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Global shipping containers shortage

Thesis work

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Abstract

The flow of maritime trade has known since the beginning of the pandemic, a growing and worrying port congestion. Numerous ports throughout the world have seen COVID 19 outbreaks and cargo delays, leading to lengthening wait times and, in some cases, weeks-long lines. Since shipping accounts for more than 80% of global trade, port congestion has had a significant negative influence on supply chains all over the world.

Without a doubt, COVID 19 has created a gap in the global container shortages, which, according to experts, will last for another two years. As a result, the pandemic is not the only issue affecting the container shortage, which is also covered in this thesis.

However, the purpose of this thesis is to analyze the global shipping container shortage using articles, news, books, and interviews with specialists in the field, and then propose solutions to mitigate this disruption using survey data.

The procedure started in March 2022 with the gathering of information, reading of pertinent literature, and creation of the theoretical framework, which was completed in October 2022. a particular interview with Kuehne Nagel, one of the biggest logistics businesses, and observations from several sources to support the data gathered.

Keywords
Supply chain, Shortage, Containers, Kuehne Nagel, COVID19

CONTENTS

LIST OF SYMBOLS AND TERMS

(CSSC) - Container shipping supply chain

(CY) - container yard

COVID 19 – Global pandemic

Kuehne+Nagel – Shipping company

(PPE) - personal protective equipment.

TEU's[1] – The measure adopted to indicate capacity is known by the acronym TEU, which means (Twenty feet Equivalent Unit).

TPEB - Transpacific East Bound (freight transportation).

(COGS) category on the income statement.

(WIP) work-in-progress

1 INTRODUCTION

People have traveled and explored the seas of planet for thousands of years, transporting the most varied types of products through it.

These products were stored in warehouses that remained in the harbor until some of the various boats were available for transport. This transport process did not have any standardization, technology or organization, the goods were transported by hand to the ship that was empty. Imagine, this process being made a load of coffee bag. All bags having to be carried one by one from one ship to the other.

For centuries, this was the only way to transport large quantities of products. However, after the industrial revolution, this lack of standardization and organization became a bigger issue, as the production of consumer goods grew uncontrollably and with the consolidation of trains (railway transport), the transfer of cargo from ships to trains was still difficult made by hand, this made the process very slow.

In 1956, Malcolm McLean, an American born in North Carolina, noticed that, in one of his deliveries to one of his customers, the longer he stopped, the less money he earned, and the process of his work took a lot of time. With the market growing, several weight restrictions and charging fees for road transport emerged.

McLean came up with the idea of creating a standard-sized trailer that could be transported in hundreds of units across the seas which is basically still in use today, as opposed to trucks that could only carry one or two "trailers" per trip. “This dramatically reduced the cost of loading and unloading a ship. In 1956, hand-loading a ship cost $5.86 per ton; the standardized container cut that cost to just 16 cents a ton. It also made it much easier to protect cargo from the elements or pirates, since the container is made of durable steel and remains locked during transport.” (Anna Nagurney, 2021)

According to Anna Nagurney this innovation made the modern globalized world possible. The amount of goods transported by containers rose from 102 million tonnes in 1980 to around 1.83 billion tonnes in 2017. Most container traffic flows across the Pacific Ocean or between Europe and Asia – usually through the Canal of Suez.

However, there is currently a crisis with container shortages, which requires consideration of several circumstances, including political, economic, festive, or worldwide pandemic difficulties. This thesis will discuss the global container shortage with a focus on the COVID-19 epidemic, which started the great gap and is still having an impact on the world now and, by all indications, has continued for a considerable amount of time.

2 PURPOSE OF THE THESES

2.1 Purpose

Containers put onto ships carry around a quarter of the volume of traded goods and three-fifths of the value transmitted by global trade. It lack has created a gap in international trade, which has an effect on how different industries and countries organize their output.

The purpose of this thesis is to examine the numerous causes of the container shortage and to suggest development based on the observations of the companies that were questioned. Articles, books, newspapers, and websites were utilized to support the given interview.

2.2 Research objectives

The thesis's primary goal was to identify the factors that contribute to global container shortages. Development recommendations can be made after analyzing the factors. Some questions must be addressed in order to accomplish this objective.

- What causes the current container shortage?
- The impact of inventory in terms of container issues.
- How does these issues impact the supply chain?
- What are the short and long-term solutions to the container shortage?

2.3 Conceptual framework

A conceptual framework illustrates the expected relationship between the variables. It defines the relevant objectives for the research process and maps out how they come together to draw coherent conclusions. (Scribor, 2022)

Before data collection began, the conceptual framework for this thesis was developed. To illustrate the cause-and-effect relationships, a visual format will be used to represent this conceptual structure.

The graphic illustration below demonstrates the main concepts that will be addressed in the thesis and how they are related to each another.

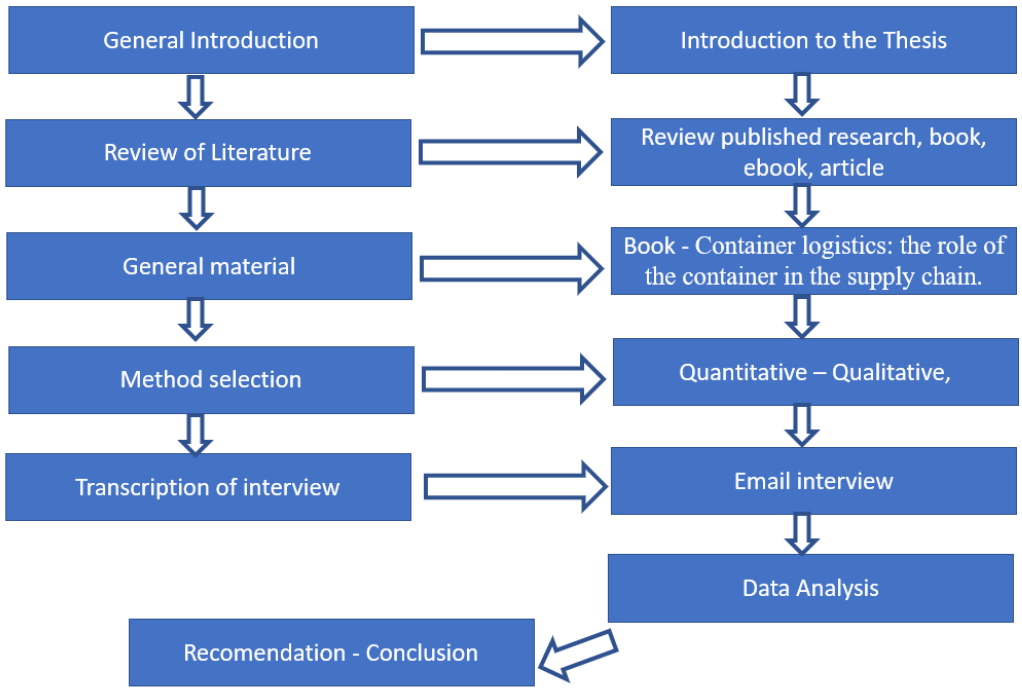

Figure 1 Conceptual framework- Graphic illustration

2.4 Boundary of the thesis

Since logistics is the primary industry involved in this thesis, a few topics like transport management are not specifically covered in this study. Although, logistics clearly identifies problems, quickly and assertively point their causes, presents workable solutions at the lowest possible cost, and responds swiftly to operational failures.

To approach good transport management departments, it would be needing the help of software and other tools, to save resources, time, and money for a company, depending on the size and robustness of the operation.

Furthermore, businesses with active fleet departments may unquestionably provide better services to clients, boosting revenue generation and profit maximization. The department of fleet management is not unimportant, but any business that wants to expand and provide better services to its direct or indirect clients must make it a strategic priority.

And for this, more detailed research on each mode of transport should be done, but there is no time and financial resources for such research, which limits this part to be studied.

Nevertheless, this study will also not address the Russian invasion, as the ongoing geopolitical turmoil resulting from the Russia-Ukraine war has affected the global supply chain, as a result, experts predict that certain Russian and Ukrainian ports could experience another round of shortage of containers. Transport delays were caused by this impact on the global supply chain. To solve the capacity problem, shipping companies are trying to add more containers, but the boxes are stuck in ports.

3 RESEARCH METHODOLOGY

3.1 Research methods

As previously stated, this thesis is based on a case study with an empirical investigation that inquire a circumstance within the context of real-world experience as its research strategy. Based on the sources from which the data was collected, the research will be splitted into qualitative research and quantitative research.

During a qualitative study, the researcher may conduct interviews or focus groups to collect data that is not available in existing documents or records. To allow freedom for varied or unexpected answers, interviews and focus groups may be unstructured or semi-structured. An unstructured or semi-structured format allows the researcher to pose open-ended questions and follow where the responses lead. The responses provide a comprehensive perspective on everyone’s experiences, which are then compared with those of other participants in the study. Qualitative research methods include gathering and interpreting non-numerical data. The qualitative data maybe,

interviews, focus groups, documents, personal accounts or papers, cultural records or Observation. (Lissie Hoover, 2021)

Quantitative studies, in contrast, require different data collection methods. These methods include compiling numerical data to test causal relationships among variables. Some forms of data collection for this type of study include experiments, questionnaires, surveys, database reports. The above collection methods yield data that lends itself to numerical analysis. Questionnaires in this case have a multiple-choice format to generate countable answers, like yes or no, which can be turned into quantifiable data. (Lissie Hoover, 2021)

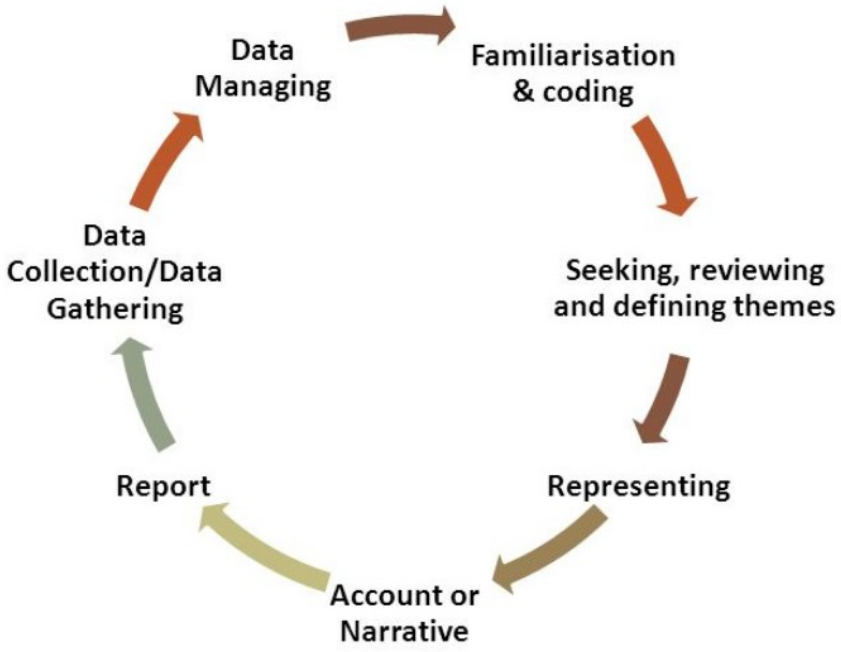

Figure 2- Phases of thematic analysis

These two research methods when combined work very well and, contrary to what many people think, they do not conflict with each other.

There are many different data and numbers available in the "Big Data" era, which provide a strong basis for decision-making. However, without the data gathered from actual individuals, which interprets the data, this base would be lacking. But how can these two research methodologies be combined? When trying to identify new issues

and opportunities, qualitative research is nearly always the place to start. This will facilitate future research. Measures will be provided by quantitative data to confirm issues and opportunities and comprehend them.

The interview that was used for this thesis was both qualitative and quantitative because it offered trends in thoughts and ideas. The data were, however, of a quantitative type because the interviewer also provided material with figures that were posted on the company's website.

3.2 Data collecting method

Both primary and secondary data will be used in the research case thesis. Primary data, sometimes referred to as raw data, are gathered from researchers themselves using their own tools and expertise with the intention of investigating the phenomenon under study. They are typically pricey since businesses need people and substantial funding to conduct the research process. They are gathered through a variety of techniques, including surveys, interviews, case studies, and questionnaires.

Primary data tends to be more complex and slower to apply compared to secondary data. The former is used to solve the phenomenon that is currently being studied. While secondary data is mainly collected for the purpose of solving different problems that could arise in the future.

The secondary data is the set of information that has already been collected by someone else during a different investigation process. Faster to obtain and at a lower cost, but in many cases, they are not updated, which can affect the success of the search. Secondary data is collected through: Publications of government organizations and private companies, books, records, articles., websites.

As previously stated, the research was conducted as follows: it was an interview with a combination of qualitative and quantitative data in which primary data were collected through a personal interview and the research was completed with content related to the topic to explain such information. The interview and research content

served as both support and criticism, as interpreted, and indicated by secondary data. It was able to accomplish several goals that would not have been possible using other methods, such as an internal database or external sources. As a result of more specific primary data, they were brought closer to the public's reality, allowing readers to form more consistent opinions on the subject.

In short, the combination of primary and secondary data enabled the generation of new and predictable insights. After all, they provide accurate information about the port situation as well as the behavior of ports, logistics companies, and supply chain.

As a result, the data assisted in maximizing the time and resources invested in the research studies.

3.3 Validity and reliability of data

Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011). It is the degree to which the results are truthful. So that it requires research instrument (questionnaire) to correctly measure the concepts under the study (Pallant 2011). It encompasses the entire experimental concept and establishes whether the results obtained meet all the requirements of the scientific research method. Qualitative research is based on the fact that validity is a matter of trustworthiness, utility, and dependability (Zohrabi, 2013). Validity of research is an extent at which requirements of scientific research method have been followed during the process of generating research findings. It is a compulsory requirement for all types of studies (Oliver, 2010).

Reliability refers to measurement that said to be reliable if it produces consistent results with similar values. It evaluates the reliability, accuracy, repeatability, and consistency of the research. It denotes the degree to which it is objective error-free, which guarantees consistent measurement throughout time and across a variety of instrument items (the observed scores). Instead of reliability, some qualitative researchers use the word "reliability." It refers to how consistently and steadily an

evaluation tool can give accurate results. demonstrates that a measure's observed score accurately represents its actual score.

Regarding, all the secondary data gathered online was checked for accuracy and subjected to editorial examination by reputable businesses and large corporations. There is no plagiarism or content change; all information gathered is the property of the authors. Wherever the content does not originate with the author, references have been made apparent, and the source of any texts or citations that have been read can be found on the reference page for the author's further observations. A summary of the author's ideas, which are the sole property of the researcher, is the information that has not been cited in any way.

4 CONTAINER AND SUPPLY CHAIN

4.1 The role of the container in the supply chain

The container has become an essential object for the transportation of goods in the supply chain. Maritime transport services have grown significantly in a globalized and competitive world. Container shipping supply chain (CSSC) is one of the most widely used modes of logistics since those compartments are the ideal size and practicality for transporting various types of loads. The most common methods of transporting containers are by sea or by truck along roads and highways. The role of the container in the supply chain will be discussed under this heading.

4.2 Global supply chain management

Various supply chain definitions have been offered in previous years as the concept has gained popularity for companies of all sizes, regardless of the material or service they work with or the industry they are a part of. According to the Supply Chain Conoucil (cc, 1997) The supply chain encompasses all the efforts involved in the

production and delivery of a final product, from the supplier's supplier to the consumer customer". It is built in four callback processes and enable have been added since then. Based on these processes, SCC developed the Supply Chain Operations Reference (SCOR) model, a cross-sector star for supply chain management (SCM) (Rolf Neise, 228).

Modern life depends on the rapid, efficient, and safe movement of a high volume of materials, components and finished products around the world. According to the World Trade Organization, world trade was about $16 trillion in 2016. Supply chains can only function if a series of interconnected systems work in harmony: shipping and transportation, information and management, and security and construction. Within these systems, there is little room for error. If the supply of cocoa from Guinea is disrupted, a factory in Pennsylvania can't produce chocolate bars. If a single supplier of paint in Japan is unable to ship goods for a week, car production in Michigan may cease temporarily. (Prologis, 2022)

Supply chain management plays a vital role in addressing the complex growth of today's global business as it brings together all the functional elements, digital optimization, and integrated automation. Companies began to look at their interactions with customers, partners, suppliers, and distribution channels within the chains in which they operate. This led to an evolution in management, which was previously primarily internal, to an extended perspective that encompasses the range of interactions and critical processes, from the origin of raw materials to the finished product offered to customers.

4.3 The importance of containers in logistics

The purpose of a container ship in the supply chain is in essence to connect the global economy and its management. Container ships carry cargo across oceans, providing the main physical link between products produced internationally and the customers who use them. Casual observers may not realize just how important the container ship remains in the era of air freight. It's estimated that more than 80% of global goods are transported across oceans via ship. That indicates the international

shipping industry continues to serve a vital purpose in the supply chain. Container ships go by many names, cargo ships, freighters, ocean liners, steam ships (whether they're steam powered or not), and sometimes simply skipping the space bar with containerships and steamships. We may jump between a few of these terms in this piece, but the gist remains the same. (Kevin Baxter, 2021)

The containers were 33 feet long, as opposed to the 40- and 20-foot containers used today. Only after the Vietnam War ended in 1968 did the container formats change and become standard models.

The container has transformed how goods are transported. 90% of all commodities in the world are transported by sea, and 60% of that, including almost all imported foods, electronics, and appliances, are packaged in substantial steel containers. The remainder is primarily made up of materials that are poured directly into the hull, like grains or oil. About US$14 trillion worth of goods go around the world within large metal boxes.

According to some experts, the invention of containers was one of the most important drivers of global globalization in the last 60 years because containers still provide greater security for cargo, lower fuel costs, and reduce pollutant emissions. Research has shown that, many of the first containers built in the world are in excellent condition to be used in dwelling projects, as containers have an extremely long life that can easily exceed 120 years.

However, in addition to being a safer environment and having simplified maintenance, since it is not necessary to update the operating systems software, transport in containers has brought several benefits to the world of maritime trade such as:

Flexibility: Containers can transport a wide variety of goods, from automobiles, grains, large machines, or food. Even oversized loads called Out-of-Gauge cargo (OOG) can be easily transported in containers.

Goods sensitive to temperature variations, such as frozen foods or pharmaceutical drugs, can be specially transported through Reefers (Refrigerated containers). It consists of an insulated material equipped with a portable refrigeration unit that can be temperature adjusted.

Efficiency: Efficiency: One of the most effective virtualization techniques for developers is containerization. Containers increase productivity in two ways: by utilizing all resources and reducing overhead.

The use of containers also eliminates the need for operational virtualization systems, hypervisors, and other obstacles that are typically introduced by virtualization techniques. The kernel of the host's operating system is used by the containers, unlike virtual machines (VMs), which rely on their own virtual kernel. This drastically reduces overconsumption and minimizes resource use.

Time optimization: Without having to handle the goods, containers can be easily transported between different means of transportation, such as from a truck to a ship or from a ship to a truck. Time is saved in this method.

Greater security: It is a safe mode of transportation because it was specifically created and made to transfer loads without causing harm or tampering. Additionally, they have security measures for customs that adhere to the technological and security requirements set forth by national laws and international conventions.

Tax break: Since containers are regarded as equipment of the transport vehicle, moving them results in tax advantages that lower the company's tax expenses.

Container transit is therefore a common technique in logistics, in addition to being a quick and affordable solution. Above all, it is a wonderful option for individuals who need to move or store loads of various shapes and sizes. This substantial compartment can be carried on

In summary, container transportation over land is not frequently the only practical route to move a commodity. It also helps to optimize logistics. Any kind of goods can be delivered in one because there are numerous different sorts of containers designed for various requirements. Despite having several benefits that are truly worthwhile, it is crucial to exercise some basic caution to ensure the shipment proceeds as smoothly as possible. Compliance with all directives issued by the authorities in destination is one of the most crucial actions to be conducted such as>

Logistics Process: Other logistics process also has significant impact on container logistic, or vice versa. This term involves all activities performed in an organization, whose objective is to apply the best strategy to ship the products and services offered, according to market demands. In this sense, tasks such as negotiations with suppliers, production planning, goods management, production, storage, and transport are part of this process.

Warehousing: Once received, the products need to be stored and organized in an intelligent and assertive way. It is important to be able to easily find each item needed to provide the service or deliver the product to ensure agility and efficiency.

Each organization usually develops its own way of storing items, by volume of circulation, by weight (staying closer to the exit), name, among other points. The ideal is to identify which is the fastest way for your business.

The less time spent locating and adding items to trucks, the lower the business costs. This organization must be periodically analyzed in order to ensure that the storage follows intelligent criteria in the stages of a logistics process.

Material handling: Numerous businesses have more than one manufacturing or distribution facility. The business has become even more difficult as a result of this reality. In order to prevent any interruptions to the production process, it is important to successfully manage the entry of products as well as the transportation and separation of cargo.

In addition to taking care to deliver goods at the proper locations and times, it is crucial to invest in technology to guarantee accurate tax data collection and employee use of personal protective equipment (PPE).

This procedure is made more efficient and automated by the employment of equipment in the warehouses, with the collection of moving items and separation for each order or customer.

Shipping Process: Shipping is basically the process of sending goods from a distribution center to customers. Involving documentation, working with carriers, tracking and handling, up to delivery and transport deadlines, as the goods move along the supply chain carrying out the shipping process.

The logistics process is an important part of the supply chain, avoiding hassles from the shipping process to the goods arrival, having container as an effective and essential tool.

4.4 The impact of container shortage on Inventory

Inventory is a very essential department for any company. It is defined as the array of goods used in production or finished goods held by a company during its normal course of business. There are three general categories of inventory, including raw materials (any supplies that are used to produce finished goods), work-in-progress (WIP), and finished goods or those that are ready for sale. (Investopedia, 2022)

In many cases, an organization's inventory its identity. More than just being an asset, inventory can be the main connection a company has with its customers. If inventory is not available when and where it is needed, customers can easily become unsatisfied. At the same time, excess inventory and returns result in a huge drain on business resources.

For the most part, inventory management is essentially a strategy for tracking products and components as they go through production, suppliers, on-hand

inventory, sales, etc. Many organizations choose to incorporate additional analysis or forecasting into their approach, but the essence and focus of inventory management will always be the inventory itself.

How inventory management works largely depends on the size of the company and the type of product being managed. For example, organizations dealing with non-perishable products, which are unlikely to become obsolete, may simply store their goods for long periods and wait for periods of low demand. However, for most companies, keeping products in inventory is not an option: food, clothing, electronic devices, and many others have different expected lifespans, after which the item's value drops significantly.

Inventory management works by cataloging and simplifying the purchase or production of these products. It helps organizations better calculate the optimal size of inventory, as well as determine which stock should be in which location at any given time. Manage inventor also helps any stored goods and controls the quantity of product for sale, picking merchandise to fulfill orders and ensuring that customer shipments are handled correctly.

How may the inventory management be impacted by the container shortage? A supply chain crisis causes a number of issues with inventory management. According to statistics, the surge in online sales increased in direct proportion to the epidemic. Sales increased as consumers moved from physical stores to online retailers, and they did so even when social isolation ended. During the height of the pandemic, even those who had never purchased anything online developed the habit.

This meant that as e-commerce grew, retail needed to adjust to the “new normal” quickly and effectively. In order to satisfy these expectations, logistics organizations then had to rethink their operations, one of which was delivery and fractional distribution. In other words, it falls under the category of a dispersed order distribution organization, wherein deliveries are dispersed across an area. As a result, multiple customers can get smaller orders in the same shipment.

Additionally, there was a stronger need for the integration of the logistical chain both during the pandemic and today, post-pandemic. Therefore, businesses with stronger integration between suppliers, products, and customers were better able to address the problems the scenario presented.

This is to ensure that communication can move more quickly, and problems can be found and fixed faster due to a well-organized import process.
The need to build both smaller and larger distribution facilities in order to serve additional regions quickly presented another difficulty for the logistics industry. As a result, some businesses in the industry were forced to switch from the centralized model of a single headquarters to a number of smaller and farther-flung operations.

According to Kuehne Nagel data, the ratio of retail inventories to sales was 1.07% in October 2021. Despite the phenomenal surge in demand (+20%), retail sales outpaced imports, bringing the ratio of inventories to sales (I/S) to its lowest level ever. Retailers are still struggling not only to keep up with sales growth, but also to replenish their inventories: the supply chain could not be suffering more.

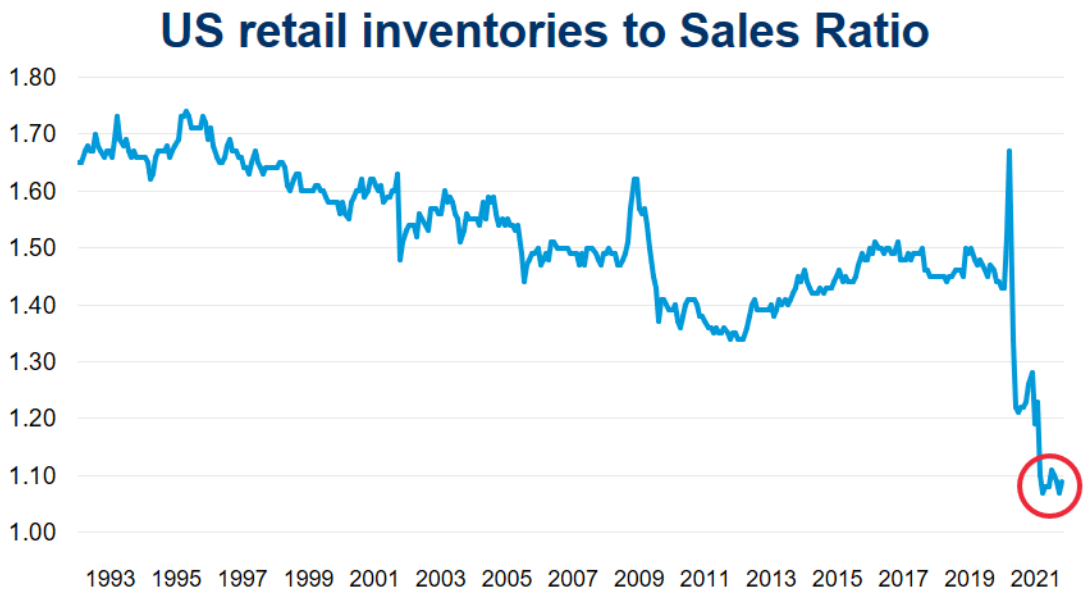

Figure 3 source: US Census Bureau, Federal Reserve Economic Data

With the establishment of small logistics and distribution centers, the units have more autonomy to devote themselves to local service, making the process more practical and organized. Furthermore, because the distance between deliveries has become shorter, this type of decentralization has another benefit: cost reduction. Thereby improving inventory management.

5 COVID19 AND CONTAINERS SHORTAGE

The global pandemic COVID-19 will be discussed under this heading since Kuehne Nagel's specialist is claimed to have never seen a serious disruption in logistics during her 20 years as a sea freighter. The specialist believes that because of the disruption, there have been tangible repercussions that call for effective study and approaches to address the worldwide shipping container shortage.

5.1 The beginning

There are several reasons for the shortage of containers and any company at a given time has already faced this issue which causes several disruptions in the supply chain and in global trade, heavily affecting shipping companies, export and import business and maritime services. A very remarkable period for this container’s shortage was the beginning of the pandemic in 2020 when shipping companies and exporters began to worry about the likely lack of containers in the global market, due to the logistics crisis caused by the coronavirus.

In early 2020, the lockdown started in China, then Europe, the US, and then almost every country. Travel and transportation restrictions have taken effect. Sales dropped dramatically, as did global trade. In June, global cargo volumes started to increase sharply; first, between Asia-US, followed by Asia-South America and Asia-Oceania. In response, carriers quickly restored capacity in some businesses, supporting the

huge increase in demand. However, as more trade routes began to recover, the situation became difficult to deal with (Kuehne+Nagel, 2022).

As a result, the shutdown of activities in China after the local New Year in late January resulted in container shortages. With the port terminals closed and the trucks stopped, there was an accumulation of cargo and, consequently, equipment in the country.

People's freedom of travel was thus limited, which led to dramatic changes in consumer habits because of the isolation of nations in early 2020. The demand for several products has risen, including electronics made primarily in China, office supplies, gloves, masks, and raw materials for medical equipment.

5.2 The impacts of the pandemic on the movement of containers

All people's lives have been significantly touched by COVID-19, which has altered both the dynamics of global logistics and the norms. When the lockdown started in March 2020 due to the need for social isolation following the pandemic, transport limitations went into place and had an influence on the import and export procedures. Without a question, the lack of containers was one of the variables that had the most impact on global logistics.

Consequently, this has hit global trade dramatically. Exports from Europe and the US. It dropped 25%. But in China it was different, exports surpassed imports. Thus, with China's exports to the US and Europe exceeding its imports from these countries, there was a sudden and unexpected shift in the direction of trade. Containers are now stuck in the west when demand is in the east. (Kragelund Lotte, 2021)

Lotte claims that as of June 2020, the situation worsened due to an increase in the volume of international shipments. Chinese exporters had to wait for boxes because of the complex cargoes that were stopped in Europe and the US.

To prevent a significant barrier for the naval sector, numerous forwarders and shippers developed novel techniques to locate containers from point A to point B as a result of the lack of containers in 2020. The Shanghai Container Availability Index is shown here, along with data showing how cargo volume grew in 2020 and 2021 (Kragelund Lotte, 2021).

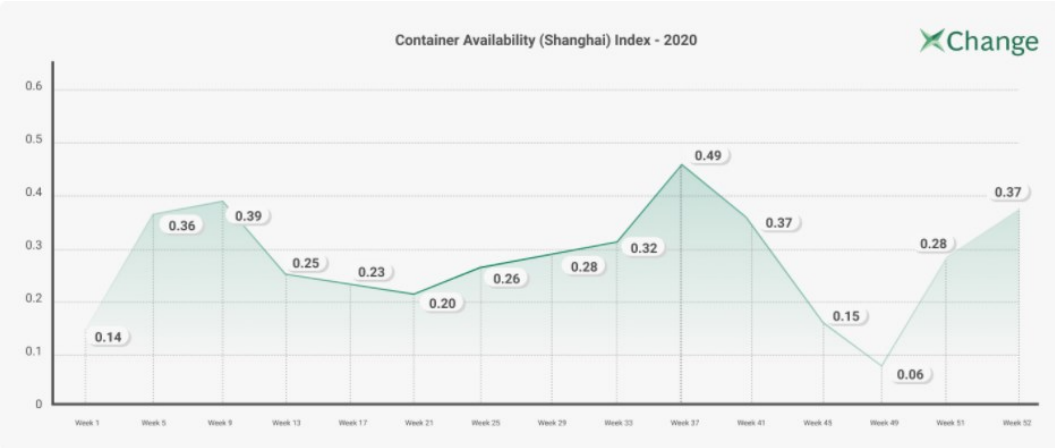

Figure 4 Container Availability Index - 2020 from Change webpage.

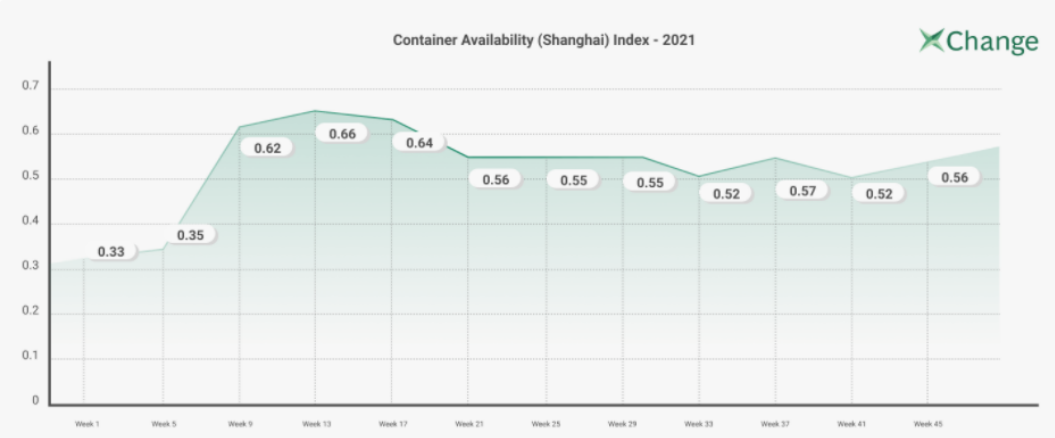

Figure 5 Container Availability Index - 2021 from Change webpage.

The challenge of high freight and a shortage of containers that everyone is currently facing demands the innovation and problem-solving skills of come managers, analysts, and customs brokers to get around any barriers that may occur. Some effects on freight are still evident as a result of the global instability caused by the Delta variation, such as:

- Delays caused on by a decline in the volume of air and sea transport.
- Customs difficulties with safety precautions.
- Improvement to the overall logistics system.
- Even with advancements in worldwide vaccination, some analysts predict that the freight dilemma will last beyond 2023.

However, in order to take action to prevent more losses, it is crucial to identify the weak points that now limit global logistics and international trade.

5.3 The decrease in container production in the year 2019

As seen, COVID 19 has clearly shown that, the lack of containers for transport around the world has been the main factor for the increase in the value of transport in recent months. However, one of the causes of the current shortage comes from the low sales and consequently the production of new containers in the year 2019, as there was surplus stock on all trade routes.

Only 2.5 million TEUs are expected to be in circulation in 2019, which is 37% less than in 2018.

Thus, with the global shock of the pandemic beginning in 2020, maritime carriers drastically reduced the amount of container entry, anticipating a worldwide drop in trade. Although a lack of containers complicates international operations, the market adaptations required to combat the virus completely deregulated maritime transport schedules.

An incredibly intricate worldwide cargo traffic system is what explains the surprising number of containers that are often visible on freighters. This means that each metal chest that carries a load that travels from one continent to another is unloaded and then replenished with goods to a new destination. Leaving problems of productivity and turnover of containers for the lack of control caused by pandemic developments.

As result, the low production of cargo units in 2019 together with the adversities of controlling global movements were the precursors of the critical situation today.

It can be seen that the normal cycle of capacity reduction against the Chinese calendar was suddenly interrupted in April 2020 by the Covid-19 outbreak.

But as the market (or demand) rapidly recovered (June 2020), the supply (or capacity) also began to increase. From the "peak supply" in September 2020 onward, growing issues with infrastructure congestion led to the suspension of a sizable portion of the available fleet, by as much as 14%.

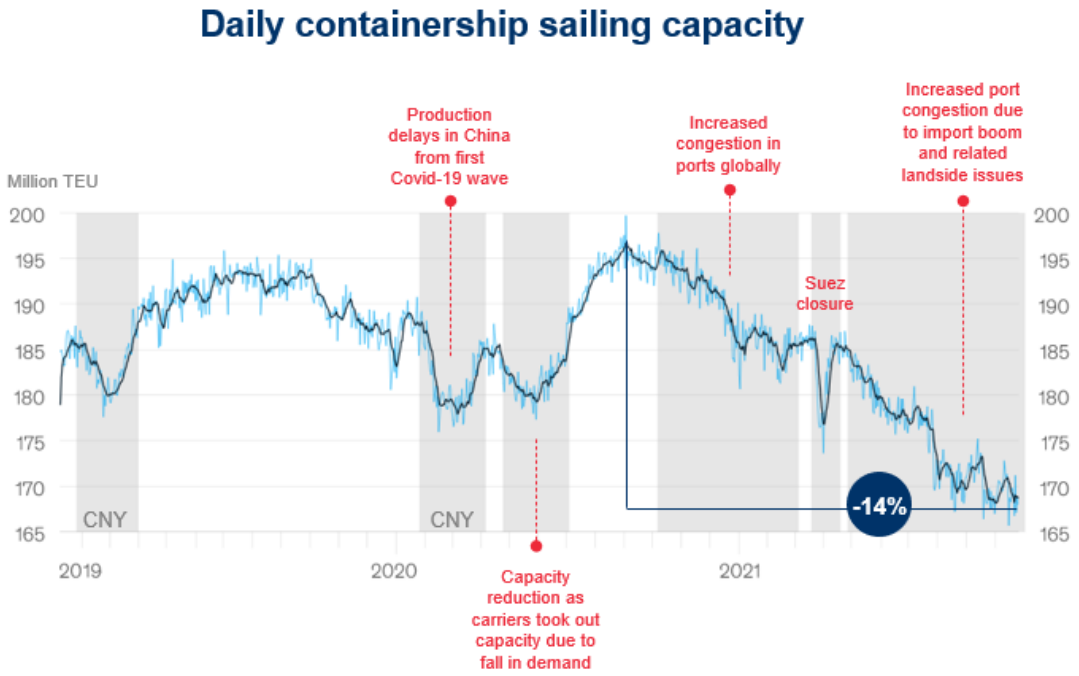

Figure 6 source: McKinsey DeepBlue – “Sporting goods 2022: The new normal is here”

5.4 The Suez Canal blockade in the pandemic

Another thing that boosted the shortage of container was the recent incident with the Ever-Given cargo ship of the shipping company Evergreen since it has implications for global trade. One of the biggest cargo transport ships in the world, the freighter became stuck in the Suez Canal for six days.

According to the BBC, the ship prevented more than 350 cargo ships from travelling the seas, blocking daily trade worth an estimated $9.6 billion.

The crew, cargo, and ship were all released on July 7 after paying a multimillion-dollar punishment. A major bottleneck that contributed to the buildup of goods and the missed deadlines that are still being felt in global maritime transportation.

The impact of the Suez Canal blockage is less dramatic, but it is not insignificant. The canal transports over 10% of global trade, including 7% of global oil. Ships was already deviating around South Africa's Cape of Good Hope to avoid it. This has slowed the arrival of containers at their destinations and delays the time when they can be emptied and refilled with goods bound for another location. This has raised costs, resulting in price increases that eventually reach consumers. (Alex, 2021)

5.5 The back of business activities

The interruption of activities in China's major cities occurred ahead of the rest of the world.

The world was gradually returning to normal life, with China serving as a starting point because it was the first to implement shutdowns in the search for coronavirus control, as well as the first to resume commercial activities. Covid's safety protocols for the movement of people and vessels in large urban areas lengthened delivery times and aggravated the situation.

Due to the disorganization of the deadlines, there was an enormous pile of containers in the ports, which forced the maritime carriers to prioritize the movement of goods over the collection of empty units in order to cut costs. Shipping firms and container producers were taken by surprise by the rapid spike in demand from the growth of trade. Everyone was dealing with a serious maritime transport issue as a result of sky-high freight charges on almost all trade routes.

In the future, 2021 may be remembered by people as a year of gradual return to normality, after a complex 2020, especially due to the COVID 19. However, although positive perspectives can already be seen in the economic sphere, the effects of this crisis are still felt in several segments, including the logistics sector. In the second half of 2022 year, for example, much has been said about the lack of containers that affects countries around the world and, consequently, negatively impacts companies that work with foreign trade.

6 RESEARCH FINDINGS AND ANALYSIS

This heading will present the findings of a research and analysis of the global shipping container situation conducted by sea freight specialist Pirjo Viherlaakso of the company Kuehne Nagel. The author's evidence for analysis was presented concurrently, along with testimony and figures to prove the research find with real data and additional information from the interviewee. The heading content was formed as follows:

6.1.1 What are the reasons for the container shortage?

There are numerous reasons for the container shortage, including the fact that large ports that did not export due to restrictions are now attracting shipowners because they are more profitable (such as Asia, the United States and Europe). This results in increased competition between routes, increased traffic, and a decrease in the proportion of containers entering and leaving ports at full capacity.

According to export experts, cargo has been piling up at ports awaiting shipment. In terms of imports, the national production chain has suffered from a lack of raw materials that do not arrive on time. Congestion, on the other hand, is a major issue for many ports around the world, and it can occur for a variety of reasons, including:

- Port or terminal overcapacity
- Delays caused by various factors
- Strikes
- Trade wars
- War
- Global Pandemic - COVID19
- Inadequate port handling equipment
- Slow productivity
- Limited yard space
- Restricted access to the door
- Port location

Due to the low volume of purchases and sales, there was a decrease in container manufacture as well. The sector is unable to meet demand while the economy is being rebuilt. Additionally, some ports only have the infrastructure necessary to handle smaller containers (20 TEUs) circumstances.

Ships can be contained for up to 15 days when restrictions are imposed in ports due to the discovery of a case of Covid in the crew. With a large volume of vessels operating at their minimum potential, optimization of the use of space is also lacking.

For instance, the two-week closure in February 2022 of the container terminal at the port of Ningbo-Zhoushan, China, the third busiest in the world because of a local outbreak of covid-19, only worsened the global situation. Sam Ruda, director of the Port Authority of New York and New Jersey, congestion will only decrease when the covid-19 pandemic is over. "That's really what will tell us how long what we're seeing today," says Ruda.

With nationwide warehouse and distribution network congestion, the number of ships waiting to port in Southern California increased. According to Global Port Tracker, major US ports processed a volume record equivalent to 2.37 million imported containers in August. The projection is for a record 25.9 million container movement of imported freight for the entire year.

Scarce slots and high shipping rates causing headaches. Almost all industries around the world are currently suffering from the same problem. Everyone is blaming COVID-19, but what's the full story? What is the cause and what can be done to mitigate this situation? (Kuehne+Nagel, 2022)

6.1.2 Congestion & disruption

Port congestion happens when the port terminal is full and vessels is unable to load or unload its cargo or operations, leading to queues and long waits for a spot at the port. Thus, congestion in ports also contributes to the container's shortage worldwide and the rising costs of ocean freight. Ports are one of many bottlenecks in global supply chains, with ships crammed with consumer goods as well as factory inputs.

In addition, port congestion is quite common in container terminals around the world, and many are attributing it to the increase in of container ships which has grown 1452.68 % in the last 50 years says Hariesh Manaadiar.

The purchase of gantry cranes as well as labour for loading and unloading operations is one method of reducing congestion and avoiding long stays in the port. However, the increased number of containers leaving a ship necessitates that the container yard (CY) be able to unload containers at the same rate.

There is an indicator for an extension of the visibility that, seaexplorer provides on global sea freight disruptions. To improve visibility of supply chain bottlenecks, the indicator aggregates worldwide vessel waiting times and shows the level of disruption at nine 'hot spot' ports. (Kuehne Nagel)

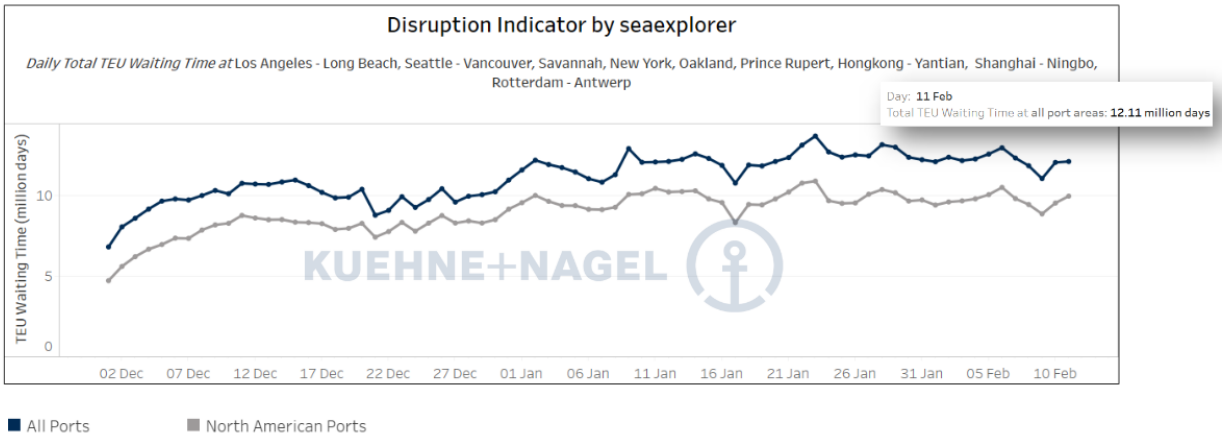

Figure 7 source: seaexplorer – 2022, Feb 11th

Pirjo estimates that North American ports are to blame for almost 80% of all disruptions worldwide. One of Vice President Biden's campaign pledges was to address the port's traffic congestion in order to save Christmas for Americans in the nation's busiest port.

"Los Angeles's ports officials, the inland capacity at the port is 90%, which means there are plenty of trucks and people to move around efficiently; 70% is considered ideal for efficient trade flow" (Lori Ann LaRocco, 2022)

In order to alert its clients, Kuehne+Nagel has been monitoring the issue and has developed a unique disruption signal. Based on vessel capacity at these important ports, the indicator calculates the total waiting time (in days) for twenty-foot equivalent units (TEUs). According to corporate measurements, a 10,000 TEU vessel sitting for 12 days is equivalent to 120,000 TEU waiting days. The data is priceless, even though the waiting days make for a catchy headline. It draws attention once more to the dysfunction at ports.

The logistics company took a broader approach to waiting at the Ports of Los Angeles and Long Beach, which are more vulnerable to the onset of global container congestion. Several factors, including a lack of drivers, skilled labour, a lack of drivers, congestion in terminals, distribution centres, and warehouses, and restrictions on maritime carriers, are the primary causes of this congestion.

The latest data from Kuehne+Nagel only reinforces the fact that the tubes of commerce are all connected and impacting each other. The Port of Los Angeles and the Port of Long Beach are essentially the largest hairballs in the system, and the ripple effects are being felt around the world. The slowness of trade had a direct impact on inflation. This revolutionary and innovative tool, which is based on the data available in seaexplorer, can also display the number of container ships waiting and the consequent value of the immobilized capacity per hot port, as well as their trend" (Lori Ann LaRocco, 2022).

6.1.3 North American bottleneck

As the pandemic spread out from its Asian epicenter, countries implemented lockdowns, halting economic movements and production. Many factories closed temporarily, causing large numbers of containers to be stopped at ports. To stabilize costs and the erosion of ocean rates, carriers reduced the number of vessels out at sea. Not only did this put the brakes on import and export, but it also meant empty containers were not picked up. This was especially significant for Asian traders, who couldn't retrieve empty containers from North America. (Hillebrand Gori, 2022)

China was the first country in the world to support exports despite being the first to be hit by the pandemic, while other countries faced and continue to face restrictions, reduced workforce, and minimal production.

Because of this, almost all the final containers coming from Asia reached Europe and North America, but they did not arrive back in time. The workforce has been impacted by the coronavirus restrictions in North America, which extend to ports, land transportation, freight terminals, and the entire continent. Without the required labour, containers started to stack. Customs procedures were difficult as the borders grew congested. Additionally, it is challenging for operators to adapt as the expectations placed on trade routes have changed swiftly.

There was no time to clear the very large backlog of containers with limited workers before more started arriving. North America currently faces a 40% imbalance, which

means that for every 100 containers that arrive only 40 are exported. 60 out of every 100 containers continue to accumulate, which is a staggering figure considering the China to USA trade route sustains on average 900,000 TEUs per month. That's during a normal year; the current shipping volume is at record highs this quarter (up 23.3% compared to last year, according to Descartes Datamyne). (Hillebrand Gori, 2022)

6.1.4 Sea explorer disruption indicator

A Seaexplorer outage indicator has been made available by Kuehne Nagel to assess the efficiency of the world's transportation networks.

The indicator shows the cumulative TEU waiting time in days in the ports of Prince Rupert, Vancouver, Seattle, Oakland, Los Angeles and Long Beach, New York, Savannah, Hong Kong, Shanghai, Ningbo as well as Rotterdam and Antwerp. Kuehne+Nagel used an example to demonstrate how the indicator is determined: One vessel with 10,000 TEU capacity waiting 12 days to enter a port equal 120,000 TEU waiting days. In addition, another box ship with 5,000 TEU waiting 10 days to enter the same port, equals 50,000 TEU waiting days. Hence, the total TEU waiting time is 170,000 TEU waiting days. (Seaexplorer, 2022)

One of the features offered by the interrupt indicator is advanced analysis and styles of the state of global commerce now. Seaexploerer by Kuehne Nagel provides enhanced visibility into international marine freight problems.

The indicator currently shows a scale and lead time of 11.6 million TEU days, a consistently high level. Less than one million TEUs of waiting days would typically occur in these nine particular ports. According to the logistics company, around 80% of the disruption is related to North American ports. 612 container ships are currently anchored or drifting in front of important ports throughout the world, according to latest Seaexploer data.

“The trendline information provided by the indicator enhances our customers' ability to predict and plan for likely future impacts on their supply chain and identify the best course of action," said Otto Schacht, Member of the Board of Directors of Kuehne + Nagel International, responsible for Maritime Logistics.
With the indicator, we have implemented a new level of data analytics for sea logistics," commented Schacht.

The technology is so innovative and cutting-edge that it makes it possible to visualise the number of container ships in port, the amount of capacity that is subsequently immobilised by hot port, as well as its trend, all based on the data accessible at seaexploere. The total blocked capacity and daily waiting vessel count at US ports are listed below.

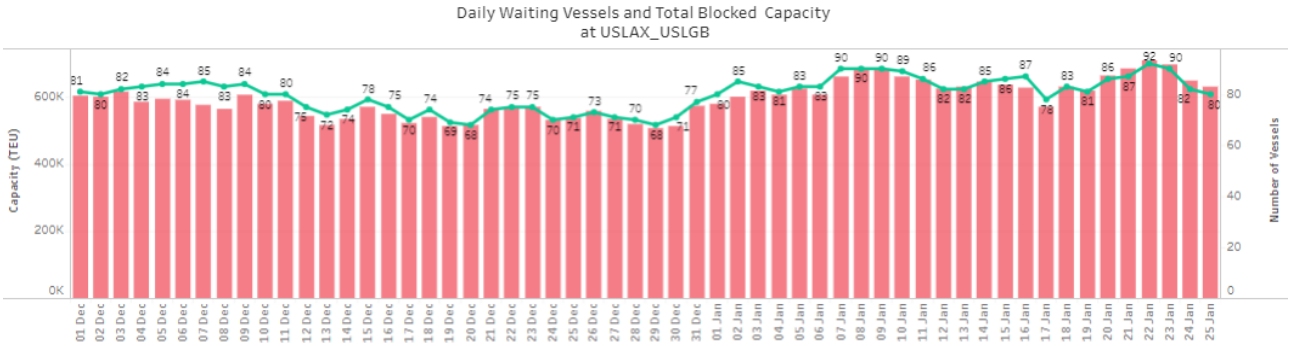

Figure 8 source: seaexplorer – 2022, Jan 25th

Current number of container ships waiting in front of world ports is 612, representing 14% of the global cellular fleet.

Figure 9 Live from the seaexplorer world map

“In terms of capacity this is highly likely to be severely skewed towards larger vessels waiting in line and therefore even more in capacity terms,” commented Lars Jensen, CEO of the Danish liner consultancy, Vespucci Maritime

6.2 How congestions can impact capacity and reliability

Across the world, several ports have faced Covid-19 outbreaks and the backlog of containers, causing waiting times to escalate and, in some cases, weeks-long queues. An example of this is Shenzhen, in southern China, one of the largest ports in the world, which at the beginning of 2022 again faced an outbreak of the virus that has been devastating the world for more than two years.

The responsible port authority was obliged to allow the arrival of containers only three days before the ships call, given the size of the queue of ships waiting to be operated in the port.

This port congestion drastically impacts supply chains all over the world, as maritime transport represents more than 80% of global trade. If there is no concrete forecast to improve this situation, how can operators minimize the impact of port congestion on the supply chain? The Supply Chain Brain portal suggests some strategies.

According to Kuehne Nagel the industry achieved an average reliability score of 77% from 2015 to 2019.

- The performance decreased to 64% in 2020 as a result of a very bad second half of the year (when the worldwide congestion began).
- With only little more than 46,000 ship arrivals observed in 2021 that were on time or earlier, that year's reliability score of 36% was the lowest recorded since monitoring began.

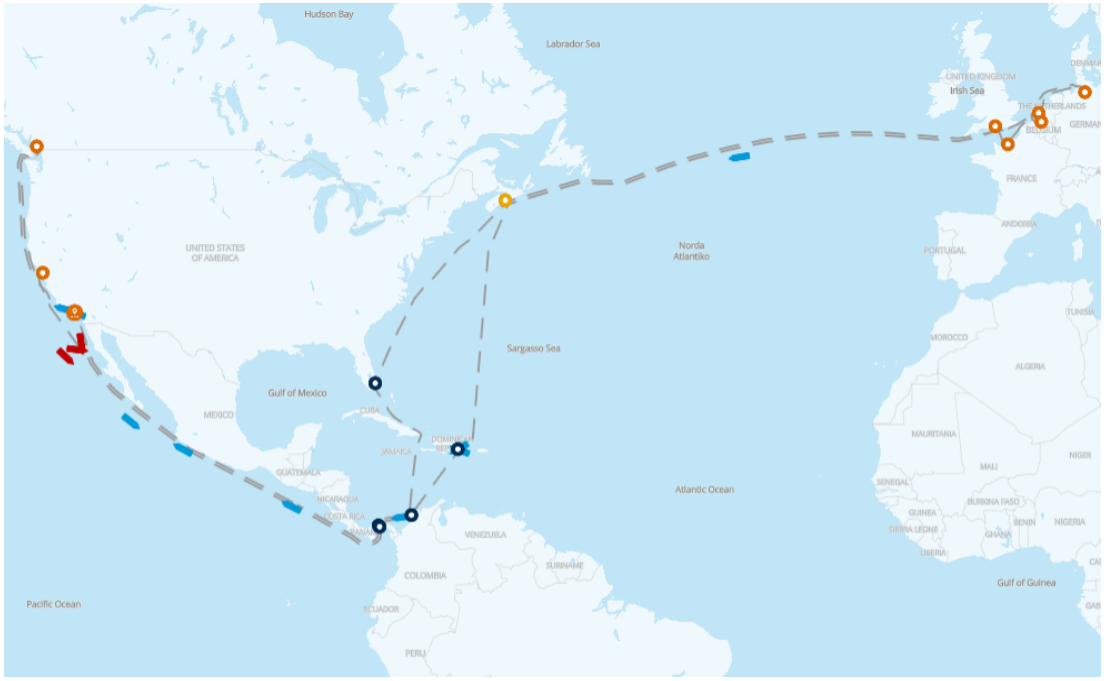

Figure 10 source: seaexplorer – 2022, Jan 25th

The service in the example above connects North Europe with US WC. Thus, the disruption is quite evident.

- 12 ships are deployed to maintain its weekly schedule.
- 1 ship is leaving Long Beach and heading to Vancouver.
- 1 ship is currently operating in Long Beach port.
- 3 ships are at anchor, waiting, in front of Long Beach.
- Other 6 ships are on their way to reach Long Beach.
- 1 ship only is heading back to Europe.

6.2.1 Schedule's reliability and unreliability 2021 analysis

The global timeliness rating fell to 32% in December 2021, the lowest level ever, according to the logistics company. The decline in performance pattern that began in the latter half of 2020 is the reason why the difference between 2021 and 2020 is now getting smaller. The number of late arrivals has also marginally increased to 7.33 days since August 2021. The delay has now lasted more than seven days.

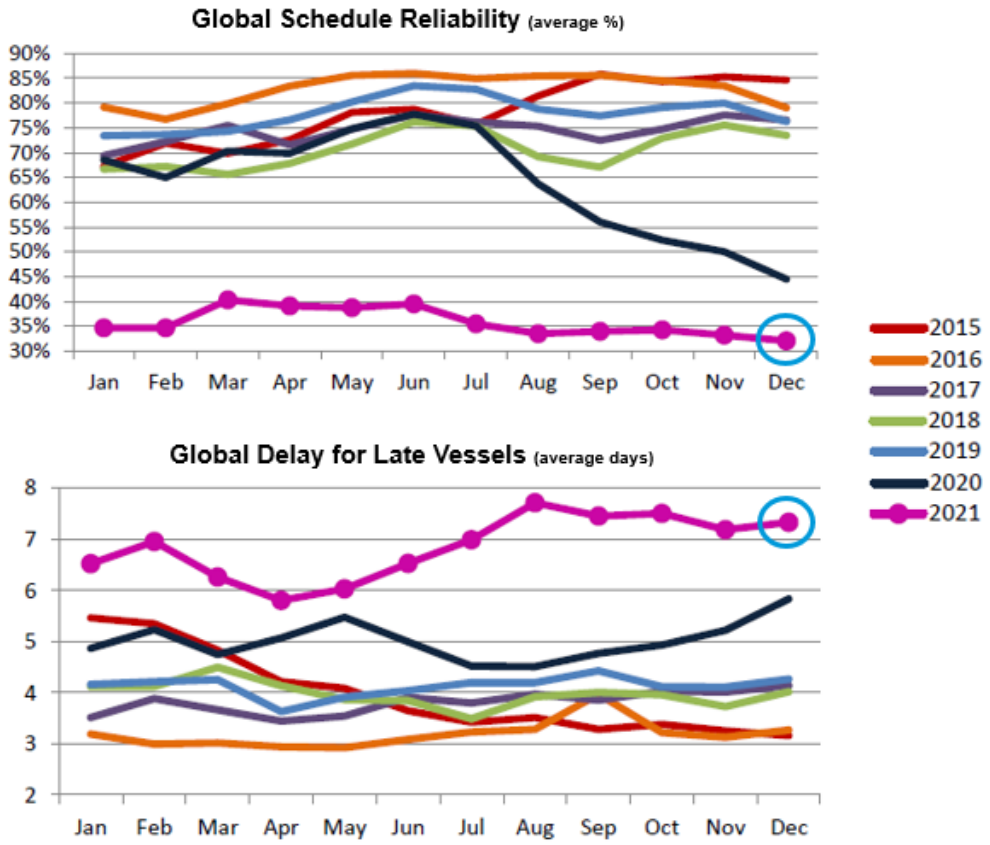

Figure 11 source: sea intelligence Maritime Analysis / Global Liner Performance Report

TPEB trade lane reliability continues to suffer as follows:

- Another 10% reduction with an average delay of 15 days was seen between Asia and the US West Coast.
- Asia/East Coast of the US received a dependability rating of 19%. (average delay: 8.5 days).
- Trade route reliability between Asia and North Europe dropped once more by 1.5%, reaching 23% with an average delay for late boats of 9 days.

6.2.2 Empty container issue

Another problem that affects port congestion is empty containers that diminish industrial activities and lock global supply networks, requiring the use of inefficient alternative methods.

For instance, at its height in 2019, it was reported that about 8,000 empty containers were stacked up at the container yard of the Manila International Container Port, some for lengthy periods of time. This prompted Customs to reduce the permitted stay of the containers from 120 days to 90 days "to free up space in the port container yards" (Hariesh Manaadiar, 2020). The UK, Kenya, Nigeria, Côte d'Ivoire, and other nations have all encountered congestion as a result of an overabundance of empty containers.

Currently, the port authority in Los Angeles is collecting fees from empty containers on its piers after considering other options. Carriers stepped up their attempts to send empty containers to Asia at the same time.

Gene Seroka, Porto's executive director, revealed plans to charge $100 for each empty container left on the property for more than nine days; the amount would rise by $100 every day. This was done in early January. Due to Porto's ongoing research into alternative possibilities, this proposal has not yet been carried out. He is searching for ways to encourage shipping companies to transport more empty containers.

Although, the port authorities, on the other hand, have stated that they do not want to encourage the rejected export container lines to receive emptier. Carriers have been accused by US exporters of leaving cargo at docks in order to take voids to Asia and take advantage of the highest rates in the East Sector. Empty containers accounted for approximately 45% of all containers in Los Angeles and neighboring Long Beach in late January, more than doubling their participation prior to the pandemic.

However, the pressure has lowered in recent weeks as carriers have added more ships to transport their containers to Asia. Between the end of October and the end of January, 27 of these trips to Los Angeles were made, carrying over 68,000 boxes, and 29 ships removed approximately 76,000 long beach voids.

The majority of containers, according to the port authorities, have so far consented to convey both their own voids and those of their rivals, removing a complexity that made efforts to remove the mountain of voids in docks challenging. If these initiatives are successful, it will take time.

6.3 Consequences

Pirjo says that the entire situation of container shortages has had significant repercussions, including excessive freight costs.

The immediate consequence of this situation is an increase in freight rates, as some shipowners are charging up to $10,000 per 40-foot container to some destinations (double pre-crisis rates). In just a few months, the price of shipping from Asia has increased four to five times. Freight rates have reached all-time highs, especially to South America and West Africa, where they are higher than all other regions. In early 2021, for example, freight rates between China and South America increased by 63% on the Asia-East - North American Coast route. On the Asia-West Coast US route, the increase is about 145%. The table below from the UNCTAD Freight Rate Increase Policy Summary illustrates this increase on the Shanghai - West Africa route. (Kuehne Nagel,2022)

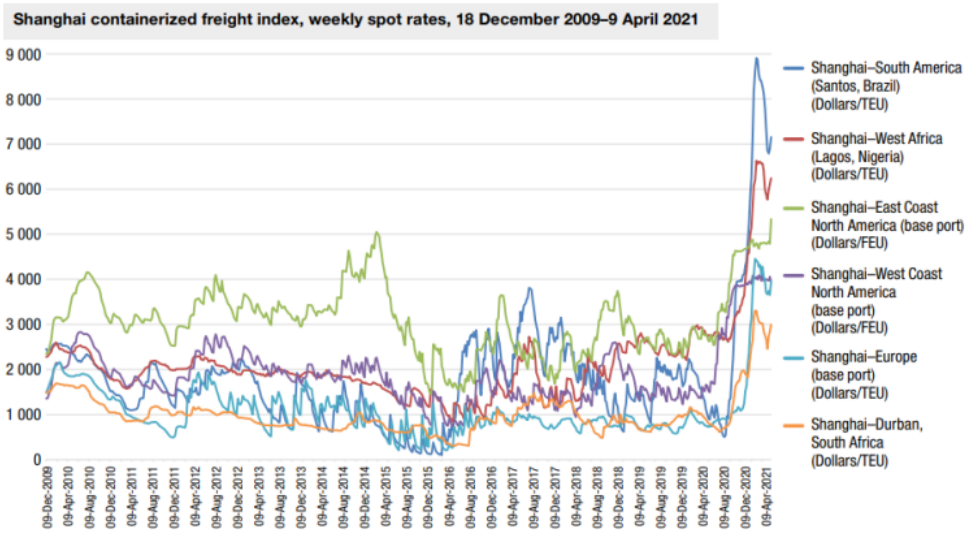

Figure 12 Shanghai containerized freight index, weekly spot rates

The price increased from less than USD 3,000 before the crisis to about USD 9,000 during the crisis, as shown in the table above. They discussed their varied tragedies during the regular meetings of the Cameroon National Shippers' Council with shippers. They openly admitted that they have seen freight rate rises from Asia of 340.15% on 20" containers and 244.04% on 40.

As an illustration, the port at Ningbo Meishan was shut down; all terminal activities had been halted since August 11, 2021. All other Ningbo terminals were operational, albeit with restrictions. Entry of export containers is restricted to two days prior to ship arrival time (ETA). Because the Covenant primarily uses the port of Meishan, ocean alliance ships are disproportionately impacted. Affected carriers have stated that they intend to divert ships to alternative Ningbo terminals or perhaps skip the port, which will likely cause lengthy delays. There will likely be delays because of congestion because other Ningbo terminals are under pressure from more ships being diverted.

During a seminar UNCTAD confirmed this trend by shippers from Cameroon, where the increase presented by Cameroon was in the range of 20 to 400%. Not only was COVID 19 the cause of this but other possible reasons for the shortage of containers around the world.

Shippers from Cameroon confirmed this pattern to UNCTAD during a seminar, where Cameroon reported an increase of between 20 and 400%. There were additional potential causes for the worldwide container scarcity in addition to COVID-19.

7 SUMMARY AND CONCLUSIONS

This thesis was based on the interview granted by Kuehne Nagel in which brought answers for many questions and updated the real situation, from the beginning of the issue to the solutions developed by the logistics company.

The period of container shortages was and can still be a hard time as the world witnessed an unprecedented disruption in the supply chain after the COVID 19 pandemic. The increase in freight and rising logistics costs have had a strong impact on all sectors of the industries. In some cases, as was presented, freight increases have grown by more than 300 percent.

As companies try to find solutions to mitigate the crisis, the domino effect continues. According to Glenn Koepke, GM Network Collaboration, FourKites, the Russia-Ukraine war is expected to have a long-term impact on global container logistics. To enable shippers to have their own containers, governments have subsidized the export and import of goods. The African continent is most impacted because there aren't enough resources to make this alternative possible. In order to leverage imports impacted by the epidemic, the National Council of Shippers of Cameroon, for instance, has already begun to take action for this issue.

Keeping in mind that, in light of the current shortage, it is not practical to utilize container cargo irresponsibly. This demands earlier planning in order to guarantee an ongoing flow of transportation services. acting more strategically in the ports, such as those in China and the USA, where there was a bigger disruption.

As new shipping capacity enters the market in 2023, new obstacles are anticipated to materialize. Therefore, it is essential that ports have the capacity to handle the required daily flow to prevent issues like COVID 19 from becoming major issues.
Thus, with a growing demand for shipping services, carriers are in a perfect position to set the rules of the game. Using the current situation to their advantage, carriers can force shippers into long-term obligations at current premium prices. Demand in the container market is still strong and is expected to remain so until 2023, according to BIMCO.

Kuehne Nagel has had success with digital solutions in which it will be of great help in mitigating future consequences of the crisis, regardless of the main reason behind the current situation, digital solutions will likely help to mitigate the consequences of the crisis.

Pirjo's overlook are the following:

- In 2022, the demand for ocean trade is anticipated to rise by more than 4%.
- Most of the growth will continue to be driven by Asia Pacific.
- Businesses in the US will replenish their stocks, mainly retailers.
- It will take 6 to 12 months for the congestion to ease (subject to demand).
- In 2022, the supply (or fleet capacity) of ships will increase by 3.6%.
- Before 2023, no new significant capacity orders will be fulfilled.
- The expansion of global infrastructure will take more time.
- Potential effects of uncontrollable elements must be considered.
- The rate intensity will not change.

To avoid shipping containers that are only partially loaded, digital technologies like Streamline and seaexplorer enable smart planning of container loading. The system considers several load characteristics like weight and volume. The number of sales days for all the items loaded in any container will remain the same thanks to

Streamline's ability to fit multiple SKUs or vendors into some containers. The GMDH Streamline automatically updates all dynamic variables, which lowers the cost of shipping and ordering as well as the quantity of manual labor and risk of human error.

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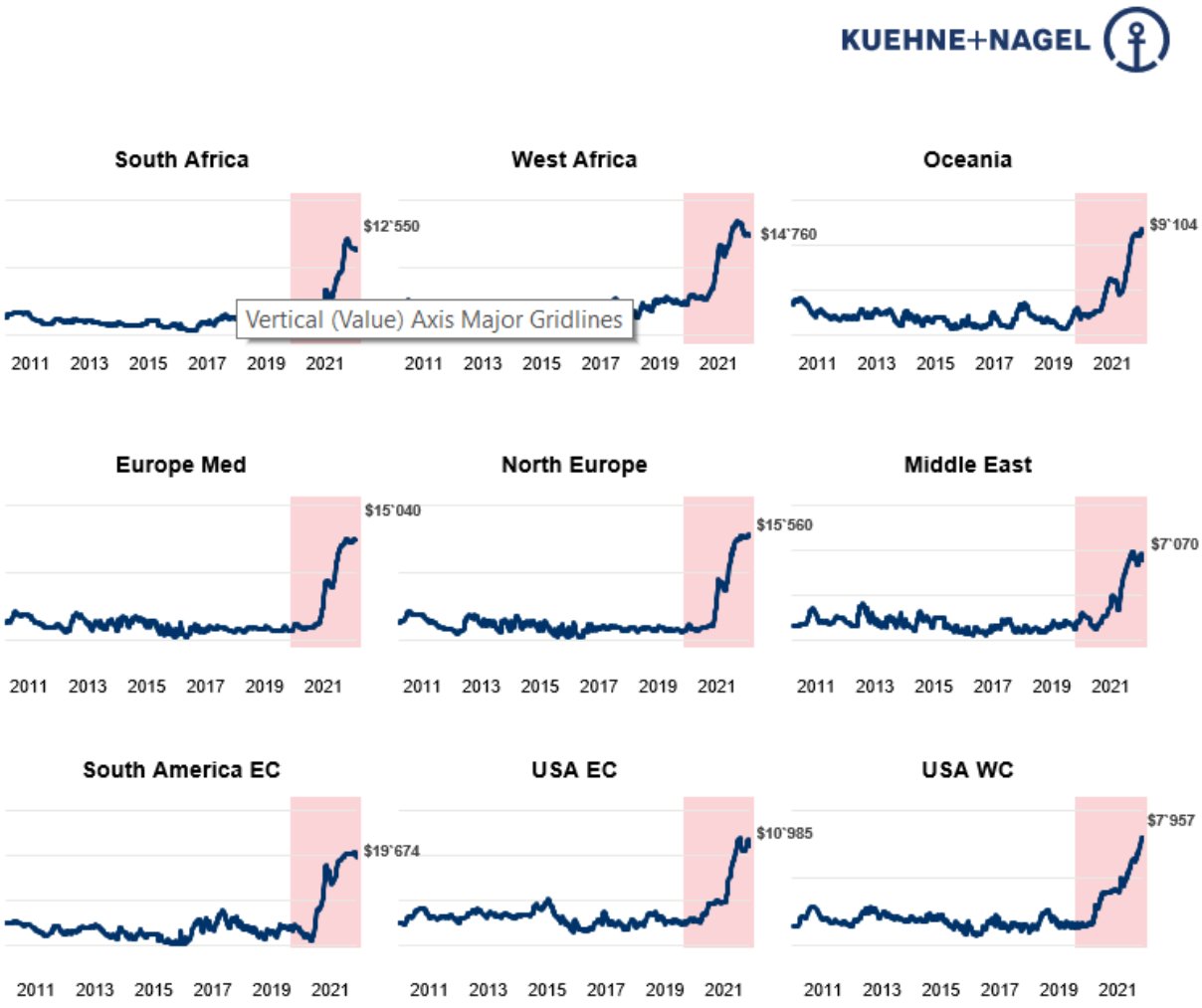
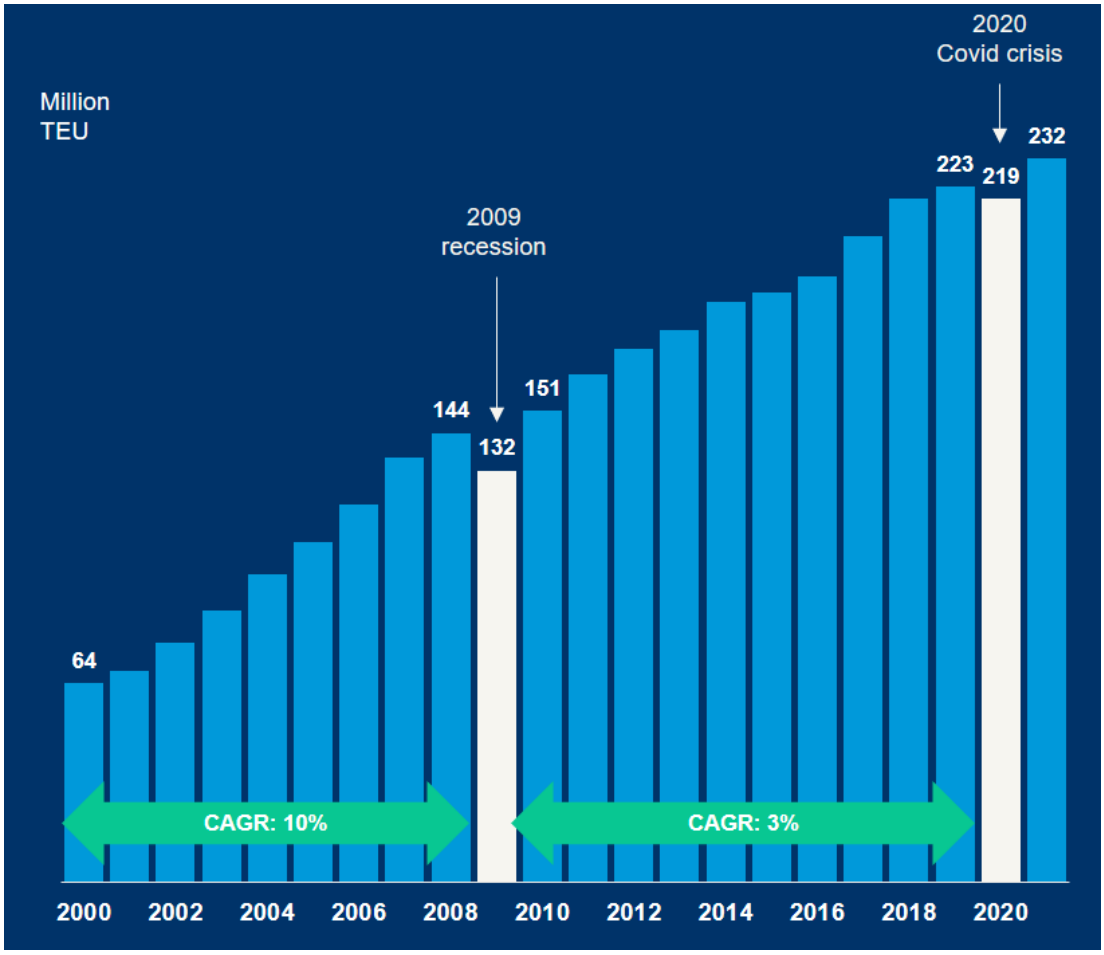
APPENDIX 1

Freight rate development - The “SCFI”



APPENDIX 2

Global containerized cargo (demand) growth



APPENDIX 3

Prepared interview questions for Ms. Pirjo Viherlaakso.

1. How would you describe the current overall situation regarding global shipping container shortage.

2. In which direction do you think the situation is going (better or worse) in the future? At which rate? Why?
• If better, what is the biggest contribution?
• If worse, what is the major reason?

3. What is your opinion on the mentioned set of impacts generated for this situation?

4. What strength and weaknesses do you think Kuehne Nagel has comparing to other Shipping companies regarding technology?

5. What would you consider the biggest challenge for mitigate the port congestion in every country especial in China and USA where the biggest bottleneck began.

6. How companies can deal better with the inventory management to minimize the harm that container shortage can cause.

7. What advise could you give for the company that are still facing trouble in the supply chain due the container shortage?