

ΥΠΟΥΡΓΕΙΟ ΕΜΠΟΡΙΚΗΣ ΝΑΥΤΙΛΙΑΣ
ΑΚΑΔΗΜΙΑ ΕΜΠΟΡΙΚΟΥ ΝΑΥΤΙΚΟΥ
ΣΧΟΛΗ ΠΛΟΙΑΡΧΩΝ - ΑΕΝ ΜΑΚΕΔΟΝΙΑΣ



Επιβλέπουσα Καθηγήτρια: Παναγοπούλου Μαρία

Advantages and Disadvantages of Using Containers

Κωνσταντίνος Βουρλάκος
Α.Γ.Μ.: 4366

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**ΑΚΑΔΗΜΙΑ ΕΜΠΟΡΙΚΟΥ ΝΑΥΤΙΚΟΥ
ΜΑΚΕΔΟΝΙΑΣ**

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ΘΕΜΑ:

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ΤΟΥ ΣΠΟΥΔΑΣΤΗ: Κωνσταντίνος Βουρλάκος
A.G.M: 4366

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Preface

In the present work, the issue of container transport will be considered. The current issue of this industry will be approached by presenting the prevailing trends. After the introduction that puts the reader of the work in the context of maritime transport in relation to the containers, the route of container's development follows, making a historical review of the beginnings of this transport phenomenon. A way of transporting goods that radically changed the method that people followed for millennia.

Reference is also made to the legal framework governing the sector. Summary information is also provided that helps to understand the whole industry in order to better understand the advantages and disadvantages of using containers. One such sector is the containerships themselves.

Particular emphasis will be placed on the advantages and disadvantages of transporting products from one place to another through containers. There is a wealth of information that is meticulously reported so that the reader can understand the magnitude of the change that has taken place in the field of transport since the application and use of containers. But a natural consequence is a number of disadvantages that follow this method. The work meticulously presents all the important and minor disadvantages of using containers.

Greek and international bibliography was used to approach the concepts and elements of the work. Organizations, companies data, scientific research, government documents and statistics were used to approximate the information that makes up the project. They were collected, analyzed and presented in a way that approaches the issue of the advantages and disadvantages of using containers.

Introduction

Maritime transport includes individual groups such as institutions, states, factors of production and productive activities. As a predominantly international economic activity, it is influenced by its wider operating environment. Transportation in general is one of the most important sectors in the economic life of a geographical place. Transportation as part of the production process depends essentially on the movement of goods produced in a place as well as those exchanged between others. That is why transportation has a direct impact on the economic and social development of the local areas and in a broader sense on national security for the states.

Between these factors, namely the national security of a country on the one hand and its economic and social development on the other, there is such a relationship that shows how important the transport sector in all its forms is. The importance of transport may vary from country to country depending on the form of transport that best serves the vital interests of each country, such as sea, air, rail, road and inland waterway.

From all the various forms of transport, the best way for a country's national economy is to develop maritime transport. Maritime transport, and in particular the shipping industry of seagoing ships, is one of the few international industries in the world today. It is the only form of industry where every transaction of economic content has an international character. A typical example of the above is when a tanker usually of large capacity belongs to a Greek company in Liberia or Panama, has headquarters in London, has been built in the Far East (Japan, South Korea), has Swiss, German or Danish engines, the crew of various nationalities for officers or crew, funded by the American Bank, insured in London and transporting oil from the Persian Gulf to Western Europe.

This form of international shipping is possible as long as there are economic systems based on supply and demand as well as free and fair competition.¹ Shipping has a greater impact than any other factor on the economic development of the world and the formation of the modern trading economy. International maritime trade is a

¹ Βλάχος Γ.Π., *Εμπορική Ναυτιλία και Θαλάσσιο Περιβάλλον*, Εκδόσεις Σταμούλη, Αθήνα 2007, σ.σ. 35-39.

huge economic mechanism, on a normal operation depends not only on the economic life of nations, but also on the very existence of hundreds of millions of people, since basic foodstuffs are among the most important products of international maritime transport. We can say that maritime trade is now an artery, the cessation of which could lead to the complete collapse of the planet's economic life.²

The Distinction of Maritime Trade

The shipping operation is not a single industry, but is made up of many sub-sectors. The same, of course, applies to the cargo that constitutes international maritime trade. There are many different cargoes and many different types of ships that carry these cargoes. In the overall examination of maritime transport, the distinction between ships and cargo is essential.

The key factors of maritime transport are the shippers, ie the owners of the cargo, who wish their cargo to be transported, and the shipping companies, to which the ships belong, which they place on the market by offering transport services. Loaders and ship owners meet at the freight market, where they agree and regulate the conditions under which the maritime transport will take place.

The demand for maritime transport services is created by the need to transport raw materials, semi-processed and final products to production and consumption sites. The offer of maritime transport services is created by the global fleet, which consists of many types of ships. At the same time, cargo ships do not all have the same characteristics or the same size.

The global fleet consists of many types of ships. A first distinction of ship types, consequently of the different markets operating within the shipping industry, is equivalent to that of cargo. There are ships that are suitable for handling and transporting bulk cargo and ships that are suitable for handling and transporting general cargo. All ships participate in the freight market competitively, seeking to meet the needs of maritime transport services.

² Βλάχος Γ.Π., σ.σ. 30-37.

Advantages and Disadvantages of Shipping Transportation

For a long time in human history, maritime shipping was the best way to transport your goods across the world. About 71% of Earth's surface is covered in oceans. Therefore, transporting goods on a ship to another continent was a relatively straightforward operation in comparison to land shipping. However, with the advancements in technology, air-shipping has become a dominant form of long-distance transportation. Still, this doesn't mean that maritime shipping doesn't come with its own unique pros that make it a better choice in some cases.³ In fact, more than 90% of the goods transported in the world are carried by the international shipping industry. But with alternative options, such as air, road and rail transportation, there are some significant benefits.⁴

Firstly Economical because the ocean shipping industry offers the most competitive freight costs to shippers, especially over long distances. By comparison, some estimates show that ocean freight shipping costs are generally four to six times less expensive than air. With statistics like this one, it is easy to argue that ocean transportation is the cheapest international shipping option. Efficiency on the other hand is a privilege. No matter the size of your shipments, sea freight companies can usually accommodate every commerce need. Smaller shipments can be grouped together with other cargo to fill a container, allowing for cost-sharing of the transportation services. Larger cargo can fill one or more containers, offering shippers unmatched bulk options. In fact, vessels are the ideal way to move high volumes of cargo as they are designed to carry large amounts of goods or raw materials.

Oversized, heavy and bulky cargo capability is an ability of the industry. A major advantage of sea freight shipping is shipping companies' ability to handle oversized, heavy or bulky cargo – often referred to as breakbulk or Not in Trailer (NIT) loads. Such cargo could include large vehicles, equipment, construction materials and more. Oftentimes too heavy or large for air

³ Global Trade 09/07/2019, <https://www.globaltrademag.com/pros-and-cons-of-maritime-shipping/> , «Pros and Cons of Maritime Shipping», (last access 24/03/2021).

⁴ Logistics Solutions, <http://logsolution.ge/en/advantages-and-disadvantages-of-cargo-transportation-by-sea-transport/> , «Advantages and disadvantages of cargo transportation by sea transport», (last access 24/03/2021).

freight or even over-the-road transportation, very large cargo is not a problem on many shipping vessels.

Safety and reliability is a major advance too. Ships are designed to carry hazardous materials and dangerous cargo safely. The industry is well-versed in the handling of such goods and has regulations in place to ensure the safety of the vessel, crew, cargo and environment. Cargo loss caused by incidents during transportation is continually dropping as maritime safety increases, and has dropped significantly in the past decade. Containers are designed to be sealed and locked during transportation for extra security. Lastly Shipping industry has an environmental friendly face. When compared to sea shipping, air and many other forms of transportation have much higher carbon footprints – a definite disadvantage for the environment. Ships, on the other hand, provide the most carbon-efficient mode of transportation and produce fewer grams of exhaust gas emissions for each ton of cargo transported than any other shipment method. These already-low emissions continue to trend downward as technology advances, new ships come online and as liquefied natural gas (LNG)-powered options are utilized.⁵

On the other hand there are some significant disadvantages of sea transportation. Cargo transportation by sea has one serious disadvantage, the time of arrival. Goods delivery by a ship takes a little longer, then by any other kinds of transport. Also, it's quite difficult to determine the exact transit time. There can be some delays during the process of transportation, connected with such weather conditions, as head wind, storm and other phenomena, which affect the course of the ship. In some cases, the time of transportation can raise to a few more weeks. Some difficulties can appear during the customs clearance. If there are some mistakes in the documentation, the cargo can be delayed indefinitely. Moreover, the cargo can be withdrawn because of the problems with documents, but problems with customs clearance are relevant to all kinds of international transportation. Today the modern containers exclude the risk of stealing or spoiling the transported cargo. They also protect the goods from external influence, including climatic factors.⁶

⁵ Crowley 03/20/2018, <https://blog.crowley.com/advantages-of-ocean-shipping> , «*Top Five Advantages of Ocean Freight Shipping*», (last access 28/03/2021).

⁶ Logistics Solutions.

General Cargo and Containers

General loads include the semi-processed and finished products. In other words, these are a large number of cargoes, most of them processing products, the demand for which is evolving normally in a long period of time. General cargo was defined as cargo consisting of a sum of goods, each of which is not offered or requested in a quantity sufficient to complement, as a similar cargo, the entire carrying capacity of a cargo ship.⁷ Thus, the general cargo of a ship can consist simultaneously of boxes of electrical items, containers with raw materials or spare parts, containers with liquid cargo, machinery, pallets with sugar bags, steel products, etc.

General cargo also includes goods of particularly high value or fragility, which require a special transport service and for which the owner prefers to pay a fixed fare rather than a fare set on the free market. This feature of the cargo leads to different approaches to regular shipping compared to bulk freight shipping. While the latter is interested in reducing unit costs, for the former the reliability, speed and quality of the transport service it provides are more important. For this reason, bulk shipping companies typically provide homogenized services, while regular shipping companies place more emphasis on diversifying their service.

Containership is the type of ship that has dominated general cargo transportation. Can and does carry containers. Their carrying capacity can exceed 4,000 teu. Cruising speed, loading and unloading are their key features.

The Route of the Modern Metal Shipping Container

Modern container shipping celebrated its 60th anniversary in 2016. Almost from the first voyage, use of this method of transport for goods grew steadily and in just six decades, containerships would carry about 60% of the value of goods shipped via sea.⁸ A standard shipping container is the most widely used, integral part of modern logistics. It seems ordinary to use a container with standardized dimensions

⁷ Γεωργαντόπουλος Ε., Βλάχος Π.Γ., *Ναυτιλιακή Οικονομική*, Εκδόσεις Τζέϊ & Τζέϊ Ελλάς, Πειραιάς 1997, σ.σ. 39 – 45.

⁸World Shipping Council, <https://www.worldshipping.org/about-the-industry/history-of-containerization> , «History of Containerization», (last access 24/03/2021).

so it's easy to load and unload, transport goods efficiently and seamlessly through all transport modes, however, there is a long history behind this invention.

Before the first types of containers appeared, freight was handled manually as break bulk cargo. Goods were taken through a series of pick-ups and loads from factory to vessel, then from vessel to warehouse, from warehouse to another vessel and so on. This method required a lot of handling and delays, which was costly, time consuming and unreliable.

The idea of using some type of shipping container was not completely novel. Boxes similar to modern containers had been used for combined rail and horse drawn transport in England as early as 1792. The US government used small standard-sized containers during the Second World War, which proved a means of quickly and efficiently unloading and distributing supplies. However, in 1955, Malcom P. McLean, a trucking entrepreneur from North Carolina, USA, bought a steamship company with the idea of transporting entire truck trailers with their cargo still inside. He realized it would be much simpler and quicker to have one container that could be lifted from a vehicle directly on to a ship without first having to unload its contents.

His ideas were based on the theory that efficiency could be vastly improved through a system of *intermodalism*, in which the same container, with the same cargo, can be transported with minimum interruption via different transport modes during its journey. Containers could be moved seamlessly between ships, trucks and trains. This would simplify the whole logistical process and, eventually, implementing this idea led to a revolution in cargo transportation and international trade over the next 60 years.⁹ By the end of the century, container shipping was transporting approximately 90% of the world's cargo. Containerization shaped the world we live in; it provides an opportunity of fast and safe delivery of millions of goods, each day. Undoubtedly, this invention influenced globalization and world economy.¹⁰

Given the large investment costs, industry experts revealed a considerable amount of uncertainty and skepticism regarding the success of the container

⁹ The first company to adopt the new transport system was SEALAND SERVICE LTD. In 1973 the company she owned 45,000 containers. The shipping container appear en masse in the West Europe around 1966 and since then they have been growing steadily worldwide. Similarly, the change in the equipment of the ports, which should be meet some standards.

¹⁰ PLS logistic services, <https://www.plslogistics.com/blog/the-history-of-containers>, «*The History of Containers*», (last access 24/03/2021).

technology at the time. Many transportation analysts judged container shipping as a niche technology and did not anticipate the dramatic transformations that this technology was about to bring to the entire domestic and international transportation sector. In the first decade following the first steps of the industry, innovation and investment in container technology remained an American affair. Ports, railroads, governments, and trade unions around the world spent those years studying the ways that containerization had shaken freight transportation in the United States. The early initiatives came from US shipping lines and by the early 1960s, containerization was firmly established on routes between the US mainland and Puerto Rico, Hawaii and Alaska. Ten years of US advancement in container technology set the foundation for containerization to go global in 1966. In that year, the first container services were established in the transatlantic trade between the US and European ports in the UK, Netherlands and West Germany.

Containerization started as a private endeavor by the shipping lines. In the early stages, shipping lines had to bear most of the costs since many ports such as New York and London were reluctant to spend significant funds on *a new technology* with uncertain returns at the time. Many shipping lines had to operate from small and formerly unknown ports and install their own cranes. The process was extremely expensive. After the container proved to be successful, ports warmed up to containerization and a race started among ports to attract the most shipping lines by building new terminals and providing the infrastructure to handle containers. Containerization required major technological changes in port facilities, which often led to the creation of new container ports. In the United States, the new container ports in Newark and Oakland took business from traditional ports like New York and San Francisco. In the UK, the ports of London and Liverpool, which handled most of the British trade for centuries, lost their dominant position to the emerging container ports of Tilbury and Felixstowe.

In many countries, port authorities fall under the administration of the government. Because of the high costs, careful planning and analysis had to be undertaken by governments to study the feasibility of containerization. In the UK, the government commissioned McKinsey (1967) to conduct a cost and benefit analysis before spending significant public funds on container port facilities. Five years later, McKinsey (1972) provided a quantitative assessment of the effects of containerization following the first five years after its adoption in the UK and Western Europe

provides a summary of the sources and magnitude of resource savings from the adoption of container technology between 1965 and 1970-71.¹¹

Definition, Legislation and Practice of Containers

Shipping containers also brought about the maritime organizations that set forth rules and regulations for the sizes and the methods used to ship internationally. This led directly to a common platform used by all shipping containers and the subsequent development of the international standardizing Authority. For the maritime law container is defined as a large metal box made mainly of steel that is tightly closed, has one or more access doors to facilitate there are various types of goods, and is used to transport solid, liquid, and gaseous cargoes. The different requirements of the countries, but also the choices of the carriers, led to the creation of many types of containers. It is designed to facilitate handling, loading, stacking on board, unloading and simultaneous transport of a large number of cargo or a large quantity using mechanical means.¹²

The concept of container is precisely presented in the International Customs Convention on Safe Containers, signed on 18 May 1956 in Geneva. Thus container is the transport instrument which is: a) strong construction so that it can be used repeatedly (b) specially designed to facilitate the carriage of goods by one or more means of transport without intermediate transshipment (c) equipped with components which enable it to be easily transported, in particular when it is transhipped from one means of transport to another (d) constructed in such a way that it can be easily loaded and unloaded e) has an internal volume of one cubic meter or more. f) The container should be enclosed by four corner edges.¹³

The International Convention, in addition to the technical instructions for the construction of containers, also defined the type of safety signs that each container

¹¹ Research Gate, https://www.researchgate.net/publication/256050923_Estimating_the_Effects_of_the_Container_Revolution_on_World_Trade, «*Estimating the Effects of the Container Revolution on World Trade*», (last access 24/03/2021).

¹² The Journal of Maritime Law and Commerce, <http://www.jmlc.org/index.php>, Simon S., *The Law of Shipping Containers 1974*, (last access 24/03/2021).

¹³ Κιάντου-Παμπούκη Α., *Ναυτικό Δίκαιο II*, εκδόσεις Σακκουλά, Αθήνα 2007.

must carry in order to approve its safety. This signs must be clearly visible on the container and legible. It must contain the following information: date of manufacture, country of approval, container number, weight, date of inspection. Containers that do not have this sign are not accepted at the port of unloading even if they come from a country that is not a party to the International Container Convention. The construction specifications of the containers used today must comply with the requirements of this Convention and the rules of the International Standard Organization (I.S.O.).

Each container has on its surface and on its sides a mixed number consisting of four letters of the Latin alphabet and 6 digits plus a seventh additional digit, which is either squared or underlined and is called a check digit. The 6 digits are called the serial number of the container while the 4 letters are the owner's code.¹⁴

Valid Types and Dimensions of Containers

There are many factors that differentiate the types of containers. The majority used worldwide today, according to the ISO standard, are mainly two and are distinguished by size. There are TEU twenty foot equivalent unit which are 6 meters and FFE forty foot equivalent which are 12 meters. However, for several years now, the ISO standard has come under repeated pressure because many agents now want wider and higher boxes. It is observed that some ship owners have given in to pressure and use containers with dimensions larger than those provided by the ISO standard.¹⁵

A general purpose container is also known as a "dry container". These shipping containers are fully enclosed, protected from the elements and weather proof, with a rigid roof, side walls and floor. Dry containers are by far the most common type of container, and as such are used to load most types of normal cargo. In addition, general purpose containers can have adaptations such as liner bags or flexi-tanks for shipping certain types of liquid bulk cargo or dry bulk cargo.

¹⁴ Γεωργακόπουλος Λεωνίδας Ν., *Εμπορικό Δίκαιο ΙΙ*, Επιμ. Τουντόπουλος Β.Δ., εκδόσεις Σακουλλά, Αθήνα 2010.

¹⁵ e-nautilia 17/10/2017, <https://e-nautilia.gr/i-istoria-ton-container-ships/>, «*Η ιστορία των πλοίων μεταφοράς εμπορευματοκιβωτίων (container ships)*», (last access 26/03/2021).

According to statistics published by Eurostat for 2012, it is the most common category and reaches 89% of the containers that move annually. They can carry almost any commodity for which there is no temperature rule to be stored. Examples of the thousands of categories that are transported daily are various metal spare parts, marble, cotton, e.t.c.¹⁶

The flat Rack Containers is a simple storage container has collapsible sides that can be folded to make a flat rack. The end walls are stable enough to allow cargo securing, so they are ideal for shipping goods that are oversized, such as heavy machinery, vehicles on tracks, big reels and construction materials. Some 40' flat rack shipping containers are suitable to carry as much as 45 metric tons of cargo.

An open top shipping container has a convertible top that can be completely removed. This is suitable for cargo that is over-height and cannot be easily loaded through the door, such as tall machinery or other heavy / bulky finished products whose handling and loading can only be performed with a crane or rolling bridge. Open top containers have lashing rings installed to the upper and lower side rails and corner posts to secure cargo, and are available in 20' and 40'.



Image No.1: Seven Major types of containers. Container units form the most integral part of the entire shipping industry, trade, and transport. These shipping containers are the structures that store various kinds of products that need to be shipped from one part of the world to another using different types of container ships.

¹⁶ Containers have become a popular way to ship private cars and other vehicles overseas using 20- or 40-foot containers. Unlike roll-on/roll-off vehicle shipping, personal effects can be loaded into the container with the vehicle, allowing for easy international relocation.

The Double Door Containers appears with doors on both ends of the shipping container, this container type is also known as a "tunnel container". Double door containers are extremely helpful for quickly loading and unloading goods, and they make an even wider room for goods such as steel and iron. Both sets of doors have the same locking assembling and weather tight seals to keep cargo protected from the elements.

The high cube shipping containers are similar in structure to general purpose containers, but taller by about 1 foot. These containers come in sizes 40' and sometimes 45', and are used in cases where a slightly bigger volume capacity is required. Most high cube containers have a recess in the floor at the front end to centre the container on so-called gooseneck chassis, which allows it to lie lower and be of taller construction.

Open side containers are very similar to regular, general purpose shipping containers, the only difference being that the doors can open completely on the side too. This feature provides much wider room and access, which makes loading and unloading materials easy. Open side shipping containers generally come in 20' and 40', and they provide adequate room for extra large items that can't fit through the regular doors.

An ISO reefer shipping container is used for the shipment of temperature sensitive, perishable cargo such as meats, fruits and vegetables. This container type relies on external power to keep the temperature regulated. Reefers generally come in 20' and 40', and are commonly made from a weathering steel known as 'Cor-ten' steel.

Insulated Containers are like the ISO Reefer container, an insulated or thermal container has a regulated temperature control that allows them to withstand a higher temperature. They are equipped with an electrical compliance (mechanical compressor) to cool or heat the air within the container. Insulated containers are typically constructed of a vacuum flask, similar to a "thermos" bottle. As such, they are most suitable for long distance transportation of products such as foods, pharmaceuticals, organs, blood, biological materials and chemicals.

20' x 8'6" Dry Cargo ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
20' DRY FREIGHT	19'10 1/2"	19'4 1/4"	8'6"	7'9 7/8"	8'0"	7'8 1/2"	7'5 5/8"	7'8 1/2"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
20' DRY FREIGHT	5,015		47,895		52,91		1,166	

40' x 8'6" Dry Cargo ISO Containers



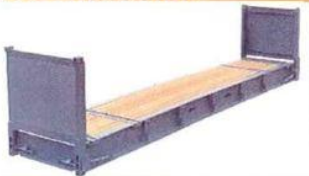
APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' DRY FREIGHT	40'0"	39'5 1/2"	8'6"	7'9 7/8"	8'0"	7'8 1/2"	7'5 5/8"	7'8 1/2"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
40' DRY FREIGHT	8,377		58,823		67,2		2,377	

20' Flat Rack



APX Container Type	Length		Height		Width		Height Collapse	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
20' FLAT RACK	19'10 1/2"	19'6 5/8"	8'6"	7'5 d"	8'0"	7'8 1/2"	1 1/2"	
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
20' FLAT RACK	6,06		68,89		74,95		1,166	

40' Flat Rack



APX Container Type	Length		Height		Width		Height Collapse	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' FLAT RACK	40' 0"	38' 3"	8' 6"	6' 5 d"	8' 0"	7' 8 1/2"	2' 1 1/2"	
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
40' FLAT RACK	13,448		85,759		99,207		1,766	

20' x 8'6" Open Top ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
20' OPEN TOP	19'10 1/2"	19'4 1/4"	8'6"	7'9 7/8"	8'0"	7'8 1/2"	7'5 5/8"	7'8 1/2"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
20' OPEN TOP	5,015		47,895		52,91		1,166	

40' x 8'6" Open Top ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' OPEN TOP	40'0"	39'5 1/2"	8'6"	7'9 7/8"	8'0"	7'8 1/2"	7'5 5/8"	7'8 1/2"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
40' OPEN TOP	8,377		58,823		67,2		2,377	

20' x 8'6" Refrigerated (Reefer) ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
20' REEFER	19'10 1/2"	18' 0"	8'6"	7'4 1/2"	8'0"	7'4"	7'4 1/2"	7'4"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
20' REEFER	6,44		46,47		52,91		1,166 - 995	

40' x 8'6" Refrigerated (Reefer) ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' REEFER	40'0"	37'11"	8'6"	7'2 1/2"	8'0"	7'4"	7'2 1/2"	7'4"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
40' REEFER	9,59		60,96		70,55		1,965 - 2,059	

40' x 9'6" Refrigerated (Reefer) ISO Containers



APX Container Type	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' REEFER	40'0"	37'11"	9'6"	8'2 1/2"	8'0"	7'4"	8'2 1/2"	7'4"
APX Container Type	Tare Weight in		Payload in		Gross Weight in		Cubic Capacity	
40' REEFER	9,66		60,89		70,55		2,289 - 2,366	

that is heavy and dense. These are good for transporting goods such as coal and stones, so they are perfect for use in the mining industry. Half height containers have a low centre of gravity so they can better handle heavier loads than taller containers, making them versatile and they're robust enough to withstand the rough industrial environment. Half-height containers are also easy for loading and unloading.

The tank containers, or tankers, are made of strong steel or other anti-corrosive materials for the transportation and long-life protection of liquid materials. A tank container must be at least 80% full to prevent dangerous surging of liquids in transit, but it must also not be over 95% full or there would not be sufficient room for thermal expansion.

The swap bodies are exchangeable containers used for road and rail. They are commonly used in Europe. Swap bodies have a convertible top, which makes them suitable for shipping a range of goods. Because swap bodies do not have upper corner fittings and are not stackable, they are restricted to land-based transportation only.¹⁷

Image No.2: The image beside presents a list for the available types and dimensions of shipping containers. Shipping containers are the most efficient means of transport across the globe. Their design allows multi-modal transport seamlessly between trucks, trailers, port handling equipment, shipping vessels and railheads. The most popular shipping method all over the world is the 20 foot long shipping container.

The Containerships

In a paperwork required by the containers it would not be impossible not to mention the ships which are carrying them and perform voyages from place to place transporting the main amount. Historically the first generation of containerships was composed of modified bulk vessels or tankers that could transport up to 1,000 TEUs. The first containership, the *Ideal-X* was a converted World War II T2 tanker. At the beginning of the 1960s, the container was an untested transport technology and reconverting existing ships proved to be of lower costs and less risky.

¹⁷ Bison 2021, <https://www.bison-jacks.com/why-bison/blog/11-most-common-types-of-containers/>, «11 Most Common Container Types», (last access 26/03/2021).

These ships were carrying onboard cranes since most port terminals were not equipped to handle containers. They were also relatively slow, with speeds of about 18 to 20 knots, and could only carry containers on the converted decks and not in their bellyhold. Once the container began to be massively adopted at the beginning of the 1970s, the construction of the first fully cellular containerships (FCC; second generation) entirely dedicated to handling containers started. The first cellular containerships, called the C7 class, were introduced in 1968.¹⁸

All containerships are composed of cells lodging containers in stacks of different heights depending on the ship's capacity. Cellular containership also offers the advantage of using the whole ship to stack containers, including below deck. Usually, an extra of two containers in width can be carried above deck than below deck. Cranes were removed from the ship design so that more containers could be carried (cranes remain today on some specialized containerships). The ability of ports to handle cellular containerships ceased to be a major concern with the setting of specialized container terminals worldwide. Cellular containerships were also much faster with speeds of 20-24 knots, which would become the speed of reference in containerized shipping.

During the 1980s, economies of scale rapidly pushed for the construction of larger containerships; the larger the number of containers being carried the lower the costs per TEU. The process became a virtuous circle, compounding larger volumes and lower costs, which significantly helped the diffusion of the container. The size limit of the Panama Canal, which came to be known as the *Panamax standard*, was achieved in 1985 with a capacity of about 4,000 TEUs. Once this limit was achieved, a decade passed before a new generation of larger containerships was designed. Simultaneously, Panamax container ship designs were evolving to take maximum advantage of the canal's limitation in beam (Panamax Max). The original dimensions of the Panama Canal, built by the US Army Corps of Engineers, are similar to the dimensions of the US Inland Waterways locks, resulting in narrow and long ship design.

Going beyond Panamax was perceived as a risk in terms of the configuration of shipping networks, additional handling infrastructure as well as draft limitations at

¹⁸The Geography of Transport Systems, <https://transportgeography.org/contents/chapter5/maritime-transportation/evolution-containerships-classes/>, «*Evolution of Containerships*», (last access 29/03/2021).

ports. The APL C10 containership class, with a capacity of 4,500 TEUs, was introduced in 1988 and was the first containership class to exceed the 32.2 m width limit of the Panama Canal. By 1996, full-fledged Post Panamax containerships were introduced with capacities reaching 6,600 TEUs. The first Post-Panamax ship classes were not much longer than the Panamax class, but wider, making them more efficient. A ship above the Panamax size requires a substantial amount of cargo to be used profitably along a service loop and by the late 1990s, the rapid growth of global trade made such a ship class a marketable proposition. Once the Panamax threshold was breached, ship size quickly increased with capacities reaching 8,000 TEUs (Post Panamax II; *Sovereign Class*). Post Panamax containerships triggered an infrastructure challenge for many ports since they require deeper drafts (at least 43 feet) and highly efficient, but costly, portainers having wider reaches. Draft constraints became a factor placing pressures on ports to dredge to accommodate post-Panamax containerships.

The *New-Panamax*, or *Neo-Panamax (NPX)* refers to ships designed to fit exactly in the locks of the expanded Panama Canal, which opened in June 2016. These ships have a capacity of about 12,500 TEU, but there are several configurations of Neo-Panamax ships in terms of length (17 to 22 bays) and width (19 or 20 containers across). Like its Panamax counterparts, Neo-Panamax ships are likely to define a specific ship class able to service the Americas and the Caribbean, either from Europe or Asia. Neo-Panamax ships are likely to become the new standard in port infrastructure design for decades to come.

By 2006, the third generation of post-Panamax containerships came online when Maersk shipping line introduced a ship class with a capacity in the range of 11,000 to 14,500 TEUs; the *Emma Maersk (E Class)*. They were dubbed Very Large Containerships (*VLCS*) since they are bigger than the specifications of the expanded Panama Canal. A further extension of the post Panamax design led to the introduction of Ultra Large Containership (*ULCV*) class of 18,000 TEUs and above in 2013 (named *Triple E* by Maersk). This class was further expanded, and by 2017, ships above 20,000 TEUs started to be delivered. The ULCS is getting close to the technical limits that the Suez Canal can accommodate, beyond which the commercial relevance declines substantially. It remains to be seen which routes and ports these ships would service, but they are limited mostly to routes between Asia and Europe. There are larger ship designs on the drawing boards, such as the *Malacca Max* class that could

carry about 27,000-30,000 TEU, but they are not expected to be constructed until there are sufficient volumes on the limited routes these ships could service.¹⁹

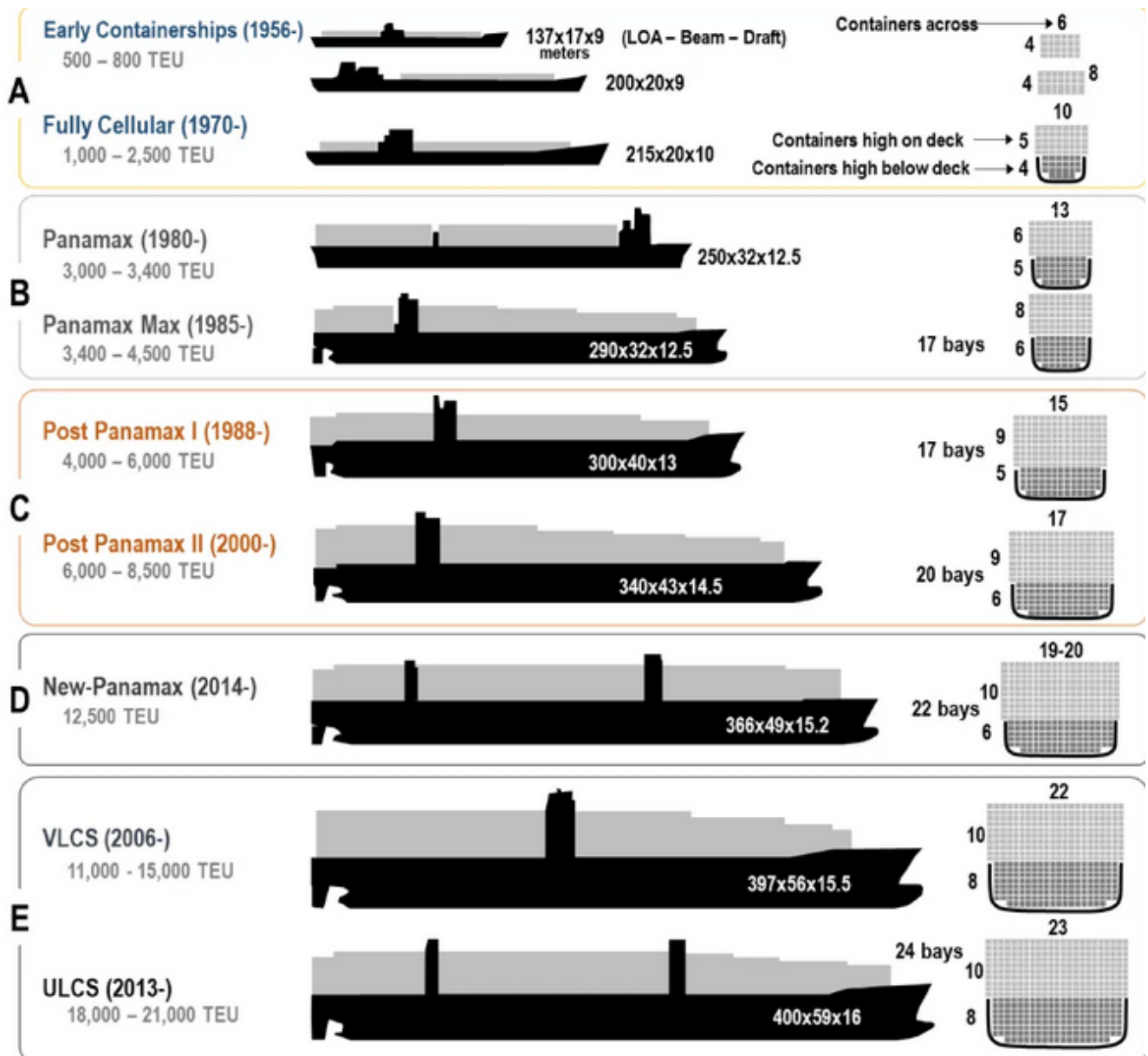


Image No.3: All dimensions are in meters. The loads displayed on deck represent maximal possible loads, which would involve a large share of empty containers. The loads are usually 1 to 3 containers less in height. Containerships usually carry fewer containers because of weight restrictions and lack of demand.

¹⁹ The Geography of Transport Systems, «Evolution of Containerships».

Containership speeds have peaked to an average of 20 to 25 knots, and it is unlikely that speeds will increase due to energy consumption; many shipping lines are opting for slow steaming to cope with higher bunker fuel prices (when there are market spikes) and overcapacity (to have more ships in a slower service). The deployment of a class of fast containerships has remained on the drawing boards because the speed advantages they would confer would not compensate for the much higher shipping costs. Supply chains have been synchronized with container shipping speeds, and the setting of landbridges, such as the Eurasian landbridge, is offering a competitive service for time-sensitive cargoes.²⁰

The Advantages of Container Shipping

Almost all goods, products, and equipment from other countries that dock to a port are stored in a container van. Transferred by 30,000 cargo ships sailing across the world. Every day aboard, a huge cargo ship carries exports and imports from around the world, maintaining the strong trading industry. The feasibility offered by shipping containers also ensured that the water navigable channels could be utilized for transiting freight internationally in addition to development of harbor facilities also took place simultaneously once the qualitative worth of container shipping began to spread far and wide.

The container is a standard transport product that can be handled anywhere in the world (ISO standard) through specialized modes (ships, trucks, barges, and wagons), equipment, and terminals.²¹ With this combination of transport can be applied door-to-door transfer, ie from the beginning planned and organized transport from the exporter's premises at the premises of the importer. One of the major benefits of containerization was to remove the bottleneck in freight transport in the crucial land-sea interface. The construction of purpose-designed container terminals

²⁰ The Geography of Transport Systems, «*Evolution of Containerships*».

²¹ The use of the same basic sizes of containers across the globe has lessened the problems caused by incompatible rail gauge sizes in different countries. The majority of the rail networks in the world operate on a 1,435 mm (4 ft 8 ½ in) gauge track known as standard gauge, but many countries (such as Russia, India, Finland, and Lithuania) use broader gauges, while many others in Africa and South America use narrower gauges on their networks. The use of container trains in all these countries makes transshipment between different trains of different gauges easier.

increased the productivity of dock labor from 1.7 to 30 tons per hour. Improvement in the efficiency and speed of cargo handling allowed shipping companies to take advantage of economies of scale by more than doubling the average ship size. The resulting increase in port capacity provided opportunities and pressures for the inland distribution of maritime containers. For example in the UK the introduction of railway container terminals went in tandem with port containerization and by 1972 the Far East service alone already operated trains between an ocean terminal and six inland rail terminals.²²

Fast transportation at a low cost is the prime effect in this sector of transfer. Because the container is the unit that documents all the goods that it contains²³, it can be shipped quickly to its destination, as the information is detailed on the outside of the container, which simplifies the customs formalities in particular. For both the sender and the recipient, containerization also has a significant economic advantage over other means of transporting goods.²⁴ The Intermodal transport decreased the time in transit between cargo closing and availability. Containerization cut the journey between Europe and Australia from 70 to 34 days. Given that the average cargo at the time was worth about £60 per ton and assuming that the opportunity cost of capital tied up in transit is about 15%, the 36-day improvement cut the capital cost of inventory by about a half.²⁵

Moving the same amount of break-bulk freight in a container is about 20 times less expensive than conventional means. Containers enable economies of scale at modes and terminals that were not possible through standard break-bulk handling. The main cost advantages of containerization are derived from lower intermodal transport costs.²⁶

A versatile, highly flexible means of transport means that the container shipping can be used to ship a large batch of goods to the other side of the world, it can also be used to send small goods a short distance. Container shipping is a

²²Research Gate , «*Estimating the Effects of the Container Revolution on World Trade*».

²³ Each container has a unique identification number and a size type code. A container is a unique transport unit that can be managed as such.

²⁴ Trans Globe Logistics, <https://www.transglobelogistiques.com/en/container-shipping-5-advantages-disadvantages/> , «*5 Benefits and Disadvantages of Shipping your Goods in Containers*», (last access 29/03/2021).

²⁵ Research Gate.

²⁶ The Geography of Transport System, «*Advantages and Drawbacks of Containerization*».

versatile, highly flexible means of cargo transport, since it can also be used to transport both dangerous liquid substances, such as hydrocarbons and chemicals, as well as solid products, such as foodstuffs (wheat, flour, feed for livestock, etc.).

Transshipment operations are minimal and rapid, and ship port turnaround times have been reduced from 3 weeks to about 24 hours. Because of this transshipment advantage, transport chains involved containers are faster. Container shipping networks are well connected and offer a wide range of shipping options. Containerships are also faster than regular cargo ships.

The container is its own warehouse, protecting the cargo it contains. This implies simpler and less expensive packaging for containerized cargoes, particularly consumption goods. The stacking capacity on ships, trains (double-stacking), and on the ground (container yards) is a net advantage of containerization. With the proper equipment, a container yard can increase its stacking density. Discarded containers can be recycled and reused for other purposes too.²⁷

The container provides great protection to the goods, because once sealed, it's a physical barrier against bad weather, temperature variations, fire, theft, and impacts during handling. The container thus greatly reduces the risks of deterioration, loss, and theft that can be found in ground transport. The container contents are unknown to carriers since it can only be opened at the origin (seller/shipper), at customs, and the destination (buyer). This implies reduced spoilage and losses (theft). Improved cargo security is also an important benefit of containerization. Once the cargo is loaded into a container, it isn't touched again until it reaches its destination. The cargo is not visible to the casual viewer and thus is less likely to be stolen; the doors of the containers are usually sealed so that tampering is more evident. Some containers are fitted with electronic monitoring devices and can be remotely monitored for changes

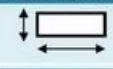
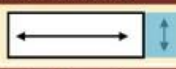


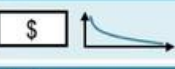







²⁷ The disappearance of the breakbulk vessel from the major trade routes helps explain why some cargoes ill-suited to transport within a closed box have nevertheless been containerised. It is important to remember that the principles of stowage apply to cargo inside a container as much as they do to breakbulk cargo. It is still necessary to segregate incompatible cargoes to avoid taint, contamination and dangerous reaction; it is still necessary to properly secure cargo to avoid damage by shifting or chafe; it is still necessary to ventilate when appropriate to avoid damage from sweat or build up of fumes, etc.; it is still necessary to monitor certain cargoes during a voyage to ensure that the correct carriage conditions are being maintained. Thus, many of the remarks on general stowage apply equally to containers.

Ship Business.com, <http://shipsbusiness.com/container-advantages.html>, «Advantages of carrying cargo through Containerships & insurance requirement», (last access 02/03/2021).

in air pressure, which happens when the doors are opened. This reduced the thefts that had long plagued the shipping industry. Recent developments have focused on the use of intelligent logistics optimization to further enhance security.²⁸

Companies today can ship large quantities from one location to another, which opens up the door to manufacturing in off-site factories in other countries where labor might be cheaper or more specifically skilled. It also brings with it the opportunity for shippers to utilize warehouses throughout the world so that goods can be shipped quickly to different customers, not just those who are local with those who are international.

The cost of shipping is now reduced compared to what it was before containers. No longer do shippers have to shoulder the financial burden of paying for unskilled labor to dismantle and subsequently reassemble their cargo at the first and final port. As more shippers are involved in the shipping process, with supply and demand fluctuating in favor of shippers, the overall cost for shipping goods is reduced as well. Companies are not forced to, for example, fill an entire 20-foot container but can share it with other shippers who help shoulder the cost so companies can focus on shipping only the goods they need to ship when they need them.²⁹

Advantages		Drawbacks	
 Standardization	ISO standard (modes and equipment). Unique identification number and size type code.	 Site constraints	Large consumption of terminal space. Draft issues with larger containerships.
 Flexibility	Commodities, manufactured goods, liquids and refrigerated goods.	 Capital intensiveness	Container handling infrastructures and equipment are important investments.
 Costs	Low transport costs. Economies of scale at modes and terminals.	 Stacking	Complexity of arrangement of containers, both on the ground and on modes.
 Velocity	Fast transshipment operations. Low terminal turnaround times.	 Repositioning	Divergence between production and consumption; repositioning. 20% of all containers.
 Warehousing	Own warehouse; simpler and less expensive packaging. Stacking capability.	 Theft and losses	High value goods vulnerable to thefts, particularly between terminal and final destination.
 Security & Safety	Contents unknown to carriers. Reduced spoilage and losses.	 Illicit trade	Illicit trade of goods, drugs and weapons, as well as for illegal immigration.

²⁸ Courtesy Transfer, <https://courtesytransferinc.com/detroit-michigan-intermodal-transport-and-drage/>, «Intermodal Transport», (last access 02/03/2021).

²⁹ Ship Lilly, <https://www.shiplilly.com/blog/the-history-of-containerization-and-its-impact-on-the-shipping-industry/>, «The History of Containerization and its Impact on the Shipping Industry», (last access 29/03/2021).

Finally, with more ports and harbors open and actively accepting shipments from around the world, shippers can move goods from one place to another faster. There are more people engaged in the process, more countries who are ready to be a part of the shipping industry on a global scale and thus provide regular ports throughout shipping lanes. This means more opportunity for ports, more opportunity for cheaper costs, and specific shipments when and where they are needed rather than loads that are forced to take circuitous routes because no other option exists. Companies can share all of these benefits with their customers, as well.³⁰

The Disadvantages of Container Shipping

Even if containerization conveys numerous advantages to freight distribution, it does not come without challenges. Although containerization provided a breakthrough in the global shipping sector, there were several adverse effects that were felt because of the changes it wrought.

The labour force that was otherwise employed in the dismantling and the assembly-line operations, prior to the development of cargo containers started to become redundant. Motorized operational links meant that lesser number of labor force needed to be involved in the loading and unloading of the freight to be shipped. Semi-skilled labour force and even skilled labour force, engaged in carrying out only one kind of operations at harbor facilities were also negatively impacted.³¹

Containers are a large consumer of terminal space (mostly for storage), implying that many intermodal terminals have been relocated to the urban periphery. Draft issues at the port are emerging with the introduction of larger containerships, particularly those of the post-Panamax class. A large post-Panamax containership requires a draft of at least 13 meters.

Image No.4: The image beside shows the top six advantages and drawbacks in the industry of shipping containers.

³⁰Ship Lilly.

³¹ Marine Insight, <https://www.marineinsight.com/maritime-history/the-history-of-containerization-in-the-shipping-industry/>, «The History Of Containerization In The Shipping Industry», (last access 29/03/2021).

Container handling infrastructures and equipment (giant cranes, warehousing facilities, inland road, rail access) are important capital investments that require large pools of available capital. Further, the push towards automation is increasing the capital intensiveness of intermodal terminals.

The complexity of the arrangement of containers, both on the ground and modes (containerships and double-stack trains), requires frequent restacking, which incurs additional costs and time for terminal operators. The larger the load unit or the yard, the more complex its operational management.

Because of trade imbalances, many containers are moved empty (20% of all flows). However, either full or empty, a container takes the same amount of space. The observed divergence between production and consumption at the global level requires the repositioning of containerized assets over long distances (transoceanic). The cost of transporting an empty container to a place where it can be used is considered to be higher than the worth of the used container. Shipping lines and container leasing companies have become expert at repositioning empty containers from areas of low or no demand, such as the US West Coast, to areas of high demand, such as China. Repositioning within the port hinterland has also been the focus of recent logistics optimization work. However, damaged or retired containers may also be recycled in the form of shipping container architecture, or the steel content salvaged. In the summer of 2010, a worldwide shortage of containers developed as shipping increased after the recession, while new container production had largely ceased.³²

The issue of imbalanced container flows is significant disadvantage of the container shipping sector. Container flows are quite representative of global trade imbalances, which have steadily been growing since the mid-1990s. For instance, there are 2.2 times as many containers moving from Asia to the United States (17.9 million TEUs in 2017) than vice-versa, meaning that the equivalent of 9.7 million TEUs had to be repositioned across the Pacific. More than half the slots of containerships leaving the United States are for empties, particularly for major container ports such as Los Angeles.

³² Universal Cargo, <https://www.universalcargo.com/Shipping-Container-Shortage-Pushing-Up-Prices/>, «*Shipping Container Shortage Pushing Up Prices*», (last access 02/04/2021).

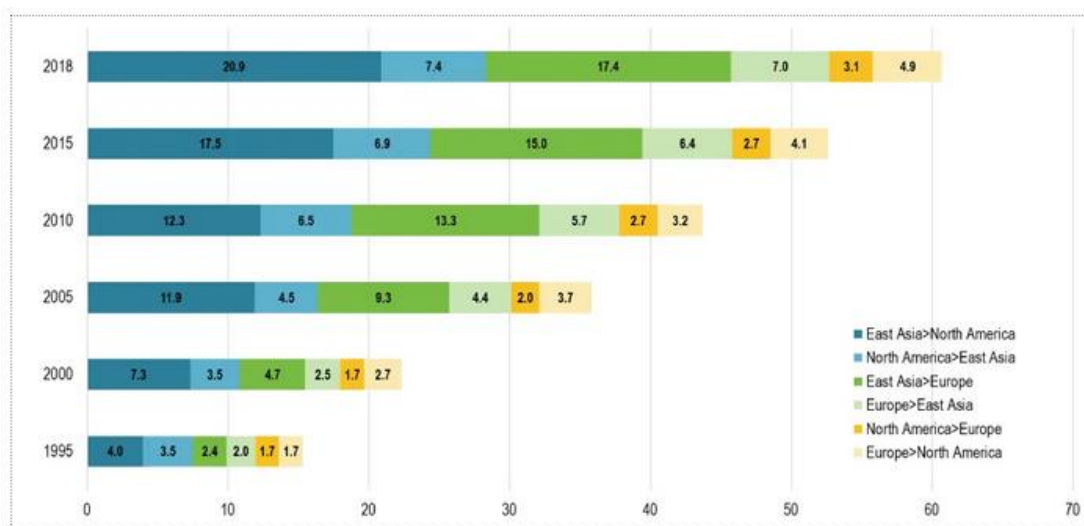


Image No.5: Containerized Cargo Flows along Major Trade Routes, 1995-2017 (in million TEUs).

The Asia-Europe trade route is facing a similar imbalance. It is not uncommon to see whole containerships being chartered solely to reposition empty containers. Thus, production and trade imbalances in the global economy are clearly reflected in imbalances in the physical flows of containers and transport rates. Repositioning empties can account for between 15 and 20% of the operating costs of a shipping line. For trans-Pacific trade, it costs more per TEU for eastbound flows than for westbound flows, making freight planning a complex task for container shipping companies. For Asia-Europe flows, westbound rates are higher than eastbound rates. Thus, production and trade imbalances in the global economy result in imbalances in physical flows and transport rates. Even if eastbound trans-Pacific rates are lower than westbound trans-Pacific rates, in theory conferring an advantage to American exports.

The issue of imbalanced container flows does not show evidence of receding, although its share of total container flows, at 20%, has stabilized. However, as global container volumes increase, the absolute number of empty containers requiring to be repositioned increases as well. This requires additional physical capabilities in terms of terminal storage space and container shipping slots.³³

³³ The Geography of Transport Systems, <https://transportgeography.org/contents/chapter5/intermodal-transportation-containerization/container-cargo-flows-trade-routes/>, «Containerized Cargo Flows along Major Trade Routes, 1995-2018», (last access 04/04/2021).

High-value goods and a load unit that can forcefully be opened or carried away (on a truck) implied a level of cargo vulnerability between a terminal and the final destination. A significant amount of containers are lost at sea each year (fall overboard), mainly because of bad weather.³⁴ The World Shipping Council (WSC) has released their 2020 update and on average 1,382 containers are lost at sea every year, but we can clearly see a downward trend and in the 2017-2019 period 779 containers were lost every year.

Catastrophic events such as sinking or grounding of vessels account for half of the containers lost, but still the container trade community's ambition is to fight the multiple causes for containers falling overboard. Semi-submerged containers are a threat to safety of crew and vessels and are also a danger to marine life. Misdeclaration of weight, improper packing of cargo, improper stowage as per ship's Cargo Securing Manual (CSM), twist locks issues or maintenance of the containers are important risk factors.³⁵

However the container is an instrument used in the illicit trade of goods, drugs, and weapons, as well as for illegal immigration.³⁶ Containers have been used to smuggle contraband or stolen cars. The vast majority of containers are never subjected to scrutiny due to the large number of containers in use. In recent years there have been increased concerns that containers might be used to transport terrorists or terrorist materials into a country undetected. The US government has advanced the Container Security Initiative (CSI), intended to ensure that high-risk cargo is examined or scanned, preferably at the port of departure.³⁷

³⁴ Rolling, parametric forces and stowage planning are key elements in loss prevention. The forces generated during sudden, heavy rolling placed excessive stress on the containers. This resulted in structural failure of containers and components of the lashing system. Skuld 04/11/2020, <https://www.skuld.com/topics/cargo/containers/containers-lost-at-sea/>, «Containers lost at sea», (last access 02/04/2021).

³⁵ Several initiatives at an international level aim at improving the international standards under SOLAS, ISO and the CTU Code and have already reshaped the risks and contributed to lowering the risk. In order to fight misdeclaration of cargo, changes to SOLAS came into effect on 1 July 2016 requiring verification of container weights (VGM) before containers can be loaded onboard. As per an IMO proposal more loss prevention work is to be done also on the shipowner's side as an alignment of the Safe Container Convention (CSC) and ISO 1496-1 container stacking strength requirements is needed. Skuld 04/11/2020.

³⁶ The Geography of Transport System. «Advantages and Drawbacks of Containerization».

³⁷ Skuld.

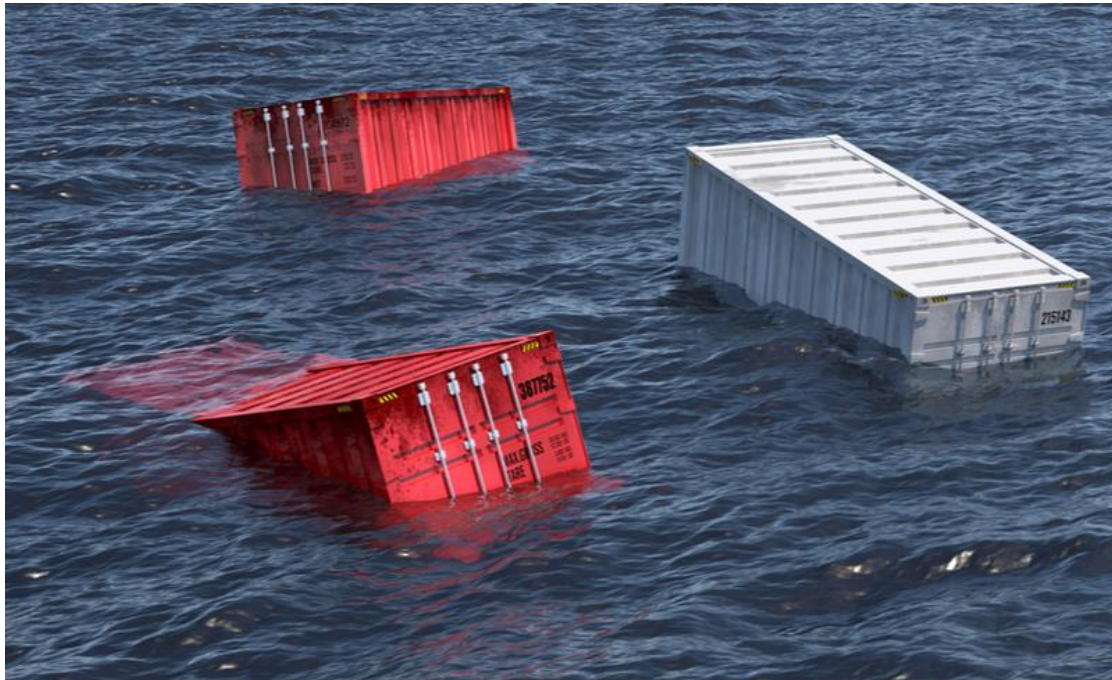


Image No.6: Floated shipping containers lost at sea.

Each subsequent generation of containership faces a shrinking number of harbors able to handle them and place pressures on port infrastructure and equipment. Maritime shipping companies are incited to use the largest containerships possible on their shipping routes since they benefit from economies of scale. However, ports³⁸ and inland transportation systems have to provide substantial capital investment if they expect to accommodate larger containerships. Thus, operational limitations are to

³⁸ The port of Shanghai was the largest container port in 2019, handling containers with a capacity of 43.3 million twenty-foot equivalent units (TEU). In 2019, nine out of the ten busiest container ports were located in Asia. The busiest container ports in Asia include Shanghai, Singapore, and Hong Kong. In the United States, the neighboring ports of Los Angeles and Long Beach form the largest container hub in the country. The cities of Rotterdam, Hamburg, and Antwerp are home to the largest ports in Europe. In terms of value, seaborne trade carried by container ships is the most important category of waterborne freight, and container handling is one of the key sources of revenue produced by the operation and management of a port. Intermodal containers usually have a capacity of one or two twenty-foot equivalent units, a standard unit of measure which is often being abbreviated to TEU. Singapore's PSA International is ranked among the world's leading marine terminal operators, followed by Hutchison Port Holdings, which is headquartered in the British Virgin Islands. PSA International operates several ports around the world, generating about four billion Singapore dollars in revenue in 2018.

Statista, <https://www.statista.com/topics/1367/container-shipping/> , «Container shipping - statistics & facts», (last access 02/04/2021).

deploy ships bigger than 8,000 TEU in terms of ports of call and the required infrastructure to provide an acceptable loading and unloading throughput. Also, large containership deployments require a substantial amount of cargo to be commercially feasible, such as adequate service frequency. Containerships in the range of 5,500 to 6,500 TEU appear to be the most flexible in terms of the ports they can access and the market they can service since using larger ships require fewer port calls. Therefore, the limits to economies of scale in container shipping are much more limited by commercial attributes than by technical constraints.³⁹

Containers are often infested with pests. Pest introductions are significantly clustered around ports, and containers are a common source of such successful pest transfers. Prevention, tracking, and decontamination are urgently needed to slow the global spread of a large number of pests this way.⁴⁰

³⁹ The Geography of Transport Systems, «Evolution of Containerships».

⁴⁰ International Plant Protection Convention, <https://www.ippc.int/en/news/200-million-reasons-to-take-global-action-on-sea-containers-to-keep-khapra-beetle-out/>, «200 million reasons to take global action on sea containers to keep khapra beetle out», (last access 02/04/2021).

Conclusion

Maritime shipping is the backbone of world trade; it is estimated that some 80 percent of all goods are carried by sea. In terms of value, global maritime container trade is estimated to account for around 60 percent of all seaborne trade, which was valued at around 14 trillion U.S. dollars in 2019.⁴¹

In the over 50-years of the initiation of shipping containers into mainstream maritime freight operations, a lot of advancement has been made. Today the global cargo shipping spectrum has widened to really enormous proportions while also helping several newer shipping conglomerates and even countries to enter the fray. With the extent of containerised operations and technological developments in the same increasing almost every day, it wouldn't be wrong to say that cargo movement in the present times cannot be visualised to fruition in the absence of container shipping.⁴²

The global context development has evolved considerably through the containerization progress. The regional seaport growth has potential access to global markets. But they are also competing in their markets with the increase number of containers. As a result, container traffic has grown over time, in particular by reducing the costs for both the world's leading shipowners and for the ports.

The number of goods carried by containers increased from around 102 million metric tons in 1980 to about 1.83 billion metric tons in 2017, vessels have likewise increased their capacity. Between 1980 and 2020, the deadweight tonnage of container ships has grown from about 11 million metric tons to around 275 million metric tons. With a total capacity of over four million TEUs*, Danish shipping line APM-Maersk is currently the largest container-shipping company globally, followed by MSC, COSCO, CMA CGM, and Hapag-Lloyd.⁴³

⁴¹ Statista, <https://www.statista.com/topics/1367/container-shipping/>, «*Container shipping - statistics & facts*», (last access 02/04/2021).

⁴² Marine Insight, <https://www.marineinsight.com/maritime-history/the-history-of-containerization-in-the-shipping-industry/>, «*The History Of Containerization In The Shipping Industry*», (last access 02/04/2021).

⁴³ Statista, «*Container shipping - statistics & facts*».

Sources

Βλάχος Γ.Π., *Εμπορική Ναυτιλία και Θαλάσσιο Περιβάλλον*, Εκδόσεις Σταμούλη, Αθήνα 2007.

Γεωργαντόπουλος Ε., Βλάχος Π.Γ., *Ναυτιλιακή Οικονομική*, Εκδόσεις Τζέι & Τζέι Ελλάς, Πειραιάς 1997.

Γεωργακόπουλος Α. Ν., *Εμπορικό Δίκαιο II*, Επιμ. Τουντόπουλος Β.Δ., εκδόσεις Σακουλλά, Αθήνα 2010.

Κιάντου-Παμπούκη Α., *Ναυτικό Δίκαιο II*, εκδόσεις Σακουλλά, Αθήνα 2007.

Bison 2021, <https://www.bison-jacks.com/why-bison/blog/11-most-common-types-of-containers/> , «11 Most Common Container Types», (last access 26/03/2021).

Crowley 03/20/2018, <https://blog.crowley.com/advantages-of-ocean-shipping> , «Top Five Advantages of Ocean Freight Shipping», (last access 28/03/2021).

Courtesy Transfer, <https://courtesytransferinc.com/detroit-michigan-intermodal-transport-and-drayage/> , «Intermodal Transport», (last access 02/03/2021).

e-nautilia 17/10/2017, <https://e-nautilia.gr/i-istoria-ton-container-ships/> , «Η ιστορία των πλοίων μεταφοράς εμπορευματοκιβωτίων (container ships)», (last access 26/03/2021).

Global Trade 09/07/2019, <https://www.globaltrademag.com/pros-and-cons-of-maritime-shipping/> , «Pros and Cons of Maritime Shipping», (last access 24/03/2021).

International Plant Protection Convention, <https://www.ippc.int/en/news/200-million-reasons-to-take-global-action-on-sea-containers-to-keep-khapra-beetle-out/> , «200 million reasons to take global action on sea containers to keep khapra beetle out», (last access 02/04/2021).

Logistics Solutions, <http://logsolution.ge/en/advantages-and-disadvantages-of-cargo-transportation-by-sea-transport/> , «Advantages and disadvantages of cargo transportation by sea transport», (last access 24/03/2021).

Marine Insight, <https://www.marineinsight.com/maritime-history/the-history-of-containerization-in-the-shipping-industry/> , «The History Of Containerization In The Shipping Industry», (last access 29/03/2021).

PLS logistic services, <https://www.plslogistics.com/blog/the-history-of-containers> , «The History of Containers», (last access 24/03/2021).

Research Gate,

https://www.researchgate.net/publication/256050923_Estimating_the_Effects_of_the_Container_Revolution_on_World_Trade , «*Estimating the Effects of the Container Revolution on World Trade*», (last access 24/03/2021).

Ship Business.com, <http://shipsbusiness.com/containership-advantages.html> , «*Advantages of carrying cargo through Containerships & insurance requirement*», (last access 02/03/2021).

Ship Lilly, <https://www.shiplilly.com/blog/the-history-of-containerization-and-its-impact-on-the-shipping-industry/> , «*The History of Containerization and its Impact on the Shipping Industry*», (last access 29/03/2021).

Skuld 04/11/2020, <https://www.skuld.com/topics/cargo/containers/containers-lost-at-sea/>, «*Containers lost at sea*», (last access 02/04/2021).

Statista, <https://www.statista.com/topics/1367/container-shipping/> , «*Container shipping - statistics & facts*», (last access 02/04/2021).

The Geography of Transport Systems,

<https://transportgeography.org/contents/chapter5/intermodal-transportation-containerization/container-cargo-flows-trade-routes/> , «*Containerized Cargo Flows along Major Trade Routes, 1995-2018*», (last access 04/04/2021).

The Geography of Transport Systems,

<https://transportgeography.org/contents/chapter5/maritime-transportation/evolution-containerships-classes/> , «*Evolution of Containerships*», (last access 29/03/2021).

The Journal of Maritime Law and Commerce, <http://www.jmlc.org/index.php>, Simon S., *The Law of Shipping Containers 1974*, (last access 24/03/2021).

Trans Globe Logistics, <https://www.transglobelogistiques.com/en/container-shipping-5-advantages-disadvantages/> , «*5 Benefits and Disadvantages of Shipping your Goods in Containers*», (last access 29/03/2021).

Universal Cargo, <https://www.universalcargo.com/Shipping-Container-Shortage-Pushing-Up-Prices/> , «*Shipping Container Shortage Pushing Up Prices*», (last access 02/04/2021).

World Shipping Council, <https://www.worldshipping.org/about-the-industry/history-of-containerization> , «*History of Containerization*», (last access 24/03/2021).

Images:

Canarship, <http://canarship.eu/en/types-of-container-for-shipping-cargo/> , «*Types of Container for Shipping Cargo*», (last access 29/03/2021).

First Shipping, <https://firstshipping.com/en/containers> , «*Container Shipments*», (last access 29/03/2021).

The Geography of Transport System,
<https://transportgeography.org/contents/chapter5/intermodal-transportation-containerization/containerization-advantages-drawbacks/> , «*Advantages and Drawbacks of Containerization*», (last access 29/03/2021).

The Geography of Transport Systems,
<https://transportgeography.org/contents/chapter5/maritime-transportation/evolution-containerships-classes/> , «*Evolution of Containerships*», (last access 29/03/2021).

The Geography of Transport Systems,
<https://transportgeography.org/contents/chapter5/intermodal-transportation-containerization/container-cargo-flows-trade-routes/> , «*Containerized Cargo Flows along Major Trade Routes, 1995-2018*», (last access 04/04/2021).

Skuld 04/11/2020, <https://www.skuld.com/topics/cargo/containers/containers-lost-at-sea/> , «*Containers lost at sea*», (last access 02/04/2021).