

UNIVERSITY OF KWAZULU NATAL

**The Impact of Insufficient Port Investment on Congestion in the
Port of Durban**

By

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**A Dissertation Submitted in Partial Fulfillment of the
Requirements for the degree of Master of Commerce**

College of Law and Management Studies

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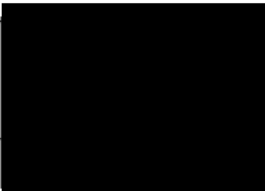
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Siphesihle Mhlongo

ACRONYMS

CAPEX	Capital Expenditure
DCT	Durban Container Terminal
DPE	Department of Public Enterprises
GCH	Gross Crane Moves per hour
ICT	Information and Communication Technology
MDS	Market Demand Strategy
MOPS	Marine Operator Productivity Standards
OPEX	Operational Expenditure
PRSA	Ports Regulator of South Africa (Ports Regulator)
ROD	Record of Decision
SA	South Africa
SAAFF	South African Association of Freight Forwarders
SADC	Southern African Development Community
SAPS	South African Police Service
SOE	State Owned Enterprise
TEUs	Twenty- Foot Equivalent Unit
The Act	The National Ports Act no 12 of 2005
TNPA	Transnet National Port Authority
TOPS	Terminal Operator Productivity Standards
TPT	Transnet Port Terminals
UNCTAD	United Nations Conference on Trade and Development

ABSTRACT

Port research is continuously evolving. One of the most relevant topics related to the performance of ports is port congestion. With Durban being the trade hub for ports in Southern Africa, the congestion experienced at the Durban Port poses a serious challenge to the effective integration of international trade with sub-Saharan economies. One of the problems evident from underinvestment made to the port, is congestion. Problems that stem from congestion consist of prolonged berth occupancy and utilization, as well as long ship turnaround time and anchorage waiting time. This study attempts to analyze port congestion in relation to investment activities. The Market Demand Strategy (MDS) will aid in identifying the investments made to the port of Durban. The MDS shows the amount of investment required in South African Ports, and it was expected to aid in expanding rail, ports, and pipeline infrastructure ahead of demand. This study further shows that, of all the amounts earmarked for investment in ports, a considerably lower actual CAPEX was invested, which causes the problem of port congestion to remain largely unresolved. Using data obtained from the Ports Regulator of South Africa and Transnet, the study employed content analysis and documentary analysis. A qualitative research approach, underpinned by two research tools, being document and content analysis to collect the secondary data, the study analysed investment expenditure from 2012/2013-2019/2020 in relation to port congestion. Literature has also revealed that there is a decrease in the actual investment made into the ports in South Africa which is cause for concern for port users. The study offers insight into port congestion, its causes, its impact and what can be done to combat it. The study makes recommendations on the rollout of investment for the betterment of the Port of Durban, whether it should be expanded, whether better systems should be put in place or can even establish whether current investment allocation is optimal.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

With transport by air on the rise, carriage of goods by sea remains most dominant way of transportation in international trade, with more than 90% of goods transported by seagoing vessels (International Chamber of Shipping, 2020). It is essential to focus on investment in the ports to ensure smooth and streamlined operations. With congestion being one of the measures of port performance, port authorities can identify areas where investment can be made to improve the port operations.

The Port of Durban is a multipurpose port with the largest container terminal in the country. According to the Ports Regulator of South Africa (2015), the Port of Durban has shown low container-handling productivity. The port is also known to be one of the most expensive ports. This illustrates a fundamental challenge faced by the Transnet Port Terminals in its ability to implement the Terminal Operator Productivity Standards (TOPS) to meet international performance norms. According to the Ports Regulator of South Africa (2015), the logistics costs, such as trucking and warehouse rent, at the Durban port are still higher on average than the logistics costs in other equally ranking middle-income countries.

With ports being key nodes in the international supply chain, there are various reasons as to why capacity does not always match the demand for ports. The bottlenecks such as long ship dwell times and the queuing, which is experienced at the port, cause port congestion. This leads to unfortunate consequences in the logistics and supply chain, (Onyemechi, 2018). The consequences include the disruptions of supply forecasting within companies. This affects companies when they must meet the demand made by clients, or when they run out of stock or when trying to meet production deadlines. The kinds of congestion prevalent in the port in Durban are, congestion associated with ship berth and ship work. This type of congestion is usually triggered by delays stemming from the time lapses in the work procedures, such as the loading and/or unloading the ship, vehicle gate congestion, vehicle work congestion, cargo stack congestion and ship entry route congestion (Onyemechi, 2018).

The efficiency of the port is determined by the ship turnaround time, the waiting/anchorage time, the number of vessels calling that port and the ship size the port can accommodate. The performance of the ports is determined by the infrastructure of the port, the depth of the quays, the berth length and how many berths are available, as well as how the port is governed. In

giving careful attention to the above determinants, the ports can be better developed and maintained to ensure optimum efficiency through the port performance, and this will help alleviate the congestion experienced. There are different causes of congestion in a port, such as bad weather that stops landside operations, accidents that could suddenly damage port infrastructure, labour protests, sudden peak in trade demand and landside transport congestion. The Port of Durban has an average four-day waiting period for import and export cargo which is close to the best practise of Europe and East Asia (Gidado, 2015). This is because the shipping lines impose high storage costs for containers that are not collected in time. The most common delays experienced in the port of Durban is the landside transport congestion where we find traffic caused by trucks waiting to collect cargo from the port. This traffic often results in the drivers sitting for days waiting in lines. Another notable delay at the port of Durban is the cargo piling up not being collected due to truck staff being on strike for equal employment opportunities. Another cause still evident in the ports in South Africa is the bad weather that halts operations due to wind speed being too high.

This dissertation will look at different types of port congestion and other port performance challenges experienced in the Port of Durban, how they have been dealt with and what infrastructure challenges contribute to the persisting congestion problems. The persisting port challenges will be looked at over time with respect to investment made in the ports since 2012 until 2019. This period was selected as this was when the Market Demand Strategy was to be implemented. This research study will also look at the different investment strategies that are employed by the Port of Durban to ensure smooth operations within it. It will also assess whether investment has been fully utilised in the appropriate manner within the port and will also evaluate whether the performance challenges experienced are caused by improper investment made within the port.

1.2 Background of the Study

Ports are recognised as important nodes in the international supply chain. But for various reasons the capacity of the port may not accommodate demand. This may lead to congestion like queues building up or can be hidden as it may come in terms of cost such as congestion costs, terminal storage and standing time of transporters. Most congestion occurs at the

terminals, hinterland connection points and hinterland transport. In looking towards the future, with an increase in world trade, port congestion will be a topic of main concern.

Congestion has detrimental effects to the cost and transportation also imposing negatively on performance. Regarding a company specialising in shipping operations, congestion leads to time lost, which results in cost being greater. Congestion also poses a problem for other port actors in such a way that if the vessels that arrive at the port delayed because of congestion, it may be difficult to fit into them into the loading and unloading schedule of the terminal operator. This has big consequences for capacity management and will result in there being higher costs yet again. This also applies for the other port stakeholders as well including storage and hinterland transportation. This can have a ripple effect along the maritime transport chain and can also in turn affect the supply chain planning and operations for companies utilising the transported cargo. Therefore, is important to acquire adequate knowledge of how port congestion arises, the costs associated with it and how it can be avoided or eliminated most effectively (Meersman, 2012).

1.3 Research Problem

Port performance is an important factor that encourages competitiveness among different ports. Ports should be responding to the pressures to upgrade as it is important that operations run smoothly with little or no disruptions. If there are disruptions that reduce efficiency of the port, that poses a problem for port users. There is a concern with the level of investments made to the Port of Durban. This results in a lack of proper care and maintenance to port equipment and infrastructure. If the port of Durban lacks proper investment in port infrastructure, the port will fail to accommodate more vessels and offer optimum productivity. This will lead to congestion as it cannot accommodate larger vessels calling the port as productivity is sub-par. Congestion experienced in ports causes delays that impact the supply chain flow within the companies and increase costs associated with cargo handling. Although businesses may make provision for different delays in their production forecasts, extended disruptions may cause harm to the economy.

1.4 Research Objective

The main research objective for this study is to establish the extent to which insufficient investments can lead to congestion.

1.4.1 Sub Research Objectives

The following are research sub-objectives of this study.

- Assess the extent and nature of investment made since 2012 into the port of Durban
- Examine the efficiency of the port of Durban
- Examine the congestion in the port of Durban and the rollout of investment

1.5 Research Question

This study aims to answer the core research question: “How does insufficient port investments affect the performance of the port and ultimately lead to congestion?”

1.5.1 Sub Research Questions

The below questions are sub research questions to be addressed by this study.

- How much investment goes into the landside infrastructure and how has it been rolled out?
- How efficient is the port of Durban?
- What links does investment have to congestion in Durban?

1.6 Significance of the Study

The significance of this study is the distinction between the level of investment made to the Port of Durban, how that potentially leads to underinvestment in the port equipment and infrastructure and how that in turn leads to the problem of congestion. This study will also offer insight into other causes of port congestion, other factors that, their impact and what can be done to combat them. It will then illuminate influences on port investment by the government and Transnet as a state-owned enterprise. In applying the qualitative and quantitative methods, the research study will help the reader to understand the explanations given as to why investment is allocated as it is at present, and how it should be allocated to ensure efficiency at the port for optimum utilisation. This information can also be beneficial to port users and stakeholders, whose trade is mainly at the port of Durban. The study will finally make recommendations on the rollout of investment for the improvement of the Port of Durban, whether it should be expanded, whether better systems should be put in place or even can establish whether current investment allocation is optimal.

1.7 Structure of Dissertation

The thesis will be broken down in the following manner:

Chapter 1: Introduction

This section will deal with the introductory information to the thesis. These will include the background, scope and context, literature review, assumptions, and limitations.

Chapter 2: Literature Review

This section will utilise a desk-based method of data collection. Literature gathered and used consists of literature on port congestion, how the Port of Durban compares to other sub-Saharan ports and how investment plays a pivotal role in efficient operations.

Chapter 3: Research Methodology

This section will explain the research methodology that will be used in this study.

Chapter 4: Data Analysis, Synthesis and Results

This section will deal with the comparative analysis.

Chapter 5: Findings and Recommendations

This chapter will explain the findings that have been brought about the research study. It will shed some light on the hypothesis made and the actual outcome of the study. Recommendations will be made on how to deal with the possible future and the predicted result for policy makers in labour primarily but possibly in maritime law as well.

Chapter 6: Conclusion

An overall conclusive statement will be made and gaps for possible future research in related to this topic made.

1.8 Conclusion

This chapter introduced the topic the researcher is pursuing to study. It gave the background of this research study, and it highlighted the problem being experienced in the field. The researcher identified the objective needed to be fulfilled by the entire study and the research questions formulated will guide the researcher on the data to collect. It also gave the structure to be followed by the dissertation. Chapter 2 will present on existing literature found on the study in topic.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Delays experienced at the ports are a great inconvenience on import-export activity. Any setback can have huge financial delays on the operations, especially in a competitive market. It would not be surprising that importers and exporters have little tolerance for poor performance. Congestion is unusually prolonged at the port of Durban. This poses a serious challenge to the effective integration of international trade with sub-Saharan economies (Steyn, 2013). Internationally, countries have continuously invested in the port infrastructure to increase capacity and enhance operational efficiency within the port.

The Durban Port was infamous for its inefficiencies in the late 1990s. This was due to the high congestion that was associated with long berthing delays for the container vessels, the long train turnaround as well as the queues for the trucks. The National Bureau of Economic Research (2012) has determined that the reduction of trade is due to the longer transport times. The Bureau also estimates that the time the goods are in transit, amounts to the value of the carriage being transported (Onyemechi, 2018). Long transit delays also greatly lower the chances that a country will successfully export its goods. It is suggested by The World Bank (2012), that certain players of the ports benefit from the long cargo dwell times. This then means that addressing the problem of the cause, will not be likely to generate a solution. Some stakeholders of the port such as the importers, store their goods at the port, as the port is cost effective, (Onyemechi, 2018).

This literature will review some issues surrounding the port of Durban. The literature will show how the investment made, or lack thereof can lead to inadequacies, as the equipment is not well maintained, or there are no infrastructural developments taking place at the port. The literature of underinvestment is then explored in this chapter as to how that can potentially lead to the congestion experienced at the Port of Durban. This chapter also looks at how congestion can be alleviated and the benefits thereof.

2.2 Port of Durban

The definition that a port serves as a gateway for goods is a fair but is limited description of what a port really is. The movement of ships and cargo through a port consists of interconnected processes. These include services to cargo such as warehousing, refrigeration, general logistics, value-added logistics and security. In addition to these services, the port also offers services to the ship such as vessel traffic, bunkers and stores, surveillance, firefighting, leasing equipment and services to the crew. These procedures have changed, over time, due to technology. The port management practices have changed, competition between ports and the role that ports play as links in global supply chains has laid stress on port efficiency first and pricing secondly. The ports' capital intensity has risen along with the rising capital intensity of the world shipping fleet. The Port of Durban and the logistics system is a significant employer. The Port of Durban is the largest port in Africa in terms of value of cargo handled as well as the number of vessels handled. It has the largest container terminal in the southern hemisphere. The employment in this sector has been growing within eThekweni district. Maharaj states the importance of the efficiency, capacity of the port is of vital importance in the logistics system, therefore the Port of Durban is incorporated within the global supply chains, and it is South Africa's most important link in its global supply chain. (Maharaj, 2014). Also, as Babounia and Imran (2018:54) state, "Port efficiency is not only an important contributor to international competitiveness but plays a crucial role in the economy and development by providing international trade links".

Kgare *et al* (2011) notes that the port of Durban is in an important location as it is on the import route for cargo moving to Zambia, Zimbabwe, Malawi. This route continues to connect for other inland countries. Therefore, it is important that the port performs efficiently as countries along the corridor depend on it.

An observation has been made, however, that most of the goods making passage through the port is for the domestic market. Transit cargo accounts for a small percentage of the total cargo traffic. Also, most of the containers that are destined for Johannesburg arrive at Durban then only are they transported by rail or road. While road transport dominates, rail transport plays a big role in transporting large cargo. However, the turnaround time for rail is high. For cargo coming through Durban and is manifested to Johannesburg, there are usually bottlenecks experienced as cargo waits to get railed. This results in cargo taking longer to get to Johannesburg. Most importers prefer to have the cargo transported by road once it has arrived in Durban. It proves to be time efficient and cost effective for others. Venter (2020) states that rail has lost its market share in both the South African economy and in the Port of Durban. However, Venter (2020) later explains that trains will be gradually reintroduced in the system. This will see one train taking 50 to 70 trucks off the road.

Despite the dominant position the Port of Durban has in Africa, its performance ranks far below the main ports in the world (Ports Sector Review, 2021). This is due to the port's inefficiency to congestion, the minimal use of rail infrastructure, above average anchoring times, congestion experienced at the port entrances and the terminal inefficiencies which increase the waiting time.

Figure 2.1 shows a summary of the number of berths for the different cargo types for the Port of Durban. The length and draft of the berth shows the vessel size that berth can accommodate and helps in knowing which type of vessel can call the Port of Durban. The researcher uses this information to determine if port has the capacity to accommodate such vessels.

Figure 2.1 Port of Durban Infrastructure

Cargo Type	No. of Berths	Total Berth Length	Berth Draft
Containers	9	2 108m	8,2m - 12,3m
Dry Bulk	9	1 610m	8,6m - 10,8m
Break Bulk	18	3 248m	5,1m - 13,7m
Liquid Bulk	9	1 965m	8,7m - 12,5m
Ro-Ro	5	1 381m	10,1m - 10,6m

Source: Ports Sector Review, 2021.

The container terminal is equipped with 9 berths and can accommodate vessels up to 4 500 DWT TEUs. The terminal has an installed capacity of 2.9 million TEUs and reached its maximum capacity due to the volumes of container cargo being handled, a total of 2.8 million TEUs in 2019/20. The berths vary in depth ranging from 8.2m – 12.3m and record a throughput of 1 274 TEUs per metre of berth. The Port of Durban received an average of 3 515 vessel calls per annum over the 5-year review period. However, the port has experienced an 18% decline in the number of vessels calls over the 5-year period (Ports Sector Review, 2021). This may be due to changes in vessel sizes, as well as overall decreasing volumes. The inefficiencies at the Port of Durban are possibly a large contributing factor to this trend.

2.3 Port Governance and Role Players

Transnet’s maritime divisions: the Transnet National Port Authority (TNPA) and Transnet Port Terminals (TPT), aim to grow the economy and develop the ports of South Africa. The ports in South Africa are under the management of the (TNPA). The TNPA was established through the National Ports Act, no. 12 of 2005 (the Ports Act) to be a landlord port responsible for the safe, efficient, effective, and economic functioning of the national ports system which it manages, controls, and administers on behalf of the State. The (TNPA) develops port rules for South African Sea Ports. It is also responsible for controlling and managing ports. The responsibility of the TNPA is to help reduce the cost of conducting business in South Africa. This is said to be done by reducing logistics costs and to contribute to economic development (TNPA, 2019).

The pricing utilised by the port authority, together with the way the port is governed, defines South Africa's port doctrine. South Africa's port governance promotes the ports in the country as a system and does not promote competition between ports. The current governance structure does not challenge the uniform system of port pricing, a single tariff to all eight commercial ports. Port authority pricing deals with the tariff methodology, tariff structure and the resulting prices. The port governance addresses the legal status of the ports company, being the landlord and the port terminal operator (Meyiwa & Chasomeris, 2016). The port doctrine is however not clearly defined for South African Ports. Certain elements resemble the Anglo- Saxon port Doctrine, the others resemble the Continental doctrine while others resemble the Asian port doctrine (Meyiwa & Chasomeris, 2016). This means that South Africa encounters conflicting port objectives. The Asian doctrine is however more aligned with South Africa's developmental objectives. The Asian Doctrine is concerned with the central government being involved as the port designer, developer, operator, port pricing maker, mediator, and investor (Lee & Flynn,2011). The feature of this doctrine is that there is a strong national state investment in heavy port infrastructure. The adoption of this doctrine, however, may prove to be burdensome considering the current and foreseeable future economic conditions.

According to Transnet (2014), of the eight commercial ports in South Africa, the Port of Durban is the busiest in Africa. This is not unique to the Port of Durban. All commercial ports in the country have challenges with the current tariff methodology and pricing strategy. The historical governance of the South African Ports has led to the inefficiencies and imbalances that are being experienced in the port pricing and port operations. The ports in South Africa had an ongoing challenge of a lack of cost-based pricing principles; not having a justifiable pricing methodology; congestion, low productivity, and inefficiency; inconsistent and unreasonable pricing of products; and poor service delivery (Gumede, 2013).

2.4. Factors that Cause Congestion in African Ports

There are different influences that cause congestion in ports. The type of contributing causes differs from port to port. With this said, the extent of the implications also varies from port to port. (Meersman, 2012). The distinctive causes of congestion in African ports include bad weather that stops ships or cargo operations; accidents that could suddenly damage port equipment or ship entry route – industrial action entails work stoppage at the port, labour strike or limitation of stevedoring services. Other causative factors are a peak in trade demand or an increase in international trade. Another causative factor is the landside transport congestion

that can slow down the clearing and delivery of cargo out of the port. This thereby blocks the discharge of more cargo as storage capacity is exhausted or overstretched (Onyemechi, 2018). More congestion is apparent at the port entry or where a terminal is accessed, congestion of port equipment or services, congestion caused by cumbersome registration, licensing, or documentation processes such as customs clearance processes and examinations (Onyemechi, 2018).

2.4.1 Studies on Port Congestion in South Africa

The Port of Durban has a four-day average waiting period for import and export cargo. This is considerably closer to the best practise, which is known to be in East Asia and Europe, which has a three to four day waiting period (Gidado, 2015). A study done by the World Bank (2011) in the Durban port shows that for ports located in the Sub-Saharan Africa, the customs and port authorities have a responsibility to put pressure on the private sector stakeholders. This was done so that there can be compliance of the port regulation and to reduce cargo dwell time. The charges, as well as the strict enforcements put in place to combat storage, are important tools to utilise in reducing the cargo dwell time (Onyemechi, 2018).

In focusing on creating capacity and equipment, Transnet invested more than \$700 million in ports over a five-year period (Onyemechi, 2018). The main stakeholders acknowledge that the introduction of the storage charge after the third day is the most important factor affecting dwell time at the Durban Port. This ultimately means that after 72 hours at the port, containers incur heavy storage charges. This results in the Durban Port having storage charges almost six times as high as other ports in the country (Onyemechi, 2018). However, investment in infrastructure has aided the process. At the time when Durban adopted its port liberalisation policy, South Africa's trade infrastructure was ageing and had been neglected for decades, resulting in ports' poor performance.

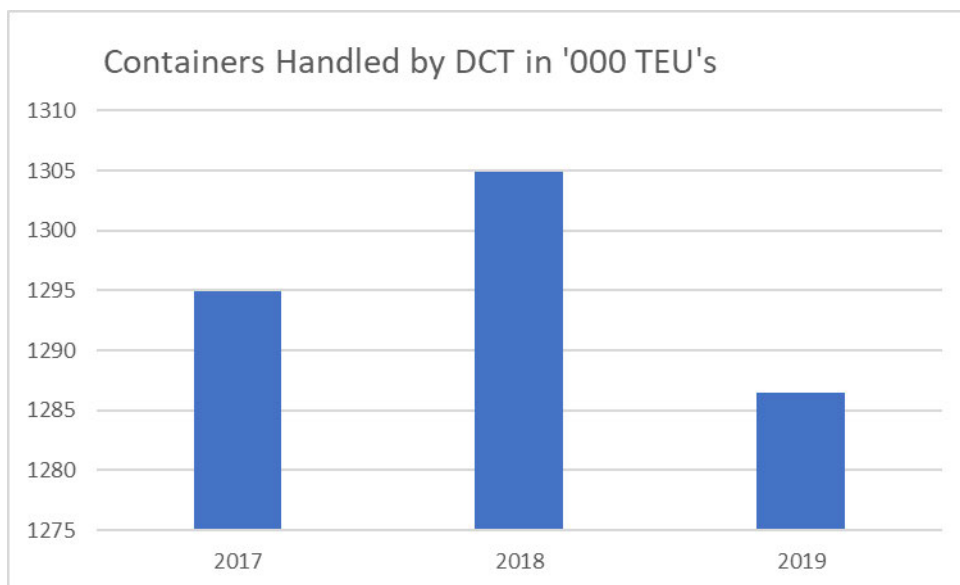
2.4.2 Congestion in the Port of Durban

Congestion is an ongoing phenomenon that hinders port performance. "Congestion in ports is a phenomenon associated with delays, queuing and extra time of voyage and dwell ships and cargo at the port, always occur with unpleasant consequences on Logistics and Supply Chain" (Gidado,2015:160). Different ports feature different types of congestion. The congestion can be visible where there are queues building up or can be hidden where it features congestion costs and implications. The congestion can be visible where there is standing time of trucks waiting in the queues to collect the containers. This increases the cargo dwell time. The African

Development Banks defines dwell time as; “the time cargo remains in a terminal’s in transit storage areas while awaiting shipment for export or onward transportation by road or rail to the hinterland as import” (Gidado, 2015: 160). Cargo dwell time is also a measure of the port’s efficiency. Hence if the cargo dwell time is higher, the inefficiency of the port is high. The longer the dwell time, the more there will be other inefficiencies that relate to the port congestion. This has a negative outcome on economic growth (Gidado, 2015).

In an article written for South Africa’s freight news, Captain Ian Rosario (2020) states that the Port of Durban has recently been hit by significant congestion. This congestion is being experienced on waterside operations as the vessels wait for an average of 5 days before berthing. The congestion is also experienced on the landside operations with the trucks queuing for kilometres with long turnaround time. In looking at the below figure, it illustrates the number of containers handled by the DCT in the years 2017, 2018 and 2019 to monitor the volume growth that has occurred in the port.

Figure 2.2 – Containers handled by DCT in 2017, 2018, 2019.



Source: Transnet Port Terminals, 2019.

The above graph illustrates the volume growth and operational performance of the Durban container terminals. In 2017 the DCT moved 1 294 949 units of containers, 2018 it moved 1 304 891 units of containers, and in 2019 it moved 1 286 491 units of containers. This is an average of 1.3 million units per annum.

One can say that the operations at DCT never comes to a halt as the number of working days are 360 out of the 365 days in the year, closing on only the most important public holidays. On the waterside operations, the number of operational days can be deduced to 300 annually. This is due to operations having to be halted due to adverse weather conditions. The reason for this stop in operations is due to Ship to Shore (STS) gantries being cut off at wind speeds greater than 70 km/hour (Rosario, 2020). On the landside operations, however, the working days are anticipated to be more than 300 days per annum as the DCT ensures that the port remain operational as the straddles are not affected by bad weather conditions. This means that the offloading and loading of the trucks continue regardless.

For the waterside operations, to move the required 1.3 million units in the number of days given to do the work, there should be a move count of approximately 4300 units per day. For the landside operations, to service the trucks that carry the import and export containers, the Durban container terminal has 3 towers. These towers are provided to approximately 25 bays. To perform to reach optimum performance, each tower would need to have 9 straddles. Each of these straddles are expected to perform 9 moves per hour making the capacity 5800 units in one day per straddle under ideal conditions. If these conditions are satisfied, there would be no congestion on the road. However, that is not the case. The equipment has not been given much attention and has been left to deteriorate (Rosario, 2020).

What can aid this problem to achieve optimal performance in the port and alleviate congestion, is to develop and have the 9 straddles per tower that is needed. But this situation has not received the attention it requires, and the equipment has been left to deteriorate. To remedy this situation, immediate procurement of equipment focusing more on the straddles is needed to add to or replace the existing or aging fleet. There should also be 24-hour service and maintenance team available.

Venter, (2020: 1) states that; “New equipment, improved access to roads, synchronised, longer operating hours and a truck booking system are all in the works for the heavily congested Port of Durban”. Trucks have been found to be queuing for long periods of time waiting to gain access into the ports. An incident that recently occurred was the congestion and heavy traffic caused by trucks at Bayhead Road waiting to gain access to the port. This traffic stretched for kilometres outside Bayhead Road and affected ongoing traffic. The queuing affected the access to Umbilo, Bluff and surrounding areas meaning other stakeholder who had nothing to do with the port were affected.

Transnet has initiated a project to help alleviate the congestion experienced at ports due to trucks awaiting access to the ports. The participants of this project are: “representatives from Transnet, the Department of Public Enterprises, the Durban Metro, the KwaZulu Natal provincial government, South African Police Service (SAPS), organised businesses through the Durban Chamber of Commerce and Industry, the South African Association of Ship Operators and Agents, the South African Association of Freight Forwarders (SAAFF), as well as representatives from the shipping lines, the trucking industry, depot operators and other industry associations and bodies” Venter, (2020: 3). In having so many participants to this project, Transnet aims to integrate to decongest. This situation will not be alleviated by a single party but by the efforts of the named parties combined, working together to achieve a common goal.

2.4.3 Costs Associated with Congestion

The costs can include storage costs where a container has exceeded its free time for collection at the port or demurrage costs where a container has been returned outside of the free time given to return the container. As there is an increase in World Trade, the risk of port congestion will be more prevalent. Out of the costs that make up congestion costs, time loss, additional fuel amongst other factors, time loss is the most significant contributing factor. An additional transport user imposes a time loss on others. A port generally has several internal bottlenecks such as pilot services, towing services, loading, and unloading quays. Each of these factors can result in a que at port (Meersman, 2012). Seaport activity is complex. This is because it involves ships of various sizes. The activity required for assistance of the ship and the handling needs differ (Meersman, 2012). Bad weather has also proven to be one of the main causes of congestion. When there are heavy winds or heavy rains, landside operations come to a halt as it is dangerous to operate in such conditions.

Congestion leads to time lost which results in higher generalised costs (Meersman, 2012). Congestion in the port can be problematic for essentially most port actors as congestion has a ripple effect on port operations. When vessels that arrive at the berth are delayed because of congestion, it may be difficult to fit them into the loading and unloading schedule of the terminal operator (Meersman, 2012). This then has a negative effect for the capacity management of the port and results in higher operating costs. This too, occurs for users within the port including storage facilities and hinterland transportation. Most importantly however, congestion can have a ripple effect that can be felt in the maritime transport industry which can in turn influences the supply chain network of companies at large. This occurs when deliveries

do not happen in time, ultimately affecting production schedules and leading to companies not meeting their supply forecasts.

The answer to the problem of port congestion would seem as straightforward as having the port authorities increase the port dues and subsequently benefit from the scarcity of capacity. The benefits of congestion charge would be that they generate higher income. They can also be a way to source the funding for the expansion of port infrastructure (Meersman, 2012). This can encourage the efficient utilisation of the port facilities. However, the downside to this suggestion is the administrative complexity of imposing such a charge. As congestion does not happen all the time but may fluctuate, the congestion charge may be imposed to third parties, which will make it more expensive to utilise the port services hence the demand may drop.

When there can be some port users who look to reduce cargo dwell time and congestion essentially, not all users have the same goal. This is because some importers prefer to store their cargo at the port storage facilities and not warehouses as it may be the cheapest option (Gidado, 2015). Gidado (2015) further explains that customs brokers also have little incentive to move the goods in the quickest time possible because they can pass the storage costs of the delay onto the importer who will in turn pass the costs onto the consumer.

2.4.4 Types of Congestion

The main type of congestion experienced in African ports is the ship berth congestion. This is when many ships are held up waiting to enter the ports as the other ships are occupying the berths available. The other type of congestion experienced is the ship work congestion. This type is usually triggered by the delays that are caused during the loading and unloading of the ship. This can result in the period of which the ship has to remain in port to accomplish the cargo operation task, to be extended, (Onyemechi, 2018). Poor programming of the landside access to the port via the truck routes scheduled to arrive at the port gate, leads to vehicle gate congestion. The vehicle work congestion results from the time taken when loading or unloading the vehicle and trucks. This can be due to lack of efficient mandatory equipment. Lastly, the cargo stack congestion originates from continuous stay of cargo at the storage area beyond reasonable hours/days or above the maximum capacity of the cargo stacking area (Onyemechi, 2018). The most common congestion in African ports are; ship berth congestion, vehicle gate congestion, ship work congestion, vehicle work congestion, cargo stack congestion and ship entry/exit route congestion (Gidado, 2015). Gidado further explains the congestion types as below:

1. Ship berth congestion – this is caused by ships waiting to enter the port because of other ships that occupy the available berths.
2. Ship work congestion – mainly caused by delays that are due to lapses in the loading and unloading the ship. This could result in stoppages that can extend the time it takes for the ship to remain in the port.
3. Vehicle Gate congestion - this is a result of poor programming of inland access to the port via trucks scheduled arrivals. If there are defaults with the programming or if the system is not updated timeously, it can cause the trucks to start queuing resulting in port gate congestion.
4. Vehicle work congestion – this is due to the time lapses associated with the loading and unloading of trucks at the port due to the lack of efficient equipment.
5. Cargo Stack congestion – mainly stems from cargo staying for long periods of time at the storage area. Usually this is more than the maximum capacity of the storage area or beyond the reasonable time or days allocated to store the cargo.
6. Ship entry /exit route congestion - this occurs when there is a blockage on the marine side access routes to the port facilities. This could essentially lead to queuing and ultimately the overstay of ships around the port facility.

Other kinds of congestion that are associated with African ports include the congestion of shipping routes that connects the ships to the port, congestion on the port entry to access a particular terminal, congestion of ships on port equipment and services, the congestion of trucks within the port, and congestion caused cumbersome registration, licensing and documentation process done to have the cargo cleared at customs.

2.4.5 Causes of Congestion

Congestion is multi-dimensional and can be caused by many different factors. The factors also differ depending on the port or on the marine terminal. Congestion can be caused by the following (Council, 2015):

- Labour productivity issues
- Unexpected surges in cargo volumes
- Inconsistent marine terminal productivity
- The efficiency of vessel operators' cargo stowage planning
- Inefficiency of the transportation infrastructure connecting marine terminal to rail and roadways
- Disruptions in intermodal rail networks that serves ports

- The lack of on- dock rail capacity at some marine terminals or the inability of more than one railroad access an on-dock rail facility
- Weather such as bad weather
- Shortages of various kinds of equipment (e.g., Yard cranes, chassis, railcars etc.)

2.4.6 Cargo Dwell Time in Port of Durban

Cargo dwell time is also contributed by not having proper alignment in cargo collection processes. It may also occur if there is a new system in place that does not offer maximum efficiency for transporters. This results in long ques from the transporters awaiting at the terminal gates to access cargo. Many have been frustrated which has often led to strikes. In most cases concessions have been reached between the Port Authority and terminal to have cargo be off loaded at the depot before making its way to the terminal. This is a way to ease the congestion being experienced at the terminal. Cargo dwell time differs from port to port. In the port of Durban, cargo must be collected within a 28-day period before the cargo gets moved to the states warehouse (Kgare, 2011). The TNPA, with the agreement by the shippers and shipping lines, has however made a benchmark for the “normal” dwell time to be 3-4 days. If cargo is uncleared during this time the shipping lines pass overstay on the containers. This means that the containers are moved to a nominated depot for storage until the importer can collect the container. Usually, containers go into overstay because they were not customs cleared timeously or the transporter did not make it to the port in time. Costs are incurred for the importer. Depending on where the delay was, that party is liable to pay for the charges associated with the moving the container to the storage facility as well the storage costs.

The dwell time for transshipments is approximately 5-10 days (Kgare, 2011). Cargo is also usually transported from the terminal to bonded warehouses before the cut off time for the free storage period of 3 days offered by Transnet. Transnet has explained that to achieve their 3 days dwell time, they impose storage charges on containers not collected within 72 hours (Kgare, 2011). It is worth also noting that in other Sub-Saharan countries the free period is higher some even going up to 11 days free storage.

2.5 Ports and Investments

Investments made to the port have economic benefits that can be direct, indirect, and induced. Ports offer value to their regions as they offer economic and social benefits. Increases in trade, particularly in the containerised sector, have put pressure for developing new port infrastructure. Port's infrastructure is capital intensive. This is important because port development and world trade are closely interconnected. Port activities produce a multiplier effect within an economy. The port throughput is positively related to employment, which means the higher the throughput the higher the employment (Rodrigue, 2020). In a world of just-in-time production processes, not only is time and cost of delivery important, but also the reliability and predictability (Rosario, 2020). A company's hedging costs due to poor reliability and predictability of logistics services can be extremely high in terms of higher inventory maintenance requirements (Arvis et al.,2010).

2.5.1 The Link between Port Investment and Port Performance

From an infrastructural perspective, prior to 2001, South Africa was not prepared for the increase in trade. The industry infrastructure was aging and had been neglected for many years (Kgare, 2011). With Durban being the largest container terminal, its inefficiency became evident.

Another challenge experienced by Transnet was the neglect of the information and communications technology (ICT). The ICT transformation was one of the key fundamentals of the Transnet reengineering strategy. Among the major developments of ICT, the introduction of automated systems was a key development. This meant that the port switched from using Cosmos to using NAVIS as a terminal operating system. NAVIS is now widely used across all ports in South Africa and has been used for over 10 years now. This means that there are no longer teething problems that can cause disturbances and delays with the use of the system. NAVIS is used for transporter allocation to cargo at the port, track a container within the port and update free time. The timeous updating and usage of this system allows allocation to be ahead of time and allows for the transporters to have access to the Port. When NAVIS is not updated on time, the transporter waits in line outside the port to gain entry as soon as the system has allocated them. This can cause long ques and congestion and the entry of the port.

Transnet is convinced that pre-trip bookings will be essential for collecting and dropping off cargo (Venter, 2020). This is to ensure that transporters do not come and go as they please as this causes congestion. This booking is done on the NAVIS system.

It has been found that the quality of port infrastructure has a positive effect on logistics performance. The quality of port service, logistics costs, regional connectivity and port accessibility plays an important role in strengthening a ports competitive position (Yeo et al., 2008). The quality of the port infrastructure has a positive effect on seaborne trade also.

Competition between ports is on the rise which has encouraged port management to invest in capacity and performance improvements, particularly of superstructures and improve work practises. Overall, ports are physical marketplaces that bring together a wide range of different market players whose interests coincide and conflict.

2.5.2 Market Demand Strategy

The Market Demand Strategy (MDS) now known as Transnet 4.0, is a capital investment programme that sees more than R300bn invested into the ports in South Africa. This programme looks to expand the rail, port, and pipeline infrastructure, increase the capacity of the port to meet market demand and seeks to provide continued financial stability and strength. This programme also seeks to create a shift from road to rail assisting in the reduction of the carbon emissions. It is important to note the job creation and skills development that will also be brought about by this programme (Transnet, 2012).

Through this programme, Transnet aims to meet the validated market demand through creating new capacity and infrastructure with the Capital Investment Plan as the key enabler. The MDS seeks to close the gap between market demand for cargo transport and handling services and the capacity to satisfy demand. This way, Transnet looks to shift its focus from expansionary to sustaining objectives. The investment in sustaining infrastructure (as a percentage of the portfolio) has increased from 40% in the first year of the MDS, to 60% in the fifth year of the MDS (Transnet Integrated Report, 2017).

2.6 Conclusion

This chapter presented a review on the available literature on the concept of congestion at the port and investment made to the port. Inadequate port/terminal/road/rail infrastructure has been a significant problem. The maintenance of equipment and infrastructure is a major investment. Based on the discussions on this chapter, it can be established that well balanced hinterland connections via road and rail will help to keep the flow of operations. Also, having centralised information systems between ports and the different means of transport will be highly beneficial.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Research, as explained by Leedy and Ormond (2005), is a systematic process of collecting, analyzing, and interpreting data to increase the understanding of the phenomenon in which the researcher is interested in. Research Methodology is a theoretically organized analysis of the processes relating to the research being studied. It encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. Birks & Mills (2014), explain that research methodology is also known to determine how the researcher thinks about a study, how they make decisions about the study and how they position themselves to engage with participants then with the data collected. It is important to note that choosing a methodology is strongly linked to the desired outcome of the research study. Choy (2014: 100) stipulates that: “qualitative research applies logical system in practice and follows a non-linear investigative path. However, quantitative research applies a reconstructed logic, and follows a linear investigative path”.

This research is an investigative study that will use secondary data. Data collection methods that will be used are of those of a qualitative and quantitative nature. The secondary data will mainly be taken from Transnet, mainly the statistics published online on TOPS and MOPS. Collecting secondary data will enable the researcher to gather existing literature on the subject matter. This research study also investigates the different investment strategies employed by the port of Durban. The study explores how the funding, or lack thereof, contributes to the various types of congestion within the port. Also, the study looks at how port performance can be improved. This section therefore covers the methodology used to conduct the research. It also covers the recommended research design, and procedure pertaining the collection of data. It thereafter discusses how the information gathered was analyzed.

Data analysis will be done by use of descriptive statistics. Descriptive statistics is described as “statistics such as frequencies, the mean and the standard deviation which provides descriptive information about a set of data” (Sekaran and Bougie, 2013:85). This research will give us an understanding as to how investment is allocated to port infrastructure, systems, and superstructure for efficient port operations to take place. With this type of researching method, trend analysis of port performance and port investment since the 2013 may be conducted. Therefore, this trend analysis will effectively be a time series analysis of port performance

versus port investment. The period under review is from the year 2013 to the year 2019. This period was selected based on the Market Demand Strategy which was introduced in the year 2012. This strategy is part of the governments' plan to boost investment in port infrastructure and superstructure. In doing so, this study will analyse how, if at all, investment made into the port of Durban has helped improve performance.

This chapter focuses on the research process, tools and procedures used, highlights how the research problem statement along with its objectives and research question were answered with the aid of research design, data collection methods and it discusses how data will be analyzed. Finally, this chapter discusses the ethical considerations and limitations of the study.

3.2 Research Objectives

The following objectives are used to guide this research paper. Although not all objectives may be fulfilled by the information gathered throughout this study, but they are used as framework to guide the researcher. The main research objective for this study is to establish the extent to which insufficient investments can lead to congestion and disruption. The below are sub research objectives that will need to be identified by this study.

- Assess the extent and nature of investment made since 2012 into the port of Durban
- Examine the efficiency of the port of Durban
- Examine the congestion in the port of Durban and the rollout of investment

3.3 Research Methodology

Under the section the researcher will identify the methodology to be followed in this research study. It will cover the research data collection methods. It will thereafter discuss how the collected data will be analysed.

3.3.1 Qualitative Approach

This approach seeks to understand and explore the meaning behind how individuals or groups behave or react to social problems (Creswell, 2011). This approach emphasizes the way people interpret and make sense of their experiences to understand social reality. Qualitative research design has qualities of narrative research, phenomenology, grounded theory, ethnographies, and case study research methods.

Qualitative research is defined as a planned or ordered inquiry, that is grounded in the world of experience. An inquiry in this instance is whereby the researcher is trying to understand how others make sense of their experiences (Shank, 2002). The qualitative research design employs tools such as case studies using participant observation, semi- structured interviewing, and document analysis. The purpose of qualitative research is to describe and interpret issues from the point of view of the individual or population being studied and to generate new concepts and theories. Furthermore, it may involve analysis of written or narrated work using Document Analysis or Content Analysis, which is what this study is planning to employ.

3.3.2 Quantitative Approach

The quantitative approach tests theories by observing the relationship between variables. These variables are measured usually with instruments so that the data can be analyzed using statistical procedures (Creswell, 2011). The quantitative research design has features of experimental and non-experimental designs such as surveys. The survey research is known to provide a numerical description of trends and opinions of a population by doing a study on the sample of that population (Creswell, 2011). This design includes instruments such as questionnaires and structured interviews, amongst others, to conduct the study. The outcome of the sample studied is then used to explain the behavior of the population. The experimental research design is used to determine whether specific treatment influences the outcome of the study. The researcher in this instance would divide the samples into groups, and only influence one group at a time to see if the change effects the outcome, *ceteris paribus* for the other groups not being tested.

Given the above meanings of the qualitative and quantitative research approaches, this study employs a mixed method approach, as it utilizes both the qualitative and quantitative research approach.

3.4 Research Design

Creswell (2014) describes research designs as types of inquiry within qualitative, quantitative, and mixed methods approaches that provide direction for procedures within the research design. For this study, the researcher follows a qualitative and quantitative approach, employing document and content analysis as tools to analyze the data that informs the study. Under the quantitative approach, the variable under study is the capital expenditure over the years 2012-2021. In addition to this variable, the other variables studied that make this study

follow a quantitative approach is the relationship between berth utilization, average ship turnaround time, anchorage waiting time and the berth occupancy for the years 2016-2022. This relationship illustrates to the researcher, productivity, and performance in the Port of Durban.

3.4.1 Document Analysis

A document is something produced to be read by society and it relates to some aspect of the social world. The analysis of documents happens when the researcher interprets the data in the documents to give voice and meaning on the topic being discussed (Bowen, 2009). Documentary work involves reading and studying a lot of written materials. The sources of records are public records, private papers, visual documents, personal documents, and physical evidence amongst many.

Qualitative researchers, to create uniformity by having sufficient evidence, usually use at least two or more resources through different data sources. The researcher can use a large volume of texts for research. Collecting a vast number of documents to study is better than working with sparse documents, although the researcher should focus on the quality of the documents rather than the quantity. This also ensures credibility and reduces the chance of potential bias of the data gathered. To ensure the credibility of the study, O'Leary (2014), states that the researcher must undergo an 8-step planning process which is as follows:

1. Create a list of texts to explore, ie participants.
2. Consider how the text will be accessed with considering the linguistic and cultural barriers.
3. Address all biases acknowledged
4. Develop appropriate skills for research
5. Consider strategies for ensuring credibility of the data
6. The researcher must know the data being searched
7. The researcher must consider the ethical issues involved in the study
8. Lastly, the researcher must have a backup plan

The researcher must note the issue of bias when collecting and reading the study material. The researcher must also consider whether the writer is a firsthand witness or secondary sources were used. Bowen (2009), states that documents should include a wide variety of types and content analysis is most useful for painting a broad picture as it offers a “first-pass document

review” (p.32) which can assist the researcher with means of identifying meaningful and relevant passages. Document analysis is often used due to the many ways it can support and strengthen the research. The document may provide background information and broad coverage of data, which can be very useful in contextualizing the research within the subject field of study. It is important to note that document analysis looks for the following in a document:

- i) What type of document is it?
- ii) When was it produced?
- iii) Why does this document exist? What motivated the author to produce it?
- iv) Who produced the document?
- v) What does the document mean to the people during that time?
- vi) What does the document tell us about the time?
- vii) What is the point of view of the author and credibility and reliability of the document?

Below is a table of the documents this study employs. They are tabulated to present the purpose of each document and it how it contributes to this study. Also, the documents are analysed for intertextuality.

Table 3.1: Purpose of each document used for document analysis

	PORTS SECTOR REVIEW 2020/21	PORT BENCHMARKING REPORT: SA TERMINALS 2015/16	PORTS SECTOR REVIEW: 2015/16	SOUTH AFRICAN PORT CAPACITY AND UTILISATION REPORT 2015/16	GLOBAL PORT PRICING COMPARATOR STUDY 2018/19	TERMINAL OPERATOR PERFORMANCE STANDARDS ANALYSIS REPORT 2020/21
PURPOSE	<p>The purpose of this document is to gain a holistic view of the ports system in South Africa. It offers a better understanding of the characteristics, the operational performance as well as the handling capability of each port. This document also highlights policy position of the government, the advancement in regulation as well as the advancement in port sector.</p>	<p>The purpose/objective of this study is to monitor the performance improvement strategies adopted by the Authority and whether the desired outcomes are starting to be produced.</p>	<p>This review gives a holistic picture of the ports system, focusing on the Regulated entity, the National Ports Authority (NPA). This document uses existing research previously conducted and published by the Regulator.</p>	<p>This report presents an assessment of the NPA published port capacity and its analysis of the utilisation with regards to the capacity levels in the SA port system, it analyses the extent to which port capacity is utilised, and it reflects on the performance of SA terminals as it relates to the use of infrastructure and projected demand in expected volume.</p>	<p>The Global Port Pricing Comparator Study is a benchmarking report of port prices for a single vessel in SA ports against international ports. This study includes marine charges, port dues, cargo dues (differentiated by cargo type). It also assists in identifying which port users are subsidising and which are being subsidised.</p>	<p>This report has interest in the efficiency through assessing various performance measures. The report serves to illustrate results on KPI's covered in the TOPS initiative, using each of the terminal operator's actual manual performance compared against each of its set annual targets</p>

Source: Researcher Compiled using documents labeled in the table

Table 3.2: Intertextuality of the Documents the Researcher used for Document Analysis

	PORTS SECTOR REVIEW 2020/21	PORT BENCHMARKING REPORT: SA TERMINALS 2015/16	PORTS SECTOR REVIEW: 2015/16	SOUTH AFRICAN PORT CAPACITY AND UTILISATION REPORT 2015/16	GLOBAL PRICING COMPARATOR STUDY 2018/19	TOPS ANALYSIS REPORT 2020/21	GLOBAL PRICING COMPARATOR STUDY 2020/21 PORT TARIFFS
PORTS SECTOR REVIEW 2020/21	1	Significant investment in infrastructure and superstructure is required to enable the handling of TEU's from large vessels. Port management and port governance impact the efficiency of the port.	The port of Durban contributed more than half of the total profits and revenue in the port system. In the year 2015/2016 it contributed revenue of 54% to NPA's overall revenue and in the year 2020/2021 contributed 66% of revenue. For both 2015/2016 and 2020/2021, the profits contributed to the NPA profits were 63%.				On average, there are more than 4.6million containers are handled by the SA ports on an annual basis, of which more than half are handled by the Port of Durban proving that it is the busiest container terminal in sub-Saharan Africa.
PORT BENCHMARKING REPORT: SA TERMINALS 2015/16	1		SA ports are performing reasonably efficiently. However, improvements need to be made in installed capacity at some ports to handle more throughput in the system.				
PORTS SECTOR REVIEW: 2015/16	1					Cargo dwell time for SA was on par with European ports in 2015/2016 however it has deteriorated over the last 3 years from 2018.	The port of Durban is a key contributor to SA's economy.
SOUTH AFRICAN PORT CAPACITY AND UTILISATION REPORT 2015/16	1				To develop terminals to meet demand there must be a balance between providing infrastructure to meet demand and optimising non infrastructure parameters to address capacity.		
GLOBAL PRICING COMPARATOR STUDY 2018/19	1					The port of Durban is struggling to reach its cargo dwell times targets.	
TERMINAL OPERATOR PERFORMANCE STANDARDS ANALYSIS REPORT 2020/21	1						
GLOBAL PRICING COMPARATOR STUDY 2020/21 PORT TARIFFS	1						

Source: Researcher Compiled using documents labeled in the table

3.4.2 Content Analysis

Content analysis is a formal and systematic research design. It is a method of analysing written, verbal, or visual communication messages. Leedy and Ormrod (2001:142) describe it as “detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes or biases.” In the collection of data in this research design, the researcher must analyse the material and put them in frequency table as each characteristic, and the researcher must conduct a statistical analysis so that the results are reported in a quantitative format (Leedy & Ormrod, 2001). In content analysis, the research paper must include five sections (Williams, 2007):

- i) The description of the material studied
- ii) The characteristics and qualities studied
- iii) A description of the methodology
- iv) The statistical analysis showing the frequency table
- v) Drawing conclusions about the patterns, themes or biases found in human communications and data collection.

There are generally two types of content analysis. There is conceptual analysis which determines the existence and frequency of concepts in a text, and there is relational analysis which develops the conceptual analysis further by examining the relationship among concepts in a text (Owen, 2012).

The researcher uses this mixed qualitative approach to get the best possible results from this study. This study uses content analysis of the Ports Regulator over the 7-year period of the Market Demand Strategy from years 2013/2014 to 2019/2020. The study examines themes that emerge from stakeholders’ comments and the Ports Regulator’s website regarding the operational efficiency of the port of Durban, the investments made during the anticipated period of the MDS, CAPEX and OPEX spend and tariff applications for the port of Durban.

Content analysis is not necessarily a stand-alone design. It can be incorporated with other research designs such as cross-sectional design amongst others. For this study, however, content analysis is used alongside document analysis. The researcher uses both content and document analysis for the purpose of this research paper as textual documentation is being

analysed. The researcher will utilise the document analysis technique first as it looks at the nature, format and structure of the document being used to gather information. Thereafter the content analysis will follow as it draws up the themes, maps out the similarities of the content of the document thereafter it analyses the content. The content that forms the base of this study is documentation found that gives the existing data to be analysed. The desk-based study uses data found in the Transnet website, the Port Regulator website including Records of Decisions and Stakeholders submissions, the terminal operator reports and the port sector review documents which are shown in the table below.

3.5 Data Collection Method

The process of data collection is used when the researcher has “limited influence on the data source, as occurs when data is extracted from static materials such as documents and the literature” (Birks and Mills, 2011: 174). The methods used to collect data consist of capturing interview records, audio-visual materials, and documents such as surveys and observations (Creswell, 2013). The most used data collection methods include interviews, focus groups, questionnaires, and document analysis, to name a few (Rule & John, 2011). Irrespective of the kind of data involved, the collection of data in a qualitative study consumes a lot of time. The researcher records data that can prove to be potentially useful. This data must be recorded thoroughly, accurately, and systematically by use of fieldnotes, audio-visuals photographs or sketches. And the researcher collects data for a qualitative study, notes are jotted down about their initial interpretations of what they are seeing and hearing (Leedy & Ormrod, 2001).

3.5.1 Data Collection Techniques

Data collection techniques allow the researcher to systematically collect information about the object of study. It is essential to collect data systematically. Collecting data in a haphazard way will result in difficulty to answer the research questions conclusively. As stated above, the techniques used for this research, is content and document analysis. The documents used are journals, newspaper articles, stakeholder submissions, port sector and port regulator reviews, and reports from Transnet mainly the statistics published online on TOPS and MOPS. The existing data is summarized to increase the overall effectiveness of the research.

Data collection and data analysis are usually integrated. Data analysis is described as the researcher’s decision-making process regarding the evidence the researcher identified in the data set. The strategies involved the data analysis include preparing and organizing the data, coding, and representing the data in text, tables, or figures (Birks and Mills, 2011). The purpose

of data analysis in research is to produce theory and to inform action. “The goal is to seek patterns as well as irregularities, examining the data for explanations on the phenomena being studied” (Birks and Mills, 2011).

3.6 Ethical Consideration

Ethical issues were considered in this study in that the researcher submitted the research proposal and was granted ethical clearance to conduct this research study by the ethics committee of the University of KwaZulu-Natal.

3.7 Limitations of the Study

The Covid-19 pandemic and the state of disaster that was announced in the year 2020 caused major disruptions in all industries and the way of life as we know it. Many sectors were shut down and not trading resulting in economic losses for many. Due to this, for this study, the researcher did not utilise the data results for the year 2021 because of the many disruptions and the reliability of this data may not be valid.

Also, the study relies on secondary information gathered throughout the years and it is not confirmed whether there is a deviation from what is currently happening at the ports. Although plagued by the pandemic, significant changes may have occurred in the year 2020 and 2021 which has not yet been documented.

3.8 Conclusion

This section covered extensively the research methodologies used to conduct the study. The section discussed the research design of the study whereby it stated that this research study followed a qualitative research approach using documents and content analysis. This section further detailed on the study site which is being studied. And lastly, to ensure that ethical issues were considered in the conducting of this study, the researcher explained how ethical clearance was applied for from the ethics committee of the university.

CHAPTER 4:

PRESENTATION AND DISCUSSION OF RESULTS AND FINDINGS

4.1 Introduction

This chapter presents an analysis and results from the data obtained using the methods described in Chapter 3 above. The chapter will describe and summarize the data and will identify the relationships between the variables of interest, which are congestion and investment. Document and content analysis were used for data analysis to help the researcher report objectively and reliably. The chapter begins by looking at port investment expenditure from 2012/2013 to 2019/2020. The researcher will also analyse performance indicators for pier 1 and pier 2 in the Port of Durban for the years 2016-2020. This is because the data available was for these years. The performance indicators will primarily be those that proxy congestion, which is the persisting problem of the Port of Durban. Finally, the researcher will determine the correlation between investment and congestion within the port of Durban.

In this chapter, the researcher analyses the CAPEX spend for the above-mentioned years. The researcher does this by comparing the planned vs. allowed vs. actual CAPEX. This will help identify what motivated the tariff applications, it will show what the Ports Regulator of South Africa (PRSA) has allowed through the Records of Decision. To achieve this, the researcher analyzed the tariff application documents, the record of decisions from PRSA and stakeholder submissions from the various stakeholders of the port of Durban, and documents which show the actual CAPEX spend for the various years covered by this study. Ideally the research should look at the projects done in the Port of Durban and how much CAPEX was for each project. This should tell the researcher how much was contributed to the investment in different projects and infrastructure in the Port of Durban. However, this has proven to be nearly impossible because of Transnet's inconsistency in reporting methods and the general unwillingness to release the data to the public ever since the SOE experienced cyber security issues in early – mid 2021.

4.2 Background of Investment to the Ports

The most common cause of congestion in Durban is the historical lack of reinvestment into the port infrastructure and superstructure. By the year 2012, TNPA made a discovery that there has been a 30-year investment gap into the port infrastructure. This means that the cargo handling equipment such as the cranes were worn out and in need of constant repairs which resulted in a lot of money being spent to maintain the existing infrastructure without investing or adding in new infrastructure. This resulted in throughput, which meant that vessels spent a longer time waiting to be serviced and proceed whenever they call at the port because of fewer gantry crane moves per hour. This also meant they spent more time at outer anchorage leading to longer turnaround times for the vessels calling the port and longer truck turnaround times. All of this contributed to the congestion at the port of Durban. What this research aimed to do with the availability of data was to assess the extent to which port congestion has been reduced at the port because of the investment plans that were formulated in the year 2012 and started being implemented under the Market Demand Strategy otherwise known as Transnet 4.0.

4.3 Presentation of Results

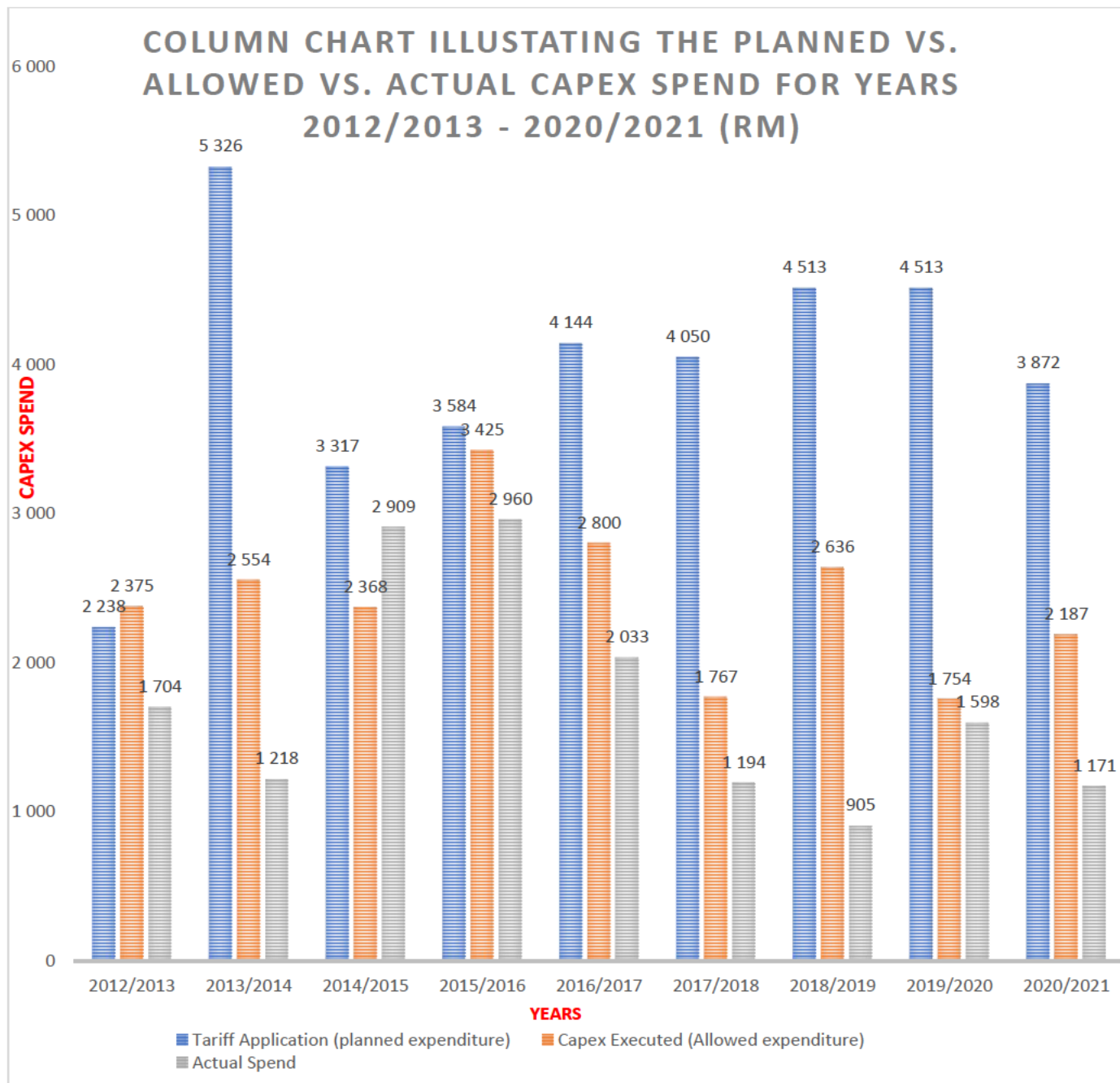
The Transnet National Ports Authority is required to generate revenue by charging tariffs for the services that it renders. The Authority charges fees, in accordance with tariffs approved by the Regulator to fulfil the functions it must perform in terms of the National Ports Act of 2005. As a landlord, the Authority's core services, as specified in the Act, result in several revenue streams, which are utilised by the Authority to fulfil its responsibility for the safe, efficient, and effective economic functioning of the national ports system.

4.3.1 Investment made since 2012 to the port of Durban

The market demand strategy was expected to have significant socio- economic impacts across South Africa through its capital expenditure (CAPEX) investment program. This strategy was expected to aid in expanding rail, ports and pipeline infrastructure which will enable economic growth. The figures below explain the capital expenditure (CAPEX) over a 10-year period. In assessing investment made into the port of Durban, the researcher has gathered information on CAPEX spend. With the data collected from the Transnet tariff applications, the record of decision and the TNPA operational and financial documents, from the years 2012/2013 - 2020/2021, the researcher has compiled a graph of figures recorded for each year. Then, the

researcher, by analysing the same tariff application documents, collects and analyse data relating to the CAPEX projects for the port of Durban. The chart below illustrates the planned vs. allowed vs. actual CAPEX spend for the years in study. The planned CAPEX spend was carefully motivated for by the Transnet tariff applications, with proper navigation as to the need for such investment being required. For the allowed CAPEX, the researcher analysed the records of decision of the stakeholders.

Figure 4.1. TNPA Capital Expenditure in South Africa’s Ports, 2012/2013 to 2018/2019



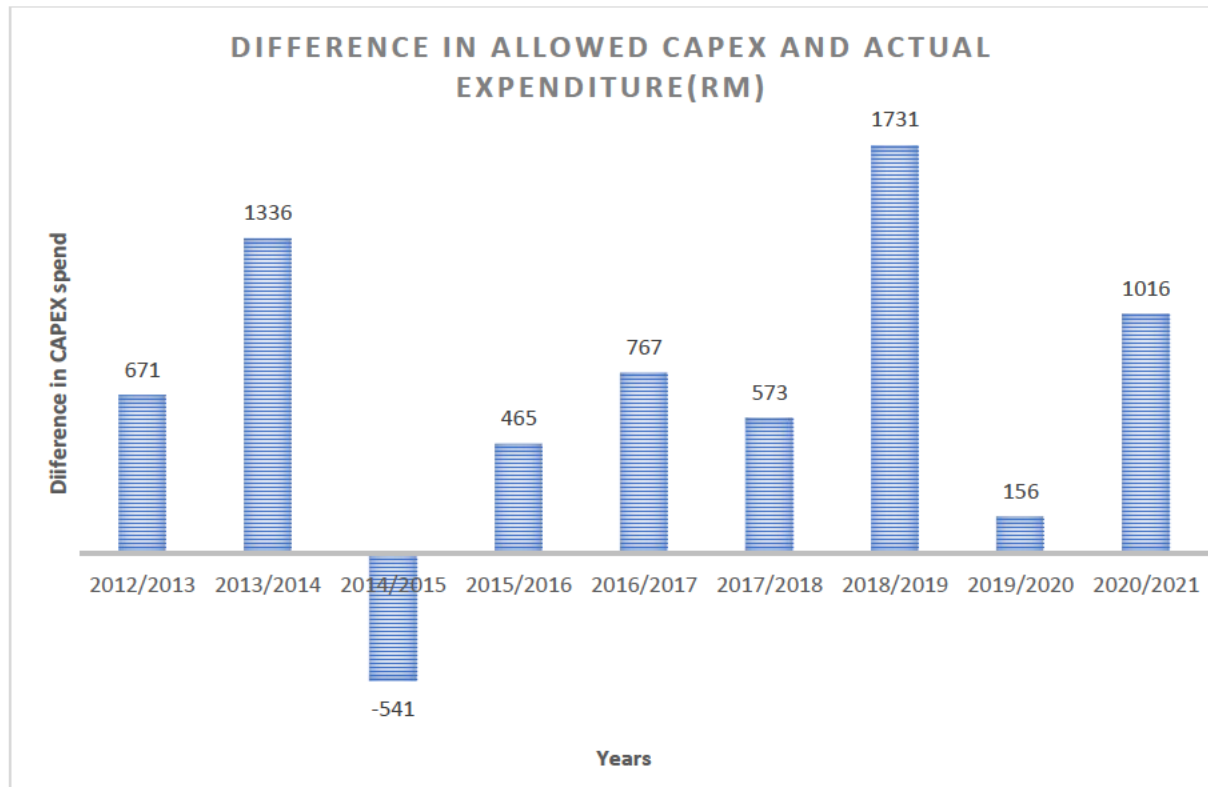
Source: Researcher compiled using TNPA tariff applications 2012/2013- 2020/2021

The above graph illustrates how the planned expenditure is alarmingly higher than the actual expenditure for all the years. This raises a question of how and where the resources are being allocated or misallocated. The revenue generated from South Africa's eight commercial ports increased by 27% over the 10-year period of 2011/2012- 2019/2020 (Ports Regulator of South Africa, 2020). Chasomeris and Gumede (2020) illustrate that from the years 2016/2017 to 2018/2019 TNPA annual profit before tax increased by 155% from over R2.9 billion in 2017 to more than R7.4 billion in 2019. Also, over the same period the TNPA was given an increase in the CAPEX from R4.1 billion to R4.5 billion.

Having observed this, it is seen also from the graph how TNPA has consistently requested for far more investment in terms of CAPEX, but in all instances, it has been granted less by the Port Regulator of South Africa (PRSA). Even though this is so, the TNPA has spent considerably even less on CAPEX. The sum of all its CAPEX is far less than the initial outlay they had planned for the ports which is about R87bn. This is a clear indication of continued underinvestment and potentially misallocation of resources. The difference between

the applied capex spent in relation to the actual capex spend is highlighted in that the actual capex spend is relatively less than the applied capex spends. Furthermore, the below figure illustrates how the actual capex spend decreases over the years.

Figure 4.2 Column chart showing the difference between allowed CAPEX and actual CAPEX.



Source: Author derived from figure 4.1

The figure above shows that the actual expenditure declined by 55%. This shows that there is a decline in investment to South African ports. This decline in investment to the port is very concerning to the port users. It is only in the year 2014/2015 where the actual CAPEX spend was higher than the allowed CAPEX. The years 2013/2014, 2018/2019 and 2020/2021 have the highest difference in CAPEX spend, with 2018/2019 being the highest. This means that this is the year that saw the port spend the least.

4.3.2 Efficiency of the port of Durban

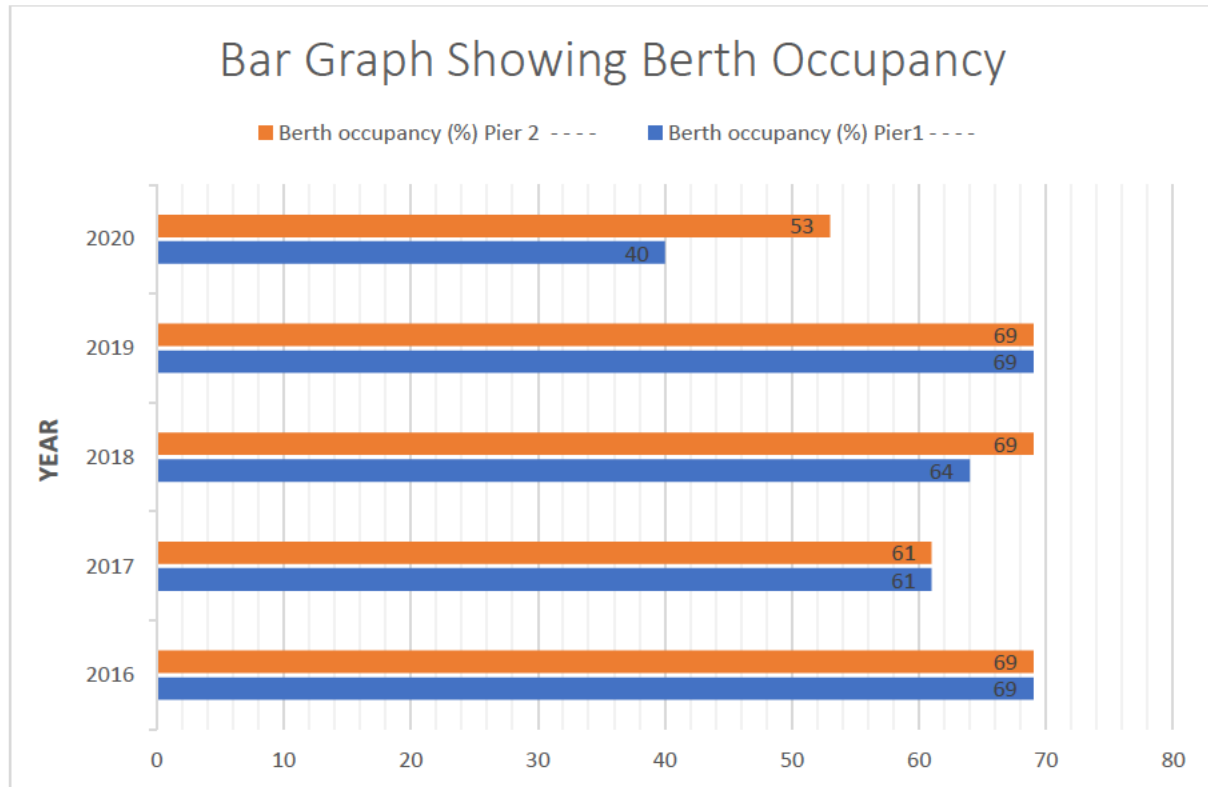
The National Ports Act 12 of 2005 states that the mandate for infrastructure and efficiency regulation is the provision of adequate, affordable, and efficient port services and facilities. This is done by ensuring that adequate investments are made within the port to ensure efficient running of operations using efficient infrastructure and superstructure. This can also be done by continuously monitoring the port capacity and utilization in measuring the container moves

per ship working hour, the gross crane moves per hour (GCH), ship turnaround time and the dwell times of the cargo at the port after being offloaded.

According to the Ports Regulator (2015), the port of Durban had 8 total berths and 22 cranes. This was the highest of the ports in South Africa. From the capacity figures drawn from the NPA's long term development plan, it becomes apparent that the Port of Durban has reached capacity with installed capacity being the same as the design capacity. Therefore, the CAPEX applied for can be justified through the performance and efficiency improvements. The Regulator concerns itself with the appropriate level of excess infrastructure that is allowed in the system, in aiding the provision of capacity ahead of demand. Because of its closeness to Gauteng, which is the economic hub of South Africa, the Port of Durban is one of the main drivers of container traffic.

In studying these reports, the researcher focused on the key performance indicators, namely: anchorage waiting time, the ship turnaround time, the berth occupancy, and the berth utilisation. The anchorage waiting time is the time for a vessel to enter the port till the time it berths. The delay in this can result from the shallowness of the quays that may have to await high tide for the vessel to make its way in. Investment project to help combat this type of congestion is the quay deepening project. The ship turnaround time is the time it takes the vessel to enter and leave the port. This is a major performance indicator as it looks at many operations in the port such berthing capacity, offloading capacity such as the functioning and efficiency of the cranes, and the depth of the quays. The berth occupancy is the time the vessel occupies a berth. The berth utilisation is the time the vessel is at berth and working. The significance to look at both these indicators closely for this study is to measure the amount of time spent at berth and to compare it to the time the vessel is working at the berth. This makes the researcher note the time lapse of when the vessel is attended to after it berths. In analysing performance under these performance indicators, the researcher notes how each indicator contributes to inefficiency, hence congestion.

Figure 4.3 Berth Occupancy for the Port of Durban for years 2016- 2020



Source: Author derived from TNPA Financial and Operational Performance for years 2016-2020

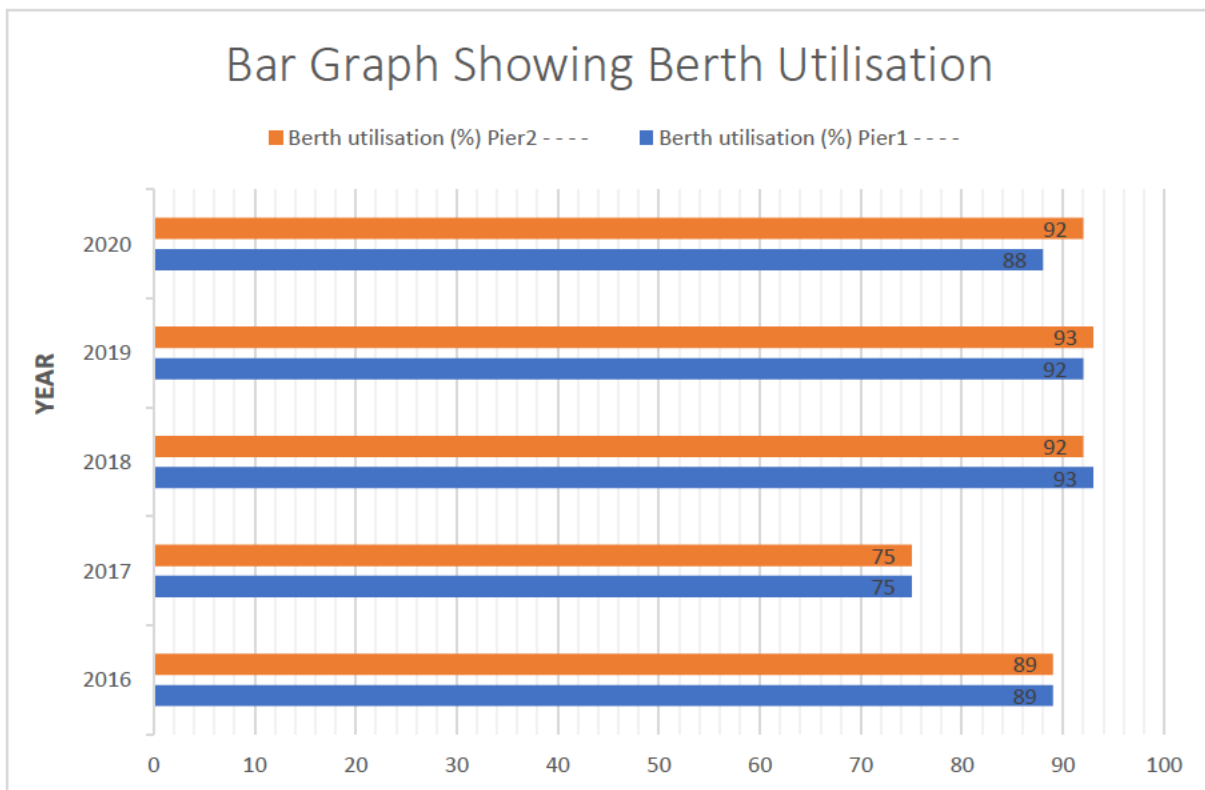
The graph above illustrates the data collected to show the berth occupancy for the Port of Durban pier 1 and pier 2. Berth occupancy is calculated as the percentage of time a berth is occupied by a vessel. This is compared to the total time the berth is available in the year. “The berth occupancy ratio (BOR) is the ration of time a berth is occupied by a vessel to the total time available in a period” (ABP,2018). From the above figure the actual berth occupancy for 2016 for both the piers was 69%. The target for 2017 was 65%-75% but the actual berth occupancy 61%. For 2018 the target was 65%-75% but the actual was 64%. The year 2019 achieved 69% for both piers, the target being 60%-70% for pier 1, and 65%-75% for pier 2. The target was met for both years. The target for the year 2020 for pier 1 was 78% but the pier achieved 40%, and for pier 2 the target was 76% but the result for pier 2 was 53%. This is a significant difference that may be attributed to slow economic activity because of the COVID-19 pandemic. Below is a table showing how many berths are available in each terminal at the Port of Durban. The below figure shows the berth capacity in TEU’s each pier has in DCT.

Pier 1 has a higher berth capacity than pier 2, meaning it can accommodate larger vessels than pier 2.

CARGO TYPE	TERMINAL	OPERATIONAL BERTHS	BERTH CAPACITY	MAXIMUM PERMISSIBLE DRAFT
Container	Durban Container Terminal - Pier 1	2	700 000 TEUs	105/106 - 12.2m 107 - 12.2m
	Durban Container Terminal - Pier 2	6	2400 000 TEUs	108/109 - 12.2m 200/201 - 12.2m 202 - 12.2m 203 - 12.2m 204 - 12.2m 205 - 12.2m

Berth occupancy looks at the marine operations. According to Hugh’s queuing model, pier 1 should have an occupancy rate of 40%-50% as it has 2 berths. However, from the graph above it can be derived that the average occupancy rate is much higher. For pier 2 which has 6 berths, the occupancy rate should be around 65%. But for years 2016, 2018 and 2019 it has been higher. This points to periods of congestion at the port. It can be said that there is an underinvestment and an over utilization of resources at the port.

Figure 4.4 Berth Utilization for the Port of Durban for years 2016 – 2020



Source: Author derived from TNPA Financial and Operational Performance for years 2016-2020

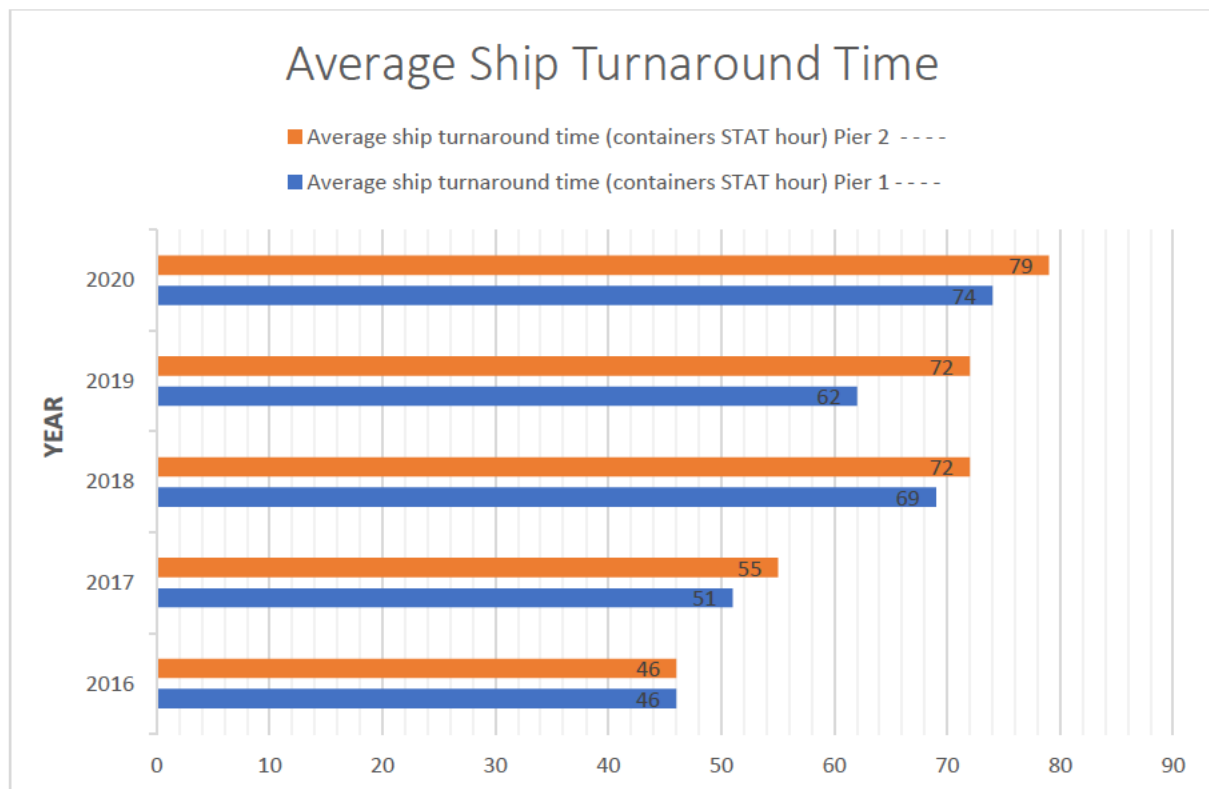
The bar graph above illustrates the Berth utilization for the Port of Durban, for Pier 1 and Pier 2. The type of congestion discussed in chapter 2 that relates to this performance indicator, is the ship berth congestion and ship work congestion. Berth utilization looks at cargo handling. The ship berth congestion is caused by ships that are waiting to enter the port. The ship work congestion is caused by the delays in loading and unloading the vessels. This results in the vessels staying at the berths longer than is needed, resulting in the ship berth congestion.

The target for 2017 was for the Durban port to obtain a berth utilization percentage between 85%-95%. For this year the target was not met as the port only obtained a percentage of 75% for both pier 1 and pier 2. For the year 2018 the target was 85%-95% for both piers as well. However, for pier 1 the actual performance was 93% and for pier 2 it was 92%. The port therefore met its target and performed well for berth utilization in 2018. The target for 2019 was 70%-80% for pier 1 and 85%-95% for pier 2. The port achieved 92% for pier 1 and 93% for pier 2. This means it exceeded the target and expectation for pier 1 by 12% and reached its target for pier 2. The target for the year 2020 is 93% for pier 1 and pier 2. The actual performance was 88% and 92% respectively. This means that both pier 1 and pier 2 failed to meet their target. In looking at the figures, one might say the port is performing fairly well. (TNPA, 2016) Another performance indicator to look at briefly although sufficient data is not presented on it is the truck turnaround time. For the year 2016, the target for pier 1 and pier 2, was less than or equal to 35 minutes. However, the port achieved 37 minutes and 40 minutes respectively for each pier (TNPA, 2016). This was higher than the stipulated target. During this year congestion was experienced as a result of slower truck turnaround times. With reference to chapter 2, the congestion caused by the truck turnaround times can be a result of vehicle gate congestion and the vehicle work congestion.

It is important to note how berth occupancy is relatively lower than berth utilization. The researcher notes that berth utilization is the actual operations time that the berth is working, taking out the time for any delays that may have occurred, it is the time worked of a vessel. Therefore, one might think that the occupancy must be greater than the utilization. The researcher identified possible reasons as to why this is not so. The berth may be working for longer because the cranes may be old and have deteriorated. This would decrease the gross

crane moves per hour (GCH). This decreases the performance of the port. If the cranes are older and not maintained regularly, the weather might be a regular challenge. The newer and more technologically advanced cranes may be able to withstand bad weather conditions such a strong wind more than the older cranes. Also, the older cranes do not have the technology the new cranes have, as the newer cranes technology makes it more efficient for the crane driver. It was important for the researcher to note that the movement time also varies. This may be because of the size of the container or how the container was stowed on the vessel. If it was incorrectly stowed it would take longer to offload as the crane would have to stow it correctly first.

Figure 4.5: Average Ship Turnaround Time in the Port of Durban for years 2016- 2020



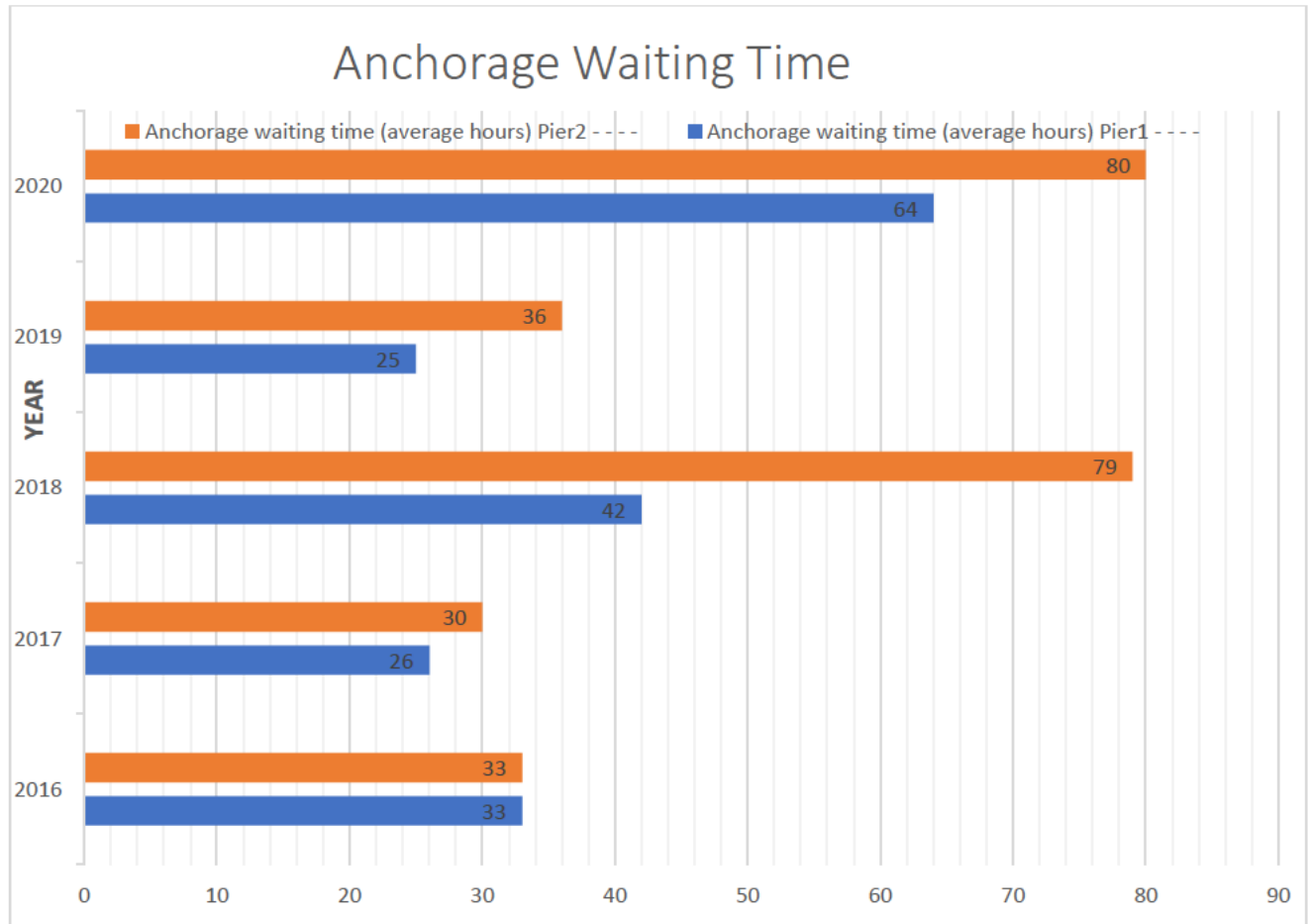
Source: Author derived from TNPA Financial and Operational Performance for years 2016-2020

The ship turnaround time is measured from breakwater in, to breakwater out. This is the time that is taken for a vessel to arrive and for the vessel to depart. The ship turnaround time is used as a measure of port efficiency. The figure above shows the ship turnaround time (STAT hour) for containers ships. In the year 2016 the above graph shows the ship turnaround time to be 46.

The target for 2017 was 43 hours for pier 1 and 53 hours for pier 2. The actual for pier 1 was 51 hours and for pier 2 it was 55 hours. Both piers missed the target. For 2018 the target was 55 hours for pier 1 and 53 hours for pier 2. The actual time achieved was 69 for pier 1 and 72 for pier 2. Again, the target time was exceeded. The target for 2019 was to achieve less than 55 hours for pier 1, and less than 53 hours for pier 2. The actual hours achieved were 62 hours for pier 1 and 72 hours for pier 2. The target was missed again. For 2020 the target was 74 hours for pier 1 and 79 hours for pier 2. For both piers the target was achieved and matched at 74 and 79 hours respectively for each pier. The targets are not being downwardly adjusted while the ongoing requests for high capital expenditure point to the desire to improve performance in pier 1 and pier 2. This shows that the actual investment is low and certainly not contributing towards the improvement in port performance.

For this performance measure, the port would hope to achieve less hours, as that would mean port performance is improving. But from the above graph and interpretation of figures, pier 1 and pier 2 have exceeded the target times, meaning it takes longer for the ship to leave the port throughout the years of the study. For the year 2020, again the high number of hours is because of the pandemic. The whole country came to a standstill as most businesses were stopped from operating. The vessels spent more time at port as South Africa was restricted to level 5 lock down, where only workers with permits would be able to operate. Level 5 restrictions saw essential services being able to operate and only essential cargo allowed to be discharged. This caused a backlog as cargo was inspected and only essential cargo was attended to.

Figure 4.6: Anchorage Waiting Time in the Port of Durban for year 2016- 2020



Source: Author derived from TNPA Financial and Operational Performance for years 2016-2020

The time the vessel spends at anchorage is determined by the operations at the port. If the operations are efficient, the time the vessel spends at anchorage will not be prolonged. The above graph shows the anchorage waiting times. This is the time the vessels wait to enter the port to berth. It is crucial to minimize port congestions as this also reduces the time vessels spend at anchor. This relies on the optimization and the utilization of the berths. For the year 2016 the average waiting hours achieved were 33 hours for each pier. The target for 2017 is 32 hours for pier 1 and 30 hours for pier 2. The actual hours achieved were 26 for pier 1 and 30 for pier 2. This means the port achieved below the target which was good for 2017. The target for 2018 was 28 for pier 1 and 36 for pier 2. However, the actual hours exceeded the target. For pier 1 the actual hours achieved were 42 for pier 1 and 79 for pier 2. The target for 2019 was to achieve less than 30 hours for pier 1 and less than 40 hours for pier 2. The actual average

hours achieved was 25 for pier 1 and 36 for pier 2. The target for this year was also achieved. For 2020, the target was to achieve less than 24 average hours for pier 1 and less than 30 hours for pier 2. However, the actual hours achieved for pier 1 was 64 hours and 80 for pier 2. For the year 2020 the average hours were significantly higher as well. In observing the port performance of better performing ports such as the port of Antwerp, which is 1.5 times bigger than the port of Durban, the average waiting time from the year 2018- 2020 has been found to be 12 hours and 17 minutes (De Hondt, 2021). This is the time at anchorage for this port for all vessel types. It would be ideal for the Port of Durban to aspire to operate close to this level.

The trend that can be seen for 2020 is that the port did not perform to its optimum levels because of the Corona Virus pandemic. The vessels at anchorage were at anchorage for long, waiting to berth because all operations ceased when the country was under a state of disaster. Port employees were minimal and only essential cargo was being attended to. Also, the vessels were at anchorage, waiting for the crew to show any signs and symptoms of the Corona Virus, and for them to get tested before entering the port. The Covid-19 pandemic has also caused various operational issues. Warehouses are full as everybody is increasing stock levels; ocean containers are being held for longer at origin and destination to secure space capacity, and truck capacity is exhausted due to high demand, resulting in overloaded terminals with low productivity. Overloaded terminals with low productivity have caused delays in terminal activities, vessels sitting idle outside ports, and a lack of extra vessel capacity. All of this has resulted in huge delays in end-to-end logistics and a rise in transportation rates. As global demand is spiking and supply chains are running into major issues, we see a spike in inflation and an increase in prices for manufacturing parts and consumer goods that are putting additional pressure on the global economy.

4.3.3 Congestion in the port of Durban and the rollout of investment

There are still traces of congestion in the port of Durban, considering berth utilisation being very high pointing to the fact that the container terminals in Durban are still facing the same level of congestion if not higher than the pre-2012 years. What would have been ideal, however, would be to juxtapose the actual investment that took place in the port of Durban with specific reference to the port infrastructure vs. the performance in the subsequent years. However, this has not been successfully executed in this study. The reason for this is TNPA started restricting access to their databases regarding port performance and it started minimising its annual publications on the investments that have taken place. This was due to the cyber-attacks that

took place mid-year of 2021. Given the data that the researcher was able to collect and the port performance the researcher managed to get access to, there are still traces of congestion.

According to TNPA, the key focus areas for the CAPEX investment programme for the years 2018/2019 - 2020/2021 amounts to R3 053bn, R5 653bn and R 5 713m respectively (TNPA, 2017). On aggregate these projects contributed 70% of the planned spend for the 3 years. The projects that were included for the port of Durban were the DCT berth deepening 203 and 205, the reconstruction of sheet pile quay walls at Maydon Wharf, the feasibility and execution on Pier 1 phase 2 infill, the acquisition of 6 tugs (replacing 4 and 2 additional), the replacement of the water pipeline and billing system, the Maydon Wharf channel deepening, and the air quality monitoring system (TNPA, 2017). The above stipulated projects are important to the growth of the port and contribute to decreasing port congestion in that the vessels calling at the ports have gotten bigger require and deeper draughts. Shallow berths mean the vessel cannot sail into the ports fully laden and will have to wait for high tide to berth. The quay walls are used for mooring vessels and for the loading and offloading of goods. Therefore, it is essential that these walls are always at the best condition for quick and efficient offloading. The implication of investing in these projects is that congestion should be reduced as well as ship turnaround time. However, these projects that have taken place since 2012 have still not yet yielded the expected outcome which is to improve port efficiency and reduce port congestion. Hence, we still see the traces for port congestion.

4.4 Conclusion

This chapter presented the data and analysis of the research. The findings were guided by the research objections and questions stated in Chapter one. The findings show that there is significant underinvestment to the infrastructure and superstructure of the port of Durban. In looking at the key performance indicators identified in this study, the data somewhat revealed instances of congestion experienced at the port. The researcher noted that there was limited data available, however, from the data available, the researcher was able to establish a correlation between the investment made to the port and the congestion experienced at the port. In the next chapter the researcher will present the summary of the study and offer recommendations for future areas of study.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes and concludes the study. It offers the reflections of each research objective and makes recommendations on the way forward. The limitations experienced throughout the study will also be discussed. The researcher will then offer areas to look at for future research.

5.1.1 Overview of Research Study

For this dissertation, chapter one provided a holistic overview of the topic being studied. It gave the reader an insight to the phenomenon of port congestion. This was achieved by introducing the port of Durban and the role the port has on the economic activity. This chapter also stated the research problem and how the researcher aimed to go about conducting the research project. Chapter two served as a review of current literature on the port of Durban, the governance of the port and on congestion. It also served to review the literature available on port investment along with the major port investment initiative being the Market Demand Strategy. The chapter also investigated the different types of congestion that is experienced by the port and what causes it. This was significant in that when doing the analysis and discussion chapter, the reader was able to link the data with the theory.

Chapter three reiterated that the aim of this study is to understand better, the role that investment has to the efficient functioning of the port. This research followed a qualitative research approach by using document and content analysis. Chapter four presented an analysis from the data obtained using content and document analysis. The researcher did this looking at the variables of interest being the investment made into the port through capital expenditure (CAPEX) and the different performance indicators of the port. The CAPEX budget spent shows how there is still underinvestment into the port of Durban, and the performance indicators show that there are still signs of congestion in the port. In conclusion, chapter five provides the summary of findings, recommendations, and the concluding remarks of the researcher.

5.2 Reflection on the Study Objectives

The main objective of this study was to establish the extent to which insufficient investments can lead to congestion and disruption. The literature gathered identified the key role players and stakeholder of the port of Durban, amplifying the importance of how it is governed. In this study, documents such as TNPA's annual tariff applications were analysed about their respective provisions to the CAPEX applied for vs. CAPEX granted vs. CAPEX budget spent. Also, the documents were used to determine which projects were worked on and how these could not contribute to the absolute reduction of congestion to the port of Durban.

5.2.1 OBJECTIVE ONE: -Assess the extent and nature of investment made since 2012 into the port of Durban

This objective looked to explore how much was invested into the port of Durban from the year 2012 to the year 2020, through the Market Demand Strategy (MDS). The research established that the MDS aimed to address the lag in investment at the port. It was a good initiative as it looked at making the port more efficient. However, the misallocation of the funds saw there being underinvestment and differences between the funding that was initially applied for, vs what was approved, vs what was actually spent. It was determined that underinvestment and potentially the misallocation of resources continues in South African ports in general and particularly in the Port of Durban.

5.2.2 OBJECTIVE TWO: Examine the efficiency of the port of Durban

This objective explored the performance indicators such as berth occupancy, berth utilisation, the average ship turnaround time and the average anchorage waiting time. To fulfil this objective, the researcher gathered and analysed the contents from the TNPA annual financial reports for the years in study.

The Berth occupancy shows instances where the port has a berth occupancy higher than the desired occupancy for pier 1 and pier 2. In looking at the berth utilisation, for the years 2016-2020, it was relatively high indicating how the berth was highly utilised. The researcher noted in the chapter that this may be due to old and worn-out equipment resulting in the operations

taking longer to complete. Regarding the average ship turnaround time, the data gathered revealed that the yearly targets were exceeded. This shows that vessels stayed longer at the port than they were supposed to as per the targets set. This too points to the operations being slow. The average anchorage waiting time data showed that the port did well as it met its targets for the years. It was seen however that the targets were not met for the years 2018 and 2020.

The performance indicators, although for a smaller sample of the years in study, shows that the port of Durban has been experiencing congestion that could have been alleviated by more investment being put into the port. The berth utilisation could have been better if the cranes were working better or were in better condition. The average ship turnaround time too could have been better if the berth deepening projects were done so the ships can berth without having to wait for high tides.

5.2.3 OBJECTIVE THREE AND FOUR: Examine the congestion in the port of Durban and the rollout of investment

This chapter reflected on how there was not sufficient data available to present on the projects that were invested into over the years 2012-2021. However, the researcher was able, to some extent, to link the congestion in the port of Durban and the rollout of investment. The researcher showed how beneficial the proper execution of the port expansion projects that included the expansion of the quay walls and the deepening of the berth, would have contributed to alleviating congestion in the port of Durban.

5.3 Recommendations

5.3.1 Based on the findings under objective one, the researcher concludes that the problem of underinvestment persists in the Port of Durban. The researcher noted that the problem is not that there is no capital to invest, the problem is that there is no accountability. We may have the Port Regulator of South Africa which may attempt to regulate TNPA, however TNPA does not present projects to their granular detail of how much is needed and how it is going to spend. This is the type of detail the Port Regulator of South Africa has continuously requested from TNPA in the Record of Decision written on an annual basis. Therefore, the researcher suggests that TNPA should submit a clear and transparent account of what projects are running in which port and how much will be spent in what manner. It needs to offer more accountability on how

the money is spent, and there should be a more detailed plan and explanation on how the money was spent in the previous year and where the remainder went to.

5.3.2 The Port Regulator of South Africa, as a regulator of a public entity, must take very seriously the information concealment by TNPA. The performance statistics, and the investment expenditure is at best scantily presented. This is unacceptable for a publicly traded entity like Transnet. The Regulator must enforce that the TNPA produces proper data and make it publicly available.

5.3.3 Under the second objective of port congestion, the researcher notes that it is a problem of underinvestment, the lack of accountability and the inability of the Regulator to regulate. It is undeniable that South African ports still maintain old infrastructure, not enough cargo handling infrastructure and superstructure has been purchased. Therefore, it is important that this must be done. It should be mandated that TNPA should invest in more gantry cranes *en masse*. It should be monitored that TNPA follows through on what they have set out to do with the investment plans to promote the efficiency of the port.

5.4 Limitations of Study

The Port of Durban is a very dynamic port that is known to handle and manage mostly containerised cargo. Congestion experienced at the port is an area of major concern as the Port of Durban services most of the sub-Saharan Africa. The results of the study somewhat provided insight to the nature of port congestion and sub-optimal investment, however, there may have been other explanatory factors that come into play that may have contributed to the congestion being experienced in the port of Durban. The research and data used to conduct this study may have not been enough to conclusively discuss the causes of congestion. It would have been very beneficial to the researcher to have been able to access the data required to explore this study.

5.5 Opportunities for Further Research

For many years, congestion has been a problem, and it remains a problem even today for the Port of Durban all because of underinvestment and neglect. Port congestion is not only a problem for the port users, but it also poses a problem for other stakeholders. These

stakeholders include other ports that are waiting for vessels to call at their port but because the vessel spends more time in the port of Durban it ultimately causes delays in other ports of call. The other dilemma associated with port congestion is the congestion experienced by the trucks when coming in to load for delivery. This leads to long lines as the trucks wait to load their cargo. The port of Durban still must remain as competitive as possible to attract more users to help increase its economic activity. Considering the sizeable gaps between CAPEX allowed and actual CAPEX in SA ports – no less the Port of Durban, the first opportunity for future research would be an investigation into the apparent misallocation of resources in CAPEX project. This, no doubt, would require more access to information than currently available. Once that has been found, systems should be put in place to ensure transparency and accountability in expenditure. Another research topic is the assessment of how port congestion impacts the competitive advantage of various stakeholders and how its adverse effects can be combatted. The researcher can gather data from the various stakeholders that use the port and stakeholders who service the port. Transnet, as the landlord of ports, must be able to open its doors to researchers who have questions to explore and must be willing to answer in the most honest way possible, as the research studies help recommend better ways to how they essentially run the port or mitigate causes of concern.

5.6 Conclusion

From the literature and data that has been gathered, presented, and analysed, it can be concluded that the objectives set out in this study have been met. The research has indeed shown the extent of investment made into the port since 2012, it has examined the efficiency of the port of Durban by investigating the key performance areas, and it has examined the link between congestion and the rollout of investment. Through this research, it has been found that underinvestment still poses a serious problem in the port of Durban. If Transnet wants to remain competitive in all ports, serious intervention is needed to establish how to better run the investment programmes. Openness, accountability, and transparency is required to ensure efficiency in how the port is run.

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APPENDIX A



11 July 2022

Ms Siphesihle Bongeka Mhlongo (212512331)
School of Accounting, Economics & Finance
Westville Campus

Dear Ms SB Mhlongo,

Protocol reference number: HSSREC/00010041/021

Project title: The role of insufficient port investment in congestion in the port of Durban.

Amended title: The impact of insufficient port investment on congestion in the port of Durban.

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 11 July 2022 has now been approved as follows:

- Change in dissertation/project title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

Best wishes for the successful completion of your research protocol.

Yours faithfully

.....
Professor Josue Mbonigaba
ACADEMIC LEADER RESEARCH

/____

Cc: Supervisor Dr Ayanda Meyiwa
Cc: Academic Leader Research: Prof Josue Mbonigaba
Cc: School Administrator: Mr Nqobizwe Memela

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APPENDIX B

Masters Dissertation

ORIGINALITY REPORT

9%	9%	3%	3%
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