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Containerization: The New Big Era

Γρυπάρη Ανδρομάχη

Διπλωματική Εργασία

που υποβλήθηκε στο Τμήμα Ναυτιλιακών Σπουδών

του Πανεπιστημίου Πειραιώς ως μέρος των

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Τέλος, ευχαριστώ θερμά την οικογένεια και τους φίλους μου, για την κατανόηση και συμπαράσταση που έδειξαν ολόκληρη την περίοδο εκπόνησης της εργασίας μου αυτής.

To my father

Vassilis

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ABSTRACT

This is a study for containerization, that analyses its historical evolution starting from the time of its inception, the way the idea of the container 'box' as an invention was conceived, follows its highlighted historical periods, with its upturns and downfalls and the biggest players' economical moves along with these developments. Containerization is a newly established segment of the international maritime industry and by extension a great part of the global trade, which has been misjudged by many, experts and non, from its inception, but its vital importance has been acknowledged many times by the humanity throughout the years that have gone by. Following the first attempts to containerize cargo, we analyse the different types of containers used, the way of stuffing ending up in the standardization of the product.

Concluding, we are attempting to demonstrate the benefits of containerization, how it has managed to create economies of scale, survive the crisis and connect the whole world by adding value. Reaching the current period of Covid-19 crisis we present and comment data gathered.

KEY WORDS:
CONTAINERIZATION
GLOBAL TRADE
STANDARDIZATION
IMPORTANCE
ADDED VALUE

ΠΕΡΙΛΗΨΗ (ΕΛΛΗΝΙΚΑ)

Η εργασία αφορά την εμπορευματοκιβωτιοποίηση, αναλύει την ιστορική εξέλιξή της από την αρχή της δημιουργία της, τον τρόπο με τον οποίο δημιουργήθηκε η ιδέα του κοντέινερ ως εφεύρεση, ακολουθεί τα σημαντικότερα ιστορικά στιγμιότυπα, με τα σημεία ανάκαμψης και πτώσης της και τις επιχειρηματικές κινήσεις των μεγαλύτερων παικτών της βιομηχανίας σύμφωνα με τις εξελίξεις. Η εμπορευματοκιβωτιοποίηση είναι ένα νεοσύστατο τμήμα της διεθνούς ναυτιλιακής βιομηχανίας και κατ' επέκταση ένα μεγάλο μέρος του παγκόσμιου εμπορίου, η οποία έχει εκτιμηθεί λανθασμένα από πολλούς, ειδικούς και μη, από την αρχή της, αλλά η ζωτική της σημασία έχει αναγνωριστεί πολλές φορές από την ανθρωπότητα μέσα στα χρόνια που έχουν περάσει.. Ακολουθώντας τις προσπάθειες που έγιναν για την εμπορευματοκιβωτιοποίηση του φορτίου, αναλύουμε τους διαφορετικούς τύπους των κοντέινερ που χρησιμοποιήθηκαν, τον τρόπο πλήρωσής τους καταλήγοντας στην τυποποίηση του προϊόντος.

Ολοκληρώνοντας, προσπαθούμε ν' αποδείξουμε τα οφέλη της μεταφοράς εμπορευματοκιβωτίων, πώς κατάφερε να επιτύχει τις οικονομίες κλίμακας, επιβίωσε από τις κρίσεις και συνέδεσε ολόκληρο τον κόσμο προσφέροντας προστιθέμενη αξία. Φτάνοντας στην τρέχουσα περίοδο της κρίσης του κορονοϊού παρουσιάζουμε και σχολιάζουμε τα δεδομένα που συλλέγονται.

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ:
ΕΜΠΟΡΕΥΜΑΤΟΚΙΒΩΤΙΟΠΟΙΗΣΗ
ΠΑΓΚΟΣΜΙΟ ΕΜΠΟΡΙΟ
ΤΥΠΟΠΟΙΗΣΗ
ΣΗΜΑΣΙΑ
ΠΡΟΣΤΙΘΕΜΕΝΗ ΑΞΙΑ

CHAPTER 1: INTRODUCTION

1.1 Object and aim of this thesis

The objective of this MSc Dissertation is the analysis and historical evolution of the container sector, with emphasis on its highlighted historical periods, with its upturns and downfalls and the industry's leaders' economical moves that kept up with these developments. Further analysis is being demonstrated regarding the different types of containers used, the main ways of stuffing and the way we choose what is best, ending up in the standardization of the product, as well as containerization's importance as an integral part of the international shipping industry and by extension as a great part of the global trade. Since everything we know in our everyday lives moves in a fast-paced environment that presents constant changes due to the rapid development of technology as well, an inherent need is created to be fulfilled, that of faster, cheaper and more efficient transportation, especially for the immediate consumption goods. Containers, since their initial invention, operate towards fulfilling this constantly growing need, managing to ''making the world smaller and the world economy bigger'' (Marc Levinson, 2016)

Despite its misjudgment by many, the popularity containerization has enjoyed, its fast-paced growth and its additional value to the international markets, even during the last years of crisis, is what led us to choose the container sector as the main object of this current analysis.

This thesis aims to present the evolution of the containers, their utility as integral part of the whole transportation system from the shipping markets to our everyday lives. Research questions to be raised are how much value the containers have added to the transported goods, how well they have served their purpose, and if there is further space for growth in the near future. Should someone invest in containerization?

1.2 Methodology

This MSc Thesis consists of two main parts, one theoretical part giving main definitions and making a historical review of the evolution of the sector from its invention until nowadays and one part of critical aspect, where given gathered

information we may find ourselves in the position to draw into some conclusions regarding the importance and greatness of containerization in the modern world.

After finalizing this thesis' main objectives, a literature review will be carried out in international and national bibliography to cover basic concepts in the operations of the international transportation system. Emphasis will be given in the specific type of market, the liner, and the competitive conditions and the structure of demand and supply that characterize it.

Further research conducted will present the basic container types used and ways of stuffing them under the axis of utility of their users.

Following up, a gathering of different elements and information is being made in this area of research to be able to evaluate the total contribution of the container sector in the world's global trade and assess if it eventually creates an additional value in the transportation system including the last years of covid-virus crisis. In the next pages we attempt to elaborate on how containerization has been working itself out in several situations throughout the years that have gone by from both theoretical an empirical perspective, and what the conditions are, if any, for a successful, promising and prosperous future, especially in this new era of advanced technologies.

1.3 Structure of dissertation

Present MSc Dissertation consists of 5 distinct chapters as follows:

CHAPTER 1: INTRODUCTION

In chapter **1.1 Object and aim of this thesis**, we explain the main objective of this thesis, its core aim and purpose and the reasons of choosing this specific thematic area.

In chapter **1.2 Methodology,** we clarify the methodology that we used based on both theoretical an empirical perspectives, and what route we follow in this thesis, basing our research on international and national literature to come up with assessing the conditions of the era, importance of containerization and future perspectives.

In chapter **1.3 Structure of dissertation**, it is the current chapter that we give a summary of what each chapter includes and refers to.

CHAPTER 2:THE INTERNATIONAL TRADE: SHIPPING

In chapter **2.1 Definitions and overview,** we base our analysis on work and quotes from Adam Smith, 1776, Erling Naess, Martin Stopford, 2009 giving some basic

definitions regarding this shipping industry's segment beginning a historical overview that follows the evolution of sea transport from the beginning of the times.

In chapter **2.2 Transportation System: The Container,** we base our analysis on the pieces of work of Sir Walter Raleigh, 1829, 1965, Maria G Burns, 2014, Marc Levinson, 2016, Matthew Heins, 2016, McKinsey 1967,1972, Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015, Paul Krugman, 2009, and attempt to demonstrate the connection of the transportation system to the container.

CHAPTER 3: HISTORICAL EVOLUTION OF CONTAINER

In chapter **3.1 Container's Shipping Background,** based on work from Marc Levinson, 2016, Containerization International, 1970, Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015 we demonstrate the initial historical background of the container shipping industry and we analyse the conditions under which the need and the idea of the container were born.

In chapter **3.1.1 Emerging 'load-centers', hinterland-foreland continuum** based on work from Marc Levinson, 2016, David Guerrero, 2014, Guerrero and Proulhac, 2014, Hoare, 1986, Mayer , 1978, Frémont and Soppé, 2007, Leah Brooks, Nicolas Gendron-Carrier, Gisela Rua, 2021we attempt to demonstrate the impact of containerization to global ports and their evolution to load-centers in the direction of creating competitive advantage leading to a hinterland-foreland continuum

In chapter **3.1.2 Containerization: the circumstances that born the idea of the 'box'** based on work from Rodrigue Guerrero, 2014, Marc Levinson, 2016, Kendall, 1986, latest reference: Leah Brooks, Nicolas Gendron-Carrier, Gisela Rua, 2021, Kerem Cosar and Banu Demir, 2018 we present the circumstances and conditions under which the idea of the container was born giving the characteristics of that era as well as containerization's main objective

In chapter **3.2 The Idea and The Inventor,** based on work from Marc Levinson, 2016, René Borruey, New York Times, 2016, Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015 , we outline the character of the container's inventor, Malcom McLean, describing the conditions under which he managed to conceive the idea of the container invention and implement it performing his first container trip.

In chapter **3.3 Container standards and uses:the pioneers,** based on work from Marc Levinson, 2016, Brooks, 2021, Thill and Lim, 2010, Capineri and Leinbach, 2006,

Wandel and Ruijgrok, 1993; Janelle and Beuthe, 1997; Helling and Poister, 2000; Hesse and Rodrigue, 2004; Notteboom, 2004;Leinbach and Capineri, 2007; Rodrigue, 2008;latest reference:Jean-Claude Thill, Hyunwoo Lim, 2010, Notteboom and Rodrigue, 2009, latest reference:Jean-Claude Thill, Hyunwoo Lim, 2010, we give the different container types that have been used so far, the key innovations of containerization, its direction towards intermodalism approach and its transformational influences

In chapter **3.3.1 The inventor of the precursor of the 20-feet-equivalent unit** based on work from Marc Levinson, 2016, Brooks, 2010, Guerrero, 2014, De Neufville and Tsunokawa, 1981, we outline also McLean's biggest competitor's efforts: Matson's, presenting the transition of ports and vessels in order to accommodate economies of scale as well as the spatial impact of containerization

CHAPTER 4: CONTAINERIZATION: The New Era

In chapter **4.1 Standardization,** we base on work from Marc Levinson, 2016, Rietveld,1997, Janelle and Beuthe (1997), Roson and Soriani (2000), Tavasszy et al. (2003), Rodrigue (2004), Hall et al. (2006), Jean-Claude Thill and Hyunwoo Lim, 2010, Kerem Cosar and Banu Demir (2018) in addition to our personal experience, we give the picture of what container meant to different groups, what types of containers were used, what happened before ending up in the standardization of the containers and container usage: We explain also the major categories of containers used today and what for.

In chapter **4.2 Stuffing: Making every cubic meter count,** based on personal experience from daily operations at work we analyse a question once raised from an academic of ours in the University in an attempt to explain his answer describing in this way the different types of stuffing of containers nowadays, and how volume of cargo matters.

In chapter **4.3 The Benefits : Economies of Scale and crisis,** based on the work from Marc Levinson, 2016, Brooks, 2021, Containerization International, 1976, Martin Stopford, 2009, Kerem Cosar and Banu Demir, 2018, David Guerrero, Jean Paul Rodrigue,2014, David Hummels, 2007, Bernhofen, El-Sahli and Kneller, 2015, Bernhofen, El-Sahli and Kneller, 201, Mayer, 1978, Hoare, 1986,, we explain how containerization has benefited the global trade and economy, how the evolution of containerships resulted in accomplishing economies of scale, and how the leading

companies of the industry walked themselves out of the crisis periods in grace.We also present findings from scientific literature regarding the fixed costs of containerization and its general impact on transportation cost reductions.

In chapter **4.3.1 The effects: How much value did containerization add?,** based on work from Bernhofen, El-Sahli and Kneller (2015), Mark Levinson, 2006, 2016,Paul Krugman, 2009, David Guerrero, 2014, Jean-Claude Thill and Hyunwoo Lim (2010), Cosar and Demir (2018), Hummels (2007), Joan Al-Kazily (1981), we reach to conclusions regarding the importance and total contribution of containerization presenting the ways containerization has managed to add value

CHAPTER 5: ''What about now?''

In chapter **5.1 Containerization: Connecting the World and adding value,** based on the pieces of work of Hu Qin, Zizhen Zhang, Zhuxuan Qi , Andrew Lim, 2013, Marc Levinson, 2016, Wikipedia.org, Chandra Prakash Garg and Vishal Kashav, 2019, Lam, 2015, Pietra Rivoli, 2009, Ta. Choo and Sum (2000), Wang, Zantow, Lai, & Wang, 2006, Wiley Blackwell,2017, Chandra Prakash Garg, Vishal Kashav, 2019, Brooks, 2021, Www.Wartsila.com; Furfari, 2016; Thomson et al., 2015, Sunil Tiwari, Hui Ming Wee, Yanjie Zhou and Leonardo Tjoeng, 2020, Nader R. Ammar and Ibrahim S. Seddiek (2020), (Rao and Holt, 2005), we connect the meaning of containerization and its great importance and vital impact on the world as we know it today, with examples of the toys that we grew up with, like Barbie dolls and the route a T-shirt is following until we buy it and wear it, discussing also China's market place and potential within this environment. We end up this chapter giving the way containerization has managed to offer a product in the trade by adding value simultaneously and close chapter with conditions and trends existing nowadays regarding the aspects of value creation, environment, strategy implementation.

In chapter **5.2 Containers in the Covid-19 crisis period,** based on data gathered from UNCTAD publications, 2021, articles publiced by Mr. Lambros Karageorgos (2021), and Professor Luigi Zingales(2021), along with personal experience of living in this period, we describe how containers behaved in the Covid-19 crisis period, giving the reasons why, and comments from people within the industry regarding their opinion on what the future withholds.

In the chapter **Conclusions,** we summarize and state in brief the results from our research so far answering in the questions initially raised as basic purpose of this thesis.

CHAPTER 2:THE INTERNATIONAL TRADE: SHIPPING

2.1 Definitions and overview

In order to give a broad definition of what international trade is, someone could say that it is the economical relations between nations developed and driven by forces all around the globe, due to the abundance of resources in some specific geographical areas and their scarcity in some others. Erling Naess, a bulk shipping magnate, did once said, that, "***God must have been a shipowner. He placed the raw materials far from where they were needed and covered two thirds of the earth with water"***. This is said to emphasize that they way the world is developed -naturally or not- has contributed to the expanded shipping transportation of cargoes. Adam Smith, the great Scottish economist and moral philosopher of the 18th century, in his piece of work ‘’Inquiry Into the Wealth of Nations’’, argued about the advantages of shipping transportation the following: ’Such therefore are the advantages of water carriage, it is natural that the first improvements of art and industry should be made where this convenience opens the whole world for a market to the produce of every sort of labor’’(Adam Smith, Inquiry Into the Wealth of Nations, 1776).

Since the ancient times of performing trade -the first time cargoes were moved by sea, was more than 5000 years ago-, people understood the utility and additional value of sea trade and transportation in comparison with the other means used. Vasco da Gama arrived in India in 1457 only to find out that he could purchase pepper for 3 ducats in Calicut and then sell it for 80 ducats in Europe. This is one plain and typical example of

how sea transport could help traders exploit the interregional arbitrages. What is more in this analysis, this does not only constitute a commercial and business success, but it is also a way of improving people's lives and this is the actual meaning of sea transport when it is characterized as ''a means of added value''. Giving some further explanation: when sea transportation was used to move spices from Asia to European countries, volumes being carried were far greater than those that could have been carried by land, by camels. It was a proven successful way of transporting goods in large quantities in an easier way. The rhetoric question that is raised from this is, ''Has this method of transportation improved people's lives or not?'' Over the passing centuries, based on this main philosophy, of bringing goods from places that can be found in the lowest prices and greatest quantities in the most economical way through sea, shipping has become more efficient, presenting rapid paces of growth. (Martin Stopford, 2009).

Someone could, although, impose an argument regarding the above-mentioned definition regarding international trade. According to Adam Smith in his work ''An inquiry into the nature and causes of the Wealth of Nations'', another aspect that must be examined when detecting the flow of international trade is the wealth produced by each nation. Adam Smith specifically stated that:

''*The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life, which it annually consumes, and which consist always either in the immediate produce of that labour, or in what is purchased with that produce from other nations. According, therefore, as this produce, or what is purchased with it, bears a greater or smaller proportion to the number of those who are to consume it, the nation will be better or worse supplied with all the necessaries and conveniences for which it has occasion*''(Adam Smith, An inquiry into the causes of the Wealth Nations'', 1776, Introduction and Plan of the Work, p.1). In every nation this proportion is regulated by two different circumstances: 1.the skill, dexterity, and judgment with which its labour is generally applied; and 2. by the proportion between the number of those who are employed in useful labour, and that of those who are not so employed. This statement draws away the attention from the type of soil, climate and/ or extent of territory of any particular nation and ends up in the conclusion that each nation's annual supply (abundance or scantiness) depends on the way labour is

generally applied and how many people are employed (Adam Smith, An inquiry into the causes of the Wealth Nations'', 1776, Introduction and Plan of the Work, p.1).

Given the different parameters defined above, we may be able to move our research one step further, following up in the next chapters, understanding how the sovereign forces are driving the global market towards one specific direction. The purpose of this chapter is not to give the so many different definitions regarding international trade, rather than depict the greater background that our research is referring to.

2.2 Transportation System: The Container

English adventurer Sir Walter Raleigh (1552-1618) wrote in the 17th century that:

''*Whosoever Commands the Sea, Commands Trade; Whosoever Commands the Trade of the World, Commands the Riches of the World, and Consequently the World Itself''(* Sir Walter Raleigh, "A Discourse of the Invention of Ships, Anchors, Compass, &c.," The Works of Sir Walter Ralegh, Kt., vol. 8, p. 325 (1829, reprinted 1965).

Throughout history, civilizations have traditionally been using their seaports to establish diplomatic and trade relations with other nations, accumulating wealth, conquering geographical boundaries, minimizing global distances. In this way, ports and ships have developed the maritime world into a fusion of markets, commodities and factors of production. (Maria G Burns, 2014). What is of paramount importance in the effective operation of this whole global transportation system is the supply chain integration. By that, we define all the facilities available and used in the flow of cargo across global supply chains. In an attempt to gain the so-called ''competitive edge-advantage'' ports, by making optimal use of the factors such as production, labor, capital, assets, land use, technology and innovation, have evolved into hub ports, whose primary purpose of existence is to connect the seaborne commodities with the inland infrastructure. Global commodities markets have enjoyed a soaring growth under the scope of globalization, technological innovations and the intensification of trade agreements (Maria G Burns, 2014).

This is the part where the homogenization of cargoes transported appears to play the most important role of all, and that the extensive use of containers seems imperative.

The value of this utilitarian object lies not in what it is but in how it is used. The container is at the core of a highly automated system for moving goods from anywhere, to anywhere, with a minimum of cost and complication on the way. (Marc Levinson, 2016). It can be loaded ex-factory, from one trader's premises, be loaded to a truck to cross land, be integrated to the rail system and then again transshipped to a boat, and all these without changing statement and/or packaging of cargo. Summing up, the container, is a ''*globally standardized object, that carries cargo moving in international trade, and it utilizes and fits within the existing transportation infrastructures of shipping, trucking and railroads. In this way it binds them together into a nearly seamless worldwide logistics network. This whole process occurs not only in ocean shipping and at ports, but also deep within national territories*'' (Matthew Heins, 2016).

McKinsey and Company documented that containerization has affected the entire transportation industry (McKinsey 1967,1972). Numerous other studies have linked it with the creation of the modern intermodal transport system that has accomplished reducing delivery time through intermodal cargo movements between ships, trains and trucks, while increasing dramatically shipping capacities. Several students of transportation technology and this field's discrete researchers have claimed that, the introduction of steamships and rail may had been the main changes in transportation technology that underpinned the first wave of globalization (1840s-1914), but containerization was the core element of revolution that characterized and supported the post World War II growth of world trade (Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015). Paul Krugman, more specifically, wrote (2009, p.7):

''*The ability to ship things long distances fairly cheaply has been there since the steamship and the railroad. What was the big bottleneck was getting things on and off the ships. A large part of the costs of international trade was taking the cargo off the ship, sorting it out, and dealing with the pilferage that always took place along the way. So, the first big thing that changed was the introduction of the container. When we think about technology that changed the world, we think about glamorous things like the internet. But if you try to figure out what happened to world trade, there is a really strong case to be made that it was the container, which could be hauled off a ship and put onto a truck or a train and moved on. It used to be the case that ports were places with thousands and thousands of longshoremen milling around loading*

and unloading ships. Now longshoremen are like something out of those science fiction movies in which people have disappeared and been replaced by machines"
(Paul Krugman 2009, p.7, latest reference:Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015).

But question inevitably raised is ,''How did we all end up here? From where did this whole idea of the container begin''?

CHAPTER 3: HISTORICAL EVOLUTION OF CONTAINER

3.1 Container's Shipping Background

Container's shipping history does not go a long way back through the past years since it is part of the maritime industry's most recent history. The early growth of containerization, can be tracked back and said that was nurtured by the port of New York Authority (which is now called the Port Authority of New York and New Jersey). Although enough records cannot support it, since the majority of them had been destroyed in the terrorist attacks on the World Trade Center on September 11, 2001, Marc Levinson (2016), in his work ''The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger'', outlines the historical evolution of the container industry very eloquently from the invention of its idea, giving the necessary emphasis on the highlights spotted, based on documents, oral histories from remarkable people from the industry, museums, libraries and universities, the military history and its extensive collection of oral histories as well.

People's everyday routine lives regarding pace of consuming goods haven't always been the way we know them today. Before the container, transporting goods was expensive, in a level that it was uneconomical to ship several categories of cargo halfway across the country. Much more halfway around the world. Back in 1956, China was not the world's workshop and French clothing designers did not have their exclusive apparel cut and sewn in Turkey or Vietnam. The entrance of the container in the transportation system is what made shipping cheap, and by doing so, changed the shape of the world economy (Marc Levinson, 2016). As expressively mentioned before (1970) : "*Born of the need to reduce labor, time and handling, containerization links the*

manufacturer or producer with the ultimate consumer or customer. By eliminating as many as 12 separate handlings, containers minimize cargo loss or damage; speed delivery; reduce overall expenditure". (Containerization International, 1970, p. 19, latest reference:Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015)

3.1.1 Emerging 'load-centers', hinterland-foreland continuum

Cities, busy ports and waterfront communities that were occupied in loading and unloading break-bulk cargo had declined since the appearance and broad use of the containers. Shipping lines that had to adapt to container shipping standards were crushed and merchant mariners' daily spare waiting time was limited to few hours ashore until cranes would finish loading/ unloading the huge metallic boxes on/ off the ship.

Even though, containers destroyed the old economy, they opened new horizons for a new one to be built. In this way, ports like Busan and Seattle moved into the front top ranks of the world's busiest ports. The pre-existing industrial complexes started being replaced gradually by specialized plants that were shipping components and half-finished goods to one another in ever lengthening supply chains. Emerging countries, in some cases, were about to become the suppliers to the developed ones. Industrial complexes mushroomed in places like Los Angeles and Hong Kong, simply because the cost of importing raw materials and exporting finished goods had 'dropped like a stone'. (Marc Levinson, 2016).

An area of great interest is what David Guerrero (2014), demonstrates in his research ''Deep-sea hinterlands: Some empirical evidence of the spatial impact of containerization'', how global ports (with reference to France, 2005 data) manage to serve also larger hinterlands (='*the inland area that delimits the points of origin and destination of maritime shipments handled by the port*''), but with their prominence over secondary ports to depend on the types of cargo handled. His model results in the conclusion that most (but not all) of the types of cargo flows are strongly constrained by distance. His findings end up in the conclusion that French hinterlands are strongly distance-constrained, meaning that the maritime flows of its inland developed regions are mainly being handled by the nearest ports. There are, though, inland regions - large

cities (with a population in excess of 200,000), such as Paris, that generate the most important manufacturing flows due to the abundance of wholesalers located there (Guerrero and Proulhac, 2014). The shipping lines that adopted the trend toward 'load centering' and 'hubbing' is what led large ports to having the largest number of port calls, serving most destinations and boosting the best of hinterland connections. The inland urban areas that were generating increasing amounts of cargo, especially manufactured goods -mostly containerized, became crucial load-centers, points that were handling the greatest volumes of cargo flows.

With regard to the consequences of containerization on hinterlands and forelands [='' the set of inland areas served by the port by means of maritime transportation'' (Guerrero,2014)], Hoare (1986), argued that containerization resulted in shippers preferring to concentrate trade and services to particular overseas destinations at particular ports, which justifies the 'boom-growth' that specific industrial complexes acknowledged as mentioned above. Mayer (1978), claimed that the high capital cost of container ships and container handling equipment and tools created a push towards its maximum utilization. This push led to the creation of the so-called 'load-centers', the concentration of freight flows at one or two big main ports by region that marginalized all other secondary ports. Areas that managed to combine the effect of development of container shipping with the completion of interstate highway network, were the ones that stood out and gained the 'competitive advantage' (Mayer, 1978) thriving in an environment characterized as 'hinterland-foreland continuum' (Frémont and Soppé, 2007).

''*Between 1950 and 2010, population in counties near containerized ports grew about twice as rapidly as in other coastal port counties because of containerization*''(Leah Brooks, Nicolas Gendron-Carrier, Gisela Rua, 2021).

3.1.2 Containerization: the circumstances that born the idea of the 'box'

A simple approach to investigate the diffusion of the containers within global transport systems is to look at the geographical growth structure of individual container

ports. (Rodrigue Guerrero, 2014). Guerrero (2014), presents his research in the cyclic behavior of containerization providing evidence through an analysis of the phases of a Kondratieff wave (K-wave). According to him, there are three basic reasons to consider waves when analyzing containerization: first is that containerization waves are indicative of global changes in a broader economic environment; second is that waves depict the circular relationship between maritime transport and economic development; and the third is that cycles are a useful tool for forecasting future containerized traffic by considering growth processes in a linear fashion, while growth's extent and rate are nonlinear. The substantial growth of containerization can be explained by an array of growth factors, the contribution of which varies in different time periods. In the 1970s, for instance, the substitution of general cargo handling tools by the container led to growth; in the 1980s and 1990s the main driver was the growth of international trade and in the 1990s and 2000s the development of intermediary hubs played the leading role (Guerrero, 2014).

Undoubtedly, the entrance of the container in the transport systems created a new economic geography and this allowed firms to become international companies, as soon as exporting and importing their products was done almost as effortlessly as selling them nearby. For those who did not want to go international, the future seemed ominous and they were up against one big decision, the type of ''take it or leave it'' because they were going to compete globally with the whole market.(Marc Levinson, 2016).

In the early 1950s, before container shipping was even a concept, the world's greatest commercial centers had docks, where millions of people were employed in the freight transportation. There were waterfronts and workers clambered up gangplanks with loads on their backs or toiled deep in the holds of the ships, stowing break-bulk cargo.The basic concept back then was for the factories and warehouses to be located near the docks for easier delivery of raw material and faster shipment of finished goods. Thus, location was playing the greatest part of minimizing the cost of transportation. These operations of loading, stowing and recording every single item one by one, either it was bales of cotton or barrels, was very time - consuming and also imposed dangers in the job of the longshoremen or otherwise called the ''dockers'', as it was considered a ''heavy'' job. The only existing means of automation arrived during World War II, when forklifts were used to move pallets from the warehouse to the side of the ship and

conveyors in some ports were used to unload bags of coffee and potatoes, but even with this kind of machinery handling cargoes with muscle power was inevitable. Longshoremen had to work irregular times, days and shifts in all weather conditions no matter what and under these circumstances they were facing high risks on their duty with an injury rate three times that of construction work and eight times that in manufacturing.(Marc Levinson, 2016)

Levinson (2016) describes that the ships of this era were breakbulk vessels that had several levels of open space below deck to handle almost any kind of dry cargo; the so-called Liberty Ships, which were very slow and cheap enough to be expendable and the Victory Ships (1944,U.S.), which were much faster than the 11-knot Liberty Ships, but only a few feet longer and wider. Both of these types were sold by the U.S. Navy after the war, for commercial use in Europe and China (late 1945). None of these ships was commercially efficient and the trickiest part was that the longshoremen had to know how exactly to fill these ships' odd dimensions, because for every shipowner, wasted space equaled with wasted money. Furthermore, each and every hold had to be stowed tightly so that no cargo would shift during the ocean voyage imposing a threat to ship's stability and, consequently, seaworthiness. Experienced longshoremen, who knew which items to push into the irregular spaces alongside the walls and which to weave into interior bulkheads accompanied with a lot of labour time were the key elements of these operations.

Shipping in the postwar era, was undoubtedly a highly labor-intensive industry; where the most costly item was not the ocean voyage itself but the wages of longshore gangs (almost half the total expense of an ocean voyage). Some other peculiarities of the docker's job lives were the means for them to find a job; days of working were irregular and there were also cliques and specific categories of men that were occupied occasionally, whereas some others were left on the sidelines; people chosen to work in the docks were also discriminated by race and ethnicity. Another remarkable aspect in that way of operations was that cargoes being handled by the dockers were prone to become objects of pilferage, since many of the workers could be carried away with stealing (Marc Levinson, 2016).

‘’Containerization which took off in the early 1960s, was premised on a simple insight: packaging goods for waterborne trade into a standardized container made them cheaper

to move; it simplified and sped packing, transit, pricing and the transfer from ship to train and to truck; it also limited previously routine and lucrative pilferage'' (Kendall, 1986, latest reference: Leah Brooks, Nicolas Gendron-Carrier, Gisela Rua, 2021)

In an attempt to express it with numbers, the Port of New York in 1950 needed 1.9 man-hours to handle a ton of cargo, and 2.5 by 1956. The obvious solution to the high cost of freight handling seemed one: instead of loading, unloading, shifting and reloading numerous of loose items, why not put the freight into big boxes and just move the boxes? Under these circumstances, the concept of shipping freight in large boxes was born. At first, in the late 19th Century, the British and French railways attempted the use of wooden containers to move household furniture, using cranes to transfer the boxes from rail flatcars to horse carts.At the end of World War I, as soon as the motorized trucks came into wide civilian use, the Cincinnati Motor Terminals Company, hit upon the idea of interchangeable truck bodies, lifted onto and off of wheels with the use of a crane. The farsighted thinking of ''a standardized unit container in the form of a demount-able closed auto-truck body , that could be transferred by cranes between railroad flat cars, auto chassis, warehouse floors and vessels'' was set at the table already from that moment. Around 1920, the first American railroad that adopted this idea was the New York Central, that introduced steel containers (Marc Levinson, 2016).

During the 1920s the new competitive threat in the means of transportation appeared to be: the truck. After the war, experimentation began again and amphibious landing ships were recycled as ''roll on-roll off'' vessels to carry trucks. In 1948 the U.S. military was using small steel containers, called ''Conex boxes'' for soldiers' personal belongings. The first ships specifically designed to move containers came in 1951 when Denmark's United Shipping Company began to operate a container service to transport beer and foodstuff among Danish ports. By 1955, containers had already been used widely but in an effort way far from what was thought at the beginning as successful; the containers led hardly to any cost savings. Their exploitable volume was small (52 percent of them were smaller than 106 cubic feet); and almost all European containers were made of wood and had no proper tops to protect transported goods. The American containers were made of steel and consequently were more resistant, but cost remained - even for them- enormous (Marc Levinson, 2016).

Kerem Cosar and Banu Demir (2018), in their attempt to quantify the effect of container technology on transport costs and trade, based on micro-level data on Turkish exports at the firm, product and destination level for the year 2013, identified four patterns in container usage; First, container usage is mainly explained by firms, rather than by products and destinations; Second, it increases with distance to destination; Third, it increases with shipment size and decreases with unit prices; and finally , it increases with firm size and labor productivity. What is remarkable until today and resulted from their findings is that even today only some exporting firms find it profitable to ship in containers mainly due to the product characteristics and the necessary infrastructure being available in both the origin and the destination (A. Kerem Cosar and Banu Demir, 2018).

Back in 1955, the extreme cost for the use of a container was connected closely to the percentage of the ship's volume that was sailing empty due to the stowage of containers in the holds of the ships; that wasted space was over 10%. What else was counted on top of this cost were the duties of customs authorities charged on the containers and also the cost of returning the empty unit back to the depot it was loaded from. A need for a remedy to this situation was created; Shippers from the one side, wanted cheaper transport with less pilferage, less damages and lower insurance rates. Shipowners from the other side wanted to build bigger vessels that would spend more time steaming at sea making profits rather than in ports losing earnings and time. Truckers wanted to reduce their waiting time at the docks to pick up cargoes and arrange deliveries and port cities were seeking ways to attract more business interests in their areas to boost traffic through their harbors. Most efforts and ideas by that time were timeworn and not efficient, but no one could guess that the solution would come from an outsider with no previous experience with ships. (Marc Levinson, 2016).

3.2 The Idea and The Inventor

After the World War II, the U.S. economy boomed whereas the maritime industry did not. There was an open spot in market shares of domestic transportation which was dominated then by trucks, but the fact that they required a lot of days kept the maritime industry at a level to be able to compete. Regarding the international routes, competition was limited and almost all occupied shipping lines in business belonged to cartels, known as 'conferences', while fixed rates were given for each type of commodity. The person who took advantage of this whole situation, was an outsider with no previous maritime experience, a self-made trucking magnate named Malcom Purcell McLean. It was a brainstorm of his that came in 1953 when he was fretting over the increasing highway congestion and domestic shipping lines that could undercut his trucking business. He then thought to put truck trailers on ships that could ferry them up and down the coast avoiding the crowded coastal highways. His initial plan for that year was to build waterfront terminals to allow trucks to drive up ramps to deposit their trailers on board specially designed ships. This idea of a trucking company to use its own trucks to drive its own trailers on board its own ships, float the trailers down the coast and then drive them to their destination was revolutionary for the context of the 1950s and violated the ICC's[1] basic precepts.

McLean reconsidered his plan when he realized that carrying trailers would be inefficient since the wheels beneath each trailer would waste a lot of precious shipboard space. Then he came up with a much more radical idea: to use the leftovers, from World War II, tankers that were available to shipping lines at very low cost.He would buy two of them and convert them to haul truck trailer bodies- meaning trailers detached from their steel beds, axles and wheels and by doing so, the space occupied by each trailer would be reduced by one-third. What is more, these trailer bodies could be stacked on top of each other, whereas the trailers with wheels could not be. McLean's vision changed to a truck that would pull the trailer alongside the ship, where the trailer body filled with twenty tons of freight, would be detached from its steel chassis and lifted aboard ship. At the port of destination, the same trailer body would be lowered onto an empty chassis and hauled to its final destination. The basic concept of containerization as we know it was set then.

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[1] ICC: Interstate Commerce Commission

This whole concept was costed out for the first time on Ballantine Beer, which McLean Trucking hauled from Newark and resulted in the conclusion that container shipping would be 94 percent cheaper that break-bulk shipping for the same product, even allowing for the cost of the container. In 1949, Tantlinger had designed what was probably the first modern shipping container; a 30-foot aluminum box that could be stacked two high on barges operating between Seattle and Alaska or placed on a chassis and pulled by a truck. This invention had back then led to a two hundred containers order because nobody wanted to invest that much of money it costed. McLean expressed his idea to Tantlinger proposing to him to use thirty-three feet long containers, which length was chosen because the available deck space aboard the T-2 tankers was divisible by thirty-three. These containers would be seven times the size of any container then in common use. McLean also proposed metal frames, called flying decks or spardecks, above the tangle of pipes that covered the decks of his two tankers to hold the containers eight a breast.

This whole idea proved to be unworkable so McLean leaned back to Tantligner's[2] initial proposal of the Brown's containers and ordered two hundred of them demanding also from him to become his chief engineer. Tantlinger's job expanded soon afterwards to convince the American Bureau of Shipping, which sets standards for maritime insurers, that the 'Ideal-X' vessel would be seaworthy when eventually loaded with containers. After performing a test voyage with two containers filled with coke briquets on negligible cost, the Bureau of Shipping's approval was received. With the use of two huge revolving cranes that were transferred from a shipyard in Chester, Pennsylvania to Newark and Houston, a solution to load the containers on board the ship without the need for longshoremen was found. This Tantlinger's invention included a spreader bar stretching the entire length and width of a container so that the crane operator, sitting in a cab sixty feet above the dock, could lower the spreader over a container and engage the hooks at each corner with the flip of a switch to secure the

[2] Keith Tantlinger:a thirty-five year old engineer from Brown Industries in Spokane, Washington who already had the reputation of a container expert and had been building truck trailers since 1932

container. It was on April 26, 1956, after several delays due to months of hearings of the ICC and delays in gaining Coast Guard's approval, that the Ideal-X vessel was loaded with containers at Port Newark and set sail on the same day to Houston. In this way Pan-Atlantic's Sea-Land Service, McLean's company, was set in business meeting a schedule of one weekly sailing between Newark and Houston.

Malcom McLean was by no means the ''inventor'' of the shipping container, because, even though, metal cargo boxes of various shapes and sizes had been in use for decades before, he was the first one to materialize the concept of setting sail to Ideal-X vessel (Marc Levinson, 2016).

Other researchers and analysts would argue that Malcom and his containers were just ''*a new adaptation of a long-used transportation formula whose birth dates to the early years of the twentieth century*'', French historian René Borruey asserts.

The New York Times (2016) wrote about McLean :*''The concept of an intermodal container was first proposed by McLean. His "big box" idea, which has revolutionized cargo handling worldwide, came to him in 1937 while he waited most of the day to deliver cotton bales on his truck to a pier in New Jersey''* projecting in this way his initial positive contribution.

As from 1929, it was also the case of an American steamship operator, Seatrain lines, that operated specially built ships holding railway boxcars in metal cells, lifting the boxcars on and off with large dockside cranes. Thus, many could argue that these were ample precedents leading historians to downplay the nature of Malcom's achievements. American historian Donald Fitzgerald concurs: "*Rather than a revolution, containerization of the 1950s was a chapter in the history of development of maritime cargo transportation*.". Even though, these critics are, in a narrow sense, correct and McLean was not writing on a blank page, they all miss out the transformational nature of McLean's accomplishments, because no one before him had put in use the invention of containers in a way to alter the economics of shipping with no wider consequences (Marc Levinson, 2016). Daniel Headrick (2009, p.146) discusses containerization as the major 20th century technological change that "…*has propelled the globalization of the world economy"* (Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, 2015).

However, what Malcom McLean had seen and set as a fundamental principle and proved to be quite radical in 1950s is that shipping industry was all about moving cargo

and not just sailing ships. This insight is what created the concept of containerization as never seen before. He understood well that in order to reduce the cost per unit when shipping goods using a metal box is not enough. Every single part of the system, including ports, ships, cranes, storage facilities, trucks, trains and the operations from shippers themselves had to be altered towards this direction. (Marc Levinson, 2016). This is what the invention that inflamed the revolution of containerization was meant to be.

3.3 Container standards and uses:the pioneers

In the years that followed container's entrance in the industry, efforts had been made towards the direction of building better designed vessels or altering existing ones to move containers.The C-2 freighters were about to be altered to accommodate a honeycomb of metal cells in their holds so that 35-foot containers (longer than the first ones carried by the Ideal-X) could be lowered and stacked five or six high. The basic idea of altering the C-2's was to widen the decks from 63 feet to 72 feet and the hatches to be expanded so that the entire container storage area could be accessible from above. Keith Tantlinger played the most important role of all when concluding in the dimensions each cell holding each container should have in order for the crane operator to ease the box into the cell guides without allowing the unit to shift too much at the end. This alteration and cells building gave the C-2's the ability to carry 226 containers - almost 4 times the load of the Ideal-X. (Marc Levinson, 2016). ''Today's Post-Panamax ship is more than 17 times larger than the first ship that carried container goods in 1956'' (Brooks, 2021).

In order to serve the new growing demand under these greater numbers, changes were needed in handling faster the containers at ports and the attention turned to: a new trailer chassis with edges sloped so that a container being lowered by a crane would be guided into place automatically being locked with a new locking system (the 'twist lock') within a few seconds. What else appeared to have paramount importance in handling containers with unprecedented speed were the huge gantry cranes , first produced by Skagit Steel, that bridged an entire ship and by moving backward and

forward on rails along the ship's sides could pick up any container from the ship's hold vertically and lower it over the dock with the use of folding arms.

Brooks (2021) identifies two key innovations of containerization. First, is the mechanization of container movement; specialized container cranes lift the boxes in and out of ships, around the port and onto rail cars and trucks decreasing in this way the per unit labor costs, cutting time at port and making ever-larger ships viable. As a second key innovation, Brooks (2021) presents the development of common standards for container size, stacking techniques and grip mechanisms that allowed a container to be used across modes of transportation -ships,trucks, rails- within and across countries. Thill and Lim (2010) regarding the intermodalism of containerization, discuss on the importance of the so-called seamlessness (Capineri and Leinbach, 2006) of freight transportation and services, which entails the dissipation of impediments to smooth freight flows between regions. In the past five decades what is nothing short of astounding and all encompassing is the dynamics of transportation and logistics activities. ''*Transformational influences pertain to all areas of concern, including a loosened regulatory environment (deregulation acts), the global scope of an increasing share of commercial activities, technological innovations in shipping equipment – from larger ships, to unitized containers, and more efficient port-side and yard-side freight handling facilities, and finally the pervasive adoption of information technologies that promote the efficient and timely management and tracking of freight loads and shipping assets*'' (Wandel and Ruijgrok, 1993; Janelle and Beuthe, 1997; Helling and Poister, 2000; Hesse and Rodrigue, 2004; Notteboom, 2004;Leinbach and Capineri, 2007; Rodrigue, 2008;latest reference:Jean-Claude Thill, Hyunwoo Lim, 2010). Operating within such an environment, containerization has managed to combine the advantages of the rail and trucking systems over land-based segments of international trade routes via the cost savings brought by rail on line-haul routes and the flexibility of trucking on more localized front-and-back-end services. Land-side seamlessness of transportation and logistics systems is strengthened as freight containerization approaches the stage of maturity becoming the defining element of the scope and vitality of global sourcing systems (Notteboom and Rodrigue, 2009, latest reference:Jean-Claude Thill, Hyunwoo Lim, 2010).

3.3.1 The inventor of the precursor of the 20-feet-equivalent unit

With Malcom McLean not being the only shipping magnate interested in containerization, we may now examine the inventor of the precursor of the 20-feet equivalent container unit: Matson Navigation Company, which was sponsoring academic research on cargo handling and had adopted an approach that was polar opposite of McLean's. Matson, established in 1882, was not interested in making profits -profits from their services appeared to be almost incidental- but only in handling an already existing large business providing services mostly in the Hawaiian Islands. It was in 1956, after commissioning outside studies for two years, that Matson recruited a geophysicist, Foster Weldon, a well-known figure in the new science of operations research: the study of efficient ways to manage complex systems. Totally in contrast with how Pan-Atlantic's technology had been designed on the fly, using obsolete tanker ships, shipbuilding cranes and containers whose length was determined by the size of the tankers, Matson's fundamental principle for a proper embarkation on container shipping was set to be finding an optimal way through academic research to use quantitative data and figure out what were the economical correct sizes of the containers that should have been used. Problem, though, was that Matson's business would require to consolidate a lot of small shipments to fill whole containers in California and then proceed with unstuffing them again in Honolulu and parcel out the loads for various destinations, operation that was too expensive. Weldon's researchers then concluded that vans of 20 to 25 feet would be more efficient in this Hawaii trade : because if larger containers were used they would end up traveling with too much empty space, while containers shorter than 20 feet would require too much loading time and unused paid crane-dock resources. Matson found in this way its forerunner of container (24 feet long, 11 feet shorter than Pan-Atlantic's) and converted six out of its fifteen C-3 cargo ships to carry these containers on deck, exactly like McLean had started with his. Matson entered the container era on August 31, 1958, when the 'Hawaiian Merchant' sailed from San Francisco with 20 containers on its deck along with general cargo in its hold, and in this way started offering weekly container service between Honolulu and both Los Angeles and San Francisco (Marc Levinson, 2016).

What was innovative enough were the Matson's cranes, that were designed from scratch with a requirement to be able to unload an incoming container and load an outgoing box within five minutes - a cycle two minutes shorter than that of Pan-Atlantic's first cranes. Volume of load of the Matson's C-3s was increased soon to 75 containers at a time and on January 9, 1959 in Alameda, on the east side of San Francisco Bay, the world's first purpose-built container crane went into operation, loading one 40,000-pound box every three minutes. Using this type of crane, the Alameda terminal could handle 400 tons per hour, more than 40 times the average productivity of a longshore gang using shipboard winches. Similar cranes were soon placed in Los Angeles and Honolulu in 1960 (Marc Levinson, 2016). ''To achieve economies of scale, containerization requires physical changes to ports''(Brooks, 2021). In order to convert a traditional port into a container port, substantial investments were required, but despite this high cost, containerization diffused extremely rapidly across the global transportation systems altering all pre-existing conditions.

Levinson (2016) points out, also, the changes that have been made in the C-3 freighters. One out of their five holds was outfitted with a cooling system and electrical hookups for refrigerated containers, and lights in the engine room that gave warnings if the temperature within any of the 72 refrigerated containers was too high or too low. After each hold was fully loaded (52 feet by 54 feet large), the hatch covers were put into place and additional containers were stacked two-high atop the covers increasing the ship's capacity to 408 25-ton containers. The main constant problem on this was maintaining vessel's stability, especially on heavily loaded runs to Hawaii; something that Matson used to solve by organizing the containers prior loading so that the heaviest would go at the bottom of each stack, lowering in this way the vessel's center of gravity.

By 1964, the biggest two players in the container shipping industry were Matson in the Pacific and Pan-Atlantic, that was renamed Sea-Land Service, in the Atlantic. The idea that was dominating was that containers would change the business, but it was not obvious yet to everyone that they would revolutionize it. Many experts also argued that container was a niche technology, useful along the coast and on routes to U.S. island possessions, but impractical for international trade. Guerrero (2014) regarding the spatial impact of containerization argued that, despite the deep transformation on forelands, the secondary ports subsist because they partly depend on niche markets and

largely on local economies generating substantial amounts on non-containerized cargo flows. Between 1960s and 2000s containerization brought radical changes in liner shipping, as soon as containers allowed transportation of goods from on means of transport to another without unpacking, creating in this way significant economies (De Neufville and Tsunokawa, 1981) . Nevertheless, these were the thoughts that were commonly causing fear for the unknown future, preventing the majority of other carriers that needed to replace their war-era fleets, to make a move entering the business as well.

In 1961 Sea-Land, while plunging into debt, bought four World War II tankers and lengthened them by inserting large sections, known as midbodies, built in a German shipyard and in this way introduced the ‘’jumboized’’ vessels that could carry 476 containers -twice as many as Sea-Land’s existing containerships, eight times as many as the Ideal-X. In June 1962, Sea-Land became the dominant carrier to the island of Puerto Rico, that was almost dependent on U.S. shipping, scheduled containership sailings from Newark to San Juan every two days and from West Coast and Baltimore, while spending more than $2 million on two new terminals in San Juan in 1962 and 1963. Total trade between Puerto Rico and the mainland of the U.S. trebled during the 1960s and the majority of it was done by ships, fact that benefited Sea-Land, which also helped causing it. Till then Puerto Rico’s dependent on shipping economy had been a prisoner of high transport costs. By 1967, though, Sea-land was carrying 1,800 containers each week between the island and the U.S. mainland, half of which were coming from Puerto Rican factories, while also using Puerto Rico as a hub to serve the Virgin Islands. (Marc Levinson, 2016). What was commonly accepted back then was that as long as McLean was involved in running it, Sea-Land never lost money again from that time on.

CHAPTER 4: CONTAINERIZATION: The New Era

4.1 Standardization

In the late 1950s containers had prevailed in the transportation world, but the word ‘container’ itself meant different things to the different groups of interest. There were the truckers that were hauling them, railroads carrying them, Pan- Atlantic’s Sea-Land Service that was shipping them, the U.S. Army that was moving them to Europe. In Europe container meant usually a wooden crate with steel reinforcements, 4 or 5 feet

tall, while for the Army, it involved the ‘’Conex Boxes’’, steel boxes 8½ feet deep and 6 feet 10½ inches high used for military families’ household goods.

The problems with these differences in the containers sizes, types and uses made the exporters cautious about putting their goods into one container, because the loaded box could go only on a single carrier’s vessel, even if another line’s ship was sailing sooner. A European railroad container, for example, could not cross the Atlantic, because U.S. trucks and railroads were not set up to handle European sizes, while the incompatibility in systems used by various American railroads meant that containers on the New York Central could not directly be transferred to the Misouri Pacific. Common practice was that containers came out in dozens of shapes and sizes -each company no matter how big or small had its own-, but this was doing little to reduce the total cost of moving freight. Thus, an urgent need appeared for the standardization of the container units in order for them to continue providing sustainable transportation (Marc Levinson, 2016).

In order for intermodalism to be successful and reach and support economies of scale, a more tightly integrated process of transportation and logistics is required, so that modal networks are interconnected through minimal seams at transfer terminals (Rietveld,1997). A great number of authors including Janelle and Beuthe (1997), Ronson and Soriani (2000), Tavasszy et al. (2003), Rodrigue (2004), Hall et al. (2006) and others, have argued that intermodalism is a powerful force that is able to change the spatial economic organization of places and spaces cutting across all geographic scales. ‘’*The core argument is that, like other transportation investments, policies, and business practices, intermodalism affects the map of freight distribution costs, and ultimately locational advantages of regions. The erosion of trans-shipment impedances resulting from better technologies and better management practices lead to an improvement of accessibility throughout the broad areas served by the network, although their magnitude may be quite variable on the basis of Location*’’ (Jean-Claude Thill and Hyunwoo Lim, 2010).

Towards the direction of accomplishing intermodalism and standardization moved the United States Maritime Administration along with the Federal Maritime Board that tried at first to put an end to this previously mentioned incipient anarchy. Supported by the Navy, they tried to set up standards worried that a merchant fleet using incompatible container systems would complicate logistics even more in the event of a war. In 1958,

Marad named two committees of experts to recommend standards of container sizes and to study container construction, but an endless series of problems followed. Someone could ask why was there a problem in setting a standard that could be viable and used internationally in shipping? The railway industry had already gone through this standardization process, but the width of the track did not determine the design of freight cars, nor the capacity of a car, nor the time required to assemble a train. The difference in standardization of shipping, was the serious economic implications the use of a certain container unit might had; it was a fact that individual companies had strong reasons to prefer one container system from another.Pan-Atlantic, for instance, used container 35 feet long, because that was the maximum allowed on the highways leading to its home base in New Jersey, while Matson's carefully studies showed that a 24-foot box was the best for its particular mix of traffic and small volumes of freight. Grace Line, with service to Venezuela worried about South America's mountain roads and opted for even shorter, the 17-foot containers.(Marc Levinson, 2016).

Fact 1, from Kerem Cosar and Banu Demir (2018) research regarding the container usage, states that a large share of the variation in containerization is explained by firms, rather than by products and destinations.

Resulting from the above explanation, the most important distinctions that created problems in standardizing containers between standardizing rail gauges were two: One was scope:the width of a railroad track affected only railroads, whereas the design and type of containers affected not just shipping lines, but also railroads, truck lines and even shippers who may owned their own equipment and the other was timing. Many believed that there was reasonable doubt created from an economic perspective that pushing containerization towards standardization before the industry's full development might lock everyone into designs that would later prove to be undesirable and unsustainable.

After numerous debates, what the chosen committee agreed upon was to define a ''family'' of acceptable container sizes and not just a single size and type. Most of experts, researchers, companies and people involved couldn't agree on a specific length, width and height of the ideal container unit, each one of them for their own reasons. Except the two committees appointed by Marad, the American Standards Association (ASA), supported by private industry, also got involved in the matter of standardization

and created in July 1958 the Materials Handling Sectional Committee 5- MH-5 in an effort to specify what would "*permit optimum interchange among carriers and also be compatible with domestic pallet containers and cargo containers, and foreign carrier*s''. (Marc Levinson, 2016)

The MH-5 subcommittee reached a consensus that all pairs of lengths in use or about to be used -12 and 24 feet, 17 and 35 feet, 20 and 40 feet- would be considered ''standard''. What followed this was that the majority of existing lines had already made large investments that could rendered worthless if their containers were deemed ''nonstandard''. Bull Line, for example, which carried containers 15 feet long and 6 feet inches high on its break-bulk ships to Puerto Rico, was one that begged to be left alone, because it had no desire to interchange containers with other companies and wanted to stick in its initial and only trade. Other shipping lines urged the government to let the market sort things out as the container industry matured.

The National Defence Transportation Association, representing companies that handled military cargo, also decided to embark on studying container dimensions and this one ended up unanimously that ''standard'' containers would be 20 feet or 40 feet long, 8 feet wide and 8 feet high. Either way by all these specifications imposed , the latecomers to containerization -that hadn't already invested on their individual ideas- would gain at the expense of the pioneers. The most powerful evidence against the international standards historically from that period eventually came from the marketplace itself. Despite all the U.S. government's pressure on carriers to use ''standard'' sizes, nonstandard containers continued to dominate. Sea-Land's 35-foot containers and Matson's 24-footers, accounted for two-thirds of all containers owned by U.S. ship lines in 1965 and only 16 % of the containers in service complied with the standards for length, while a good number of those were not of standard 8-foot height. The two biggest players, Pan-Atlantic and Matson, that had raised tens of millions of dollars of private capital to buy their own equipment and convert their own ships to carry containers and had not yet sought federal construction subsidies, were the ones that did not worry about the drive for standardized containers. According to some, ''the key to automation was the existence and provision of a standardized product'', as a British steamship executive G.E. Prior-Palmer had testified. The two biggest carriers at that time were the ones disrupting the effort to make containers compatible around the

world. Malcom McLean himself had affirmed that he didn't care about what size container is adopted as a standard. ''If the market place can find one that moves cheaper, then that is the way the marketplace will dictate it and we want to be flexible enough to follow the marketplace'' he had said specifically. After 1966, aside from Sea-Land and Matson, though, almost all of the world's major ship lines and leasing companies were using and investing in compatible containers making the international container shipping eventually a reality. (Marc Levinson).

Nowadays, the majority of modern Conex containers have standard sizes in terms of 20-foot Equivalent Unit (TEU) and the 40-foot Equivalent Unit (FEU= 2 TEU). As per their names, these containers are respectively 20 and 40 foot long and are intermodal in nature. Their width is 8 feet and height 8 feet 6 inches to ensure compatibility and even spacing on ships, trains and tracks, while there is another option for larger space requirements that of a high cube container, 9 ft 6 in tall. Furthermore, there are more unusual sizes also in circulation, such as as the 10 ft, 25 ft, 45 ft , 48 ft and 53 ft long containers.

Picture 1. Photograph of a 45 High Cube Pallet Wide Container, Globus Container

According to the commodity transported or type of stuffing (FCL or LCL) a certain type of container may be preferred. The maximum permissible gross weight for each container type is usually specified and written in numbers outside the container, mostly referred to 'MAXIMUM PAYLOAD', meaning the weight of beneficial cargo that is being transported.

Inside Dimension

Measure	Length	Width	Height
Millimeters	12,032	2,350	2,700
Feet	39' 5 5/8"	7' 8 1/2"	8' 10 1/4"

Door Opening

Measure	Width	Height
Millimeters	2,340	2,597
Feet	7' 8 1/8"	8' 6 1/4"

Weight

Measure	Max Gross	Tare (Weight)	Max Payload
Kilograms	32,500	3,900	28,600
Pounds	71,650	8,598	63,052

Picture 2. Dimensions of a 40 Standard High Cube Container, Hapag-Lloyd

All of these containers, built out of corrugated steel sheets, can withstand sufficient forces and strains before crumpling, while there is specialized locking mechanism in place that prevents theft of the goods being transferred. The use of container seals and declaration of its number to each shipping line is also a common practice indicating that a container unit has been locked in its place/factory of loading and remained secured until opened again at its final place of delivery. Each carrier - shipping line's depot gives away with every container unit a seal number together to the trucker that hauls the empty box from depot, usually characterized by specific initial letters, i.e. the Mediterranean Shipping Company , MSC usually gives out seal numbers with the letters ''EU'' at the front, like, e.g. EU20821966, Sea-Land with the initials ''ML-GR…'' etc.

According to the type of transported goods there are plenty of other container types offered at special rates that are mainly more rare to find when asked for. Especially for loosely stored items or powders, the so-called bulk containers are used. The logic behind these is similar to bulk carrier vessels: these containers are rigid on all four sides and at the bottom. However, the top is often made separately, or with specialized gaps

for the loading of loose items. that may be powders, grains, ores and rocks. Another similar type to the previously discussed bulk container is the open-top container, 20-feet or 40-feet, that can be used to store large objects that would have otherwise required the container itself to be dismantled, type that is ideal and mostly used for large machinery that must be loaded through the top, like cranes, forklifts, vehicles, anchors, glasses - tempered or not-, marbles, structures etc. The basic difference between the open-top and bulk containers are that while bulk containers can have removable lids, the open-top often do not have roofs for the containers and instead they are being offered with tarpaulins. Common practice says that they must be loaded ‘in gauge’ without anything exceeding the containers dimensions, otherwise the carrier has the right to charge the shipper an extra amount of rate for ‘out gauged container’. The major benefit of these types is that for extremely large objects, multiple containers can be stacked and used for transport with minimum modifications.

Picture 3. 40 Open Top Container, Hapag-Lloyd

4.2 Stuffing: Making every cubic meter count

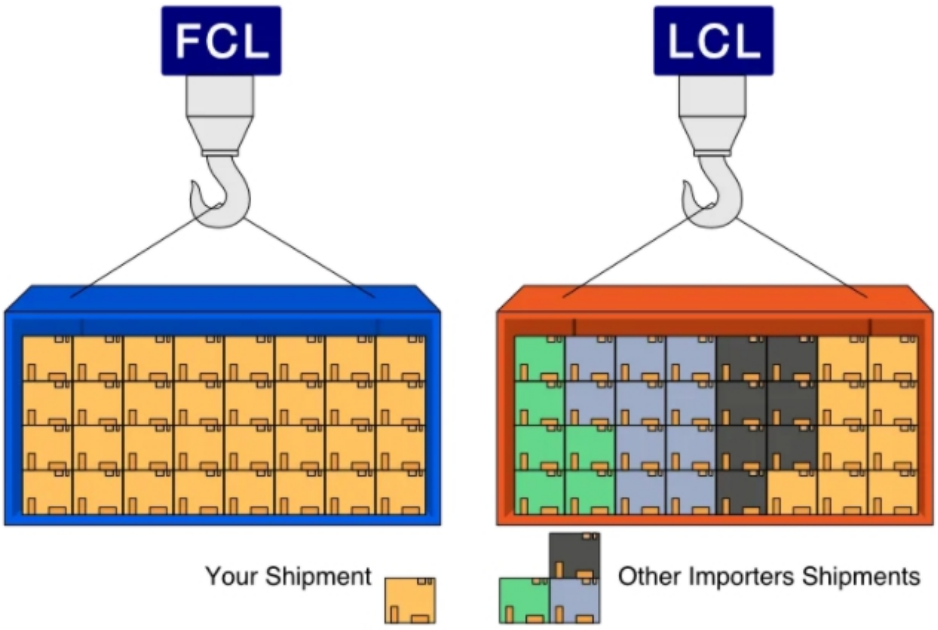
Recalling one of our lectures in the University the last year, one of our academic professors that was teaching us about the container's evolution, had placed a question in the amphitheater asking us ''What is the commodity being transported in the biggest percentage, something like 90 %, in all the containers all over the world?''.

We were all squeezing our heads in order to find the right answer to his question and after a big debate and several arguments he gave us the answer telling us that the commodity being transferred in the biggest percentage inside the containers all over the globe right now is 'air'.

Several thoughts started overwhelming my head starting from the way containers are being stuffed, or at least the way I have seen them being stuffed from my daily work in the business. To begin with, there are the FCL shipments, meaning 'FULL CONTAINER LOAD', in which agreement the buyer is renting the full container space, and there are also the LCL shipments, meaning 'LESS THAN CONTAINER LOAD'', agreements in which one buyer is sharing space in a container with others. There is no optimal solution in general to choose one of the two. The best choice depends each time on the buyer's - shipper's needs: the quantity - volume of cargo he is selling and/ or the frequency in which he wants to send away his cargo.

Picture 4. Graphic show of FCL and LCL shipment

Full Container Load vs. Less than Container Load: the Difference in Shipping



If a shipper, for instance, is producing and selling a small quantity of cargo as little as 1 CBM or even less (case in which he may examine sending it via the air if cargo is also light, less than 200 kgs), or in that matter counting from 1 CBM till 15 CBM, he may consider sending his cargo under an LCL shipment and being charged on a Cubic Meter's basis, considering also that the minimum chargeable volume is usually 1 CBM. Another shipper wanting to transport or selling bigger quantities such as of 15 CBM or more may on the other hand consider the FCL agreement. The most common container sizes for FCL shipments and their approximate capacity in each case normally go like this: for 1 x 20 Dry Van container approximately 33 CBM, for a 40 Dry Van container 67,5 CBM and for a 40 High Cube container 76 CBM (these amounts are counting and the volume of air inside the containers, because in case we refer to palletized cargo instead of loose cargo is almost impossible to fill every inch of the container without damaging the goods or their packaging). (source:Guidedimports). There are carriers, forwarding companies, agents, warehouses, other logistics companies that offer this kind of services to stuff the so-called 'groupage containers' and their basic aim is to make every chargeable CBM of a full container to count. Their job is to fill in the containers combining in the best possible way many LCL shipments most of the times having the same final destination, or at least the same country as destination. There are

numerous types of cargoes that can be stuffed into a groupage container, such as aluminium sheets in pallets, loose paper goods, tyres, barrels of oil and olives, cartons with spare parts, loose pipes and fittings and the job of finding the best combination to co-load all these things available each time falls upon the agent or the logistic coordinator that is offering this service.

Picture 5. Stuffing of 1 x 45 HCPW groupage container in DSS Logistics, Vista Maritime and Logistics daily operations, combination of LCL shipments

The first questions that deluged my mind at that time when our professor told us that the good that is being transported in the biggest quantity is air, were 'How is this possible since everyone is charging every CBM inside these containers?'' , ''How this industry can operate with this outcome , transporting containers with 90% of them loaded with thin air?'', ''How is this possible since there are people whose job is to maximize the utility of each container unit and exploit in the best possible way the available space offered by each unit?''. After giving it a second thought though, I concluded that professor was right. What is of paramount importance in most of the cases when choosing among FCL and LCL shipment is the freight cost. An FCL

shipment may be cheaper with a volume of around 15 CBM, so a shipper may proceed with this type of agreement under an agreed rate for a specific container unit with that much of a volume considering only the price afterwards depending on the route. But the fact is, that with a volume of 15 CBM he may not fill completely a full container -that's for sure- not even 1 x 20 DV, that is the most common in use and this may lead to exporting a container half loaded with goods and half loaded empty-with air as a consequence. So, as a result of many people's choices in this logic, the previously mentioned statement is true and stands completely. The good that's inside the majority of the containers all over the world is thin air. Indeed.

4.3 The Benefits : Economies of Scale and crisis

At the start of 1966 container shipping was still an infant industry and the big players in it were two shipping lines: Sea-Land Service and Matson Navigation, but they both offered a service only for U.S. domestic traffic by using old ships, originally built for a very different sort of business, but modified to get the new job done. Outside the United States, back at that time, there was no port that had the ability to load containers aboard ships except by having longshoremen clamber atop each box attaching hooks at each corner to help stack the containers. The majority of people was still thinking that it was not the right time then for the container shipping to grow nor in the next decade. But the majority's thinking, as it appeared, was pretty far from what happened in reality in the next three years that followed in fast-forward pace. Amounts like 3,400 20-foot containers as imports or exports passed through U.S. ports each week during 1968 from zero in 1965. Facilities for handling containers expanded in many ports all over the world that grew also in commercial value as port cities:Rotterdam, Bremen, Antwerp, Felixstowe, Glasgow, Montreal, Yokohama, Kobe, Saigon, and Cam Ranh Bay. The first ships, as previously mentioned in Chapter 3, had no container cells in their holds and most lines that started operating were packing containers into conventional break-bulk ships' holds in their desperate efforts to meet their clients' demands. What came to be the vision at seas by the end of 1969 was the second generation of containerships that were totally different. These vessels were initially designed from scratch to work smoothly with dockside container cranes and they were large, fast but expensive. Sea-Land's biggest competitor, the United States Lines, owned one of these first new vessels

that was named ‘American Lancer’. She had capacity of carrying 1,210 20-foot containers at a speed of 23 knots, half again as fast as the reconstructed ships in Sea-Land’s fleet. Other American, European and Japanese companies were already placing their orders for these new larger containerships. Ships destined to operate in the Asian Trade were typically larger, carrying 1,300-1,600 20-foot containers, because the relatively long ocean voyage from Europe or America to Japan generated enough additional revenue to cover the added construction cost. Between 1967 and 1972 it was a big stagger even for the largest shipping lines to build and equip that second generation of vessels.

McLean, the pioneer, had again actively entered the game in October 1968 when he order an entirely new kind of containership, the SL-7, with a capacity of 1,096 of Sea-Land’s 35-foot containers with a travelling speed of 33 knots and could have the ability to sail around the world in only 56 days. McLean’s plan was to deploy these new ships of his in the Pacific charging the same rates as its competitors, but offering the fastest available transit time in order to attract cargo and this is what again stepped up his game. Under this environment the first stage of the container boom occurred on the North Atlantic and the second on the Pacific. Matson started a partnership with Japanese lines in September 1967 but soon after within the next year the Japanese started their own container service to California. Within a year, container tonnage between Japan and California had grown to two-thirds that across the North Atlantic. Within only three years nearly one-third of Japanese exports to the United States were containerized as were half of Japan’s exports to Australia.The first Japanese exporters that took advantage of this boom were the electronics manufacturers, since their products were fragile and theft-prone. They now had found a way to exploit the lower freight rates, inventory costs and insurance losses and make their products into everyday items in the United States and soon afterwards in Western Europe. That’s the way televisions started to appear in every household after 1968 along with Japanese clothing that took new life under this container business. The Japanese government had put a lot of effort in putting shipping at the center of its economic development strategy and that’s one more reason that Japanese merchant fleet reached 50 percent expansions in a five-year plan as scheduled. Everyone had to participate: Hong Kong received its first visit from a fully

containerized ship in July 1969, even before its container terminal was ready (Marc Levinson, 2016).

‘’*Bernhofen et al. (2016) estimated that containerization caused international trade to grow by more than 20% percent between 1962 and 1990, an effect larger than that of regional trade agreements and contemporaneous tariff cuts* ‘’. (Brooks, 2021)

In the containerization era shipyards around the world were choked with new orders for even bigger ships. Korean exports to the United States trebled as well as their garments found a way to be competitive in the U.S. market. Australia with its participation in the container traffic accomplished a dramatic shift from its traditional exports: meat, ore, greasy wool to manufactured goods and in this way left behind its past as a resource-base economy and began to develop a much more balanced economic structure (Marc Levinson, 2016).

Concluded from these facts: container cannot claim sole credit for this burst of international commerce, but it is surely entitled to a share. The total savings from containerization were so great that traditional ships abandoned almost immediately the routes that were being served by containerships. Launching, though, so many vessels quickly resulted in a quantum jump in capacity and the basic economics of containerization dictated as much. The capital-intensive nature of container shipping put a premium on size; a container line entering a particular route needed enough ships, containers and chassis to run a high-frequency service between major ports on a regular schedule. When one shipping line decided to enter the trade, it had to do so in a large way in order to be and remain competitive. This was the exact opposite of what used to happen in break-bulk shipping, in which an owner of a ‘’tramp’’ ship could eke out a profit picking up freight wherever and whenever it could be found.

‘’In containerized shipping there is a trend towards the use of large vessels. Economies of scale can be realized for such vessels if the time in port is kept low. Thus these large vessels generally have few ports of call and require efficient terminal operations. Past experience has shown that trans-shipment is often economical ‘’ (Containerization International, 1976).

Capacity on the largest international routes increased fourteen times over between 1968 and 1974. Demand and supply dictate the shipping industry and shipping cycles in Economics tend to repeat themselves with an average shipping cycle able to last

approximately 7 years (Martin Stopford, 2009). Overcapacity of the vessels -something that was an old story in ocean shipping by that time- could not satisfy the existing demand, robust though it was, and this sparked a new war: a rate war. The flow of cargo and consequently demand in international trade had always been volatile depending on general economic growth, wars and embargoes, changes in tariffs and trade restrictions, political and environmental factors. The last time that this had happened was in the 1950s and 1960s, but that temporary imbalance between the amount of general cargo needed to be transported and the amount of space offered by break-bulk ships was not so catastrophic. Based on the fact that most merchant fleets consisted of war-surplus ships that had been acquired and modified for little or even nothing, shipowners were not coming up against huge mortgage payments and their main expenses were limited to operating costs: cargo handling, fees for the use of docks, crew payments, fuels. The best obvious solution for a shipowner back at that time to stop his economic''bleeding'' was to lay his vessel up and make the most of the costs go away. Economics of the container shipping though, appeared to be completely different due to the huge capital required and borrowed to build and buy the containerships, the regular payments of interest and principal for the equipment used. Use of the facilities of a state-of-the-art terminal was synonymous with debt service, if the shipping line had used others' funds to build its own or rent, if the terminal was leased from a port agency to the line. All these were fixed costs that accounted for up to three-quarters of the total cost of running a container operation and they had to be paid regardless of the quantity of cargo that was available. There was no such a solution as to lay up a containership and make these costs go away.

According to Kerem Cosar and Banu Demir (2018), ''*fixed cost of containerization is 40 to 100% percent higher than that of breakbulk, with a median of 70% across destinations. Several channels could justify higher fixed costs associated with containerization. For instance, container links between ports are less frequent than break-bulk links. This implies, for any given shipment, that the exporter has to spend additional effort to better manage the production and inventory scheduling. Another source is the importance of transaction-specific scale in container shipping: if the shipment size is large enough to fill a container (FCL-full-container-load), firms can schedule door-to-door shipping services. Otherwise, if the shipment is less than-*

container load (LCL), exporters have to purchase additional services from freight-forwarders who consolidate and store shipments at ports''

Consequently, there was an urgent need to keep the containerships moving, because, unlike break-bulk shipping in the past, overcapacity would not diminish as owners temporarily idled their vessels. Results, instead, would be that freight rates would fall as carriers would struggle with every available container and overcapacity would persist until demand level would eventually catch up with the supply (Martin Stopford, 2009). In early 1967, ''the disaster came'', as it was a year after fully cellular containerships entered the trade that rates for containers were cut by 10 percent.

''The container, like any technical innovation, has a market and diffusion potential where a phase of maturity is eventually reached. Evidence from the global container port system suggests five distinct waves of containerization with a shift in the momentum from advanced economies to developing economies, but also within advanced and developing economies '' (David Guerrero, Jean Paul Rodrigue,2014).

For break-bulk shipping the logic behind calculation and setting of rates was different per commodity or sometimes they were measured based on weight and volume. This system seemed illogical economically for the container shipping; a shipping line's cost to move a 40-foot container filled with bicycle tires was identical to its cost for a 40-foot container of table lamps; On the North Atlantic, the rate per ton of a product shipped in a container was the same as if it were shipped breakbulk, with a discount of 5 to 10 percent for and FCL of a single commodity. In Europe-Australia trade a mixed container would be charged the per-ton rate for each commodity, but in that case, the only way to calculate the correct rate was to open the container and weigh its content. Carriers had no reason to care about the commodities they were moving; due to the excess capacity the only thing that mattered to them was any payment that exceeded their costs to carry the container in terms of survival. In early 1967, Waterman Steamship, one of McLean's former companies, started charging a flat rate for shipments from the United States to southern Europe: $400 for a shipper-owner 20-foot container, $800 for a 40-foot container regardless of their contents. Seeing the results from this application, eight lines formed a conference aiming to leave the commodity-based rate system that made no sense at all, establishing logical rates for the containers. The other solution in this period of recession were the company mergers; In July 1969,

barely three years after the globalization of containerization, West Germany's two largest shipping companies agreed to merge as the known Hapag-Lloyd, picking up the reins in the North Atlantic trade. Malcom McLean's Sea-Land signed a deal with United States Lines, which was then building 16 containerships, and agreed to lease all these 16 vessels for the upcoming 20 years. Sea-Land threw out of the game one of its biggest competitors and got the upper hand on both the Atlantic and the Pacific trade by having one of the largest fleets. In their desperation to survive, carriers tried an old-fashioned way: to reduce competition. Five competitors in the Europe-Far East Trade, two British, two Japanese and the German Hapag-Lloyd combined creating an alliance named TRIO agreeing to build 19 large ships, in which each company allocated a specific number of container slots to handle. What also helped in stabilizing the rates was an even more powerful cartel, the North Atlantic Pool Agreement, in June 1971, in which 15 separate shipping lines from 6 countries backed by 6 European governments combined their forces and spelled out exactly what percentage of cargo each company would carry agreeing to charge identical rates and share the revenues. Economy and flow of trade recovered in 1972, where it became a principle that rate wars would obviously be a permanent feature of the container world, recurring every time the global economy turned down or shipping lines decided to expand their fleets. Freight rates would be charged according to the distance the containers traveled, regardless of the weight or the nature of their contents and in difficult times would dip so low, that carriers receiving them would barely cover their operating costs just to keep holding their share in the marketplace.The constant pressure to build larger vessels and faster cranes would continue to exist in order for the carriers to reduce even more their costs per unit of container handled, in the fear of overcapacity's return at some point in the future.The carriers accomplishing the lowest costs per unit would be the ones surviving the next current of rate drops (Marc Levinson, 2016).

Hummels (2007) declared three ways to put the economic importance of transportation costs in perspective: a) transportation costs relative to the value of the goods being moved; b) transportation costs relative to other known barriers to trade, like tariffs; and c) the extent to which transportation costs alter relative prices. '' *In periods of rapidly rising demand, shipping capacity becomes scarce and spot shipping prices rise quickly. Over longer periods however, rising demand for shipping may actually*

lower shipping prices. The reason is that the capacity of a modern ocean-going liner vessel is large relative to the quantities shipped by smaller exporting nations. As a consequence, vessels may stop in a dozen ports and in many different countries to reach capacity'' (David Hummels, 2007). Hummels detected an actual increase in ocean shipping rates during 1974-84, a period after the adoption of containerization in the US (Bernhofen, El-Sahli and Kneller, 2015).

The sharp rises in oil prices in 1973 proved to be a blessing for the container shipping, since containerships were able to move more cargo per barrel of oil in contrast to the remaining break-bulk ships.This was a nightmare for the shippers that were facing skyrocketed freight rates this time, a boom that lasted into 1974. As an ending product of the oil crisis, though the shipping industry also suffered in the end; world exports of manufactured goods fell in 1975 for the first time since the war and the amount of seaborne trade along with them dropped 6 percent. New buildings kept being delivered from the shipyards increasing the already existent oversupply (Marc Levinson, 2016). Hummels (2007) also finds that freight cost reductions from increasing an exporter's share of containerized trade have been eroded by the increase in fuel costs resulting from the 1970s hike in oil prices (Bernhofen, El-Sahli and Kneller, 2015).

The second crisis of container shipping occurred mainly due to the majority of the carriers' choice to build vessels in the first half of the 1970s that belonged to the world of the late 1960s. The high speed of these vessels mattered because of the closure of the Suez Canal in 1967 Arab-Israel war, that forced ships between Europe, Asia and Australia to take the longer route around the tip of Africa, but was also a characteristic that was inevitably identical to high fuel consumption and didn't matter enough because oil was cheap. This situation turned its way around in the mid 1970s were the price of fuels quadrupled, and suddenly fuel went from one-fourth of operating cost in 1972 to half in 1975; whoever carrier had high-speed vessels at that time had been stuck with the wrong vessel for that period. McLean was one of the carriers who was stuck with the SL-7s at that time , the costliest and thirstiest ships at a period when bunkers jumped from $22 per ton to $70 within a matter of months. That was the time McLean sold his stock in 1975 and left the board of Sea-Land in 1977. Sea-Land stood as an independent company after the departure of Reynold's in 1984, McLean's 'funding' partner (Marc Levinson, 2016).

Concluding, shipping lines' end product is and will always be basically a commodity; they will always be -exactly like farmers and steelmakers- hostages to external forces, with their prices and profit margins depending on economy's course and on their competitors' decisions to expand their fleets. The Financial Times had written that '*'By 1976, less than a decade after container shipping became an international business, the revolutionary impact of containerization, the biggest advance in freight movement for generations, has largely worked itself out*''. Except that the *Financial Times* got it wrong: the revolutionary impact of containerization was yet to come.

What was the holy grail of the maritime industry since always was: scale. Bigger ships lowered the cost of carrying each container; bigger ports with bigger cranes lowered the cost of handling each ship; bigger containers -the 20-foot box, shippers' favorite in the early 1970s, was yielding to the 40-footer-which was cut down on crane movements and reduced the time needed to turn a vessel around in port, making more efficient use of the capital invested. If ever there was a business in which economies of scale did matter, container shipping was it; the lower costs per unit allowed lower rates, which attracted more freight, which in its turn supported more investments in a direction of lowering unit costs even more. The quest for scale brought along with it not just more ships, but bigger ships as well. The big players in the trade, companies such as Sea-Land, United States Lines and Hapag-Lloyd, had as basic aim to be present at every major trade and consequently port, either by the use of their own ships or by the space they were booking on someone else's through agreements. The more ships they had under their control, the more ports they ended up serving, the more widely they could spread their fixed costs of container operations.

Increasing payloads instead of the speed of the vessels was the naval architects' new target and that's the way the trade reached the Panamax vessels sizes-the maximum size that could fit through the Panama Canal- and could haul a container at much lower cost than could their predecessors. By the 1980s, new ships' capacity had reached the equivalent of 4,200 20-foot containers and were able to move a ton of cargo at 40 percent less fuel consumption than could a ship built for 3,000 containers and at one-third the cost of the vessel designed for 1,800 units. By 1988, carriers had started investing in vessel sizes that were too wide to fit through the Panama Canal. This

triggered a new era that by 2015 reached the sizes of the Malacca-Max vessels -whose sizes were constrained by the Straits of Malacca, the busy shipping lane between Malaysia and Indonesia- able to transport 20,000 TEUs, so large that a single one could carry in other numbers 144 million bottles of wine (Marc Levinson, 2016).

A same kind of development has been noticed in the ports involved and inevitably containers were the invention that turned ports into mere ‘’load centers’’, places through which large amounts of cargo flowed without a break to the interior region of each port city. The new maritime geography that was created opened new horizons and decidedly non-traditional trade patterns, since cargo flow was following the cheapest possible way to meet its final destination. Mayer (1978) observed that combining the effect of development of containerization with the completion and addition of interstate trucking network increased the competitive advantage that these ‘load-centers’ experienced. Hoare (1986) concluded that shippers preferred to concentrate trade and services at particular ports demonstrating in this way that containerization transformed port hinterlands in a positive way.

In the contrary of the importance of government’s investment that had been crucial to the development of container shipping in the 1960s and 1970s -with the exemptions of Felixstowe and Hong Kong- leading to the development of every major containerport at public risk and expense, situation was completely altered when the British prime minister Margaret Thatcher broke the ice by selling off 21 ports to a private company in 1981. Things changed a lot and the interested parties in port investments included now: stevedoring and transport companies, but also the leading ocean carriers.This led to insisting on long-term contracts, backed by banks or by collateral, to assure that the involved parties would be able to recover whatever investments they made, not caring to expand for the sake of local economic developments. Privately controlled ports, thus, were core parts of nearly the half of the world’s trade in containers by the end of the twentieth century; container world as we mainly see it nowadays.

4.3.1 The effects: How much value did containerization add?

Reaching conclusions about the importance of containerization:

‘’*How much the container matters to the world economy is impossible to quantify*’’ (Mark Levinson, 2006, p.8). This claim has been challenged through this paper and

Bernhofen, El-Sahli and Kneller (2015) research as well reaching the point to argue that containerization has been a major revolutionary change in the 20th century transportation technology, responsible for the acceleration of the globalization of the world economy since the 1960s. The tremendous growth in international trade appears to have coincided with the genesis of the global container era.

''American President Lines studied the matter a few years after 1986, and concluded that freight rates from Asia to North America had fallen 40 to 60 percent because of the container. Between 1966 and 1990, economists Daniel M. Bernhofen, Zouheir El-Sahli, and Richard Kneller reported in 2013, the container was more than twice as important in increasing the flow of international trade among the wealthy countries as governments' efforts to eliminate formal trade barriers. The 'box' made the world economy much, much bigger'' (Marc Levinson, 2016).

Paul Krugman (2009, p.7) among other students and prominent commentators links the post World War II growth of world trade to containerization that made possible to ship goods to long distances fairly cheaply, by linking, simultaneously, ports with the interstate highway networks increasing the competitive advantages of these areas and creating a hinterland-foreland continuum (David Guerrero, 2014). The great magnitude of this easier shipment of freight to container ports has been supported and connected to the connotation of intermodalism by Jean-Claude Thill and Hyunwoo Lim (2010), which has been proven to benefit in terms of freight cost savings that can be greater in remote places to sea ports, given low enough shipping cost decay effects and proximity to intermodal infrastructures.

The introduction and evolution of the variable container types, units and vessels have managed to accommodate shipping and moving many different types of cargoes around the globe at a lower cost, something that was not feasible before.

The results from Cosar and Demir (2018), confirm that the role of container technology in the global economy implies variable cost savings around 20 percent at distances that are relevant for major trading economies, with a fixed cost around 50 to 100 percent higher than its breakbulk alternative. Container shipping is demonstrated as a major driver of the increased international trade in the past several decades resulting in the so-called ''death of distance'' condition, that refers to technological advancements in transportation; Container shipping costs appear to be less distance-elastic. There is a

great possibility that containerization might have helped countries that are located further apart start trading with each other which confirms the statement that the 'box' made the world smaller and brought people closer'' (Marc Levinson, 2016).

Another aspect supported by Hummels (2007) states that containerization didn't reduced ocean shipping rates. *''If containerization and the associated productivity gains led to lower shipping prices, as is widely believed and as Levinson (2006) qualitatively argues, the effect should appear in the liner series. Yet liner prices exhibit considerable increases, both in absolute terms and relative to tramp prices after containers are introduced''*. However, Joan Al-Kazily's (1981) conclusion ends up to quantifying the cost savings that had been made possible by consolidation of container service to a developing region through a trans-shipment terminal. In order to attain this goal he presents a quantified analysis of the relevant system involved.

Bernhofen, El-Sahli and Kneller (2015) suggest that containerization resulted in far reaching complementary technological and organizational changes in port and railway services that affected economies' entire transportation sectors. These previously mentioned findings confirm Hummel's (2007, p.144) intuition as well, that '*'the real gains from containerization might come from quality changes in transportation services……To the extent that these quality improvements do not show up in measured price indices, the indices understate the value of the technological change*".

The technological breakthrough that has been accomplished by the diffusion of the containers within the transportation industry is the addition of value in terms of quality, something that eliminated problems that had emerged in the post World War II era, when two-thirds of a ship's productive time was spent in port causing port congestion and low levels of ship utilization. Handling great volumes of cargo within reasonable time, between long distances at the lowest possible costs, minimizing labor intensity and maximizing vessels' utilization are some of the goals that containerization has managed to attain in the last past decades.

CHAPTER 5: ‘’What about now?’’

5.1 Containerization: Connecting the World and adding value

Reasonable question raised is, ‘’What about now? What about today?’’. How containerization has managed to connect the world so far by adding extra value? In all of the above analysis in previous chapters, we followed the route and evolution of containerization from its invention till nowadays. But how each and every single one of us can spot the difference the containerization brought in our lives? To begin with, is it possible to spot the difference?

The world economy became highly integrated in the nineteenth century. The globalization of the late twentieth century took on quite a different character; International trade was no longer dominated by essential raw materials or finished products; the majority of the containers imported through Southern California in 1998 were links in big and long global supply chains and were carrying what economists call ‘intermediate goods’ - factory inputs that have been partially processed in one place and will be processed further someplace else- rather than ‘finished consumer goods’ (Marc Levinson, 2016).

Third-party logistics providers, known as 3PLs, are becoming increasingly important in today’s global free market. Due to the fact that major business enterprises commonly span across several geographical locations at different sides of international borders, central logistics planning has become difficult and inefficient. As a consequence, the majority of the companies prefer to outsource some of its manufacturing needs to suppliers located in other places along the supply chain, such as in i.e. China, taking advantage of the lower costs in this rapidly developing region. In this way companies are enabled to focus on their core business, while saving costs without sacrificing product quality. Employing 3PLs for the storage and transportation of goods along the different parts of the supply chain creates benefits:1)the company doing so avoids the setup costs involved in managing the logistics in a new location; 2)3PLs are specialized in logistics and able to perform the required tasks more efficiently by taking advantage of economies of scale; 3) 3PLs possess regional expertise as well, meaning that they are able to take local conditions into account during logistics management; and 4)3PLs often provide additional value-added services (except storage and transportation of goods), such as inbound operations, inspection, sorting, labeling, containerization,

tracking and outbound operations (Hu Qin, Zizhen Zhang, Zhuxuan Qi , Andrew Lim, 2013). 3PLs positioned as one-stop shops for the logistical needs of their customers and operating in such a way as to minimize the total container transportation and parcel delivery costs, is what made them core integral elements of the maritime supply chain and contributed in the aspect of 'creating additional value' in the post-containerization era.

Barbie, the doll, that if she was to given an actual age would be now as old as one of our grandmothers at the age of 62, was a toy doll first launched in March 1959 by Mattel Corporation. Even though, Barbie was conceived as the all-American girl and additionally created the ''Barbie syndrome'' -the desire to have a physical appearance (blond, tall, thin, with blue eyes) and lifestyle representative of the Barbie doll, it is actually curious and reasonably questionable how she was first produced at a factory in Japan (Wikipedia.org). Giving it a second thought though, and assessing the importance of containerization furthermore, it starts appearing not so peculiar anymore.And we explain: Barbie was produced in a factory in Japan. A plant in Taiwan, along with a large cadre of Taiwanese women, sewed Barbie's clothes in their homes. By the middle of the 1990s, Barbie's citizenship had become even less distinct since workers in China produced her statuesque figure, using molds coming from the United States and other machines imported from Japan and Europe. Her nylon hair was Japanese, the plastic in her body from Taiwan, the pigments American, the cotton clothing Chinese. Barbie, simple American girl though she was conceived to be, had created her very own global supply chain (Marc Levinson, 2016). These kind of supply chains that were created are the direct screaming results of the changes wrought by the rise of container shipping.

The global industry has, thus, discovered then and operates now under the command of the 'just-in-time' principle in manufacturing, a concept originated by Toyota Motor Company in Japan, involving raising quality and efficiency by eliminating large inventories. Manufacturers all over the world have contracts with other companies of raw materials and components in countries where they can lock their supplies at the lowest possible rates, and also sign transportation contracts to assure that their inputs will arrive when needed and in the quantities required (Marc Levinson, 2016).

''*Global Maritime Supply Chains (GMSCs) are the networks of freight transportation through which cargo is moved from origins to destinations using water (the maritime*

transport) and land mode (Roadways, Railways and Inland Waterways etc.) of transport" (Chandra Prakash Garg and Vishal Kashav, 2019). The maritime supply chain in the context of container shipping, is also explained by Lam (2015), as ''the connected series of activities pertaining to shipping services, which is concerned with planning, coordinating and controlling containerized cargoes from the point of origin to the point of destination''.

The lowest possible and achievable through containerization 'door-to-door' freight rate is what each and every manufacturer or retailer cares about, being at the top of the supply chain seeking to find the most economical location to place each part of the process of producing their products. The majority of the metal boxes moving around the world has ended up containing not finalized end-products such as televisions and dresses, but industrial products such as synthetic resins, engine parts, wastepaper, screw, and, yes, including Barbie's hair (Marc Levinson, 2016).

Has anyone in the 21st century ever wondered how he/she ended up wearing a specific T-shirt? How have our favorite brands of garments managed to earn a position in the shelves of our nearest shopping mall? For the majority of people this is something that is taken for granted but has anyone ever considered how containerization has contributed into this accomplishment? Pietra Rivoli, in her piece of work: 'The Travels of a T-Shirt in the Global Economy: An Economist Examines the Markets, Power, and Politics of World Trade' outlines the route a T-Shirt follows upon by giving a narrative story explaining and commenting on how the container shipping industry operates in this sector.

''*Cotton leaves the Compress in Lubbock, Texas, USA, and turns left toward China. Usually by truck, but sometimes by train, the cotton heads through the blank space of west Texas, New Mexico, and Nevada, stopping finally at the Pacific Ocean in Long Beach, California. The cotton boards a ship and keeps going west, arriving a few days later at the port in Shanghai, and into the deafening pulse of China's weird new capitalism. Here, the Nelson Reinsch's cotton is spun into yarn, knitted into cloth, cut into pieces, and finally sewn into a T-shirt. A "Made in China" label will be tacked to the collar. Thus transformed, the Texas cotton will return to America*'', Pietra Rivoli narrates. (Pietra Rivoli, 2009)

China's economy has grown into one of the largest buyers of American cotton, and it also projected to soon production more than 40 percent of the world's cotton textiles.Through this Pietra's Rivoli (2009) narration it is made more than obvious that American cotton, originated from Texas, that is being shipped in Shanghai, enters not only a completely new country to be processed but a new global industry, where the production of textiles and apparel is almost as old as agriculture. Since the beginning of the times, though, agriculture and textiles have been linked:Whatever the humans have spun or woven to produce garments, whether raw materials were wool, silk, flax, or cotton, it had to first of all be grown somewhere. Today, however, as seen also in other sectors of the industry, the agricultural and industrial chapters in a T-shirt's life often take place on completely different continents. An owner of a cotton plant for example, somewhere in America, can be the top of a supply chain offering as end products T-shirts by supervising not people, but land, capital and technology. While the component labor of American cotton production is almost too small to be measured, labor still accounts for more than half of the value added in the whole production of apparel. Thus, cotton as raw material is being sent to China, where people can be found offering labor work to process it and create the finalized product at even lower costs. (Pietra Rivoli, 2009) Isn't it this the basic principle that keeps containerization always on the move?

Hu Qin, Zizhen Zhang, Zhuxuan Qi and Andrew Lim (2013) also discuss the matter of contracting between a major manufacturer of clothing for babies, toddlers and children with 3PLs based in China for transporting these manufactured products to their target markets: thousands of national department stores and some of the largest retailers across the United States. 3PLs based in countries such as China service manufacturers via warehouse hubs in their regions following an approach of keeping the total costs of transportation constantly at the lowest possible level.

The containers stuffed with the semi-end products: T-shirts travel from Shanghai heading back to America crossing the Pacific Ocean, south along the western coast of Mexico, squeezing through the Panama Canal before reaching north to the Miami port, where they access the screen-printing factory. This consists the most complex and challenging phase of a T-shirt's life and it comprises all efforts to gain access to the U.S. market. The journey might be expensive, risky and often illegal resembling with what Pietra (2009) emphasizes and deserves further consideration:

‘’*Chinese T-shirts and Chinese immigrants have similar experiences in attempting to get to America. There is an army waiting on shore, ready to fight the invasion. The U.S. apparel industry has lost the race to the bottom from China, but this is something that not everybody is happy about*’’

It is mostly an unfair race, because U.S. producers of yarn, fabric and apparel have no hope of competing with China, even as costs in China increase and the Chinese firms experience threats on their own. China’s part in this whole supply chain of garments has such a great impact that it is a common belief that ‘’Unless somebody stops China, there won’t be another war to fight because there won’t another industry left to save’’. Just think about the waves of T-shirts, socks, underwear, caps, sweaters, pants and ties that are coming flooding the U.S. market as well as the European. In 2007, 95 percent of the 20 billion garments Americans purchased were produced overseas resulting from containerization’s consequences, China’s rapid economical growth and other political games played at the background.. (Pietra Rivoli, 2009).

This is the 21st century that we live in , so which should eventually be the fair rules for participating legally in the global trade? Pietra (2009) indicates that the best course of action for all involved parties, countries etc. under the widely accepted doctrine of ‘free trade’, is for everyone to clear the ring and let the best T-shirts, dresses, socks etc. win.

Despite the fact that the 3PL industry in China has experienced significant and rapid growth since the economic reforms of 1978 when China opened its borders to foreign investors, especially since its entry into the World Trade Organization in 2001, there is still major concern of some investors with regards to logistics in China and its poor transport infrastructure, as Ta. Choo and Sum (2000) argued. Nevertheless, the tremendous growth potential in the Chinese logistics market enforced by the trends of rapid development and modernization that dominate China’s internal environment is what raised the standards of 3PLs in China, that are now constantly seeking new sources of competitive advantage in order to be competent enough and keep adding value to the goods they are handling (Wang, Zantow, Lai, & Wang, 2006). There is still further room for progress.

However cynical this may seem, if someone wanted to depict the 21st Century by using 3 icons of this era he could use: a mobile phone, a migrant and a container box (Wiley Blackwell,2017). This is the raw truth and reality that we are facing in the 21st century,

a belief not accepted by all unanimously and apparently manifested, but one that no one can ignore of its existence.

In 2014, when Rotterdam's massive Maasvlakte 2 terminal began its operations, it was surrounded by a two-mile wall built to keep out the North Sea and had an automated system notifying the truck drivers when to bring an outbound box to the terminal. At an appointed time, a truck driver would enter through an automated gate after sensors had verified his credentials and scanned the truck and the container, and another automated system would instruct him where to back up to the security fence that surrounded the storage yard. Afterwards, a computer-controlled vehicle would lift the container off its chassis, bring it over the fence, carry it to its assigned location, and finally stack it at the proper level. Every single function of the whole operation has become automated at such a great level, that the trucker gets the job done and drives away having encountered no human being face to face. This is the current level of automation that has been accomplished in the container-handling process through the massive attack and rapid evolution of the modern communications and technology. In the past, loading required teams of vessel planners to pore over sheets listing the weight and destination of each container as they figured out the best way to load each ship.(Marc Levinson, 2016). The important role of computers replacing people in these kind of cargo operations has not been manifested until 1965.

Containerization has added value to all involved parts of its operation. We discussed this previously regarding the products and the way they are being handled throughout the whole supply chain. As far as it concerns the ports and places involved it has created value in a way of managing to combine the current trends that were occurring in other segments of the international trade, meaning communications, media, logistics, technology. In order for a port place to grow and get benefited from containerization, as Singapore did, that ended up handling six times as many containers in 2014 as in 1990, or Busan eight times as many, it had to understand the rules of the game and play along, because ''it's not a game about tons only, it's a game about employment and diversification along with added value creation'', as one port executive once explained the new rules. As container volumes are rising arithmetically, shippers- clients are constantly seeking for an even more sophisticated product-service about managing their cargo; this may be called warehousing or distribution centers service performing the

work once considered to be in the manufacturing sector, processing goods before final delivery to customers rather than merely storing them; or extended logistics with the meaning of direct links from ports to the interior, through rail yards, river ports, or even airports. It is a fact, though that supply chains can run in many different directions, using many possible combinations of railroads, trucks, ports and shipping lines and will get through specific ports and connection hubs as long as the total cost and transit time offered is competitive enough among the other routes through other ports and places. In order to remain unharmed and attract additional cargoes, ports should have a cause to smoothing the passage of cargo through them. After all, in Maritime Finance terms, adding ‘’value is said to be created by when revenues generated by the business exceed the costs incurred’’ (Chandra Prakash Garg, Vishal Kashav, 2019).

Maybe one of the places that better exemplifies the struggle for port supremacy would be that of the Persian Gulf emirate of Dubai. In the past, Dubai was a small fishing port that centered its economy on the tidal creek used by dhows transferring goods to and from emirates nearby. It was in 1979 that Jebel Ali port was constructed filling up the niche that was created for the need of a modern port able to handle the consumer goods that had started to flood in due to the soaring oil prices which had raised economically Saudi Arabia. After the creation of a free trade zone in 1985, Jebel Ali shifted from an import destination into a major hub, because now it could enable shippers to bring merchandise into the country, store it in tax-free warehouses near the port, and then ship in onward. In 2013, Jebel Ali’s computers allowed 9,000 over-the-road trucks to deliver and pick-up containers per day with very small delay. By 2015, with its three terminals was able to accommodate 10 of the latest megaships at once, handling more containers than New York and Los Angeles combined. Jebel Ali’s containerport remade Dubai’s economy and in 2013 was held accountable for the percentage of re-exports from the emirate that were over passing the emirate’s gross domestic product (Marc Levinson, 2016).

Brooks (2021) argued, also, that in the post-containerization era the distribution of dominant ports has shifted. Brooks, though, stated that two of the ten largest ports before containerization (in 1955, measured in terms of value of waterborne trade) never containerized: New York (Manhattan), NY and Newport News, VA.’’ *In fact, the Port of Manhattan, the largest in the world in 1956 , no longer exists as a freight port. Of*

today's 25 largest ports, four did not rank in the pre-containerization top 25. Only two of today's ten largest ports were in the pre-containerization top ten: Norfolk, VA and Los Angeles, CA" (Brooks, 2021). Brooks equation on how containerization impacts local population identified three factors: local consumer amenities, local productive amenities and access to international markets. As a conclusion of Brooks' findings, containerization exercises impact on all of these three factors.

Concluding in giving up the necessary credit to containerization: global supply chains were not on anyone's mind in the spring of 1956 the way we experience them today. No one could have envisioned the outcome of loading those first containers back then on the Ideal-X departing from the Port Newark.

''*Perhaps the most remarkable fact about the remarkable history of the box is that time and again, even the most knowledgeable experts misjudged the course of events. The container proved to be such a dynamic force that almost nothing it touched was left unchanged, and those changes often were not as predicted*''. (Marc Levinson, 2016)

The idea of the container as an invention that would cause a revolution in shipping seemed by a great number of people, experts and non, more than a little far-fetched, and something like, James Hetfield from Metallica once wrote ''The Day That Never Comes''. While the initial target of the container was to help ships recover a tiny share of the domestic freight business and to benefit Hawaii and Puerto Rico, truckers ignored it, railroads shunned it and even shipping lines underestimated it considering it as an adjunct to the business they already knew -just as another of the many shapes and sizes of cargo that they would get used to accommodate in their holds-, who could have ever guessed that the 'box' would possess right now a great part of our lives and would be the main reason we are wearing the clothes we are wearing and shopping directly from the shelves of our nearest stores the products we want?

Coming up to conclusions extracted from evidence given from the history of the container era so far, we can assert that haste has never been a prerequisite for survival in container shipping. Matson that raced to become the first line to carry containers across the Pacific believing that an early start would assure him loyal customers was one of the first to by betrayed by them and learn that when other companies barged into the business offering a greater and better package customer loyalty counted for little. History and facts proved that the relative latecomers to the industry were the ones that

emerged as the world's largest containership operators in the early twenty-fist century. A. P. Møller's Maersk Line built its first containership only in 1973, Mediterranean Shipping Company (MSC), based in Switzerland, did not
even exist until 1970, and Evergreen Marine was founded only in 1968. What such late-entering companies were bringing to the table in contrast to the carriers they were replacing in the industry, were financial and managerial skills foreign to their predecessors. One great example of this strategy is that while Maersk's headquarters were in Denmark, by 2015 it had gained control of more than six hundred containerships and one-sixth of the world's market by absorbing colossal companies as diverse as Britain's Overseas Containers Ltd., South African Marine, the Dutch shipping giant Nedlloyd, and even Malcom McLean's old company, Sea-Land Service. Undoubtedly the concept and logic of putting freight into containers became so compelling and popular, the cost savings so relatively enormous, that the box took the world by storm.

''*Sixty years after the Ideal-X, the equivalent of more than 300 million 20-foot containers were making their way across the world's oceans each year, with perhaps a fourth of them originating in China alone*''(Marc Levinson, 2016).

Regarding conditions and trends nowadays, attention is drawn toward value, environment and customers.Garg and Kashav (2019) studied the factors and sub-factors that create value in the entire GMSCs of containerized freight, including the forwarding stage (Inland transportation), at container seaports/ terminals and at the maritime transport stage. Shipping lines are now competing on strategic factors like speed, cost, flexibility and care for the BCOs (Beneficial Cargo Owners) and other stakeholders. In order to grab major chunk of market share, companies must maintain well-planned and managed containerized freight transportation networks and manage operating under the label of ''Green shipping'' (=the common term used to describe the bringing of environmental aspect in GMSCs of containerized freight).

Achieving sustainable competitiveness and environmental friendly processes is a goal attained by cutting CO2 emissions and decreasing the effect of greenhouse gasses, indicating the use of vessels propelled with cleaner fuel and installed with economic and energy efficient engines. These type of engines were first installed by Maersk line on its EEE class vessels (Www.Wartsila.com; Furfari, 2016; Thomson et al., 2015).

Scientific research and literature on shipment containerization strategies under carbon tax regulation have held maritime logistics accountable for about 2.5% of global greenhouse gas emissions (Sunil Tiwari, Hui Ming Wee, Yanjie Zhou and Leonardo Tjoeng, 2020) and this fact in combination with the constant urge and nature of containerization itself of always keeping the total transportation costs as low as possible is what drives the managerial and strategic movements of the players within the industry now. Reducing exhaust gas emissions from ships is one of the main concerns of the IMO and the findings from the research conducted by Nader R. Ammar and Ibrahim S. Seddiek (2020) show that environmentally, A19 container vessel generates the lowest average pollutant emissions per TEU.

Nevertheless, all fields' of research and studies point to one direction, that of constant creation of value. ''*If a company works on its service reliability and sustainability then that also creates value in customer's mindset because it indicates that the company has a vision to stay longer in the market. The strategy of value creation in GMSCs of containerized freight is a costly affair but it will be revenue generating and cost minimizing business strategy in a long run for containerized freight carriers*'' (Rao and Holt, 2005).

Through historical observations, only one time can be spotted that the world's containership fleet declined in 2014, and that was only as a result of the scrapping of the older, smaller vessels that were going to be replaced by the newer and larger ones when coming into service. We now have reached the capacity of ships of 20,000 TEUs and even larger ones are on order. Experts and naval architects now examine the possibility of vessels at Malacca-Max sizes (the maximum size of vessel that could pass through the Straits of Malacca) and if they would be practically workable and economically efficient vessels that could exceed 25,000 TEUs capacity. There is no sure answer to the question whether containerships and containerports have already reached their maximum efficiency's sizes or whether is there any further place to accommodate even larger and costlier ships and ports giving rise to yet more economies of scale. Whether these margins have been reached or can be overcome is a question of considerable consequences for the world economy (Marc Levinson, 2016).

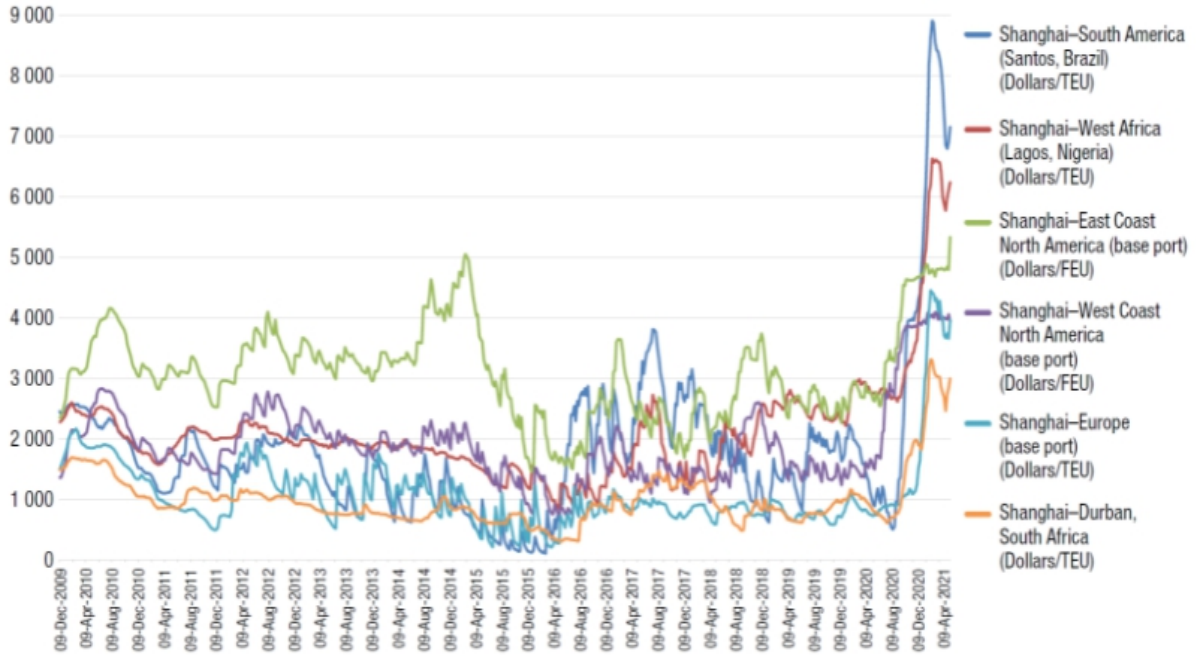
''But everything comes with a cost e.g. bigger vessels need bigger and better cranes at ports, larger berth area and larger cargo yards which is a capital intensive matter. More

cargo at ports, loaded/unloaded by bigger vessels may lead to hinterland congestions'' . All these will require quick evacuation of cargoes from ports and efficient inland connection in order to do so. Therefore, the benefit of additional economies of scale may get impeded. ''Hence, all parties involved: industry managers, strategists in governments and policy makers need to plan out wisely'' (Chandra Prakash Garg, Vishal Kashav, 2019).

5.2 Containers in the Covid-19 crisis period

Since December 2019, that was spotted for the first time and started spreading all over the world, the coronavirus disease (COVID-19) pandemic has become a part of our everyday lives and still keeps substantially impacting livelihoods and putting extreme stress on socioeconomic systems.

Since in the world as we know it, including clothes, electrical appliances, medicines, processed foodstuff etc, almost all manufactured goods are shipped in containers, container rates have a particular impact on global trade. The abrupt fluctuations that have been noticed in the covid-19 period found their way out reaching and hitting most consumers and we, ourselves, became eyewitnesses of the rapid rises in the goods' prices. The majority of the business wasn't able to bear the brunt of the higher rates and passed them on to their customers, as Mr. Jan Hoffmann (2021), head of UNCTAD's trade and logistics branch, commented.



Abbreviations: FEU, 40-foot equivalent unit; TEU, 20-foot equivalent unit.
Source: UNCTAD calculations, based on data from Clarksons Research, Shipping Intelligence Network Time Series.

Picture 6. Shanghai containerized freight index, weekly spot rates, 18 December 2009-9 April 2021, UNCTAD calculations, based on data from Clarksons Research, Shipping, intelligence Network Time Series

Through a UNCTAD policy brief we may examine why freight rates surged during the pandemic. Even tough in the beginning of this whole 'pandemic crisis' a slowdown in the global market had been noticed, contrary to the majority's expectations, and as a result of the numerous lockdowns imposed in many countries around the globe, demand for container shipping has grown during the pandemic, bouncing back quickly from that initial downturn.

"*Changes in consumption and shopping patterns triggered by the pandemic, including a surge in electronic commerce, as well as lockdown measures, have in fact led to increased import demand for manufactured consumer goods, a large part of which is moved in shipping containers*," the UNCTAD policy brief says. (UNCTAD, 2021)

People that was experiencing the lockdowns due to the pandemic all over the world, may in the beginning decreased their total expenditure by staying at their homes, but soon enough got back on track ordering stuff online boosting the electronic commerce as well; there was no other immediate way to cover their needs. The way to bring in all these orders at a moment when demand skyrocketed at once was, of course, through the containers. From the one side of the coin, some governments tried to keep the maritime

trade flow and proceeded with eased lockdown approving national stimulus packages, while on the other hand, businesses stocked up in anticipation of new bigger waves of the pandemic. The rapid increase in demand was higher than most expected and the supply of shipping capacity was not sufficient to keep the balance in the market, while the subsequent shortage of empty containers that was noted as unprecedented was being added in the pile of problems created inflating the negative situation even more. All members of the industry, including carriers, ports, shippers, were taken by surprise, because none of them was expecting such a disease to appear and change the world overnight. No one had planned for this kind of situation and empty containers being left in places where they were not needed, unable for repositioning resulted in this 'unprecedented shortage' of needed equipment for the transportation.

On trade routes to developing regions, where consumers and businesses could least afford it, the impact on freight rates appeared to be greater. Currently, rates to western Africa and South America are higher than to any other major trade region.

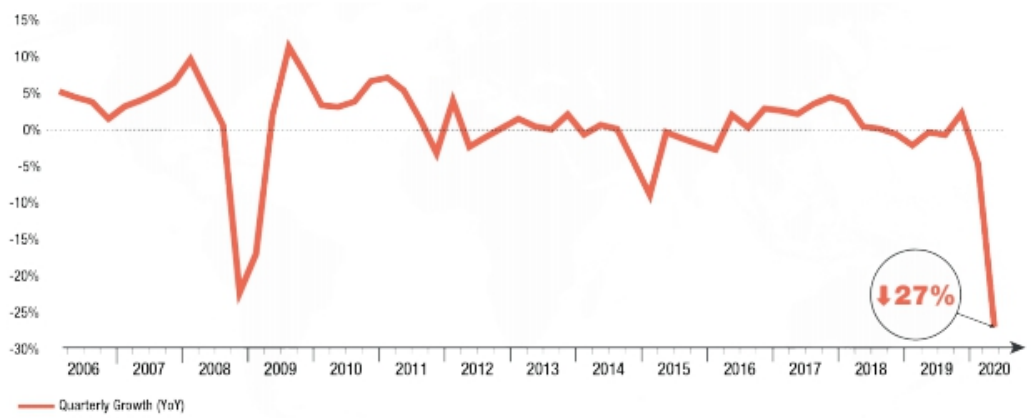
''*By early 2021, for example, freight rates from China to South America had jumped 443% compared with 63% on the route between Asia and North America's eastern coast. Part of the explanation lies in the fact that routes from China to countries in South America and Africa are often longer. More ships are required for weekly service on these routes, meaning many containers are also "stuck" on these routes.*

When empty containers are scarce, an importer in Brazil or Nigeria must pay not only for the transport of the full import container but also for the inventory holding cost of the empty container" the policy brief says. (UNCTAD, 2021)

Another reason that drove towards this direction of higher rates in these regions is the lack of backhaul trips -meaning the available return cargo. It is costlier for carriers to return empty boxes to China on long routes from South America and western Africa, since the later import more manufactured goods than they export.

It is now already economically accepted that the COVID-19 pandemic affected global trade flows at an unprecedented speed and scale. During the pandemic, access to essential goods and medical items has been secured largely by the ability of the maritime supply chain to quickly adapt.

''UNCTAD estimated global merchandise trade to have fallen by 5 per cent in the first quarter of 2020 and expected a deeper contraction of 27 per cent in the second quarter. For the full year, UNCTAD expected a drop of 20 per cent. The World Bank further noted that that merchandise trade appeared to have bottomed out in April, falling nearly 20 per cent year on year, after a 10 per cent decline in March. The trade contraction caused by COVID-19 is deeper than the one observed during the financial crisis of 2008- 2009 ''



Source: UNCTAD (2020). Global Trade Update. June (https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2392).

Picture 7. Trends in Global Trade (percentage change), source UNCTAD (2020), Global Trade Update, June

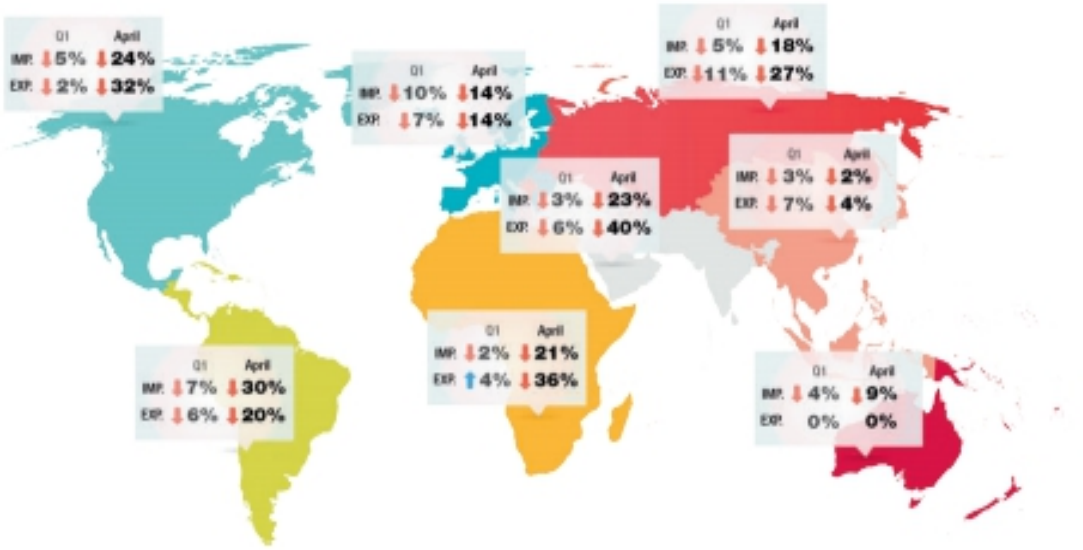
'' Global trade performance has been uneven suggests that the sharpest year-on-year downturn in April took place in the Middle East, which registered trade declines of up to 40 per cent. Trade also collapsed in sub-Saharan Africa, Latin America, the Caribbean, North Africa, North America, and the European Union (EU 27), following the declaration of the pandemic by the World Health Organization (WHO) in mid-March 2020. Declines in East Asia and the Pacific trade were less severe, with exports registering a 7 per cent decrease in Q1 2020 and 4 per cent in April. In April, China appears to have performed better than other major economies, registering modest growth in exports. However, data for May 2020, indicate that China's imports and exports fell by about 8 per cent. Although the trade slowdown was visible in both developing and developed countries, trade in developing countries, especially imports, appears to have fallen relatively faster. While the decline in the exports of developing countries may reflect reduced demand in destination markets, falling imports are also

driven by the suppressed demand as well as other factors such as exchange rate movements, concerns regarding debt and shortage of foreign currency. Meanwhile, with the continued lockdowns in Latin America, forecasts are increasingly pointing to a further and rapid deterioration in the trade of developing countries''

UNCTAD report in ''Covid-19 Impacts on Global Trade Flows'', continues:

''As shown many sectors have been negatively affected during the first four months of 2020. Variations across sectors reflect both reduced demand and supply-side disruptions. In the first quarter of 2020, Textiles and Apparel declined by nearly 12 per cent. Office Machinery and Automotive sectors fell by about 8 per cent. In contrast, the value of international trade in the Agri-food sector, which has been the least volatile, grew by about 2 per cent. Trade in Transport Equipment and Fuels fell respectively, by 30 per cent 50 per cent in April. Sharp contractions in Energy trade (-40 per cent) and Automotive Products (-50 per cent) have been recorded. Meanwhile, trade in Office Machinery appears to have rebounded in April, largely because of China's positive export performance. As can be expected, trade in Essential goods recorded a modest increase during the pandemic.

With store closures in major consuming markets, the suppressed demand induced major apparel brands to reportedly delay and cancel orders. Suppliers in garment-producing countries have faced order cancellations, reduced order volumes and extended payment terms, which resulted in many having to reduce operations or stop them altogether. As it is standard practice for brands not to pay for products until after they are shipped, when an order is put on hold or cancelled, payments are also held or cancelled. Some brands have even reportedly asked for discounts on orders that had already been shipped. The precise trajectory of the economic recovery remains uncertain. Recovery will depend on the pandemic's evolution as well as the capacity of the economies to quickly recover from lockdown measures used to slow the COVID-19 outbreak.''



Source: UNCTAD (2020). Global Trade Update. June (https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2392).
Notes: UNCTAD calculations based on national statistics; Statistics for April are preliminary and based on a limited number of countries. Data excludes intra-EU trade.

Table 2. Global trade by sector in 2020 (Percentage change over 2019)

	Q1 2020	April 2020
Agri-food	2%	-2%
Automotive	-8%	-49%
Chemicals	0%	-14%
Communication Equipment	-6%	-4%
Electrical Machinery	-4%	-13%
Energy	5%	-39%
Machinery various	-8%	-11%
Materials and Ore	-2%	-7%
Office Machinery	-8%	8%
Precision instruments	-3%	-14%
Textiles and Apparel	-11%	-6%

Picture 8. Global Trade by Region in 2020 (Percentage change over 2019), source: UNCTAD 2020, Global Trade Update, June (https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2392).

The widespread lockdowns, travel restrictions, the fast-rising unemployment, the government rescue packages and oil and stock market crashes are some of the high lights that marked the first half of 2020. The second half of the year remained uncertain in expectation of a muted recovery as lockdowns were expected also to be lifted. In June 2020, a global GDP contraction of 4.9 percent has been projected by the International Monetary Fund (IMF). The upcoming performance in 2021 is dependable upon the ability to contain the outbreak of the disease, the progresses in the search of the vaccine,

the effectiveness of the different stimulus packages, the impact all these will have on consumer habits as well as the government debt-tackling policies. GDP forecasts for the year 2021 range from -2 percent to +6 percent.

During the Covid-19 crisis period another consequence was the great decline of port calls. The sector that noted a minor decline of 1.1 percent in the first quarter of 2020, was that of containership port calls, which fell by 5.8 percent in the second half of the year, numbers that were not the greatest within the maritime industry but not so little as to no be considered accountable. All this data has been managed to be gathered through the Automated Identification System (AIS) data that tracks and traces ship movements, providing near real-time information on maritime transport and trade currently in motion.

What has been noticed in the months that followed in 2021 eventually caught many by surprise. New records have been spotted in the freight rates in the dry bulk cargoes along with containerships, as Mr. Lambros Karageorgos wrote in Naftemporiki's site on the 14th of August 2021. Drewry's World Container Index rose the week from 2/08/2021 to 08/08/2021by an additional 0.5% or $50 to $9,421.48 per 40-foot (ft) container reaching the highest point of the year and 358% higher than, what in the same week of 2020. This trend which is also reflected in the freight rates with which liners hire from their shipowners their containerships, is expected to continue. An indicative fact, however, of what is currently happening in the container transport segment is the chartering of the Euroseas' container vessel M/V Diamantis P. This ship, with a capacity of 2,008 TEU, and built in 1998, has been chartered from the upcoming October for a period of 36-40 months with an average hire freight rate of $ 27,000, an amount which is four times higher than the existing hire rates.

Euroseas Ltd, the shipping company of Aristides Pittas listed in NASDAQ, announced for the second quarter of 2021 total revenues of $ 18.3 million, increased by 35.4% compared to the corresponding period of 2020, and net profits of $ 7.9 million against earnings of $ 1.3 million in the same period last year.

In his statements, Mr. Pittas noted, that among other things, the container shipping industry continues to move in relation to freight rates at record levels, and estimated that this situation is expected to continue, since apart from the short-term effects due to the pandemic, demand is expected to continue growing at high rates after the return to

normality in the economies. According also to Mr. Pittas, the strong demand for tonnage for the next two to five years is fueled and supported by the expectation that ships' capacity will be deficient in the following years. The new requirements of environmental legislation, though, that are about to be imposed from 2023 onwards, will also play an important role in this development. (Lambros Karageorgos, 2021).

Luigi Zingales, Professor of Economics in the University of Chicago and co-organizer of the podcast 'Capitalisn't' once wrote :''*This is the biggest political lesson from Covid-19. A globalized economy makes local problems global. Even though there might be a confusion created from this pandemic, this has not necessarily have to be existent in the next one- or in other problems such as climate change, which also have an exponential and unequal impact and require global solutions. If we do not take this lesson on time, our species deserves to disappear*''. (Luigi Zingales, 2021)

By this, he illustrates in his own 'glossy' way the great impact that such a disease appeared to have in a globalized economy affecting all known segments and aspects of it. Economy's downturns, under the sphere of globalization, must be handled and given solutions at a global level in order to continue towards a prosperous and viable future. When the Covid-19 pandemic began to spread, series of actions such as the implementation of national lockdowns and cease of the production of goods, ultimately pulled the plug on economic growth. All shipping companies performing operations began reducing the quantity of cargo ships that were being sent out and their port calls resulting in a steep cease of the usual flow of trade and as a direct consequence in an unprecedented shortage of empty container units, that were not being collected for repositioning. In American regions, Asian containers were 'stuck', because the lines couldn't send them back to their origin due to the Covid-19 restrictions. This imbalance continued soon afterwards, because as the majority of the countries globally were still struggling with Covid-19 in their efforts to recover, China from the other side -the country that is conceived it was the first to be impacted by the disease- had already recovered at an acceptable level being able to re-activate its imports and exports. But to where would this part of the trade been forwarded since the other countries were still under the regime of Covid-19 restrictions? In this equation came to be added the shift that has been noticed in costumer expenditure from services to goods due to restrictions

imposed by national lockdowns, something that sparked the demand for goods, in a period where the flow of trade had been stopped in general and the supply of vessels and equipment was limited. In these uncertain waters the shipping industry was left to fight the impacts of Covid-19 crisis, hoping to see improvements on the horizon within the years that follow.

Conclusions

Following the evolution of the containers throughout the ages, from their time of their first actual establishment on April 26, 1956 (Levinson, 2016), we have seen and acknowledged, what to many might have been at the start a big failure and just another waste of time and funds, the importance of containerization and its utility as integral part of the whole transportation system from the shipping markets to our everyday lives (Pietra, 2009; Hu Qin, Zizhen Zhang, Zhuxuan Qi , Andrew Lim, 2013; Lam, 2015;Chandra Prakash Garg, Vishal Kashav, 2019). The way we experience many things nowadays and the way we end up seeing things might not have been the way we know it if it wasn't for the containers. We wouldn't be able to have the consumer habits we have, eat whatever we want, dress with whatever we dress with or find the products that we need 'just-in-time'' needed. Big places of economical growth (Brooks, 2021) wouldn't be the same as they are today if containerization hadn't enjoyed such a great development and popularity. Geographically the biggest ports in financial growth and commercial areas might not have been those we know today (David Guerrero, 2014;Marc Levinson, 2016; Brooks, 2021).

To our research question of the additional value that containerization has contributed we've reached to the conclusion that: Containerization is a revolutionary change in the 20th century's transportation technology, responsible for the acceleration of the globalization of the world economy since the 1960s (Bernhofen, El-Sahli and Kneller, 2015); Containerization is linked to the post World War II growth of world trade (Paul Krugman 2009, p.7) making possible to ship goods to long distances fairly cheaply, by linking, simultaneously, ports with the interstate highway networks increasing the competitive advantages of these areas, creating the so-called 'load-centers' (Mayer,1978;

Hoare, 1986; Brooks, 2021), creating a hinterland-foreland continuum (David Guerrero, 2014), moving towards the direction of intermodalism's approach (Jean-Claude Thill and Hyunwoo Lim, 2010), which has been proven to benefit in terms of freight cost savings. Containerization made possible to move different types of cargo around the world that wasn't feasible before; it contributed in cost savings around 20 percent at distances that are relevant for major trading economies (Cosar and Demir, 2018), with a fixed cost around 50 to 100 percent higher than its breakbulk alternative and helped remote countries begin trading with each other eliminating the ''death of distance'' condition (Cosar and Demir, 2018); Cost savings had been made possible by consolidation of container service to a developing region through a trans-shipment terminal as proven by quantified analysis (Joan Al-Kazily, 1981); Containerization resulted in far reaching complementary technological and organizational changes in port and railway services that affected economies' entire transportation sectors (Bernhofen, El-Sahli and Kneller, 2015) and consequently the real gains from it might come from the improved quality changes in transportation services (Hummel, 2007, p.144).

To the question raised regarding if there is any further space for growth in the near future: after all these years of survival through economic crisis and even the latest covid-19 pandemic crisis, the prospects seem still optimistic (A. Pittas, L.Karageorgos, 2021; UNCTAD 2021). To the question whether ships will become larger, ports along with them, volumes of cargo being transported as well, creating even bigger economies of scale, the answer is that it is something uncertain, as most economical aspects; it is something that the future withholds and only the bold and daring may take advantage of; (Marc Levinson,2016) and it is something that eventually will be dictated by the basic principles of economy: where there is demand, there will be a supply to satisfy it. But keeping in mind that everything big comes with a cost, all involved parties must plan ahead wisely in order to survive (Chandra Prakash Garg, Vishal Kashav, 2019)

Closing our last findings we resulted in that Covid-19 pandemic affected mostly the first half of 2020 (UNCTAD, 2021) with an only mediate increase in the trade of Essential Goods as a result of customers' behavior shift. Record high container freight rates had been acknowledged within 2021(A.Pittas, L. Karageorgos, 2021) and it has become apparent that local problems within a globalized economy are becoming as a consequence global (Luigi, 2021).

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