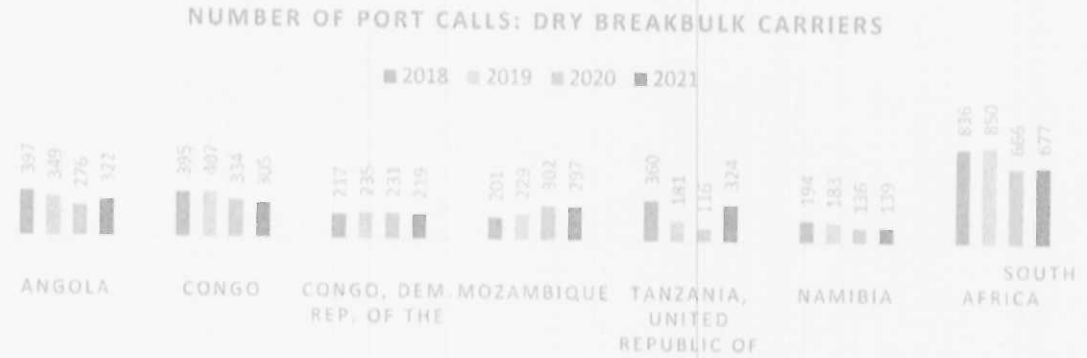


Figure 7: Number of port calls – dry breakbulk carriers between 2018 – 2021
(Source: the authors)

Regarding the number of Roll-On/Roll-Off ships, the results in Figure 8 illustrate that Angola was in the fourth position. It was not a strong competitor in the region.

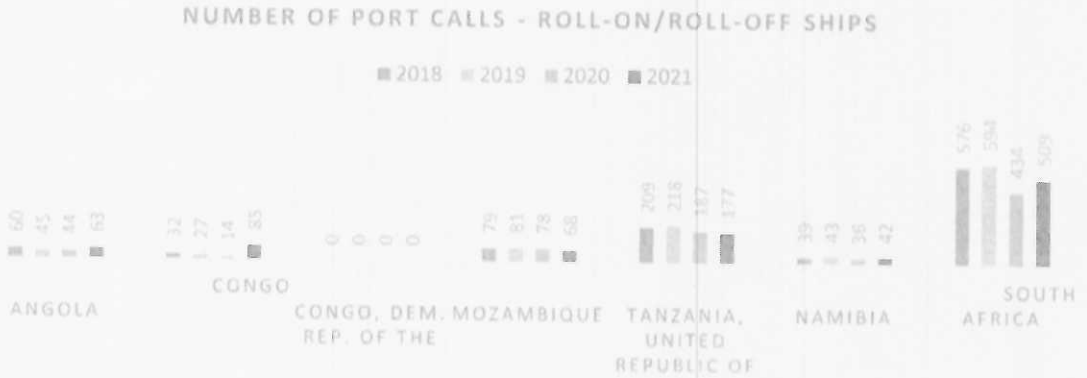


Figure 8: Number of port calls – Roll-On/Roll-Off between 2018 – 2021
(Source: the authors)

Regarding the number of container ships registered in SADC countries between 2018 and 2021, the results in Figure 9 illustrate that Angola was in third place.

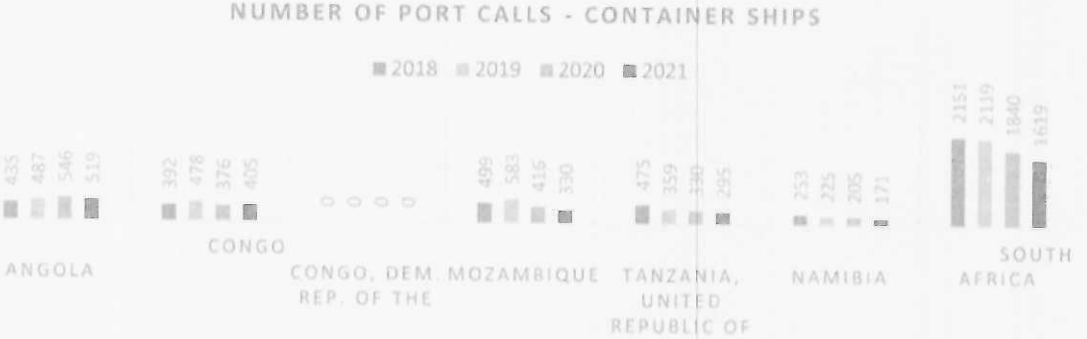


Figure 9: Number of port calls – container ships between 2018 – 2021
(Source: the authors)

Regarding the waiting time of container ships at SADC ports during the year 2021, the results in figure 10 illustrate that Namibian ports had the best performance at the SADC level with almost two days, while the worst performance was at Tanzanian ports, with 3 days.

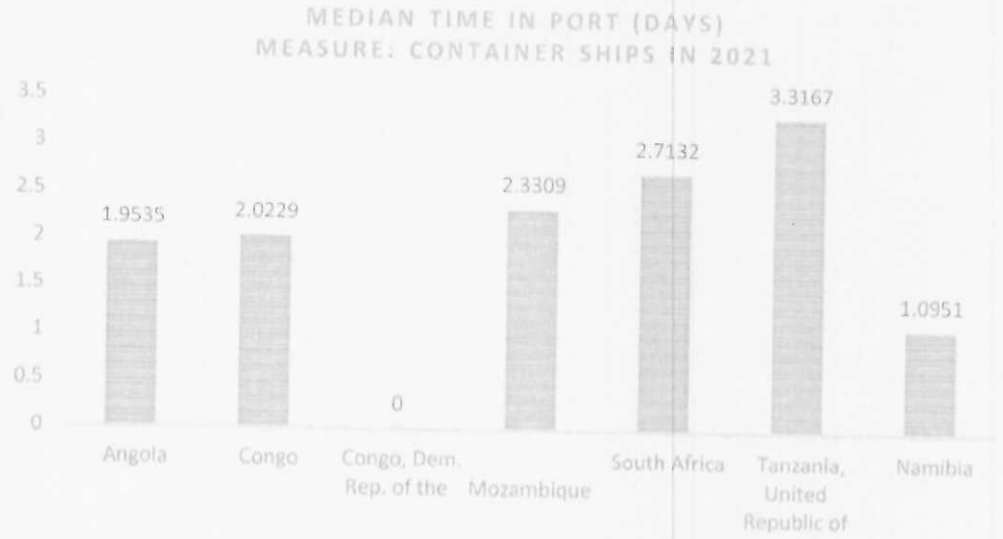


Figure 10: Median time in port in 2021
(Source: the authors)

Regarding the maximum capacity supported by ports in the SADC region during the year 2021, the results in Figure 11 illustrate that South African ports have the highest capacity, while the lowest capacity was recorded at Tanzania ports.

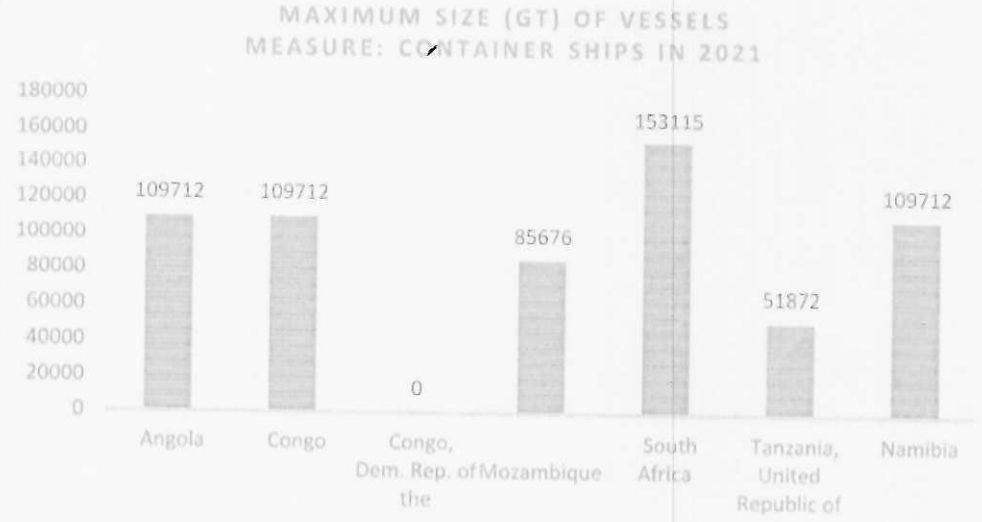


Figure 11: Maximum size of vessels
(Source: the authors)

Regarding the *Average container carrying capacity (TEU) per container ship* registered in SADC during the year 2021, the results in Figure 12 illustrate that the South African ports have the highest average capacity in SADC, while the lowest average capacities were registered in Mozambique and Tanzania.

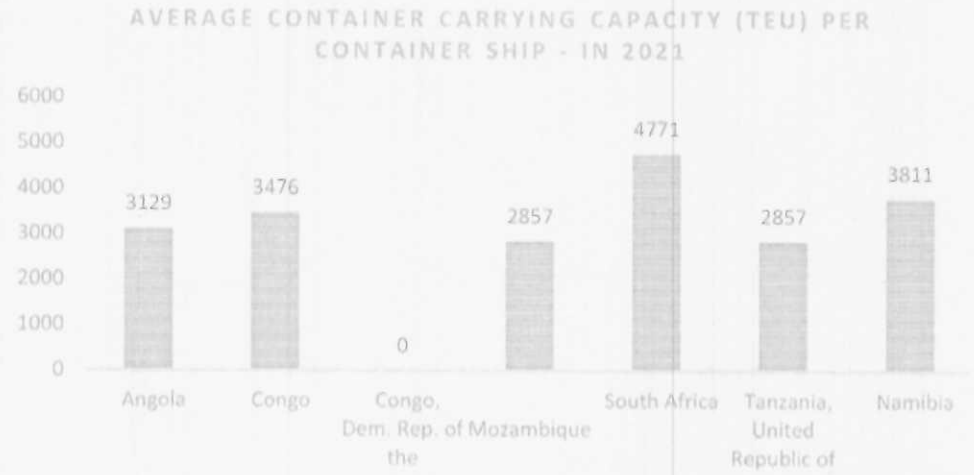


Figure 12: Average container carrying capacity per container ships
(Source: the authors)

Regarding the *maximum container carrying capacity (TEU) of container ship* of container ship supported by the ports in the SADC region during the year 2021, the results in Figure 13 illustrate that the South African ports have the highest capacity in SADC, while the lowest maximum capacities are in Mozambique and Tanzania.

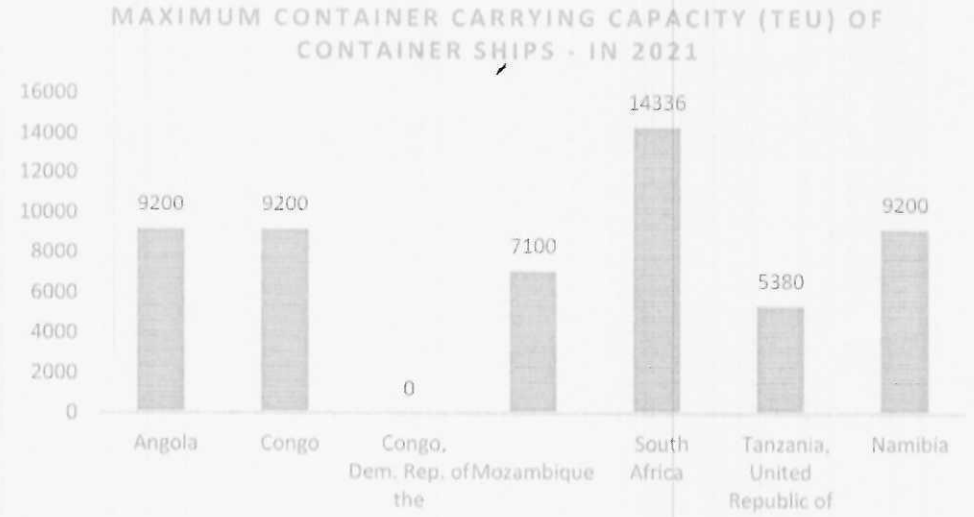


Figure 13: Maximum container carrying capacity of container ships
(Source: the authors)

Based on these comparative analyses, it can be concluded that the Angolan port infrastructure has undergone some improvements that have allowed it to correct the inefficiencies presented until then. Currently, the port of Luanda is neither the best nor the worst in the SADC region. It is believed that if there is strong investment in road and rail infrastructure, the Angolan port infrastructure will each higher level.

Angola´s weak investment in its transport infrastructure is reflected in the weak competitiveness of the Angolan economy vis-à-vis the other SADC economies, the country presents a weak logistical development. The lack of a railway network in the country is undermining the potential of the port of Luanda, which served as a strategic port for Zambia and the DRC. If the country´s road and rail infrastructure were in full operation, the country would have collected a lot of revenue from container allocation in the landlocked countries of the region. According to Deloitte (2014), the poor development of the logistics sector in the country has limited the efficient movement of people and goods, thus compromising Angola´s development. Given the situation, one of the mechanisms to reverse this situation is the rehabilitation of transport infrastructure so that the ports of Angola provide better service, because the price, time and quality reflect significant impact on port competitiveness.

6. Conclusion

Port infrastructure is a fundamental pillar for the Angolan economy, it is the gateway for more than 80% of the products traded in the country. Its management presents complex and hermetic trade-offs, mainly due to the lack of investments and the underdevelopment that the country presents. Although Angola´s port infrastructure has benefited from some improvements, the inefficiency of road and rail infrastructure continues to hold back the performance of Angolan ports in SADC. Currently, Angolan ports have not only become uncompetitive with the Port of Walvis Bay in Namibia, but have also lost domestic clients to this port.

Thus, this study, in addition to allowing the identification of the determining factors, also allowed us to understand the importance that the Angolan port infrastructure represents for the mining regions of the DRC, Zambia, Zimbabwe and Angola itself, which makes the rehabilitation of rail and road infrastructure necessary, since the poor performance of the Angolan port infrastructure is mainly associated with the poor development of road, rail and logistics infrastructure. Without good transport infrastructure, it will be difficult to make the Angolan port infrastructure competitive in the African arena, as other countries have invested heavily in their transport infrastructure. Thus, this study can help decision-makers to develop management strategies that enable efficient and effective investment in Angola´s port infrastructure in the short, medium, and long term.

This study is one of the first to be conducted in a comprehensive manner on Angolan port infrastructure, which, in a way, brings contributions that can help managers make decisions aimed at improving Angola´s port infrastructure. In terms of

limitations, this study was limited to the analysis of comparative results, which to some extent limits in-depth knowledge of the nature of each port infrastructure discussed here. Regarding future studies, we intend to develop work to characterize the state and impact of Angola´s road and rail infrastructure on the development of the Angola economy, as well as on the integration of supply chains at the SADC level. The current context of Angola shows that as long as the country does not have good road and rail infrastructure, the Angolan port infrastructure will not be competitive enough in SADC. The outflow routes must be improved to enable an efficient and effective supply of goods in the short, medium and long term.

7. Recommendations

Therefore, to increase the volume of national trade and increase the level of growth of the Angolan economy, it is essential that the Angolan government invest heavily in transport infrastructure. We believe that without good transport infrastructure there are no conditions to boost logistics, the agricultural sector, local industry, regional trade, and supply chain.

Declaration of Conflicting Interests
The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
This research received no funding.

About the Author(s)
Pedro Manuel Campos is a student of the Doctoral Program in Economics in the Lisbon University. His research interests include Microeconomics, Transport Infrastructure, Operation Research, Applied Mathematics and Supply Chain Management.
[ORCID]: (https://orcid.org/0000-0002-8957-833X).

References

Aerts, G., Grage, T., Dooms, M., & Haezendonck, E. (2014). Public-Private Partnerships for the provision of port infrastructure: an explorative multi-actor perspective on critical success factors. *The Asian Journal of Shipping and Logistics, 30*(3), 273–298. https://doi.org/10.1016/j.ajsl.2014.12.002

Alexis, A., Guihua, N., & Pingfeng, L. (n.d.). Measuring logistics performance of the autonomous Port of Cotonou in Benin. *Proceeding of the 7th International Conference on Innovation & Management.*

Alrukaibi, F., Alkheder, S., & Almashan, N. (2020). Sustainable port management in Kuwait: Shuwaikh port system. *The Asian Journal of Shipping and Logistics, 36*(1), 20–33. https://doi.org/10.1016/j.ajsl.2019.10.002

ANEME. (2016). *Enquadramento sócio-económico, perspectivas do país e potenciialidades de parceria Portugal/Angola.*

Angola, C. de comércio e indústria P. (2016). Anuário angola 2016/17. *18ª Edição*, 222.

Awad-núñez, S., González-cancelas, N., Soler-flores, F., & Camarero-Orive, A. (2016). A methodology for measuring sustainability of dry ports location based on Bayesian networks and multi-criteria decision analysis. *Transportation Research Procedia, 13*, 124–133. https://doi.org/10.1016/j.trpro.2016.05.013

Bank, T. W. (2005). *Private solutions for infrastructure in Angola.*

Bennett, R., & Gabriel, H. (2001). Reputation, trust and supplier commitment: The case of shipping company/seaport relations. *Journal of Business & Industrial Marketing, 16*(6), 424–438. https://doi.org/10.1108/EUM0000000006018

Caldeirinha, V., Felício, J. A., Salvador, A. S., Nabais, J., & Pinho, T. (2020). The impact of port community systems (PCS) characteristics on performance. *Research in Transportation Economics, 80*(2020), 100-818.

Campos, P., Pimentel, C., & Lopes, J. (2022). Determinant factors for the strategic management of the supply chain of the Angolan cement industry. *Journal of Industrial Engineering and Management, 15*(4), 566. https://doi.org/10.3926/jiem.3410

Campos, P., Pimentel, C., & Lopes, J. (2023). Angolan cement industry: Marketing channel and distribution channel strategies. *Spring Nature, International Conference on Quality Innovation and Sustainability* pp 323-335. https://doi.org/10.1007/978-3-031-12914-8_25

Caschili, S., & Medda, F. (2015). The port attractiveness inde: application on African ports. *Région et Développement.*

Castilla-rodríguez, I., Expósito-izquierdo, C., Melián-batista, B., Aguilar, R. M., & Moreno-vega, J. M. (2020). Simulation-optimization for the management of the transshipment operations at maritime container terminals. *Expert Systems With Applications, 139*, 112852. https://doi.org/10.1016/j.eswa.2019.112852

Chenhao, Z., Wencheng, W., & Haobin, L. (2020). Container reshuffling considered space allocation problem in container terminals. *Transportation Research Part E, 136*(2), 1–23. https://doi.org/10.1016/j.tre.2020.101869

Clark, X., Dollar, D., & Micco, A. (2004). Port efficiency, maritime transport costs, and bilateral trade. *Journal of Development Economics, 75*, 417–450. https://doi.org/10.1016/j.jdeveco.2004.06.005

Cosco, C. Di. (2017). The impact of logistics on exports. In *Universidad Austral.*

Cullinane, K., Song, D.-W., & Wang, T. (2005). The application of mathematical programming approaches to estimating container port production efficiency. *Journal of Productivity Analysis, 24*, 73–92.

D´Este, G. M., & Meyrick, S. (1992). Carrier selection in a RO/RO ferry trade Part 1. Decision factors and attitudes. *Maritime Policy & Management: The Flagship Journal*

of International Shipping and Port Research, 19(2), 115–126. https://doi.org/10.1080/03088839200000019

Deloitte. (2014). Logística em Angola : desafios actuais e perspectivas de desenvolvimento. *Relatório.*

Duarte, A., Santos, R., & Tjønneland, E. N. (2014). Angola's Lobito Corridor: From reconstruction to development. *Angola Brief, 4*(5), 1–4.

Dwarakish, G. S., & Salim, A. M. (2015). Review on the Role of Ports in the Development of a Nation. *Aquatic Procedia, 4*, 295–301. https://doi.org/10.1016/j.aqpro.2015.02.040

Dyck, G. K. Van, & Ismael, H. M. (2015). Multi-Criteria evaluation of port competitiveness in West Africa using analytic hierarchy process (AHP). *American Journal of Industrial and Business Management, 5*, 432–446.

Esmer, S., Nguyen, H., Bandara, M. Y., & Yeni, K. (2016). Non-price competition in the Port Sector: a case study of Ports in Turkey. *The Asian Journal of Shipping and Logistics, 32*(1), 003–011.

Fancello, G., Pani, C., Serra, P., & Fadda, P. (2014). Port cooperation policies in the mediterranean basin: An experimental approach using cluster analysis. *Transportation Research Procedia, 3*(July), 700–709. https://doi.org/10.1016/j.trpro.2014.10.049

Ferrari, R. (2016). Writing narrative style literature reviews. *The European Medical Writers Association, December 2015.* https://doi.org/10.1179/2047480615Z.000000000329

Gasparyan, A. Y., Ayvazyan, L., Blackmore, H., & Kitas, G. D. (2011). Writing a narrative biomedical review: considerations for authors, peer reviewers, and editors. *Rheumatol Int, 31*, 1409–1417. https://doi.org/10.1007/s00296-011-1999-3

Ghiara, H., & Caminati, M. (2017). Maritime and logistics advanced producer services within the Mediterranean: the liner shipping companies' positioning strategies in new market areas. *Transportation Research Procedia, 25*, 165–186. https://doi.org/10.1016/j.trpro.2017.05.388

Golub, S., & Prasad, V. (2016). *Promoting economic diversification and international competitiveness in Angola* (Issue 4).

González, M. M., & Trujillo, L. (2008). Reforms and infrastructure efficiency in Spain's container ports. *Transportation Research Part A, 42*, 243–257. https://doi.org/10.1016/j.tra.2007.08.006

Goss, R. O. (1990). Economic policies and seaports: The economic functions of seaports. *Maritime Policy and Management, 17*(3), 207–219. https://doi.org/10.1080/03088839000000028

Green, B. N., Johnson, C. D., & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal of Chiropractic Medicine, 5*(3), 101–117.

Guy, E., & Urli, B. (2006). Port selection and multicriteria analysis: an application to the Montreal-New York Alternative. *Economics, Recently Maritime, 8*, 169–186. https://doi.org/10.1057/palgrave.mel.9100152

Ha, M. (2003). A comparison of service quality at major container ports: implications for Korean ports. *Journal of Transport Geography, 11*, 131–137. https://doi.org/10.1016/S0966-6923(02)00069-8

Haddad, E. A., Perobelli, F. S., Araújo, I. F., & University, T. P. D. (2020). Uneven integration: the case of Angola. *Researcch Square*.

Hales, D. N., Chang, Y. T., Lam, J. S. L., Desplebin, O., Dholakia, N., & Al-Wugayan, A. (2017). An empirical test of the balanced theory of port competitiveness. *International Journal of Logistics Management, 28*(2), 363–378. https://doi.org/10.1108/IJLM-06-2015-0101

Hochrein, S., & Glock, C. H. (2012). Systematic literature reviews in purchasing and supply management research: a tertiary study. *International Journal of Integrated Supply Management, November*. https://doi.org/10.1504/IJISM.2012.052773

Hsu, W. K., Lian, S., & Huang, S. S. (2020). An assessment model based on a hybrid MCDM approach for the port choice of liner carriers. *Research in Transportation Business & Management, 34*(November 2019), 100426. https://doi.org/10.1016/j.rtbm.2019.100426

Jacobs, W., & Hall, P. V. (2007). What conditions supply chain strategies of ports? The case of Dubai. *GeoJournal, 68*, 327–342. https://doi.org/10.1007/s10708-007-9092-x

Jensen, S. K. (2018). Angola's infrastructure ambitions through booms and busts policy, governance and refor. *The Royal Institute of International Affairs, Chatham House, September*.

Jouili, T. A., & Allouche, M. A. (2016). Impacts of seaport investment on the economic growth. *Promet – Traffic&Transportation, 28*(4), 365–370.

Kaliszewski, A., Kozłowski, A., Dąbrowski, J., & Klimek, H. (2020). Key factors of container port competitiveness: a global shipping lines perspective. *Marine Policy, 117*(2), 103896. https://doi.org/10.1016/j.marpol.2020.103896

Kawasaki, T., Hanaoka, S., Saito, Y., & Tagawa, H. (2021). Port choice problem in a linear city: application to Manila and Batangas ports in the Philippines. *Maritime Transport Research, 2*(January), 100010. https://doi.org/10.1016/j.martra.2021.100010

Malchow, M. B., & Kanafani, A. (2004). A disaggregate analysis of port selection. *Transportation Research Part E, 40*, 317–337.

Michal, Mg., Huynh, N., Shukla, N., Munoz, A., & Barthelemy, J. (2017). RailNet: a simulation model for operational planning of rail freight. *Transportation Research Procedia, 25*, 461–473. https://doi.org/10.1016/j.trpro.2017.05.426

Mokhtari, K., Ren, J., Roberts, C., & Wang, J. (2011). Application of a generic bow-tie based risk analysis framework on risk management of sea ports and offshore terminals. *Journal of Hazardous Materials, 192*(2), 465–475. https://doi.org/10.1016/j.jhazmat.2011.05.035

Montwill, A. (2016). The impact of the development of seaport objective functions for a cargo logistics system in urban areas, illustrated with an example of the Szczecin

Parida, P. (2014). Unlocking mineral resource potential in Southern African countries: is rail infrastructure up to the Challenge? *Transportation Research Procedia, 1*(1), 206–215. https://doi.org/10.1016/j.trpro.2014.07.021

Parola, F., Risitano, M., Ferretti, M., & Panetti, E. (2017). The drivers of port competitiveness: a critical review. *Transport Reviews, 37*(1), 116–138. https://doi.org/10.1080/01441647.2016.1231232

Porto, J. G., & Clover, J. (2003). Chapter 3. The peace dividend in Angola: Strategic implications for Okavango basin cooperation. In *The peace dividend in Angola.*

Pushak, N., & Foster, V. (2011). Angola's infrastructure. A continental perspective. *The World Bank Africa Region Sustainable Development Unit September 2011, September.*

Refas, S., & Cantens, T. (2018). " Maritime transport in Africa: challenges, opportunities and an agenda for Future research" - why does cargo spend weeks in African ports? The case of Douala, Cameroon. *The World Bank Africa Region Transport Department, UNCTAD Ad Hoc Expert Meeting (Under the Framework of the IAME Conference 2018) 11 September 2018, Mombasa, Kenya.*

Ragin, C. C, & Rihoux, B. (2004). Qualitative comparative analysis (QCA): State f the art and prospects. *Qualitative Methods, 2(2), 3-13.*

Ragin, C. (2008). " What is qualitative comparative analysis (QCA)? Presentation at 3th ESRC research methods festival. *Departament of Sociology and Department of Political Science, University of Arizona, Tucson, AZ 85721 USA.*

Ries, J., González-Ramírez, R. G., & Miranda, P. (2014). A fuzzy logic model for the container stacking problem at container terminals. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 8760,* 93–111. https://doi.org/10.1007/978-3-319-11421-7_7

Rimmer, P. J. (1998). Ocean liner shipping services: corporate restructuring and port selection/competition. *Asia Pacific Viewpoint, 39*(2), 193–208.

Rodrigue, J., & Notteboom, T. (2012). Dry ports in European and North American intermodal rail systems: two of a kind? *Research in Transportation Business & Management, 5,* 4–15. https://doi.org/10.1016/j.rtbm.2012.10.003

Roig-Tierno, N., Gonzalez-Cruz, T. F. & Llopis-Martinez, J. (2017). An overview of qualitative comparative analysis: A bibliometric analysis. *Journal of Innovation & Knowledge, 2(2017), 15-23.*

Roso, V., Woxenius, J., & Lumsden, K. (2009). The dry port concept: connecting container seaports with the hinterland. *Journal of Transport Geography, 17*(5), 338–345. https://doi.org/10.1016/j.jtrangeo.2008.10.008

Rusu, L. I. (2015). Economic efficiency of sea transport. Case study: Constanta - Galati. *Procedia Economics and Finance, 32*(15), 1598–1607. https://doi.org/10.1016/S2212-5671(15)01486-0

Santos, A. M. P., Mendes, J. P., & Soares, C. G. (2016). A dynamic model for marginal cost pricing of port infrastructures. *Maritime Policy & Management, 8839*(4), 1464–5254. https://doi.org/10.1080/03088839.2016.1152404

Song, D.-W., & Yeo, K.-T. (2004). A Competitive Analysis of Chinese Container Ports Using the Analytic Hierarchy Process. *Maritime Economics & Logistics, 6*, 34–52. https://doi.org/10.1057/palgrave.mel.9100096

Starr, J. T. (1994). The mid-Atlantic load centre: Baltimore or Hampton Roads? *Maritime Policy & Management: The Flagship Journal of International Shipping and Port Research, 21*(3), 219–227. https://doi.org/10.1080/03088839400000045

Teng, J., Huang, W., & Huang, M. (2004). Multicriteria evalution for port competitiveness of eight east Asian container ports. *Journal of Marine Science and Technology, 12*(4), 256–264.

Tongzon, J., & Heng, W. (2005). Port privatization, efficiency and competitiveness: Some empirical evidence from container ports (terminals). *Transportation Research Part A: Policy and Practice, 39*(5), 405–424. https://doi.org/10.1016/j.tra.2005.02.001

Trujillo, L., Campos, J., & Pérez, I. (2018). Competition vs . cooperation between neighbouring ports: a case study in Chile. *Research in Transportation Business & Management, 26*(September 2017), 100–108. https://doi.org/10.1016/j.rtbm.2018.03.005

Trujillo, L., González, M. M., & Jiménez, J. L. (2013). An overview on the reform process of African ports. *Utilities Policy, 25*, 12–22. https://doi.org/10.1016/j.jup.2013.01.002

Wiegmans, B., Witte, P., & Spit, T. (2015). Inland port performance: a statistical analysis of Dutch inland ports. *Transportation Research Procedia, 8*, 145–154. https://doi.org/10.1016/j.trpro.2015.06.050

Wilmsmeier, G., Hoffmann, J., & Sanchez, R. J. (2006). The imact of port characterics on international marritime transport costs. *Port Economics Research in Transportation Economics, 16*(06), 117–140. https://doi.org/10.1016/S0739-8859(06)16006-0

Wilmsmeier, G., & Sanchez, R. J. (2017). Evolution of national port governance and interport competition in Chile. *Research in Transportation Business & Management, 22*, 171–183. https://doi.org/10.1016/j.rtbm.2017.01.001

Woo, S. H., Pettit, S. J., Kwak, D. W., & Beresford, A. K. C. (2011). Seaport research: A structured literature review on methodological issues since the 1980s. *Transportation Research Part A: Policy and Practice, 45*(7), 667–685. https://doi.org/10.1016/j.tra.2011.04.014

Woodside, A. G. & Zhang, M. (2012). Identifiyng X-Consummers using causal recipes: "Whales" and "Jumbo Shrimps" Casino Gambers. *J Gambl Stud* (2012) 28: 13-26.

Yeo, H. (2015). Participation of private investors in container terminal operation: influence of global terminal operators. *The Asian Journal of Shipping and Logistics, 31*(3), 363–383. https://doi.org/10.1016/j.ajsl.2015.09.003

Yip, T. L., Sun, X. Y., & Liu, J. J. (2011). Group and individual heterogeneity in a stochastic frontier model: container terminal operators. *European Journal of Operational Research, 213*(3), 517–525. https://doi.org/10.1016/j.ejor.2011.03.040

Yuan, Y., & Hunt, R. H. (2009). Systematic reviews: the good, the bad, and the ugly. *The American Journal of Gastroenterology, 104*(5), 1086–1092. https://doi.org/10.1038/ajg.2009.118

Yudhistira, M. H., & Sofiyand, Y. (2017). Seaport status, port access, and regional economic development in Indonesia. *Maritime Economics & Logistics*, *4*. https://doi.org/10.1057/s41278-017-0089-1

Yuen, C. A., Zhang, A., & Cheung, W. (2012). Port competitiveness from the users' perspective: an analysis of major container ports in China and its neighboring countries. *Research in Transportation Economics*, *35*(1), 34–40. https://doi.org/10.1016/j.retrec.2011.11.005

European Journal of Economic and Financial Research
ISSN: 2501-9430
ISSN-L: 2501-9430
Available on-line at: http://www.oapub.org/soc

DOI: 10.46827/ejefr.v7i1.1429

Volume 6 | Issue 4 | 2022

THE IMPACT OF ROAD, RAIL AND PORT INFRASTRUCTURE ON THE ANGOLAN EXPORT GROWTH: AN AUTO-REGRESSIVE DISTRIBUTED LAG ANALYSIS

Pedro Manuel Campos[i]
Lisbon School of Economics & Management,
Lisbon University,
Portugal

Abstract:
This study seeks to analyze the impact of investment in road, rail, and port infrastructure on Angola's exports growth, using imports and GDP per capita as control variables. This study uses annual data for the period 2000-2020. The Auto-Regressive Distributed Lag is applied to determine the existence of short-run and long-run correlation between the variables. The results of the model suggest that there is a short-run and a long-run relationship between transport infrastructure investment, imports, exports, and economic growth. The coefficient of the variables in the short run and in long run is statistically significant at 5% of significance, which means that all variables impact the growth of exports significantly.

JEL: R40; R41; F10; F15

Keywords: Angolan transport infrastructure; impact of transport infrastructure, import; export; economic growth

1. Introduction

Achieving a sustainable level of economic growth with low import indexes and high export indexes is the main objective of the macroeconomic policies of several countries. Angola's main export product since independence has been crude oil. Already among the imports are foodstuffs, clothing, industrial equipment, automobiles, construction materials, medicines, and hospital equipment, among others.

The literature states that there is a close relationship between transportation infrastructure, exports, imports, and economic growth. The impact of these variables on the lives of citizens and the growth of the country is immediate. Developing roads, railroads and ports positively impact a country's economy. For example, mercantilists

[i] Correspondence: email pecampos001@yahoo.com.br

from the early days of economics as a science believed that the effective way to achieve the greatest wealth of the nation is through foreign trade. According to McConnell *et al.* (2019), in this context, it is essential to increase exports and decrease imports.

Export plays a very important role in economic development. Export increases the total demand in society, which in turn increases the level of national income (Abdulrahman, 2021). Exports represent the value of goods sold abroad to active an increase in national income. Export represents a demand for goods and services produced by an economy for residents outside that economy. In a broad sense, it is the value of all goods, services and capital exported to the rest of the world to achieve an increase in national income *(Morgan et al.,* 2012). The more exports that are made, the greater the level of income in the circular flow of national income.

Angola has an area of 1.246.700 km^2, and is the seventh largest country in Africa. Despite its long continental border of 84.837 km, connections to other economies in the region are limited by poor land transport infrastructure. The country's eastern, northeastern, and southwestern provinces are isolated from the rest of the country due to a lack of good transportation infrastructure (Haddad *et al.,* 2020). The weak development of the Angolan supply chain is strongly linked to the poor development of transportation infrastructure that limits the large flows of goods and services, especially in the interior of the country (Campos *et al.,* 2022) and (Campos *et al.,* 2023).

After independence, a civil war supported by both the capitalist and the communist bloc began (Åkesson & Orjuela, 2019). The war seriously affected the infrastructure, leading the country's economy to rely heavily on imports following the collapse of domestic industry and agriculture (Porto & Clover, 2003). The war devasted the country and destroyed most of its economic infrastructure (Pushak & Foster, 2011). After the war, the government began to rebuild the transportation infrastructure (Jensen, 2018). Peace and political stability set the stage for an economic boom fueled by revenues from oil production. However, despite the significant improvements that have been recorded in the rehabilitation of roads, railways, ports and airports, the country still faces vast infrastructure shortages (Ojukwu *et al.,* 2013) and (Duarte *et al.,* 2014).

Despite the investment made, in terms of infrastructure and logistics Angola still faces serious difficulties in achieving levels of efficiency and services desired by companies operating in the Angolan market. Angolan's supply of logistics services is composed of an inefficient supply of customs, roads and railway (Deloitte, 2014). The levels achieved are still far below what is needed to close the gap (ANEME, 2016) and (Haddad *et al.,* 2020). Thus, given the importance that transport infrastructure (road, railway, and ports) plays in the movement of flows of goods, it is essential to understand the impact they have on the import and export of goods and services at the local level.

The objective of this research is to analyze the impact of investment in roads, railway, and ports on the growth of the Angolan economy. For that, the following research question was raised:

1) What impact does investment in road, rail and port infrastructure have on Angolan export growth?

There are very few scientific papers addressing the state of Angola's transportation infrastructure, as well as the correlation of the variables mentioned above. The existence of little literature signals a deficit that somewhat hinders the understanding of the balance of trade balance as well as the growth and development of the impact of these variables becomes fundamental to understanding the dynamics of the country's economic growth.

This article is organized into six sections. Section 1 presents the problem under study, the objective, the research question, and the justification of the need for the research conducted. Section 2 discusses transport infrastructure, its classification, impact, export, and import. Section 3 presented the methodology and research method. Section 4 presented the data, econometric model specification. At Section 5 it is presented the discussion of the empirical results. Finally, the section 6 presents the final considerations.

2. Literature review

2.1. The impact of imports and exports on the economy

Hye & Boubaker (2011) developed a study to investigate Tunisia's growth based on exports, imports and sustainability using annual time series data for the period 1960-2008. The authors used the ARDL approach to determine the long-run causality relationship between exports, imports, and GDP. Their results indicate unidirectional causality from exports to economic growth and bidirectional relationship between imports and economic growth.

Exports are a component of aggregate expenditures. Net exports are calculated by adding the trade balance and the services balance (McConnell *et al.* (2019). The trade balance is the difference between the value of services a country exports and the value of services a country import (Enders & Ma, 2011).

Gross domestic product (GDP) measures the value of final goods and services produced in a given country over a given period, usually a year (McConnell *et al.*, 2019) and (Abdulrahman, 2021). Real GDP keeps the price constant, which makes it a better measure than nominal GDP of changes in an output of goods and services from one year to the next. Growth in the economy is almost always measured as real GDP growth (McConnell *et al.*, 2019).

The impact of export promotion on GDP growth has been extensively investigated. Examining growth based on exports, imports and external debt sustainability is important for the following reasons (Hye & Boubaker, 2011):

- It serves as an indicator for the government of the effectiveness of regulations and reforms undertaken, as well as guidelines for policy making and planning;
- Second, export-oriented growth reflects the health of the eternal environment within which the country's trade is evolving.
- Export oriented growth and trade import-oriented growth is fixed in an association or agreement between a group of countries.

Ghirmay *et al.* (2001) studied the relationship between exports and economic growth in nineteen developing countries using a multivariate causality analysis based on error correction model. Their results showed a long-term relationship between the two variables only in twelve developing countries, with export promotion attracting investment and increasing GDP in these countries. Moutinho & Madaleno (2020) in their study on economic growth in African OPEP countries, refer that there is a significant expansion of trade flows of African countries (among them Angola) with China and India, thus increasing exports as well as imports.

Figure 1 show the trends of GDP per capita, exports and imports growth of Angola between 2000 and 2020. Despite the reports on the economic growth that the country achieved in the post-war period, in the broad sense the determinants that should drive or have repelled economic growth and development in the country have not been explored in depth.

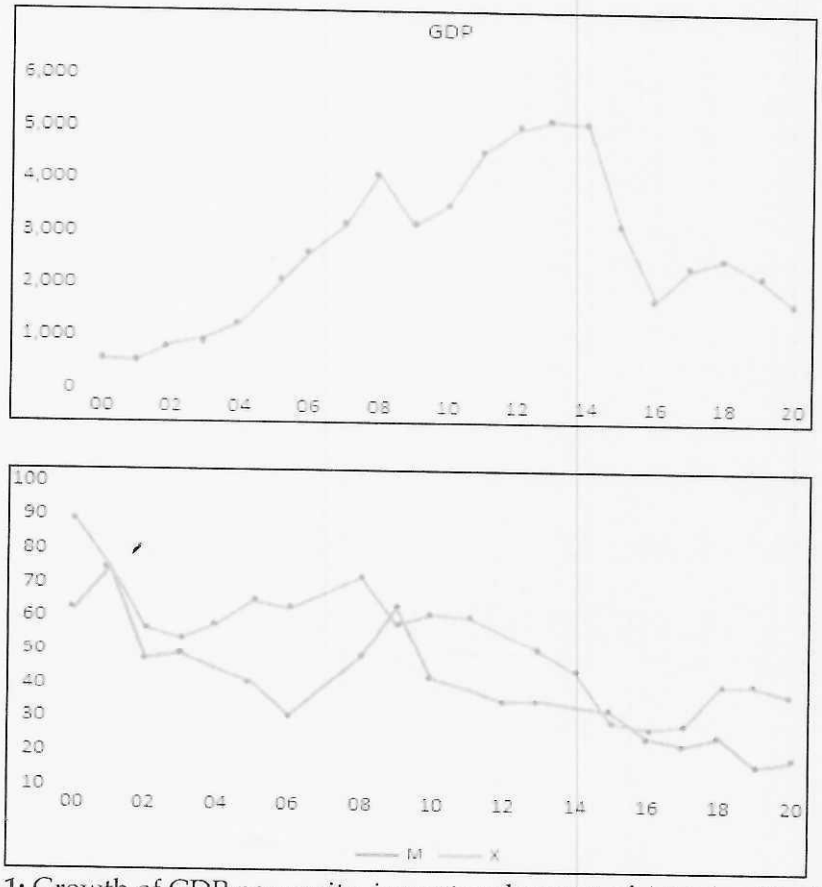


Figure 1: Growth of GDP per capita, import and export of Angolan (% of GDP)
(Source: World Bank)

Thus, it is felt that the challenge for the country today is to explore the transportation infrastructure which are the main drives of economic growth in the country.

2.2. The impact of transport infrastructure on the economy

Different authors, whether in the field of public policy, economics, infrastructure planning, as well as other areas, have analyzed the role of transportation infrastructure. Examining the relationship between transportation infrastructure and economic growth helps clarify some questions regarding transportation improvements and economic development.

A well-developed transport infrastructure provides certain benefits through certain micro and macroeconomic factors of productivity. It has a direct impact on the quality and cost of logistic services, allows reducing the time and cost of transportation, decreases the risk and improves the quality of logistics services, improves comforts, safety and security (Skorobogatova & Kuzmina-merlino, 2017).

Transport infrastructure developments lead to the creation of new economic activities necessary for the construction, maintenance of transport infrastructures and provide comfort to the users of these infrastructures. In this context, high levels of investment in transport infrastructure imply higher economic growth and increased future output, especially, when these investments are properly targeted and managed. Their results impact on social welfare (Grimsey & Lewis, 2002) and (Carnis & Yuliawati, 2013).

Arbués *et al.* (2015) noted that the construction of transport infrastructure between point A and point B causes impacts (direct and/or indirect) on the economy of neighboring regions (spillover effect). Road transport infrastructure positively affects the output of the region in which the infrastructure is located and neighboring regions, while the construction of ports and airport cause less significant impacts. The role that transportation infrastructure plays in a region's economy is determined by the services it provides.

There are many approaches on the impact of investment in transport infrastructure and most of them converge in considering that public spending on infrastructure boosts economic growth. Transport infrastructure increases productivity and economic growth, facilitates the transport of goods between regions, reduces travel time and accident risks, and indirectly generates employment opportunities.

The spillover effects of the economy derived from the construction of transportation infrastructure began to gain notability from Aschauer's studies dating back to 1989 (Condeço-melhorado *et al.*, 2014). The connection between transportation infrastructure investments and economic growth and vice versa has attracted considerable attention from researchers in recent decades (Mohmand *et al.*, 2020). However, the pioneer to suggest a positive relationship between economic growth and infrastructure was Aschauer in 1989. Similarly, Wan & Zhang (2018) in analyzing the direct and indirect effects of infrastructure on firm productivity have distinguished the relevance of the contribution of (Aschauer, 1989) and (Krugman, 1991).

Transportation infrastructure allows firms to serve wider markets more economically, allows firms to obtain skilled labor and transport goods more safely and

quickly, thus making them more productive (Ahmed *et al.*, 2013), (Arbués *et al.*, 2015) and (Banerjee *et al.*, 2020).

2.3. The road infrastructure

The road network is one of the most important transport infrastructure (Anor *et al.*, 2012), its rehabilitation contributes to the growth of a country, increases productivity and reduces production costs, especially in the agricultural sector (Peter *et al.*, 2015) on the contrary, poorly maintained roads restrict mobility, significantly increase vehicle operating costs, increase accident rates and exacerbate isolation between regions, poverty, poor health and illiteracy in rural communities (Burningham & Stankevich, 2005).

Road infrastructure is an essential part of everyday life. Its users, logistics companies, and public transportation agents expect a reliable and safe road infrastructure to travel from one place to another and transport goods. Thus, managers need to properly plan, build, maintain, and operate road infrastructure so that it adds value to users (Hartmann *et al.*, 2016). Road infrastructure and all transportation services that use roads, such as private vehicles, public transportation, and freight carriers improve the public's standard of living, support commercial integration, provide social services, and contribute to the development of the economy (Rensburg & Krygsman, 2020).

Road infrastructure performance is closely associated with passenger and freight transportation systems and socioeconomic development. Moreover, it is commonly measured by indicators monitored by sensors (Song *et al.*, 2021). Transportation infrastructure is a vital socioeconomic asset, it structures space and determines the mobility of trade flow as well as the location of industries and markets. Its construction and maintenance absorb significant resources, and its importance and public nature raise political and economic concerns (Short & Kopp, 2005). As such, transportation infrastructure is a crucial component of economic growth (Barzin *et al.*, 2018).

2.4. Railway infrastructure

Rail transportation is more economical compared to road transportation (Sala & Ravishankar, 2019), it is an important and irreplaceable means of transportation due to its peculiar characteristic such as, high energy efficiency in handling large masses, especially in medium and long distances, high operation speed, comprehensive system and less climate action (Cao *et al.*, 2020).

Several railway infrastructure exhibit very high levels of degradation, which makes the maintenance of these infrastructure a great challenge due to the volume of financial capital required (Rama & Andrews, 2014). However, despite rolling stock wear and tear, rail infrastructure continues to play a vital role in the multimodal freight and passenger transportation market due to its advantages in volume, speed, efficiency, and environmental friendliness (Meng & Corman, 2020). The goal of rail infrastructure is to provide access to destination while ensuring punctuality, safety, comfort, and reliability

in the transportation of people and goods as a function of the quality of design, construction, operation, and maintenance (Nathanail, 2014).

2.5. Port infrastructure

Port infrastructure plays a crucial role for the stability and growth of economies. However, its development is quite costly (Aerts *et al.*, 2014). Port and offshore terminals are essential infrastructure and play important roles in the transportation of goods. With over 80% of international trade by volume being conducted by sea, these infrastructures are vital to maritime trade (Mokhtari *et al.*, 2011). Ports are key nodes in supply chains, port authorities focus on increasing their efficiency and effectiveness (Caldeirinha *et al.*, 2020). A port is a geographical area where ships dock to load and unload cargo, generally it is a protected deep-water area. Ports are composed of several terminals (Dwarakish & Salim, 2015) and (Alrukaibi *et al.*, 2020).

The economic relevance of ports stems from the fact that most of a region's foreign trade is conducted by sea. Thus, the level of port efficiency greatly affects a country's competitiveness, since port efficiency results in lower export tariffs that, in turn, favor the competitiveness of domestic products in international markets (González & Trujillo, 2008).

In general, ports fall into two categories: seaports and dry ports. A seaport is a gateway, connecting regions and countries. Ports generate significant impacts on the regions in which they are located and on adjacent regions (Yudhistira & Sofiyand, 2017). Dry ports are classified into three categories (Roso *et al.*, 2009). Dry ports function as inland hubs to facilitate the movement of cargo between seaports and the hinterland (Nguyen & Notteboom, 2016). Based on the literature, three types of cargo terminal are distinguished: satellite terminals (A), cargo centers (B), and transfer centers (C). Satellite terminals tend to be close to a port facility, but mostly on the periphery (sometimes less than 100 km away). They accommodate additional traffic and empty container depots (Rodrigue & Notteboom, 2012).

2.6. Angola's transport infrastructure

The bulk of public spending on infrastructure was directed to the transport sector, of which more than 2/3 was used for road construction. From 2002 to 2009, Angola spent an average of $2.8 billion per year on road reopening programs. This effort was maintained throughout the 2009-2018 period and about $2.1 billion/year or 2.1% of Angola's GDP was allocated to the road sector. Almost 97% of public expenditure in this sector was allocated to rehabilitation and resurfacing works. Spending on road maintenance represents on average only 5% of total road spending, or $28 million/year (Benmaamar *et al.*, 2020). Angola began rebuilding its infrastructure in 2002. In the transportation infrastructure sector, 13.000 km of roads have been rehabilitated and four major ports have been upgraded (Muzima, 2019).

Despite the investment made, about 2/3 (64%) of the road networks is in critical condition. The quality of Angola's road infrastructure is reflected in the 136th place in a

list of 141 countries, based on the 2019 Global Competitive Report. Angola's score is 2.2 out of 7.0 and is one of the lowest in Africa. Angola lags countries that have lower GDP (Ghana, Senegal, Ivory Coast) (Muzima, 2019) and (Benmaamar *et al.*, 2020).

The current asset value of the road network is about $11.20 billion or about 11,0% of Angola's GDP and every US dollar spent on road maintenance will generate $3.4 in cost savings for the road user. The current asset value as a share of the maximum road asset value is 74.5%. This indicates that over 25% of the asset value of the road network is lost due to lack of maintenance or postponement of road rehabilitation (Benmaamar *et al.*, 2020).

Regarding the railway infrastructure, railway construction in Angolan began in 1887, and in 1989 the Luanda railway line was inaugurated, and in 1910 and 1912 the Moçâmedes and Benguela railway lines were inaugurated respectively. In 1961, the Moçâmedes railway was extended to Menongue in the interior (Olukoju, 2020). Currently, the country has a railway network of 2.950 km, of which 2.725 km have been rehabilitated with the investment of more than $3 billion, all the way the railway network still needs interventions (Muzima, 2019).

As for port infrastructure, there are currently seven seaports in Angola (Amboim, Cabinda, Lobito, Luanda, Malongo, Namibe e Soyo), four of which are deep-water (Luanda, Lobito, Amboim and Namibe) and three are shallower (Malongo, Soyo and Cabinda). According to (Muzima, 2019), Angola has four major seaports (Luanda, Cabinda, Lobito and Namibe) that make the country a regional transportation hub for neighboring landlocked countries.

Luanda with 11 berths is the most important port and receives 80% of Angola's import. The second most important port in the country is the port of Lobito. Most of Angola's port are limited by factors such as, poor management, low container flow and poor connection with rail (Golub & Prasad, 2016). The capacity of the port of Lobito has been expanded, but its utilization rate is still less than 25% due to the lack of infrastructure that would allow in to be connected to neighboring landlocked inland countries (Zambia mining companies) (Muzima, 2019). The Malongo port in general is more used for the provision of services to the oil industry, for this reason it is not very busy. To keep control of container flows, the seaport of Luanda is assisted by the dry port of km-30, installed adjacent to the special economic zone of Luanda.

3. Material and Methods

The present study used the unsystematic literature review based on the approach of (Green *et al.*, 2006), (Yuan & Hunt, 2009), (Gasparyan *et al.*, 2011), (Hochrein & Glock, 2012) and (Ferrari, 2016). Searches were conducted in Scopus, Web of Science, Science Direct and Google Scholar, using the following keywords: *"Angolan transport infrastructure"*, *"import"*, *"export" and "growth economic"*. The following filtering criteria were used: (1) *publication years: 1990 – 2021; (2) document type: article; (3) source type: journal; (4) language: English.* All extracted articles were manually analyzed considering

the following inclusion an exclusion criterion: title analysis, research area, keywords used, contributions, and main results.

Regarding the research method, the present study used the Auto-Regressive Distributed Lag (ARDL) approach to analyze the relationship between variables in the growth and development of the Angolan economy. The implementation of the ARDL approach was adopted for the following reasons:

- the sample use in this study is small, containing 21 annual observations;
- the ARDL cointegration limit tests developed by (Pesaran *et al.*, 2001) fit small samples (Odhiambo, 2009) and (Hye & Boubaker, 2011);
- the ARDL method is superior to other cointegration procedures, since it allows working with variables of different orders I(0), I(1) or factionally cointegrated (Hye & Boubaker, 2011);
- in the ARDL technique, the long-term and short-term factors of the model are evaluated at the same time (Belloumi, 2014).

3.1. Data sources and model variables

This section sets out the analytical framework in this study, providing the model used to examine the impact of investment in transport infrastructure (roads, railway, and ports) on Angola's exports growth, using imports and GDP per capita as a control variable. The data was taken from two databases: Angola's Ministry of Finance and World Bank.

Table 1: Variables in the Models and Data Sources

Variables	Symbol	Meaning	Data Source
Crescimento económico	GDP	GDP per capita (current US$) – is gross domestic product divide by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	World Bank
Imports	M	Imports of goods and services (% of GDP) represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	World Bank
Road infrastrucutures	ROAD	Total de investment in road.	Ministry of Transporte
Railway infrastructures	RAIL	Total de investment in railway	Ministry of Transporte

Port infrastructures	PORT	Total de investment in ports.	Ministry of Transporte
Exports	X	Exports of goods and services (% of GDP) represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	World Bank

To analyze the impact of the variables on X growth, the economic function was specified in equation (1). The independent variables are GDP per capita, imports, and investment in road, rail, and port infrastructure. The dependent variable is exports of goods and services growth. The model is shown as follows:

$$X = f(Road, Rail, Port, GDP, M) \quad (1)$$

The econometric form of the equation is presented as follows in equation (2):

$$X_t = \beta_0 + \beta_1 Road_t + \beta_2 Rail_t + \beta_3 Port_t + \beta_4 M + \beta_5 GDP_t + \varepsilon_t \quad (2)$$

Where X represents the exports growth. Road represents investment in road infrastructure. Rail represents investment in railway infrastructure, Port represents investment in port infrastructure, import, and GDP per capita represents the control variables. The parameters β_1, β_2, β_3 β_4 and β_5 are the long-terms elasticity of export. t and ε_t represents time and the white noise perturbation error term. The expected signs of β_1, β_2, β_3 β_4 and β_5 are positive because an increase in the level of investment capital of transport infrastructure should grater effects on export, greater economic activity, and higher GDP per capita growth.

4. Results and Discussion

4.1. Trend of the series and Unit Root Test

There are three ways to identify whether a series is stationary or not (graphical method, Autocorrelation Function (ACF) and Dickey and Fuller test (AF)). For this purpose, in this research, to identify whether the series are stationary or not and to understand the order of integration of the variables, we performed the unit root test and the conventional Augmented Dickey-Fuller (ADF) test. The results in Figure 2 show that some variables are stationary at level and other are stationary at first difference. To understand the analysis, two parameters must be considered: the *t-statistic* and the probability value, using the following hypotheses with an $\alpha = 0{,}05$ or 5%:

- H0: the series has a unit root and is not stationary (null hypothesis);
- H1: the series does not have a unit root and is therefore stationary.

For the series to be considered stationary, we must reject the null hypothesis (H0), concluding with 95% confidence that it is a stationary series, as shown in Figure 2.

1	UNIT ROOT TEST RESULTS TABLE (ADF)							
2	Null Hypothesis: the variable has a unit root							
3		At Level						
4			X	GDP	M	ROAD	RAIL	PORT
5	With Constant	t-Statistic	-2.1698	-1.9486	-1.6456	-2.0891	-2.7660	-3.7246
6		Prob.	0.2222	0.3049	0.4421	0.2505	0.0819	0.0119
7			n0	n0	n0	n0	*	**
8	With Constant & Trend	t-Statistic	-2.3006	-0.7412	-2.9963	-1.9158	-2.9360	-3.7030
9		Prob.	0.4148	0.9548	0.1572	0.6091	0.1742	0.0461
10			n0	n0	n0	n0	n0	**
11	Without Constant & Trend	t-Statistic	-2.0490	-0.4228	-1.4908	-1.4645	-1.4424	-1.4156
12		Prob.	0.0415	0.5177	0.1239	0.1298	0.1350	0.1412
13			**	n0	n0	n0	n0	n0
14		At First Difference						
15			d(X)	d(GDP)	d(M)	d(ROAD)	d(RAIL)	d(PORT)
16	With Constant	t-Statistic	-3.3715	-2.9447	-5.9824	-4.5998	-4.1936	-7.8404
17		Prob.	0.0256	0.0588	0.0001	0.0020	0.0050	0.0000
18			**	*	***	***	***	***
19	With Constant & Trend	t-Statistic	-3.2108	-3.3430	-3.3370	-4.6572	-4.0667	-7.7763
20		Prob.	0.1118	0.0950	0.0939	0.0079	0.0254	0.0000
21			n0	*	*	***	**	***
22	Without Constant & Trend	t-Statistic	-3.3593	-3.0258	-5.4959	-4.7330	-4.3126	-8.0672
23		Prob.	0.0020	0.0046	0.0000	0.0001	0.0002	0.0000
24			***	***	***	***	***	***
25								
26	Notes:							
27	a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant							
28	b: Lag Length based on SIC							
29	c: Probability based on MacKinnon (1996) one-sided p-values							

Figure 2: Unite Root Test
(Source: the authors)

A stationarity test is necessary before carrying out the regression analysis because if the time series is no stationary, the regression results will become spurious. If the series is not stationary, we need to do the differencing. Differencing can help stabilize the mean of a time series by removing changes in the level of a time series, and therefore eliminating (or reducing) trend.

4.2. Regression of the model using the ARDL method

In this section we are going to discuss the ARDL cointegration, long run and shot run coefficient and long run adjustment (Error correction form). ARDL cointegration is used when considered variables have different order of integration that is some variables are stationary at level and some are stationary at first difference. Thus, when performing the regression, the following results illustrated on the Figure 3 were obtained.

The variable X that represents the Angolan export, with lag presents a positive coefficient (0.519015) and its p-value is statistically significant (0.0206), this means that this variable positively impacts the growth of export. GDP per capita at level presents a positive coefficient (0.010070) and its p-value is statistically significant (0.0168), this means that this variable positively impacts the growth of export. GDP per capita with

one and two lags presents a negative coefficient (-0.006276; -0.003555) and its p-value are statistically insignificant (0.1876; 0.2534), this means don't impact the growth of export. M has a positive coefficient (1.325412) and its p-value is statistically significant (0.0065), this means impact positively the export growth. M variable with one and two lags presents a negative coefficient (-0.484609; -0.507612) and its p-value are statistically significant (0.0283; 0.0280), this means impact the growth of export negatively. The road variable at level has negative coefficients (-1.96E-09) and statistically insignificant p-value (0.3373), which mean that do not impact the X growth. The road variable with one lag has negative coefficients (-7.00E-09) and statistically significant p-value (0.0090), which means that impact negatively the X growth.

Dependent Variable: X
Method: ARDL
Date: 11/30/22 Time: 13:48
Sample (adjusted): 2002 2020
Included observations: 19 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): GDP M ROAD RAIL PORT
Fixed regressors: C
Number of models evaluated: 243
Selected Model: ARDL(1, 2, 2, 2, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
X(-1)	0.519015	0.166475	3.117675	0.0206
GDP	0.010070	0.003069	3.281467	0.0168
GDP(-1)	-0.006276	0.004221	-1.486782	0.1876
GDP(-2)	-0.003555	0.002814	-1.263289	0.2534
M	1.325412	0.324291	4.087103	0.0065
M(-1)	-0.484609	0.168715	-2.872357	0.0283
M(-2)	-0.507612	0.176084	-2.882781	0.0280
ROAD	-1.96E-09	1.88E-09	-1.042547	0.3373
ROAD(-1)	-7.00E-09	1.85E-09	-3.793410	0.0090
ROAD(-2)	5.91E-09	1.31E-09	4.509220	0.0041
RAIL	-2.20E-08	9.58E-09	-2.298186	0.0613
PORT	7.29E-09	4.68E-09	1.557337	0.1704
C	18.47746	6.591960	2.803030	0.0310

R-squared	0.981695	Mean dependent var	51.46842
Adjusted R-squared	0.944786	S.D. dependent var	13.70231
S.E. of regression	3.219711	Akaike info criterion	5.392202
Sum squared resid	62.19924	Schwarz criterion	6.038397
Log likelihood	-38.22592	Hannan-Quinn criter.	5.501564
F-statistic	26.66722	Durbin-Watson stat	3.469954
Prob(F-statistic)	0.000326		

*Note: p-values and any subsequent tests do not account for model selection.

Figure 3: Regression of the model ARDL
(Source: the authors)

The road variable with two lags has positive coefficient (5.91E-09) and p-value (0.0041) is statistically significant, meaning that impact X positively. The rail variable at level has negative coefficient (-2.20E-08) and p-value (0.0613) is statistically insignificant, meaning that does not impact X. The port variable at level has positive coefficient (7.29E-09) and p-value (0.1704) is statistically insignificant, meaning that don't impact X. However, the constant (C) presents a positive coefficient (18.44746) and p-value (0.0310) statistically significant at 5%, meaning that if everything remains constant the X will have a positive impact.

4.3. ARDL long run and bound test

The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). According to Belloumi (2014), in the presence of I(2) we cannot interpret the values of the F Statistics provided by (Pesaran *et al.*, 2001). The ARDL cointegration equation is formulated as follows:

$$\Delta X_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta Road_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta Rail_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta Port_{t-1} + \sum_{i=1}^{n} \beta_4 \Delta GDP_{t-1} + \sum_{i=1}^{n} \beta_5 \Delta M_{t-1} + \mu_t \quad (3)$$

Where Δ presents the first difference, β_0 denotes the drift component, μ_t is the white noise residual and X, GDP, road, rail, port, and M are as defined earlier.

Interpreting the coefficient of the variables in the Figure 4, we can see that the constant (C) presents a positive coefficient (18.44746) and p-value (0.0310) statistically significant at 5%, meaning that if everything remains constant the X will have a positive impact.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(X)
Selected Model: ARDL(1, 2, 2, 2, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 11/30/22 Time: 13:52
Sample: 2000 2020
Included observations: 19

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.47746	6.591960	2.803030	0.0310
X(-1)*	-0.480985	0.166475	-2.889233	0.0277
GDP(-1)	0.000240	0.001996	0.119970	0.9084
M(-1)	0.333192	0.180228	1.848721	0.1140
ROAD(-1)	-3.05E-09	2.37E-09	-1.286932	0.2455
RAIL**	-2.20E-08	9.58E-09	-2.293186	0.0613
PORT**	7.29E-09	4.68E-09	1.557337	0.1704
D(GDP)	0.010070	0.003068	3.281407	0.0166
D(GDP(-1))	0.003555	0.002814	1.263289	0.2534
D(M)	1.325412	0.324291	4.087103	0.0065
D(M(-1))	0.507612	0.178084	2.850781	0.0285
D(ROAD)	-1.98E-09	1.88E-09	-1.042547	0.3373
D(ROAD(-1))	-5.91E-09	1.31E-09	-4.509220	0.0041

*p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.000498	0.004189	0.118876	0.9093
M	0.692708	0.251920	2.749797	0.0333
ROAD	-6.33E-09	5.76E-09	-1.102097	0.3127
RAIL	-4.58E-08	2.47E-08	-1.851623	0.1135
PORT	1.52E-08	9.33E-09	1.624353	0.1554
C	38.41587	12.72335	3.019319	0.0234

EC = X - (0.0005*GDP + 0.6927*M -0.0000*ROAD -0.0000*RAIL + 0.0000 *PORT + 38.4159)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	4.799403	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	19	Finite Sample: n=35		
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419
		Finite Sample: n=30		
		10%	2.407	3.517
		5%	2.91	4.103
		1%	4.134	5.761

Figure 4: Limit test of ARDL
(Source: the authors)

GDP variable with lag has positive coefficient (0.700914) and its p-value (0.0147) is statistically significant at 5% significance, meaning that it positively impacts the growth of GDP per capita. The variable X with lag presents a negative coefficient (-0480985) and its p-value is statistically significant (0.0277), this means that this variable negatively

impacts them self. GDP per capita with lag presents a positive coefficient (0.000240) and its p-value is statistically insignificant (0.9084), this means that this variable doesn't impacts the growth of export. M with lag presents a positive coefficient (0.333192) and its p-value are statistically insignificant (0.1140), this means that don't impact the export growth.

Road with lag has a negative coefficient (-3.05E-09) and its p-value is statistically significant (0.2455), this means don't impact the growth of export. Rail at level has a negative coefficient (-2.20E-08) and its p-value is statistically insignificant (0.0613), this means that don't impact the export growth. Port at level has a positive coefficient (7.29E-08) and its p-value is statistically significant (0.1704), this means don't impact the export growth.

The difference of GDP per capita at level has a positive coefficient (0.010070) and its p-value is statistically significant (0.0168), this means that impact the export growth positively. The difference of GDP per capita with a lag has a positive coefficient (0.003555) and its p-value is statistically insignificant (0.2534), this means that don't impact the export growth. The difference of M has a positive coefficient (1.325412) and its p-value is statistically significant (0.0065), this means that impact the export growth positively.

The difference of M with one lag has a positive coefficient (0.507612) and its p-value is statistically significant (0.0280), this means that impact the growth of export positively. The difference of road has a negative coefficient (-196E-09) and its p-value is statistically insignificant (0.3373), this means that don't impact the export growth. However, the difference of road with lag has a negative coefficient (-591E-09) and its p-value is statistically significant (0.0041), this means that impact the export growth negatively.

Regarding the long-run coefficient we see that the GDP per capita has a positive coefficient (0.000498) and its p-value (0.9093) higher that 5% significance, which means that statistically it is insignificant, it does not impact the X growth. The variable M has a positive coefficient (0.692728) and p-value (0.0333) statistically significant at 5% of significance, which means that statistically impact the X positively. The variable *road* has a negative coefficient (-6.33E-09) and p-value (0.3127) statistically insignificant at 5% of significance, which means that statistically don't impact the X.

The variable *rail* has a negative coefficient (-4.58E-08) and p-value (0.1135) statistically insignificant at 5% of significance, which means that statistically don't impact the X. The variable *port* has a positive coefficient (1.52E-08) and p-value (0.1554) statistically insignificant at 5% of significance. However, the constant (C) has a positive coefficient (38.41587) and a p-value (0.0234) statistically insignificant at 5% of significance, which means that statistically impact positively the X at long-run. The constant elucidates that if everything remains constant, the transport infrastructure investment and the control variable in the long-run will impact the X growth positively.

To understand the ARDL bound test is used the following rules from (Pesaran *et al.*, 2001) and (Narayan, 2005):

- if *F-stats* is greater than value of upper bound, this shows there is cointegration;

- if *F-stats* is in between the value of upper bound and lower bound, this shows the result is inconclusive;
- if *f-stats* is less than value of lower bound, this show there is no cointegration.

After checking the F-Bounds tests it is noted that, the calculated *F value* is 4.799403 which is above the upper and lower bound test. The critical value of the upper bound is 4.15 at 1% significance at level. This means that the null hypothesis of no cointegrating relationship can be rejected which implies that X is cointegrated with transport infrastructure investment and control variables. So there exists a long-run relationship between the variables.

4.4. Error correction form

Therefore, applying the Error Correction form for short-run coefficient and long-run adjustment we obtained the results shown in Figure 5. Error correction regression are represented by with summation signs while α in second part of the equation representing the long-run relationship. The estimation of short-run relationship based on error correction model is specified as:

$$\Delta X_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta Road_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta Rail_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta Port_{t-1} + \sum_{i=1}^{n} \beta_4 \Delta GDP_{t-1} + \sum_{i=1}^{n} \beta_5 \Delta M_{t-1} + \lambda ECT_{t-1} \quad (4)$$

Where λ measure the speed of adjustment and significant and negative coefficient (λ) of ECT_{t-1} implies that any disequilibrium in short-run between the dependent and explanatory variables will converge back to the long-run equilibrium relationship.

All variables that represent the short run become statistically significant et 5% of significance. The difference of GDP per capita has a positive coefficient (0.010070) and its p-value is statistically significant (0.0001), this means that impact the growth of export positively. The difference of GDP per capita with a lag has a positive coefficient (0.003555) and its p-value is statistically significant (0.0279), this means that impact positively the growth of export. The difference of M has a positive coefficient (1.325412) and its p-value is statistically significant (0.0000), this means that impact the export growth positively. The difference of M with one lag has a positive coefficient (0.507612) and its p-value is statistically significant (0.0004), this means that impact the export growth positively.

The difference of road has a negative coefficient (-196E-09) and its p-value is statistically significant (0.0176), this means that negatively impact the export growth. The difference of road with one lag has a negative coefficient (-591E-09) and its p-value is statistically significant (0.0002), this means that impact the growth of export negatively. In the long run, the adjustment or cointegration equation (CointEq(-1))* has a negative coefficient (-0.480985), and its P value (0.0002) is significant. This implies that the speed of adjustment towards long run equilibrium is 48% or system corrects its previous period disequilibrium at a speed of 48% time within one period.

ARDL Error Correction Regression
Dependent Variable: D(X)
Selected Model: ARDL(1, 2, 2, 2, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 11/30/22 Time: 17:32
Sample: 2000 2020
Included observations: 19

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP)	0.010070	0.001115	9.029587	0.0001
D(GDP(-1))	0.003856	0.001233	2.883298	0.0279
D(M)	1.325412	0.110707	11.97225	0.0000
D(M(-1))	0.507612	0.072263	7.025439	0.0004
D(ROAD)	-1.96E-09	6.04E-10	-3.245266	0.0176
D(ROAD(-1))	-5.91E-09	7.18E-10	-8.230695	0.0002
CointEq(-1)*	-0.480985	0.058678	-8.197051	0.0002

R-squared	0.939934	Mean dependent var	-1.973684
Adjusted R-squared	0.909901	S.D. dependent var	7.584789
S.E. of regression	2.276680	Akaike info criterion	4.760623
Sum squared resid	62.19924	Schwarz criterion	5.108574
Log likelihood	-38.22592	Hannan-Quinn criter.	4.819510
Durbin-Watson stat	3.460954		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.799403	10%	2.08	3
k	6	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Figure 5: Error correction regression
(Source: the authors)

In order to analyze the existence of cointegration and the interactions of short-run and long-run dynamics between highway investment and economic growth, this study applied the bounds test developed by (Pesaran *et al.*, 2001). The results show that the calculated value of *F statistics* (4.499403) is greater than the *critical value* of the *upper bound* (4.15). Therefore, the hypothesis of the absence of cointegration is rejected, which implies the existence of a long-run relationship between the variables.

4.5. Residual diagnostics

After the limit test of the long-term and short-term coefficients of the ARDL model, several diagnostic tests were performed whose results showed that the ARDL approach has no problems with autocorrelation. Based on the Jarque-Bera the residuals of the test are normal. The value is 0.022029 and p value (0.989046) is greater than 5%.

Breusch-Godfrey Serial Correlation LM Test proves that the residual obtained from the ARDL model is free from serial correlation. The Obs*R-squared is 15.57480 and Prob value is 0.0004. Likewise, Heteroskedasticity Tests: Breusch-Pagan-Godfrey proves that the residual obtained from the ARDL model are free heteroskedasticity. The Obs*R-squared is 16.56025 and Prov value is 0.1669.

5.6. Stability diagnostics

The Ramsey RESET Test was used to check the appropriate functional form. The probability value of F-statistic is 1.404058 suggesting that the model is well specified.

As can be seen from the results of the Wald Test in Figure 6, exception lags c(3), c(4), c(8) and c(12) which aren't statistically significant, lags c(1), c(2), c(5), c(6), c(7), c(9), c(10) and c(13) are statistically significant at 5% significance, this means that impact the export growth positively.

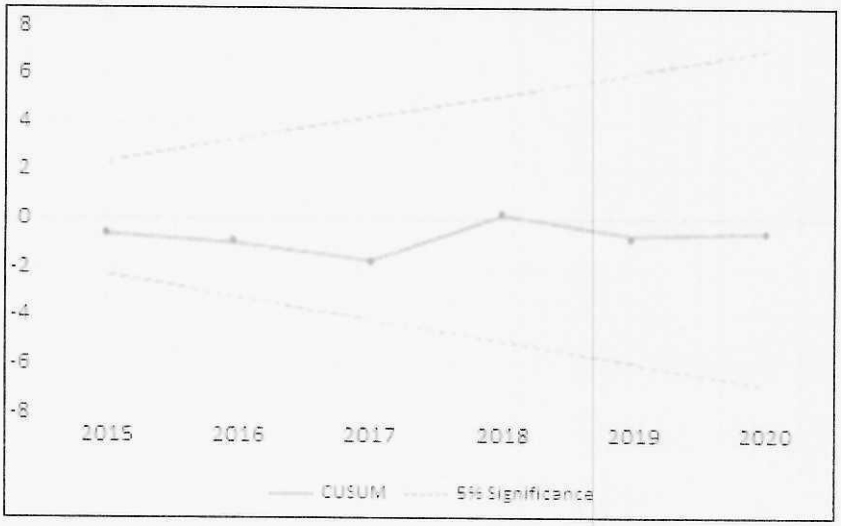
Dependent Variable: X
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 11/30/22 Time: 19:44
Sample (adjusted): 2002 2020
Included observations: 19 after adjustments
X = C(1)*X(-1) + C(2)*GDP + C(3)*GDP(-1) + C(4)*GDP(-2) + C(5)*M + C(6)*M(-1) + C(7)*M(-2) + C(8)*ROAD + C(9)*ROAD(-1) + C(10)*ROAD(-2) + C(11)*RAIL + C(12)*PORT + C(13)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.519016	0.166475	3.117675	0.0206
C(2)	0.010070	0.003069	3.281467	0.0166
C(3)	-0.006276	0.004221	-1.486782	0.1876
C(4)	-0.003556	0.002814	-1.263289	0.2534
C(5)	1.325412	0.324291	4.087103	0.0065
C(6)	-0.484609	0.168716	-2.872357	0.0283
C(7)	-0.507812	0.176084	-2.882781	0.0280
C(8)	-1.96E-09	1.88E-09	-1.042547	0.3373
C(9)	-7.00E-09	1.85E-09	-3.793410	0.0090
C(10)	6.91E-09	1.31E-09	4.509220	0.0041
C(11)	-2.20E-08	9.58E-09	-2.298186	0.0613
C(12)	7.29E-09	4.68E-09	1.557337	0.1704
C(13)	18.47746	6.591960	2.803030	0.0310

R-squared	0.981596	Mean dependent var	61.46842
Adjusted R-squared	0.944786	S.D. dependent var	13.70231
S.E. of regression	3.219711	Akaike info criterion	5.392202
Sum squared resid	62.19924	Schwarz criterion	6.038397
Log likelihood	-38.22592	Hannan-Quinn criter.	5.501564
F-statistic	26.66722	Durbin-Watson stat	3.469954
Prob(F-statistic)	0.000326		

Figure 6: Wald Test
(Source: the authors)

After analyzing the lags, Figure 7 shows the plot of cumulative sum (CUSUM) Test and cumulative sum of squares (CUSUMSQ) remained between the 5% critical bounds which prove the stability of the parameters. The model is structurally stable. But, if CUSUM Test and CUSUMSQ exceed the 5%, critical bounds we can confirm instability of the coefficient.



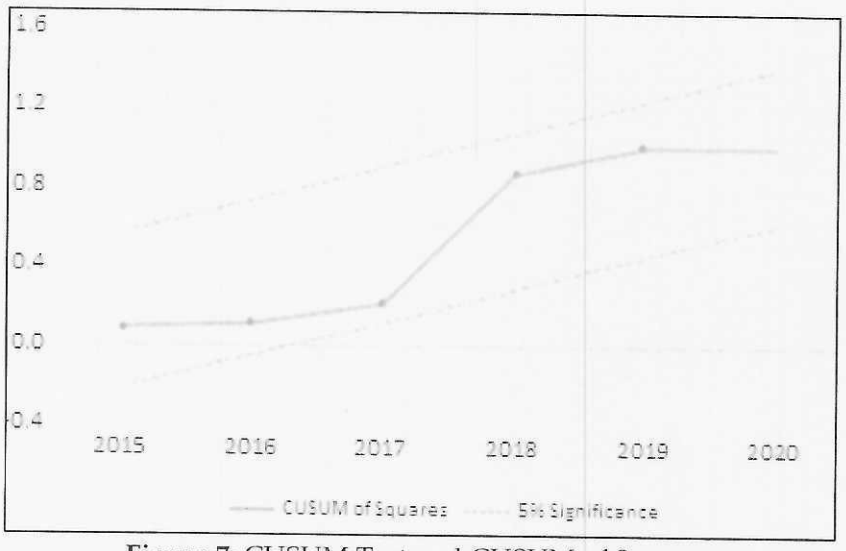


Figure 7: CUSUM Test and CUSUM of Squares
(Source: the authors)

It can be seen in Figure 7 that the *CUSUM* and CUSUMSQ are well within the critical limits, which implies that all coefficients in the error correlation model are stable.

5. Conclusion

The objective of this study was to analyze the impact that Angola's investment in its road, rail and port infrastructure has on the export's growth. For this purpose, annual time series data were used to estimate an econometric model with five variables (roads, railways, ports, imports, and GDP per capita) that basically explain the growth process of the Angolan economy. Angola has a predominantly subsistence economy that is becoming increasingly fragile due to the poor quality of its transportation infrastructure. As verified, the results show that the variables are intrinsically related to each other in the short and long term, significantly impacting the growth of Angolan exports in the short run and in the long run. Overall, the results allow for the conclusion that the poor quality of transportation infrastructure is a determining factor that is hindering agricultural development, supply chains and the subsequent export of products, which results in the hindering of the growth of the Angolan economy.

6. Recommendations

Therefore, to increase the volume of agricultural exports and increase the level of growth of the Angolan economy, it is essential that the Angolan government invest heavily in land transport and port infrastructure. We believe that this infrastructure would boost logistics, the agricultural sector, and supply chain.

Declaration of Conflicting Interests
The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
This research received no funding.

About the Author(s)
Pedro Manuel Campos is a student of the Doctoral Program in Economics in the Lisbon University. His research interests include Microeconomics, Transport Infrastructure, Operation research, Applied Mathematics and Supply Chain Management.
[ORCID]: (https://orcid.org/0000-0002-8957-833X)

References

Abdulrahman, B. M. A. (2021). Analysis of export determinants in Sudan by using Auto Regressive Distributed Lag Model. *Academic Journal of Interdisciplinary Studies, 10*(4), 96–105. https://doi.org/10.36941/AJIS-2021-0101

Aerts, G., Grage, T., Dooms, M., & Haezendonck, E. (2014). Public-Private Partnerships for the provision of port infrastructure: an explorative multi-actor perspective on critical success factors. *The Asian Journal of Shipping and Logistics, 30*(3), 273–298. https://doi.org/10.1016/j.ajsl.2014.12.002

Ahmed, V., Abbas, A., & Ahmed, S. (2013). Public infrastructure and economic growth in Pakistan: a dynamic CGE-microsimulation analysis. *Economic Studies in Inequality, Social Exclusion and Well-Being*, https://doi.org/10.1007/978-3-319-03137-8_5

Åkesson, L., & Orjuela, C. (2019). North - South migration and the corrupt other: practices of bribery among Portuguese migrants in Angola. *Geopolitics, 24*(1), 230–250. https://doi.org/10.1080/14650045.2017.1379510

Alrukaibi, F., Alkheder, S., & Almashan, N. (2020). Sustainable port management in Kuwait: Shuwaikh port system. *The Asian Journal of Shipping and Logistics, 36*(1), 20–33. https://doi.org/10.1016/j.ajsl.2019.10.002

ANEME. (2016). Enquadramento sócio-económico, perspectivas do país e potenciialidades de parceria Portugal/Angola.

Anor, N., Ahmad, Z., Abdullah, J., & Hafizah, R. N. (2012). Road network system in Port Klang, Malaysia and impacts to travel patterns. *Procedia - Social and Behavioral Sciences, 35*(December 2011), 629–636. https://doi.org/10.1016/j.sbspro.2012.02.130

Arbués, P., Baños, J. F., & Mayor, M. (2015). The spatial productivity of transportation infrastructure. *Transportation Research Part A, 75*, 166–177. https://doi.org/10.1016/j.tra.2015.03.010

Arfaoui, L., Ziadi, A., & Manai, S. (2016). The Relationship between Democracy and Economic Growth in Tunisia: An Application of Autoregressive Distributed Lag

Model. *International Journal of Social Science Research, 4*(1), 137. https://doi.org/10.5296/ijssr.v4i1.8870

Aschauer, D. (1989). Does public capital crowd out private capital? *A Series of Occasional Papers in Draft Form Prepared by Members of the Research Department for Review Nd Comment. Federal Reserve Bank of Chicago, SM-88-10.*

Banerjee, A., Duflo, E., & Qian, N. (2020). On the road: access to transportation infrastructure and economic growth. *Journal of Development Economics, 145*(February), 102- 442. https://doi.org/10.1016/j.jdeveco.2020.102442

Bank, T. W. (2005). *Private solutions for infrastructure in Angola.*

Barzin, S., Costa, S. D., & Graham, D. J. (2018). A pseudo – panel approach to estimating dynamic effects of road infrastructure on fi rm performance in a developing country context. *Regional Science and Urban Economics, 70*(April 2017), 20–34. https://doi.org/10.1016/j.regsciurbeco.2018.02.002

Belloumi, M. (2014). The relationship between trade, FDI and economic growth in Tunisia: an application of the autoregressive distributed lag model. *Economic Systems, 38*(2), 269–287. https://doi.org/10.1016/j.ecosys.2013.09.002

Benmaamar, M., Arroyo, F. A., & Eduardo, N. T. (2020). *Angola road sector public expenditure review* (Issue June).

Burningham, S., & Stankevich, N. (2005). Why road maintenance is important and how to get it done. *Transporte Notes*, 1–10.

Caldeirinha, V., Felício, J. A., Salvador, A. S., Nabais, J., & Pinho, T. (2020). The impact of port community systems characteristics on performance. *Research in Transportation Economics, 80*(2020), 100-818

Campos, P., Pimentel, C., & Lopes, J. (2022). Determinant factors for the strategic management of the supply chain of the Angolan cement industry. *Journal of Industrial Engineering and Management, 15*(4), 566. https://doi.org/10.3926/jiem.3410

Campos, P., Pimentel, C., & Lopes, J. (2022). Angolan cement industry: Marketing channel and distribution channel strategies. *Spring Nature, International Conference on Quality Innovation and Sustainability* pp 323-335. https://doi.org/10.1007/978-3-031-12914-8_25

Cao, N., Tang, T., & Gao, C. (2020). A study of hindrance-caused unscheduled waiting time in railway systems. *Sustainability, 12*, 5754. https://doi.org/10.3390/su12145754

Carnis, L., & Yuliawati, E. (2013). Nusantara: between sky and earth could the PPP be the solution for Indonesian airport infrastructures? *Case Studies on Transport Policy, 1*(1–2), 18–26. https://doi.org/10.1016/j.cstp.2013.08.003

Condeço-melhorado, A., Tillema, T., Jong, T. De, & Koopal, R. (2014). Distributive effects of new highway infrastructure in the Netherlands: the role of network effects and spatial spillovers. *Journal of Transport Geography, 34*, 96–105. https://doi.org/10.1016/j.jtrangeo.2013.11.006

Deloitte. (2014). Logística em Angola : desafios actuais e perspectivas de desenvolvimento. *Relatório.*

Duarte, A., Santos, R., & Tjønneland, E. N. (2014). Angola's Lobito Corridor: From reconstruction to development. *Angola Brief*, *4*(5), 1–4.

Dwarakish, G. S., & Salim, A. M. (2015). Review on the Role of Ports in the Development of a Nation. *Aquatic Procedia*, *4*, 295–301. https://doi.org/10.1016/j.aqpro.2015.02.040

Enders, W., & Ma, J. (2011). Sources of the great moderation: a time-series analysis of GDP subsectors. *Journal of Economic Dynamics and Control*, *35*(1), 67–79.

Ferrari, R. (2016). Writing narrative style literature reviews. *The European Medical Writers Association, December 2015*. https://doi.org/10.1179/2047480615Z.000000000329

Gasparyan, A. Y., Ayvazyan, L., Blackmore, H., & Kitas, G. D. (2011). Writing a narrative biomedical review: considerations for authors, peer reviewers, and editors. *Rheumatol Int*, *31*, 1409–1417. https://doi.org/10.1007/s00296-011-1999-3

Ghirmay, T., R. Grabowski, & S. Sharma. (2001). Exports, investment, efficiency and economic growth in LDCs: an empirical investigation. *Applied Economics*, *33*(6), 689–700.

Golub, S., & Prasad, V. (2016). *Promoting economic diversification and international competitiveness in Angola* (Issue 4).

González, M. M., & Trujillo, L. (2008). Reforms and infrastructure efficiency in Spain's container ports. *Transportation Research Part A*, *42*, 243–257. https://doi.org/10.1016/j.tra.2007.08.006

Green, B. N., Johnson, C. D., & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal of Chiropractic Medicine*, *5*(3), 101–117.

Grimsey, D., & Lewis, M. K. (2002). Evaluating the risks of public private partnerships for infrastructure projects. *International Journal of Project Management*, *20*, 107–118.

Haddad, E. A., Perobelli, F. S., Araújo, I. F., & University, T. P. D. (2020). Uneven integration: the case of Angola. *Research Square*.

Hartmann, A., Yeang, F., & Ling, Y. (2016). Value creation of road infrastructure networks: a structural equation approach. *Journal of Traffic and Transportation Engineering (English Edition)*, *3*(1), 28–36. https://doi.org/10.1016/j.jtte.2015.09.003

Hochrein, S., & Glock, C. H. (2012). Systematic literature reviews in purchasing and supply management research: a tertiary study. *International Journal of Integrated Supply Management, November*. https://doi.org/10.1504/IJISM.2012.052773

Hye, Q. M. A., & Boubaker, H. B. H. (2011). Exports, imports and economic growth in India: an empirical analysis. *Theoretical and Applied Economics*, *XXVII*(4), 323–330.

Jensen, S. K. (2018). Angola's infrastructure ambitions through booms and busts policy, governance and refor. *The Royal Institute of International Affairs, Chatham House, September*.

Krugman, P. (1991). History and industry location: the case of the manufacturing Belt. *The American Economic Review*, *81*(2), 80–83.

McConnell, T. E., Tanger, S. M., & Henderson, J. E. (2019). International trade's contributions to the United States forest sector and its import-export chain. *Journal of Forestry, 117*(3), 210–225. https://doi.org/10.1093/jofore/fvz004

Meng, L., & Corman, F. (2020). Editorial: special issue on practical value of railway operations research. *Journal of Rail Transport Planning & Management, 13*(February), 100179. https://doi.org/10.1016/j.jrtpm.2020.100179

Mohmand, Y. T., Mehmood, F., Mughal, K. S., & Aslam, F. (2020). Investigating the causal relationship between transport infrastructure, economic growth and transport emissions in Pakistan. *Research in Transportation Economics, April*, 100-972. https://doi.org/10.1016/j.retrec.2020.100972

Mokhtari, K., Ren, J., Roberts, C., & Wang, J. (2011). Application of a generic bow-tie based risk analysis framework on risk management of sea ports and offshore terminals. *Journal of Hazardous Materials, 192*(2), 465–475. https://doi.org/10.1016/j.jhazmat.2011.05.035

Morgan, N. A., Katsikeas, C. S., & Vorhies, D. W. (2012). Export marketing strategy implementation, export marketing capabilities, and export venture performance. *Journal of the Academy of Marketing Science, 40*(2), 271–289. https://doi.org/10.1007/s11747-011-0275-0

Moutinho, V., & Madaleno, M. (2020). Economic growth assessment through an ARDL approach: The case of African OPEC countries. *Energy Reports, 6*, 305–311. https://doi.org/10.1016/j.egyr.2020.11.253

Muzima, J. (2019). Angola. *2018 African Economic Outlook, African Development Bank Group*, 1–10.

Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics, 37*(17), 1979–1990. https://doi.org/10.1080/00036840500278103

Nathanail, E. (2014). Framework for monitoring and assessing performance quality of railway network infrastructure: Hellenic Railways Case Study. *Journal of Infrastructure Systems*.

Nguyen, L. C., & Notteboom, T. (2016). A multi-criteria approach to dry port location in developing economies with application to Vietnam. *The Asian Journal of Shipping and Logistics, 32*(1), 23–32.

Nkoro, E., & Uko, A. K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. *Journal of Statistical and Econometric Methods, 5*(4), 63–91.

Odhiambo, N. M. (2009). Energy consumption and economic growth nexus in Tanzania: An ARDL bounds testing approach. *Energy Policy, 37*(2), 617–622. https://doi.org/10.1016/j.enpol.2008.09.077

Ojukwu, C., Oumarou, A., & Harada, T. (2013). Study for national transport sector master plan update country: Angola. *African Development Fund*.

Olukoju, A. (2020). African seaports and development in historical perspective. *The International Journal of Maritime History, 32*(1), 185–200. https://doi.org/10.1177/0843871419886806

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis. *Journa of Applied Econometrics, 326*(February), 289–326. https://doi.org/10.1002/jae.616

Peter, S., Rita, E., & Edith, M. (2015). the impact of road transport infrastructure on economic growth in Nigeria. *International Journal of Education and Research, 3*(9), 295–312.

Porto, J. G., & Clover, J. (2003). Chapter 3. The peace dividend in Angola: Strategic implications for Okavango basin cooperation. In *The peace dividend in Angola.*

Pradhan, R. P., & Bagchi, T. P. (2013). Effect of transportation infrastructure on economic growth in India: the VECM approach. *Research in Transportation Economics, 38*(1), 139–148. https://doi.org/10.1016/j.retrec.2012.05.008

Pushak, N., & Foster, V. (2011). Angola's infrastructure. A continental perspective. *The World Bank Africa Region Sustainable Development Unit September 2011, September.*

Rama, D., & Andrews, J. (2014). System-wide assessment of intervention strategies for railway infrastructure. *Nottingham Transportation Engineering Centre Faculty Of Engineering University Of Nottingham, University Park Nottingham, NG7 2RD.*

Rensburg, J. Van, & Krygsman, S. (2020). Funding for roads in South Africa: understanding the principles of fair and efficient road user charges. *Transportation Research Procedia, 48*(2019), 1835–1847. https://doi.org/10.1016/j.trpro.2020.08.218

Rodrigue, J., & Notteboom, T. (2012). Dry ports in European and North American intermodal rail systems: two of a kind? *Research in Transportation Business & Management, 5*, 4–15. https://doi.org/10.1016/j.rtbm.2012.10.003

Roso, V., Woxenius, J., & Lumsden, K. (2009). The dry port concept: connecting container seaports with the hinterland. *Journal of Transport Geography, 17*(5), 338–345. https://doi.org/10.1016/j.jtrangeo.2008.10.008

Sala, E., & Ravishankar, K. V. R. (2019). Effect of passaeway with on pedestrians flow characteristics intercity railway stations. *Transport and Telecommunication, 20*(4), 357–364. https://doi.org/10.2478/ttj-2019-0029

Short, J., & Kopp, A. (2005). Transport infrastructure: investment and planning. Policy and research aspects. *Transport Policy, 12*, 360–367. https://doi.org/10.1016/j.tranpol.2005.04.003

Skorobogatova, O., & Kuzmina-merlino, I. (2017). Transport infrastructure development performance. *Procedia Engineering, 178*, 319–329. https://doi.org/10.1016/j.proeng.2017.01.056

Song, Y., Thatcher, D., Li, Q., Mchugh, T., & Wu, P. (2021). Developing sustainable road infrastructure performance indicators using a model-driven fuzzy spatial multi-criteria decision making method. *Renewable and Sustainable Energy Reviews, 138*(October 2020), 110-538. https://doi.org/10.1016/j.rser.2020.110538

Wan, G., & Zhang, Y. (2018). The direct and indirect effects of infrastructure on firm productivity: evidence from Chinese manufacturing. *China Economic Review, 49*(April 2017), 143–153. https://doi.org/10.1016/j.chieco.2017.04.010

Yuan, Y., & Hunt, R. H. (2009). Systematic reviews: the good, the bad, and the ugly. *The American Journal of Gastroenterology, 104*(5), 1086–1092.

Yudhistira, M. H., & Sofiyand, Y. (2017). Seaport status, port access, and regional economic development in Indonesia. *Maritime Economics & Logistics*, *4*. https://doi.org/10.1057/s41278-017-0089-1

OmniaScience

Journal of Airline and Airport Management

JAIRM, 2023 – 13(1), Online ISSN: 2014-4806 – Print ISSN: 2014-4865

https://doi.org/10.3926/jairm.356

Impact of airport infrastructure investment on the growth of the Angolan economy: An auto-regressive distributed lag analysis

Pedro Campos

[1]Lisbon University (Portugal)

pecampos001@yahoo.com.br

Received January, 2023

Accepted March, 2023

Abstract

Purpose: The airport infrastructure plays capital importance in the development of national trade. It facilitates the flow of people, goods, and services more quickly. Thus, given its importance, this study seeks to analyze the impact of the Angolan investment in airport infrastructure between 2000 – 2020.

Design/methodology: This article presents the results of quantitative and qualitative research, based on narrative review and output of the Auto-Regressive Distributed Lag (ARDL) technique, which aimed to analyze the impact of investment in airport infrastructure on the growth of Angola GDP per capita.

Findings: The results of the stationarity tests performed shows mixed integration in both I(0) and I(1), which justifies the used ARDL. Similarly, the bounds test showed that there is a very strong relationship between airport infrastructure investment and GDP per capita growth in the short and long run. However, in the Angola case study, the impact that exists is negative, meaning that airport infrastructure negatively impacts per capita GDP growth in both the short run and in the long run.

Research limitations/implications: This research has been among the first to analyze the impact of investment in airport infrastructure on the growth of Angola GDP per capita. Besides the contribution of this research, some limitations are the difficulty to find data of investment and the literature about transportation infrastructure in Angola.

Originality/value: The analysis of the impact of investment in airport infrastructure in the growth of Angola GDP per capita is a fundamental step that can help public and private entities

in making decisions that aim to improve the management of the Angola transport infrastructure.

Keywords: Angola airport infrastructures, economic growth, imports, exports

To cite this article:

Campos, P. (2023). Impact of airport infrastructure investment on the growth of the Angolan economy: An auto-regressive distributed lag analysis. *Journal of Airline and Airport Management, 13*(1), 12-30. https://doi.org/10.3926/jairm.356

1. Introduction

Economic development is an important indicator for improving the people´s standard of living (Alam et al., 2020). Similarly, the development of the trade depends on how each country conducts its trade policy (specialization, main export and import markets, dependence on forms of financing, degree of internationalization of domestic firms, supply chain development, among others) (Allen & Giovannetti, 2011).

Angola with 1.246.700 is the seventh largest country in Africa. It has a continental border of 84.837 km, but the poor quality of its transport infrastructure limits connection with its eastern, northeastern, and southwestern provinces, as well as with neighbor countries (Haddad et al., 2020). Angola is a resource rich country, but a considerable portion of its population lacks access to basic services, such as access to transportation infrastructure (Temudo et al., 2019). After the civil war in 2002, the government set ambitious goals to rebuild the transportation infrastructure (Jensen, 2018). However, twenty years later, Angola still faces a number of difficulties regarding the airport infrastructure (Deloitte, 2014). The poor development of transport infrastructure is one of the main causes of the poor distribution of cement and other products in the Angolan market (Campos et al., 2022).

The weakness of Angola´s transportation infrastructure has caused a gap between agricultural, rural, and urban areas, between the east and the coast. It limited the movement of people, goods, and services, compromised the country´s growth and socioeconomic development. Subsequently, it caused airfare prices to rise. Currently, flying from Luanda to the center and east of the country is more expensive than flying from Luanda to South Africa.

Therefore, given the importance of airport infrastructure, it is important to analyze the impact of investment in airport infrastructure on the economic development. To this end, the following research question guiding the research was raised:

1) What is the impact of the investment in airport infrastructure on the Angola economy development?

The literature contains a considerable number of articles on airports and there is no doubt that there is a strong correlation between the presence of an airport and economic development in a given region (Greeny, 2007). Airport development and air transport contribute significantly to broader socioeconomic development and are key drives of new business generation (Dimitriou & Sarttzetaki, 2022). But, based on the literature, there are few articles addressing the impact of airport infrastructure on economic growth, for example, (Akinyemi, 2019), (Arbués et al., 2015), (Brugnoli et al., 2018) and (Dimitrios & Maria, 2018). However, there are not scientifically articles addressing this issue in the Angola context. Thus, the lack of literature addressing the impact of airport infrastructure on economic growth in Angola signals a deficit that somewhat hinders the understanding of this sector in the Angolan context.

This article is organized int six sections. Section 1 presents the problem under study, the objective, the research question, and the justification of the need for the research conducted. Section 2 discusses airport infrastructure, its classification, impact, and the management of airport infrastructure. Section 3 it´s presented the methodology and research method. Section 4 presented the data, econometric model specification. At Section it is 5 presented the discussion of the empirical results. Finally, the section 6 presents the final considerations.

2. Literature review

High quality transportation infrastructure expands the productive capacity of a nation, increases mobility, productivity and economic growth (Pradhan & Bagchi, 2013) and (Barzin et al., 2018). Transportation infrastructure is a vital socioeconomic asset, it structures space and determines the mobility of trade flow as well as the location of industries and markets. It´s construction and maintenance absorb significant resources, and its importance and public nature raise political and economic concerns (Short & Kopp, 2005).

2.1. Airport infrastructure

Airport infrastructure is classified as either technically efficient or inefficient. The development of airport infrastructure drives a country´s economic growth, provides employment, boosts trade, and captivates tourism. For Addie (2014) airports are major catalysts for urban growth and economic development, their economic function, multiscale connectivity and the impact of air transport place airports at the center of transport infrastructure development policy.

Historically, airports were considered state-owned and aimed to provide and operate infrastructure for airlines. However, this sector has changed over the last two decades, many airports are no longer seen as public services, they now operate as modern ventures with commercial objectives. Several airports have been privatized in order to reduce government involvement, increase airport productivity and innovation (Gillen, 2011) and (Adler & Liebert, 2014).

Airport inefficiency can be explained not only by excess input and production deficiencies, but also by exogenous factors over which management has little or no control (Adler & Liebert, 2014).

The literature on measuring and understanding the factors affecting airport efficiency has expanded considerably in recent years, driven primarily by ongoing changes in the airline industry and evolving airport governance models (Assaf & Gillen, 2012).

Privatized airports show more efficiencies than mixed capital or majority government-owned airports (Oum et al., 2008). In general, the Airport industry is varied and heterogeneous, with a high degree of quality differentiation, heterogeneous ownership and regulatory structures, different combinations of service and operational characteristics (Graham & Shaw, 2008). Therefore, assessing and comparing airport performance is a complex task (Carlucci et al., 2018).

However, due to the growing strategic and economic importance of Airport infrastructure, Airport efficiency analysis has become crucial (Sarkis & Talluri, 2004), as it allows airlines to select the most efficient airports, municipalities to understand their ability to attract business and tourists, and governments to optimally allocate resources to improve airport infrastructure (Barros & Dieke, 2007).

Airports play important roles in economic growth, connecting cities and nations. The deal with outbound passage flow and inbound passenger flow. Departures procedures include airport access facilities, check-in security check, immigration, customs, and boarding. Arrival procedures include boarding, immigration, baggage claim, customs, quarantine, and airport departure procedures. The passenger system´s boarding flow is most important because it has the greatest impact on the entire operation of the passenger terminals and other elements of the airport (Alodhaibi et al., 2017). Departures at airports involve providing services to passenger that generally require more time than the arrival process (Neufville et al., 2013).

Airports are take-off and arrival spaces for aircraft carrying passengers and goods. Airports are at the heart of air transport operation. A portion of airports serve commercial services such as, shopping centers, parking lots, subway and bus stations (Pius et al., 2017). Air transport enables fast travel over long distances, while airport infrastructure boosts local economic development through several mechanisms (Tveter, 2017). First, it makes a region more attractive. If interpreted as a regional amenity, the impact of airport infrastructure can lead to population growth due to increased attractiveness. Second, airport infrastructure can improve market access. Third, air transport can facilities direct contact between people living far from each other (Glaeser et al., 2001).

Air cargo logistics has an increasing importance in the economic development of a nation, as well as a strong correlation with many economic metrics such as economic growth (Chang & Chang, 2009). As a driver economic development, air cargo stands out as a vehicle that bridges the gap between global trade and the supply chain in a faster and more reliable manner (Kasarda & Green, 2005). The airport´s ability to attract transshipment cargo traffic, including existing traffic flow patterns, airport infrastructure capacity and activities, linkage with regional and intercontinental airport network is critical to shaping an air cargo terminal´s competitiveness (Wasesa et al., 2015). The performance of the air cargo terminal directly inside on the supply chain (Gardiner et al., 2005).

2.2. Airport infrastructure and economic development

The regional connections between infrastructure and economic development have been of interest to geographers, economists, policy makers, and many others for a long time (Cidelly, 2015). An important question in economic geography relate to the scale and nature of the contribution of transportation infrastructure to the overall economy. The ability to utilize transportation infrastructure and transportation services expand opportunities for interaction, as an economy can benefit from these interaction opportunities by increasing its output (Lakshmanan, 2011).

In general, the economic effects of air transport are analyzed based on the impact of air services (Allroggen & Malina, 2014). For example, the flow of air cargo promotes economic development (Button & Yuan, 2013). However, a major specific interest of airports is their role in facilitating the movement of labor. Economic growth theory has largely focused on fixed geographic endowments, but as the importance of extractive industry has declined, factor mobility has gained importance for the economic development of regions (Button et al., 2009). Thus, while substantial aggregate impacts of air transport on economic activity have been identified, their scale and direction may differ across airports (Allroggen & Malina, 2014).

Therefore, the development of large infrastructure such as Airport often requires a high financial investment, time, and the involvement of various stakeholders (London et al., (2017), because a proposal to build an airport in a region not only sparks the interest of politicians and investors, but also impacts the region´s economy (Nguyen et al., 2022). For this reason, airports are recognized as essential drives of economic development that support local economic activity as they generate new employment opportunities and stimulate further investment in catchment areas (Robertson, 1995).

Airport infrastructure is part of the underlying basis of an airport system. Its existence and the associated ground infrastructure are an essential factor for regional development. The literature states that the presence of this infrastructure has a direct relationship with the overall economic functioning of the surrounding region (Crockatt & Ogston, n. d.). therefore, Airport services with quality improve economic development, where airport services with less quality hinder the economic development of the region. In general, economic performance is measured in terms of employment growth, population growth, and/or income growth. For example, the literature on economic development focuses on empirical studies of the effect of government policies on economic outcomes (Greeny, 2007).

At airports where a significant increase in capacity is not expected, mitigating air traffic delays may require the implementation of demand management mechanisms aimed at controlling demand for airport access to limit imbalances between demand and capacity (Gilen et al., 2016). Therefore, investments in Airport infrastructure are evaluated based on improvements in transportation infrastructure to meet the demand for transportation. However, evaluating airport investments in terms of maximizing regional development requires a comparison of the regional impact of investments in other sectors, such as manufacturing, education, and health. The investment should positively impact the economic development of the region (Jorge & Rus, 2004).

Air transportation has influenced economic development it is therefore important to know the scale of this effect both for airport development and management and for policy makers making strategic decisions about airport planning and investment. However, studies on the economic impact of air transport have focused

primarily on the links between large airports and regional economic development. Little attention has been paid to the impact of small airports on their local areas (Button et al., 2009).

2.3. Impact of airport infrastructure

The transportation infrastructure impact on the economy is seen in economic development and differs in developed and developing countries. Immediate benefits and sustainable growth occur over different time periods (Alam et al., 2020), (Esfahani & Ramírez, 2003) and (Short & Kopp, 2005).

Arbués et al. (2015) when testing the existence of direct and indirect effects of road, rail, airport, and port infrastructure projects by estimating a production function noted that transportation infrastructure impacts the economy, not only of the region in which they are located, but also the economy of adjacent regions (spillovers effect).

Efficient air transport infrastructure can boost regional economic development, enable access to the world market, facilitate labor integration and mobility, and stimulate local industries (Brugnoli et al., 2018). Aviation plays an important role in modern society and economy. It provides connectivity, accessibility, and facilitates trade. Along with the growth of airport infrastructure, business, commercial, residential, and spatial development occurs (Ferrulli, 2016).

Airport infrastructure determines the socio-economic structure of a territory. With globalization, air accessibility has become one of the essential factors for economic development. Airports need to attract passengers and airlines, acting strategically in marketing and route development and differentiating their offer. Thus, efficiency in the management of airport infrastructure is key to ensure and facilitate mobility and economic growth (Burbidge, 2016), (Bucovetchi et al., 2019) and (Bergantino et al., 2020).

Air transport is one of the most important industries in the world, it directly and indirectly contributes to the rapid growth of the world economy. Air transport is a major contributor to global economic prosperity. Aviation directly creates jobs in the industry, as well as other sectors indirectly, providing 62,7 million people worldwide with their livelihoods. GDP, tourism and employment are the main factors causing this growth in air transport and an increase in these factors drives the demand for air transport (ATAG, 2016), (Küçükönal & Sedefoğlu, 2017), and (Dimitrios & Maria, 2018). Already, the evolution of new airline business models has increased passenger demand and the need for more airport infrastructure (Carmona-benítez et al., 2017). However, among the biggest barriers to air cargo trade are customs regulations and procedures that do not keep up with the rapid development of the industry (Zhang, 2002).

Offering high quality infrastructure is important for attractiveness and competitive advantage, it also aims to boost local economic development. For example, (Akinyemi, 2019) report that understanding the causal relationship between economic variables and demand for domestic air travel in Nigeria had policy implications for airlines, airports, local governments and consumers. The policy implication caused by these variables helped policymakers to understand the role of air travel demand in the country´s economic growth, guide airport development and operation, and regulate air services.

Therefore, air transport boosts internal and external trade, facilitating the displacement of people for various activities, whether for commercial purposes, health, study, or leisure. Thus, developing the airport infrastructure to guarantee a greater flow of people and goods is fundamental.

3. Research methodology, method and data

Based on the approaches by Green et al. (2006), Yuan & Hunt (2009), Gasparyan et al. (2011), Hochrein & Glock (2012) and Ferrari (2016) a systematic literature review was carried out with searches in Scopus, Web of Science, Science Direct and Google Scholar, using the following keywords: "airport infrastructure", "impact of airport infrastructure" and "Angola airport infrastructure". The following filtering criteria were used: (1) publication years: 1990 – 2020; (2) document type: article; (3) source type: journal; (4) language: English. All

extracted articles were manually analyzed considering the following inclusion and exclusion criteria: title analysis, research area, keywords used, contributions and main results.

From the four databases, 127 articles were extracted, 36 duplicates were organized and excluded. The remaining 91 articles were analyzed and 26 were excluded because they are not focused on the airport infrastructure. The remaining 65 articles were again subjected to a more in-depth analysis which resulted in the selection of only 63 articles. Later, 14 supplementary articles were added.

Regarding the research method, In order to answer the research question identified in this research, the present study used the Auto-Regressive Distributed Lag (ARDL) approach developed by Pesaran & Shin (1997) and Pesaran et al. (2001). The ARDL approach was adopted for the following three advantages compared to other traditional cointegration technique:

- The variables do not have to have the same order of integration, they can be I(0), I(1) or fractionally integrated;
- The ARDL test can be applied to small samples;
- In the ARDL technique, the long-term and short-term factors of the model are evaluated at the same time (Belloumi, 2014).

The ARDL technique employs a single reduced form equation, unlike to other cointegration techniques that require laborious systems of equations to estimate the term relationship. An additional advantage of ARDL is that when evaluating the long and short-term factors of the model, the difficulties in testing the hypothesis of the coefficients, as observed in the Engle-Granger method, are avoided, especially when the samples are small (Narayan, 2005).

Data for this study were obtained from the Angolan Ministry of Finance and the World Bank. The dependence variable is economic growth (GDP). The independent variables are investment in airports infrastructure, exports and imports. The data contains 21 observations, which is why the ARDL approach was adopted. The choice of the study period was due to lack of data on investment in airport infrastructure.

Variables	Symbol	Meaning	Data source
Economic growth	GDP	GDP per capita (current US$) – is gross domestic product divide by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	World bank
Import	M	Imports of goods and services (% of GDP) represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	World Bank
Export	X	Exports of goods and services (% of GDP) represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	World Bank
Airport	Air	Total investment in airports infrastructure in the country. The	Ministry of

Variables	Symbol	Meaning	Data source
infrastructures		national currency was converted to U.S dollars on the period-end conversion rate (IMF data)	Transporte

Table 1. Variables in the Models and Data Sources

4. The Angolan airport infrastructure

As far as the Angolan airport sector is concerned, except for Luanda, most airports were built in the 1960s to meet the needs of that decade. The aircraft were slow and medium sized, with the Douglas DC3 being a representative type. However, from 1975 to 2005 investment in airport infrastructure did not keep up with the rapid growth in demand for these services. Air navigation services for all airports are the management of the National Air Navigation Company (ENANA) (Bank, 2005). The Table 2 reference the entities that are managing the control of the airports.

Managing Companies	Quantities of airports
ENANA	18
Provincial governments	7
Mining companies	5
Air Force	6
Total	36

Table 2. Companies that manage and control airports in Angola (Bank, 2005)

Despite the importance of airport infrastructure, the number of airports in operation in Angola is decreasing considerably as their wear and tear increases. In Angola there are several municipal airports/aerodromes that do not receive flights. The main concentration of traffic is in Luanda, while the level of traffic in some provinces is decreasing. The airport "4 de Fevereiro" is the main airport in the country being "Transportes Aéreo de Angola (TAAG)" is the main public sectors airline.

The capacity of the Angolan airline has growth. After the restructuring, TAAG expanded its routes and fleet (includes several Boeing 777s) operating on routes to Portugal and Brazil (Pushak & Foster, 2011). Has intercontinental flights to: Lisbon, Dúbai, Brussels, Frankfurt, Paris São Paulo, Rio de Janeiro, Havana, and London. In addition to these, there are other continental destinations originating in Luanda: Addis Ababa, Brazzaville, Cape Town, Casablanca, Harare, Johannesburg, Kinshasa, Maputo, Nairobi, São Tomé and Windhoek. Many other countries such as, Germany, United Kingdom, Portugal, Spain, France, Belgium, Netherlands, Qatar and Turkey also have direct flights to Angola. Similarly, China being one of Angola´s main trading partners and one of the most significant investors has played an important role in modernizing the country´s transportation infrastructure, from ports, roads, and airports (Nonkenge & Luiz, 2018).

However, prior to restructuring, the runways restricted airport capabilities, the runways were and some still are too short, have poor geometry for modern craft, and have rough surfaces and weak bases. Consequently, Boing 737s could not operate across the network and could not use high-pressure tires for risk of damage to the runway by impact loading. More expensive low-pressure tires wear out faster on rough runway surfaces and subsequently haver shorter service life, leading to higher operating costs (Bank, 2005). Figure 1 shows the location of some airports in Angola. There are many other airports/aerodromes in different municipalities that are not shown on this map.

Regarding the restructuring or expansion of airport infrastructure, the Lobito corridor has one international airport, Catumbela, located between Lobito and Benguela. It was built by a consortium of companies including Odebrecht (Brazil), Somangue (Portugal) and Imbodex (Cuba), and financed with government funds and foreign

credit lines. Several provincial airports along the corridor, including Benguela, Huambo, Kuito and Luena were also rehabilitated and modernized (Duarte et al., 2014).

However, not all airport infrastructure has been rehabilitated (Haddad et al., 2020). For example, the airport of Malanje is the only in the province and is located on the outskirts of the city. It was expanded and now has a 2.220, meter asphalt runway that can accommodate only smaller aircraft (Ferreira et al., 2015). The Angolan airport network consists of international airports, national airports, and aerodromes. However, the international airports of Catumbela and Lubango does not receive international flights.

Figure 1. Angola´s airport network (Angola, n.d.-a)

However, given the demand for air services at the February 4 international airport, the Angolan government decided to build a new international airport 40 km the capital city of Luanda. The new international airport will serve as a regional hub with capacity for 13,5 million passengers per year (Muzima, 2019).

However, in the distant year 2000, Luanda airport handled 1.405.125 departing passengers and 478.305 metric tons of cargo. 100 aircraft regularly used the parking space designed for 18 aircraft. This statistic shows a high level of demand for airport services (Bank, 2005), as in general, southern African countries of similar size and population in a peaceful state and without an oil-based economy would probably not record these levels of traffic.

According to Campos et al. (2022), in Angola the provincial airports played an important role during the first decade of the 21st century because at that time, the road and rail infrastructures were still at a high level of degradation. According to Bank, (2005), at that time the roads were still mined, in that period aircraft served as a bridge for supplying the hinterland areas not accessible by road and rail carrying basic consumer goods such as, food, building material, fuel and medicines. However, the airports facilities in the provinces are precarious and the levels of comfort and safety are minimal, few airports control the weight of cargo adequately due to the lack of scales and trained personnel.

	Nº of passengers	Cargo (tons)	Aircraft (Landings)
Luanda Total	1.405.125	478.305	25.910

	Nº of passengers	Cargo (tons)	Aircraft (Landings)
Benguela	75.887	5.932	8.287
Cabinda	87.214	2.036	14.022
Huambo	61.843	74.408	9.610
Lubango	108.991	4.742	7.576
Kuito	5.102	10.809	4.520
Luena	26.264	15.011	4.688
Malange	21.264	1.772	1.496
Menongue	16.548	17.524	3.088
Namibe	18.936	3.821	1.597
Ondjiva	16.759	3.045	1.344

Table 2. Passenger and cargo traffic at provincial airports, 2000 (Bank, 2005)

5. Empirical results

5.1. Trend of the series

A time series can be written as a sum of four elements: trend, seasonality, cycle and random shocks (random term). The graphics in figure 2 illustrate the GDP growth trend, the Airport infrastructure investment trend, Exports, and Imports trade. The trend of the series in figure 2 show that they are not stationary. A time series is said to be stationary when there is not trend in the time series, it is known as stationary series. But why it is important to determine stationary property of the time series?

A stationarity test is necessary before carrying out the regression analysis because if the time series is no stationary, the regression results will become spurious. If the series is not stationary, we need to do the differencing. Differencing can help stabilize the mean of a time series by removing changes in the level of a time series, and therefore eliminating (or reducing) trend.

Figure 2. Graphic of the series

5.2. Unit root test

In the analysis of series, before applying the regression, the variables must be tested to verify whether or not they are stationary. A variable is considered to be stationary if its Prob value is between 0 and 5%, that is, with no tendency to grow or decline. To ascertain this fact, in this work the conventional unit root test with the Augmented Dickey-Fuller (ADF) method was used. The results are presented in Table 4.

To understand the analysis, the probability value parameter must be considered, using the following hypotheses with 0,05 or 5% of significance:

- *H0: the series has a unit root and is not stationary (null hypothesis);*
- *H1: the series does not have a unit root and is therefore stationary.*

If P value is ≤ 5%, reject H0. For the series to be considered stationary, we have to reject the null hypothesis (H0), concluding with 95% confidence that it is a stationary series.

As can be seen in Table 4, the variables became stationary only in the first difference. At level the variables are in their original state and they are not stationary because they have a trend. If the series is not stationary we must to applied the first difference because the variables need to be significant on 5% of significance. If the Prob value is higher 5%, the variable become insignificant. We cannot used regression in ARDL technique if the Prob value of the series are higher 5%.

Variables	With constant		With Constant & Trend		Without Constant & Trend	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
At level						
GDP	-1.9486	0.3049	-0.7412	0.9548	-0.4228	0.5177
X	-1.6456	0.4421	-2.9963	0.1572	-1.4908	0.1239
M	-2.1698	0.2222	-2.3006	0.4148	-2.0490	**0.0415**
Airport	-2.2764	0.1883	-2.3043	0.4130	-1.5258	0.1163
At first Difference						
GDP	-2.9447	0.0588	-3.3430	0.0950	-3.0258	**0.0046**
X	-5.9824	**0.0001**	-3.3370	0.00939	-5.4959	**0.0000**
M	-3.3715	**0.0256**	-3.21108	0.1118	-3.3593	**0.0020**
Airport	-4.4621	**0.0027**	-4.3886	**0.0132**	-4.5861	**0.0001**

Table 4. Unit Root test

5.3. Model specification

To investigate the impact of variables on GDP per capita growth, the economic function was specification as follows:

$$GDP=(f(Airports,Exports,Imports) \quad (1)$$

In equation (1), Gross Domestic Product (GDP) is declared as a dependent variable on government investment in Airport infrastructure (Airport) and national trade (Imports and Exports). The econometric model of the equation is presented as follows:

$$GDP_t=\beta_0+\beta_1 Airport_t+\beta_2 Exports_t+\beta_3 Imports_t+\varepsilon_t \quad (1)$$

Where GDP indicates GDP per capita. Airport represents investment in airports infrastructure, Exports and Imports represents the sum of exports and imports. The parameters β_1, β_2 and β_3 are the long-terms elasticity of GDP per capita for investment in Airport infrastructure. t and ε_t represents time and the white noise perturbation error term. The expected signs of β_1, β_2 and β_3 are positive because an increase in the level of investment capital of Airport infrastructure should grater effects on trade, greater economic activity and higher GDP per capita growth.

5.4. Regression of the ARDL model

ARDL cointegration is used when the considered variables are stationary at level, and some are stationary at first difference. So, in this section we are going to discuss the ARDL cointegration, long run and shot run coefficient and long run adjustment (Error correction form). Figure 4 illustrates the chosen method (ARDL), the selected model criterion (Akaike info criterion (AIC)), the lags for each of the variables, and the resulting characteristics. Equation for ARDL cointegration is formulated as follows:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta\, Airport_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta X_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta M_{t-1} + \mu_t \qquad (3)$$

Where Δ presents the first difference, β_0 denotes the drift component, μ_t is the white noise residual and GDP, Airport and Exports and Imports are as defined earlier.

Once the regression was performed, the results obtained were summarized and presented in Table 5. The ARDL technique was used as the method for performing the regression. The long run estimates of the ARDL techniques were selected based on Akaike´s information criterion (AIC). The optimal lag length selected for the model is ARDL (1, 0, 0,0). The coefficients of the variables are illustrated in Table 5. The interpretation of the results presented in the Table 5 should be as follows, for example:

- If the variable presents a positive coefficient and its p-value is statistically significant at 5% significance, it means that the variable positively impacts the growth of GDP per capita (GDP);
- If the variable has a negative coefficient and its p-value is statistically significant at 5% significance, it means that the variable negatively impacts the growth of GDP per capita (GDP);
- If the variable presents a positive or negative coefficient and its p-value is statistically insignificant at 5% significance (above 5%), it means that the variable does not impact the growth of GDP per capita (GDP).

Variable	Symbol	Coefficient	Prob.	Impact on DGP
GDP per capita with 1 lag	GDP(-1)	0.798098	0.0000	Positive (+)
Exports	X	60.86967	0.0001	Positive (+)
Imports	M	-38.49132	0.0044	Negative (-)
Airport	Airport	1.08E-06	0.1335	Insignificant
Constant	C	-1342.157	0.0268	Negative (-)

Table 5. Analysis of the regression results

Finally, can be observed that the Constant (C) presents negative coefficient (-1342.157) and P-value (0.0268) statistically significant, meaning that if everything remains constant the negative coefficients will negatively impact the growth of GDP per capita.

5.5. ARDL long-run form and bound test

The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). To ensure this principle, the order of integration of all variables was determined using root tests. The objective was to ensure that the

variables were not I(2), in order to avoid spurious results, because according to Belloumi (2014), in the presence of I(2) we cannot interpret the values of the F-statistics provided by (Pesaran et al., 2001).

Once the ARDL long-run form was performed, the results obtained were summarized and presented in Table 6.

Regarding the long-run coefficient at levels equations we can see that the variables does not impact de growth of GDP per capita.

Variable	Symbol	Coefficient	Prob.	Impact on DGP
Constant	C	-1372.157	0.0268	Negative (-)
GDP per capita with 1 lag	GDP(-1)	-0.201902	0.0698	Insignificant
Exports	X	60.86967	0.0001	Positive (+)
Imports	M	-38.49132	0.0044	Negative (-)
Airport	Airport	1.08E-06	0.1335	Insignificant

Table 6. Analysis of the regression results

Variable	Symbol	Coefficient	Prob.	Impact on DGP
Exports	X	301.4809	0.0878	Insignificant
Imports	M	-190.6433	0.1041	Insignificant
Airport	Airport	5.35E-06	0.0575	Insignificant

Table 7. Analysis of the regression results

To understand the ARDL cointegration or bound test is used the following rules from Pesaran et al. (2001):

- If F-stats is greater than value of upper bound, this shows there is cointegration;
- If F-stats is in between the value of upper bound and lower bound, this shows the result is inconclusive;
- If f-stats is less than value of lower bound, this show there is no cointegration.

Test Statistic	Value	Significance	I(0)	I(1)
			Asymptotic: n=1000	
			Lower bound	Upper bound
F-statistic	7.940061	10%	2.72	3.77
K	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Table 8. Analysis of the F-Bounds Test results

After checking the F-Bounds tests in Table 7, it is noted that the calculated F value is 7.940061 which is above the upper and lower bound test. The critical value of the upper bound is 5.61 at 1% significance at level. This means that the null hypothesis of no cointegrating relationship can be rejected which implies that GDP per capita is cointegrated with airport investment, Exports, and Imports. So there exists a long-run relationship between the variables.

Therefore, applying the Error Correction form for short-run coefficient and long-run adjustment we obtained the results shown in Table 9, whose results illustrate that in the short run coefficient of error correction the

Constant (C) variable has negative coefficient (-1342.157) and its p-value (0.0001) statistically significant, which means that its coefficient negatively impacts the growth of GDP per capita at short run.

In the long run the adjustment or cointegration equation (CointEq(-1))* has a negative coefficient (-0.201902), but its P value (0.0000) is significant. This implies that the speed of adjustment towards long run equilibrium is 20% or system corrects its previous period disequilibrium at a speed of 20% time within one period.

Variable	Symbol	Coefficient	Prob.	Impact on DGP
Short run Adjustment	C	-1342.157	0.0001	Negative (-)
Long run Adjustment	(CointEq(-1))*	-0.201902	0.0000	Negative (-)

Table 9. ARDL error correction regression

Error correction regression are represented by with summation signs while β_0 in second part of the equation representing the long-run relationship. The estimation of short-run relationship based on error correction model is specified as:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta Airport_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta X_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta M_{t-1} + \lambda ECT_{t-1} \quad (4)$$

Where λ measures the speed of adjustment and significant and negative coefficient (λ) of ECT_t implies that any disequilibrium in short-run between the dependent and explanatory variables will converge back to the long-run equilibrium relationship.

In order to analyze the existence of cointegration and the interactions of short-run and long-run dynamics between highway investment and economic growth, this study applied the bounds test developed by (Pesaran et al., 2001). The results show that the calculated value of F-statistics (7.940061) is greater than the critical value of the upper bound. Therefore, the hypothesis of the absence of cointegration is rejected, which implies the existence of a long-run relationship between the variables.

5.6. Residual diagnostics

After the limit test of the long-term and short-term coefficients of the ARDL model, several diagnostic tests were performed whose results showed that the ARDL approach has no problems with autocorrelation. Based on the Jarque-Bera the residuals of the test are normal. The value is 0.563067 and p value (1.148712) is greater than 5%.

Breusch-Godfrey Serial Correlation LM Test proves that the residual obtained from the ARDL model is free from serial correlation. The Obs*R-squared is 8.234248 and Prob value is 0.0163. Likewise, Heteroskedasticity Tests: Breusch-Pagan-Godfrey proves that the residual obtained from the ARDL model are free heteroskedasticity. The Obs*R-squared is 4.647826 and Prob value is 0.3254.

5.7. Stability Diagnostics

The Ramsey RESET Test was used to check the appropriate functional form. The probability value of F-statistic is 2.041418 suggesting that the model is well specified.

Having analyzed the Ramsey RESET Test, next the Wald Test was analyzed, taking into consideration the lags presented in Table 10. As can be seen from the results obtained, with the exception of c(1), c(2), c(3) and c(5) which are statistically significant, lag c(4) is statistically insignificant at 5% of significance, which do not impact GDP per capita growth.

After analyzing the lags, figure 3 shows the plot of cumulative sum (CUSUM) Test and cumulative sum of squares (CUSUMSQ) remained between the 5% critical bounds which prove the stability of the parameters. The

model is structurally stable. But, if CUSUM Test and CUSUMSQ exceed the 5%, critical bounds we can confirm instability of the coefficient.

It can be seen in Figure 12 that the CUSUM is well within the critical limits, which implies that all coefficients in the error correlation model are stable. But CUSUMSQ plots is not well within the critical limits in 2014, which implies that not all coefficients in the error correlation model are stable.

Lags	Coefficient	Std. Error	T-Statistic	Prob.
C(1)	0.103418	0.103418	7.717209	**0.0000**
C(2)	60.869667	11.90155	5.114434	**0.0001**
C(3)	-38.49132	11.48784	-3.350615	**0.0044**
C(4)	1.08E-06	6.81E-06	1.586317	0.1335
C(5)	-1342.157	-1342.157	-.2454695	**0.0268**

Table 10. Wald Test

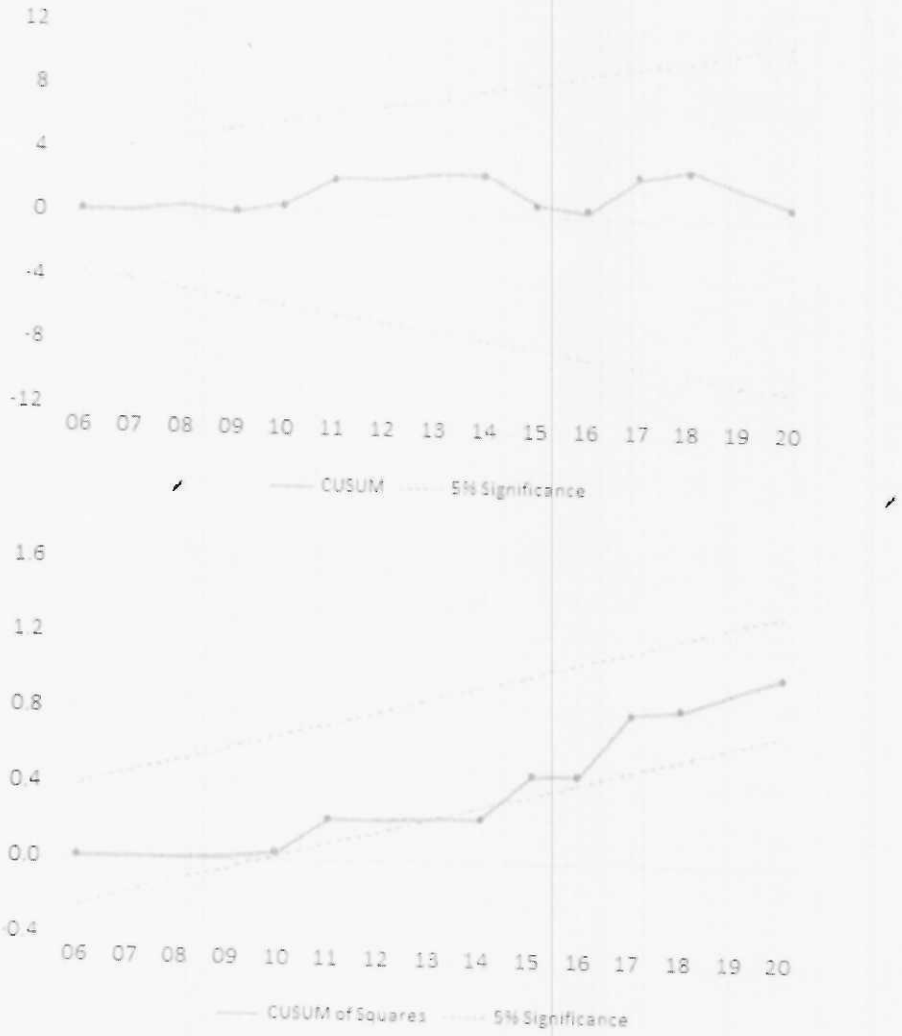


Figure 3. CUSUM Test and CUSUM of Squares

6. Conclusion and future work

This work analyzed the relationship between economic growth, investment in airport infrastructure, Exports and Imports in Angola with data from 2000-2020, using the ARDL cointegration test. The results show that the investment in airport infrastructure impact consistently the growth of GDP per capita. However, ARDL Error Correction Regression show that the coefficient of the variables impacts negatively the growth of GDP per capita in short-run and in long-run. This indicates that the investment made in airport infrastructure has no positive return for the Angolan economy. This situation is due to the lack of air connections to the interior provinces, which in turn reduces economic attractiveness. There are several airports/aerodromes in the country, but unfortunately most of them does not receive flights during the year, which makes them an investment without return. This observation is in line with Pontes and Pais (2018) when they point out that the fact that a transportation infrastructure is not used as much as it could be is a cause of low aggregate productivity because it represents low productivity for an important item of social capital. However, this situation may change with the development of logistic platforms, the expansion of the road network, and the construction of the railway network, which are included in the Angolan government´s development plan (Angola, n.d.). Regarding limitations, this work consisted only in analyzing the impact of investment in airport infrastructure in Angola, the results obtained were derived from the use of the ARDL technique, which may limit the understanding of the factors that determine the management of Angolan airport infrastructure. Regarding the future, it is intended to develop a study in order to understand the factors that determine the management of airport infrastructure in Angola.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

References

Addie, J. D. (2014). Flying high (in the competitive sky): conceptualizing the role of airports in global city-regions through "aero-regionalism ". *Geoforum*, 55, 87–99. https://doi.org/10.1016/j.geoforum.2014.05.006

Adler, N., & Liebert, V. (2014). Joint impact of competition, ownership form and economic regulation on airport performance and pricing. *Transportation Research Part A*, 64(2014), 92-109. https://doi.org/10.1016/j.tra.2014.03.008

Akinyemi, Y. C. (2019). Determinants of domestic air travel demand in Nigeria: cointegration and causality analysis. *GeoJournal*, 84(5), 1239-1256. https://doi.org/10.1007/s10708-018-9918-8

Alam, K. M., Li, X., Baig, S., Ghanem, O., & Hanif, S. (2020). Causality between transportation infrastructure and economic development in Pakistan: An ARDL analysis. *Research in Transportation Economics*, 88(August), 100974. https://doi.org/10.1016/j.retrec.2020.100974

Allen, F., & Giovannetti, G. (2011). The effects of the financial crisis on Sub-Saharan Africa. *Science Direct*, 1(1). https://doi.org/10.1016/j.rdf.2010.10.002

Alodhaibi, S., Burdett, R. L., & Yarlagadda, P. K. (2017). Framework for airport outbound passenger flow modelling. *Procedia Engineering*, 174, 1100-1109. https://doi.org/10.1016/j.proeng.2017.01.263

Allroggen, F., & Malina, R. (2014). Do the regional growth effects of air transport differ among airports? *Journal of Air transport Management*, 37(2014), 1-4. https://doi.org/10.1016/j.jairtraman.2013.11.007

Angola, G. de. (n.d.). *Estudo de viabilidade do traçado da ligação ferroviária entre o novo porto da barra do Dande e o novo aeroporto internacional de Luanda*. Volume 4.

Angola, G. de. (n.d.-d). *Síntese integrada da rede nacional do plano estratégico nacional de acessibilidades, mobilidades e transportes*. Volume 7.

Arbués, P., Baños, J. F., & Mayor, M. (2015). The spatial productivity of transportation infrastructure. *Transportation Research Part A*, 75, 166-177. https://doi.org/10.1016/j.tra.2015.03.010

Assaf, G. A., & Gillen, D. (2012). measuring the joint impact of governance form and economic regulation on airport efficiency. *European Journal of Operation Research*, 220(2012), 187-198. https://doi.org/10.1016/j.ejor.2012.01.038

ATAG. (2016). *Aviation benefits beyond borders*, ATAG reports, July 2016.

Bank, T. W. (2005). *Private solutions for infrastructure in Angola*.

Barzin, S., Costa, S. D., & Graham, D. J. (2018). A pseudo – panel approach to estimating dynamic effects of road infrastructure on firm performance in a developing country context. *Regional Science and Urban Economics*, 70(April 2017), 20-34. https://doi.org/10.1016/j.regsciurbeco.2018.02.002

Barros, C. P., & Dieke, P. U. C,. (2007). Performance evaluation of Italian airports: a data evelopment analysis. *Journal of Air Transport Management*, 13(2007), 184-191. https://doi.org/10.1016/j.jairtraman.2007.03.001

Bellizzi, M. G., Eboli, L., & Mazzulla, G. (2020). Air transport service quality factors: a systematic literature review. *Transportation Research Procedia*, 45(2019), 218-225. https://doi.org/10.1016/j.trpro.2020.03.010

Belloumi, M. (2014). The relationship between trade, FDI and economic growth in Tunisia: an application of the autoregressive distributed lag model. *Economic Systems*, 38(2), 269-287. https://doi.org/10.1016/j.ecosys.2013.09.002

Bergantino, A. S., Intini, M., & Volta, N. (2020). Competition among at worldwide level: a spatial analysis. *Transportation Research Procedia*, 45, 621-626. https://doi.org/10.1016/j.trpro.2020.03.049

Brugnoli, A., Bianco, A. D., Martini, G., & Scotti, D. (2018). The impact of air transportation on trade flows: a natural experiment on causality applied to Italy. *Transportation Research Part A*, 112(3), 95-107. https://doi.org/10.1016/j.tra.2018.01.010

Bucovetchi, O., Georgescu, A., Badea, D., & Stanciu, R. D. (2019). Agent-Based Modeling (ABM): support for emphasizing the air transport infrastructure dependence of space systems. *Sustainability*, 11, 5331. https://doi.org/10.3390/su11195331

Burbidge, R. (2016). Adapting European airports to a changing climate. *Transportation Research Procedia*, 14, 14-23. https://doi.org/10.1016/j.trpro.2016.05.036

Button, K., & Yuan, J. (2013). Airfreight transport and economic development: an examination of causality. *Urban Studies*, 50(2), 329-340. https://doi.org/10.1177/0042098012446999

Butto, K. & Doh, S., Yuan, J. (2009). The role of small airports in economic development. *Airport Management*, 4(2), 1-12.

Campos, P., Pimentel, C., & Lopes, J. (2022). Determinant factors for the strategic management of the supply chain of the Angolan cement industry. *Journal of Industrial Engineering and Management*, 15(4), 566-586. https://doi.org/10.3926/jiem.3410

Carlucci, F., Cirà, A., & Coccorese, P. (2018). measuring and explaining Airport efficiency and sustainability: evidence from Italy. *Sustainability*, 10(2018), 400. https://doi.org/10.3390/su10020400

Carmona-benítez, R. B., Nieto, M. R., & Miranda, D. (2017). An econometric dynamic model to estimate passenger demand for air transport industry air transport industry. *Transportation Research Procedia*, 25, 17-29. https://doi.org/10.1016/j.trpro.2017.05.191

Cidell, J. (2015). The role of major infrastructure in subregional economic development: an empirical study of aairports and cities. *Journal of Economic geography*, 15(2015), 1125-1144. https://doi.org/10.1093/jeg/lbu029

Chang, Y., & Chang, Y. (2009). Air cargo expansion and economic growth: finding the empirical link. *Journal of Air Transport Management*, 15(5), 264-265. https://doi.org/10.1016/j.jairtraman.2008.09.016

Crockatt, M. A., &Ogston, J. (n.d). *Airport infrastructure as an instrument for regional economic development*. Prairie perspectives, University of Manitoba.

Deloitte (2014). *Logística em Angola: desafios actuais e perspectivas de desenvolvimento*. Relatório.

Dimitriou, D., & Maria, Sartzetaki (2018). Assessing air transport socio-economic footprint. *International Journal of Transportation Science and Technology*, 7(2018), 283-290. https://doi.org/10.1016/j.ijtst.2018.07.001

Dimitriou, D., & Sarttzetaki, M. (2022). Diversification from transport infrastructure projects: the case of a new regional airport. *Transportation Research Record*, 2676(4), 732-745. https://doi.org/10.1177/03611981211064999

Duarte, A., Santos, R., & Tjonneland, E. N. (2014). Angola's Lobito Corridor: From reconstruction to development. *Angola Brief*, 4(5), 1-4.

Esfahani, H. S., & Ramírez, M. T. (2003). Institutions, infrastructure, and economic growth. *Journal of Development Economics*, 70(2), 443-477. https://doi.org/10.1016/S0304-3878(02)00105-0

Fernández, X. L., Coto-Millán, P., & Díaz-Medina, B. (2018). The impact of tourism on airport efficiency: the Spanish case. *Utilities Policy*, 55(2018), 52-58. https://doi.org/10.1016/j.jup.2018.09.002

Ferrari, R. (2016). Writing narrative style literature reviews. *The European Medical Writers Association*, December 2015. https://doi.org/10.1179/2047480615Z.000000000329

Ferreira, S., Strydom, J., Kriel, M., & Gildenhys, S. (2015). Tourism and development after civil war in Malange province, Angola. *South African Geographical Journal*, 97(2), 158-182. https://doi.org/10.1080/03736245.2015.1028983

Ferrulli, P. (2016). Green airport design evaluation (GrADE) – methods and tools improving infrastructure planning. *Transportation Research Procedia*, 14, 3781-3790. https://doi.org/10.1016/j.trpro.2016.05.463

Gardiner, J., Ison, S., & Humphreys, I. (2005). Factors influencing cargo airlines' choice of airport: An international survey. *Journal of Air Transport Management*, 11(11), 393-399. https://doi.org/10.1016/j.jairtraman.2005.05.004

Gasparyan, A. Y., Ayvazyan, L., Blackmore, H., & Kitas, G. D. (2011). Writing a narrative biomedical review: considerations for authors, peer reviewers and editors. *Rheumatol Int*, 31, 1409-1417. https://doi.org/10.1007/s00296-011-1999-3

Gillen, D. (2011). The evolution of airport ownership and governance. *Journal of Air Transport Management*, 17(2011), 3-13. https://doi.org/10.1016/j.jairtraman.2010.10.003

Gillen, D., Jacquillat, A., & Odoni, A. R. (2016). Airport demand management: the operations research and economics perspectives and potential synergies. *Transportation Research Part A*, 94(2016), 495-513. https://doi.org/10.1016/j.tra.2016.10.011

Glaeser, E. L., Kolko, J., & Saiz, A. (2001). Consumer city. *Journal of Economic Geography*, 1, 27-50. https://doi.org/10.1093/jeg/1.1.27

Graham, B. & Shaw, J. (2008). Low-cost airline in Europe: Reconciling liberalization and sustainability. *Geoforum*, 39(2008), 1439-1451. https://doi.org/10.1016/j.geoforum.2007.12.006

Green, B. N., Johnson, C. D., & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal of Chiropractic Medicine*, 5(3), 101-117. https://doi.org/10.1016/S0899-3467(07)60142-6

Green, K. R. (2007). Airports and economic development. *Real State Economics*, 35(1), 91-112. https://doi.org/10.1016/j.trpro.2016.05.461

Haddad, E. A., Perobelli, F. S., Araújo, I. F., & University, T. P. D. (2020). Uneven integration: the case of Angola. Research Square. https://doi.org/10.21203/rs.3.rs-29035/v1

Hochrein, S., & Glock, C. H. (2012). Systematic literature reviews in purchasing and supply management research: a tertiary study. *International Journal of Integrated Supply Management*, November. https://doi.org/10.1504/IJISM.2012.052773

Isa, N. A. M., Ghaus, H., Hamid, N. A., & Tan, P. (2020). Key drivers of passengers' overall satisfaction at klia2 terminal. *Journal of Air Transport Management*, 87, 101859. https://doi.org/10.1016/j.jairtraman.2020.101859

Jensen, S. K. (2018). *Angola's infrastructure ambitions through booms and busts policy, governance and refor.* The Royal Institute of International Affairs, Chatham House, September.

Jorge, J., & Rus, G. (2004). Cost-benefit analysis of investment in airport infrastructure: a practical approach. *Journal of Air Transport Management*, 10(2004), 311-326. https://doi.org/10.1016/j.jairtraman.2004.05.001

Kasarda, J. D., & Green, J. D. (2005). Air cargo as an economic development engine: a note on opportunities and constraints. *Journal of Air Transport Management*, 11, 459-462. https://doi.org/10.1016/j.jairtraman.2005.06.002

Küçükönal, H., & Sedefoğlu, G. (2017). The causality analysis of Air transport and socio-economics factors: the the case of OECD countries. *Transportation Research Procedia*, 28, 16-26. https://doi.org/10.1016/j.trpro.2017.12.164

Lakshmanan, T. R. (2011). The borader economic consequences of transport infrastructure investments. *Journal of Transport Geography*, 19(2011), 1-12. https://doi.org/10.1016/j.jtrangeo.2010.01.001

Liou, J. J. H., Tang, C., Yeh, W., & Tsai, C. (2011). A decision rules approach for improvement of airport service quality. *Expert Systems With Applications*, 38(11), 13723-13730. https://doi.org/10.1016/j.eswa.2011.04.168

London, W. R., Moyle, B., D, & Lohmam, G. (2017). Cruise infrastructure development in Auckland, New Zealand: a media discourse analysis (2008–2016). *Asia Pacific Journal of Tourism Research*, 22(6), 615-633. https://doi.org/10.1080/10941665.2017.1308390

Malandri, C., Mantecchini, L., & Postorino, M. N. (2017). Airport ground access reliability and resilience of transit networks: a case study. *Transportation Research Procedia*, 27, 1129-1136. https://doi.org/10.1016/j.trpro.2017.12.022

Muzima, J. (2019). Angola. 2018 African Economic Outlook. *African Development Bank Group*, 1–10.

Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*, 37(17), 1979-1990. https://doi.org/10.1080/00036840500278103

Neufville, R. de, Odoni, A. R., Belobaba, P. P., & Reynolds, T. G. (2013). *Airport systems planning, design, and management* (T. M.-H. E. LLC. (ed.); Second Ed.). e-Book conversion by Cenveo.

Nguyen, D., Lohmann, N., & Esteban, M. (2022). Airport infrastructure development in Ogasawara Islands Japan: A comparison of media and public discourse analysis. *Journal of Air Transport Management*, 102(2022), 102-220. https://doi.org/10.1016/j.jairtraman.2022.102220

Nonkenge, B., & Luiz, J. M. (2018). Dimensions of distance: International flight connections, historical determinism, and economic relations in Africa. *Critical Perspectives on International Business*, 14(1), 27–48. https://doi.org/10.1108/cpoib-01-2017-0001

Oum, T. H., Yan, J., & Yu, C. (2008). Ownership forms matter for airport efficiency: a stochastic frontier investigation of worldwide airports. *Research in Agricultural & Applied Economics*. https://doi.org/10.1016/j.jue.2008.03.001

Pesaran, H., & Shin, Y. (1997). An Autoregressive Distributed Lag Modeling Approach to Co-integration Analysis. *Research Gate*, December 2013.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis. *Journal of Applied Econometrics*, 326(February), 289-326. https://doi.org/10.1002/jae.616

Pius, A., Nwaogbe, O. R., Opeoluwa, O., & Guenane, I. (2017). An Investigation into the Effect of Airport Touting from the Passengers' Perspective: A Case of Nnamdi Azikiwe Airport Abuja. *Transportation Research Procedia*, 28, 69–78. https://doi.org/10.1016/j.trpro.2017.12.170

Pontes, J. P., & Pais, J. (2018). The role of infrastructure efficiency in economic development - the case of underused highways in Europe. *Journal of Infrastructure, Policy and Development*, 2(2). https://doi.org/10.24294/jipd.v2i2.857

Pradhan, R. P., & Bagchi, T. P. (2013). Effect of transportation infrastructure on economic growth in India: the VECM approach. *Research in Transportation Economics*, 38(1), 139-148. https://doi.org/10.1016/j.retrec.2012.05.008

Pushak, N., & Foster, V. (2011). Angola's infrastructure. A continental perspective. *The World Bank Africa Region Sustainable Development Unit September 2011*. https://doi.org/10.1596/27281

Roberstson, J. A. W. (1995). Airports and economic regeneration. *Journal of Air Transport Management*, 2(2), 81-88. https://doi.org/10.1016/0969-6997(95)00033-X

Sarkis, J., & Talluri, S. (2004). Performance based clustering for benchmarking of US airports. *Transportation Research Part A*, 38(2004), 329-346. https://doi.org/10.1016/j.tra.2003.11.001

Short, J., & Kopp, A. (2005). Transport infrastructure: investment and planning. Policy and research aspects. *Transport Policy*, 12, 360-367. https://doi.org/10.1016/j.tranpol.2005.04.003

Temudo, M. P., Cabral, A. I. R., & Talheira, P. (2019). Petro-Landscapes : urban expansion and energy consumption in Mbanza Kongo City, Northern Angola. *Springer Science+Business Media, LLC, Part of Springer Nature*, 565-575. https://doi.org/10.1007/s10745-019-00088-6

Tveter, E. (2017). The effect of airports on regional development: evidence from the construction of regional airports in Norway. *Research in Transportation Economics*, 63, 50-58. https://doi.org/10.1016/j.retrec.2017.07.001

Wasesa, M., Rahman, M. N., Rizaldi, A., & Mashuri. (2015). Relocating a multiple-tenants logistics center: lesson learned from an air cargo terminal relocation project. *Procedia Manufacturing*, 4(Iess), 139-145. https://doi.org/10.1016/j.promfg.2015.11.024

Yuan, Y., & Hunt, R. H. (2009). Systematic reviews: the good, the bad, and the ugly. *The American Journal of Gastroenterology*, 104(5), 1086-1092. https://doi.org/10.1038/ajg.2009.118

Zhang, A. (2002). Electronic technology and simplification of customs regulations and procedures in air cargo trade. *Journal of Air Transportation*, 7(2).

V.1. N.1. 2025

PERSPECTIVAS DO SABER- REVISTA CIENTÍFICA MULTIDISCIPLINAR
E-ISSN 3079-5974

TRANSPARÊNCIA E INTEGRIDADE NA GESTÃO TRIBUTÁRIA: UM ESTUDO SOBRE OS IMPACTOS ÉTICOS NA ARRECADAÇÃO FISCAL

TRANSPARENCY AND INTEGRITY IN TAX MANAGEMENT: A STUDY ON THE ETHICAL IMPACTS ON TAX COLLECTION

TRANSPARENCIA E INTEGRIDAD EN LA GESTIÓN TRIBUTARIA: UN ESTUDIO SOBRE LOS IMPACTOS ÉTICOS EN LA RECAUDACIÓN DE IMPUESTOS

Denilson Gonçalves Ricardo Lunga

https://orcid.org/0009-0000-5131-5369

Data de Submissão: 31/03/2025.
Data de Aprovação: 31/03/2025.

RESUMO

Este artigo aborda a importância da ética, transparência e integridade na gestão tributária para a democracia e o desenvolvimento social. A falta de ética no sector público leva à corrupção, desvio de recursos e privação dos direitos da população. A administração fiscal desempenha um papel crucial na arrecadação de tributos, seguindo princípios como legalidade e justiça. No entanto, escândalos financeiros envolvendo gestores públicos e arrecadadores de tributos são comuns, prejudicando a actividade financeira do Estado. O Estado precisa de recursos financeiros para suas actividades, principalmente provenientes de tributos. A ética na arrecadação fiscal é fundamental para garantir a operacionalidade dos serviços públicos e o bem-estar colectivo. O objectivo principal deste estudo é analisar os impactos éticos da transparência e integridade na gestão tributária e sua influência na arrecadação fiscal, identificando desafios éticos e a relação entre integridade e eficiência na arrecadação. A ética estuda os valores morais e é essencial na prática profissional, promovendo honestidade e responsabilidade. A actividade financeira do Estado, que inclui a arrecadação de receitas e gestão de despesas, é crucial para atender às necessidades públicas.
PALAVRAS-CHAVE: Ética, Gestão Tributária, Transparência.

ABSTRACT

This article addresses the importance of ethics, transparency, and integrity in tax management for democracy and social development. The lack of ethics in the public sector leads to corruption, misappropriation of resources and deprivation of the rights of the population. The tax administration plays a crucial role in tax collection, following principles such as legality and fairness. However, financial scandals involving public managers and tax collectors are common, harming the state's financial activity. The State needs financial resources for its activities, mainly from taxes. Ethics in tax collection is fundamental to ensure the operability of public services and collective well-being. The main objective of this study is to analyze the ethical impacts of transparency and integrity in tax management and their influence on tax collection, identifying ethical challenges and the relationship between integrity and efficiency in tax collection. Ethics studies moral values and is essential in professional practice, promoting honesty and responsibility. The financial activity of the State, which includes revenue collection and expenditure management, is crucial to meet public needs.
KEYWORDS: Ethics, Tax Management, Transparency.

RESUMEN

Este artículo aborda la importancia de la ética, la transparencia y la integridad en la gestión tributaria para la democracia y el desarrollo social. La falta de ética en el sector público conduce a la corrupción, la malversación de recursos y la privación de los derechos de la población. La administración tributaria desempeña un papel crucial en la recaudación de impuestos, siguiendo principios como la legalidad y la equidad. Sin embargo, son comunes los escándalos financieros que involucran a funcionarios públicos y recaudadores de impuestos, lo que perjudica la actividad financiera del Estado. El Estado necesita recursos financieros para sus actividades, principalmente provenientes de los impuestos. La ética en la recaudación tributaria es fundamental para garantizar la operatividad de los servicios públicos y el bienestar colectivo. El objetivo principal de este estudio es analizar los impactos éticos de la transparencia y la integridad en la gestión tributaria y su influencia en la recaudación tributaria, identificando los desafíos éticos y la relación entre la integridad y la eficiencia en la recaudación tributaria. La ética estudia los valores morales y es esencial en el ejercicio profesional, promoviendo la honestidad y la responsabilidad. La actividad financiera del Estado, que incluye la recaudación de ingresos y la gestión del gasto, es crucial para satisfacer las necesidades públicas.
PALABRAS-CLAVE: Ética, Gestión Tributaria, Transparencia.

INTRODUÇÃO

A transparência e integridade na gestão fiscal são cruciais para a democracia, pois permite que os cidadãos acompanham as acções do governo e participem positivamente do controlo social. A falta de transparência leva a ausência de ética no sector público, o que causa corrupção, desvio do erário e priva a população dos seus direitos.

A administração fiscal desempenha o papel crucial na arrecadação de tributos, garantindo que todos cumpram com as suas obrigações fiscais, baseando-se sempre nos seguintes princípios da legalidade, igualdade, capacidade contributiva, justiça material e irretroactividade.

Tem sido comum, ouvir-se relatos de escândalos financeiros envolvendo não somente por parte dos gestores públicos mas também, de quem tem a responsabilidade arrecadar os tributos, o que desencadeia consequências gravíssimas a actividade financeira do estado.

Para financiar suas actividades, um governo necessita da arrecadação de recursos que, em sua maioria, é proveniente de tributos (impostos, taxas e contribuições). O Estado necessita de efectuar despesas para satisfazer as necessidades colectivas dos seus utentes, designadamente as necessidades de ensino, segurança, saúde pública e de defesa nacional. Acolhendo-se a esta ordem de ideias, o comportamento ético na arrecadação fiscal assume-se de capital importância para para garantir que os serviços públicos se mantenham operacionais.

O Estado realiza actividades sociais, administrativas, políticas, económicas, financeiras, educacionais, e outras, com o propósito de organizar a convivência humana na sociedade, promovendo o bem-estar colectivo. Para realizar essas acções, o Estado precisa de recursos financeiros, os quais são obtidos por meio de sua actuação no âmbito da actividade financeira.

A actividade financeira do Estado compreende todas as acções relacionadas à arrecadação, gestão e alocação de recursos financeiros públicos. Segundo Nelito (2024, p. 22), "a principal actividade financeira do Estado é caracterizada pela realização das despesas derivadas da satisfação das necessidades colectivas e pela arrecadação das receitas para cobertura das despesas. [...]."

Deste modo, a actividade financeira do Estado desdobra-se na obtenção de meios como forma de financiamento das necessidades colectivas, bem como a coordenação entre esses meios e as necessidades a satisfazer. Este financiamento é feito através de receitas, designadas por receitas públicas.

É, neste sentido, que observa-se a importância da ética, analisar quais os factores e características dos indivíduos que levam a uma maior preponderância para as práticas antiéticas, defraundando o erário e as consequências à actividade financeira do Estado.

Objectivo Geral: Analisar os impactos éticos da transparência e integridade na gestão tributária e sua influência na arrecadação fiscal.

Objectivos Específicos:

1. Apresentar os fundamentos teóricos que sustentam a ética.
2. Identificar os principais desafios éticos enfrentados na gestão tributária.
3. Analisar a relação entre integridade e arrecadação fiscal, (buscando evidências de como prática éticas influenciam a eficiência e eficácia da arrecadação).

Justificativa

A principal fonte de receitas da maioria dos Estados deriva, indubitavelmente, dos tributos (impostos). Estes, enquanto prestação pecuniária e coactiva que reverte a favor do Estado, são o principal instrumento a que este recorre de modo a fazer face às despesas decorrentes do cumprimento da sua tarefa de satisfação das necessidades colectivas.

Os contribuintes por imposição legal e pela conscientização do dever cívico, pagam os seus tributos, cujo objectivo é garantir o crescimento e desenvolvimento do seu país, e que os serviços basicos necessários para a dignidade humana sejam consagrados. A falta de transparência e integridade na gestão tributária pode levar a práticas antiéticas, como corrupção, evasão fiscal e má afectação de recursos, acometendo a arrecadação fiscal e a confiança dos cidadãos no sistema tributário.

Com o crescente aumento de escândalos que envolvem o desvio do erário, fez disparar o interesse em investigações que abordem esta temática, nomeadamente no sentido de tentar compreender e identificar os impactos de tais actos na transparência e integridade ga gestão tributária. Torna-se, portanto, imprescíndivel uma postura ética a quem tem o dever de garantir que os recursos (financeiros) arrecadados sejam distribuídos de forma correcta, não deixando que os objectivos individuais sobreponham-se aos objectivos colectivos.

Problema

De que forma os impactos éticos da transparência e integridade na gestão tributária influenciam na arrecadação fiscal?

A crescente demanda por transparência e responsabilidade na gestão dos recursos públicos tem impulsionado pesquisas sobre os mecanismos de controlo da actividade financeira do Estado. Procura-se explorar o papel dos órgãos de controlo, da participação social e das tecnologias da informação na promoção da transparência e na prevenção da corrupção.

PERSPECTIVAS DO SABER- REVISTA CIENTÍFICA MULTIDISCIPLINAR
E-ISSN 3079-5974

1. CONCEITOS E FUNDAMENTOS DE ÉTICA

A palavra ética, deriva da palavra grega *ethos*, que significa carácter e que na filosofia estuda os valores morais.

A ética tem vindo a ser estudada e reflectida desde o século IV a.C. na antiga Grécia, tendo sido os filósofos gregos os primeiros a pensar numa definição para o termo ética, nomeadamente os filósofos Sócrates, Platão e Aristóteles. Sócrates defendia que o conhecimento é a base do comportamento ético, que a ética colectiva se deveria sobrepor à ética individual de cada pessoa em prol da comunidade e que as leis devem ser obedecidas de forma a garantir a ordem na sociedade (Maurício, 2020).

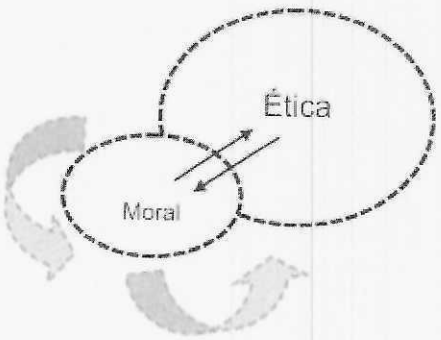
Como disciplina interdisciplinar, a ética é estudada sob diferentes perspectivas, como filosofia, direito, economia, medicina e até mesmo ciências tecnológicas. Cada área contribui para aprofundar reflexões éticas, levando em conta as especificidades dos dilemas que se colocam nos seus respectivos campos. (António, 2025, p. 2)

1.2 DIFERENÇAS ENTRE ÉTICA E MORAL

A distinção entre a ética e moral é importante para a reflexão sobre questões como direitos humanos, justiça social e responsabilidade individual.

Comumente, a ética e a moral têm sido tratadas como sinôninmos por muitos, todavia, existe uma certa relação e interdependência entre as mesmas ou seja, não é possível falar de uma sem abordar a outra. Portanto, apesar de estes conceitos serem distintos, existe uma estreita articulação entre si, na medida em que a ética tem como objecto de estudo a própria moral, não existindo desligada uma da outra, mas sendo independentes entre si, tal como podemos verificar no gráfico 1 que se segue. neste sentido, tanto a ética implica a moral, enquanto matéria-prima das suas reflexões e sem a qual não existiria, como a moral implica a ética para se repensar, desenhando-se, assim, entre elas uma importante relação de circularidade ascendente e de complementaridade (Pedro, 2014).

Gráfico 1 – Relação Entre a Ética e a Moral



Fonte: Pedro (2021, p.5).

Partindo disso, é possível dizer que: Ética são os conhecimentos obtidos da investigação do comportamento humano em relação às regras morais, explicadas de forma racional, fundamentada, científica e teórica, ou seja, ética é uma reflexão sobre a Moral.

Segundo Cavela (2021), a ética é o estudo geral do que é bom ou mau, correcto ou incorrecto, justo ou injusto, adequado ou inadequado. Um dos seus objectivos é a busca de justificativas para as regras propostas pela Moral e pelo Direito. Ela é diferente de ambos – Moral e Direito - pois não estabelece regras (p.40).

Sendo assim, é possível afirmar que a ética pode influenciar a moral, ao questionar e transformar normas sociais existentes. Ou seja, infleunciam a moral individual, fazendo com que as pessoas reflictam sobres os seus valores e comportamentos, podendo levar a mudanças nas atitudes e acções individuais, que, em contrapartida, podem contribuir para a transformação da moral social.

1.3 OS PRINCÍPIOS FUNDAMENTAIS À PRÁTICA PROFISSIONAL

Segundo Andrade (2017), o profissional deve seguir os padrões éticos da sociedade e as normas e regimentos internos das organizações. A ética profissional proporciona ao profissional um exercício diário e prazeroso de honestidade, comprometimento, confiabilidade, entre tantos outros, que conduzem o seu comportamento e a tomada de decisões em suas actividades. A recompensa é ser reconhecido, não só pelo seu trabalho, mas também por sua conduta exemplar.

As organizações, actualmente, têm aumentado o seu interesse por atitudes éticas, pois o que tem sido observado é quando a mesma é negligenciada passa a vigorar a desconfiança entre empresas, a falta de lealdade dos empregados e o uso da tecnologia a serviço da fraude, colocando em jogo o destino da organização. No sector público, o cenário não é diferente, torna-se imprescindível que os servidores tenham uma postura ética. Quando verifica-se o oposto, origina problemas graves a execução orçamental dos demais sectores que compõem.

Weiss (2014) define cinco princípios fundamentais usados no raciocínio ético que podem ser utilizados no quotidiano bem como em situações de carácter profissional. Os princípios definidos são:

- ***Utilitarismo.*** Este conceito foi primeiramente abordado por Bentham e por Mill. Existem dois tipos de utilitarismo, sendo eles o utilitarismo baseado nas regras e o utilitarismo baseados nas acções. O primeiro defende que os princípios universais são utilizados como critério de decisão para atingir o melhor benefício tendo sempre em consideração a acção praticada. Já o segundo analisa as acções ou os comportamentos de forma a verificar se a máxima utilidade consegue ser atingida. Neste sentido considera-se que um acto é moralmente correcto se a relação custo-benefício for a melhor para o maior número de pessoas.
- ***Universalismo.*** Este princípio foi inicialmente abordado por Kant. O universalismo defende que os fins não justificam os meios, não se devendo agir de forma incorrecta e prejudicial, mesmo que estas acções impactem de forma positiva o maior número de pessoas. Neste sentido, uma acção considerada moralmente correta deve ter como objectivo o tratamento de todos os indivíduos de forma igualitária e com respeito, considerando que todos indivíduos agiriam de igual forma perante as mesmas circunstâncias.
- ***Direitos.*** Os direitos são baseados em diferentes autoridades. Os direitos legais dizem respeito a um sistema jurídico e legal. Por outro lado, os direitos morais e humanos são direitos universais e baseados em normas e estão implementados em todas as sociedades. Os direitos morais implicam que os indivíduos têm o dever de não violar os direitos uns dos

outros. Assim uma acção é moralmente correcta se for baseada nos direitos legais e morais e tiver em conta os deveres de cada indivíduo para com os restantes.

- ***Justiça.*** Este princípio baseia-se na máxima de que os todos indivíduos devem ser tratados de igual forma e que a justiça desempenha bem o seu propósito quando todos os indivíduos possuem iguais oportunidades e vantagens na sociedade em que se inserem. Nesta óptica, uma acção é moralmente correcta se todos os indivíduos possuírem oportunidades e vantagens iguais na sociedade onde se inserem.
- ***Ética da virtude.*** Platão e Aristóteles são os pioneiros no que diz respeito à abordagem do tema da ética da virtude. A ética da virtude foca-se essencialmente no tipo de pessoas que os indivíduos anseiam ser e não em acções especificas.

A ética profissional transcende um mero conjunto de regras, englobando virtudes. Estas qualidades, enraizadas no carácter do profissional, guiam a sua conduta, promovendo o bem-estar da equipa e a relação com os *stakeholders*.

Partilhando da mesma visão, Chimpolo (2020, p.259), afirma que, normalmente, a ética é definida pelo senso comum como o conjunto de regras que devem ser cumpridas para o bem-estar de toda uma equipa de profissionais e entre profissionais e clientes, pelo que deve ser sinónimo de respeito consigo mesmo e com o próximo. Porém, o sentido de ética profissional não se resume apenas às condutas normativas que devem ser postas em prática como se fossem regras extremamente ditatórias, mas sim, a um conjunto de virtudes que fluem do superego do profissional as quais podemos tirar como exemplos:

- Honestidade;
- Competência;
- Compreensão;
- Optimismo;
- Sigilo;
- Prudência;
- Humildade;
- Responsabilidade.

2. CARACTERIZAÇÃO DA ACTIVIDADE FINANCEIRA DO ESTADO

A actividade financeira do Estado é um tema central no Direito Financeiro, sendo este último, a área do direito que trata das normas, princípios e regras que regulam as finanças públicas, abrangendo o conjunto de acções estatais voltadas para a obtenção de recursos financeiros (como arrecadar impostos, empréstimos ou outras fontes de financiamento) e gestão dos mesmos de forma eficiente para o cumprimento de suas funções (como educação, saúde, segurança, infraestrutura, entre outras).

Considera-se actividade financeira, sendo a arrecadação de receitas, juntamente com sua gestão, fiscalização e a realização de seus gastos, com o cunho de atender as necessidades públicas. (Garcia, 2018).

Segundo o Ministério das Finanças (2016), receita pública é o montante total (impostos, taxas, contribuições e outras fontes de recursos) em dinheiro recolhido pela Administração Geral Tributária e depositada no Tesouro Nacional, incorporado ao Património do Estado, que serve para custear as despesas públicas e as necessidades de investimentos públicos.

Em consonância com o descrito no ponto anterior, o art.º 8º da Lei Quadro do Orçamento Público, especifica que, constituem receitas orçamentais todas as receitas públicas, cuja titularidade é o Estado ou a Autarquia, bem como dos órgãos que deles dependem, inclusive as relativas a serviços e fundos autónomos, doações e operações de crédito. Realçando ainda que tributo é a receita derivada instituida pelo Estado compreendos impostos, as taxas e as contribuições nos termos legais em matéria financeira. Partindo do pressuposto de que as receitas públicas correspondem a todo montante arrecadado pelo Estado e, que servem para fazer face as despesas incorridas para a satisfação das necessidades colectivas, o Ministério das Finanças (2016) define despesas públicas como:

> Despesa Pública é o conjunto de dispêndios realizados pelos entes públicos para custear os serviços públicos (despesas correntes) prestados à sociedade ou para a realização de investimentos (despesas de capital). As despesas públicas devem ser autorizadas pelo Poder Legislativo, através do acto administrativo chamado orçamento público. (p. 4)

A arrecadação de tributos é uma das principais formas de obtenção de receita pelo Estado, e sua relação com a actividade financeira é crucial. Estudos recentes têm analisado os impactos da carga tributária na economia, na distribuição de renda e na justiça social.

2.1 CARACTERIZAÇÃO DOS TRIBUTOS

Segundo o Código Geral Tributário Angolano, os tributos são prestações patrimoniais, pecuniárias ou susceptíveis de avaliação pecuniária, sem carácter de sanção, impostos pelo Estado ou outras entidades de direito público ou concessionárias de serviços públicos, com vista à satisfação das necessidades colectivas e a prossecução do interesse.

Elas correspondem a uma da os impostos, taxas e contribuições. Eis as diferenças entre os mesmos:

Imposto - é uma prestação pecuniária, coactiva, unilateral, a título definitivo, sem carácter de sanção, devida ao Estado ou entes públicos com vista à realização de fins públicos.

Taxa - referem-se aos valores autoritariamente fixados e que o Estado recebe em contrapartida. As taxas são tributos bilaterais, implicando uma contraprestação pública ao seu pagamento, sendo este elemento que diferencia com nitidez a taxa do imposto.

Contribuição - são cobradas para financiar sectores específicos, como é o caso da previdência social. Ou seja, são valores destinados para um fim específico.

2.2 GESTÃO PÚBLICA

Teixeira (2022), define gestão como "o processo de se conseguir obter resultados (bens e serviços) com o esforço dos outros. Pressupõe a existência de uma organização, isto é, várias

pessoas que desenvolvem uma actividade em conjunto para melhor atingirem objectivos comuns" (p.5)

A gestão pública é fundamental para o sucesso do Estado em atender às necessidades da sociedade. Uma abordagem inadequada pode levar a perdas significativas para a população, contrariando os princípios da administração pública. A organização dos órgãos administrativos, a distribuição de funções, a definição de responsabilidades e a capacitação dos agentes são cruciais para a prestação eficaz de serviços públicos. O objectivo principal deve ser sempre o interesse colectivo. A gestão pública eficiente garante que os recursos sejam utilizados de forma optimizada, os serviços sejam prestados com qualidade e os objectivos do Estado sejam alcançados.

Segundo Machado (2013), a Gestão Tributária, também, está inserida no contexto da Gestão Pública, sendo essa responsável por meio de seus agentes por arrecadar os recursos necessários para a manutenção da máquina pública, para bem servir aos cidadãos. Sendo, por esse motivo, uma importante atividade de um Ente Público.

2.2.1 ÉTICA NA TRANSPARÊNCIA DAS CONTAS PÚBLICAS

Para Menezes et al (2015), ao falar em ética voltada para o sector público pode-se perceber o quanto a transparência é fundamental para demonstrar como as actividades públicas foram realizadas, a ética e transparência tornam os governos mais democráticos. Além de inibir a corrupção, induzindo aos gestores públicos a aplicar os recursos públicos de forma eficiente, eficaz e com efectividade.

Alguns dos dilemas éticos enfrentados na gestão tributária, destacam-se os conflitos de interesse, corrupção e falta de *accountability*. Uma gestão tributária eficaz, obedecendo os princípios éticos, que poderá dar ao Estado relativo sucesso, o contrário, ou irá condenar a mesma a decadência empresarial.

A falta de ética na gestão tributária pode ter um impacto significativo e prejudicial em várias áreas, tais como a perda de receita e instabilidade económica, limitando serviços públicos essenciais, como saúde, educação e infraestrutura e consequentemente, aumentar a dívida pública, inflação e desigualdade social, a desconfiança pública e deterioração da governança, retirando a confiança dos cidadãos no governo e no sistema tributário, a concorrência desleal e distorção no mercado, fazendo com que as empresas que praticam a evasão fiscal obtenham vantagens competitivas injustas em relação às que cumprem suas obrigações tributárias, impacto social negativo, danos à reputação e à imagem do país no exterior, afastando investimentos e dificultando o comércio internacional.

3. METODOLOGIA

A metodologia refere-se ao caminho que o pesquisador percorre para alcançar os objectivos da sua pesquisa, garantindo a validade e a sua confiabilidade dos reultados. É, portanto, um componente essencial de qualquer pesquisa.

Metodologia oferece o desenho ou a estratégia usada na construção do conhecimento científico, indicando o tipo de método, a população/amostra do estudo ou informantes, os instrumentos de recolha de dados, as técnicas de tratamento de dados, o processo de recolha de dados, incluindo as questões relacionadas com a ética na investigação. (Tumbula, 2023, p. 148)

3.1 TIPO DE PESQUISA

Relativamente ao tipo de pesquisa, foi feita em três perspectivas, quanto ao modo de abordagem, aos objectivos e aos procedimentos técnicos.

Quanto ao modo de abordagem do problema, este estudo constituiu uma pesquisa qualitativa, caracterizando-se, pela não-utilização de instrumental estatístico na análise dos dados.

De acordo com Guerra (2024), a pesquisa qualitativa não se baseia em números para representatividade. Não realiza medições ou quantificações. Devido à natureza subjetiva desse tipo de pesquisa, os resultados não podem ser apresentados por meio de estatísticas, mas sim por relatórios que destacam as opiniões dos entrevistados. Assim, os resultados da pesquisa qualitativa não são obtidos simplesmente tabulando dados quantitativos e nunca serão números exatos.

A opção pela pesquisa qualitativa se justifiva quando o intento é explorar e compreender fenómenos complexos, subjectivos e contextuais, que não podem ser devidamente medidos ou quantificados.

Em função dos seus objectivos, o estudo assumir-se-á numa pesquisa exploratória. De acordo com Gil (2019), "as pesquisas exploratórias "são desenvolvidas com o objectivo de proporcionar visão geral, de tipo aproximação, acerca de determinado facto. Este tipo de pesquisa é realizado especialmente quando o tema escolhido é pouco explorado e torna-se difícil formular hipóteses precisas e opercionalizáveis sobre ele (p. 45). "

A relação entre transparência, integridade e ética na gestão tributária é um campo complexo e em constante evolução. A pesquisa exploratória permite uma imersão inicial nesse terreno, buscando identificar as principais variáveis e relações entre elas. A pesquisa exploratória busca identificar padrões e tendências emergentes na gestão tributária, especialmente no que diz respeito aos aspectos éticos e à sua influência na arrecadação fiscal.

Em relação aos procedimentos técnicos, constituirá uma pesquisa bibliográfica, cuja elaboração será feita a partir de fontes secundárias (obras literárias, livros, artigos científicos, dissertações, teses, entre outros materiais publicados em meio impresso ou digital, de autores reconhecidos).

Segundo Marconi & Lakatos (2017), a pesquisa bibliográfica, ou de fontes secundárias, abrange toda a tornada pública em relação ao tema de estudo, desde publicações avulsas, boletins, jornais, revistas, livros, pesquisas, monografias, teses, artigos científicos impressos ou electrónicos, material cartográfico e até meios de comunicação oral: programas de rádio, gravações, audiovisuais, filmes e programas de televisão. Sua finalidade é colocar o pesquisador em contacto directo com tudo o que foi escrito, dito ou filmado sobre determinado assunto, inclusive conferências seguidas de debates que tenham sido transcritas de alguma forma.

Este tipo de pesquisa, permitiu fazer consulta de várias obras a volta do tema para servir de base para fundamentação teórica facilitou na compreensão dos problemas éticos na gestão tributária e sua influência na arrecadação fiscal.

3.2 MÉTODO

"O método é a organização interna dos processos investigativo. É uma reconfiguração sucessiva de procedimentos que envolvem diversas técnicas e instrumentos que finalmente lhe outorgam validade" (Ramos & Naranjo, 2014, p. 99).

Para o presente artigo, optou-se pelo método indutivo.

Segundo Marconi & Lakatos (2017), o método indutivo a indução "é um processo mental por intermédio do qual, partindo de dados particulares, suficientemente constatados, infere-se uma verdade geral ou universal. O objectivo dos argumentos indutivos é levar a conclusões cujo conteúdo é muito mais amplo do que o das premissas nas quais se basearam" (pp 93-94).

Este método é especialmente útil, pois o objectivo é de possibilitar ao pesquisador, recolher dados e identificar padrões que podem levar à formulação de novas hipóteses e teorias.

Gil (2021, p. 30), detaca que "o método indutivo procede inversamente ao dedutivo: parte do particular e coloca a generalização como um produto posterior do trabalho de colecta de dados particulares. [...].

Não obstante, empregou-se este método pois, permitiu analisar casos específicos de transparência e integridade na gestão tributária, identificando padrões e tendências que podem revelar os impactos éticos na arrecadação fiscal.

3.3 TÉCNICAS E INSTRUMENTOS PARA A RECOLHA DE DADOS

Numa pesquisa bibliográfica qualitativa, sendo o investigador o principal de recolha e análise de dados. Para esta pesquisa, processamento e tratamento dos dados foi realizado empregandoa técnica de análise de conteúdo.

Nesse segmento, a análise de conteúdo é entendida como um conjunto de técnicas de "análise das comunicações, que visa obter, por procedimentos sistemáticos e objectivos de descrição do conteúdo das mensagens, indicadores (quantitativos ou não) que permitem as inferências de conhecimentos relativos de condições de produção/recepção (variáveis inferidas) destas mensagens" (Bardin, 2004, p. 41).

4- RESULTADOS

A ética na gestão tributária resulta em serviços públicos de qualidade e maior satisfação da população.

A ética do servidor público é imprescindível, pois o mesmo é um agente de extrema importância para o perfeito funcionamento da máquina pública. O conhecimento do cidadão a respeito da ética e dos seus direitos perante o Estado, juntamente com o investimento do poder público na qualificação de seus servidores, por meio de treinamentos, com o intuito de conscientizá-los quanto à responsabilidade de suas funções e da importância de uma conduta ética, poderá aumentar o nível de satisfação dos cidadãos quanto aos serviços públicos prestados pelos agentes (Lima de Andrade, 2018).

Na realidade, não existe um ponto de referência ético em relação ao serviço público ou à gestão pública em geral para seguir ou se guiar. O facto é que, nos dias atuais, a gestão pública virou apenas um meio de *status* e 'bolso cheio'. Não existir um padrão ou um ponto inicial do qual

possamos utilizar para julgar a actuação dos servidores públicos ou daqueles que estiverem envolvidos na vida pública, a Administração Pública prevalecerá apenas de verdadeiros "actores" mostrando qual o real intuito de assumir o comando ou direcção de uma instituição pública: seus próprios interesses (Almeida, 2018).

Sendo assim, compreende-se a necessidade de ética na gestão pública, mas enquanto o primeiro destaca a formação e a conscientização dos servidores como uma solução para garantir serviços de qualidade, o segundo critica a falta de padrões éticos e a prevalência de interesses pessoais. A reflexão é que, sem uma base ética sólida e um compromisso genuíno com o bem público, os esforços para qualificar os servidores podem ser insuficientes se não houver também uma mudança na cultura e nos valores da administração pública. A ética no serviço público não deve apenas ser ensinada, mas também ser praticada de forma consistente e transparente, para que os servidores possam, de facto, cumprir seu papel de agentes do bem-estar colectivo.

5. CONSIDERAÇÕES FINAIS

Actualmente, a questão da boa governança é central e aplica-se amplamente tanto ao sector público quanto ao privado. A falta de transparência na gestão tributária impacta significativamente na arrecadação fiscal dos estados, uma vez que retira a confiança dos contribuintes, o que poderá levar a práticas de evasão fiscal.

A ética desempenha um papel crucial na gestão pública, especialmente na área tributária. A transparência e integridade são fundamentais para garantir que os recursos arrecadados sejam utilizados de forma eficiente e para satisfazer as necessidades colectivas. A falta de ética, como a corrupção, desvio do erário e a consequente evasão fiscal, pode prejudicar gravemente a arrecadação de tributos e a confiança da população no sistema tributário, comprometendo a capacidade do Estado de fornecer serviços essenciais.

A transparência na gestão fiscal é essencial para fortalecer a democracia e o controlo social. Ela permite que os cidadãos acompanhem as acções do governo, promovendo a participação activa e o controlo social. Quando a gestão pública carece de transparência, ocorrem práticas antiéticas que não apenas desviam recursos do erário, mas também prejudicam os serviços essenciais, como saúde, educação e segurança. A ética é, portanto, um pilar para garantir que os recursos públicos sejam geridos de forma justa e equitativa.

A relação entre ética e arrecadação fiscal é directa: práticas éticas influenciam positivamente a eficiência e eficácia da arrecadação de tributos. Quando os gestores públicos e os cidadãos cumprem suas obrigações fiscais com transparência e responsabilidade, os recursos financeiros são melhor geridos, o que resulta em um melhor financiamento dos serviços públicos. Por outro lado, a falta de ética, como a corrupção ou o favorecimento de interesses individuais, pode levar a uma gestão ineficaz e prejudicar o bem-estar colectivo.

A ausência de ética na gestão tributária tem sérias repercussões. Ela pode gerar uma série de problemas sócioeconómicos, como a perda de receita, instabilidade económica, desconfiança pública e distorções no mercado.

A ética no serviço público é imprescindível para garantir que a máquina pública funcione correctamente e de maneira eficiente. A ética deve ser vista não apenas como o cumprimento de regras, mas como a promoção de virtudes como honestidade, responsabilidade e transparência, que devem guiar as acções dos servidores públicos em todos os níveis de gestão. A actuação ética é um factor decisivo para garantir que os recursos públicos sejam utilizados da melhor forma possível em benefício da sociedade.

A ética do servidor público é fundamental para a boa gestão pública e a satisfação dos cidadãos. Servidores éticos garantem o uso correcto dos recursos públicos, a imparcialidade no atendimento e a transparência nas acções do governo. A ética na gestão tributária garante o investimento local, acesso aos serviços públicos imprescindíveis, transparência para o resto do mundo, confiança, fortalecendo a relação entre governo e cidadãos.

REFERÊNCIAS

Almeida, M. T. (2018). *Ética na Gestão Pública: Responsabilidades e Desafios*. Monografia, Universidade Federal de São João Del-Rei, São João Del Rei. Disponível em: http://dspace.nead.ufsj.edu.br/trabalhospublicos/bitstream/handle/123456789/133/TCC%20FINAL%20-%20Marta%20Terezinha%20de%20Almeida.pdf. Consultado e, 31 de Março de 2025.

Andrade, I. R. S. (2017). *Ética geral e profissional*. Universidade Federal da Bahia, Faculdade de Ciências Contábeis; Superintendência de Educação a Distância.

António, M. I. dos S. R. (2025). ÉTICA DESDE UMA PERSPECTIVA MULTIDISCIPLINAR: DESAFIOS ÉTICOS NA AVALIAÇÃO DE DESEMPENHO E REMUNERAÇÃO. *Perspectivas do Saber- Revista Científica Multidisciplinar, 1*(1), 1-17. Disponível em: https://doi.org/10.5281/zenodo.14867549 Consultado aos 25 de Março de 2025.

Bardin, L. (2004). *Análise de conteúdo*. Edições 70.

Cavela, J. (2021). *Lições de Ética e deontologia profissional dos agentes de Educação em Angola* (1ª ed.). Chela Editora. Disponivel em https://academiadeautoresdahuila.net/arquivo_obras/LI%c3%87%c3%95ES%20DE%20%c3%89TICA%20E%20DEONTOLOGIA%20PROFISSIOANL%20DOS%20AGENTES%20DE%20EDUCA%c3%87%c3%83O%20EM%20ANGOLA%20(Jos%c3%a9%20Caleva)%20Prod%20By%20Belson%20Hossi.pdf Consulatdo em 22 de Março de 2025.

CESÁRIO, Jonas Magno dos Santos., FLAUZINO, Victor Hugo de Paula., MEJIA, Judith Victoria Castillo. (2020). Metodologia científica: Principais tipos de pesquisas e suas caraterísticas. *Revista Científica Multidisciplinar Núcleo do Conhecimento. 5*[s. n.], 23-33. Disponível em: https://www.nucleodoconhecimento.com.br/educacao/tipos-de-pesquisas Consultado aos 11 de Março de 2025.

Chimpolo, J. M. F. (2020). *Inovação e Gestão do Conhecimento no Desenvolvimento Organizacional* (1ª ed.). Nova Editora.

Garcia, E. (2018). Atividade Financeira do Estado e Receitas Públicas. *Anais do Congresso Brasileiro de Processo Coletivo e Cidadania*, n. 6, p. 308-318, out./2018. ISSN 2358-1557.

Gil, A. C. (2021). *Como elaborar projetos de pesquisa* (7ª ed.) 3. Reimpr. Atlas.

Guerra, Avaetê de Lunetta e Rodrigues. (2024).. METODOLOGIAS E CLASSIFICAÇÃO DAS PESQUISAS CIENTÍFICAS. *RECIMA21 - Revista Científica Multidisciplinar - ISSN 2675-6218*, *5*(8), e585584. https://doi.org/10.47820/recima21.v5i8.5584 Consultado aos 17 de Março de 2025.

Lei n.º 15/10, de 14 de julho (Lei Quadro do Orçamento Geral do Estado).

Lei n.º 21/20, de 9 de julho (Que Altera o Código Geral Tributário).

Lima de Andrade, S. (2018). *Ética na Gestão Pública: uma abordagem teórica*. Trabalho de Conclusão de Curso (Administração) - UFPB/CCSA.

Machado, H. B. (2013). *Curso de Direito Tributário* (33ª ed.). Malheiros Editores LTDA.

Marconi, M. A,, & Lakatos, E. M. (2017). *Fundamentos de metodologia científica* (8ª ed.). Atlas.

Maurício, T. I. S. (2020). *Caracterização da investigação em ética no contexto da fiscalidade*. Dissertação de Mestrado, ISCTE - Instituto Universitário de Lisboa, ISCTE Business School, Lisboa, Portugal.

Menezes, L. P., Santos, E. S., & Carvalho, M. B. (2015). A gestão fiscal com foco na ética e transparência das contas públicas. *Caderno de Graduação - Ciências Humanas e Sociais UNIT – SERGIPE*, *2*(3), 167 -181. Disponível em: https://periodicos.set.edu.br/cadernohumanas/article/view/1959 Consultado em 30 de Março de 2025.

Ministério das Finanças (Angola). (2016). *Orçamento cidadão 2016: Suplemento especial*. Gabinete de Estudos e Relações Internacionais. Disponível em: https://www.ucm.minfin.gov.ao/cs/groups/public/documents/document/zmlu/mdmy/~edisp/minfin032953.pdf. Acesso em 23 de Março de 2025.

Nelito, J. K. (2024). *Um Olhar à Fiscalidade Angolana* (2ª ed.). WA Editora.

Pedro, A. P. (2014). Ética, moral, axiologia e valores: confusões e ambiguidades em torno de um conceito comum. *Kriterion: revista de filosofia*, *55*, 483-498. Disponível em: https://doi.org/10.1590/S0100-512X2014000200002 Consultado em 22 de março de 2025.

Ramos, S. T. C., & Naranjo, E. S. (2017). *Metodologia da Investigação Científica*. Escolar Editora.

Teixeira, S. (2022). *Gestão das Organizações* (4ª ed.). Escolar Editora.

Tumbula, S. H. (2023). *Metodologia de Investigação Científica*. Elite-Editora.

Weiss, J. (2014). *Business Ethics: A Stakeholder and Issues Management Approach* (6th ed). Berrett Koehler Publishers, Inc.

Gmail Denilson Gonçalves Ricardo Lunga <denilsonlunga@gmail.com>

Obrigado pela sua submissão para Perspectivas do Saber. Revista Multidisciplinar

1 mensagem

Drª. Yanai Valdés López <perspectivasdosaber@revistasacademicas.renascerdosaber.com> 31 de março de 2025 às 20:59

Para: Denilson Gonçalves Ricardo Lunga <denilsonlunga@gmail.com>

Prezado(a) Denilson Gonçalves Ricardo Lunga,

Obrigado pela sua submissão para Perspectivas do Saber. Revista Multidisciplinar. Recebemos sua submissão, TRANSPARÊNCIA E INTEGRIDADE NA GESTÃO TRIBUTÁRIA: UM ESTUDO SOBRE OS IMPACTOS ÉTICOS NA ARRECADAÇÃO FISCAL, e um membro de nossa equipe editorial a verá em breve. Você receberá um e-mail quando uma decisão inicial for tomada e poderemos entrar em contato com você para obter mais informações.

Você pode visualizar sua submissão e acompanhar seu progresso por meio do processo editorial no seguinte local:

URL de submissão: https://revistasacademicas.renascerdosaber.com/index.php/rula/authorDashboard/submission/37

Se você tiver sido desconectado, poderá fazer login novamente com o nome de usuário denilson_lunga.

Se tiver alguma dúvida, entre em contato comigo pelo painel de submissão.

Obrigado por considerar Perspectivas do Saber. Revista Multidisciplinar como um local para o seu trabalho.

Esta é uma mensagem automática de Revistas da Universidad Lusíada de Angola .

Largo Lumeji (10-11) Ex casa Americana. Ingombotas. Luanda. Angola

Drª. Yanai Valdés López.

Gmail Denilson Gonçalves Ricardo Lunga <denilsonlunga@gmail.com>

Sua submissão foi enviada para avaliação

1 mensagem

Dra. Yanai Valdés López <valdeslopez84@gmail.com>
Para: Denilson Gonçalves Ricardo Lunga <denilsonlunga@gmail.com>

28 de abril de 2025 às 17:34

Prezado(a) Denilson Gonçalves Ricardo Lunga,

Tenho o prazer de informar que um editor revisou sua submissão, TRANSPARÊNCIA E INTEGRIDADE NA GESTÃO TRIBUTÁRIA: UM ESTUDO SOBRE OS IMPACTOS ÉTICOS NA ARRECADAÇÃO FISCAL, e decidiu enviá-la para revisão por pares. Um editor identificará revisores qualificados que retornarão avaliações sobre sua submissão.

Este periódico realiza avaliação por pares anônima dupla. Os avaliadores não verão nenhuma informação de identificação sobre você ou seus coautores. Da mesma forma, você não saberá quem avaliou sua submissão e não receberá notícias diretamente dos avaliadores. Você receberá de nós os resultados das avaliações dos revisores e informações sobre as próximas etapas.

Por favor, observe que enviar a submissão para a revisão por pares não implica que esta será publicada. Consideraremos as recomendações dos revisores antes de decidir aceitar a submissão para publicação. Talvez você seja solicitado a fazer revisões e responder aos comentários dos revisores antes que uma decisão final seja tomada.

Se você tiver alguma dúvida, por favor entre em contato comigo através do painel de submissão.

Dra. Yanai Valdés López

PERSPECTIVAS DO SABER- REVISTA CIENTÍFICA MULTIDISCIPLINAR
E-ISSN XXXX-XXXX

A TRANSFORMAÇÃO DIGITAL E O PERFIL DO NOVO PROFISSIONAL DE RH
DIGITAL TRANSFORMATION AND THE PROFILE OF THE NEW HR PROFESSIONAL
LA TRANSFORMACIÓN DIGITAL Y EL PERFIL DEL NUEVO PROFESIONAL DE RH

Autor – Faustina Inocência Rogaciano
ORCID https://orcid.org/0009-0004-2423-0860
N. º ORCID: 0009-0004-2423-0860

Autor – Lucrécia Pascoal Domingos Bráz
ORCID https:// https://orcid.org/0009-0008-2280-6677
N. º ORCID: 0009- 0008- 2280-6677

Autor – Osvaldo Marcos Guias
ORCID https://orcid.org/0009-0007-7778-1166
N.º ORCID: 0009-0007-7778 -1166

Data de Submissão:09/05/2025.
Data de Aprovação:

RESUMO

A ascedente integração das tecnologias no nosso contexto actual tem como consequência mudanças rápidas e por vezes disruptivas na gestão das empresas. No mesmo sentido, os gestores de Recurso Humanos – RH, são impactados de forma ainda mais intensa, pois são os responsáveis por gerir as equipas de modo linear e definir o posicionamento da área de RH frente aos desafios estratégicos da empresa que estão inseridos. Neste contexto, é objectivo deste artigo analisar o impacto da transformação digital no perfil dos gestores de RH e perceber quais as competências necessárias que os mesmo devem adquirir para que possam adaptar-se nesta época da digitalização. O comprometimento da pesquisa foi realizada através de pesquisa bibliográfica, onde procurou-se destacar a evolução das revoções industriais até alcançamos a 4 revolução industrial, denominada também como industria 4.0 ou era da digitalização. De seguida, abordou- se as diferentes habilidades e competências que os gestores de RH precisam desenvolver para actuar num contexto de mudanças e transformações digitais. Após a pesquisa bibliográfica e uma análise profunda ao tema, concluiu-se que a tranformação digital tem reformulado o papel dos profissionais de RH, exigindo um perfil mais estratégico, maiores competências técnicas e comportamentais para que possam consolidar-se como um agente essencial na sustentabilidade e competitividade das empresas em que estão inseridas nesta era da digitalização.

PALAVRAS - CHAVE: Industria 4.0. Recursos Humanos 4.0. Hard Skill e Soft Skills.

ABSTRACT

The increasing integration of technologies in our current context results in rapid and sometimes disruptive changes in company management. In the same sense, Human Resources – HR managers are impacted even more intensely, as they are responsible for managing teams in a linear way and defining the positioning of the HR area in the face of the strategic challenges of the company they are part of. In this context, the aim of this article is to analyze the impact of digital transformation on the profile of HR managers and to understand the necessary skills that they must acquire so that they can adapt in this era of digitalization. The research commitment was carried out through bibliographical research, where we sought to highlight the evolution of industrial revolutions until we reached the 4th industrial revolution, also known as industry 4.0 or the era of digitalization. Next, the different skills and competencies that HR managers need to develop to act in a context of digital change and transformation were discussed. After bibliographical research and an in-depth analysis of the topic, it was concluded that digital transformation has reformulated the role of HR professionals, requiring a more strategic profile, greater technical and behavioral skills so that they can consolidate themselves as an essential agent in the sustainability and competitiveness of the companies in which they operate in this era of digitalization.

KEYWORDS: Industry 4.0. Human Resources 4.0. Hard Skills and Soft Skills.

RESUMEN

La creciente integración de tecnologías en nuestro contexto actual da como resultado cambios rápidos y a veces disruptivos en la gestión de las empresas. En el mismo sentido, los gerentes de Recursos Humanos – RRHH se ven impactados aún más intensamente, ya que son los responsables de gestionar los equipos de forma lineal y definir el posicionamiento del área de RRHH ante los desafíos estratégicos de la empresa de la que forman parte. En este contexto, el objetivo de este artículo es analizar el impacto de la transformación digital en el perfil de los responsables de RRHH y comprender las habilidades necesarias que deben adquirir para poder adaptarse en esta era de digitalización. El compromiso investigativo se realizó a través de una investigación bibliográfica, donde buscamos resaltar la evolución de las revoluciones industriales hasta llegar a la 4ta revolución industrial, también conocida como industria 4.0 o la era de la digitalización. A continuación, se discutieron las diferentes habilidades y competencias que los gerentes de RH necesitan desarrollar para actuar en un contexto de cambio y transformación digital. Luego de una investigación bibliográfica y un análisis en profundidad del tema, se concluyó que la transformación digital ha reformulado el rol de los profesionales de RRHH, requiriendo un perfil más estratégico, mayores habilidades técnicas y comportamentales para que puedan consolidarse como un agente esencial en la sostenibilidad y competitividad de las empresas en las que operan en esta era de digitalización.

PALABRAS - CLAVE: Industria 4.0. Recursos Humanos 4.0. Habilidades duras y habilidades blandas.

PERSPECTIVAS DO SABER- REVISTA CIENTÍFICA MULTIDISCIPLINAR
E-ISSN XXXX-XXXX

INTRODUÇÃO

Ao longo da evolução tecnológica foram surgindo novos desafios a serem solucionados, obrigando assim, as empresas a adaptarem-se a fim de sanar de forma mais ágil e eficaz possíveis problemas e necessidades que possam surgir. A transformação digital surge para facilitar este caminho. (SAP, 2017). A qualidade, o tempo de acesso às informações e as inúmeras combinações de indicadores e análises, tornaram as empresas mais estratégicas e competitivas. A integração de tecnologias físicas e digitais, está impulsionando a criação de novos negócios, visto que a potencialização de resultados gerados é muito relevante.

As inovações no âmbito tecnológico têm transformado de forma significativa o mundo dos negócios sob diversos aspectos: a situação econômica, contextos políticos, presença de diferentes gerações nas empresas, temas de diversidade de gênero, além da necessidade de áreas de negócio atuando com uma posição mais estratégica, são alguns dos fatores da transformação digital que estão influenciando o mundo dos Recursos Humanos (RH). (BENNER, 2015).

A transformação digital, conforme mencionado por Stefan Ries, Diretor de Recursos Humanos da SAP na Alemanha, contribui para que as organizações possam prosperar em um mercado tão competitivo do qual fazem parte. Neste sentido, reside a necessidade de muitos diretores de RH e directores gerais identificarem quais são as mudanças necessárias para serem aplicadas na área de Recursos Humanos. (SAP, 2018).

As mudanças necessárias são pautadas por diversos estudos. Conforme o *Internacional Data Corporation* (IDC), é responsabilidade do RH endereçar os elementos-chave da transformação digital, assim como transformar a suas próprias funções. O IDC estabelece quatro premissas que devem conduzir essa transformação, desde a definição clara dos objetivos a se atingir, até o mapeamento dos resultados obtidos, sendo elas: entender as necessidades da empresa, formar um grupo diverso de agentes de mudança encarregados pela mesma, definir a tecnologia/sistema de informação aplicável e, por fim, entender o progresso feito e entregar os resultados. (IDC, 2018).

As principais fontes de transformação no contexto organizacional que ditam a competitividade das empresas atualmente estão nas pessoas e nas tecnologias da informação e comunicação (TIC), principalmente com a emergência de novos modelos de negócio facilitados pelo meio digital. (MASCARENHAS; VASCONCELOS, 2004).

Considerando o contexto apresentado e para dar sequência ao presente estudo, efectuamos a seguinte pergunta de partida:

Como a transformação digital tem impactado o perfil do novo profissional do RH?

Assim, na sequência, apresentam-se os objetivos que conduziram este estudo e a justificativa da sua escolha.

OBJECTIVO GERAL

- Investigar as novas competências exigidas dos gestores de recursos humanos no contexto 4. 0.

OBJECTIVO ESPECÍFICO

- Identificar os desafios da organização no contexto 4.0 na GRH;
- Compreender o papel da inovação tecnológica na construção de um novo modelo de actuação para profissionais de RH;
- Descrever as diferentes habilidades e competências que os gestores precisam desenvolver para actuar num contexto de mudanças e transformações digitais.

JUSTIFICATIVA

O presente estudo de caso justifica-se tendo em vista a importância da transformação digital presente na área Recursos Humanos e o quanto ela se torna cada vez mais essencial para que as empresas se mantenham actuando de forma competitiva em seu mercado actuando de forma mais estratégica e tecnológica. No entanto, muitos profissionais da área ainda não possuem as competências digitais e comportamentais exigidas por esse novo cenário, o que gera uma lacuna entre a prática atual e as necessidades futuras das organizações.

2. ENQUDRAMENTO TEÓRICO

É impossível ignorar o impacto que a transformação digital tem causado na sociedade e nas empresas/organizações, pois é preciso conhecer e entender qual deverá ser a nova dinâmica das organizações e como dar-se-á a articulação entre estruturas, pessoas e processos à luz desse design proposto, qual seja, de descentralização, virtualização, interoperabilidade, modularidade, capacidade em tempo real, orientação a serviços. Por outo lado, não podemos falar de transformação digital sem antes mesmo fazermos uma análise histórica da revolução industrial, desde a primeira até a quarta, também denominada industria 4.0.

2.1 A PRIMEIRA REVOLUÇÃO INDUSTRIAL

A primeira revolução industrial centrou-se no uso de máquinas à base da utilização do vapor e da água como fonte de energia, substituindo os métodos artesanais de fabricação e trouxe, principalmente para a indústria têxtil, mudanças sociais e econômicas com a mecanização de processos de fabricação. "Embora os têxteis fossem o produto que mais chamava a atenção no início da Revolução Industrial, essa também mecanizou a produção de praticamente todos os outros produtos mais importantes, como papel, vidro, couro e tijolos.

O impacto não se limitou, de maneira alguma, aos bens de consumo, a produção de ferro e de seus derivados - arame, por exemplo - mecanizou-se e passou a ser movida por máquinas a vapor, na mesma velocidade que os têxteis e com os mesmos efeitos sobre custos, preços e volumes produzidos. No final das guerras napoleônicas, a produção de armas em toda a Europa já era movida a vapor. Canhões eram feitos de um vigésimo a um décimo do tempo anterior, e o custo caiu mais de dois terços. Na mesma época, Eli Whitney tinha mecanizado a manufatura de mosquetes nos Estados Unidos, criando a primeira indústria de produção em massa." (Drucker, 2000, pág. 12).

Segundo Allen (2009), o surgimento de máquinas movidas a vapor para produção de bens foi o ponto principal da primeira revolução industrial, mas as descobertas suportadas pela ciência, não aconteceriam antes dos anos de 1870. "A Revolução Industrial é uma das bacias hidrográficas mais célebres da história da humanidade. Não é mais considerada como a descontinuidade abrupta que seu nome sugere, pois foi o resultado de uma expansão econômica iniciada no século XVI. No entanto, o décimo oitavo século representa uma rutura decisiva na história da tecnologia e da economia, com a invenção famosa, a maquia a vapor." (Allen, 2009, pág. 271).

2.2. A SEGUNDA REVOLUÇÃO INDUSTRIAL

A segunda revolução industrial ocorreu entre 1870 e a segunda guerra mundial, foi marcada pelo aperfeiçoamento das tecnologias e das pesquisas científicas relacionadas aos conhecimentos práticos obtidos na primeira revolução.

Esta revolução, ocorreram nas áreas elétrica, química, biológica, transportes, engenharia de produção, agricultura, materiais, trazendo com ela as micro-invenções, como a lâmpada elétrica incandescente com filamento de carvão e as novas fontes de energia com custos mais baixos, que permitiu que as máquinas passassem a ser utilizadas. (Ribeiro, 2023, pág. 22).

A criação de máquinas industriais movidas a energia elétrica permitiu uma produção em massa e com baixos custos. "Surgiram os primeiros barcos de aço movidos por potentes motores a vapor, revolucionando o transporte de mercadorias. Surgiram também as primeiras linhas de produção que viriam a permitir a produção em massa e a baixos custos. A invenção e inovação andaram de mãos dadas nesta que foi a segunda revolução Industrial." (Coelho, 2016, pág. 14).

É importante ressaltar que a Segunda Revolução Industrial também trouxe consigo várias consequências e o processo continuo de acúmulo de capital e de transformações, que deu origem ao capitalismo financeiro, que influenciou a vida cotidiana da população, com a elevada produtividade das indústrias, que proporcionou um maior volume de mercadorias que chegavam ao público. A mesma Revolução deu resultado em várias invenções, como por exemplo: o automóvel, trens a vapor e ferrovias, lâmpadas inandescentes, rádio, televisão, motor a combustão e elétrico, plásticos, entre outras invenções.

2.3 A TERCEIRA REVOLUÇÃO INDUSTRIAL OU REVOLUÇÃO INFORMACIONAL

Logo após a segunda guerra mundial, surge a terceira revolução industrial e com ela, a energia atómica, os primeiros computadores e difundiu o uso de semicondutores, computadores, automação e robotização de linhas de produção das empresas, que passou a processar e armazenar informações em meio digital, como forma de optimizar a comunicação e até mesmo ser mais veloz nas devidas melhorias do sistema.

A década de 1990, foi quando os segmentos da indústria começaram a integrar a automação industrial programável e flexível. "A evolução em direção a esse estágio avançado de automação flexível tende a articular-se intensamente com as técnicas de desenho (CAD), engenharia (CAE) e manufatura (CAM), auxiliados por computadores. Esse novo paradigma em formação, que marcara a indústria das primeiras décadas do século XXI, significa, no limite, a fusão radical da mecânica e da eletrônica digital, 23 acarretando uma profunda reestruturação do setor ou das indústrias de bens de capital e serviços." (Coutinho, 2016, pág. 69).

A tendência tecnológica gerou impacto nos processos industriais, tornando-se objeto de melhorias e aprimoramentos dos sistemas, e cada vez mais passou a ser comum a utilização de robôs industriais na linha de produção.

Nas organizações, processos contínuos de produção passaram a ter reforço com a utilização de controladores lógicos programáveis, sensores, medidores digitais controlados, dentre outras, e ficou sendo conhecida como a terceira revolução industrial. (Ribeiro 2023, pág. 24). A Terceira Revolução Industrial, não só causou impacto nos processos industriais e empresariais, mas também mudou a relação entre as pessoas no mundo todo e fez com que a elevada produção fosse realizada em pouco tempo, em massa e com maior celeridade.

As tecnologias inseridas nas empresas, passaram a estar ao alcance da população fazendo com que a comunicação fosse imediata ao redor do mundo e a barreiras físicas que foram rompidas e fizeram com que houvesse a interligação social, econômica, política e cultural ficaram conhecidos como globalização. Está revolução trouxe consigo: telefonia móvel, a internet, desenvolvimento da biotecnologia, etc.

2.4 A QUARTA REVOLUÇÃO INDUSTRIAL – INDÚSTRIA 4.0

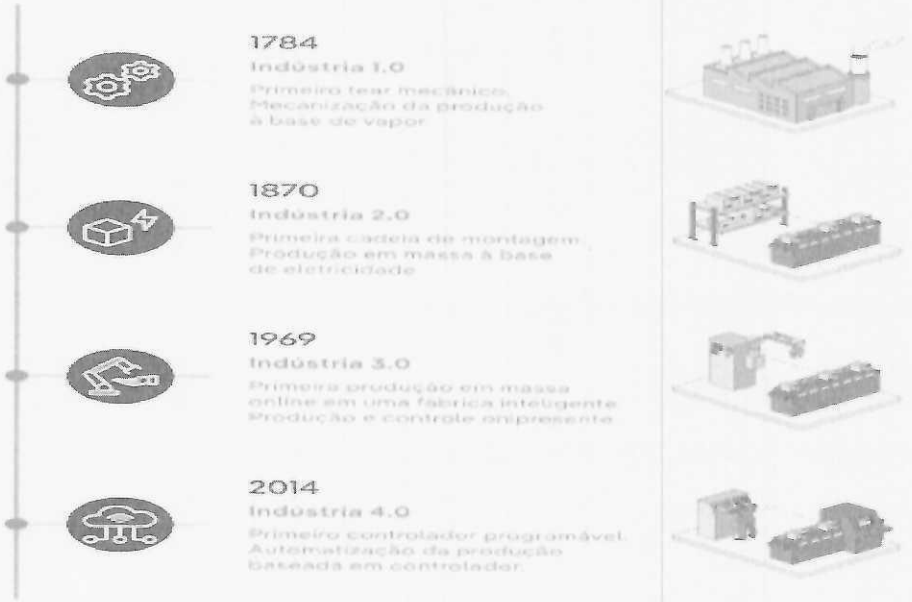
Segundo Schwab (2016), "Estamos no início de uma revolução que está mudando fundamentalmente, a forma como vivemos, trabalhamos e nos relacionamos um com o outro" (Schwab, 2016, pág.1). Trata-se da indústria 4.0, que tem alterado de forma muito significativa a cadeia de valor e o ecossistema dos negócios industriais e, nesse contexto, a forma como estão sendo fabricados os produtos que consumimos, como se estrutura a cadeia produtiva e a forma como está sendo realizada a gestão de pessoas/dos recursos humanos nas organizações.

O termo Indústria 4.0 surgiu na Alemanha, em 2011, durante a Hannover Fair, principal feira de tecnologia industrial do mundo. Na ocasião, uma nova tendência industrial foi proposta, as chamadas fábricas inteligentes. (Junior 2019, pág. 13). Almada (2018), o termo Indústria 4.0 ou a Quarta Revolução Industrial é considerado um termo relativamente novo e consiste em três partes, sendo "Indústria" com o foco principal na produção de bens, o ".0" a conexão a tecnologia e a internet, e por fim o "4", a quarta revolução industrial. Embora o conceito de Indústria 4.0 seja relativamente recente, é possível encontrar muitas publicações que abordam este tema.

De acordo com Baur e Wee (2015), para a consultoria americana McKinsey & Company, Indústria 4.0 significa a próxima fase da digitalização do setor manufatureiro, impulsionada por quatro grandes movimentos: (i) o impressionante aumento do volume de dados, da potência computacional e da conectividade; (ii) o surgimento de "analytics" e de novos recursos de inteligência de negócios; (iii) novos meios de interação entre seres humanos e máquinas, como interfaces "touch" e sistemas de realidade aumentada; e (iv) melhorias na transferência de instruções digitais para o mundo físico, como a robótica avançada e a impressão 3D. Abatiello et al. (2017), na pesquisa da Deloitte, caracteriza Indústria 4.0 como uma nova Revolução Industrial, que combina técnicas avançadas de produção e operações, com tecnologias digitais inteligentes, a fim de criar empresas digitais, que além de serem interconectadas e autônomas, possam comunicar, analisar e utilizar os dados de forma estratégica para conduzir ações bem-sucedidas no mundo físico.

Está quarta revolução ou Indústria 4.0 é marcada pelo surgimento da: robótica, analítica, inteligência artificial e tecnologias cognitivas, nanotecnologia, computação quântica, Internet das Coisas e manufatura aditiva.

Imagem 1 – As revoluções industriais ao longo da história



Fonte: Deloitte

2.5 TRANSFORMAÇÃO DIGITAL NO CONTEXTO EMPRESARIAL

A transformação digital trata-se da utilização da tecnologia por parte das empresas a fim de optimizar o seu desempenho operacional e no mercado, aumentando, assim, as chances de obter melhores resultados, mas, além disso, é a mudança de um ponto de vista estrutural que ocorre nas organizações em que coloca-se a tecnologia como um papel fundamental para o seu negócio. (SAP, 2017).

Considerando o impacto exercido pela transformação digital na sociedade, torna-se evidente a importância da implementação de programas que sustentem estes processos vinculados às mudanças oriundas da transformação. (BOHLANDER; SNELL, 2015). Ou seja, a evolução rápida da técnologia exige que as pessoas sejam defensores do aprendizado contínuo.

Nesta senda, a transformação digital passa a ser uma atribuição não somente das áreas de marketing e tecnologia, mas, principalmente de gestão nas organizações. Não obstante, a transformação precisa vir de cima, dado que grandes mudanças não demandam somente liberdade por parte de quem as estiver executando, mas também iniciativas por parte da liderança a fim de garantir a adoção e implementação das mesmas com sucesso. (SAP, 2017).

A transformação digital é parte do chamado progresso tecnológico, sendo ele formado por três fases principais: digitalização, digitização e, a mais actual, transformação digital. (SAP, 2017).

A digitalização pode ser definida como o processo em que ocorreu a transição da informação de forma analógica para a digital, isto é, informações como sinais, sons, imagens e outros sendo representados através de valores binários, onde cada valor é representado por 0 ou 1, sendo estes dados transformados em bits e seu armazenamento realizado em dispositivos eletrônicos, possibilitando, assim, guardar com a devida segurança principalmente aqueles dados considerados confidenciais. (SAP, 2017).

Já no que tange a segunda fase, conhecida como digitização, identifica-se de forma mais clara as mudanças realizadas pelas organizações de facto através da tecnologia, incluindo, até mesmo, conceitos mais recentes, como a ciência de grandes volumes de dados, Internet das coisas e moedas digitais, que comprovam que a digitalização não se trata somente de maior utilização de tecnologia da informação, mas, sim, uma visão muito mais abrangente da tecnologia como meio para de fato causar mudanças no ambiente interno e externo das organizações. (SAP, 2017).

Chegando então na fase mais actual do progresso tecnológico, a transformação digital ocorre quando as empresas atingem o que é considerado o efeito completo da digitalização. Sendo assim, pode-se dizer que a digitalização é a mudança, a digitização é o processo, e, por fim, a transformação digital é o efeito completo que se busca alcançar. (SAP, 2017).

Podemos identificar três pilares principais que conduzem as organizações nesta jornada da transformação digital e que fazem parte do seu alcance, sendo eles: experiência do cliente, processos operacionais e modelos de negócio. (SAP, 2017). A transformação digital também contribui para a globalização dos negócios, tendo em vista que, por meio da utilização da tecnologia, as empresas passam a adoptar esta cultura a fim de manter a sinergia com suas filiais e representantes espalhados por todo o mundo, ao mesmo tempo em que continuam actuando localmente com excelência e sem perder o foco. (SAP, 2017).

São beneficiados neste contexto da globalização mediante o uso da tecnologia e por meio de serviços compartilhados, por exemplo, as áreas de Recursos Humanos, financeiro, projectos e até mesmo linhas de produção. Esta comunicação por meios digitais das tarefas e responsabilidades de cada área torna-se um poderoso facilitador para o compartilhamento de conhecimento, dado que, por exemplo, a equipe de vendas consegue facilmente identificar especialistas de seus produtos e serviços, e resolvem, muitas vezes até em tempo real, possíveis dúvidas levantadas por seus clientes que influenciariam nas vendas. (SAP, 2017).

Com a transformação digital, passa-se a ter canais centralizados (e muitas vezes globais) de informações relevantes para as diferentes áreas de uma empresa, fazendo, assim, com que todos estejam alinhados, a par de mudanças e acessando tudo em fontes de informação confiáveis, constantemente actualizadas e que podem ser facilmente transformadas em relatórios a serem utilizados em tomadas de decisão. (SAP, 2017).

Diversos executivos de grandes organizações já chegaram à conclusão de que não se trata simplesmente da forma de utilizar a tecnologia, mas, sim, de fazer e conduzir os negócios. Consequentemente, se as empresas não acompanharem este ritmo e transformarem seus negócios, torna-se bastante provável que ficarão para trás em termos de competitividade. (SAP, 2017).

Logo, as empresas devem analisar suas estratégias e definir onde focarão, a fim de dar início à jornada da transformação digital em seu contexto, começando, então, a actuar em determinadas áreas e/ou processos que tenham impactos e resultados mais tangíveis, para, com isso, demonstrar os benefícios de passar a investir nesta cultura a fim de motivar o restante da organização. (SAP, 2017).

Historicamente, as empresas já utilizavam a automatização como meio para tornar seus processos mais eficientes e escaláveis, principalmente no contexto de grandes e globalizadas organizações, tomando como exemplo a utilização de Sistemas de Gestão Empresarial (ERP) para os principais processos da empresa, como controle financeiro, gestão da cadeia de fornecedores e estoques, mas não somente neste sentido, como também em contextos como o da gestão de Recursos Humanos, em que SIRHs autoatendimento estão cada vez mais difundidos nas organizações. (SAP, 2017).

Com isso, algumas empresas estão indo além da simples automatização em busca de benefícios adicionais, considerando que a automatização permite que as empresas direcionem o foco de seus funcionários para tarefas significativamente mais estratégicas, como a capacitação e desenvolvimento das habilidades de gestão e liderança, em vez de despenderem energia em tarefas meramente burocráticas, como pedidos de férias, entre outros. (SAP, 2017).

Considerando a evolução da área de Recursos Humanos e a forma como a transformação digital está definindo os novos caminhos no mundo dos negócios, é abordado abaixo um conceito ampliado de computação em nuvem, considerada uma das tecnologias parte da transformação digital.

Computação em nuvem trata-se do fornecimento de serviços de computação, tais como servidores, bancos de dados, rede, softwares, armazenamento, entre outros, disponibilizados por meio da Internet e, de modo geral, custeados em forma de assinaturas/subscrições. (SAP, 2017).

A computação em nuvem pode ser utilizada para diversos fins, como desenvolvimento de aplicativos e sistemas de informação, incluindo softwares sob demanda, hospedagem de sites e blogs, análise preditiva com base em dados e até mesmo a transmissão e armazenamento de documentos, vídeos, etc. (MICROSOFT, 2017). Conforme relato da ADP (2017), as iniciativas de transformação da área de RH que mais obtiveram sucesso em termos de tecnologia foram aquelas conduzidas por soluções de computação em nuvem.

A capacidade de armazenamento de dados e registros, a facilidade de acesso ampliada pela mobilidade, além da velocidade de inovação, facilita para a contribuição da gestão dos Recursos Humanos nos resultados financeiros da empresa, na melhor atração, retenção e gestão de talentos, além de que sua tomada de decisão baseada em dados auxilia no posicionamento da organização em termos de vantagens competitivas. (ADP, 2017). Ou seja, é necessário que gestor de recursos humanos tenha competências e habilidades para poder manusear de forma correta essas ferramentas.

David Ludlow, vice-presidente global de RH da SAP, no estudo Future of HR, afirma que, ao avançar para a computação em nuvem, o RH tem a oportunidade de simplificar e melhorar processos. (ACCENTURE, 2015). Por tanto, os sistemas de informação de Recursos Humanos baseados na nuvem contribuem de diversas formas em processos de recrutamento e serviços terceirizados (em que se reduz o tempo do registro das informações), em projetos de gestão de desempenho, além de otimizar também a precisão da folha de pagamento (baseando-se nos registros previamente realizados e que podem ser facilmente atualizados até mesmo pelo próprio funcionário em tempo real). (SPTIZER et al., 2013).

Portanto, é imprescindível que os GRH busquem constante capacitação, afim de estarem alinhados aos padrões das novas tecnologias já adoptadas por diversas empresas ao redor do mundo, afinal, a transformação digital tem provocado mudanças significativas no cenário empresarial.

2.6 COMPETÊNCIAS EXIGIDAS DOS GESTORES DE RH NO CONTEXTO 4.0

Para clarificar a temática em estudo, é necessário enquadrar devidamente os principais conceitos aqui explorados, nomeadamente o de competência. Le Deist & Winterton, (2005). Fleury & Fleury (2001), classificam a competência como o conjunto de conhecimentos, habilidades e atitudes que possibilitam um alto desempenho e acrescentam que os melhores desempenhos estão fundamentados na inteligência e personalidade das pessoas. Nesta pesquisa, apresentamos o conceito de competências como conjunto de conhecimentos, habilidades e atitudes que permitem a um indivíduo desempenhar de forma eficaz as funções de uma determinada tarefa ou situação, contribuindo para o alcance de objetivos.

Os gestores de RH possuem várias competências que se traduzem em papéis ao longo dos vários processos que exercem. Estas competências têm vindo a sofrer alterações, em virtude da digitalização, nomeadamente os processos e as ferramentas de IA, Data Mining e Big Data.

Para que os gestores de RH tenham sucesso nesta era da indústria 4.0, caracterizado pela transformação digital, automação, inteligência artificial e mudanças no comportamento organizacional é necessário um equilíbrio no desenvolvimento entre competências técnicas (hard skills), habilidades comportamentais (soft skills) e competências digitais e estratégicas. Essas competências torná-lo-ão em um elemento fundamental na transição para a Indústria 4.0, contribuindo para que a organização seja mais ágil, inovadora e centrada no ser humano, mesmo em um ambiente cada vez mais tecnológico.

De seguida, apresentamos abaixo algumas Hard Skill e Soft Skill que serão necessário para o novo perfil dos gestores de RH na industria 4.0

2.6.1 Competências Técnicas – Hard Skills

2.6.1.1 Conhecimento em tecnologias digitais

O conhecimento em tecnologias digitais é uma das principais hard skills exigidas dos gestores de Recursos Humanos no contexto da Indústria 4.0, pois essas ferramentas estão transformando profundamente a forma como as organizações gerenciam pessoas, desempenho e cultura.

As tecnologias digitais na industria 4.0 necessárias aos gestores de RH envolvem o uso de Inteligência Artificial (IA), aplicada em recrutamento inteligente, chatbots para atendimento a colaboradores e análise preditiva de desempenho; Sistemas de RH baseados em nuvem (ERP/HCM), tais como Plataformas como SAP *SuccessFactors*, Oracle HCM ou Totvs que integram folha, desempenho, benefícios e carreira; e tecnologias de colaboração remota que englobam o domínio de ferramentas como MS Teams, Zoom, Slack, Trello, ou outras que facilitam o trabalho remoto e a gestão de equipes distribuídas.

2.6.1.2 People Analytics

O *people analytics* é uma abordagem de gestão de recursos humanos que utiliza tecnologia de análise de dados para avaliar processos de RH e fornecer *insights* sobre a situação atual e previsões futuras. (DA SILVA, et.al. 2019). Mike West (2020) conceitua *People analytics* como sendo a aplicação de dados e análises para tomar decisões gerenciais no que diz respeito aos colaboradores, combinando estatística, ciência comportamental, tecnologia e estratégia de pessoas para ajudar as organizações a gerenciar seus funcionários de forma eficaz.

A estratégia de pessoas envolve a tomada de decisões conscientes sobre como gerenciar e motivar uma equipe. Os autores De Souza Moraes e Damian (2021) elucidam que o *People Analytics* requer e oferece aprendizado constante e visão de futuro para criar estratégias baseadas em dados que podem apoiar projetos estratégicos de recursos humanos, maximizando aspectos como recursos financeiros e tempo. Ressalta-se ainda que o *people analytics* pode ser usado para analisar dados de recursos humanos de diferentes maneiras.

Desse modo, salienta-se que o objetivo da análise de pessoas é usar dados para melhorar o desempenho organizacional e a tomada de decisões relacionadas à gestão de pessoas. Essa análise se mostra como uma ferramenta útil na averiguação do comportamento e no desenvolvimento de estratégias que permitirão melhorias no contexto laboral dos colaboradores, chegando a torná-los mais felizes e produtivos à medida que certas estratégias são implementadas (FRANCISCO; SILVA; MARTINEZ, 2019).

Assim, conclui-se que o desenvolvimento de hard skills para o gestor de RH na industria 4.0 é de capital importância porque melhora a eficiência dos processos de RH (recrutamento, onboarding, treinamento, avaliação); reduz erros humanos e retrabalho com uso de automações; fortalece a tomada de decisão baseada em dados; aumenta a competitividade organizacional ao alinhar o capital humano com as exigências tecnológicas do mercado e facilita a gestão de equipes híbridas ou totalmente remotas, uma realidade pós-pandemia da Covid-19.

2.6.2 Habilidades Comportamentais – Soft Skills

O termo soft skill, ou habilidade comportamental, como será tratado neste trabalho, por si só traz consigo uma imprecisão conceitual sobre quais são as habilidades contempladas em seu escopo. Por sé tratarem de habilidades de difícil mensuração, em oposíção às hard skills, há autores que afirmam que a definição destas habilidades não são claras, o que torna a questão bastante desafiadora e abre um amplo espaço para pesquisas e debates (PENHAKI, 2019).

Nesta época da Indústria 4.0 — marcado por automação, inteligência artificial, big data e transformações digitais — os gestores de Recursos Humanos precisam de um conjunto de soft skills actualizadas para liderar equipes com eficácia, promover inovação e garantir a adaptação organizacional. Dentre as inúmeras habilidades comportamentais necessárias aos gestores de RH no contexto 4.0, podemos destacar as seguintes:

- Comunicação eficaz
- Inteligência Emocional;
- Trabalho em equipe

2.6.2.1 Comunicação eficaz

Segundo Asiltürk (2019, p. 173), no ambiente de Indústria 4.0, onde as interações homem-máquina são observadas em harmonia com as interações humanas, a habilidade de Comunicação é um requisito mínimo para que pessoas tenham capacidade de colaborar e estabelecer laços sociais com outros colegas e seus times, no contexto de relação "homem-homem".

Ainda de acordo com Krason et al. (2018), a comunicação eficaz é, "entre outras, a capacidade de convencer, motivar os outros, explicar decisões difíceis e impopulares", e está entre elementos de muita importância para o trabalhador do contexto da Indústria 4.0, junto de atitude, julgamento de valores e respeito ao próximo.

A comunicação eficaz engloba também a habilidades de comunicação digital, que pode ser compreendida como a capacidade de se comunicar eficazmente por meio de e-mails, mensagens instantâneas e videoconferências, bem como a habilidade de redigir anúncios de emprego atraentes e criar conteúdo para mídias sociais.

No contexto 4.0 a comunicação eficaz envolve:

- Comunicação geral;
- Dar e receber Feedback;
- Escuta ativa;
- Habilidades de linguagem;
- Saber se comunicar de forma clara e empática com equipes diversas e multiculturais.

2.6.2.2 Inteligência Emocional

A inteligência emocional é definida segundo Mayer, Salovey e Caruso como: "a capacidade de raciocinar sobre as emoções e das emoções para aprimorar o pensamento". Os autores também comentam que essa soft skill necessita de um conhecimento a respeito das próprias emoções para que ela seja efetiva: "Inclui habilidades para perceber emoções com precisão, para acessar e gerar emoções de forma a auxiliar o pensamento, para compreender as emoções e o conhecimento emocional e para regular reflexivamente as emoções de modo a promover o desenvolvimento emocional e crescimento intelectual" (apud MAYER, SALOVEY, 1997).

No contexto 4.0, ela é bastante importante para o gestor de Recursos Humanos, pois ela permite lidar com os desafios humanos em um ambiente cada vez mais digital, dinâmico e imprevisível. A inteligencia emicional envolve:

- Atitude pessoal;
- Gerenciamento de estresse da equipe durante transições digitais;
- Motivar os colaboradores mesmo diante de incertezas;
- Promover segurança psicológica, essencial para adaptação.

2.6.2.3 Trabalho em equipa

O trabalho em equipe pode ser definido tanto como a eficácia do grupo (Carnevale et al., 1988) como a capacidade de auxiliar os colegas de equipe a atingir as metas e objetivos (DEST et al., 2002; ETA, 2016). Ela é uma soft skill considerada uma necessária para as organizações e para o gestor de RH especialmente na industria 4.0 (Crebert et al., 2004; Robles, 2012).

No contexto 4.0, nenhuma pessoa domina todas as habilidades necessárias (como dados, tecnologia, soft skills). Neste quesito os gestores de RH precisam facilitar essa cultura de colaboração, dando suporte à formação de equipes eficazes e bem alinhadas e valorizar e organizar equipes com habilidades complementares, promovendo sinergia e aprendizado coletivo.

O trabalho em equipa envolve também:

- Profissionalismo Coletivo;
- Colaboração mutua;
- Envolvimento total no processo de trabalho

Nesta era da digitalização podemos ainda destacar outras soft skill cruciais ao Gestor de RH tais como:

- **Competências Sociais e de Networking**;
- **Criatividade e Inovação**;
- **O Gerenciamento de Tempo e a Organização**.

Dessa forma, a capacidade de adaptação à mudança é fundamental, já que as tecnologias e as melhores práticas de recrutamento estão em constante evolução.

2- MÉTODO

Optou-se pela análise qualitativa, com particular realce a análise bibliográfica e documental permitindo a recolha de dados em diversos documentos e obras escritas, dissertações, artigos científicos sobre as a transformação digital e o perfil do novo profissional de RH. A metodologia, visa a descrição precisa do problema, dos métodos, das técnicas, dos instrumentos de pesquisa, dos materiais e dos equipamentos utilizados no trabalho (SARMENTO, M. 2013). Como podemos definir também metodologia como técnicas e procedimentos, visam a definir ou alcançar a finalidade de um certo estudo.

Ainda assim, (OLIVEIRA, E. R., & Ferreira, P. 2014) definem os métodos de pesquisa são definidos como sendo um agrupamento de procedimentos lógicos da investigação, envolvendo a selecção de técnicas de recolha e tratamento da informação adequadas, bem como o controlo da sua utilização. Tendo em conta os objectivos que pretendemos alcançar selecionamos a seguinte técnica:

Análise documental – que se baseia na análise de documentos ou históricos de todo género, desde que contenham informação, actual ou passada, sobre acontecimentos relevantes para a investigação. As fontes de informação que alimentaram a nossa pesquisa foram:

1 – Literatura científica sobre os temas ligados com o objecto do estudo;

2 – Artigos;

3 – Dissertações.

3 – CONSIDERAÇÕES FINAIS

Não restam dúvidas de que estamos atualmente a viver uma transformação radical da indústria, por via da implementação de tecnologias digitais com o objetivo de aprimorar a eficiência e potenciar a produtividade.

Dizer que, quanto ao problema levantado sobre como a transformação digital tem impactado o perfil do novo profissional do RH, foi confirmado em função das informações coletadas. Outrossim Quanto aos objectivos Geral e específicos foram também confirmados pois, quanto ao geral foi possível investigar as novas competências exigidas dos gestores de recursos humanos no contexto 4. 0. E os específicos que visou Identificar os desafios da organização no contexto 4.0 na GRH, compreender o papel da inovação tecnológica na construção de um novo modelo de actuação para profissionais de RH, Descrever as diferentes habilidades e competências que os gestores precisam desenvolver para actuar num contexto de mudanças e transformações digitais.

De um modo geral, a tranformação digital tem reformulado significativamente o papel dos profissionais de RH, exigindo um perfil mais estratégico, exigindo maiores competências sobre tudo na actual revolução da industria 4.0 e neste contexto actual o profissional de RH assume uma função central na promoção da inovação, na gestão de mudança organizacional e na construção alinhada aos desafios actuais, consolidando-se assim como um agente essencial na sustentabilidade e competitividade das organizações, de salientar que os profissionais, por mais que tenham conhecimento sobre a indústria 4.0, precisam de atualizações constantes de suas competências e também nas habilidades comportamentais.

REFERÊNCIAS BIBLIOGRÁFICAS

Almeida, L. (2023). Recruitment and selection of people in the digital age. Rio de Janeiro. Trabalho de Conclusão de Curso. Pontifícia Universidade Católica do Rio de Janeiro.

ASILTÜRK, A. Several Dimensions of Innovation, Technology and Industry 4.0. The Effects of Industry 4.0 Revolution on Several Areas. Berlim: editora Peter Lang, 2019.

CIMATTI, Barbara. Definition, development, assessment of soft skills and their role for the quality of organizations and enterprises. International Journal for Quality Research, Podgorica, 2016. Disponível em: http://ijqr.net/journal/v10-n1/5.pdf. Acesso em 04 de julho de 2021.

JONES, Katherine. HR digital transformation: how SAP leveraged design thinking and its own launch methodology to drive change globally. [S.l.], 2016. Disponível em: . Acesso em: 16 abr. 2018.

KRASON, P.; MACZEWSKA, A.; POLAK-SOPINSKA, A. Human Factor in Maintenance Management. Advances in Intelligent Systems and Computing, 2018. Disponível em: https://link.springer.com/chapter/10.1007/978-3-319-94196-7_5. Acesso em 30 de novembro de 2022.

Marconi, M. A,, & Lakatos, E. M. (2017). Fundamentos de metodologia científica (8ª ed.). São Paulo: Atlas.

PENHAKI, J. R. SOFT SKILLS NA INDÚSTRIA 4.0. Universidade Tecnológica Federal Do Paraná, 2019. Disponível em: http://repositorio.utfpr.edu.br/jspui/bitstream/1/4275/1/CT_PPGTE_M_Penhaki%2c%20Juliana%20de%20Rezende_2019.pdf. Acesso em 07 de novembro de 2022.

PWC. Indústria 4.0: digitação como vantagem competitiva no Brasil. [S.l.], 2016. Disponível em: . Acesso em: 29 maio 2018.

SAP. Design thinking and digital transformation: use SAP's proven design thinking approach to drive your digital transformation journey. [S.l.], 2016. Disponível em: . Acesso em 18 mar. 2018.

SAP. Leading with purpose: insights on SAP's digital HR transformation. [S.l.], 2018. Disponível em: Acesso em: 22 fev. 2018.

SOFTTEK. SAP SuccessFactors. Monterrey, 2017. Disponível em: . Acesso em: 8 nov. 2017.