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**MSc in Maritime Economics and Logistics**

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**A Qualitative study on the need of another container  
terminal on the Pacific Coast of the Panama Canal**

by

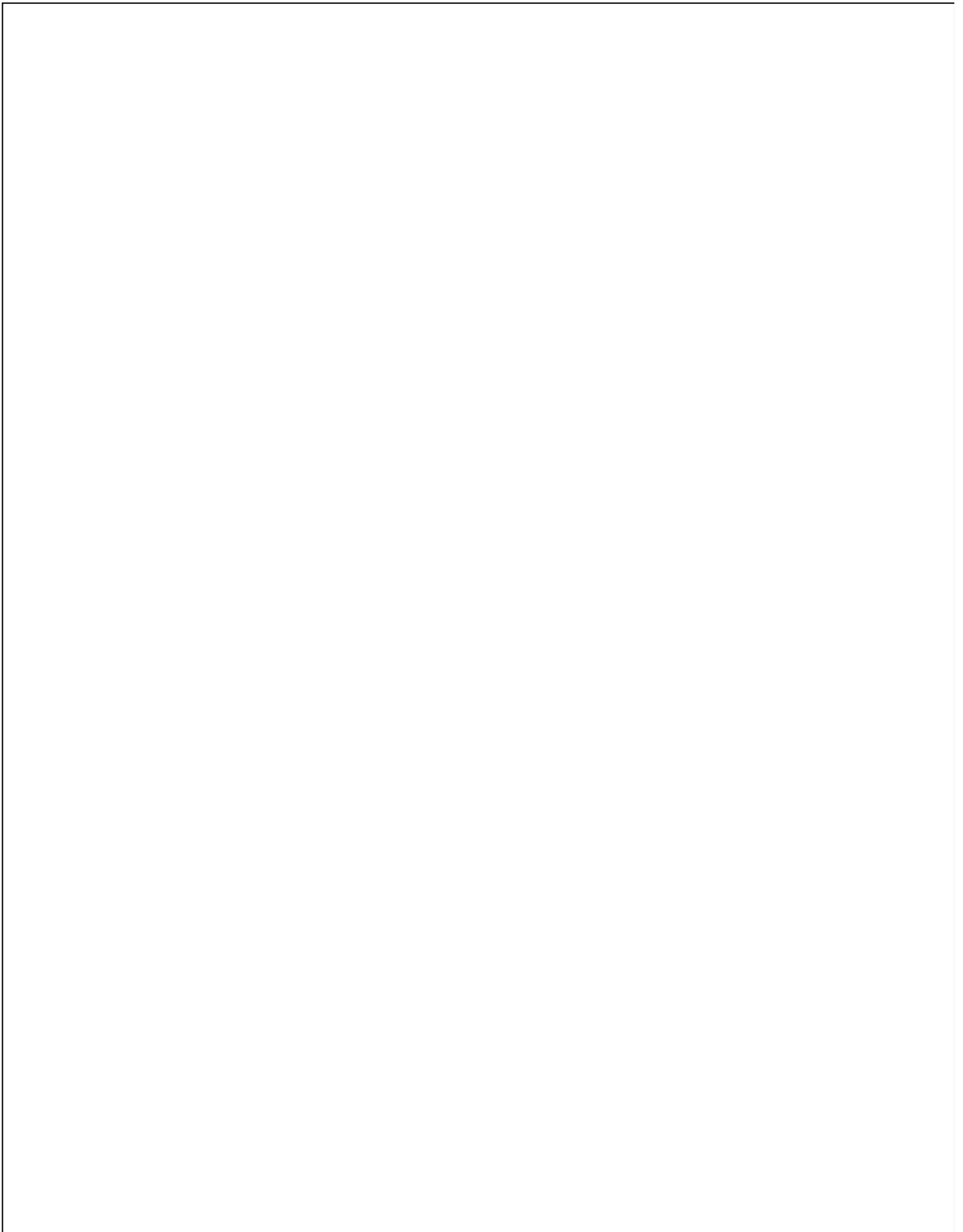
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## **Abstract**

This thesis focuses on the impact of the Panama Canal expansion on container handling in local ports. The research conducted showed that after the widening of the Canal, TEU movements increased or remained stable in the five major seaports on the Atlantic and Pacific sides of the Panama Canal. However, the study also showed that the Pacific side underperformed due to its lower TEU capacity than the Atlantic side. Due to this fact, the country has lost competitiveness to countries such as Colombia and Brazil.

The Corozal transshipment port could be a project that improves Panama's position in world trade and strengthens its competitive position within the region. In addition, a project of this magnitude could bring more employment opportunities, domestic and foreign investment to the country and become a significant source of revenue for the country.

With the current trend of developing larger container ships, Panama has the opportunity to become the hub of the Americas by further exploiting its advantageous geographic location. In addition, future plans by the Panama Canal Authority to add a fourth set of locks to the canal must be accompanied by a plan to further develop port infrastructure.



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### **List of Abbreviations**

ACP:	Panama Canal Authority
MIT:	Manzanillo International Terminal
PPC-Cristobal:	Panama Ports Company – Cristobal
PPC-Balboa:	Panama Ports Company – Balboa
PSA:	PSA (Panama International Terminal)
TEU:	Twenty-foot Equivalent Unit
MSC:	Mediterranean Shipping Company
PMA:	Panama Maritime Authority
PCE:	Panama Canal Expansion
LAC:	Latin American and the Caribbean
RTG:	Rubber tired gantry cranes
CBA:	Cost-Benefit Analysis
GDP:	Gross Domestic Product
GRP:	Gross Regional Product
FTE:	Full-time equivalents
VALS:	Value-added logistics services
MIDA:	Maritime Industrial development areas

## **Chapter 1: Introduction**

### **1.1 Background and Relevance**

Prior to the expansion of the Panama Canal, the vessels that could pass through the canal were limited in size. With its expansion, larger vessels can now transit through it. For instance, prior to the widening, the maximum TEU load that the canal could accommodate was around 5,000. The new locks built as part of the expansion project now allow vessels with a capacity of up to 13,000 TEU to pass through the canal. This fact challenges the capacity of local container terminals to handle the demand. There are currently five container terminals along the Panama Canal, three on the Atlantic side and two on the Pacific. The Atlantic Coast terminals have a total capacity of 8 million TEUs, while the Pacific terminals have a total capacity of 4.5 million TEUs. Therefore, this thesis studies the impact of developing another container terminal on the Pacific Coast of the Panama Canal.

Because of its central location linking the Atlantic and Pacific Oceans, the Panama Canal is one of the world's largest most well-known and heavily traveled waterways. The Canal, which opened in 1914, has transformed how ships travel between the two seas and has become a vital part of the country's economy, bringing in billions in revenue annually. Today, the Canal is considered one of the world's most technologically advanced waterways, with superhighways of steel and concrete allowing vessels of every size and type to pass through quickly and safely. As a result of the Canal, Panama's economy has benefited greatly, with tens of thousands of individuals finding work with billions of cash being brought in. Moreover, in 2009 an intensive construction program added two new lanes for the transit of neopanamax vessels. This has added a third lane for the transit of neopanamax vessels and has expanded the capacity of the waterway to ensure that it remains the most important waterway in the world. In June 2016, the new set of locks was inaugurated, and for the first time a neopanamax vessel was able to transit through the Canal. The extension of the Panama Canal not only surpassed traffic outlooks but also confirmed its environmental governance in the maritime industry, focusing on water savings and playing a key role on decreasing CO2 emissions, which has been a quicker route and offered greater cargo capacity to its clients. The Panama Canal Authority (ACP) is a leader in the industry when it comes to reducing the use of energy and water and continues to improve its environmental performance

through such initiatives as the implementation of a comprehensive energy reduction program and the implementation of the world's largest solar power system at the Canal (Pagano et al., 2016).

The new locks allow the passage of ships capable of carrying up to 13,200 TEUs (Twenty Foot Equivalent Units), instead of the maximum 5,100 TEUs carried in Panamax vessels. There are currently ships on order that carry more than 13,200 TEU, such as the Maersk Triple E, which has a capacity of 18,000 TEU. These vessels exceed the capacity of the expanded canal after the expansion. ACP has already determined the route for a fourth lock facility, if needed and warranted (Pagano et al., 2016).

The Panama Canal is used to transport nearly 50% of American grain exports to Asia yearly. The increase will enable the U.S. exporters to ship vessels with a capacity of up to 95,000 tons (DWT) and take advantage of economies of scale. Similarly, Brazilian exporters will be able to ship their soybean shipments from northeastern Brazilian ports to Asia on larger vessels. The growth prospects for shipping soybeans from the United States to Asia through the Panama Canal are promising. The expanded canal will allow ships up to 49 meters wide (Pagano et al., 2016).

Panama faces the challenge of taking advantage of its geographic location and continuing its development from an interoceanic transit and multimodal transportation hub to an economic corridor and global logistics center. To promote the growth of the logistics industry and transportation in the country, the ACP has conducted a series of studies that assess the impact of expansion on Panama's economy and the Panama trade and logistics cluster. In addition, analyzes are being conducted on potential new commercial enterprises around the waterway (Pagano et al., 2016).

No one can deny that North America and the Latin American and Caribbean (LAC) area have felt the effects of the expansion of the Panama Canal. It has increased container flow (TEU) and cargo capacity at the area's terminals by allowing the transit of gigantic vessels like neo and post-Panamax vessels. The Panama Canal expansion (PCE) has increased competition among major transshipment ports in Panama, Brazil, Jamaica, Mexico, the Bahamas, and the Dominican Republic. Most of these nations have spent vast sums expanding and dredging ports and building logistics hubs in order to welcome and profit from megaship traffic. (Miller and Hyodo, 2021).

The effects of the widened Panama Canal were thought to be the result of interventions, projects, and programs implemented as part of larger governmental decisions. Subprojects in the LAC region and elsewhere in the Americas have benefited from the PCE project's efforts to deepen

and modernize port facilities. The added capacity for processing cargo and the volume of containers moving among transshipment ports are both benefits of the widened canal. The PCE, on the other side, is worried about the LAC container terminals' capacity due to port facilities and usage. In addition, the ACP indicated that some shipping companies are moving away from mega-ships due to the high operating costs per container (Miller and Hyodo, 2021).

The containerized cargo-focused seaport complex with three Atlantic and two Pacific terminals processed 7 million TEUs last year. 69 liner services, most of which are devoted to transshipment, contribute to the port complex's high degree of connection to the main industrial and consuming areas. Over eighty-five percent of the country's annual traffic is due to transshipment. There are a total of 22 berths, 45 quay cranes, and 90 rubber tired gantry cranes (RTGs) at the Atlantic cluster's Manzanillo International Terminal (MIT), Colon Container Terminal (CCT), and Cristobal, while the Pacific cluster's Balboa and PSA Panama International Terminal have 10 berths, 37 quay cranes, and 56 RTGs. These five ports have more quay cranes than any others in Latin America and can accommodate reefer containers with a total capacity of almost eight thousand plugs (82 in total). Five neopanamax and two panamax can be handled by the Pacific cluster at once, whereas eight panamax and five post-panamax can be handled by the Atlantic cluster all at once.

## **1.2 Research Questions and Objectives**

The fact that TEU capacity is unequal between the Atlantic and Pacific coasts of the Panama Canal prompts the following research question: *To what extent would the development of another container terminal on the Pacific coast of the Panama Canal affect Panama's port competitiveness in the region?* This research question will be addressed with the following objectives

- To know the impacts of the development of another container terminal on the Pacific Coast of the Panama Canal regarding the country's port competitiveness.
- Knowing the available data of the current demand of containers on the Pacific Coast of the Panama Canal.
- To know the impacts on the competitiveness of the country within the region.
- Knowing the socio-economic and environmental impact of the development of another container terminal on the Pacific Coast of the Panama Canal.
- To know the economic activities of the immediate hinterland.

### **1.3 Scope and limitation of the research**

Currently, the Panama Canal has a total of five container terminals on both exits. These container terminals were given under concession by the Panamanian government to important port operators such as Hutchison Ports and PSA International. These ports have several services to manage cargo such as Ro-Ro, break bulk, general cargo, intermodal, among others. In this study, we focus on the container throughput of these ports to have a better understanding of the volume these ports handle on a yearly basis. In addition, we will analyze performance indicators such as the LSCI, PLSCI, Container throughput, and number of port calls. This information will be relevant to understand how the Panamanian container terminals perform in global trade.

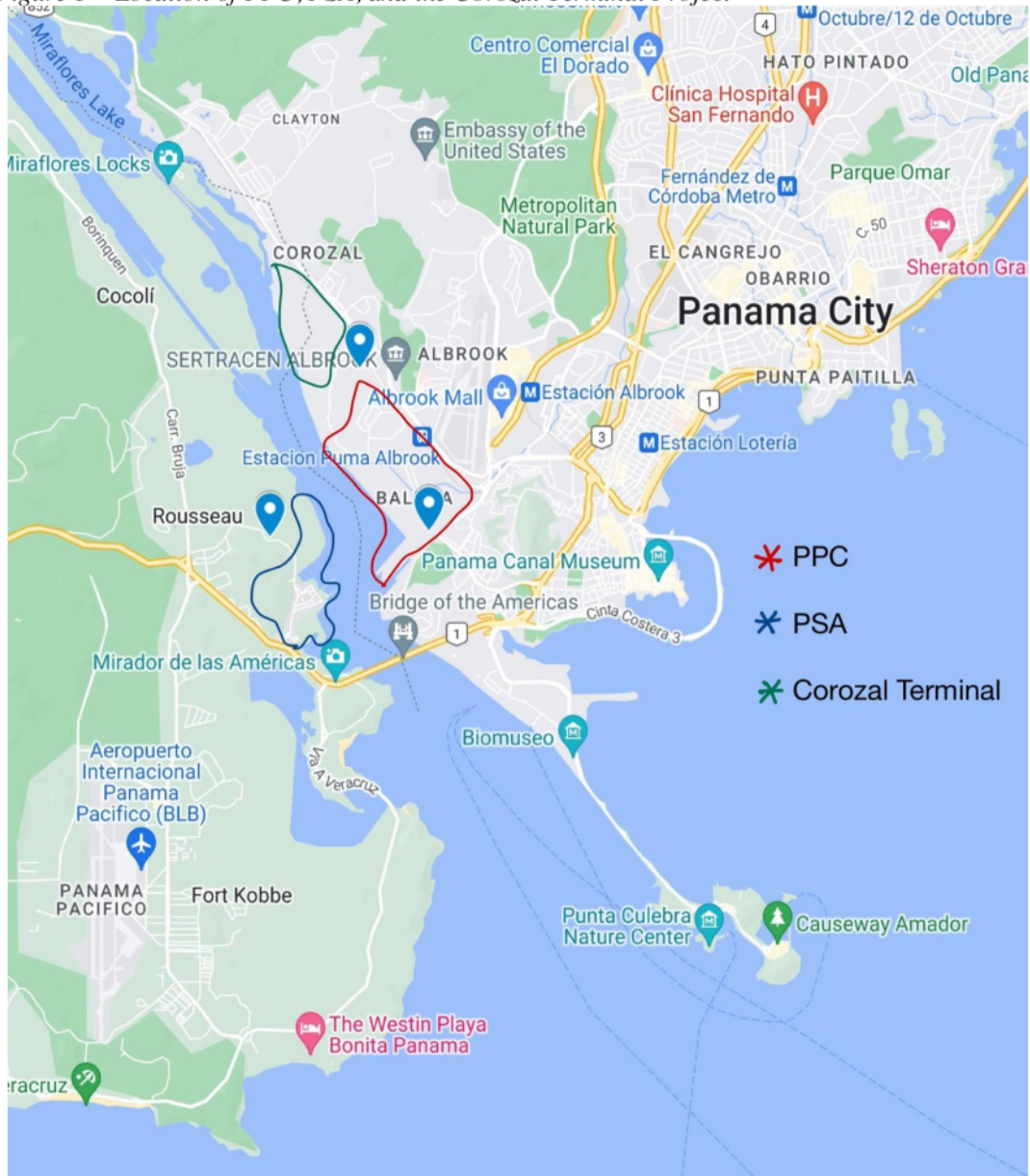
### **1.4 Research Methodology**

The research methodology for this project will be based on qualitative and quantitative data, using a cost-benefit approach to understand the social and economic impacts of building another container terminal at the Pacific exit of the Panama Canal due to the high demand for container handling and how this project could promote the country's competitiveness within the region. In addition, a cost-benefit analysis works as a systematic way to include all benefits and costs, much like a private sector investment. Because this type of evaluation tool addresses public policy issues, it should consider types of benefits and costs that go beyond business decisions and focus on maximizing net benefits (Haezendonck, 2008).

Moreover, cost-benefit analysis provides information for the decision-making process, but it does not provide sufficient information to make decisions that require a multi-actor view. Therefore, the most efficient project from an economic perspective should not be automatically pursued without considering other important criteria that may affect overall social desirability. (Haezendonck, 2008).

The qualitative data (non-quantifiable data) used in this study comes from secondary research, using key sources such as those of the Panama Canal Authority, the Panama Maritime Authority, the Georgia Tech Panama Logistics Innovation & Research Center, academic papers, and others. On the other hand, the quantitative data (numerical data) used in this study are from sources such as the UNCTDA, Clarksons Shipping Intelligence Network, and some numerical data from the Panama Maritime Authority

Figure 1 – Location of PPC, PSA, and the Corozal Terminal Project



Source: Google maps & author creation

## **Chapter 2: Literature Review**

### **2.1 Panama Canal Expansion**

To assess whether or not it would be feasible from a technical, financial, and environmental standpoint to widen the Canal, the ACP initiated the monumental job of commissioning more than 70 separate studies at a total cost of US\$140 million. The ACP hired the world's leading consulting firms in engineering, environmental studies, demand analysis, economic impact, and financial modeling, among others, to conduct these studies, which were integrated into a Master Plan that had to be taken to a national referendum in 2006, in which nearly 78% of voters said YES to the expansion project (Sabonge, 2014).

At the same time, the ACP focused on improving its financial performance, made substantial investments to improve the quality and reliability of service, measured in Canal waters, and broke traffic and cargo records. All the above allowed the ACP to obtain an investment grade with which it obtained the necessary financing, under excellent terms and conditions, to carry out the expansion project, estimated at a cost of \$5.25 billion (Sabonge, 2014).

Although the global economy was in a downturn, many international financial institutions gave their blessing to the project and agreed to lend the country a total of \$2.3 billion to fund the expansion. Some of these financial entities were the Inter-American Development Bank, and the European Investment Bank, among others. Meaning that the project was of significant importance to global trade and the economy. (Sabonge, 2014).

As was to be predicted, commerce has remained dynamic since the construction project started in 2007, necessitating revised projections of economic productivity and customer needs. These things have an effect on the volume of cargo passing through the Panama Canal, although for Panama, what really matters is expansion in the pathways that use the Canal (Sabonge, 2014).

The demand for interoceanic traffic is determined by two main components: the movement of cargo arising from trade, and the location of the point of origin and destination of the cargo. The movement of cargo through the Panama Canal has evolved in its 99 years of operation in accordance with the transformations that have occurred in the international economic-political environment, technological changes, international trade policies, and the requirements of raw materials, processed and finished products of the main economies that benefit from the Canal route (Sabonge, 2014).



The most important aspect of interoceanic traffic behavior is the dramatic growth experienced by container transport. This pattern is due, in part, to the increasing containerization of cargo that traditionally moved in general cargo vessels. In the particular case of interoceanic traffic, there are two alternatives for moving cargo from one ocean to the other: multimodal transport in the United States, and all-water routes, which currently use the Panama Canal, the Suez Canal, or the Cape of Good Hope route (Sabonge, 2014).

## **2.2 National Port System**

Seaports are essential interfaces in the supply chain between sea and land transport and a component of the distribution of goods as a gateway for products, goods, and passengers to enter a country, but also as an exit gateway for all exports to international markets (logistics.gatech.pa, n.d.).

The area around a port area is made up of the places where inland and coastal transport networks meet. This function can be direct, where cargo reaches a port directly via road transport, or indirect, where cargo reaches a seaport via an inland port it is transported along the coast from its origination point (e.g., a rail station) or a local major port where transportation is consolidated. Similarly, seaports are distribution points for inland and coastal transportation systems that define the foreshore of a seaport (logistics.gatech.pa, n.d.).

Panama has a complex of ports that offer a diversity of amenities for general cargo, bulk, containerized, and liquid as well as for travelers in cruise terminals. The major ports of Panama that constitute the NPS are split evenly between state-run and privately operated facilities. Following the centralization of formerly state-owned ports, terminal companies were granted control of the private terminals (concession). In essence, the state-owned ports continue to be run by the authorities under the supervision of the Panama Maritime Authority (AMP), serving both user communities but also short-sea transportation. (logistics.gatech.pa, n.d.).

Taking advantage of Panama's geographic location as the country's most important asset, several ports around the Atlantic and Pacific entrances to the Panama Canal have specialized in handling containerized cargo, turning the cluster into a transshipment hub (logistics.gatech.pa, n.d.).

Panama has been home to numerous port facilities in the Atlantic region, the most significant of which are the Manzanillo International Terminal (MIT), PPC-Cristobal and Colon Container Terminals (CCT). These terminals primarily serve the eastern seaboard of North and South America, as well as the Caribbean. PPC-Balboa and PSA are two of its port facilities that are located in the Pacific exit, and both provide transshipment solutions. Panama Ports Company (PPC), which is an official partner of Hutchison Port Holdings, is responsible for the management and operation of both the Balboa as well as Cristobal terminals. The primary functions among these terminals can be divided into the following distinct phases: distribution, handling, shipping, and reception (logistics.gatech.pa, n.d.).

### **2.3 Five Major Ports on the Atlantic & Pacific Coast**

- **Manzanillo International Terminal (MIT)**

Coco Solo Sur's former U.S. naval base. In the 1980s, this was a Latin American storage and traffic strategic location. The original ro-ro berth idea was expanded in 1993 into a state-of-the-art transshipment facility with more than 2,300 meters of 8 berths. These berths are 6 containers and 2 ro-ro. Over two thousand reefer connections, cutting-edge terminal management software, and 19 post-panamax and super-post-panamax quay cranes are just some of the amenities at the container berths. It can handle 3.5 million TEUs. 85% of activity involves containers. Geographically, MIT can be found on the Atlantic coast of Panama, close to where the canal begins in the north. Over on the other side of Randolph Avenue, MIT has constructed a logistics park complete with four warehouses, a rail siding, and a value-added area for processing and reselling cargo. Moreover, MIT has developed into a comprehensive logistics complex, complete with a state-of-the-art container and ro-ro terminal, ample container storage space, a logistics park, and a multimodal system that links maritime, terrestrial, rail, and aerial transport (logistics.gatech.pa, n.d.).

- **Colon Container Terminal (CCT)**

Since 1997, the Evergreen Group has managed the **Colon Container Terminal (CCT)** in Panama. The Group first suggested the construction of cutting-edge port facilities in Panama in 1994 so that it can take full use of the country's strategic position, its advantageous interconnectivity, and its extensive marine and logistical offerings. A

detailed proposal for a port facility at Coco Solo North was presented to the Panamanian authorities in 1995. A historic U.S. Navy facility now serves as the location for the CCT terminal. Coco Solo North in Colon Province is where you'll find Colon Container Terminal. With its convenient position near the Colon Free Zone, this port is seeing an increase in freight traffic in both directions. Located at the Atlantic end of the Panama Canal, CCT facilitates the transport of goods from Asia to the regional markets of the Americas. The overall land area of this terminal is 74.33 hectares, and it features a turning basin with a radius of 600 meters and an access canal with a draft of 16.4 meters. Ships may pass through the breakwater into the Bay of Manzanillo, which is 200 meters wide. This port is also easily accessible by road and rail, making it a prime gateway to the Colon Free Trade Zone. CCT is capable of handling 2.4 million TEUs because to its four container berths, eleven quay cranes, and other dock amenities. Additional cargo storage capacity is planned for the area immediately around the port facility and throughout Randolph Avenue (logistics.gatech.pa, n.d.).

- **Panama Ports Cristobal**

Is the earliest known terminal still in use on the Atlantic end. Originally constructed to house laborers and supplies for the Transisthmian Railroad, Cristobal has also been in operating condition for over 150 years. Cruise steamers fueled by the Gold Rush traveled from New York to California via the Atlantic window of Colon (then known as Aspinwall). Back then, this harbor had a few wooden and metal terminals at most. Cristobal was in use fifty years before the Balboa Port was opened. Limon Bay, in the southern part of Colon City, is home to the port of Cristobal, which sits at the Atlantic end of the Panama Canal. Given its proximity to both the Caribbean and Atlantic, this terminal plays an important role in facilitating trade between the two regions. The terminal has an amount of 1,200 reefer interconnection, three container berths, twelve hectares of container storage space, thirteen quay cranes, and more than thirty RTGs to manage container activities, with a volume of more than two million TEUs. There is substantial room for growth for Cristobal as a main Atlantic center for container, bulk, liquid, but also general cargo. Its proximity to the Canal and other major shipping lanes, as well as ongoing and planned infrastructure

development and investments in both machinery and human resources, will allow it to handle increased cargo volumes in the near future. According to (logistics.gatech.pa, n.d.).

- **Panama Ports Balboa**

which had been known as Ancon Port prior to 1997, was officially opened for business that year. With a volume of 5 million TEUs per year, Balboa has been the most valuable transshipment spot in Latin America. It collaborates with a number of shipping companies to load, unload, and transship commodities out from Pacific end to the region. Balboa's strategic location makes it an attractive candidate for development as a cargo traffic hub, linking major liners traveling between the Far East and North America with those traveling between the west coast of South America, Central America, and the Caribbean. The terminal has 5 container berths and an overall container storage facility of 43 acres. To meet the needs of its customers, Balboa maintains a fleet of more than 50 RTGs and 25 quay cranes (10 Post Panamax, 8 Panamax, and 7 Super Post Panamax). The majority (90.4%) of the containers passing through the port are for the purpose of cargo handling, while the remaining containers are bound for the domestic economy. Containers bound for Colon's ports can be processed thanks to a convenient connection with the railway company. Balboa offers a total of 3,552 refrigerated ports and accepts and ships dry and liquid bulk cargo in addition to specific cargo (logistics.gatech.pa, n.d.).

- **PSA Panama International Terminal**

A container terminal, constructed on the site of the former U.S. Naval Base Rodman at the Pacific entry of the Panama Canal. Within the first section, there is a 330-meter berth with three post-Panamax quay cranes and nine RTGs. The 2nd section, there are 12 rail-mounted gantry cranes and 8 quay cranes that can carry 24 larger containers to support 18,000 TEU vessels. The terminal can manage 2.5 million TEUs in total. The port's facilities are designed to bring new freight from Asia to the West Coast of the Americas, with Panama serving as a transportation hub to accommodate the rising needs of shipping companies to carry more containers to Latin American countries as well as to increase their inland transshipment potential (logistics.gatech.pa, n.d.).

## 2.4 Relevant future projects

- **Green Port, Panama Atlantic**

In Largo Remo Island in Cristobal, Colon Province, a 127-hectare mega port was planned. On April 10, 2014, the \$7.97 billion in investments were finalized, and the project was given the green light. Management, building, testing, environmental impact, and implementation are all factors to consider (logistics.gatech.pa, n.d.).

The terminal's primary function will be to service and refuel future Post-panamax ships as they navigate the widened channel. It will also be a second terminal for the berthing of super post-Panamax vessels, those that are too large to fit through the Panama Canal's locks. It is hoped that this terminal will develop into a leading international logistics hub, facilitating the distribution of goods (both passenger and freight) between different points in the Americas, housing shipyards, and fostering commerce on a global scale. The proposed multimodal maritime structure will involve fuel terminals, fishing and cruise zones, commercial and tourist zones, logistics zones, bulk and liquid cargo, an eco-park, five buildings, a power plant, and other amenities (logistics.gatech.pa, n.d.).

- **Mystic Rose Terminal**

Near Balboa's Bridge of the Americas, the 9.5-acre **Mystic Rose Terminal** sits in the Pacific Ocean, where ferries once docked. Port & Harbor Society Marine Service Corp. is putting USD\$17 million into the project's design and construction.

A variety of services, including fuel dispatching and supply, cargo and passenger transportation, ship repair and maintenance, motorboat boarding and disembarking, storage facility development and management, and retail outlets selling maritime support services will all be available at this multifunctional dock. Additionally, the terminal will have the capability to pump water to ships, collect, treat, transport, transfer, and care for liquid and solid waste from vessels. (logistics.gatech.pa, n.d.).

- **Panama Colon Container Port (PCCP)**

The Panama Maritime Authority (AMP) has authorized a brand-new project called Panama Colon Container Port, which will be built near the Atlantic end of the Panama

Canal. Located in the Coco Solo neighborhood of Isla Margarita, the new terminal will be a reconstruction of the former Fort Randolph, a U.S. Navy facility. A \$600 million improvement allows the terminal to manage roughly 2 million TEUs annually across an estimated 37 acres, with room to take 18,000 TEUs ships and four berths.

The PCCP is expected to have a draft of 52 feet and provide two berths for super post-Panamax vessels, one berth for post-Panamax vessels measuring up to 3,450 feet in length, and one berth for multifunctional and bulk cargo ships measuring up to 522 feet in length. It'll be able to hold 36,000 TEUs, have 800 reefer berths, and use a total of 10 quay cranes, including 8 super post-Panamax and 2 Panamax models (logistics.gatech.pa, n.d.).

- **Corozal Terminal**

The Panama Canal Authority (ACP) is contemplating starting something new in the Corozal area, and they have come up with an idea called the **Corozal Terminal**. This brand-new project will extend across an area of 118 hectares, of which the APC offices occupy approximately 75 hectares at the moment.

Although the Corozal terminal continues to be in the planning stages, it is anticipated that it will eventually become a transshipment spot for container vessels and will have immediate access to the railway line (logistics.gatech.pa, n.d.).

### **Chapter 3: Cost-Benefit analysis—Port of Corozal**

In this chapter, we will develop the objectives and understand the social, environmental, and economic impact of the development of the Port of Corozal. In addition, we will also analyze the change in the demand of the five major container terminals from 2016 to 2021. This information is relevant to have a better understanding on the fluctuation of TEU movements, the social, environmental, and economic impact, the performance indicators, and how the project could integrate with the immediate hinterland.

#### **3.1 Social Impact**

In areas where the port has relocated far from the city, residents may feel cut off from the port and the rest of society. In a nutshell, ports can't assume universal approval. As land and other resources become scarcer and the economic function of seaports is put to the test by other, more

pressing social and environmental concerns, it is clear that this facet of port competitiveness will grow in importance in the years to come (Notteboom, Pallis and Rodrigue, 2020).

Large social and economic conflicts may arise over the development and operation of ports if different groups see a significant disparity between the advantages and disadvantages of having larger ports. When a sizable portion of the population does not understand the inner workings of the port or the port's economic impact, public support for the port erodes. Road congestion, landscape encroachment, noise and air pollution, and use of scarce land are some of the primary sources of local community concern. Port administrators have valid concerns about the possible decline in public support for seaports (Notteboom, Pallis and Rodrigue, 2020).

These days, ports can't just be driven by economics; social and environmental impacts are becoming increasingly important. When it comes to urban development, security, and long-term sustainability, ports present a unique challenge for policymakers and port administrations. Some parties now factor in a port's financial worth, so arguments no longer center solely on ecological and social concerns (Notteboom, Pallis and Rodrigue, 2020).

Ports can win over locals if they are environmentally beneficial. The environmental reputation of a port and the level of social support it receives are two factors that are becoming increasingly significant to attracting trading relationships and venture capitalists. Port planning and development should ensure long-term sustainability from an ecological perspective. The economic and financial viability of port developments and activities must now be balanced with their impact on the environment (Notteboom, Pallis and Rodrigue, 2020).

Port social value assessment is a challenging endeavor. In an effort to win over the local populace, many ports fund a variety of community events and programs. Yet, the greatest benefit to local societies comes from indirect social aids. Some ports, for instance, may finance educational and training initiatives. These kinds of community involvement are crucial to the prosperity of ports because they foster not only commercial responsibility but also social acceptance and commitment (Notteboom, Pallis and Rodrigue, 2020).

Attracting the younger generation interested in maritime professions is crucial to improving the ports' image. Employers in the port industry owe it to their staff to foster a positive work environment, promote from within, and instill a sense of civic pride.

### **3.2 Environmental Impact**

Port development and management should prioritize environmental sustainability. Now more than ever, port developments and operations need to be environmentally sustainable in addition to being financially viable. Seaports, as hubs of economic activity, have taken on a conservation mandate, paving the way for more environmentally friendly supply chains. Ports have multiple impacts on the environment due to their roles as hubs in global supply chains and major transportation nodes. Terminal activities can be broken down into several classes, each of which contributes to the environmental damage done by seaports (Notteboom, Pallis and Rodrigue, 2020).

- Associated port-related construction and maintenance pollution.
- Ships' berthing emissions and those produced by terminal machinery that processes cargo (such as cranes and wharf equipment).
- The noise that is made when cargo is being loaded and unloaded.
- Pollution and traffic congestion from barges, trains, and trucks using the road system.

There are environmental effects at every point in a container terminal's life cycle, from initial planning to construction to operations to expansion to eventual closure or termination. Negative effects, such as air pollution, are felt by the environment due to intermodal connections and congestion, which affect landside operations that are linked to surface transportation. Depending on factors like price and time commitment, various modes of transportation have varying degrees of environmental impact. Other port activities, such as manufacturing, warehousing, and distribution, also have an effect on the environment (Notteboom, Pallis and Rodrigue, 2020).

Natural and urban environments are both disrupted by pollution from ports. It contributes to the already high risks of operating a port and has a negative effect on global warming. Creating a low-carbon economic system is considered crucial in combating global warming and other environmental crises. The concept of developing ports sustainably is gaining traction. The numerous green initiatives undertaken by individual ports and the concerted efforts of the port community as a whole are practical manifestations of this philosophy. Increasing environmental consciousness among port stakeholders is a key factor in the development of the green port concept. In 2009, at the United Nations Climate Change Conference, the term "green port" was formally proposed for the first time. The concept of green port is based on the organic integration



of port development, resource utilization, and environmental protection, and it denotes a development that maintains a balanced ecological system, makes efficient use of its resources, consumes little energy, and produces little waste. Responsible action on the part of all relevant parties in port governance and operation is essential to the concept of green port, also known as the sustainable and climate-friendly formation of port facilities (Notteboom, Pallis and Rodrigue, 2020).

### **3.3 Economic Impact**

The main significance of ports is cost-effective, as they encourage trade flows and the ecosystem of associated events. Because they can represent a significant economic investment, ports are expected to provide sufficient value to justify that investment. From an economic and legal standpoint, seaports are seen as economic facilitators for the areas they work with. There are two ways to evaluate ports' strategic and economic significance. The first order of business is to establish a method for calculating the value added by ports to the economy. Many indicators could be used, some of which would be defined in absolute terms, while others may be explained relative to something else. A few examples of such indicators are (Notteboom, Pallis and Rodrigue, 2020).

- Gross value added, which shows how much port activity contributed to national or regional output in a given time frame (often annually). Ports have direct influence on operations which are specifically related to them and without which the terminal also couldn't function effectively, so calculating this value added can be difficult. Even beyond the direct effects of the port on the local economy, there are several secondary effects that may have unexpected interactions with the primary ones. The importance of ports' indirect effects on national or regional economies has grown alongside the expansion of international trade (Notteboom, Pallis and Rodrigue, 2020).
- Full-time equivalent (FTE) employment is a primary measure of the economic impact of a port's operations. Once a year is the norm for taking a snapshot to calculate total employment or port activity. A wide variety of jobs, like value added, are tangentially connected to port operations (Notteboom, Pallis and Rodrigue, 2020).
- The quantity and value of goods traded which reveals the role of ports in international commerce. Some ports serve primarily as export hubs, while others cater more toward imports, so it is possible to differentiate between them based on the direction of traffic.

Diverse economic systems can exist on the same volume and trade composition (Notteboom, Pallis and Rodrigue, 2020).

- Taxation; describing in depth the fiscal impact of port operations on state, regional, and federal governments. This is especially crucial for defending the government's investment in port activities, especially in infrastructure (Notteboom, Pallis and Rodrigue, 2020).
- The amount of money spent or raised for port activities over a certain time period by the public and private sectors. The construction and upkeep of a port's superstructure and infrastructure are costly and time-consuming endeavors (Notteboom, Pallis and Rodrigue, 2020).

The first theory holds that seaports contribute to societal and economic development through value creation, particularly through value added and employment. Ports can have sizable external spillover effects. However, the port's economic effects are no longer confined to the immediate area. They now span a much broader geographical area and involve a plethora of international actors. The economic benefits of port operations are expanding beyond the borders of the local port system. When a port fails to cultivate local value-added activities related to transit cargo or establish a robust local industrial and logistics cluster, the economic impacts are felt in a much wider area. In this scenario, the port acts as a conduit for cargo flows, generating economic benefits for the surrounding area through increased employment in the cargo handling, marine service, and inland transportation sectors (Notteboom, Pallis and Rodrigue, 2020).

The growth of logistics hubs by major transportation arteries or near seaports reflects a shift in the distribution of economic benefits. Containerization and the development of intermodal transport have aided this pattern. By providing VALS (value-added logistics services) to cargo and operating as mere transit points, logistics hubs and zones can generate substantial economic benefits. To the contrary, it is highly unlikely that these areas and locations would have grown without the presence of seaports (Notteboom, Pallis and Rodrigue, 2020).

The competitiveness of a country or region is typically the lens through which policymakers and authorities examine the macroeconomic impact of ports. In most cases, the national or regional economic impact of seaports is presented in reports and statistics. There is a lack of focus on logistics, even though ports have a significant impact on regional economies and international trade. Although there may be important spillover of port-related benefits to regions further inland, policymakers tend to prioritize the port's contribution to the communities within

their purview. Development of ports should prioritize serving local, regional, and national interests while minimizing the overall financial burden on the port and its customers (Notteboom, Pallis and Rodrigue, 2020).

If we look at the economy as a whole, seaports typically play a significant role in generating new jobs. Even after the initial influx of workers is accounted for, a port's economic impact on the region continues to grow. The scope of the economy considered affects how significant the employment impacts of ports are. Because of the increasingly global nature of seaports and shipping transactions, as well as the nature of global supply chains, the economic effects of ports' activities tend to ripple outward from their immediate geographic vicinity. For instance, shipping lines have worldwide impacts on employment, including for ship crews. Through their liner shipping agencies, they can help boost local employment in port cities (Notteboom, Pallis and Rodrigue, 2020).

Management of ships and container fleets, as well as investment and trading strategies, are typically centralized in corporate or regional offices. Similarly, PSA (based in Singapore), Hutchison Ports (Hong Kong), DP World (Dubai), and APM Terminals (based in the United States) are all examples of global container terminal operators (The Hague). Although these businesses generate a great deal of employment at seaports across the country, they still perform some functions, such as the procurement of equipment and the conducting of R&D, at their international or regional headquarters. Port authorities may need products and services from companies abroad, such as ZPMC of Shanghai or Kalmar of Gottwald, Sweden. The national or international economic effects on employment from a given port activity are typically larger than the local economic effects (Notteboom, Pallis and Rodrigue, 2020).

Through profitable, trustworthy, and numerous networks to foreign and local markets, terminals have an important part in enabling trade and intensifying the competitiveness of a nation or region. This strategic value manifests itself in a variety of ways:

- First, the **contiguity of well-organized terminals** can be a vital factor in business position evaluations.
- Next, the **disposal of an aggressive port scheme** can decrease the need for international ports for commerce and lower total logistics fees for companies placed in the area.

- Finally, **ports can contribute meaningfully to the global competitiveness of businesses** in an area or country, particularly through existing improvements and superior business networks and administration.

Suitable infrastructure and prominent availability or connectivity are progressively essential needs for competitiveness. To maintain their competitive edge, high-income economies need to invest in new technologies and more sophisticated factors of production. Seaports are losing some of their strategic significance. Seaports are no longer simply hubs for transporting goods to and from international and domestic markets; they are also serving as hubs for the development of new products and services. Nowadays, a port is much more than just a wharf where ships unload their cargo. Its significance within the international distribution network is growing. Seaports that want to become innovation hubs should work to improve their competitiveness and efficiency. Management of port clusters fosters collaboration and the sharing of information among member companies, fostering a culture of innovation. By encouraging collaboration and sharing of information, clustering can boost productivity and prosperity (Notteboom, Pallis and Rodrigue, 2020).

The presence of major corporations, market leaders, and clusters of supporting industries can provide a port with a foundation for innovation, productivity growth, and strategic partnership. Working together with other ports and logistics hubs in the area can also encourage specialization, innovation, and increased productivity. Finally, ports can aid in advancing the spread of knowledge and fostering the development of expertise in port management and logistics. These more strategic considerations should be factored in alongside purely economic ones when assessing port development proposals (Notteboom, Pallis and Rodrigue, 2020).

One can examine seaports not only from a macroeconomic vantage point, but also from a microeconomic one. Traditionally, a port's operations have revolved around two main pillars: ships and cargo (Notteboom, Pallis and Rodrigue, 2020).

- Services rendered at the interface between a ship and the shore, such as dredging, piloting, mooring, and unmooring, are considered to be part of the broader category of "vessel services" (berthing, repair and maintenance, provisioning, and bunkering).
- Stowage, loading, and unloading are all examples of ship-to-shore cargo services, while integration, storage, and allocation are all examples of land-based services.

At the operational level, where the micro perspective is most useful, it is crucial to keep in mind such concepts as productivity, effectiveness, and sustainability (i.e., of a company or terminal). Instead of focusing on seaports themselves, this method of port analysis treats individual companies and the terminals they operate as the primary units of analysis.

Even though goods movement through and handling at ports is their primary purpose, seaports have expanded and diversified their roles over time. Wharfs are only one part of the complexity of a seaport. Seaports' breadth and depth of service have increased as a direct result of fundamental economic and technological processes. When seaports expanded beyond their original purpose of merely storing and processing cargo, they took on new responsibilities. The industrial function grew rapidly after World War II. Some ports have grown into what are known as maritime industrial development areas (MIDAs), which are large industrial complexes with many but related sectors (Notteboom, Pallis and Rodrigue, 2020).

In modern times, seaports have taken on a more vital role in logistics. There has been a shift in attention toward the value created by cargo as a result of the port, as a result of the growing significance of port and terminal integration into value-based supply chains. Major ports' convenient locations present opportunities to boost VALS through the integration of the supply chain's production and distribution processes. Ports compete for a larger piece of the product chain's value by providing VALS. These days, seaports serve a larger logistical purpose than simply as cargo hubs (Notteboom, Pallis and Rodrigue, 2020).

The supply chain method can shed light on the competitiveness of ports. Ports compete not just as individual locations for ship handling, but also as integral nodes in transnational distribution networks. Selecting ports and routes considers the entire network, of which the port is merely a part. If a shipper is concerned about inventory or quality, they can rest assured that the ports they choose will help them save money across the board. The overall cost and network performance become more important factors in port selection. Seaports can more easily become part of sophisticated logistics and distribution networks when their distribution and logistics functions are well-integrated with a variety of service providers, allowing for the introduction of a plethora of new, high-quality value-added services (Notteboom, Pallis and Rodrigue, 2020).

Ports are frequently viewed as centers of commerce and industry at the intermediate level. Businesses in the fields of transportation, commerce, and manufacturing tend to congregate in ports and work closely together. In terms of the costs and benefits of handling physical cargo, port

clusters enjoy significant economies of scale and scope. There are more chances for cargo flows to be clustered using multimodal transportation (shortsea, barge, or rail) and for the region to be better connected to the rest of the world thanks to increased service frequency when activities are concentrated. There is a wide variety of events that can be held in port clusters (Notteboom, Pallis and Rodrigue, 2020).

Seaport communities can bring substantial environmental benefits, even though manufacturing activities in seaports are commonly associated with hazardous effects in the exercise of emissions and noise pollution. The petrochemical industry, for instance, reaches “environmental scale” through the utilization of byproducts like heat and other waste products. If the relevant facilities were geographically dispersed, this would be a much more formidable task. The importance of ecological economies of scale is becoming more and more prominent in environmental policy. It's possible that prosperous port clusters will encounter difficulties, most notably in the form of reduced accessibility (traffic) and increased land prices (Notteboom, Pallis and Rodrigue, 2020).

### **3.4 Demand for transshipment services**

#### **Container terminals demand**

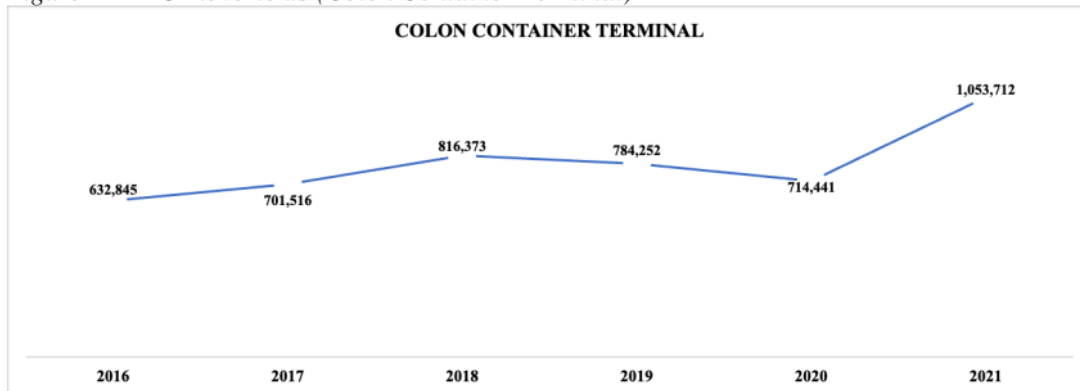
In today's efficiency-focused, competitive, and highly aggressive marketplace, ports play a pivotal role as hubs connecting international supply chains. Port services are in high demand as globalization, which is predicated on free trade and open markets, continues to expand. The last fifty years have been especially pivotal in expanding the role of ports and maritime shipping on a global scale. Yet, globalization is being investigated. The expansion potential of ports can be hampered by shifting market opportunities and rising trade barriers. Global trade flows are volatile and uncertain because of factors such as Brexit, trade disputes between China and the United States, and challenges associated with both old and new bilateral and multilateral trade agreements. This calls for greater adaptability and resilience on the part of ports and the people who work in them, as well as greater efforts to incorporate sports into global supply chains and supply chain logistics (Notteboom, Pallis and Rodrigue, 2020).

Ports must be able to withstand and adapt to a wide variety of disturbances. Constant disruptions include economic tremors, health emergencies, and significant trends like the evolution of energy sources and the rise of automation. To get ready for potential long-term shifts in the

nature of their foreshore and hinterland flows, ports are increasing their preparatory activities. While the container industry has received the majority of the focus in recent decades, it is anticipated that a more well-rounded discussion will emerge in the near future, with an emphasis on other types of cargo as well as the passenger/cruise market. It is inevitable that the global structure of production, distribution, and consumption, which is facilitated by ports and ocean shipping, will continue to be heavily influenced by geographical factors (Notteboom, Pallis and Rodrigue, 2020).

### TEU movements per Container Terminal 2016 - 2021

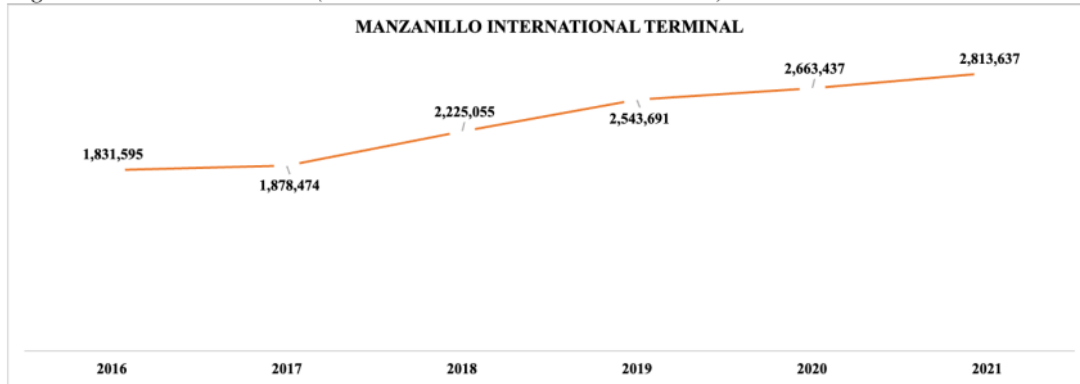
Figure 2 - TEU movements (Colon Container Terminal)



Source: Panama Maritime Authority & author creation

This graph shows that the Colon container terminal experienced some fluctuations after the Panama Canal expansion, however, it took a big leap in 2021, increasing its TEU movements by a full 32%.

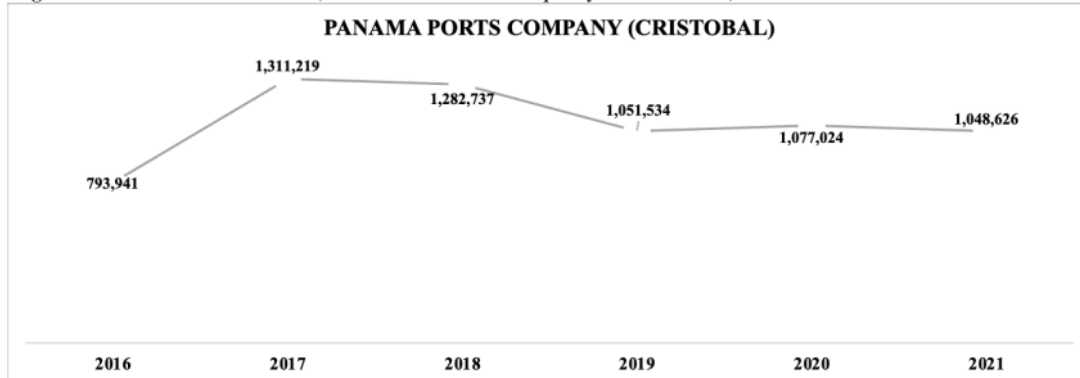
Figure 3 - TEU movements (Manzanillo International Terminal)



Source: Panama Maritime Authority & author creation

This graph shows container throughput in TEUs after the Panama Canal expansion. MIT has been one of the most consistent ports in container throughput. It can be seen that after the expansion in 2016, the TEU measurement showed a small decline, but from 2018 to 2021, TEU movements have steadily increased.

Figure 4 - TEU movements (Panama Ports Company - Cristobal)

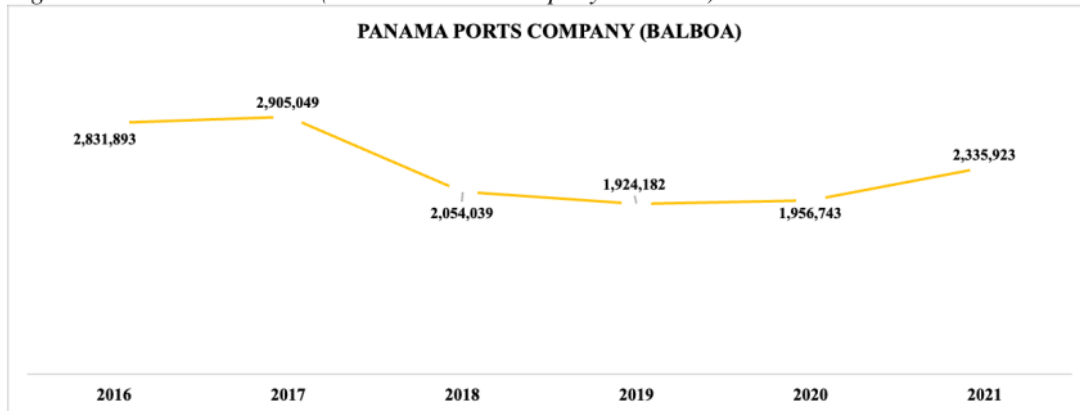


Source: Panama Maritime Authority & author creation

This graph shows that the expansion of the Panama Canal had a great impact on the TEUs of PPC - Cristobal. From 2016 to 2017, the port saw a 40% increase in container movements, and since then, the port has been in constant numbers. Meaning that the expansion had a significant impact on the TEU volume handled by this container terminal.



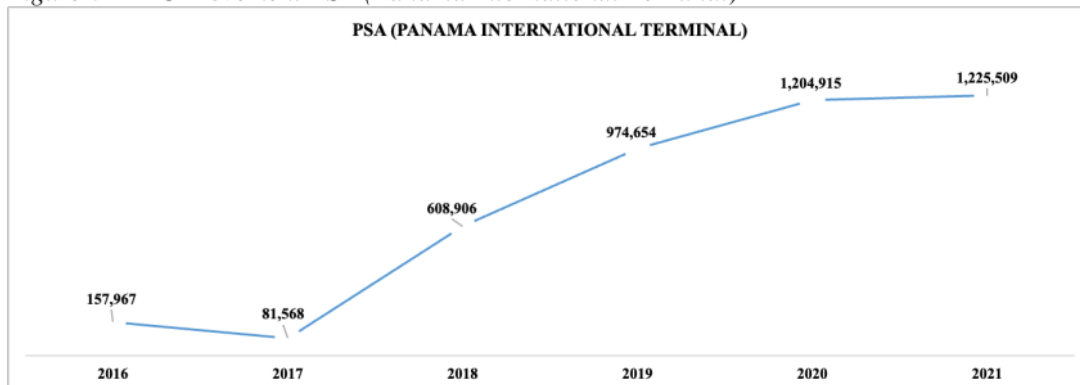
Figure 5 - TEU Movements (Panama Ports Company - Balboa)



Source: Panama Maritime Authority & author creation

This graph shows the performance in TEU for PPC-Balboa. It is important to emphasize that this container terminal is located at the Pacific exit of the Panama Canal. Since the PCE this terminal has handled the majority of container traffic on the Pacific coast. Even though the volume of TEUs decreased, the terminal has been posting some strong, consistent numbers.

Figure 6 - TEU Movement PSA (Panama International Terminal)



Source: Panama Maritime Authority & author creation

This table shows how efficient a new terminal at the Pacific outlet of the Panama Canal can experience growth. PSA began operations in 2010 but did not start handling containers until 2012. This terminal had a gigantic lip after the canal expansion, especially starting in 2018, and has steadily increased its container throughput since then.

### **3.5 Port competitiveness**

#### **Port Competition**

These days, ports compete for more than just cargo. The increasing significance of incorporating ports and terminals into supply chains has led to a better effort on generating value linked with cargo transiting through the port. Additionally, a supply chain perspective aids in comprehending port competitiveness. Ports compete not just as individual locations where ships are handled, but as critical links within global supply chains. Port choice is increasingly becoming a function of total cost and network performance (Notteboom, Pallis and Rodrigue, 2020).

Although competition between nearby ports is still vital, the development of sea and land-based transportation systems has increased inter-port rivalry on a global scale. A highly dynamic and competitive landscape has emerged in terms of servicing both nearby and far-flung hinterlands as a result of corridors, dry ports, and inland strategies by market participants and port authorities. Captive hinterlands and customers have given way to divided hinterlands and large, unattached port users. The business strategies of these port users affect competition between ports and within ports (Notteboom, Pallis and Rodrigue, 2020).

To increase profits, boost sales, and better meet the needs of their customers, businesses in the shipping, port, and logistics industries are pursuing two parallel courses of action. The key is to keep expenses under control by utilizing horizontal integration, and to segment services by utilizing vertical integration in tandem with the supply chain. These initiatives can't be carried out without first undergoing digital transformation and capturing value all the way along their supply chains. Ports, along with other hubs in the global logistics and transportation network, have undergone structural changes to better accommodate modern global supply chains in order to remain competitive. Bundling transport flows with the hinterland is one way in which ports are trying to work together and coordinate their operations. Competition between nodes is complemented by cooperation between nodes (Notteboom, Pallis and Rodrigue, 2020).

Competition between ports is increasingly influenced by consolidation and growth in scale in shipping and logistics. Larger and larger container ships were initially seen as a boon to international trade and shipping. The mega-ship era ushered in an era of lower container transportation costs and a reordering of port importance as a result of the economies of scale they ushered in. Recently, concerns have emerged about who should bear what share of the financial burden and reward associated with these massive vessels. The effects of mega-ships on logistics,

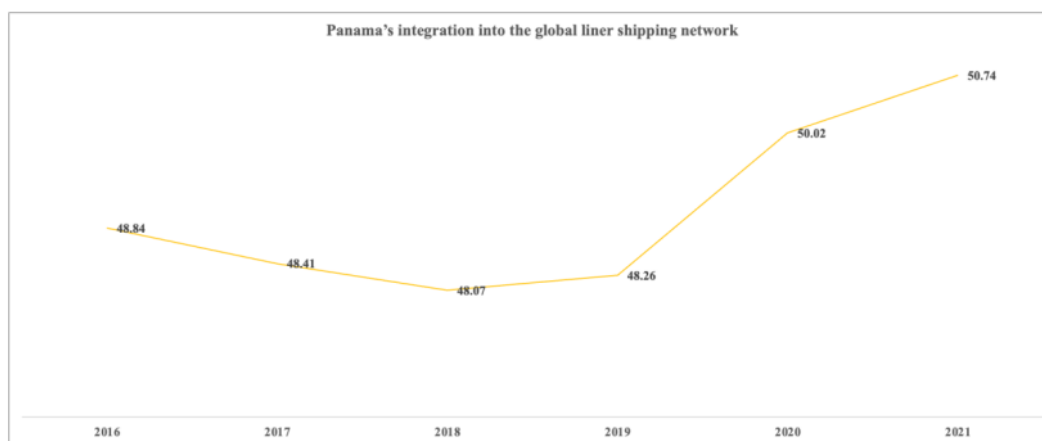
port operations, government spending on maritime access, and public opinion have all been called into question. We might have reached a limit, or we might be able to keep taking advantage of the economies of scale. Legislators, regulatory authorities, and the citizens are much more aware of the important role of shipping and terminals in enabling global trade as a result of the COVID -19 crisis and incidents like the Suez Canal blockade. This has led to heated debates about the benefits and drawbacks of increasing the size and scope of the port and shipping industry. (Notteboom, Pallis and Rodrigue, 2020).

### 3.6 Performance Indicators

During this section, performance indicators were analyzed to understand how the container terminals have performed before and after the canal expansion. The indicators used were the following. Liner shipping connectivity (LSCI) which indicates the degree of integration of a country into the global liner shipping networks, Container port throughput which indicates the estimated total amount of containers handled expressed in TEUs, Port liner shipping connectivity (PLSCI) which indicates the position of a port in the global liner shipping network, and the total number of port calls which indicates how many port calls were received during a period of one year.

#### Liner Shipping Connectivity index (LSCI)

Figure 7 (Panama's integration into the global liner shipping network)



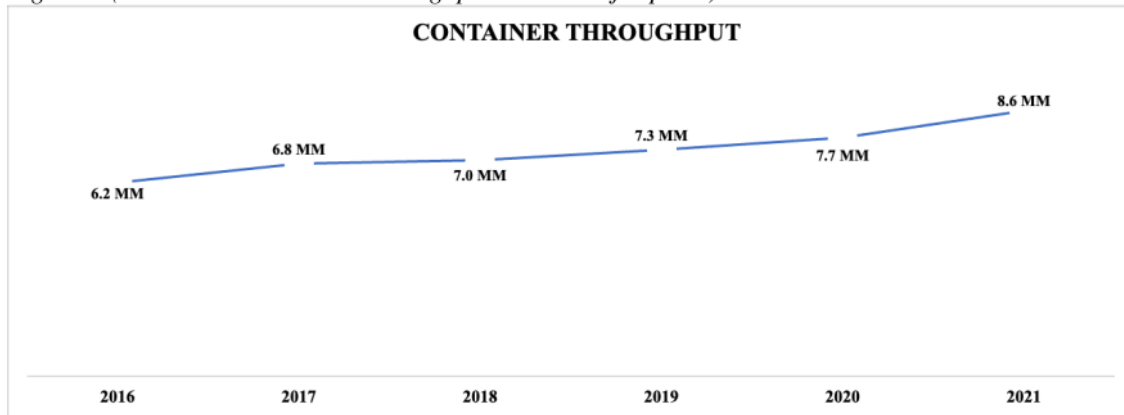
Source: UNCTADSTAT & author creation

This graph shows how the country increased its connectivity in the global liner network immediately after the canal expansion. This means that Panama has improved its position as a

logistical hub, where the movement of containerized cargo is of great importance for transshipment. In addition, this index also proves that Panama has evolved from a mere canal country to one of the most important logistics hubs in North and South America. Considering that most of the world's cargo is transported in containers, the country must continue to develop and improve its port infrastructure to further strengthen its position in the global trade network.

### Container Port Throughput

Figure 8 (Total Container Port Throughput – Five major ports)

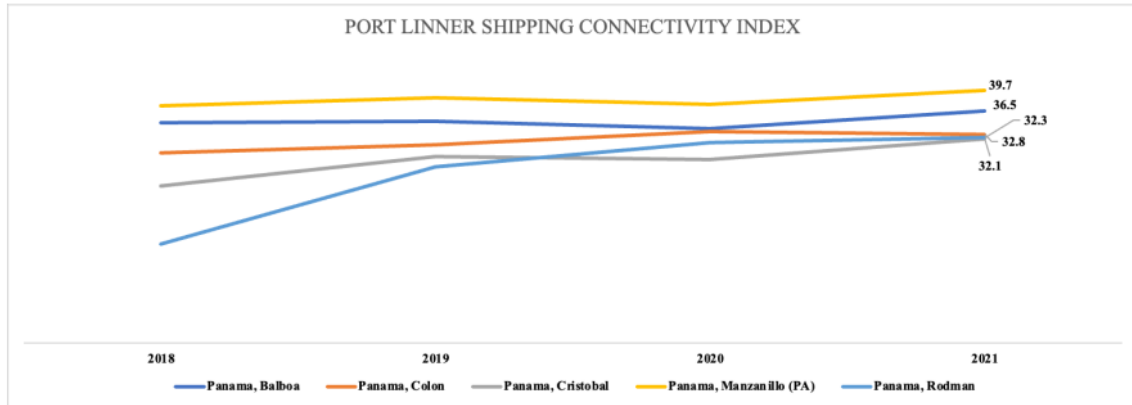


Source: UNCTADSTAT & author creation

This graph shows the container throughput in ports, i.e., the total number of containers handled in TEU. This indicator is significant for world trade, as it shows the development of a port's economy. In addition, the graph also shows the significant growth in throughput after the canal expansion, which means that larger container ships are using the canal and the Panamanian port system. The country's economy and its standing in international trade have been severely impacted as a result. However, the question is whether these numbers can continue to increase and whether the ports have sufficient capacity to meet the demand, which seems to keep growing.

### Port Liner Shipping Connectivity Index (PLSCI)

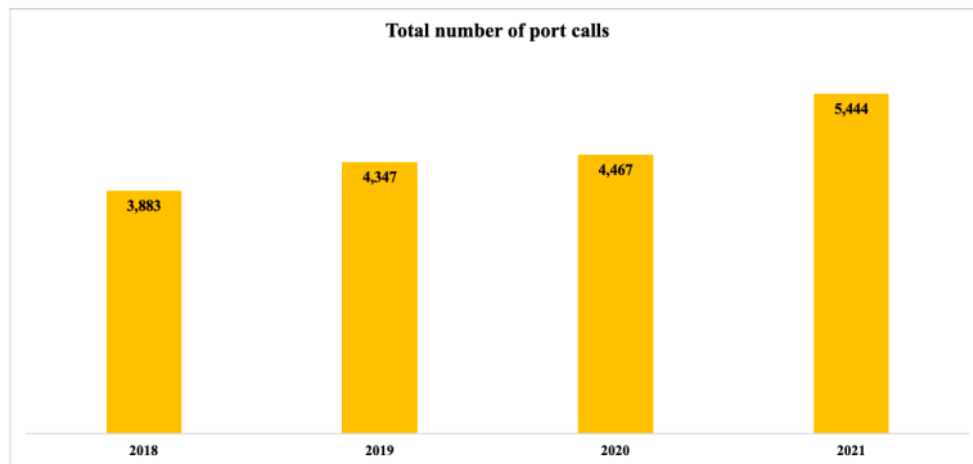
Figure 9 (Port Liner Shipping Connectivity Index – Five major ports)



Source: UNCTDA STAT & author creation

This graph shows the position of the five main Panamanian ports in the global liner shipping network. This indicator is supplemented by others such as the number of direct liner connections to other ports, the number of liner companies offering services to and from the port, the number of regular vessels calls to the port, and the number of regular liner services to and from the port. It is clear that the connectivity of these ports has increased significantly after the canal expansion.

Figure 10 (Total port calls)



Source: UNCTADSTAT & author creation

This graph shows the total number of port calls received by the five major Panamanian ports. Since 2018 there has been a constant increase, which can be attributed to the expansion of

the Panama Canal. Furthermore, the country has improved its port infrastructure, which now makes them more accessible for bigger ships and allows them to be more efficient when handling containerized cargo. In addition, this proves that the logistics implemented has been well-developed, and the country has strengthened its status as a logistic hub.

#### **Chapter 4: Findings of Research**

After analyzing the 2016-2021 container movement data from the five major ports, it can be concluded that the Panama Canal expansion has had a positive impact on the transit of container ships through the ports, which has contributed to the country's connectivity to global trade. Within the Atlantic ports, for example, MIT increased from 1.8 million TEU in 2016 to 2.8 million in 2021, CCT from 600,000 thousand to 1.1 million, and PPC-Cristobal from 800,000 thousand TEU to 1.3 million TEU. On the Pacific side of the Panama Canal, the behavior was different, as PPC-Balboa was the only container terminal and its throughput decreased from 2.8 million TEU in 2016 to 2.3 million TEU in 2021. However, this decrease is due to the development of the container terminal called PSA, whose throughput increased from 100,000 thousand TEU in 2016 to 1.2 million TEU in 2021. This could be considered a huge increase in the country's competitiveness in terms of its position as a logistics hub. Based on this analysis, we found out that the development of the other container terminal (PSA) brought more business to the country and improves the country's position within the region

Data obtained from the performance indicators also showed that the Panama Canal expansion had a significant impact on the country's port system. For example, the LSCI, which indicates the country's level of integration into the global liner shipping network, increased from 35.05 to 50.74. It is higher than the LSCI of competitors such as Colombia, Mexico, Costa Rica, Brazil, Chile, and Ecuador. Container throughput, which is the estimated total number of containers handled, expressed in TEUs, increased from 6.2 million TEUs in 2016 to 8.6 million TEUs in 2021. According to Labrut (2022) "Panama's Colon Port – highest Latin American box volume in 2021", the Atlantic ports integrated by MIT, CCT and PPC-Cristobal had the highest container throughput with 4.91 million TEU in 2021, while the Port of Santos is second with 4.44 million TEU. Labrut (2022) also noted that the Pacific coast of Panamanian ports, integrated by PPC-Balboa and PSA, ranked third with a total throughput of 3.56 million TEU, followed by Colombia (Port of Cartagena) with 3.40 million TEU and Mexico (Manzanillo) with 3.30 million TEU. Other indicators such as the PLSCI, which indicates a port's position in the global liner

shipping network, also show that Panamanian ports have increased their connectivity in global trade after the canal expansion. In addition, these ports have created an upward trend that is critical for the country's strategy to become the HUB of the Americas. Finally, the number of port calls, which has increased from 3,883 in 2018 to 5,444 in 2021.

The increase in TEU movements and the improvement in the main performance indicators of Panamanian ports following the expansion of the Canal have shown that container throughput is a category in which the country excels and can further improve its position in world trade. As mentioned earlier, the total capacity of the canal at the Atlantic exit is 8 million TEUs, while the Pacific exit has a total capacity of 4.5 million TEUs. This fact suggests that Panama's development of another terminal at the canal's Pacific exit could increase container throughput and enhance the country's ability to become the most important transshipment hub in the Americas. Panama must take advantage of its privileged geographic location and prioritize infrastructure projects that address port congestion and logistical problem areas, promote the development of multipurpose ports, and integrate its logistics system.

In order to increase its competitiveness with the Suez Canal, the Panama Canal Authority (ACP) considered the construction of a fourth lock facility. This new lock facility was to carry up to 20,000 TEUs and cost about \$17 billion. This strategy, however, had to be put on hold because of the canal's unstable water levels and increasing ship sizes. The largest container ship in 2019 was operated by the shipping company MSC and carried a maximum of 23,756 TEU. Future projections show that this figure will rise. The ACP has continued to conduct studies on how to increase the water supply to the canal, and it is finally closed to show some positive results. This fact indicates that the addition of a fourth lock system could become a reality sooner rather than later, which would mean that 20,000 TEU vessels could pass through the canal. The need for port services, especially container handling, will be significantly affected.

If expansion to a fourth lock is studied, another container terminal must also be included. That is why the Corozal transshipment port project is crucial. This project would consist of a total investment of \$750 million which would include two phases, consisting of a 2,081-meter dock, a container depot with a capacity of 3.2 million TEUs, offices and storage facilities on the surrounding 120-hectare site owned by the Panama Canal. The Port of Corozal, would be located on the shore of the Panama Canal on the Pacific side, and it is an example of the Canal's ongoing commitment to develop its products and services and strengthen Panama's importance as a logistics

hub. It is expected that the project allows more cargo to be transported through the waterway, improve the services offered, increase port capacity for customers, and create long-term employment opportunities (Dutch Kingdom in Panama, 2020).

Construction and operation of this project was put out to tender in 2016 and has been delayed in the past. However, the new government has noticed that shipping companies are moving their business away from this port, such as to the Port of Buenaventura in Colombia and the Port of Limón in Costa Rica because the National Assembly did not approve the ACP concessions in 2017. The government and ACP recognize that this was a costly mistake. Therefore, they are joining forces to increase competitiveness with the Awakened Plan, which means that the agreements for the tender package are currently being made (Dutch Kingdom in Panama, 2020).

Even without the extension of a fourth set of locks to the Panama Canal, the Corozal transshipment port project could improve the country's competitive position, efficiency, and connectivity, and also have an important impact on global trade, benefiting not only the country but the entire region.

#### **4.1 Port Governance**

The search for a suitable port management model has been accelerated by shifts in the competitive landscape, environmental and social challenges, and the shifting roles of ports. The administration of ports has been the subject of much recent innovation and individualized strategy. Among the many reasons why port reforms have created both challenges and opportunities is the fact that ports must operate within a global economic system, even as they adapt to and become embedded in a regional or local political and economic context. Opportunities exist to improve how port governance solutions are evaluated, and to equip stakeholders with the resources they need to select the best governance model for their needs (Notteboom, Pallis and Rodrigue, 2020).

The movement away from managing single ports toward managing clusters or regions of ports is a notable trend in port governance. Due to rising market and financial pressures and opportunities, as well as the desire to avoid duplication of facilities and unnecessary competition, port authorities are increasingly merging and engaging in other forms of extensive collaboration. The potential for monopolistic or oligopolistic situations to emerge as a result of this could prompt regulatory action (Notteboom, Pallis and Rodrigue, 2020).



Greater independence, a shift toward commercially focused strategies, resilience, accountability, and a drive toward sane investment are common outcomes of policy reforms in the port sector. They have also opened up opportunities for new forms of revenue and business structures for port authorities. While port authorities in different parts of the world may use different pricing structures to generate income, the majority of ports stick with tried-and-true methods. Seaport and land fees are typically set using straightforward and honest strict pricing approaches, and they provide a significant portion of the funding needed by port authorities. It is expected that port pricing strategies and revenue models will evolve. This may involve exploring the potential for more dynamic, adaptable, and distinctive pricing strategies. Investments in technological transformation, decarbonization, and the circular economy can all generate additional revenue, which could be supplemented by port and shore fees (Notteboom, Pallis and Rodrigue, 2020).

Authority figures at ports are likely to remain pivotal. Despite the skepticism that has accompanied the recent realignment of the network connection in port governance, it is expected that the quest for and integration of port governance framework will ensure that port governance bodies continue to play a central role in the management of ports. The same can be said about the function of terminal operators, especially considering the global scope of the industry and the persistence of current trends toward greater vertical integration. Even if a new equilibrium between port authorities and terminal operators does emerge, communication between the two will be crucial to the expansion of ports (Notteboom, Pallis and Rodrigue, 2020).

Finally, diversity has been a unifying factor in the transformation of ports from elementary critical infrastructures that merely facilitate trade to nodes in complex global supply chains that aggregate port-related activities functionally and spatially. Each port's development is one-of-a-kind due to factors like size, location, governance and institutional structures, port functions, differentiation, and market dynamics. When it comes to ports, the adage that “to know a port is to know a port” still holds true. (Notteboom, Pallis and Rodrigue, 2020).

There is no reason to assume that ports will all react and adapt in the same way to the significant and difficult problems that may arise in the future. Ports will continue to be an interesting sector to study because of the wide variety of ports around the world (Notteboom, Pallis and Rodrigue, 2020).

## **4.2 Economic activities – Immediate hinterland**

### **Integration of National Logistics**

One of Panama's main concerns is avoiding the “dualization” of the country's logistics, in which the logistically productive interoceanic area remains as it is with poor connections to the country as a whole and the world. (Dutch Kingdom in Panama, 2018).

90% of all container traffic in Panamanian ports is transshipped, with the ports of PPC-Balboa and MIT serving as the main transshipment hubs. After the canal was expanded in 2016, a new set of locks was built on both the Atlantic and Pacific sides. This increased the canal's cargo capacity by twofold by adding a third lane. The employment of “neopanamax” ships was made possible by this third lane. These bigger ships can carry up to 14,000 TEU of cargo, which is a threefold increase. To stay up with these advances and the rivalry in the region, Panama's major ports have likewise improved their capacity (Dutch Kingdom in Panama, 2018).

The amount of trade passing through the waterway has greatly risen as a result of the canal's extension. Since the canal's enlargement, more than 3000 “neopanamax” vessels have transited through it, and both the quantity of cargo moved, and the number of transits are still growing. With 38.1 million tons (PC /UMS) passing through the canal in May 2018, the canal set a new monthly tonnage record for the third time since the expansion opened in 2016. (Dutch Kingdom in Panama, 2018).

Panamanian ports see a wide range of occupancy rates. Balboa (Pacific) has the highest occupancy rate in Central America and the Caribbean at 78%, whereas Colon's (Atlantic) rate of only 47% is the result of recent development and still has plenty of room for growth. As a result, the port is about to become congested and won't be able to provide necessary services. Congestion can be avoided by implementing expansion plans on the Pacific side of the ocean, such as the new Corozal terminal. Investments in Panama are expected to be needed at a rate of \$1.8 billion by 2025 and \$7.9 billion thereafter (by 2040), according to CAF (Development Bank of Latin America). These numbers account for the majority, if not all, of the necessary investment in the port industry in Central America and the Caribbean. The new terminals at Corozal and PCCP-Isla Margarita, among other growth plans for the Panamanian port industry, won't be sufficient to meet the rising demand. If they are not extended, the terminals in Colón will have a capacity gap of 5.7

million TEU by 2040 while the terminals on the Pacific side will have a gap of 5.3 million TEU (Dutch Kingdom in Panama, 2018).

The most active shipping lane through the Panama Canal connects Asia with the East Coast of the United States. The west coast of Latin America serves as both the origin and destination of other significant commercial routes. The United States, which was the origin of 166 million tons of cargo in 2017, is by far the canal's most significant user. After the US, the next largest producers are China (44 Mt), Chile (28 Mt), Japan (27 Mt), and Mexico (25 Mt). The Netherlands, the second-largest player in Europe just behind Spain, is ranked 14th with 4,2 million tons (Dutch Kingdom in Panama, 2018).

The most significant economic region in Panama is the interoceanic zone. The majority of the nation's population, the canal, and all the country's major ports, airports, free trade zones, are all concentrated in one relatively small area. The western part of the nation must be developed to stop increasing logistical dualization. The agricultural center of Panama is located in this area, which includes the Bocas del Toro and Chiriquí provinces. Infrastructure improvements along with additional agricultural and logistical development in the western region could improve the connection between this pole and the interoceanic zone. Additionally, the area can serve as a connection between the interoceanic zone of Costa Rica and Panama (Dutch Kingdom in Panama, 2018).

### **Value Added Logistics**

Panama aims to invest in “Value Added Logistics” to reduce the reliance of its economy on conventional sectors like the maritime industry. Panama has recognized the need to invest in value-added logistics services to take use of its advantageous geographic location and the Panama Canal and continue to bring cargo to its ports, despite the fact that its ports are currently used nearly entirely for transshipment (Dutch Kingdom in Panama, 2018).

Currently, Panama's special economic zones house the majority of the nation's value-added logistics. To entice both domestic and international investors, these zones have various tax, immigration, and labor rules. The primary goals of special economic zones are to advance global commerce, industry, and provision of new services. A platform for the transfer of wholesale and tax-exempt commodities from Asia, Europe, and North America to Latin America and the Caribbean is provided by the Colón Free Trade Zone, which is regarded as the most significant

free trade zone in the Americas 2017 saw \$9.2 billion in imports and \$10.4 billion in re-exports. Other significant special economic zones include City of Knowledge, which encourages knowledge-based industries, Panama Pacific, which concentrates on transportation, international logistics services, specialized manufacturing, and high-tech (Dutch Kingdom in Panama, 2018).

All logistical processes must be better connected in order for value-added logistics to flourish further in Panama. The building of a cargo terminal and an adjacent zone with value-added businesses is part of Tocumen International Airport's goal to create a multimodal zone, which intends to connect all significant actors, ports, free trade zones, and airports. Panama also intends to establish an agricultural products-focused logistics zone (Dutch Kingdom in Panama, 2018).

### **Integration of Interoceanic Zone**

The country used to only care if the canal functioned efficiently. The next step is to achieve interagency cooperation where all systems, services, and procedures are linked. A successful integration of the interoceanic zone, the nation's logistical and economic hub, would reduce time, wasteful information, and consequently expenses. The proximity of all the hubs, some of which serve as regional or global nodes, highlights Panama's potential as a logistical hub (Dutch Kingdom in Panama, 2018).

The Canal Authority has started to rebuild Borrinquen Road, which links the Centenario Bridge and the Americas Bridge on the west side of the Canal, in order to increase the area's accessibility. Operators will save a lot of time because the route can exclusively be used for goods transportation. Through the implementation of the Metropolitan Plan 2035, the Ministry of Territorial Administration will also enhance the region's connectivity and coordinate urban development. By 2035, \$20 billion will have been invested in the interoceanic zone for this proposal. 24% of this goes toward finishing the metro system that is being built in Panama. The management of residual waters (14%), and the road network (23%) are two additional significant expenses (Dutch Kingdom in Panama, 2018).

### **Connectivity and Bidirectional Hub**

Currently, the majority of cargo passing through the Panama Canal is headed from the eastern United States to East Asia. The traffic in the canal becomes unbalanced as a result. Traffic

diversification is regarded as a key objective for enhancing Panama's hub status. Strengthening should focus especially on the routes from north to south, south to north, and from East Asia to the east side of the Americas. To make up for its small market, Panama must also grow its hinterland. Infrastructure, trade agreements, and marketing can all help with this. The first and second expansion circles for Panama's hinterland would cover Central America, the Caribbean, and the northernmost portion of South America, respectively. Panama would rise to the top of the area for transshipment in this fashion. The government should also concentrate on the aforementioned lack of national connectivity because it is crucial for the link with the rest of Central America, or for the growth of the first circle (Dutch Kingdom in Panama, 2018).

Figure 11 (Panama's Interoceanic Zone)



Source: Dutch Kingdom in Panama

Figure 1 one shows how the country is connected from the Atlantic to the Pacific or vice versa. There you can see the main roads, the Panama City-Colon highway, the train, the Panama Canal, Airports, Ports, Ports in construction, oil ports, and logistical zones. The development of the Corozal Transshipment port would make a considerable impact on the integration of all of these routes and would help the connectivity and competitiveness of the country as a logistic hub.

## Chapter 5: Conclusion, and Recommendations

Panama has always been in a privileged geographic location, and the Panama Canal is the center of that location. Since its expansion in 2016, larger ships can pass through the canal, especially containerized cargo. This has made the country one of the most important locations for

cargo handling, which at the same time has strengthened the competitiveness of ports on the Atlantic and Pacific exits of the Canal. However, the current trend toward larger container ships and the increase in cargo transported in containers is challenging the nation's port system to meet global demand. The construction of a new container terminal at the Pacific exit of the canal would increase Panama's chances of becoming the hub of the Americas, and the Corozal transshipment port could help to achieve this goal.

Let us take as an example that PPC-Balboa was the only container terminal and then PSA was built. The total number of container ships that used the services of the seaport at the Pacific outlet increased. While it is true that the individual numbers for PPC-Balboa declined, the entry of PSA benefited the entire economy of the country by bringing a total investment of \$450 million, forming alliances with the Panama International Maritime College to improve local education in the maritime and logistics sectors, and creating jobs for more than 800 Panamanians, to name a few ([www.martesfinanciero.com](http://www.martesfinanciero.com), 2019).

In addition to investing millions of dollars, container terminals have paid a significant amount in concept of TEUs fees to the Panamanian state during their concessions. For example, PPC Balboa & Cristobal paid \$584 million, MIT about \$185 million, CCT \$85 million, and PSA contributed about \$20.5 million in its short time ([economia.pa@epasa.com](mailto:economia.pa@epasa.com) | @PanamaAmerica, 2021).

Because 90% of the cargo handled by the ports in Panama is transit cargo. All these foreign earnings contribute to the country's economy in the following ways: purchases from local suppliers, payroll payments to the Social Security Fund (CSS), payment of the tax per container, payment of the tax on employees' salaries, all port systems pay to the State and Panama Ports is the one that contributes the most to the economy. During the pandemic, this industry grew 10%. Up to August of this year, cargo transit grew by 9.5%. Last year, transshipment grew by more than 8% in the pandemic. All ports in the region have fallen in cargo because they are domestic ports, only for export or import (“PSA Panamá Fortalece El Sector Portuario Nacional | Revista Martes Financiero”).

Considering the other container terminals analyzed, the magnitude of a project such as the Corozal transshipment port could have a positive impact on the investments made, payments to the State, direct and indirect impacts, and added value of port operations. The port operators of the other terminals have proven that they can manage their facilities efficiently, improving their

operations while increasing their revenues. The Panama Canal Authority has also demonstrated its expertise in managing the country's most important source of revenue. So, if the new terminal is built, it would be in good hands if it is concessioned or managed by the Canal Authority.

Considering the dimensions of the Corozal transshipment port and using the data collected from PPC-Balboa and PSA as a reference. If everything is settled, the new terminal would increase the total capacity of the Pacific side to about 8.2 million TEUs, which is equal to the capacity of the Atlantic side. This gives a total capacity of about 16 million TEU for the whole country. This means that the country will become more competitive through well-developed port infrastructures, which are crucial for world trade, and will strengthen its position as a transshipment point for container ships. Moreover, the development of this terminal would be in line with the country's Strategy 2030, which aims to become the hub for the Americas.

The Corozal Transshipment port on average could handle the following TEU movements once it is operating at its full capacity.

*Possible Average TEU movements*

<b>Panama Ports Company (Balboa)</b>	<b>PSA (Panama International Terminal)</b>	<b>Corozal Transshipment Port</b>
1,924,182 (TEU)	974,654 (TEU)	1,449,418 (TEU)
1,956,743 (TEU)	1,204,915 (TEU)	1,580,829 (TEU)
2,335,923 (TEU)	1,225,509 (TEU)	1,780,716 (TEU)

*Source: Panama Maritime Authority & author creation*

Based on the dimensions of the project, and in comparison, with the neighboring container terminals, the transshipment port could handle, on average, the TEU capacity mentioned above. Based on these figures, Panama could regain and expand its share of the port operations from the Pacific coast. In addition to this, it would make it the nation in the region with the highest level of connectivity.

Finally, Panama has effectively exploited its geographic location. The Corozal transshipment port could be considered another mega-development that raises the country's international profile by creating jobs, promoting training in the maritime and logistics sectors,

supporting local and foreign investment, and last but not least, making the country a very strong player in global trade. Most importantly, the country still has the opportunity to further develop its port infrastructure and logistics activities.

### **5.1 Recommendations**

Analyzing the impact of the Panama Canal expansion on the transit of container ships through Panamanian ports, we find that the impact has been positive, with all container terminals increasing their TEU throughput. Moreover, given the market trend towards the development of larger container ships, Panama is in the best position to further develop its port infrastructure on the Pacific coast of the Canal. In light of these findings, the country should move forward with the following recommendations

- Resume construction plans and prove to the National Assembly that building the new port is important and necessary.
- Form a negotiating committee to set the terms for concession or management of the port by the Panama Canal Authority.
- Promote the construction of the new port to attract local and foreign investment.
- Conduct studies of global demand for container handling and other port services
- Continue to develop new strategies and ideas to achieve the goal of becoming the hub of the Americas.



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