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

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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.

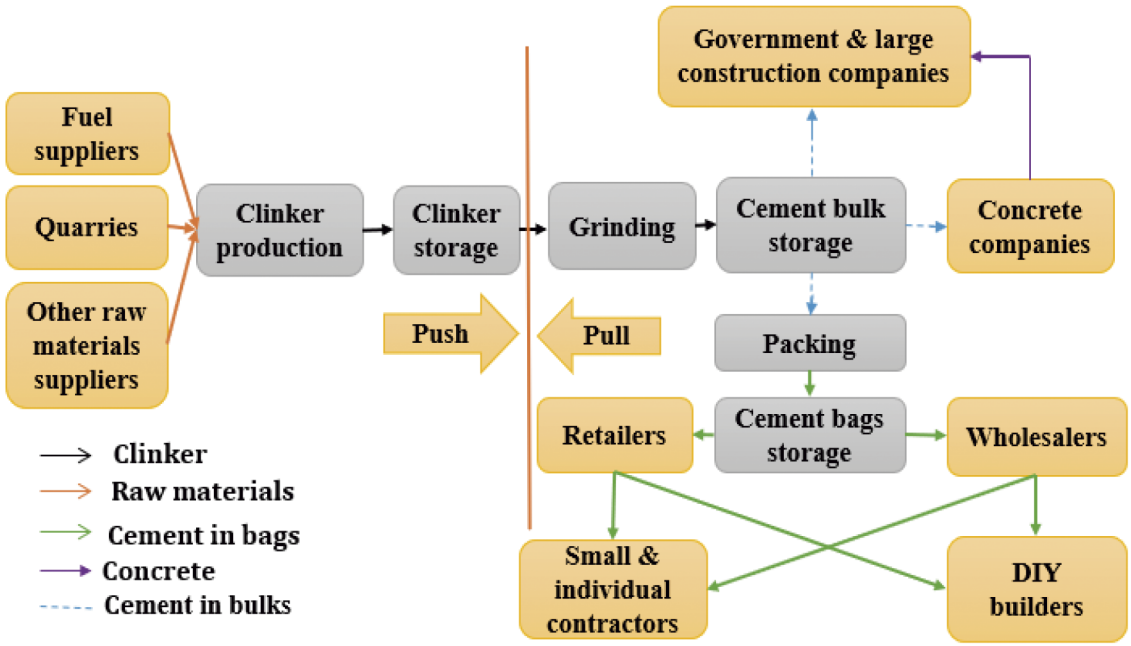

Figure 3. Build-to-Stock model (Agudelo, 2009)

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.

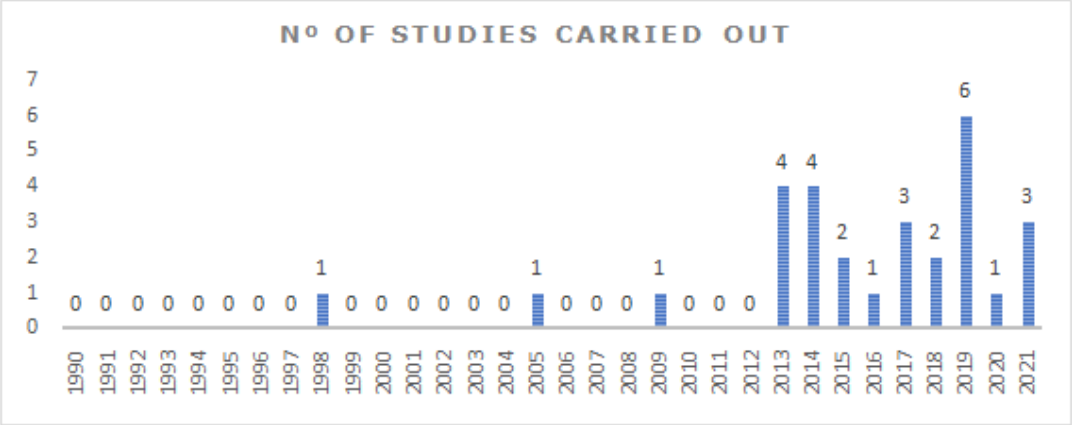

Figure 4. Research on the supply chain of the cement industry between 1990 and 2021

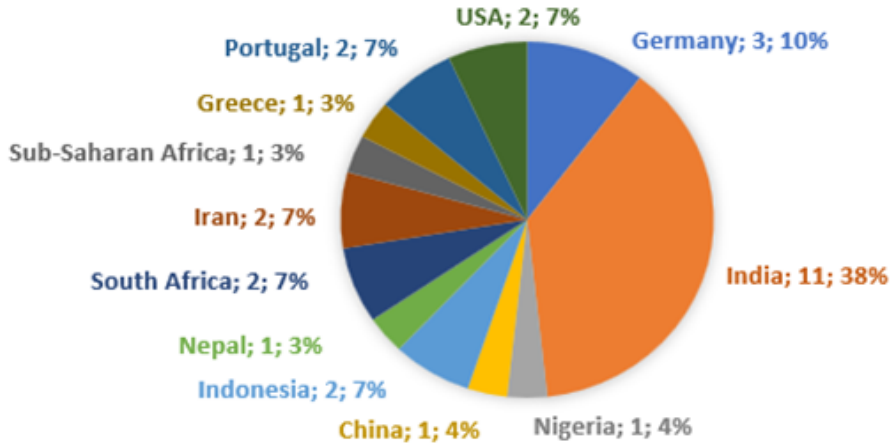

Figure 5. Articles on strategic supply chain management in the cement industry

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_5].

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_5].

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_9].

> *"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).

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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?