

UNIVERSIDAD ESAN



**Improvement of cargo consolidation in the export logistics process of
a zinc refinery: The Nexa Resources Cajamarquilla Case Study**

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Montpellier Business School – Montpellier, France

Advisor: Linda Hollebeek

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of Maestro en Administración by:**

Enrique Antonio GARCIA MONCADA

Programa de Maestría en Administración a Tiempo Parcial 61

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Esta tesis

**Improvement of cargo consolidation in the export logistics process of
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ha sido aprobada.

.....
Jorge Guillén Uyen (Jurado)

Universidad ESAN

2019

DEDICATORIA

A Dios, por su infinita misericordia e inmensurable amor.
A mi madre, que desde el cielo guía mis pasos todos los días
de mi vida y a quien dedico cada objetivo que logro.
A mi padre y hermanos por su gran amor y apoyo incondicional.

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ENRIQUE ANTONIO GARCIA MONCADA

Profesional titulado en Ingeniería Industrial con estudios en Maestría en Administración de Negocios (MBA) en Perú, con doble grado internacional en Francia. Con más de 7 años de experiencia liderando la gestión integral de proyectos de mejora y optimización de procesos bajo las metodologías six sigma y gestión de proyectos (PMI), contribuyendo a la reducción de costos, uso eficiente de recursos y excelencia operacional en empresas de los sectores de minería y seguros. Gestión fundamentada en liderazgo efectivo y trabajo en equipo. Certificado como Six Sigma Green Belt. Con nivel avanzando del idioma inglés.

EXPERIENCIA PROFESIONAL

NEXA RESOURCES

Marzo 2013 – Julio 2018

Empresa del rubro minero con una producción de 335,000 T de zinc refinado y ventas de US\$ 800MM.

Ingeniero Senior de Planeamiento y Gestión

- Líder de la gestión integral de proyectos de mejora continua y rediseño de procesos logísticos y productivos basados en las metodologías PMI y Six Sigma: evaluación de las necesidades, definición del alcance de la mejora, análisis del proceso AS-IS, diseño del proceso TO-BE, evaluación de factibilidad económica y elaboración de indicadores meta.
- Supervisión del avance de la cartera de proyectos de mejora, elaboración y presentación de reportes gerenciales de los resultados: avance del cronograma, control del presupuesto, cumplimiento de KPIs de gestión y monitoreo de los riesgos asociados.
- Responsable de la implementación del Programa de Gestión Corporativo: mapeo de procesos y subprocesos, definición y control de KPIs de gestión, control de costos fijos, la gestión de reclamo de clientes internos y/o externos y documentación de los procesos.
- Identificar oportunidades innovadoras de mejora de procesos mediante la adopción de tecnologías con el objetivo de automatizar procesos operacionales y administrativos.
- Asesorar a las Gerencias sobre las metodologías y herramientas de mejora a implementar con énfasis en incrementar los índices de productividad y lograr ahorro en costos.
- Fomentar la participación de los colaboradores dentro de la cultura corporativa de mejora continua: capacitaciones y formación de equipos de mejora en todas las áreas.
- Líder de las auditorías internas en las normas ISO 9001, ISO 14001 y OHSAS 18001, asegurando el control y mantenimiento del Sistema de Gestión de Calidad (SGC)

Logros:

- Ahorro de US\$ 800M anual e incremento de productividad del 60%, a través de la reducción de productos no conformes en la producción de zinc refinado (2015 - 2016)
- Proyecto de certificación Operador Económico Autorizado (OEA), obteniendo ahorros anuales de US\$ 200M en costos logísticos de exportación. Además, se redujo en 40% el lead time de transporte del producto terminado hacia el cliente final (2017 - 2018).
- Implementación de código de barras para la identificación y trazabilidad del producto terminado, generando una reducción de tiempo del 70% en las actividades de almacenamiento y distribución, mediante la automatización de tareas manuales (2018).

PACIFICO SEGUROS

Enero 2011 – Marzo 2013

Empresa peruana perteneciente al grupo Credicorp del rubro seguros con ventas de US\$ 50MM.

Analista de Procesos y Mejora Continua

- Participé activamente en la gestión de proyectos de mejora de los procesos CORE del negocio, en el análisis funcional de los requerimientos de las áreas internas, diagnóstico de procesos AS-IS y TO-BE, implementación de KPIs de gestión del proceso y elaboración de reportes gerenciales sobre el avance de los proyectos de mejora.
- Análisis, mapeo, rediseño y documentación de los procesos de negocio de acuerdo con el programa corporativo de mejora continua, de acuerdo a la norma ISO 9001.
- Recolectar, procesar y analizar información para la ejecución de proyectos de mejora.
- Capacitación a los usuarios sobre la modificación de los procesos impactados.
- Responsable de la elaboración de procedimientos de Inicio, Planificación, Ejecución, Seguimiento y Control y Cierre del Proyecto
- Diseñé e implementé tableros de control automatizados para el seguimiento del avance de los proyectos y de los planes de acción corporativos, informando y exponiendo semanalmente a las gerencias los desvíos encontrados.

Logros:

- Reducción de tiempo de facturación de pólizas de seguros en 80% de 20 a 4 días, mediante la automatización de actividades manuales y eliminación de tareas innecesarias.
- Incremento del 60% en la atención de llamadas en el área comercial, detectando y eliminando tiempos muertos en el proceso.

FORMACIÓN PROFESIONAL

MONTPELLIER BUSINESS SCHOOL 2018-2019
Doble grado – Maestría con especialización en Negocios Internacionales.

ESAN GRADUATE SCHOOL OF BUSINESS 2016-2017
Maestría en Administración de Negocios - MBA

UNIVERSIDAD NACIONAL DE INGENIERIA 2005-2010
Titulado en Ingeniería Industrial

OTROS ESTUDIOS

PM CERTIFICA: *Curso de Gestión de Proyectos* 2016

UNIVERSIDAD ESAN: *Curso de Administración y Organización* 2013

UNIVERSIDAD ESAN: *Curso de Análisis Estratégico Empresarial* 2013

UNIVERSIDAD ESAN: *Curso de Gestión de Compras y Abastecimiento* 2013

IDIOMAS

Inglés a nivel avanzado: TOEIC (815), IELTS (6.5)

Francés a nivel avanzado: DELF B2

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EXECUTIVE SUMMARY

Over the last few years, there has been a notable increase in the literature concerning the different concepts and activities related to Supply Chain Management (SCM). Moreover, it is widely known that the influence of supply chain in terms of performance and competitiveness plays a crucial role in the corporative world, taking into account the network of relationships between a firm with its suppliers, intermediaries, third-party providers and customers in order to increase adding value, maximize efficiency, reduce operational costs and improve customer satisfaction.

Therefore, the goal of this research is to contribute to fill the gap in literature regarding third-party logistics providers, freight transportation and container port terminals in terms of cargo consolidation process at Nexa Resources Cajamarquilla, which is the most important zinc producer in Latin American market.

The cargo consolidation process implies the transportation of final products to the external warehouse by wagons, containers filling activities in external warehouse and the transportation of filled containers to port terminals according the final destination.

Qualitative data were collected during semi-structured interviews with managers and professionals from different fields with a high level of experience and background, since a process improvement involves knowing the impact in terms of manufacturing, sales, finance, corporate management and supply chain activities within the company.

In terms of content analysis, time and cost, management of shipments and benefits of a new alternative were defined as the three main categories in this research since APM Terminals can provide Nexa Resources with benefits intended to cargo consolidation process, ensuring not only the possibility to reduce logistics

costs and transportation time, but also the improvement of management of shipment process of the firm avoiding the use of an external warehouse.

The findings of this research suggest that choosing a new strategy for cargo consolidation process, which means using LICSA and APM Terminals at the same time will provide the firm with the opportunity to have a significant impact on saving costs, improving process quality and increasing market share; taking into consideration the decision of avoiding a dependence on an exclusive warehouse.

Last but not least, the findings also show that the implementation could be considered as a crucial alternative intended to obtain the best corporative results. That is why, keeping focus on continuous improvement and operational strategies represents one of the best decisions that a supply chain firm can take in order to improve its operational efficiency and to increase its standards to international level.

Key words: supply chain management, cargo consolidation, consolidation center, export logistics process, external warehouse, port terminal.

CHAPTER I. INTRODUCTION

Nowadays, it is widely known that plenty of companies worldwide not only have put their efforts on reducing logistics costs, but also, they have defined goals such as reducing storage, distribution costs and delivery times. As a result, their priority is focusing on customer satisfaction thanks to an integrated supply chain process. According to Kafetzidakis and Mihiotis (2015), the concept of supply chain management has become a critical part of the business environment since the dynamics of the global marketplace have changed dramatically in terms of customized products with squeezed lead-time. In addition, the fact of linking the supply chain to the business strategy is one of the most critical issues that can lead the company to increase its competitiveness.

Furthermore, it is important to mention that many measures have been taken by certain companies in order to face logistic over cost such as the implementation of new distribution logistics centers, load consolidation centers and outsourcing of logistics operations. Thanks to the implementation of these ideas, companies are gaining relevant competitive advantages within the market in which they develop their activities.

Likewise, according to a study of Ulku (2012), businesses should strive to become smarter in their use of resources in their operations by any means possible, as customers are demanding more in terms of quality. This is the case of Nexa Resources Cajamarquilla, which is the most important zinc producer in Latin American market with an annual refined zinc production of 312,600 tons in 2017¹; working together with its clients towards better technical and cost-effective solutions in order to accomplish new and consolidated projects (See Appendix 02).

Moreover, the main activity of Supply Chain department of the firm is getting an essential cost reduction caused by the movement of finished product

¹ <http://www.rumbominero.com/noticias/mineria/nexa-resources-planea-iniciar-reconversion-de-refineria-de-cajamarquilla/>

(refined zinc) to a consolidation center (external warehouse) for the filling of containers and afterwards the transfer to a port terminal in order to ship it to the different markets worldwide. In order to do that, Nexa Resources Cajamarquilla has an external warehouse called LICSA (Logística Integral Callao in Spanish) which is located at a distance of 422km and where consolidation of zinc cargo and shipping management take place (See Appendix 03).

Regarding to LICSA services, they include the activities of unloading the material that arrives by train, its temporary storage in a defined area, the collection of empty containers, control of stock of the material, filling of containers, sealing and the mobilization of the containers from the warehouse towards the port for the respective shipment.

1.1. Gap in the literature review

It is widely known that the effective manner of managing resources within supply chain of a firm represents a crucial chance to improve its competitiveness in the supply chain field and it is vital to consider the importance of developing adding-value activities and a trust relationship with supply chain players. However, several authors, and particularly Goodale, Kuratko and Hornsby (2011) consider that organizations need to take high risks in supply chain management activities during innovation process since firms have to deal with the fact of ensuring a good performance of some factors such as people, tools, methods and resources.

Many concepts are often found in the literature such as supply chain management, third-party logistics providers, freight transportation and container port terminals that have been defined and explored separately. By extension, it is necessary to acknowledge the impact of supply chain in terms of performance and competitiveness because of the intensity of commitment of all supply chain players in processes such as planning, procurement, manufacturing, distribution and customer relationship management in order to achieve companies' goals.

Likewise, authors such as Zhu, Lean and Ying (2002) highlighted third-party logistics concept which represents one of the most acceptable way that a firm uses

another company expertise in order to move products from suppliers to manufacturers, and products from manufacturers to distributors. It is not rocket science that this decision can represent a critical advantage for all the parties involved in the supply chain of the firm in order to response to the final customers' requirements with high quality standards.

Additionally, in terms of ensure a specialized supply chain in export process, several authors, and particularly Lieb, Millen and Wassenhove (1993) explained the role of container port terminal becomes crucial when it comes down to handle containers in cargo consolidation process. Indeed, the fact that port terminals use adding-value cargo activities, extensive infrastructure and automated equipment is considered as a competitive advantage for supply chain firms.

1.2. Research Questions

This study is going to focus on the case of Nexa Resources Cajamarquilla taking into account its corporative goals of reducing operational costs² and improving performance in the cargo consolidation process of refined zinc such as transportation of final products to the external warehouse by wagons, containers filling activities in external warehouse and the transportation of filled containers to port terminals according the final destination. Therefore, this master thesis aims to answer the following **Research Question (RQ)**:

How does Nexa Resources Cajamarquilla improve its organizational performance in cargo consolidation process of refined zinc?

At this point, the problematic issue may decline into some other research questions:

² <http://minerandina.com/es/cajamarquilla-aumentara-a-97-recuperacion-de-zinc/>

- **RQ1:** How does the firm reduce its logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?
- **RQ2:** How does the firm improve its performance in management of shipments when it comes down to the export process of refined zinc?
- **RQ3:** What are the benefits for the firm regarding to the optimization of its cargo consolidation process?

Such a pattern of organizational performance improvement is addressed to supply chain managers worldwide, who need to integrate an effective and innovative development in the export activities of the organization they work for. In fact, projects of improvement in logistics activities are increasing and becoming more and more applicable for corporations around the world.

Thus, supply chain managers worldwide seeking inspiration for innovative logistics practices when it comes down to export process can dig into the different concepts analyzed in this research.

1.3. Research Objectives

Now, it is important to acknowledge the main objectives to study, according to the defined RQs:

- **OB1:** Find a new option of consolidation center at Nexa Resources Cajamarquilla in order to ensure a reduction of logistics costs and transportation time.
- **OB2:** Make sure that the new consolidation center may improve the management of shipments performance in terms of export logistics process at Nexa Resources Cajamarquilla.

- **OB3:** Describe the major benefits for the firm through the implementation of the new consolidation center.

1.4. Thesis Overview

Now, this thesis is composed by six chapters and their main concepts are described below:

- Chapter 1 includes an Overview of the thesis, where the topic is outlined, the gap in literature and the research questions of this paper.
- Chapter 2 shows the Literature Review which complies description and the theoretical basis related to distribution logistics, the importance of logistics operators as well as the concept of export logistics. Likewise, it includes a description of the company and its main activities and cargo consolidation in port terminals.
- In Chapter 3, there is an explanation the kind of methodology for this study, the justification of the epistemological choice, description of the way of collecting data and process that collected data.
- Chapter 4 describes the main results of our study and an acceptable interpretation of these results in order to select the best alternative for cargo consolidation process.
- In Chapter 5, the contribution of this study in terms of theoretical and managerial level are presented. Next, it also includes limitations intended to this thesis.
- Finally, in Chapter 6, summarizes conclusions related to this research.

This thesis is structured according to the following figure 1:

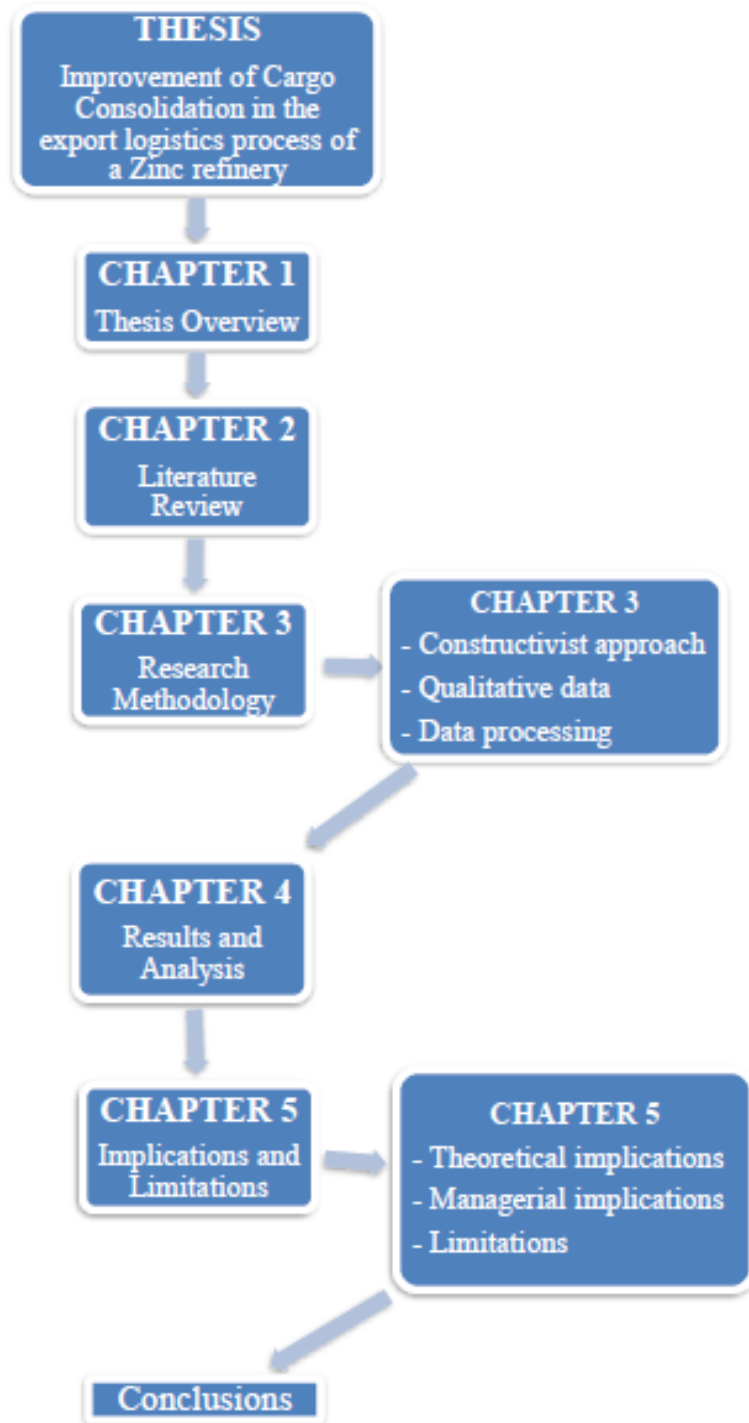


Figure 1. Outline of chapters of the thesis

CHAPTER 2. LITERATURE REVIEW

2.1. Supply Chain Management (SCM)

2.1.1. Definition

Research on supply chain management has increased over the last 10 years, as the matter of logistics activities improving in organizations became a key concern for companies when it comes down to produce and distribute a specific product to the customer. It is widely known that there are many definitions and points of view regarding supply chain management. In fact, as some might consider it as a network of relationships between a firm and its suppliers in order to facilitate the forward and reverse flow of products and services (Stock and Boyer, 2009); others view it as a coordination and collaboration with suppliers, intermediaries, third-party providers and customers with the benefits of adding value, maximizing efficiencies, reducing operational costs and achieving customer satisfaction (Institute for Supply Management, 2010).

Admittedly, integration, coordination and collaboration are tools that a firm must implement and develop throughout its supply chain, mainly regarding the external operations of suppliers and customers.

Moreover, Friemann and Verhasselt (2013) explain that one most critical factors of success for a firm is the supply chain management, since this is a concept that includes other key topics such as increasing competition, globalization, greater product variety, outsourcing, shorter product life cycles and continuous advances in technology. All these topics might be linked in an effective supply chain in order to ensure a continuous flow for balancing supply and demand.

Furthermore, supply chain management's research focus on many concepts such as activities, participants and benefits, although these researches could vary in complexity and length. In essence, supply chain management is considered as "a kind of management that plans, implements, and controls the efficient, effective

forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements in a timely, safe and cost-efficient manner.” (The Council of Supply Chain Management, 2012).

2.1.2. Objectives of SCM

Li et al. (2006) outline the decision of acquire the necessary resources in order to provide the specific level of service to a customer segment. The findings of the study highlight that the implementation of practices such as reducing inventory levels, synchronizing the customers' requirements of final goods from suppliers and increasing customer service are considered as key objectives of SCM within a firm. In 1998, Christopher emphasized the idea of the SCM allow manufacturing companies to achieve financial and an adding-value advantage because of implementing innovative, technological and high-quality products.

It is not rocket science that as much as a SCM becomes stronger in terms of production performance and product quality, it can lead to enhance competitive advantage, improve organizational performance and offer superior performance to enterprises. Also, enterprises will obtain higher profits results and enable them to be market leaders thanks to an effective implementation of SCM where there will be important improvements intended to product quality, operating costs, inventory levels and on-time deliveries.

In their study, Hogan and Armstrong (2001) explain how SCM can influence positively and successfully a variety of decisions and operations for companies. Indeed, the improvement of quality products and delivery service are supported by innovative projects, new technologies and reduction in lead time. Also, this study takes into account the choice of building new relationship and working closely with suppliers in order to integrate operational decisions when it comes down to the success of the products as well as quality information exchange.

Besides, according to Carr and Kaynak (2008), organizations agree that implementing SCM can bring better results in building trust relationship with suppliers where communication, mutual support and information sharing about logistics activities, customers and markets, inventory levels and product availability play a crucial role in business objectives. These trust relationship, as well as the quality information exchange among supply chain members, allow a firm to accomplish long-term benefits, integrate suppliers in supply chain process and a faster time-to-market when it comes down to operational activities.

2.1.3. The seven dimensions of SCM

In 1997, Anderson, Britt and Favre define the dimensions that the supply chain management implies taking into account former experience of managers when it comes down to improve both customer satisfaction and profitability. Likewise, seven different dimensions are considered within organizations:

- **Segment customers**, which has to be intended to specific groups' needs in order to modify the current supply chain to accomplish customers satisfaction. This will enable managers to step forward in terms of competitiveness.
- **Customize the logistics network**, according to customers' requirements, so it may increase profitability level of a company. It is no wonder that this might help a firm to attract and retain its customers.
- **Organize demand planning across the supply chain**, which takes into account markets' behaviors and an effective resource allocation for the firm.
- **Differentiate product**, which is the successful process of creating state-of-art products in order to be closer to customers. Indeed, managers need to ensure a quick conversion across the firm's supply chain.

- During the process of supply chain management, managers should be ready to reduce the total cost of materials and services thanks to a strong **bargaining power with suppliers**.
- Create a **supply chain-wide technology strategy**, which will enable managers to take better decisions when it comes down to products, services and information.
- When managers are seeking for reaching the customers effectively and efficiently, it is necessary to **develop channel performance measures**. Thus, it will provide a competitive advantage in terms of cost and price.

2.1.4. The process of SCM

In their research, Croxton, García-Dastugue and Lambert (2001) highlight the correlation among all supply chain processes and its benefits. It is important to acknowledge that multiple players within supply chain processes have to be involved in order to make them work. Additionally, understanding their roles would be a key factor for supply chain players to develop powerful strategies and to build a good relationship with their teammates. That is why, many companies worldwide focus on the importance of process integration in supply chain management when it comes down to achieve a necessary integration between supply chain members (Monczka and Morgan, 1997). Then, SCM players can implement the following processes:

- **Planning**, which allows to develop long-term and short-term supply chain strategies according to seasonality and changes of the prediction of customer demand. Supply chain managers have to take into account the capacity and flexibility along the supply chain network.
- **Procurement**, which is considered the buy process intended to the purchase of raw materials, components and good. Indeed, it is very important to identify key suppliers for the firm in terms of some important criteria such as

performance, capabilities, growth and profitability. The way of building a strong relationship with suppliers plays a crucial role in this process.

- **Manufacturing**, which is a process intended to make finished goods in order to deliver them to the final customers at the right time, right place and the right cost. In fact, it is necessary that all supply chain managers would be willing to provide an effective support in terms of materials' availability.
- **Distribution**, which involves the logistical flow of necessary goods and services from the producers to the final consumers across the supply chain, where transportation companies and third party logistics companies play a key role in order to ensure an adequate delivery of the products toward the point of requirement.
- **Customer relationship management**, which is a critical process of identifying key group of customers to be targeted in terms of companies' goals; that is why, supply chain managers may seek for improving processes and eliminating demand variability in order to satisfy customers' needs and to ensure the organization's success in the long-term.

2.1.5. The influence of SCM on firm performance

According to Vickery et al. (2003), due to the impact of an integrated supply chain management, a company may show positive and direct relationships when it comes down to customer service and financial performance. In order to accomplish that, firms are able to develop business competences and create adding-value activities, taking into consideration a closed relationship and collaboration with some key players of the supply chain such as suppliers and stakeholders, and that is how, developing alliances with them, organizations can manage effectively their operations in terms of manufacturing and distribution process.

Besides, it is important to ensure collaboration between partners since it allows a firm to improve its adding-value provided to its consumers, taking into

account costs and time requirements (Cao and Zhang, 2011). Thus, Pohle and Chapman (2006) argue how important is for a company the decision of choosing strategic partners who are often suppliers and customers with long-term relationships with the firm, in order to accomplish its innovative activities.

Furthermore, Tracey et al. (2004) outline several benefits intended to business performance for firms to develop a strong SCM: customer value, risk reduction, customer loyalty and responsiveness to customer. It is important to recognize the importance of managing resources in an accurate and effective manner, since it provides firms with the opportunity to increase their competitive advantage, organizational performance and their market share in the supply chain network.

It is not rocket science that innovation is considered as a key factor when it comes down to firm performance and competitiveness (Panayides and Venus, 2010) where it is necessary to build integrated relationships with partners such as customers, suppliers and distributors.

As a result, the success of a company in terms of innovation depends on the commitment and the degree of involvement from its partners related to accomplishment of companies' goals. Supply chain managers have to show commitment and support in terms of implementing innovation projects in a firm even if it implies taking high risks in SCM activities (Goodale, Kuratko and Hornsby, 2011).

Therefore, a well-managed commitment to quality management and an understanding of supply chain changes are not only correlated in terms of operational activities, but also considered by plenty of companies worldwide as part of their operations strategy in order to enhance their performance and increase customer satisfaction levels (Kannan and Tan, 2005). Likewise, current businesses have to seek innovative organizational processes along their supply chain rather than competing for new consumers, so they could respond customer requirements in an efficient way when it comes down to quality, time and cost.

2.2. Third-party logistics

2.2.1. Definition

According to Zhu, Lean and Ying (2002), third-party logistics refers to the decision of a firm in terms of externalizing logistics activities that were previously performed within the firm's operations. Indeed, the third party companies must link in a perfect way with the selected logistics activities; that is why, they are in charge of facilitating the movement of products from suppliers to manufacturers, and products from manufacturers to distributors.

In their research, Coyle, Bardi and Langley (2003) argue that third-party logistics implies any kind of outsourcing of all or part of main logistics activities such as transportation, warehousing, packaging and inventory management. This decision allows companies to focus on their core businesses to drive growth in order to maximize profitability through their supply chain functions.

In 1993, Lieb, Millen and Wassenhove emphasized the long-term relationship, in a win-win arrangement, between the firm and its third-party logistics provider where they are committed to understand and accomplish the customer's logistics needs. Therefore, they will seek for designing and developing innovative logistics solutions with the aim of effectiveness and efficiency. Due to these aspects, the interest in third-party logistics service has been growing over the last years in the supply chain management field.

2.2.2. The role of third-party logistics providers

According to Bhatnagar and Vaidyanathan (2000), companies worldwide may be willing to build relationships with state-of-art third-party logistics providers since they offer specialized management and advanced information technology that will be integrated in companies' supply chain.

It is not rocket science that third-party logistics providers play a crucial role in many industries since they offer plenty of advantages such as improvement of service levels, reduction in lead times, productivity profits and cost reduction.

Also, third-party logistics providers use an increased number of resources which could be easily adapted to customers' requirements (Simchi-Levi, 2008); allowing companies not only to focus efforts on their core activities, but also to have a flexible supply chain to react quickly to variations in consumer needs.

To illustrate, it is necessary to mention that a production unit of a firm has the responsibility to deliver the final goods on time, so it means the third party logistics providers are in charge of supplying to final customers on time to accomplish lead times and service levels.

Furthermore, it is important to acknowledge that having access to technology represents a critical advantage for all the parties involved in the company's supply chain because it will allow to get requirements of customers timely and respond to the information to meet the customer's expectations (Guo and Han, 2010).

In terms of third-party logistics providers, they could offer firms with reliable and automated data when it comes down to some components of the logistics workload such as the tracking of materials and shipments, order status inquires, the location of critical deliveries to the customers, the diagnosis of a possible problem and the update of the order processing (Vaidyanathan, 2005).

Last but not least, the way of sharing information between a firm and its third-party logistics provider might significantly enhance the performance of the firm's supply chain with value added services, reducing any level of risk and uncertainty along the logistics activities.

2.2.3. Benefits to select third-party logistics providers

Bardi and Tracey, in 1991, go deeper into the analysis of the fact that third-party logistics providers can offer many advantages intended to cost savings, operational efficiency, equipment and manpower and increased flexibility and productivity through the supply chain of a firm. Thanks to these results, firms could access to international distribution network in order to increase their competitiveness.

Next, according to Andersson (1997), the main benefits of having a third-party logistics provider in a supply chain management are improvement of efficient operations, quick development of new systems, reengineering of supply chain process, network with other providers.

Likewise, it is important to acknowledge that third-party logistics providers have the ability to coordinate plenty customers at the same time without losing the focus on their activities. Additionally, they are able to adapt their systems and products to customers' requirements since it shows their commitment to the firm. So, this decision allows the company to make its supply chain more flexible and reactive in its offerings to the final customers (Sharma & Vagrecha, 2016).

According to Halldórsson and Skjoett-Larsen (2004), when a firm decides to establish a short-term or long-term relationship with a third-party logistics provider, both of them can take advantage of growth opportunities and innovative ideas because of a synergic work, relational exchange and a shared knowledge when it comes down supply chain activities.

Regarding closer relationships with its third-party logistics provider, the company could get better results and increase the possibility of maximizing supply chain effectiveness and performance. In fact, trust and communication play a vital role when it comes down to build these relationships and promote a mutual development. Thus, it is not rocket science that the firm might be more competitive and in terms of the entire supply chain in the marketplace.

2.3. Freight Transportation

2.3.1. Definition

The concept of freight transportation is related to the movement of raw materials, intermediate goods and finished goods from one area to another, using different transport modes such as road transport, rail transport, air transport and maritime transport. In 2002, Panayides explained that the use of freight transportation provide organizations to specialize in production activities and to trade with other companies to receive more sophisticated products. It is necessary to point out that this process is linked with the freight infrastructure which includes railroads, airports, marine ports roadway system and locks and dams on rivers; and the freight carriers who are the owners of the trains, trucks, ships and airplanes.

Also, it is widely known that any supply chain's success is closely linked to the appropriate use of freight transportation, so it is no wonder that supply chain managers are seeking new competitive strategies to ensure the firm's transportation strategy in an effective way.

2.3.2. The modes of freight transportation

In 2008, Caris, Macharis and Janssens emphasized the service and cargo characteristics of the most common kinds of freight transportation (air, truck, rail, water and pipeline) where the accomplishment of a continuous and fast delivery service plays a crucial role (see figure 2). It is necessary to acknowledge that cargo characteristics determine the kind of service demanded by shippers.

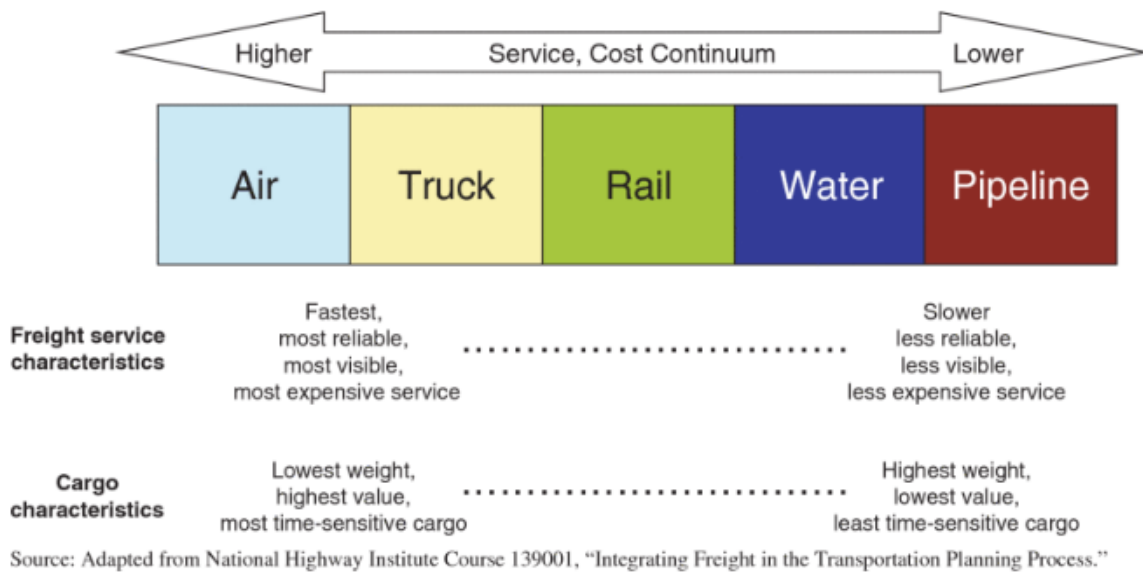


Figure 2. Freight service and cargo characteristics

Regarding freight service characteristics, the least expensive when it comes down to cost investment are water and pipeline transportation, however, the most expensive are air and truck transportation. In terms of quality of service, the fastest and the most flexible is truck transportation, but pipeline is the slowest and less flexible service. In terms of cargo characteristics, truck and air transport becomes the most important ones intended to move high-value cargo since it provides companies with the opportunity to reduce transport time and improve levels of reliability. Rail and marine transport usually carry lower-value cargo for which time and speed are not a big deal.

In addition, as Hofmann and Locker (2009) consider, freight transportation becomes one of the most important parts of companies' supply chain since it allows them to gain a competitive advantage in logistics field. These -in the long run- make firms seem to be aware of avoiding possible damage of final goods during transit from the place of origin to the place of destination.

2.4. Container port terminal

In 1993, Heaver stated the importance of container port terminals as facilities to handle containers where specialized equipment plays a crucial role related to load and discharge cargo. It is necessary to emphasize that containers are considered the unit load concept when it comes down international freight. Admittedly, container terminals usually take into account users' requirements in terms of adding-value cargo activities, extensive infrastructure and specialized supply chain. According to Lee and Cullinane (2005), the use of technological and automated equipment in handling process represents one of the best practices because it produces a positive impact in the development of container port terminals.

On reflection, the high level of demands on container port terminals might increase the number of container shipments where the use of technical equipment is strongly required. It is also fair to point out that container port terminals will be able to deliver value to shipping lines and third-party logistics providers; so it is no wonder that port terminal accessibility has become a cornerstone in terms of port competitiveness and the supply chain process.

On the contrary, Olivier and Slack (2006) considered that some operational factors such as storage space, overcapacity, scheduling changes, gate access, traffic flows and waiting times can bring some disadvantages in the severe competition between container terminals, since it will have a serious impact on the performance and the reliability of the terminals.

It is necessary to mention that a container port terminal is considered as a complex system where there are plenty of dynamic interactions among storage, handling and transportation units. Thus, it is really important to focus on keeping a high level of customer service and eliminating any kind of operational issue in order to improve productivity performance and satisfy users.

2.4.1. The role of container port terminals

In their study, Steenken and Stahlbock (2004) explain the main activities that container port terminals in terms of export activities (see figure 3). First of all, the container arrives at the port terminal by train or truck, depending on companies' decision. Next, all container's information (weight, destination and outbound vessel) is collected using technological equipment and moved to a storage location using specific cranes. In terms of the storage location, it is assigned in real time at the time the container arrives to the terminal due to the ever-changing terminal conditions. Finally, the container is transported to the designated vessel and loaded to the respective vessel's container.

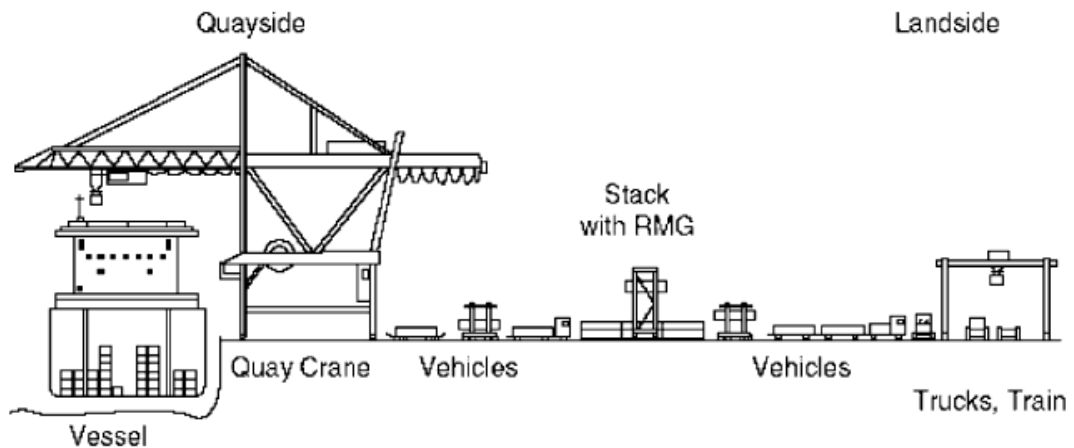


Figure 3. Transportation and handling chain within a container terminal.

To be fair and square, as technology in handling equipment provide port terminals with more benefits day by day, it is necessary to acknowledge the main role that it plays in the complex task of scheduling export operations when it comes down to collect the precise information of each container. Moreover, in 2003, the study of Vis and de Koster shows that container port terminals have the responsibility of managing the time factor and improving reliability in supply chain operations, eliminating any kind of port congestion and overcapacity in order to accomplish shipping schedules and build an attractiveness relationship with users, providing faster and cost-efficient services.

2.4.2. Examples of port terminals

It is widely known that the Port of Callao is the most important one in Peru since it handles 90% of the country's maritime trade because of its international standards in its activities. Its infrastructure is divided into two terminals: The North Terminal under concession to APM Terminals since 2011 and the South Terminal under concession to DP World since 2010.

Both of these terminals have a modern engineering in terms of world class standards, and they play a crucial role in the development of port infrastructure, boosting economic growth and welfare. It is necessary to point out that their operations and activities are regulated by the General Customs Law in Peru.

2.4.2.1. APM Terminals

APM Terminals³ is considered a multi-purpose terminal capable of handling both containerized cargo and general cargo including metals, chemicals and machinery thanks to its technologically advanced equipment. Moreover, it allows APM Terminals to improve its operational efficiency and increase its standards to international level. In fact, this terminal handle around 45% of the country's total container traffic because of its modern infrastructure.

In terms of cargo consolidation, container filling process and shipping management take place in the North Terminal of the Port of Callao. One of the advantages of APM Terminals is that it has free access to railways, so it means that final products can be transported directly from a factory to the port terminal (see figure 4).

³ <https://www.apmterminals.com/en/callao>



Figure 4. Export logistics process with APM Terminals

2.4.2.2. DP World Callao

DP World Callao⁴ is a peruvian company the concession holder for the design, construction, financing, conservation and operation of the South terminal in the port of Callao. Furthermore, this terminal is considered as the top container terminal facility in South America since it implies world class standards in terms of efficiency and productivity in logistics solutions. Indeed, this terminal handle around 55% of the country’s total container traffic because of its modern infrastructure.

In terms of cargo consolidation, container filling process and shipping management take place in the South Terminal of the Port of Callao, where its high technology process in terms of shipment management is a key advantage. However, one of the main disadvantages of DP World is that it does not have access to railways for transporting the products to the port terminal, so it is necessary the use of tracks units when it comes down to transport final goods (see figure 5).



Figure 5. Export logistics process with DP World

⁴ <https://www.dpworld.com/en/what-we-do/our-locations/Americas/Callao-District-Peru/callao>

According to Nam and Ha (2001), when a port terminal decides to develop advanced technologies within its logistics process, it means that the terminal is able to implement planning systems and automated handling operations. As we speak, this decision does not guarantee a higher productivity by itself, but it is necessary to anticipate and response in a quick way some unexpected issues intended to supply chain management.

2.5. Chapter summary

In this charter, some previous researches were explained in order to better understand the relevance of supply chain management worldwide, taking into consideration its direct influence on business performance and how a firm is able to customize its logistics network in order to increase profitability results and respond customers' requirements in an effective way.

Likewise, focusing on the distribution process within SCM field, it was also necessary to get previous information on some others logistics players such as third-party logistics providers, freight transportation and container port terminals not only because those logistics actors play a crucial role in a cargo consolidation activity - which is related to the RQ – but also, because those players ensure an adequate delivery of the products toward the point of customer's requirement.

That is why, all these concepts are considered as the foundation for this study and it is time to get meaningful information from a qualitative approach and discover how the RQs can be answered.

CHAPTER 3. RESEARCH METHODOLOGY

The purpose of this chapter is to explain the kind of methodology for this study, the justification of the epistemological approach, description of the way of collecting data and process that collected data.

3.1. Epistemological positioning

The epistemological position adopted for the research is an interpretive approach that not only considers the relevance of real experience in the study, but also the crucial role that observation and interpretation play in this epistemological positioning since to observe is to collect information about events, while to interpret is to make meaning of that information. That is why, interpretive researchers attempt to understand through accessing the meanings that participants in a same situation give to this situation (Denzin and Lincoln, 1996). Thus, the interpretive approach is characterized by a need to understand the world as it is from a subjective point of view and seeks an explanation taking into consideration the participant's point of view rather than the objective observer of the action

In 2003, Reeves and Hedberg highlighted the importance of understanding the world as it is from subjective experiences and perceptions of the research participants from an interpretive paradigm. In order to do that, researchers use oriented methodologies such as interviewing or participant observation because it enables to build a subjective relationship between the researcher and subjects. Likewise, the results of the interpretative approach do not aim to determine general laws that are true in all circumstances, but rather take into account convincing results that enrich existing knowledge by adding new facts, by diversifying or by questioning their existence.

According to Carr and Kemmis (1986), in the interpretive approach the researcher is considered as a participant observer who engages in the activities and discerns the meanings of actions as they are expressed. Additionally, the researcher needs to create an environment where participation, collaboration and engagement

govern in order to ensure its the role of participant observer and to build a free flow of information.

In order to analyze the improvement of cargo consolidation in the export logistics process of Nexa Resources Cajamarquilla (see Appendix 03), this study is considered as a qualitative research since it is concerned with exploring and make sense of a phenomena from an interpretive perspective using a data-generation method like semi-structured interviews conducted by the researcher. It is important to take into consideration the guidance, control and direction provided by the researcher, and also the values of the researcher and participants throughout the study. Moreover, the researcher should be able to answer questions about the relevance of the research without creating bias since it enables to make the study more interesting for the respondents and they will able to ask different questions.

Then, developing an interview guide helps the researcher conduct the interview in an effective manner. Last but not least, Merriam (1998) stated that the researcher is considered the main instrument of data collection and analysis because he/she prioritizes to collect data in a non-interfering manner and make sense of the multiple interpretations of situations, so it is no wonder that the analysis and interpretation of data results are considered as the most important outputs of using a qualitative study.

Thus, it is necessary to remain that the purpose of this research is intended to answer the following research questions that were defined before:

- **RQ1:** How does the firm reduce its logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?
- **RQ2:** How does the firm improve its performance in management of shipments when it comes down to the export process of refined zinc?

- **RQ3:** What are the benefits for the firm regarding to the optimization of its load consolidation process?

3.2. Data Collection

In this paper, we decided to collect qualitative data since it allows an exhaustive understanding of our study. 15 semi-structured interviews were conducted. This number of interviews was obtained by the principle of information saturation. According to Glaser and Strauss (1967), within the qualitative research, the principle of information saturation plays a crucial role which explains that an specific research gets a point of saturation where information collected starts to repeat itself, so it is no wonder that any kind of additional research's data becomes redundant and might provide not further understanding of the topic.

Besides, this research consists in interviewing managers and professionals of Nexa Resources Cajamarquilla from different departments such as Supply Chain, Commercial & Sales, Finance, Manufacturing and Project Management departments. It is also fair to point out that there is a diversity in these interviewees since they are professionals who have experience and background in terms of taking decisions about investments in new projects intended to achieve the objectives of the firm.

Regarding their answers, they will be based on their former experiences and their personal point of view, without losing their focus on some important company's goals: saving costs and operational performance.

3.3. Interview guide

In terms of the respective interview guide, it is important to emphasize that printing a paper-pencil questionnaire was the most suitable method to formulate the different questions, since it provides interviewees with the opportunity to express his/her personal point of view about the list of questions in order to obtain a maximum of information, without having the possibility to ask me about an expected interpretation.

It is not rocket science that interviewees decided the order of answering the questions and needed time to think about their responses, which were mainly based on their past experience and their knowledge. The interview guide is introduced in Appendix 01 and covers the following topics:

- a) Presentation of Interviewees' profile.
- b) Analysis of the current's cargo consolidation center (LICSA).
- c) Description of the new cargo consolidation project.
- d) Alternatives of possible cargo consolidation centers (APM Terminals and DP World).
- e) Understanding each evaluation's factor.
- f) Reasons of choosing the best alternative.

3.4. Interview procedure

3.4.1. Sampling technique

It is widely known that sampling plays a crucial role in a research since it is impossible to be testing every single individual in the population, so it is no wonder that using a sampling technique is considered suitable for research in terms of cost, convenience and time. Regarding sampling technique, a self-selection sampling was carried out within this research since this kind of non-probability sampling allows individuals to take part in a study on their own accord.

Additionally, these individuals usually have strong opinions about the research and a specific interest in the study or its findings. In this case, it was important to send emails within the company in order to let potential respondents know about this study and its relevance, an explanation about the use of the questionnaire and the semi-structured interviews.

Moreover, the internal policy of the firm when a new project will be implemented is taking into account the opinions and expectations of key departments such as commercial & sales, finance, manufacturing and supply chain because

professionals from those departments might provide more insight into the phenomenon being evaluated. Indeed, the diversity within the panel of respondents is a key tool in this research intended to the interviewees who are managers and professionals from different departments with different background and experience. This decision is linked with the goal of qualitative research when it comes down to consider diversity and context.

3.4.2. Interview description

In this research, semi-structured interviews were conducted because this kind of interview is one of the most used techniques within the qualitative research. In fact, semi-structured interviews allows researcher to go further than a simple questionnaire, taking into consideration that the interaction with the interviewees enables researcher to get a meaningful information within the research field. That is why, a questionnaire must include open-ended questions and ask respondents for elaboration and example, so that interviewees will be free to express themselves.

It is relevant to acknowledge the role of the interviewer since he/she should empower respondents to point out important characteristics of the topic and suggest improvements in the interview procedure, so it is no wonder that respondents are also considered as co-researchers.

All semi-structured interviews were face-to-face interactions in Spanish language, and they were completely transcribed and translated to English language. It is important to mention that my participation (researcher) implied to explain interviewees about some questions related to the topic, avoiding any influence and suggestions from researcher about the topic.

Admittedly, my role of interviewer in this study is supported with my 5 years of working experience at Nexa Resources Cajamarquilla, participating in former meetings with the interviewees intended to supply chain projects' implementation within the firm.

3.4.3. Profile of the respondents

As explained before, 15 respondents participated in this study and it is important to mention their roles at Nexa Resources Cajamarquilla in order to acknowledge the grade of engagement of each respondent in the current research. It is also fair to point out that the main roles described below are related to the development and investment in new process improvement projects:

- **Supply Chain Manager:** she is responsible for planning, implementing and monitoring the supply chain strategy of the firm, suggesting innovative solutions for process improvements and building collaborative relationships with Finance, Commercial & Sales and Manufacturing departments in order to select the most affordable players in the supply chain of the company.
- **Project Management Manager:** she is in charge of the establishment and management of a project methodology incorporating structures, standards, processes, documentation and reporting that puts emphasis on the quality and timeliness of project delivery.
- **Finance Business Manager:** his main tasks are focus on cross functional business partnership, complex business problems, financial reporting and analysis for strategic Supply Chain projects to enable better decision making.
- **Commercial & Sales Manager:** he leads the designment and implementation of a strategic business plan that allows company to expand its customer base and ensure its strong presence.
- **Manufacturing Manager:** he is responsible for planning and organizing production schedules, taking into account project requirements. He coordinates with supply chain department in order to ensure stable stream of inventory level of final goods without any excess.

- **Supply Chain Supervisor (2 persons):** they are in charge of supervising supply chain operations, ensuring effectively functioning processes to avoid costly delays and lost opportunities and encouraging the team to solve day-to-day operational issues and reach short- and long-term performance goals.
- **Project Management Analyst (2 persons):** they are responsible for monitoring the project execution to ensure that the plan is being followed, providing assistance with identifying, assessing, mitigating project risks and issues and informing the updates on project status to the rest of the organization.
- **Finance Business Senior Analyst (2 persons):** they lead and direct monthly forecasting of future results with the operations team and new projects for the firm and supporting operations in all accounting and finance functions to aid in business decisions.
- **Commercial & Sales Analyst (2 persons):** they are in charge of elaborating reports to the project management team regarding sales, revenues, expenses and forecasts, working closely with supply chain, finance and manufacturing departments.
- **Manufacturing Supervisor (2 persons):** their main tasks are focus on ensuring that production plans are completed, implementing cost-saving strategies and suggesting improvements with support from other departments.

3.5. Data Processing

According to Strauss and Corbin (1990), the process of qualitative analysis implies not to the quantifying of qualitative data but rather to a nonmathematical process of interpretation, since this kind of analysis provides the research process with the opportunity to obtain all relevant aspects of the topic with the purpose of discovering concepts and relationships in raw data and then organizing these into a theoretical scheme.

3.5.1. Relevant respondents' statements

During this initial analysis, it was useful to read the whole data set obtained throughout the semi-structured interviews since it allowed the researcher to get a whole picture of the current study. Admittedly, it is pertinent to mention that obvious redundancies, repetitions or unimportant information could be omitted, so it is no wonder that this research need to focus on data that are considered as significant and coherent in terms of getting a clear interpretation and answering our research questions (RQs).

Moreover, during the different interviews, the researcher identified plenty meaningful concepts which were included in some relevant statements. These concepts were identified from respondents' opinions and answers and they play a crucial role in order to provide the researcher with the relevant meanings in order to organize the data. It is necessary to point out that they represent the interpretation of the researcher about the language used by the respondents and also, they include the researcher's knowledge of previous similar studies. Indeed, this process ensures an in-depth understanding of the current study.

The relevant respondent statements and the meaningful concepts associated with them are shown in the following table 1:

Respondent	Relevant statement	Meaningful concept
Supply Chain Manager	“Nowadays, the firm monthly pays more than USD30,000 of logistics over costs due to delays detected in the current external warehouse to export our products, so we need to find a new alternative of consolidation center and save money immediately”.	<ul style="list-style-type: none"> • Cost of external warehouse activities • Logistics over costs • Shipping lead time • Shipment management time • Cargo consolidation process

Finance Business Manager	“The company monthly pays 26.31 dollars per ton of zinc with the current external warehouse, which is higher in comparison to the average market of 24.2 dollars”	<ul style="list-style-type: none"> • Cost of external warehouse activities • Logistics over costs
Commercial & Sales Manager	“Over the last 5 months, we have received some complaints of our key clients because of the delay of the arrival and kinds of damage within the product. So, the current consolidation center needs to improve its logistics process, or we could lose our clients”	<ul style="list-style-type: none"> • Transport time to consolidation center • Shipping lead time • Equipment and infrastructure
Logistics Analyst	“In Peru, there are external consolidation centers which are closed to the port terminal and offer innovative logistics operations in terms of load consolidation process”	<ul style="list-style-type: none"> • Container filling process • Load consolidation • Proximity to the port terminal
Commercial & Sales Analyst	“As the firm wants to save extra costs in cargo consolidation process, it is necessary to find a new company that allows to move the final goods directly to the port terminal”	<ul style="list-style-type: none"> • Transportation to the port terminal • Cargo consolidation process
Project Management Manager	“There are important consolidation centers with modern infrastructure and equipment that may ensure the firm with a better efficiency in terms of logistics process”	<ul style="list-style-type: none"> • Cargo consolidation process • Equipment and infrastructure

Table 1. List of relevant respondents' statements

3.5.2. Generation of categories and sub-categories

Once the statements were analyzed and the meaningful concepts were identified by the researcher, the following step is to organize elements for this research into three main categories and sub-categories, taking into consideration how to answer the defined RQs. The main categories and its sub-categories are shown in the following table 2:

Main categories	Sub-categories
Time and Cost	<ul style="list-style-type: none"> • Transport time to consolidation center • Shipping lead time • Shipment management time • Cost of external warehouse activities • Logistics over costs • Equipment and infrastructure
Management of shipments	<ul style="list-style-type: none"> • Container filling process • Load consolidation • Transportation to the port terminal • Proximity to the port terminal
Benefits of a new alternative	<ul style="list-style-type: none"> • Cargo consolidation process

Table 2. List of main categories and sub-categories

As explained before in the literature review, one of the most vital dimensions in SCM is how the firm can customize its logistics network in order to increase profitability results and respond customers' requirements in an effective way.

Also, the distribution process within the firm implies the importance of transportation companies and third-party logistics companies in order to ensure an adequate delivery of the products toward the point of requirement. That is why, time and cost, management of shipments and benefits obtained represent the main categories for this study are considered as relevant.

3.5.3. Relevance of the RQs

After the categorization of data set, it is important to determine the importance of the main categories and how they link with the research questions (RQ1, RQ2 and RQ3):

a) Time and Cost:

This main category is linked with the following RQ1: “How does the firm reduce logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?”. Admittedly, it is necessary to acknowledge that this category wants to include key concepts when it comes down to decreasing logistics cost and transportation time.

In terms of logistics costs, this research wants to explore the level of cost savings due to some decisions such as eliminating external warehouse activities, diminishing over costs and reducing the payment of port terminals providers that have access to modern equipment and infrastructure.

In terms of transportation time, this study wants to emphasize the reduction of transportation time from the company to load consolidation center (port terminal), the fulfillment of shipping lead time and the optimization of shipment management time.

b) Management of shipments:

This main category is linked with the following RQ2: “How does the firm improve its performance in management of shipments when it comes down to the export process of refined zinc?”. On reflection, it is important to acknowledge that this category will include key concepts regarding management of shipments when it comes down to improve firm’s performance in the export process of refined zinc.

In terms of shipment process, this research focuses on ensuring vital activities for the firm such as control in the container filling process, autonomy in load consolidation, availability of transportation units from the firm to port terminal and avoid moving products to a temporary extra-port warehouse.

c) Benefits of a new alternative:

This main category is linked with the following RQ3: “What are the benefits for the firm regarding to the optimization of its load consolidation process?”. It is also fair to point out that it is necessary to acknowledge that this category seeks to discover all benefits that the alternative of a port terminal provider will offer the firm regarding the improvement of cargo consolidation process.

It is not rocket science that getting benefits of a new alternative could be considered as an important step forward for the firm in terms of operational activities, competitiveness, market share, export volume and financial results.

Moreover, as explained before, all interviews were completely transcribed and translated to English language. Afterwards, once the qualitative information were transcribed, this research used a grid analysis worksheet of Microsoft Excel taking into account the identified categories, and sub-categories. In this grid analysis worksheet, the most important criteria are the relevance with the research field and the repeatability of the meaningful concept in respondents' answers.

CHAPTER 4. RESULTS AND INTERPRETATION

This chapter presents the main results of our study and an acceptable interpretation of these results in order to select the best alternative for cargo consolidation process. It is important to point out that all results are answered from the firm's point of view since it is a new project to develop in a short term.

4.1. Results

The results of this study are presented in the table 3. It shows the main categories, sub-categories, their respective themes, the number of interviewees who considered the themes as relevant (N) and the number of interviewees who consider APM Terminals or DP World as the best option of cargo consolidation center which could achieve the respective theme. As stated before, the results are intended to the most important aspects that Nexa Resources will take into account in the idea of improving its cargo consolidation in its export logistics process.

Main categories	Sub-categories	Themes	N	APM Terminals	DP World
Time and Cost	Transport time to consolidation center	Reduce transport time	10	5	5
	Shipping lead time	Fulfillment of shipping lead time	13	8	5
	Shipment management time	Optimize shipment management time	13	7	6
	Cost of external warehouse activities	Decrease cost of external warehouse activities	14	8	6

	Logistics over costs	Eliminate logistics over costs	10	5	5
	Equipment and infrastructure	Availability of modern equipment and infrastructure	13	8	5
Management of shipments	Container filling process	Control in the container filling process	14	7	7
	Load consolidation	Autonomy in load consolidation	12	6	6
	Transportation to the port terminal	Availability of transportation to port terminal	12	6	8
	Proximity to the port terminal	Avoiding transferring products to a temporary extra-port warehouse	14	7	7
Benefits of a new alternative	Cargo consolidation process	The firm will obtain benefits in its export process	15	10	5

Table 3. Presentation of study's results

In the table 4, we consolidate the total amount of votes for each new cargo consolidation center in terms of each main category. In this case, we can note that APM Terminals is considered as the best alternative for all respondents.

Main categories	APM Terminals	DP World
Time and Cost	41	32
Management of shipments	26	28
Benefits of a new alternative	10	5

Table 4. Results by new cargo consolidation centers

4.2. Analysis of the results

It is important to show the link between these results and the research questions (RQ1, RQ2 and RQ3) defined before:

4.2.1. Time and cost

As stated before, **in terms of the category “time and cost”**, this category is linked with the following RQ1: “How does the firm reduce logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?”.

According to Table 3, it is also fair to point out that in terms of logistics costs, the most important themes considered by our respondents are: Decrease cost of external warehouse activities (14 answers) and Availability of a port terminal with modern equipment and infrastructure (13 answers) and in terms of transportation time, the most preferred themes are: Optimize shipment management time (13 answers) and Fulfillment of shipping lead time (13 answers). Regarding the new cargo consolidation center, Table 4 shows that the most preferred one by our interviewees in this category is APM Terminals.

As a conclusion in this part, these results enable us to answer the RQ1 with the fact that APM Terminals would be the port terminal provider which offers Nexa Resources Cajamarquilla with the opportunity to reduce its logistics costs and transportation time when it comes down to export process of refined zinc.

4.2.2. Management of shipments

Moreover, **in terms of the category “management of shipments”**, this main category is linked with the following RQ2: “How does the firm improve its

performance in management of shipments when it comes down to the export process of refined zinc?”.

According to Table 3, it is necessary to take into consideration that the most important themes considered by our respondents are: Control in the container filling process (14 answers) and Avoiding transferring products to a temporary extra-port warehouse (14 answers). As for the new cargo consolidation center, Table 4 indicates that the most chosen one by our interviewees in this category is APM Terminals.

As a primary conclusion in this part, these results enable us to answer the RQ2 with the fact that APM Terminals would be the port terminal provider which offers Nexa Resources Cajamarquilla with the opportunity to improve its performance in management of shipments, ensuring an effective control in the container filling process and avoiding a waste of time due to the fact of moving products to a temporary extra-port warehouse.

4.2.3. Benefits of a new alternative

Besides, **in terms of the category “benefits of a new alternative”**, this main category is linked with the following RQ3: “What are the benefits for the firm regarding to the optimization of its load consolidation process?”.

According to Table 3, it is necessary to take into account that all our respondents agree with the fact that Nexa Resources Cajamarquilla will obtain benefits in the project of improving its export process (15 answers). Regarding the new cargo consolidation center, Table 4 reveals that the most preferred one by our interviewees in this category is APM Terminals.

As a conclusion in this part, these results enable us to answer the RQ3 with the fact that APM Terminals would be the port terminal provider which offers Nexa Resources Cajamarquilla with the opportunity to have benefits improve its performance in terms of operational activities, competitiveness, market share, export volume and financial results.

4.3. Interpretation of the results

This section provides an interpretation of our study results regarding our main categories, themes and our research questions.

4.3.1. Time and cost

The way of decreasing the current cost of external warehouse activities in the export process of Nexa Resources represents the most important advantage supported by 14 interviewees where APM Terminals appears as the alternative of cargo consolidation center.

This result does not surprise Supply Chain Manager since she argues: “Signing an agreement with APM Terminals would be positive in order to save 8% in terms of cost of an external warehouse in comparison to LICSA.”

In addition, Finance Business Manager explains: “Nowadays, we pay 26.31 dollars per ton of zinc, but APM Terminals offers us a cost of 24.2 dollars per ton of zinc in external warehouse activities. If we save money, it will be positive for us”. Next, we have to acknowledge that both of those arguments are intended to one Nexa Resources ‘s organizational goals: save operational costs.

Concerning fulfillment of shipping lead time, this theme was supported by 13 respondents because it is very important to accomplish the customers’ requirements in terms of time and quality. More than a half of those respondents select APM Terminals as the cargo consolidation center.

It is widely known that many interviewees consider that this new alternative would not only provide the firm with an economic improvement, but also trust a strong relationship with customers, that is why, fulfillment of shipping lead times is one of the most attractive offers Nexa Resources should be able to make.

As Commercial & Sales Manager reports: “With APM Terminals as new consolidation center, I can ensure that our firm would be willing to offer a higher service level and a better on-time performance in its logistics operations since it will help us to negotiate better contract conditions with our customers.”

Regarding optimization of shipping management time was supported by 13 respondents in the way that it implies to optimize products inventory and shipping fulfillment which provide the firm a better control over its logistics operations. More than a half of those respondents select APM Terminals as the cargo consolidation center.

As Supply Chain Supervisor highlights: “This new consolidation center enables us to obtain an analysis delivery performance and to track shipments online in order to improve on-time deliverables. In addition, we might keep operations costs low and productivity high, as a result, we would be willing to deliver high quality service for our customers.” Thus, we point out that an efficient shipping management could provide customers with an effective customer experience and also, Nexa Resources must boost its productivity in a short-term.

When it comes down to availability of modern equipment and infrastructure, 13 interviewees supported this theme as substantial for the firm, where 8 interviewees chose APM Terminals as the cargo consolidation center since they consider that APM may provide the firm with value-added services and operations improvement in terms of making better business decisions.

It is also fair to point out that Project Management Manager underlines the competitive advantage of having a modern consolidation center intended to technology:

“APM Terminals is a company with an operationally efficient and modern terminal, which is able to invest in equipment and port infrastructure, increasing its terminal space to operate as the modernization project of the North Terminal in order to improve the efficiency of its logistics services.”

It seems important to remind the first research question (RQ1) and linked with the result of this analysis:

RQ1: How does the firm reduce its logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?

Therefore, as a result of this analysis in terms of time and cost, and answering our first research question, choosing APM Terminals as new consolidation center allows Nexa Resources Cajamarquilla the possibility to reduce its logistics costs and transportation time avoiding the use of an external warehouse in order to be successful in this competitive field.

4.3.2. Management of shipments

The way of controlling the container filling process represents for Nexa Resources Cajamarquilla one important advantage when it comes down to management of shipments, which was supported by 14 interviewees. In terms of the alternative of cargo consolidation center, APM Terminals and DP World are considered in the same level of logistics service since they offer a highly efficient way of working.

As Supply Chain Manager affirms: “We can choose APM Terminals or DP World without problems because they include innovative systems in its logistics operations that help our firm to improve efficiency of export operations and safety standards.”

Next, Logistics Analyst reports: “These terminals will provide us to save money during our operations since the terminals will give us the opportunity to use a specific operational area during the assigned free days included in the contract, so it is no wonder that we may avoid paying over cost per day.”

Concerning the theme of avoiding transferring products to a temporary extra-port warehouse, it is important to acknowledge that it has a direct impact on management of shipments in terms of time, costs and operations. Likewise, this theme was supported by 14 interviewees because the way of moving final goods represents a key part in Nexa Resources' supply chain.

Regarding the alternative of cargo consolidation center, APM Terminals and DP World are considered in the same level of logistics service since both of these terminals offer a direct access to the port terminal, eliminating the use of an external warehouse when it comes down to product storage and distribution.

As Commercial & Sales Analyst states: "The decision of directly moving our products to the final port terminal not only saves extra cost for us in warehouse activities, but also it ensures that we need to apply just in time activities during our cargo consolidation process, so we could increase our efficiency.

Thus, APM Terminals is the best alternative for that reason, and thanks to its access to railway line in its facilities."

It seems important to remind the second research question (RQ2) and linked with the result of this analysis:

RQ2: How does the firm improve its performance in management of shipments when it comes down to the export process of refined zinc?

On reflection, as a result of this analysis in terms of management of shipments, and answering our second research question, it is necessary to take into account that Nexa Resources Cajamarquilla has to ensure the logistic performance taking into consideration container filling process and the products transport to the port terminal instead of using an extra-port warehouse.

In order to do that, selecting APM Terminals as new consolidation center implies to eliminate constraints that could appear during export logistics process.

4.3.3. Benefits of a new alternative

Regarding the way of getting benefits for Nexa Resources Cajamarquilla because of the improvement's project of its export process, this theme was supported by all of 15 respondents since they believe that this project represents an important step forward for the firm in terms of operational activities, competitiveness, market share, export volume and financial results.

That is why, more than a half of those respondents selected APM Terminals as the optimal cargo consolidation center to obtain the best corporative results and competitive advantage.

One of the main competitive advantages is the well-located terminal in relation to the Pacific trade, its modern infrastructure and its cheaper tariffs. Additionally, Nexa Resources Cajamarquilla has to take into account that one of the important benefits could be the APM Terminals' wide experience in leading world-class terminals

As Finance Business Senior Analyst affirms: "It is not rocket science that APM Terminals will give us a plenty of advantages for us such as saving logistics cost, fulfillment of shipping lead times, better operational efficiency in our process, increasing our leveraging power with our suppliers and improving trust relationship with our customers." This professional emphasizes the importance of making long-term relationships with suppliers and customers in order to change processes in terms of quality.

In addition, it is also fair to point out that Project Management Manager underlines the implementation of this new project might enable to improve quality control performance in a logistical point of view, reducing many chances of losing time because of unexpected issues with export logistic process.

It seems important to remind the third research question (RQ3) and linked with the result of this analysis:

RQ3: What are the benefits for the firm regarding to the optimization of its load consolidation process?

Consequently, as a result of this analysis in terms of benefits of this new alternative, and answering our third research question, Nexa Resources Cajamarquilla must obtain many advantages when it comes down the optimization of export process of refined zinc, choosing APM Terminals as its new cargo consolidation center in order to stablish a high reliability of logistics and services.

CHAPTER 5. IMPLICATIONS AND LIMITATIONS

This chapter presents the contribution of our study in terms of Theoretical and Managerial level. Next, limitations intended to this thesis are described.

5.1. Theoretical implications

Taking into account results and analysis of this study, we are able to explain different elements that support existing research in logistics field. Beyond any reasonable doubt, many mining companies worldwide which want to survive in a competitive supply chain context, for this reason, Nexa Resources Cajamarquilla has to take decisions and create new ways to make its supply chain operations more flexible and responsive as Sharma & Vagrecha (2016) argue.

Besides, according to Carr and Kaynak (2008), organizations agree that implementing SCM can bring better results in building trust relationship with suppliers where communication, mutual support and information sharing about logistics activities, customers and markets, inventory levels and product availability play a crucial role in business objectives.

Moreover, the answer of the RQ2: “How does the firm improve its performance in management of shipments when it comes down to the export process of refined zinc?” is directly linked with the fact that Nexa Resources Cajamarquilla is facing plenty of challenges in terms of economy aspects and efficient operations; so, it is no wonder that the firm decides to implement new ways and new projects to get better results.

Therefore, the way of Nexa Resources chooses its right export process represents the most important tool for the gain of competitive advantage in mining field as Hofmann and Locker (2009) assert. Likewise, it was necessary to

acknowledge the impact of innovation on SCM in terms of performance and competitiveness because of the intensity of commitment of all supply chain players when it comes down to achieve companies' goals (Panayides and Venus, 2010).

Regarding to load consolidation services with the optimization of export process of refined zinc, and taking into account what Choi, Govindan, X. Li and Y. Li (2017) referred to outsource part of logistics activities to a third party operator, the answer of the RQ3: "What are the benefits for the firm regarding to the optimization of its load consolidation process?" is directly linked with the decision of choosing APM Terminals as the optimal cargo consolidation center for Nexa Resources has a great impact in the company's supply chain in order to obtain the best corporate results, to improve its operational efficiency and to increase its standards to international level.

Also, third-party logistics providers use an increased number of resources which could be easily adapted to customers' requirements (Simchi-Levi, 2008); allowing companies not only to focus efforts on their core activities, but also to have a flexible supply chain to react quickly to variations in consumer needs.

Moreover, the answer of the RQ1: "How does the firm reduce logistics cost and transportation time if the firm decides to transport final products directly to the port terminal avoiding the use of an exclusive external warehouse?" is directly linked with this study results which illustrates that more than 80% of our interviewees state the idea of avoiding using external warehouse activities since APM Terminals enables Nexa Resources to save time and costs in terms of logistics process, so as Sharma & Vagrecha (2016) explained, this decision allows the company to make its supply chain more flexible and reactive in its offerings to the final customers. To illustrate, we can point out that APM Terminals must be in charge of coordinating all the processes of exports, offering greater control in all operations along the entire supply chain.

Likewise, thanks to APM Terminals' proximity to Port of Callao and its access to railway line in its facilities for transporting wagons, both of them represent great ideas to sign a respective agreement in export process. Indeed, this is linked what

Skjoett-Larsen (2000) argued, when it comes down to externalize logistics activities with another firm which not only offers services much more tailored, but also offers specific investments in technologically advanced equipment and specialized employees training to meet the service requirements of customers.

Admittedly, the decision of investing in staff and operational performance is key when it comes down to have an efficient running company. So, it is no wonder that having access to advanced information technology represents a critical advantage for all the parties involved in the company's supply chain because it will allow to get requirements of customers timely and respond to the information to meet the customer's expectations (Guo and Han, 2010).

5.2. Managerial implications

It is not rocket science that many supply chain managers are concerned about the idea of continuous improvement in logistics operations from their firms, so it is no wonder that this improvement could have a significant impact on saving costs, improving process quality and increasing market share in mining field. Undoubtedly, Nexa Resources managers are committed to reach corporative goals where implementing new projects plays a crucial role.

Based on the results and analysis we have obtained from this study; our interviewees, who are professionals of the firm with an important making-decision role, agree that Nexa Resources Cajamarquilla is ready to implement the project when it comes down the optimization of export process of refined zinc, choosing APM Terminals as its new cargo consolidation center.

It is also fair to point out that the current cargo consolidation center is LICSA and there is a valid contract agreement between Nexa Resources Cajamarquilla and LICSA, where the firm has to ensure a minimum of 200,000 tons per year of refined zinc in terms of export volume. The volume of exported zinc using LICSA as consolidation center over the last three years is shown in the table 5:

Consolidation Center	Net weight of exported Zinc (Tons)		
	2016	2017	2018
LICSA	227,234	209,055	211,146

Table 5. Refined Zinc exported in LICSA

Source: Nexa Resources Cajamarquilla

From a managerial perspective, Nexa Resources seeks for progressive changes in its logistics operations; that is why, this research aims to suggest Supply Chain's team members using both logistics operators, APM Terminals and LICSA as load consolidation centers. Indeed, it is necessary to define which volume of refined zinc has to be distributed between those two consolidation centers:

- a) LICSA: it is widely known that there is a contract that implies a minimum of annual volume to respect (200,000 tons), however this study considers taking into consideration the average volume of refined zinc from 2016 to 2018. According to the next table 6, the average volume for LICSA is 215,812 tons.

Consolidation Center	Net weight of exported Zinc (Tons)			
	2016	2017	2018	Average (2016 – 2018)
LICSA	227,234	209,055	211,146	215,812

Table 6. Average volume of refined zinc in LICSA

Source: Nexa Resources Cajamarquilla

- b) APM Terminals: it is relevant to consider the amount of refined zinc from Nexa Resources that was shipped in the North Terminal operated by APM Terminals from 2016 to 2018 and also, determine the average volume of

refined zinc over the last three years. According to the following table 7, the average volume for APM Terminals is 74,431 tons.

Port Terminal	Shipping Line	Net weight of Zinc (Tons)			
		2016	2017	2018	Average
APM Terminals	CCNI	2,978	3,514	4,147	
	CMA	1,937	2,286	2,697	
	CSAV	18,308	21,604	25,493	
	MSC	27,502	32,453	38,294	
	PIL	2,495	2,945	3,475	
	SEA	8,511	10,043	11,851	
	EVERGREEN	697	823	971	
APM Terminals Export		62,430	73,667	86,927	74,431

Table 7. Average volume shipped in APM Terminals

Source: Nexa Resources Cajamarquilla

- c) Proposed cargo consolidation system: using the average volume of refined zinc calculated before, it is an important decision to consider that information to build a new consolidation system and the respective percentage that they represent for the new system as it is shown in table 8:

Consolidation Centers	Net weight of exported Zinc (Tons)	
	Average weight	%
LICSA	215,812	74%
APM Terminals	74,431	26%
TOTAL	290,153	100%

Table 8. New consolidation system for Nexa Resources Cajamarquilla

Therefore, it is necessary to mention that this proposed system may let the firm not only to know the performance of APM Terminals as new consolidation center in the North Terminal, operating more than 74,000 tons or a 26% of annual total volume, but also to keep the contract conditions with the consolidation center LICSA in the South Terminal ensuring the minimum refined zinc volume of 200,000 tons and a 74% of annual total volume.

Moreover, it represents the best distribution of cargo expo in order to do the first step in this improvement project. Indeed, it is necessary that managers can choose more than one alternative in terms of cargo consolidation process in order to avoid depending on an exclusive warehouse. Thus, it will bring better results when it comes down to costs and time.

Admittedly, in order to participate to the development of the firm's operational activity, managers need to be committed with the way to promote new ideas inside their teams when it comes down to reach right stakeholders and customers. Even though, the initial performance of the project with APM Terminals could not meet the expectations in the first months of its implementation, we suggest managers to keep improving, acknowledge all shipping errors and take into account all opportunities for improvement that appear during this stage.

It is necessary to acknowledge that working on continuous improvement and operational strategies is a foundation for successful supply chain operations in order to accelerate growth and profitability, improve organizational efficiency and provide customers with differentiated value.

5.3. Limitations

In terms of limitation, it is necessary to acknowledge that the sample size of our study might be considered as a kind of limitation. As stated before, we selected 15 professionals from Nexa Resources Cajamarquilla who are high-qualified workers when it comes down to making decisions activities. In the next steps of this project's implementation, increasing the number of samples will be needed.

Furthermore, we considered the only two options of Port Terminals that Peru has in the Port of Callao (North and South Terminals). We decided to take into account that because almost 80% of shipping activities have taken place in this zone over the last 20 years.

Likewise, as every project that needs to be implemented in a firm, it is necessary to have the necessary budget to invest on it, so it is no wonder that CEO's Nexa Resources would be committed with this new idea to support Supply Chain's team in terms of economic and operational resources.

CONCLUSIONS

This thesis is a research combining very large and widely searched subjects into one question: How does Nexa Resources Cajamarquilla improve its organizational performance in cargo consolidation process of refined zinc? The first step was to gather all previous researches in order to better understand supply chain management, as well as its direct influence on business performance. It was also important to get previous information on some others logistics players such as third-party logistics providers, freight transportation and container port terminals. Then, taking into account all previous researches, the second step was to establish our own research through 15 semi-structured interviews which allow us an effective interaction with the interviewees in order to get a meaningful information within the research field. The last step of this research was to collect and organize raw data where three main categories and its link with the research questions play a crucial role in this study: time and cost, management of shipments and benefits of a new alternative.

When analyzing results of this research, it is necessary to emphasize that the main categories were not only important, but also sub-categories, themes and their relevance, and the interviewees who consider APM Terminals or DP World as the best option of cargo consolidation center. Next, the interpretation of interviewees regarding the positive effects of improving cargo consolidation process enabled us to answer the three research questions defined for this study where the obtained results throughout the respondents' answers showed that APM Terminals as new consolidation center can provide Nexa Resources with benefits intended to cargo consolidation process, ensuring not only the possibility to reduce logistics costs and transportation time, but also the improvement of management of shipment process of the firm avoiding the use of an external warehouse.

Furthermore, it is important to point out that one of the first measures that supply managers can choose is avoiding a dependence on an exclusive warehouse, so it is no

wonder that Nexa Resources Cajamarquilla can develop its new cargo consolidation process using LICSA and APM Terminals at the same time. Indeed, this study proposes a new cargo consolidation system taking into account the average weight of exported zinc over the last three years (2016, 2017 and 2018) and the contract's terms with LICSA that implies a minimum of annual volume to respect (200,000 tons). That is why, future supply chain's managers should consider a distribution of more than 74,000 tons or a 26% of annual total volume using APM Terminals in the North Terminal and also, ensuring the minimum refined zinc volume of 200,000 tons and a 74% of annual total volume using LICSA in order to keep the contract conditions with this third-party logistic provider.

Finally, focus on continuous improvement and operational strategies represents one of the best decisions that a supply chain firm can take in order to accelerate growth and profitability, improve organizational efficiency and provide customers with differentiated value.

REFERENCES

- Adams, R., Bessant, J. & Phelps, R. (2006), “Innovation management measurement: A review”, *International Journal of Management Reviews*, 8(1), 21-47
- Anderson, D., Britt, F. & Favre, D. (2017), “Innovative supply chain optimization models with multiple uncertainty factors”, *Annals of Operations Research*, 257(1-2), 1-14.
- APM Terminals, *Faster container handling in Callao*, Retrieved January 01, 2018. <https://www.apmterminals.com/en/news/news-releases/2017/faster-container-handling-callao>.
- Bardi, E. J., and Tracey, M. (1991), “Transportation outsourcing a survey of US practices”, *International Journal of Physical Distribution & Logistics Management*, 21(3), 15-21.
- Bhatnagar, R. Viswanathan, S. (2000), “Re-engineering global supply chains: alliances between manufacturing and global logistics service providers”, *International Journal of Physical Distribution & Logistics Management*, 30 (1), 13-34.
- Caris, A., Macharis, C., Janssens, G. K. (2008), “Planning problems in intermodal freight transport: accomplishment and prospects”, *Transportation Planning and Technology*, 277-302.
- Carr, W., Kemmis, S. (1986), “Becoming critical: Education, knowledge and action research”, *Philadelphia: Falmer Press*, 249.

- Christopher, M. (1998), “Logistics and supply chain management: Strategies for reducing cost and improving service”, *Financial Times*, Pitman Publishing.
- Coyle, J.J., Bardi, E.J. and Langley, C.J. (2003), “The Management of Business Logistics – A Supply Chain Perspective”, *South-Western Publishing, Mason*.
- Creswell, J., W. (2007), “Research design. Qualitative and mixed methods approaches”, *London: Sage Publications*.
- Crotty, M. (1998), “The foundations of social research: Meaning and perspective in the research process”, *London: Sage Publications*.
- Denzin, N.K., Lincoln, Y.S. (2000), “Handbook of qualitative research, 2nd edition”, *Newberry Park*, 121-124.
- DP World, *Callao Terminal*, Retrieved January 01, 2018. <https://www.dpworld.com/what-we-do/our-locations/Americas/Callao-District-Peru/callao>.
- Glaser, B.G., Strauss, A.L. (1967), “The Discovery of Grounded Theory: Strategies for Qualitative Research”, *Aldine Publishing*.
- Goodale, J.C., Kuratko, D.F., Hornsby, J.S., Co, J.G. (2011), “Operations management and corporate entrepreneurship: The moderating effect of operations control on the antecedents of corporate entrepreneurial activity in relation to innovation”, *Journal of Operations Management*, 29(1-2), 116-127.
- Guo, B., Han, N. (2010), “Competitiveness of supply chain – customer satisfaction”, *International Conference on E-Business and E-Government*, 3351-3353.

- Halldórsson, A., Skjoett-Larsen, T. (2004), “Developing logistics competencies through third party logistics relationships”, *International journal of operations & production management*, 24(2), 192-206.
- Hofmann, E., & Locker, A. (2009), “Value-based performance measurement in supply chains: a case study from the packaging industry”. *Production Planning and Control*, 20(1), 68-81.
- Hogan, J.E., & Armstrong, G. (2001), “Toward a resource-based theory of business exchange relationships: the role of relational asset value”. *Journal of Business to Business Marketing*, 8(4), 3-28.
- Kafetzidakis, I., & Mihiotis, A. (2015), “ABC in metal industry: a tool for gaining a competitive advantage”, *Journal of Economics and Business*, 18(1).
- Kannan, V. R. & Tan, K. C. (2005), “Just in time, total quality management and supply chain management: understanding their linkages and impact on business performance”. *Omega-International Journal of Management Science*, 33, 153-162.
- Li, S., Ragu-Nathanb, B. & Ragu-Nathanb, T. S., *et al.* (2006), “The impact of supply chain management practices on competitive advantage and organizational performance”. *Omega-International Journal of Management Science*, 34(2), 107-124.
- Lieb, R. C., Millen, R. A. and Wassenhove, L. V. (1993), “Third-party logistics services: a comparison of experienced American and European manufacturers”. *International Journal of Physical Distribution & Logistics Management*, 6(23), 35-44.
- Merriam, S.B. (1998), “Qualitative Research and Case Study Applications in Education”. *Jossey-Bass Publishers*, 22(5), 141-145.

- Nam, K-C., Ha, W-I. (2001), “Evaluation of handling systems for container terminals”. *Journal of Waterway, Port, Coastal and Ocean Engineering*, 127(3), 171-175.
- Nexa Resources, *Smelting Process*, Retrieved July 7, 2017. <https://www.nexaresources.com/smelting>.
- Olivier, D., Slack, B. (2006), “Rethinking the port”, *Environment and Planning*, 38, 1409-1427.
- Panayides, P.M. (2002), “Economic organization of intermodal transport”. *Transport Reviews*, 22(4), 401-414.
- Panayides, P.M. & Venus Lun, Y.H. (2010), “The impact of trust on innovativeness and supply chain performance”, *International Journal of Production Economics*, 122(11), 35-46.
- Pohle, G., Chapman, M. (2006), “IBM's global CEO report 2006: Business model innovation matters”, *Strategy & Leadership*, 34(5), 34-40.
- Reeves, T.C., Hedberg, J.C. (2003), “Interactive Learning Systems Evaluation”, *Educational Technology Publications, Englewood Cliffs*, 44(10), 27-34.
- Rumbo Minero, *Nexa Resources Cajamarquilla Reconversion*, Retrieved January 20, 2019. <http://www.rumbominero.com/noticias/mineria/nexa-resources-planea-iniciar-reconversion-de-refineria-de-cajamarquilla/>
- Sharma, R., Saxena, A., & Vagrecha, K. (2015), “Supply Chain Optimization of Zinc Industry: Opportunities, Strategies and Challenges”, *Global Journal of Enterprise Information System*, 7(3).
- Simchi-Levi, D., Kaminsky, P. & Simchi-Levi, E. (2008), “Designing and managing the supply chain: concepts, strategies and case studies (3rd edition)”, *Mass: McGraw-Hill/Irwin, Boston*.

- Skjoett-Larsen, T. (2000), “Third party logistics—from an interorganizational point of view”, *International journal of physical distribution & logistics management*, 30(2), 112-127.
- Tracey, M., Lim, J. S., Vonderembse, M. A. (2004), “The impact of supply-chain management capabilities on business performance”, *Supply Chain Management – an International Journal*, 10(3-4), 179-191.
- Vaidyanathan, G., (2005), “A Framework For Evaluating Third-Party Logistics”, *Communications of the Acm*, 48(1), 89-94.
- Vickery, S. K., Jayaram, J., Droge, C., *et al.* (2003), “The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships”, *Journal of Operations Management*, 21(5), 523-539.
- Wilson, J. (2010), “Essentials of Business Research: A Guide to Doing Your Research Project”, *SAGE Publications*.
- Zhu, J., Lean, H. S. and Ying, S. K. (2002), “The Third-Party Logistics Services and Globalization of Manufacturing”, *International Planning Studies*, 7(1), 89-104.

