Examining the impact of Coronavirus on marine operations at the Port of Durban

By

Thiruvasan Govender

Student no: 217047390

A dissertation submitted in partial fulfilment of the requirements for the degree of Master of Business Administration

Graduate School of Business & Leadership
College of Law and Management Studies

Supervisor: Professor Mihalis Chasomeris

December 2022

Declaration

I, Thiruvasan Govender, declare that:

i) The research reported in this thesis, except where otherwise indicated is my original work.

ii) This thesis has not been submitted for any degree or examination at any other university.

iii) This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

iv) This thesis does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

a) Their words have been re-written, but the general information attributed to them has been referenced;

b) Where their exact words have been used, their writing has been placed inside quotation marks, and referenced.

c) Where I have reproduced a publication of which I am author, co - author or editor, I have indicated in detail which part of the publication was actually written by myself alone and have fully referenced such publications.

d) This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.

Signed:  Date: 8 February 2023

Acknowledgements

The Lord Jesus Christ deserves all honor, praise, and gratitude. I would like to thank the Highest for giving me the fortitude, perseverance, and strength to complete the MBA. I will give thanks to you, Lord, with all my heart; I will tell of all your wonderful deeds. Psalm 9:1.“Praise the lord .Give thanks to the lord for he is good;His love endures forever”.(Psalm 106:1).“I can do all things through Christ who strengthens me”. (Philippians 4:13).

I would like to express my heartfelt gratitude and appreciation to each member of my family for their support and, most importantly, their prayers for me.

My gratitude and appreciation to my supervisor , Professor Mihalis Chasomeris, for his patience and continuous support towards this study, with him, this dissertation was a success.

I would like to extend my gratitude to all the respondents , who took their time to participate in this study.

I am grateful to the Transnet National Ports Authority for allowing me to conduct research within the organisation.

Thank you to all who have blessed me with their support, advice and assistance in navigating my MBA and completing this dissertation.Thank you! Each of you played a tremendous role in my life during this period; may the almighty bless you abundantly.

Abstract

The COVID-19 pandemic has resulted in unprecedented disruption to humankind, global trade, and business. Ports as gateways to international markets handle about 90 % of international trade and are essential for promoting global trade and economic expansion. An efficient port operation directly impacts a region's economic prosperity. The Port of Durban is one of the largest and busiest commercial seaports in the southern hemisphere, handling the largest value of seagoing traffic in South Africa. The Port of Durban is paramount to South and Southern Africa's regional economic prosperity. The port is supported by marine operations, which work in accord to service vessels that call at the port. This study examined the impact of the COVID-19 pandemic on marine operations at the Port of Durban.

The main objective of the study included: To examine the impact of the COVID-19 pandemic on marine operations at the Port of Durban during the period January 2020 to December 2020. A mixed methods research approach was adopted for this study. Secondary data on marine operation's operational performance was compiled and examined for 2019-2021. Thematic analyses of interviews with 15 TNPA marine operations employees representing management and marine operations provided findings that show a comprehensive view of the impact of the Coronavirus pandemic. This study contributes to an understanding of how marine operations at ports were affected by the COVID-19 pandemic. Findings and recommendations provide the TNPA marine operations with information to plan for future disruptions and identify best practices that can be implemented in other South African seaports.

Table of Contents

Declaration ii

Acknowledgments iii

Abstract iv

Table of Contents v

List of Tables x

List of Figures xi

Abbreviations xii

CHAPTER 1 1

OVERVIEW OF THE STUDY 1

1.1. Introduction 1

1.2. The aim of the study 3

1.3. Background to the study 3

1.4. Problem statement 5

1.5. Research objectives 6

1.6. Research questions 6

1.7. Research methodology 6

1.8. Significance of the study 8

1.9. Structure of the study 8

1.10. Summary of chapter 9

CHAPTER 2 10

LITERATURE REVIEW 10

2.1 Introduction 10

2.2 Pandemics 10

2.3 Coronavirus 11

2.4 The global economic impact of the Coronavirus 12

2.5 Impact of the Coronavirus pandemic on Global International Trade 18

2.6 Impact of the Coronavirus pandemic on Maritime Commerce 18
2.7 Impact of the Coronavirus pandemic on commercial seaports 19
2.8 Impact of the Coronavirus pandemic on vessel calls 21
2.9 Impact of the Coronavirus pandemic: Vessel restrictions and delays at the port 22
2.10 Impact of the Coronavirus pandemic on port workers 22
2.11 Port maritime employees 24
2.12 Marine services 25
2.13 Marine pilotage 26
2.14 Towage services 27
2.15 Vessel Traffic Services 28
2.16 Mooring Services 29
2.17 The impact of the Coronavirus pandemic on Africa 29
2.18 The Coronavirus pandemic's impact on South Africa 31
2.19 The economic impact of the Coronavirus pandemic in South Africa 34
2.20 The economic impact of the Coronavirus pandemic on South Africa's Gross Domestic Product 35
2.21 The Coronavirus Pandemic's Impact on Employment 38
2.22 The impact of the Coronavirus pandemic on the South African tourism industry 41
2.23 The impact of the Coronavirus pandemic on the South African cruise tourism industry 43
2.24 The impact of the Coronavirus pandemic on the Logistics sector in South Africa 43
2.25 The impact of the Coronavirus pandemic on the South African Maritime sector 45
2.26 Transnet National Ports Authority 45
2.27 Ports in South Africa 45
2.28 Port of Durban 46
2.29 Marine Services at the Port of Durban 47
2.30 Conclusion 48
CHAPTER THREE 49

RESEARCH DESIGN AND METHODOLOGY 49
3.1 Introduction 49
3.2 Study Aim 49
3.3 Study objectives 49
3.4 Research Design 50
3.4.1 Research Approach 50
3.4.2 Research Methods 51
3.4.2.1 Critical Paradigm 52
3.4.3 Target Population 52
3.4.4 Sampling Strategy 53
3.5 Research Process 54
3.5.1 Data collection 54
3.5.2 Data Analyses 54
3.5.3 Ethical Clearance and Informed Consent 54
3.5.4 Limitations of the Research Process 56
3.5.5 Validity and Reliability 56
3.6 Conclusion 58
CHAPTER 4 59
PRESENTATION AND DISCUSSION OF DATA 59
4.1 Introduction 59
4.2 Response Rate 59
4.3 Details of participants 59
4.4 Results based on the primary study 60
4.5 Analysis of data 60
4.5.1 Objective one: To examine the impact of the Coronavirus pandemic on maritime operations at the Port of Durban over the period January 2020 to December 2020 61
4.5.1.1 Workplace changes caused by the Coronavirus pandemic 66

4.5.1.2 Challenges brought about by COVID-19 health and safety measures. 75
4.5.1.3 Inherent challenges facing Marine operations 77
4.5.1.4 Impact on staffing 78
4.5.1.5 The impact of COVID-19 on marine resource deployment and utilization 81
4.5.2 Recommendations for mitigating the effects of the Coronavirus pandemic's disruptions. 86
4.6 Discussion 87
4.7 Conclusion 89
CHAPTER 5 90
CONCLUSION AND RECOMMENDATIONS 90
5.1 Introduction 90
5.2 How the Study's Objectives Were Accomplished 92
5.2.1 Objective One: Disruptions to marine services 92
5.2.2 Objective Two: Recommendations for mitigating the impact of COVID-19-related disruptions 100
5.3 Recommendations 100
5.3.1 Dissemination of information 100
5.3.2 Investment in advanced technological systems 101
5.3.3 Public-Private partnerships 102
5.3.4 Investment in marine operations 103
5.3.5 Dedicated support services and aligned procurement policies 103
5.3.6 Vigorous Business Continuity management 104
5.3.7 Adoption of Technology 104
5.4 Limitations of the study and areas for future research 105
5.5 Conclusion 106
References 107
Appendix 1: Editor’s certificate 119
Appendix 2: Informed consent from 120

Appendix 3: Interview schedule.....123
Appendix 4: Ethical clearance.....124

List of Tables

Table 2.1 Timeline of pandemics in the last century 10
Table 2.2 Stimulus packages instated by African nations to ease the impact of COVID-19 .. 30
Table 2.3 COVID -19 multilateral institutional packages available for African states 31
Table 2.4 COVID -19 alert levels and related restrictions, March 2020 –March 2021..... 34
Table 4.1 Themes and sub-themes..... 60
Table 5.1 Optimal Marine Fleet Resources…….. 96
Table 5.2 Deficit Marine Fleet Resources 94

List of Figures

Figure 2.1 World Pandemic Uncertainty Index 15
Figure 2.2 Government income support during the COVID -19 pandemic, December 2020 . 16
Figure 2.3 Economic stimulus packages as a percentage of a country's GDP 17
Figure 2.4 Declines in vessel calls compared to normal conditions 21
Figure 2.5 Ports reporting a shortage of workers 23
Figure 2.6 Ports reporting a shortage of dockworkers 25
Figure 2.7 Daily recorded COVID-19 infections, South Africa, March 2020-November 2021 32
Figure 2.8 Daily recorded COVID -19 deaths, South Africa, March 2020-November 2021 .. 33
Figure 2.9 Quarter-on-Quarter GDP growth rate In South Africa, Q4 2019 –Q4 2020 36
Figure 2.10 Sectoral change in GDP, Q4 2018 –Q4 2020 37
Figure 2.11 South Africa's official unemployment rate versus expanded unemployment rate 39
Figure 2.12 Percentage and absolute employment change, Q4 2018 - Q4 2020 40
Figure 2.13 Tourism sector jobs, 2018 – 2020 42
Figure 2.14 Logistics jobs, 2018 - 2020 44
Figure 4.1 Vessel Movements (April 2019 to March 2022) 70
Figure 4.2 Number of vessels attended to by the Water Services department (April 2019 to September 2022) 71
Figure 4.3 Fresh water provided to vessels per Ton (April 2019 to September 2022) 72
Figure 4.4 Berthing Services revenue (April 2018 to March 2021) 73
Figure 4.5 Marine Fleet Services revenue (April 2018 to March 2021) 74
Figure 4.6 Deployment of berthing gangs (April 2019 to September 2022) 75
Figure 4.7 Marine Absenteeism (April 2019 to June 2022) 80
Figure 4.8 Tug Availability (April 2019 to August 2022) 83
Figure 4.9 Tug Deployment (April 2019 to August 2022) 84
Figure 4.10 Tug Utilisation (April 2019 to August 2022) 85

Abbreviations

AfDB	African Development Bank
COVID-19	Coronavirus of 2019
DOT	Department of Transport
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HSE	Health, Safety, Environment
IAPH	International Association of Ports and Harbours
ICT	Information and Communications Technology
ILO	International Labour Organisation
IMF	International Monetary Fund
IMO	International Maritime Organisation
MSC	Mediterranean Shipping Company
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PPE	Personal Protective Equipment
PHEIC	Public Health Emergency of International Concern
SA	South Africa
SARB	South African Reserve Bank
SAIMI	South African International Maritime Institute
SAMSA	South African Maritime Safety Authority
SARS-COV	Severe Acute Respiratory Syndrome -Associated Coronavirus
SARS	Severe Acute Respiratory Syndrome

SOC	State Owned Company
TEU	Twenty Feet Equivalent Unit
TNPA	Transnet National Ports Authority
UNECA	United Nations Economic Commission for Africa
UNCTAD	United Nations Conference on Trade and Development
UK	United Kingdom
USA	United States of America
USD	United States Dollar
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
VTS	Vessel Traffic Services
WHO	World Health Organisation
WPSP	World Ports Sustainability Program
WTO	World Trade Organisation

CHAPTER 1
OVERVIEW OF THE STUDY

1.1. Introduction

According to estimates, the 1918 Spanish flu, a zoonotic virus, infected 500 million and killed 50 million people died worldwide (Statistics South Africa, 2020). In the twenty-first century, global pandemics are not uncommon. In 2002, Severe Acute Respiratory Syndrome (SARS) spread around the world. The Severe Acute Respiratory Syndrome -Associated Coronavirus (SARS-COV pandemic), which originated in China, was caused by a coronavirus that spread to 29 countries, infecting over 8000 people (Stats SA, 2020), and disrupting economies and international trade (Brahmbhatt, and Dutta, 2008).

The novel coronavirus that caused Coronavirus Disease 2019 (COVID-19) first emerged in the port city of Wuhan, China in December 2019 (The Maritime Executive, 2020), spreading sporadically throughout the world and killing millions (World Health Organisation, 2021). In March 2020, the World Health Organization (WHO) announced COVID-19 as a worldwide epidemic (Stats SA, 2020). There have been over 223022538 confirmed COVID-19 cases, with 4602882 deaths (WHO, 2021). Many nations implemented hard lockdowns to control the spread of COVID-19, negatively impacting global trade and Gross Domestic Product (GDP) (United Nations Conference on Trade and Development, 2020). The pandemic has spared no territory, causing a global health and economic catastrophe (UNCTAD, 2020).

The coronavirus (COVID-19) outbreak has had a global impact. Globally, the pandemic has had a significant impact on business. Economic and social turmoil also endangers the long-term livelihoods and well-being of millions of people, in addition to having a severe influence on public health (International Labour Organization, 2021). The pandemic is wreaking havoc on the world's labour markets, economies, businesses, and supply chains, resulting in severe commercial disruptions (ILO, 2021). While predicting the exact economic impact of the global coronavirus pandemic is impossible, research demonstrates that it had a highly detrimental effect on the world economy, with major economies losing a significant percentage of their GDP (World Bank, 2021). The pandemic has resulted in global GDP declines (Stats SA, 2020). According to Statista (2021), global gross domestic product (GDP) fell by 6.7% in 2020 as a result of the Coronavirus pandemic.

According to the International Labour Organization (ILO), (2021), the COVID-19 pandemic disrupted the global labour market on a never-before-seen scale. Moreover, 8.8% of all working hours worldwide in 2020 were lost, which translates to 255 million full-time jobs, compared to the fourth quarter of 2019. Global labour income fell by 8.3%, amounting to US$3.7 trillion, or 4.4% of global GDP (ILO, 2021). Working-hour losses are expected to be four times higher in 2020 than they were during the global financial crisis of 2009.

The maritime industry is critical to global logistics. Seaports handle approximately 90% of international trade (United Nations Conference on Trade and Development, 2018), accounting for 80% of total global trade volume and 70% of total global trade value (UNCTAD, 2020). The importance of maritime logistics in supply chain linkages cannot be overstated (UNCTAD, 2020). The COVID -19 pandemic has significantly impacted global trade flows (UNCTAD, 2020) and the maritime freight sector has been one of the most significant casualties (South African International Maritime Institute, 2020). Global maritime freight has decreased significantly, affecting a variety of businesses in the maritime trade sector (SAIMI, 2020).The entire maritime industry has been devastated by the lockdown's economic impact (Maritime Executive, 2020)

According to the TNPA (2020), the Port of Durban is a leading port in the Southern Hemisphere, with a reputation as one of the country's busiest ports. It handles the most seagoing traffic amongst South Africa's commercial seaports (TNPA, 2020; Gumede and Chasomeris, 2017; Meyiwa and Chasomeris, 2016; Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Each year, approximately 4000 vessels pass through the Port of Durban (TNPA, 2020). The Port of Durban is the TNPA's main container and breakbulk port, handling the majority of containers and breakbulk cargo (TNPA (2020). The Port of Durban is critical to South Africa's regional trade (Gumede and Chasomeris, 2016; Meyiwa and Chasomeris, 2016; Mthembu and Chasomeris, 2020; Mthembu and Chasomeris,2023a) and plays an important role in the country's economy (Mokone, 2016).

Marine operations in the port system are an important component of port operations (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris,2023a) because they are crucial to the flow of ships through ports and to the effective operation of ports (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). The efficiency of cargo flows is determined by the efficiency of marine operations (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris,2023a). Marine operations at the Port of Durban include marine

pilotage, vessel traffic control, towage services, mooring services, and fresh water, which all have a 24-hour a day and seven-days a week availability (Mthembu and Chasomeris, 2020). Port marine operations are not interrupted for any reason, and any disruption to the port system harms trade and the South African economy (Mthembu and Chasomeris, 2020).

The study aims to examine the impact of the COVID-19 Pandemic on marine operations at the Port of Durban. It seeks to determine what disruptions occurred as a result of the COVID-19 pandemic and the impact thereof on marine operations ability to marine services at the Port of Durban. The study will also provide lessons that can be applied in other South African seaports.

1.2. The aim of the study

The study aims to examine the impact of the COVID-19 pandemic on marine operations at the Port of Durban.

1.3. Background to the study

The maritime industry is critical to global logistics. Seaports handle approximately 90% of international trade (United Nations Conference on Trade and Development, 2018), accounting for 80% of total global trade volume and 70% of total global trade value (UNCTAD, 2020).

Due to the COVID-19 pandemic, The entire maritime industry has been devastated by the lockdown's economic impact (Maritime Executive, 2020), with the maritime freight sector being one of the most significant casualties (SAIMI, 2020). Global maritime freight has significantly declined, affecting various businesses within the maritime trade sector (SAIMI, 2020). The global maritime and port sector has experienced a financial crisis, significantly impacting global trade flows (UNCTAD, 2020).Global ports have reported a decrease in port activity due to the pandemic and the accompanying limitations (Notteboom and Pallis, 2020), with commercial seaport operations being negatively impacted (Mannan, Shaheen and Saha, 2021). Moreover, health and safety restrictions imposed to contain the pandemic have resulted in significant port and shipping interruptions (UNCTAD, 2020).

Ports were not immune to the unpredictable effects of the global pandemic, which were felt in other areas of the economy such as international trade and interconnected commercial sectors. According to Notteboom et al. (2020), the pandemic posed numerous challenges for the maritime industry, as it had a negative impact on the availability of marine employees in ports, with ports reporting a significant scarcity of marine employees (Notteboom et al., 2020). The pandemic had a negative impact on the availability of critical staff. Significant workforce

shortages, such as those in nautical and technical services, have been reported in several ports (Notteboom et al., 2020).

The absence of such critical personnel had a significant impact on how ports serviced ships and port efficiency (Notteboom et al., 2020). Moreover, ports reported up to 8% employee shortages in the vessel traffic control department (Notteboom et al., 2020). An essential function in marine operations, responsible for deploying marine resources at ports. Workforce disruptions in this department have a knock-on effect on the allocation and deployment of marine resources (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a). Due to COVID-19 safety protocols, a significant number of marine staff had to stay at home as they were considered high-risk and were not permitted to come to work (Notteboom et al., 2020). Furthermore, the COVID-19 pandemic required ports to implement strict safety protocols and hygiene measures on ships and employees in order to control the spread of COVID-19, resulting in minor and major disruptions (Notteboom et al., 2020).

Several global ports reported losses due to port and terminal closures (SAIMI, 2020). Sub-Saharan Africa experienced similar declines to international ports, with ports in the region reporting a -9.7% drop in port activity (Notteboom et al., 2020). Ports reported operating at 60% capacity (SAIMI, 2020), with a decrease in marine-related activity. As a result, trade flows have declined significantly (UNCTAD, 2020).

Port operations are critical in ensuring that goods are moved to South Africa's hinterland (TNPA, 2020), as well as ensuring that the country's capital and financial hub functions optimally. As South Africa's busiest port, The Port of Durban handles an average of 4000 vessels per year (TNPA, 2020). Crucial to Sub-Saharan trade and economy, the Port of Durban is known as the "Gateway to Africa" (Gumede and Chasomeris, 2016; Meyiwa and Chasomeris, 2016; (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a). South Africa, as an emerging market economy and member of the international trade community, requires efficient marine operation at its ports to facilitate imports and exports at the Port of Durban (Mthembu and Chasomeris, 2020).

Marine operations are an essential component of port operations (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Marne operations at ports play an important role in assisting vessel calls (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a), and they must operate with minimal disruptions in order to provide efficient service to vessels (Mthembu and Chasomeris, 2020; Mthembu and

Chasomeris, 2023b). The primary function of marine operations in a port is to ensure the safe navigation of vessels when they call at a port or disembark to continue their journey (Zhen, Wang, Wang and Qu 2018). It also plays an important role in cargo flow through ports, ensuring that ports run smoothly (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023b). The efficiency of marine operations determines cargo flow efficiency (Mthembu and Chasomeris, 2020). For the commercial seaport to be a preferred destination for shipping lines and international trade, marine operations at a port must operate effectively and efficiently (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a).

Inefficient port operations can have a negative impact on the economy, import and export business, and downstream job opportunities (Hsu, 2012). Hence, the role of marine operations in the Port of Durban has a direct impact on South Africa's Gross Domestic Product. South Africa, as an emerging market economy and member of the international trade community, requires an efficient marine operation to facilitate imports and exports at the Port of Durban (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023b).

Marine operations have faced numerous challenges over the years (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023b), with the impact of COVID-19 not yet visible in many sectors. This study will investigate how the COVID-19 pandemic has impacted marine operations in the Port of Durban. Interviewees' learnings, experiences and the collation and analyses of quantitative data will be collected, analysed and shared to support marine operations in South African ports.

1.4. Problem statement

The Port of Durban is a strategic port with the TNPA's largest marine operations workforce and marine fleet resources. As a result, any disruption to the Port of Durban has an impact on South Africa's port ecosystem as well as the country's economic performance (Gov, 2021). For long-term port operations, efficient goods movement and vessel turnaround times are critical (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Ports promote trade, but an inefficient port can stifle economic growth in a region. The COVID-19 epidemic has had a detrimental effect on the maritime industry and global port business (Notteboom *et al*., 2020), causing significant disruptions to ports, shipping and international trade flows (UNCTAD, 2018) and resulting in reduced vessel calls and a shortage of critical marine workers (Notteboom and Pallis, 2020). According to Notteboom and Pallis (2020), the COVID -19 pandemic has resulted in a decreased marine activity at ports.

The COVID -19 pandemic resulted in a -9.7% decline in vessel activity in Sub-Saharan ports, leading to decreased marine activity at ports (SAIMI, 2020), with some only operating at 60% of their capacity (SAIMI, 2020).

The pandemic had a significant impact on port nautical services as well as the availability of marine employees. Significant workforce shortages, such as those in nautical services, have been reported in several ports. Moreover, ports experienced a shortage of marine labour (Notteboom *et al*., 2020) because strict safety precautions prevented employees over the age of sixty from coming to work (Notteboom *et al*., 2020). The absence of these critical personnel had a significant impact on how ports serviced ships and port efficiency (Notteboom *et al*., 2020).

COVID-19 and its subsequent measures have severely disrupted the global maritime port industry, but little is known about how the pandemic has affected marine operations at the Port of Durban.

The purpose of this study is to examine the impact of the COVID-19 Pandemic on marine operations at the Port of Durban.

1.5. Research objectives

To address the critical research topic, the following research objectives were formulated:

a) To examine the impact of the Coronavirus pandemic on marine operations at the Port of Durban over the period January 2020 to December 2020.

1.6. Research questions

The study was guided by the following research questions:

a) What impact did the Coronavirus have on marine operations at the Port of Durban over the period January 2020 to December 2020?
b) What recommendations can be made to marine operations in an effort to mitigate the impact of Coronavirus-related disruptions at South African seaports?

1.7. Research methodology

Prior studies on the COVID-19 pandemic's local and worldwide effects on the maritime industry and the South African port system were thoroughly researched, which contributed to the development of the study's framework.

The study will be conducted using a mixed methods approach. Mixed methods blend quantitative and qualitative methods, allowing the researcher to link participants' opinions and measurable variables (Mokone, 2016). This strategy is the most ideal for exploring and evaluating the study problem and situation since the objective is to collect accurate and palpable scientific evidence in order to analyse and identify concerns and their impact on marine operations.

The qualitative research method is deductive and effective in exploring the impact of COVID-19 on marine operations (Mthembu, 2014). This method will aid in gaining a thorough grasp of the problem being researched and is also suited for looking into the problem at marine operations (Mthembu, 2014). A qualitative approach will be adopted due to its flexibility in data collection through interviews. Interviews will be recorded and transcribed, and the qualitative data generated analysed thematically using thematic analysis to identify, analyse and interpret the data. The study employs a non-probability judgemental purposive sampling approach. The study's participants were not chosen at random, as those chosen had expertise, and familiarity with marine operations. Employees of marine operations who play a critical role in the operations and have expert knowledge in the industry are invited to participate in the study and share their experiences and knowledge, which will help to answer the research questions. The researcher conducted 15 to 30 minute open-ended semi-structured interviews with a total of fifteen marine operations employees. To encourage participants to speak freely during the interview process, open-ended questions were used.

Component control and numerical nature define quantitative research (Newman, 2014). A statistical method will further suffice for this investigation of marine operations. Secondary data about marine operations operational performance on tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism rates, number of vessels water services attended to was also examined in order to observe what disruptions marine operations experienced during the onset of the COVID-19 pandemic.

Marine operations operational performance data on tug availability, tug utilisation, tug deployment, berthing deployment, marine employee absenteeism, and number of vessels attended to (water services) was sourced from Transnet’s database and examined using descriptive statistics. Data was examined to identify trends over the study period, specifically between January 2020 and December 2020. Data was presented in a graphical form, providing a visual representation of the quantitative data collected.

Triangulation is commonly used to describe research that employs two or more methods, sometimes known as mixed methods. Using both quantitative and qualitative methodologies to answer a specific research question (Heale and Forbes, 2013). For the purposes of this study, Triangulation was employed to corroborate suggested findings and to check the completeness of data research, which involves two independent data-gathering methods: qualitative and quantitative. The combining of findings from two or more rigorous methodologies offers a more comprehensive perspective of the outcome, with the goal of corroborating the findings and increasing the validity and credibility.

There have been few studies on the impact of man-made and natural disasters on marine operations. However, evidence suggests that there is a growing interest in maritime logistics around this subject in order to build port resilience and develop business continuity plans to prepare for future disruptions.

1.8. Significance of the study

This study is critical in several ways. Firstly, it aims to identify what disruptions marine operations faced and what impact these disruptions had on marine operations at the Port of Durban. Understanding these disruptions and how they affect marine operations at ports can help the industry develop plans to protect itself from future disruptions. Import and export firms, trade, employment and the South African economy can all benefit from an efficient, uninterrupted marine operations at the Port of Durban (Mthembu and Chasomeris, 2020).

Ports play an important role in promoting international supply chain trade (International Transport Forum Report, 2013). Efficient port operations support employment and any disruption could have a significant impact on South Africa (Gov, 2021). Ports have a direct impact on economic growth and international trade (UNCTAD, (2018). As the backbone of the nation's commercial port system, South African ports play a significant role in the world's nautical community (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Commercial ports in South Africa are essential to the country's economic success (TNPA, 2020). Since the majority of products transit through South Africa's seaports, the country's economic development is entirely dependent on a well-functioning port (TNPA, 2020).

1.9. Structure of the study

The following section summarises and briefly describes each chapter's content:

Chapter 1: Introduction to the research

This chapter contains an introduction to the study, as well as a brief discussion of the problem statement, the significance of the study, and the research questions. This chapter deduces the research methodology used in this study and outlines the subsequent chapters. It closes by providing a summary of the chapter.

Chapter 2: Literature review

The second chapter examines scholarly literature relevant to the study and includes literature reviews on the COVID-19 pandemic, its impact on global maritime trade and ports; as well as the impact on the South African economy and marine operations. An overview of the TNPA, as well as the South African commercial ports and maritime industry, is included.

Chapter 3: Research design and methodology

This chapter presents the methodology chosen for this study and describes the research strategy used to carry out the study. The research methodology, target population, sampling design and data collection procedures, data analysis plans, and ethical considerations are presented.

Chapter 4: Presentation and discussion of data

Chapter Four presents and discusses findings from the primary and secondary data gathered through interviews and observations. The research questions, aims and objectives guide the analyses. The data is analysed based on themes that emerge from data analysis, which serves as the foundation for recommendations.

Chapter 5: Conclusion and recommendations

The final chapter concludes the study, assesses the achievement of the research objectives, identifies the study's limitations, and makes recommendations for future research.

1.10. Summary of chapter

This chapter provided the background and context for the study, examining the impact of COVID-19 on marine operations at the Port of Durban. The research objectives and questions were outlined, as well as the methodology used to collect data and analyse it. The following chapter provides a literature review of various aspects of the impact of COVID-19 and the subsequent pandemic.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The COVID-19 pandemic has spared no territory, causing an economic catastrophe. This chapter provides a topical and thematic review of the literature on the worldwide and domestic impact of the COVID-19 pandemic. The chapter presents extant literature on the COVID-19 pandemic and its impact on the marine industry. Section 2.2 to section 2.16 provides an overview of the COVID-19 pandemic and its impact on global economies, global trade, and international maritime commerce. Section 2.17 to section 2.25 reviews the academic literature on the impact of the Covid-19 pandemic on the South African economy, employment, and marine trade sector. Section 2.26 to section 2.29 provides a theoretical context and explores ports in South Africa, notably marine activities in the Port of Durban. Section 2.30 draws some concluding remarks on the impact of the COVID-19 pandemic.

2.2 Pandemics

Pandemics have emerged and spread on numerous occasions throughout human history (Piret and Boivin, 2021). As a result of encroachment on previously undisturbed habitats, ever-expanding cities, larger trading territories, climate change and increased human-animal interaction through various forms of trade, the transmission of zoonotic diseases has significantly increased, contributing to the emergence and spread of infectious diseases with the potential to cause pandemics.

Table 2.1 Timeline of pandemics in the last century

Year/s	***Pandemic***
1918 -1919	Spanish Flu
1957- 1959	Asian Flu
1962-ongoing	Cholera Pandemic
1968-1970	Hong Kong Flu
2002-2003	Severe Acute Respiratory Syndrome (SARS)
2009-2010	Swine Flu
2015 –Ongoing	Middle East Respiratory Syndrome (MERS)
2019-Ongoing	COVID-19

Source: Piet *et al*. (2021)

2.3 Coronavirus

In December 2019, a cluster of people with severe pneumonia cases of unknown cause was observed in Wuhan, Hubei Province, China (Cucinotta and Vanelli, 2020). In the weeks that followed, a significant number of Chinese residents developed symptoms of atypical pneumonia, with some being hospitalised and others dying. According to Priyadarshini *et al*. (2020), the Novel Coronavirus is the most recent infection to cause the current global pandemic. The virus has been identified as a novel type of virus (Priyadarshini *et al*., 2020). According to researchers (Cucinotta and Vanelli, 2020), the novel coronavirus, later dubbed SARS-COV 2, was the source of these infections. The coronavirus is a zoonotic disease that belongs to a family of viruses that is a causative agent in Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), according to Priyadarshini *et al*. (2020).

With more than 80 000 confirmed cases worldwide as at February 28, 2020, the World Health Organization (WHO) proclaimed the SARS-COV2 pandemic a Public Health Emergency of International Concern (PHEIC) on January 30, 2020 (Vanelli and Cuccinotta (2020). The World Health Organization labelled the COVID-19 novel coronavirus a global pandemic on March 11, 2020 (Vanelli and Cucinotta, 2020). Individuals with mild respiratory symptoms were advised to isolate themselves and maintain a social distance (WHO, 2020). There are no recognised risk factors for severe illness, according to Cucinotta and Vanelli (2020). However, older adults and those with co-morbidities are the most vulnerable. The new Coronavirus frequently mimics a common cold, with many infected people experiencing upper respiratory disease. Furthermore, the virus causes symptoms such as pneumonia, fever, lethargy, and a dry cough (Cucinotta and Vanelli, 2020).

To reduce the risk of infection and delay the spread of the virus, WHO authorities recommended avoiding close contact with those who were sick; maintaining one's personal hygiene; washing one's hands with soap and water, or, if this was not available, using a hand sanitizer with 60% alcohol (Cucinotta and Vanelli, 2020). The introduction of this new virus had a significant impact on society in a short period of time, and the fear of COVID -19 causing hospitalisation and deaths became a focal point of public concern (Cucinotta and Vanelli, 2020).

2.4 The global economic impact of the Coronavirus

The COVID -19 pandemic, which began in mid-March 2020, precipitated the world's second disaster since the global financial crisis of 2009. Thus far, COVID-19 has caused a global pandemic (SAIMI, 2020 and WHO, 2020), rapidly spreading throughout Europe and the rest of the world. The virus has resulted in a public health disaster as well as a global economic downturn (Mannan, Shaheen, and Saha, 2021). The COVID-19 pandemic has infected millions of people worldwide, resulting in deaths and disruptions to a variety of industries (Priyadarshini *et al*., 2020). Countries around the world have taken drastic measures to combat the spread of COVID-19 (Maritime Executive, 2020). As a result of such precautions, countries implemented strict lockdown procedures to restrict people's movement in order to prevent the virus from spreading.

These lockdowns imposed severe restrictions on movement and commercial activity (SAIMI, 2020). As governments attempted to halt the spread of COVID-19, industries were forced to halt production due to the implementation of stringent health and safety regulations. The COVID-19 pandemic has wreaked havoc on both the demand and supply sides of the global economy. In addition, COVID-19 infections harmed the supply of goods by causing lower labour and productivity, as well as travel restrictions, social distancing and business closures. Income and job losses caused by the pandemic reduced household consumption and private sector investment, coupled with deaths and dwindling prospects, all of which had a negative impact on the demand side of economies (Vitenu-Sackey and Barfi, 2021). The emergence of the COVID-19 pandemic, which has no end in sight, has slowed and reduced global economic activity, significantly disrupting global supply chains, marine trade (SAIMI, 2020), ports activity and international trade (Notteboom and Pallis, (2020).

The world has never seen such massive disruption, with the consequences wreaking havoc on many economies (World Bank, 2020). While the pandemic is a public health emergency, the socio-economic consequences are severe, having directly affected lives and economies (Vitenu-Sackey *et al*., 2021). Due the global economic structure, the pandemic's impact differs from region to region. However, it is very likely that it will exacerbate global inequality and poverty (Vitenu-Sackey *et al*., 2021). In addition, harsh non-pharmaceutical measures in order to stop the COVID-19 virus from spreading, such as travel restrictions, lockdowns, quarantines, social isolation and the closure of public business areas, have harmed global economic development (Gautam and Hens, 2020). The strict actions taken by states to limit the spread of COVID-19 have harmed economic activity and livelihoods.

According to Sarkodie and Owusu (2020), the strict non-pharmaceutical procedures used to prevent the virus's spread, such as lockdowns, have had disastrous consequences for humanity.

Outdoor congregation restrictions, travel restrictions and attendance restrictions at outdoor events and tourist destinations have all had a negative impact on production levels. Most tourism-related businesses saw a nearly 90% drop in revenue (Vitenu-Sackey *et al*., 2021). Furthermore, businesses that rely on social gatherings, such as the entertainment and tourism industries, experienced downturns, with many of their employees losing their jobs as a result of job redundancies and retrenchments, resulting in a drop in previous workforce consumption and a reduction in their spending power. Many businesses were forced to close as a result (Vitenu-Sackey *et al*., 2021).

The COVID-19 pandemic has exacerbated economic consequences, as many citizens have died as a result of the pandemic, and others have lost their jobs as a result of company failures and disruptions in supply and demand in economies. However, it is critical to emphasise that the global pandemic is a health and socio-economic crisis that threatens global sustainability. This may be seen in developed economies where robust healthcare systems are rapidly deteriorating as a result of the virus's spread (Vitenu-Sackey *et al*., 2021). The pandemic has also exacerbated the plight of the most vulnerable and marginalised residents, including the elderly, people with special needs and youth, who are now living in appalling conditions.

Those who do not have access to shelters, namely refugees, migrants and displaced people, bear the brunt of the pandemic and are expected to suffer even more (Vitenu-Sackey *et al*., 2021). These difficulties are primarily the result of job loss, travel restrictions and the inability to support themselves. While the pandemic is undoubtedly wreaking havoc on the economy, it is also a social issue that, in the long-run, will result in an ever-widening inequality gap (Vitenu-Sackey *et al*., 2021).

Despite the lack of specific evidence on the economic consequences of the global pandemic, the pandemic, according to analysts, has significantly hurt the world economy. Several developed nations may have lost over 2.4% of their GDP in 2020, according to early projections. Several analysts lowered their projections for the world economy's growth from 3.0% to 2.40%. With a global GDP of USD 86 trillion in 2019, it follows that a 0.4% decline in economic growth would cause a loss of economic output of USD 3.5 trillion. Despite various states' monetary and fiscal policy interventions, global financial forecasts (World Bank, 2020) indicated that global GDP would fall by 5.2%. Regardless, the post-pandemic aftermath is expected to have a lasting impact on the global economy and harm human capital development

as a result of job losses, the breakdown of international supply chains, trade ties and lower investment (World Bank, 2020). However, these assumptions were made before COVID-19 spread globally and before states imposed strict controls on the disease's spread. Global equity markets have plummeted since then (Vitenu-Sackey *et al*., 2021). On March 16, 2020, the US Dow Jones saw a plunge of nearly 3000 points, shattering the previous record of 2300 points established just days before (Vitenu-Sackey *et al*., 2021).

While some studies claim that COVID-19 control mechanisms aided in the establishment of healthcare programs, the pandemic and its stringent control measures have caused havoc (Vitenu-Sackey *et al*., 2021). However, it has taught the world that economic relief programs are required to counteract the gradual decline of economic development. Extreme uncertainty about the pandemic's impact, particularly its scope and duration, could set off a vicious cycle of financial strain and a drop in business and consumer confidence (Vitenu-Sackey *et al*., 2021), resulting in job losses and reduced investment.

According to (Vitenu-Sackey *et al*., 2021), the COVID-19 pandemic has created more uncertainty than any other in history. In contrast to SARS, which caused widespread concern in 2002/2003, the COVID-19 pandemic far outstrips SARS's levels of uncertainty, with COVID-19 levels far exceeding those of any other pandemic in history.

Figure 2.1 depicts pandemics from Q1 1996 to Q3 2020, as well as the levels of uncertainty since the SARS outbreak in 2002. The COVID-19 pandemic, as previously stated, far outweighs any other level of uncertainty tracked.

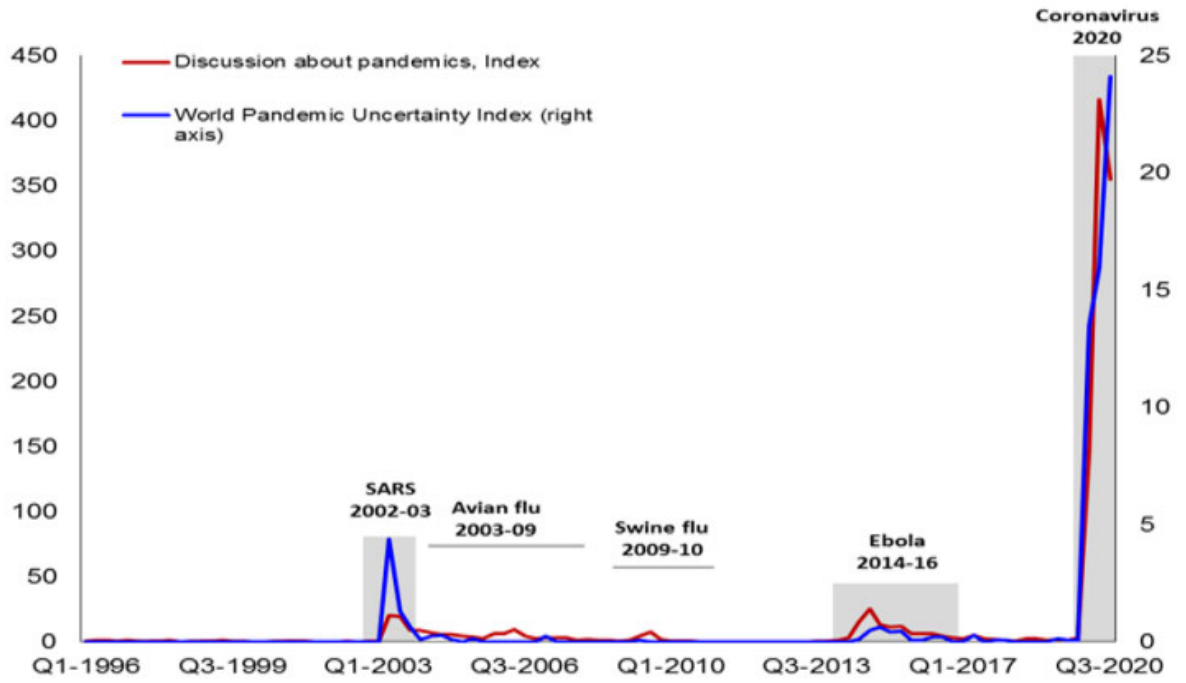

Figure 2.1 World Pandemic Uncertainty Index

Source: Vitenu-Sackey *et al* (2021, p. 34)

As a result, many nations have predicted decreased GDP and economic growth. The IMF (2020) anticipated that the world economy will contract by 3% by the end of 2020, which would be significantly worse than the global financial crisis of 2008. Notably, global economic behemoths fared the worst economically in the pandemic. GDP losses of 5.9%, 6.5%, 7.0%, 7.2% and 5.4% were expected in the United States of America (USA), the United Kingdom (UK), Germany, France and Japan in 2020, according to the International Monetary Fund (IMF, 2020).

As a result of the outbreak, states reduced the economic impact of the pandemic on their citizens. While it will always be difficult to mitigate the pandemic's negative impact on the global economy, countries established economic measures to assist their citizens, such as financial support for economies through stimulus packages (Vitenu-Sackey *et al*., 2021). These financial responses were significant economic stimulus programmes put in place by governments around the world to combat the economic downturn caused by the COVID-19 pandemic (Vitenu-Sackey *et al*., 2021).

Figure 2.2 depicts the government's' income support during the COVID-19 pandemic to mitigate the impact of the Coronavirus on citizens. Salaries, direct cash payments and basic income grants were used to support those who had lost their jobs.

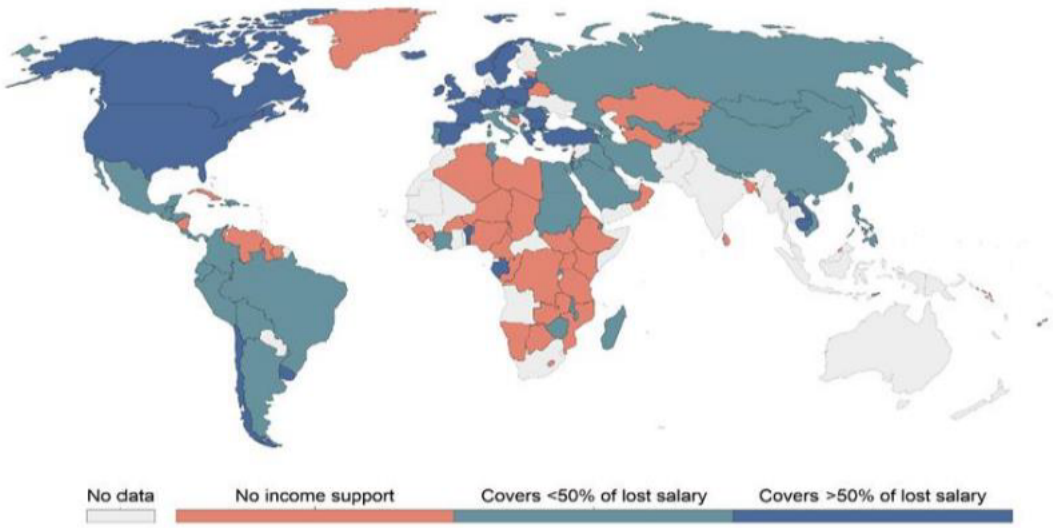

Figure 2.2 Government income support during the COVID -19 pandemic, December 2020

Source: Vitenu-Sackey *et al*., (2021, p. 36)

The majority of state stimulus packages included fiscal and monetary policies aimed primarily at the manufacturing sector, household consumption, the servicing sector and healthcare services, as well as liquidity support for the banking sector, funding allocations to households and businesses, and policies aimed at reducing the impact of layoffs (Elgin, Basbug, Yalaman, 2020; (Vitenu-Sackey *et al*., 2021). Notably, each country's response to the pandemic influenced the global stimulus response and forms of stimulation (Capano, Howlett, Jarvis, Ramesh and Goyal, 2020; (Vitenu-Sackey *et al*., 2021).

Figure 2.3 shows government economic stimulus packages as a percentage of GDP, with wealthier states providing significantly more stimulus than poorer states. Notably, as previously stated, the impact of COVID-19 negatively impacted wealthier nations far worse than other countries, despite the fact that these countries' stimulus packages were much larger. Notably, economic constraints and sovereign credit ratings influenced a country's choice of fiscal and monetary stimulus packages to combat economic collapse (Vitenu-Sackey *et al*., 2021).

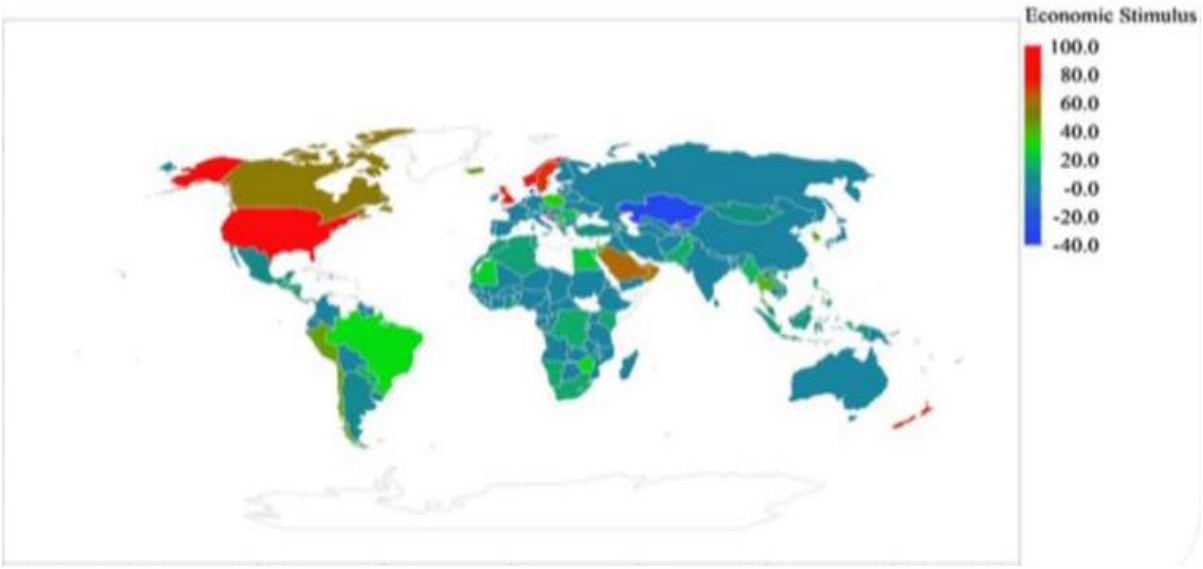

Figure 2.3 Economic stimulus packages as a percentage of a country's GDP

Source: Vitenu-Sackey *et al*., (2021, p.36)

Bahrain (31.30%), Malta (25.61%), Austria (25.11), Luxembourg (22.91%), France (22.59%), Oman (22.59%), Belgium (19.61%), Sweden (18.65%), Germany (17.29%) and Malaysia (16.42%) were amongst the top ten states with the most significant fiscal stimulus packages as a percentage of GDP (Vitenu-Sackey *et al*., 2021).

The COVID-19 pandemic and subsequent lockdowns had an inverse effect on poverty alleviation. In particular, pandemic-related lockdowns harmed human capital development by causing job losses, education interruptions, healthcare deterioration and pressure on healthcare systems, as well as the loss of business income (Vitenu-Sackey *et al*., 2021). Furthermore, decreases in state revenues as a result of business failures and job losses in the formal and informal employment sectors harmed human development, owing in part to lower investment in education and healthcare, suffocating a favourable environment for employment and poverty reduction (Vitenu-Sackey *et al*., 2021)

The COVID-19 pandemic had a wide-ranging impact on economic development due to the stringent measures put in place to prevent the virus from spreading. According to the World Bank (2020), increased investment should be focused on boosting human development, particularly in education, health and employment, which will lead to increased household consumption and private investment, propelling economic growth. Furthermore, states should create more significant fiscal space through recovery-oriented policies and a coordinated and broad-based international strategy (Vitenu-Sackey *et al*., 2021).

Lockdowns, personal hygiene, social distancing and the use of personal protective equipment are all safety procedures that can save lives. The COVID-19 pandemic harms businesses, society and the most vulnerable. Therefore, states and legislators must act quickly to implement policies that will ensure a rapid and long-term recovery (Vitenu-Sackey *et al*., 2021). If pragmatic and socio-economic measures fail, the pandemic's shock will worsen, jeopardising people's lives and causing global problems (United Nations Development Programme, 2020).

2.5 Impact of the Coronavirus pandemic on Global International Trade

The COVID-19 pandemic triggered a global disaster that has significantly impacted international trade (Notteboom and Pallis, 2021). In early 2020, China implemented one of the world's strictest lockdowns in response to the COVID -19 pandemic. The resulting disruptions in China's supply chain caused global supply chain trade shocks, harming manufacturing and workers (Notteboom and Pallis, 2021). The world faced global demand shocks in March 2020 as a result of COVID-19-related worldwide disruptions, resulting in a drop in global derived demand due to weaker consumer demand (Notteboom and Pallis, 2021). COVID-19 disruptions, such as lockdowns, reduced consumer bases and reduced workforces, caused consumption patterns to alter (Notteboom and Pallis, 2021). Consumer demand was further reduced by the suspension of travel and tourism activities, the closure of entertainment businesses, and the imposition of stringent controls on the restaurant industry (Notteboom and Pallis, 2021).

2.6 Impact of the Coronavirus pandemic on Maritime Commerce

The maritime industry is critical to global logistics. Seaports handle approximately 90% of international trade (United Nations Conference on Trade and Development, 2018), accounting for 80% of total global trade volume and 70% of total global trade value (UNCTAD, 2020). The importance of maritime logistics in supply chain linkages cannot be over-stated (UNCTAD, 2020). However, the COVID-19 pandemic has significantly impacted global trade flows (UNCTAD, 2020). The maritime freight sector has been one of the most significant casualties (SAIMI, 2020). A number of enterprises in the marine trade sector have been impacted by the sharp fall in global maritime freight (SAIMI, 2020). Fewer cargo ships are visiting ports due to decreased demand for cargo, which results in fewer shipments at several ports (SAIMI, 2020). The entire maritime industry has been devastated by the lockdown's economic impact (Maritime executive, 2020). Moreover, health and safety restrictions imposed

to contain the pandemic have resulted in significant port and shipping interruptions (UNCTAD, 2020).

2.7 Impact of the Coronavirus pandemic on commercial seaports

According to Mannan *et al*. (2021), a port of call is an intermediate port where ships usually stop for supplies, repairs and cargo discharge or transhipment. Harbours are frequently used as logistical hubs, establishing financial and commercial connections with cities as well as global supply chains (World Bank, 2007). As the demand for goods rises to keep economies afloat, port-related services are in high demand (Xing *et al*., 2018). Harbours are an important link between land-based and maritime logistics because they provide a safe environment for ships to load and unload cargo (Notteboom, 2017). Ports, as gateways to global markets, play a critical role in facilitating international trade (International Transport Forum Report, 2013).

Seaports handle approximately 90% of international trade (UNCTAD, 2018), accounting for 80% of total global trade volume and 70% of total global trade value (United Nations Conference on Trade and Development, 2020). Ports, which are considered the economic heart of a region, facilitate commodity movement, with a 10% increase in commercial seaport throughput translating to a 6% to 20% increase in the region's GDP (Mannan *et al*., 2021). Any disruption or disturbance in trade affects a country's harbour activity (Notteboom *et al*., 2020), with losses in sea traffic negatively influencing port expansion and related port activity (Mannan *et al*., 2021). Ports, regardless of cargo, serve as transfer points for commodities and are critical to global supply chain management (Mannan *et al*., 2021).

Kavirathna, Kawasaki, Hanaoka and Matsuda (2018) define waiting time as the time vessels must wait at anchorage before being allowed to enter a port, as well as vessel turnaround time, which includes time spent in the harbour for operations. Port users consider vessel waiting times when deciding whether to stop at a particular port. As a result, importers, exporters and vessel operators prefer ports with shorter ship waiting times.

Ports were not immune to the unpredictable effects of the global pandemic, which were felt in other areas of the economy, such as international trade and interconnected commercial sectors. Due to the COVID-19 pandemic, the global maritime and port sector has experienced a financial crisis (UNCTAD, 2020), with commercial seaport operations being negatively impacted (Mannan *et al*., 2021). Global ports have reported a decrease in the number of vessel calls as a result of the pandemic and the resulting restrictions (Notteboom and Pallis, 2020). Vessel calls were reported to be 8.7% lower in mid-2020 compared to 1.1 million in mid-2019

(UNCTAD, 2020), with several global ports reporting losses due to port and terminal closures (SAIMI, 2020). Sub-Saharan Africa experienced similar declines to international ports, with ports in the region reporting a -9.7% drop in vessel calls (Notteboom *et al*., 2020). Ports reported operating at 60% capacity (SAIMI, 2020), with a decrease in maritime-related activity. As a result, trade flows have declined significantly (UNCTAD, 2020).

According to SAIMI (2020), more than 40% of global ports suffered moderate declines in port activity of 5% to 25%, with some ports experiencing declines of more than 25% in the number of vessel calls at ports. According to the International Association of Ports and Harbours-World Ports Sustainability Program (IAPH-WPSP) Impact Barometer (2020), several variables reduced vessel calls at ports around the world due to the COVID-19 pandemic. Factors such as decreased cargo volumes and ports seeing vessel liner itineraries being postponed, as well as the closure of European and Asian destination ports, hurt some commercial seaports. Furthermore, state-imposed restrictions and declarations of a state of emergency stifled economic activity at several ports worldwide (Mannan *et al*., 2021).

Chittagong Port, according to Mannan *et al*. (2021), is the nerve centre of Bangladesh's economy, handling nearly 90% of the country's trade. The port had reached a peak in the number of twenty-foot units handled prior to the COVID-19 outbreak. However, the pandemic has had a negative impact on the port. Since January 2020, Chittagong port's exports and imports have decreased. The port saw a significant decrease in port trade in April 2020, specifically 46.76% in containers (TEUs) and 27.59% in breakbulk.

Ports around the world implemented several protocols to control the spread of the COVID-19 virus. In most cases, ships were required to provide sanitary certificates, and additional regulations required crew and ground staff to make health declarations. Sailors were also confronted with the lack of landing permissions and sanitary inspections (Mannan *et al*., 2021). Personnel were required to wear face-masks, face shields, goggles and use hand sanitisers, as well as practice social distancing and personal hygiene in order to limit the spread of COVID-19.

Although some ports permitted limited crew changes, the majority of ports mandated a 14-day quarantine period for suspected vessels (Notteboom and Pallis, 2020). Ports imposed 14-day quarantine periods and dedicated quarantine anchorages for ships entering and trading in areas with high infection rates (Mannan *et al*., 2021). As a result, berthing delays were severe, turnaround times were longer than usual, and vessels stopping at ports were required to submit

medical declaration documents and obligatory health certificates, in addition to other COVID-19 regulations. A decline in cargo volumes exacerbated the drop in vessel calls (Mannan *et al*., 2021). Moreover, the COVID-19 pandemic exposed flaws in maritime networks and port efficiency (Mannan *et al*., 2021). The impact of the pandemic has been felt in cargo volumes and port marine services (Maritime executive, 2020). To date, there has been little research into the effects of COVID-19 on port operations (Mannan *et al*., 2021).

2.8 Impact of the Coronavirus pandemic on vessel calls

According to the International Association of Ports and Harbours-World Ports Sustainability Programme: Port Economic Barometer (2021), results from a survey-based analysis of the impact of COVID -19 on global harbours from April to September 2020 show that 4% of ports worldwide experienced more than 5% vessel call drops when compared to normal conditions. More than half of all global ports reported a 50% decrease in container vessel calls between April 2020 and July 2020. Nonetheless, the situation had improved to a low of 28% by September 2020 (Notteboom *et al*., 2020). In comparison to the same period last year, 56% of ports reported container vessel calls, and 16% of harbours reported increased container vessel activity, which was significantly lower (8%) during the April to July 2020 period (Notteboom *et al*., 2020). The COVID-19 pandemic, according to the report, also impacted the ports of call of other vessels. According to Notteboom *et al*. (2020) , vessel calls were severely impacted not only by the COVID-19 pandemic but also by the economic crisis, trade conflicts and restrictions, which meant that even when ports were open for business, only critical cargo was processed at some ports (Notteboom *et al*., 2020).

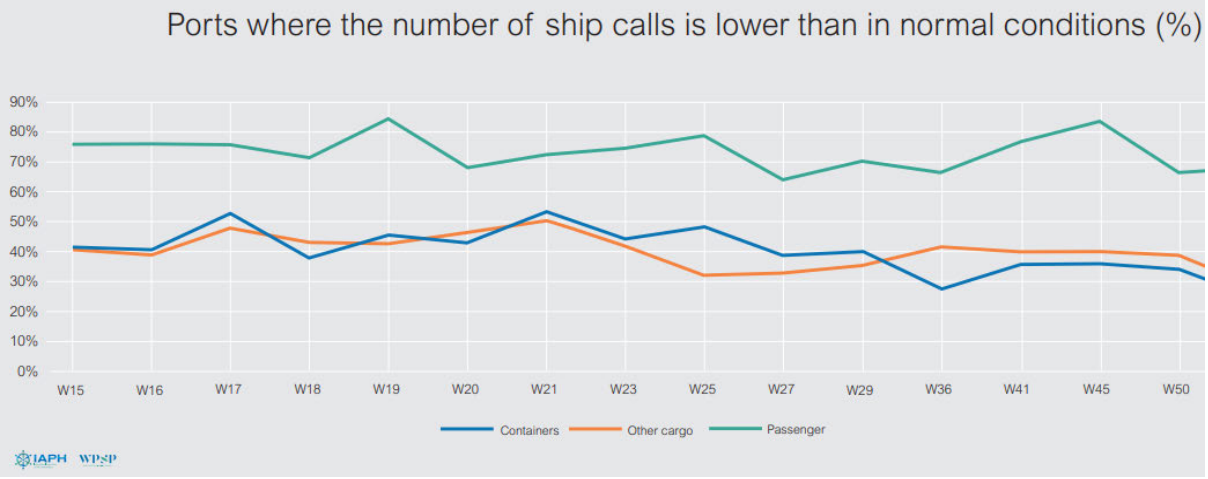

Figure 2.4 Declines in vessel calls compared to normal conditions

Source: Notteboom and Pallis (2020, p.7)

2.9 Impact of the Coronavirus pandemic: Vessel restrictions and delays at the port

As a result of the COVID-19 pandemic, Port maritime operators placed restrictions on vessels in order to protect crews (Notteboom *et al*., 2020). Furthermore, Port authorities imposed restrictions on ships visiting their ports in order to ensure adherence to local protocols and avoid the spread of infection, which could disrupt terminal performance (Notteboom *et al*., 2020). Port authorities also inspected ships that called at ports while they were at anchorage or docked (Notteboom *et al*., 2020). The approval for berthing vessels was only granted after the vessel had been cleared by various interdepartmental structures (Notteboom *et al*., 2020). Many ports reported minor delays (Notteboom *et al*., 2020). Amongst the observed delays were changes to port call procedures, disruptions of port services, hygiene practices, social distancing and sanitary precautions, as well as port staff restrictions to control the spread of COVID-19. Port disruptions were significantly higher in early 2020, at 92%. However, nearly 80% of global ports reported stabilising port activity by the end of 2020, with fewer delays and disruptions (Notteboom *et al*., 2020). Port employees returned to work in greater numbers than usual by the end of 2020, and fewer vessels at ports than usual aided in avoiding port delays (Notteboom *et al*.,2020).

2.10 Impact of the Coronavirus pandemic on port workers

According to Borton and Turnball (2002), Port workers are employees who work in the harbour under the supervision of port authorities. These people are considered low-skilled and perform manual port work (Van Hooydonk, 2014). They are frequently hired on a permanent or contract basis by the port authority to perform work in the harbour (Mannan *et al*., 2021). COVID -19 had a significantly negative impact on port personnel (Mannan *et al*., 2021). During the world's stringent lockdowns in early 2020, many nations needed to maintain a continuous supply of essential items such as medications, food and critical components for manufacturing in-demand goods (Mannan *et al*., 2021). However, under lockdown laws, only essential personnel were permitted to move freely. As a result, several ports designated key personnel as essential employees, allowing them to come to ports and provide services to port users, vessels and other stakeholders. According to Mannan *et al*. (2021), port employees were recognised as essential workers to gain priority access to movement during harsh lockdowns because they were critical to sustaining port operations throughout the pandemic. The majority of these individuals' skills required them to be present and on-site to ensure that operations were carried out. Many of those whose skills could not be provided remotely, thus physical presence in the port was critical to the movement of essential cargo. These employees work in the maritime industry

(marine pilots, vessel traffic controllers, towage and mooring services). These divisions were deemed necessary because they all played a role in delivering and servicing ships into ports.

According to Mannan *et al*. (2021), when the authorities enacted lockdowns and other related regulations, one-third of the world's ports experienced a labour shortage. The marine departments, particularly those concerned with pilotage, towage and mooring services, experienced the greatest reduction in personnel (Mannan *et al*., 2021). Mannan *et al*. (2021) also states that the port of Chittagong experienced a labour shortage. As a result, in order to maintain commercial stability, the port implemented shift work, with one week on and two weeks off. To avoid massive quarantines of maritime departments, ports organised shift work, and employees were encouraged to maintain social distancing and use COVID-19 personal protective equipment to prevent the virus from spreading (Mannan *et al*., 2021). Shifts were also established to accommodate quarantine periods. Furthermore, the port authority reduced the number of people utilised in the port. It altered how the department operated, such as moving marine-related billing documentation to the internet. The port authority also provided employees with COVID-19 safety equipment to ensure their safety. Additionally, the port authority added COVID-19 testing booths as well as COVID-19 centres with oxygen supplies (Mannan *et al*., 2021). According to Mannan *et al*. (2021), the Chittagong Port Marine Services Department recommended that in order to protect marine services staff, the department provide sanitisers, personal protective equipment, gloves, and goggles, as well as strict social distancing, claiming that the precautions were sufficient to protect its employees. Clients at the Chittagong Port, on the other hand, complained that these procedures hampered the port's productivity (Mannan *et al*., 2021).

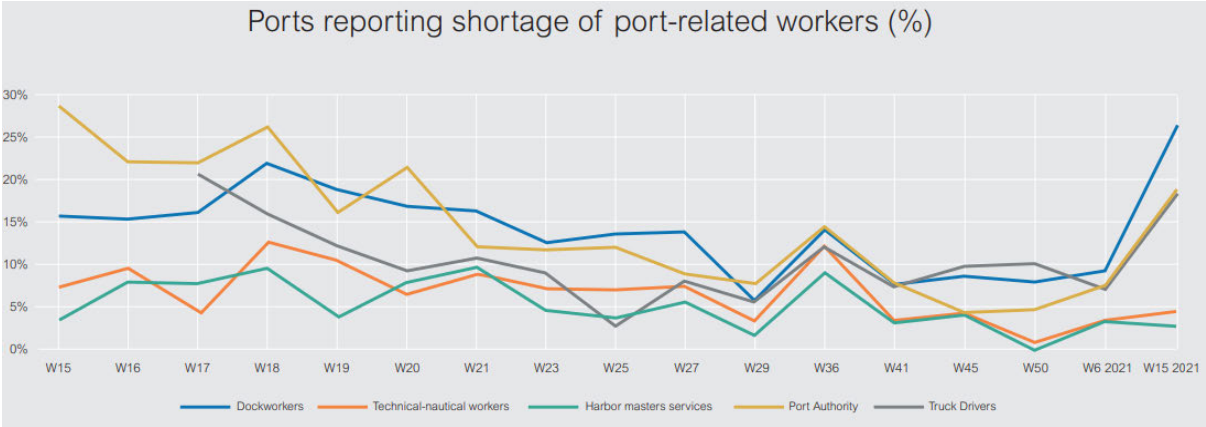

Figure 2.5 Ports reporting a shortage of workers

Source: Notteboom and Pallis (2021, p.6)

2.11 Port maritime employees

The COVID-19 pandemic impacted maritime services and the availability of marine services personnel in ports around the world (Notteboom *et al*., 2020). Port employee shortages ranged from 13% to 22%, with some ports reporting significant shortages (Notteboom *et al*., 2020). During the first few weeks of the global pandemic, ports reported a decrease in the availability of port workers at all levels of operation (Notteboom *et al*., 2020). According to the IAPH - 2020 report (Notteboom *et al*., 2020), one-third of the ports surveyed reported difficulties in employee availability as a result of the COVID-19 pandemic, and 6% of harbours worldwide reported marine employee shortages, which peaked at 22% at the start of the pandemic. Almost 30% of ports, ranging from 22% to 26%, cited a lack of marine-related labour as a barrier (Notteboom *et al*., 2020). According to an IAPH (2020) survey, 10% of global ports experienced moderate to severe shortages in the provision of nautical services, as evidenced by a lack of maritime services staff (Marine pilotage, tug services and berthing services) (Notteboom *et al*., 2020).

COVID-19-related health and safety procedures implemented to combat the pandemic reduced the number of maritime staff available at seaports. Additionally, COVID-19 control measures impacted the availability of marine employees at ports (Notteboom *et al*., 2020). Some ports experienced minor losses, while others experienced significant decreases in the availability of marine-related professionals. Furthermore, due to state-imposed lockdowns and COVID-19 safety regulations such as age restrictions; quarantining of individuals with co-morbidities; and limits on the number of people who could be present in a given location, only essential personnel were permitted to report to work (Notteboom *et al*., 2020).

These COVID-19 regulations had a significant impact on port marine service departments. Absences of port employees, such as operational maritime staff, were attributed to people staying at home since the beginning of the pandemic. As a result, ports faced an increase in employee shortages (Notteboom *et al*., 2020). The majority of the decreases were attributed to the Harbour Master nautical services department, as well as staff absenteeism (Notteboom *et al*., 2020). The provision of vessel traffic services management was hampered and complicated by a lack of marine employees in the Harbour Master's department, which was severely hampered and complicated by employee shortages caused by the pandemic (Notteboom *et al*., 2020).

According to certain harbours, many employees did not return to work due to reduced port activity and work (Notteboom *et al*., 2020). Working in harbours was subject to stringent safety regulations, with some limiting attendance to maritime employees under the age of sixty (Notteboom *et al*., 2020). However, some ports reported only minor staff shortages (Notteboom *et al*., 2020), which were minor in comparison to the large number of ports studied. Furthermore, port marine labour availability levels fluctuated throughout the pandemic, implying that the degree of influence restricting a port's ability to operate efficiently was limited (Notteboom *et al*., 2020). The situation improved as employees returned to work. According to the IAPH WPSP (2020) survey results, moderate shortages of marine employees have begun to materialise, with 13% of ports reporting that shortages have been handled.

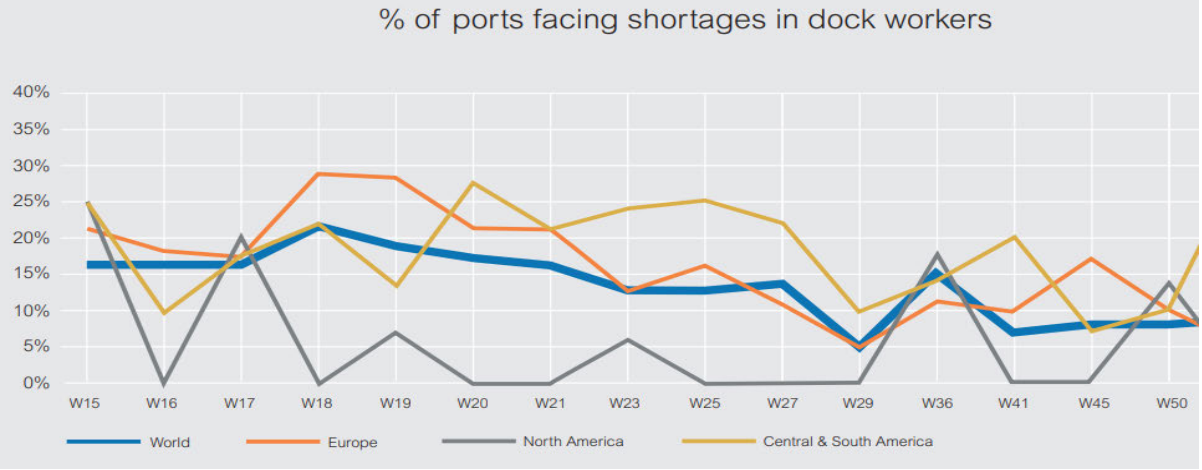

Figure 2.6 Ports reporting a shortage of dockworkers

Source: Notteboom and Pallis (2021, p. 25)

2.12 Marine services

Ports serve as the primary entry and exit points for commodities entering and exiting a country. As a result, the maritime industry is critical to international trade (Radisic, 2013). Marine services are an essential component of port operations (Mthembu and Chasomeris, 2020). Marine services' main job in a port is to make sure that ships visiting there can navigate safely at a port or disembark to continue their journey (Zhen, Wang, Wang and Qu 2018). It also plays an important role in cargo flow through ports, ensuring that ports run smoothly (Mthembu and Chasomeris, 2020;). The efficiency of marine services determines cargo flow efficiency (Mthembu and Chasomeris, 2020). The primary responsibility is to safely navigate vessels from the sea to mooring and cargo handling facilities in the harbour (Mthembu and

Chasomeris, 2020). Marine services is a labour-intensive operation that relies on competent and committed maritime professionals to provide safe and effective marine services.

Marine services in ports have a direct impact on a country's regional and national economic performance through facilitating trade and enabling the timely passage of cargo ships. Import and export businesses, trade, employment and economies all benefit from continuous marine service in a port (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). A harbour master or port captain is in charge of ensuring the port and its users' safety, security and sustainability, as well as exercising power over the ports to ensure emergency readiness (Zhen *et al*. 2018). The Harbour Master's office represents a port authority. It fulfils its statutory obligations and responsibilities to international vessels calling at a port by providing marine services 24 hours a day, seven days a week. This regulatory duty includes providing a safe and clear entrance channel to ports, navigational aids, and safe berths; providing, training and appointing marine pilots; providing vessel traffic management services; and providing marine-related crafts, such as tugs, to assist marine pilots in navigating a vessel in the port (Ugboma, Ogwude, Ugboma and Knadi, 2007). In some global regions, the private sector provides some marine services, such as towage and marine pilotage. The port authority contacts these organisations, which are members of associations, for their services (Gans and King, 2003). However, in South Africa, the public sector provides marine-related services such as pilotage, vessel traffic management, towage services, mooring services, and the provision of freshwater ships (Gumede and Chasomeris, 2017).

2.13 Marine pilotage

Local experts in the harbour are the marine pilots. Marine pilotage is performed by locally trained mariners who have a thorough understanding of the port's contours and environmental risks. These experts advise ship captains on the best maneuvering tactics for entering and exiting a port (Helmick, 1992). Moreover, they guide and advise foreign vessels approaching the harbour on navigable waters, as well as assist in safely docking and undocking vessels (Khuzwayo, 2019). Except for strong, gale-force winds, piloting is done in a variety of weather conditions (Chakrabarty, 2017). The navigational duties include keeping a close eye on the vessel, ensuring that it is on the correct path, constantly counteracting currents, and navigating the vessel in safe, deep waters while avoiding close-quarter collisions with other ships (Khuzwayo, 2019). The Transnet National Port Authority is responsible for providing pilotage in South Africa through the office of the Harbour-Master, and the office of the Harbour-Master

is accountable for determining qualifications for marine pilots and authorising individuals to act as marine pilots (Gumede and Chasomeris, 2015; National Ports Act, 12 of 2005).

2.14 Towage services

A vessel calling at a port cannot dock on its own due to its complex sizes and the short, shallow channels of ports, which pose a risk of grounding. Tugboats are ordered by marine pilots and sent by marine services to safely dock vessels with high-powered engines designed to push and pull these massive floating vessels (Wang *et al*., 2014). When a ship arrives in a port, but no berth is available, it anchors (International Transport Forum, 2014). When a berth becomes available, a pilot is dispatched to bring the vessel in, and tugs are dispatched to assist the pilot in navigating the vessel through the port to its berth. Towage services, according to Haider, Katsogiannis, Pettit and Mitroussil (2013), are services that vessel operators require when their vessels call at or depart from a port. One of the port authority's primary goals is to ensure that tug services are efficient and do not impede vessel liners from docking (Ozbas and Or, 2007).

A tugboat is a 30- to 50-meter-long marine craft (Khuzwayo, 2019). A tugboat's role is to assist ships in entering and exiting the harbor, as well as docking and undocking vessels (Radistic, 2003). Tugboats can tow either powered or unpowered ships (Karan , 2015). Today's ships' engines have grown in size and power, but they can only move the ship forward and backwards. They still require tugboat assistance, especially in bad weather, because the massive vessels' construction limits their side-to-side motion (Karan , 2015). Tugs are essential to a smooth and efficient port operation because they help in bad weather or constrained port settings all over the world (Radisic, 2003).

A tug master controls the vessel and operates the craft, a chief marine engineering officer operates the engines, and general-purpose ratings maintain the ship and assist the tug master in managing the heaving lines, making up a team of five seafarers who operate harbour tugs (Khuzwayo, 2019). A tug master is qualified and authourised to operate a tug, which cannot be used unless one is on board. Furthermore, a tug must have a safe manning of five mariners on board and thus cannot be operated in a port without a team comprised of a tug master, chief engineer, and three general-purpose ratings (Khuzwayo, 2019). The tug master follows a shift routine whether working the day or night shift. An internal bridge is used to pilot the tugboat. As the tug master must interact with port control, pilots and other vessels in the harbour, he or she must have excellent communication skills. The tug master's job is to execute a marine pilot's commands while the vessels are docked or undocked, as well as to assist the pilot during

pilotage (Chakrabarty, 2017). The tugboat's marine engineer is in charge of the engine room and main engine. The engineer must be able to keep the tugboat's engine running smoothly and efficiently (Khuzwayo, 2019).

Terminal and port productivity is dependent on vessel docking and undocking. According to Radisic (2003), the decision to use tugs is based on the type of vessels calling at the port, the port's navigational constraints, the volume of marine traffic in the harbour, weather conditions, environmental sustainability and protection conditions, and the type and availability of tug type and size. Tugs are required for vessel docking procedures, starting with the deployment of tugs to assist the pilot. Tug assignment refers to the act of deploying tugs and arranging vessels to reduce ship turnaround time (Wang, Shu, Kakiu, Chen and Wang 2014). Cargo vessels grow in size dramatically and quickly year after year, and as the number of vessels docking at ports grows in tandem with rising commodity demand, the need for tug services and efficient docking operations at ports has become a critical responsibility in port operations (Wang *et al*., 2014). Tugs play an important role in marine services and port operations, and because the execution of this function in a port directly impacts a vessel's turnaround time, handling time, and departure time, the International Transport Forum (2014) concludes that tug services should always be deployed optimally. To track efficiency, Beckman (2007) suggests evaluating marine tug services based on tug availability and deployment.

2.15 Vessel Traffic Services

The maritime transportation industry is a global enterprise with high efficiency requirements (Praetorius, Hollnagel and Dahlman, 2015). To ensure efficient and safe vessel traffic in a harbour, port authorities provide vessel traffic services (Tangzon, 1993). Vessel traffic management, according to Kim and Myung Lee (2018), is in place to improve safety, operational efficiency and environmentally friendly marine operations. Vessel traffic controllers or operators are in charge of interacting with foreign vessels, as well as controlling, responding to and managing marine traffic within port boundaries (Hsu, 2012). To avoid vessel collisions, marine traffic is prioritised and regulated (Hsu, 2012). Marine traffic controllers also collect and disseminate information to port users about vessel tragedies and port operations (TNPA, 2017). An effective vessel traffic control service includes communication systems, data collection capability, vessel radar tracking software, control operators, and vessel traffic controllers (TNPA, 2017). Vessel traffic management strives to reduce marine accidents and commercial risks within the port environment (Kim and Myung Lee, 2018).

2.16 Mooring Services

Mooring is the process of securing a vessel to the dockside (Binkley, 2007). The vessel's crew throws heaving lines to onshore berthing services crews, who place them on bollards alongside the berths, preventing the vessel from swaying wildly during cargo handling or in bad weather (Jones, 1997). Tangzon (1993) concurs by stating that the various types of vessel lines used in this operation are bow lines, stern lines and spring lines, with stern lines preventing a vessel from drifting forward or backwards and spring lines preventing a vessel from drifting sideways This is a critical function in marine services, according to Jones (1997), because it prevents vessels from drifting away from the dock.

2.17 The impact of the Coronavirus pandemic on Africa

To stop the spread of Covid-19, many nations utilised border restrictions and partial or whole lockdowns of commercial and social activity. Nonetheless, these actions had a considerable negative impact on African economies, notably in terms of production and commerce within and amongst African nations. In some African countries, measures have considerably weighed down vital industries (Gondwe, 2020). The COVID-19 disruptions in global commerce and value chains were expected to cause the global economy to decline by 13% to 32% in 2020, according to the World Trade Organization (WTO). Additionally, the United Nations Economic Commission for Africa (UNECA) estimated that Africa's top ten fuel exporting countries would lose at least USD 65 billion in revenue (Gondwe, 2020).

Africa is more vulnerable to the pandemic's detrimental effects because of its lack of resilience. African economies risk suffering severe economic consequences as many are likely to face trade and production restraints as a result of COVID-19 pandemic (Gondwe, 2020).Due to supply chain disruptions, lower demand for African exports, and those with significant participation in global supply chains bear the brunt of the impact (Gondwe, 2020). Additionally, the implementation of COVID-19 infection control measures in these areas had a considerable negative impact on foreign direct investment, tourism, and official development assistance (ODA) to Africa . . Many daily wage earners in African countries work in the informal sector, and a strict lockdown meant no income and no essentials like food. Small and informal businesses that support and contribute to the livelihoods of the poor also face negative consequences.

Gondwe (2020) States that border closures were believed to reduce cross-border infections. However, this strategy, adopted by many African countries, hindered cross-border trade,

tourism, foreign direct investment and most significantly, Africa's interregional economy, which is primarily driven by cross-border trade. In other locations, however, this technique was considered beneficial in reducing infections, but was detrimental to low-wage employees whose lives heavily depend on international trade (Gondwe, 2020).

Recessions are a distinct possibility due to Africa's global economic ties, with few African countries having the financial resources to fund stimulus packages to cushion their economies from COVID-19 pandemic-induced recessions (Gondwe, 2020). Many African nations have passed laws reducing interest rates and providing households and businesses with cash. Additionally, nations with more latitude for budgetary policy have boosted social protection spending to help less fortunate households during lockdowns (Gondwe, 2020).

Table 2.2 outlines the important monetary and fiscal stimulus measures put in place by various African nations to lessen the effect of COVID-19 on their economy.

Table 2.2 Stimulus packages instated by African nations to ease the impact of COVID-19

Source: Adapted from Gondwe (2020, p.8)

Countries	Interest rate			Fiscal Policy	
	Jan 1	Current Rate	End of 2nd quarter	Increase in government spending (%GDP)	Fiscal Support through loans and loan guarantees (% GDP)
Egypt	12.25	9.25	9.25	0.80	0.80
Ghana	16.00	14.50	14.50		
Kenya	8.50	7.20			
Nigeria	13.50	13.50		2.30	7.50
South Africa	6.50	5.25	4.75		

Along with the aforementioned fiscal and monetary measures, global institutions have implemented stimulus packages that are freely accessible to all African nations. This covers loans, as well as assistance in times of need and debt reduction. These World Bank, EU, African Development Bank (AfDB) and IMF actions are summarised in Table 2.3.

Table 2.3 COVID -19 multilateral institutional packages available for African states

Source: Adapted from Gondwe (2020, p8)

Institution	Policy Response
World Bank	The World Bank (2020a) announced the availability of US$160 billion which will be available to countries until late 2021. The package is set to enhance the ability of the beneficiary economies in easing the effects of COVID-19 on small businesses and the vulnerable populations.[9]
African Development Bank (AfDB)	The AfDB has a US$10 billion COVID-19 response package in the pipeline of which US$5.5 billion is set for its sovereign operations in the AfDB countries and US$3.1 billion is operations under the African Development Fund. The Bank also launched a US$3 billion fight COVID-19 social bond which was allocated to central banks and official institutions (53%), Bank treasuries (27%) and asset managers (20%). Notably, 8% of this social bond is set aside for African countries.[10]
IMF	The IMF approved US$2.7 billion for COVID-19 related emergency responses in African countries
European Union (EU)	The EU announced Euro 3.25 billion COVID-19 toolkit for African countries.[11]
Afreximbank	The Afreximbank announced a US$3 billion Pandemic Trade Impact Mitigation Facility (PATIMFA) to enhance the capacity of African countries in dealing with COVID-19 related health and economic impacts.12 In addition, the bank set aside US$200 million to finance the production of COVID-19 equipment and supplies within Africa.

COVID-19's overall impact varies across African states and sectors (Gondwe, 2020). Africa's main concern is a global decline in exports and commodity price declines, as well as declines in Foreign Direct Investment (FDI) linked to the mineral extraction sector and crude oil price declines, which have significantly strained oil-producing nations, particularly those whose revenue is heavily reliant on crude oil sales (Gondwe, 2020). Revenue declines have a direct impact on a country's ability to import critical components for domestic production. Low demand for African exports, as well as the revenue losses that result, will harm agriculture and other sectors of the African economy, exacerbating poverty and food insecurity (Gondwe, 2020). According to recent food security estimates, 73 million Africans are food insecure, a situation exacerbated by the direct impact of the COVID-19 pandemic on global trade, logistics, production and value chains (Gondwe, 2020). Furthermore, COVID-19 control measures imposed by the government, Lockdowns, limits on movement, and social isolation have made the issue worse (Gondwe, 2020). Households with low incomes and those doing informal work are disproportionately affected by COVID-19 restrictions due to their inability to access markets and the loss of their livelihoods (Gondwe, 2020).

2.18 The Coronavirus pandemic's impact on South Africa

Economic activity in South Africa was significantly impacted by the COVID-19 pandemic and the country's efforts to contain it. As of 14 November 2021, there were 2 925 677 COVID-19 positive cases, with approximately 89 746 deaths (South African Department of Health, 2021). South Africa, like other countries, instituted various controls at the start of the pandemic. The

nation was placed under a strict state of lockdown for five weeks starting on March 26, 2020, after the nation was proclaimed to be in a state of calamity on March 15, 2020. The stringent lockdown allowed only essential personnel to move, forbade the sale of alcohol, reduced pressure on the healthcare system, and left no room for non-essential activity outside of households (Asmal and Rooney, 2021). Except for a few critical services such as healthcare, security, agriculture and cargo transportation, most economic activity in the country ceased immediately.

COVID-19 infections and deaths in South Africa from March 2020 to November 2021 are depicted in Figures 2.8 and 2.9. The graph shows both infections and deaths peaking at the same time, indicating the virus's high mortality rate.

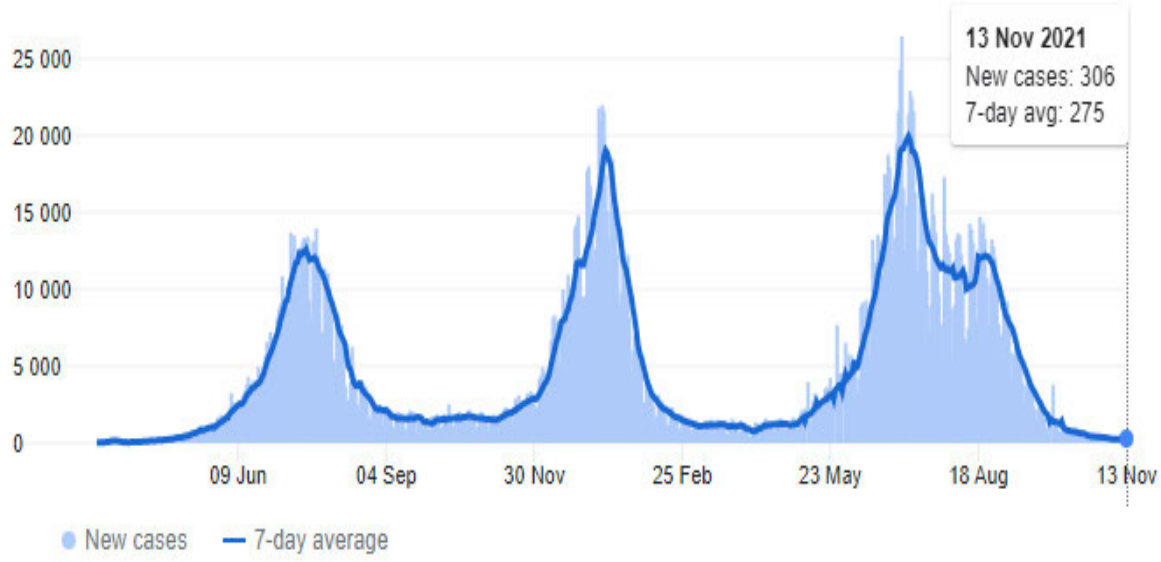

Figure 2.7 Daily recorded COVID-19 infections, South Africa, March 2020-November 2021

Source: South African Department of Health (2021, p.21)

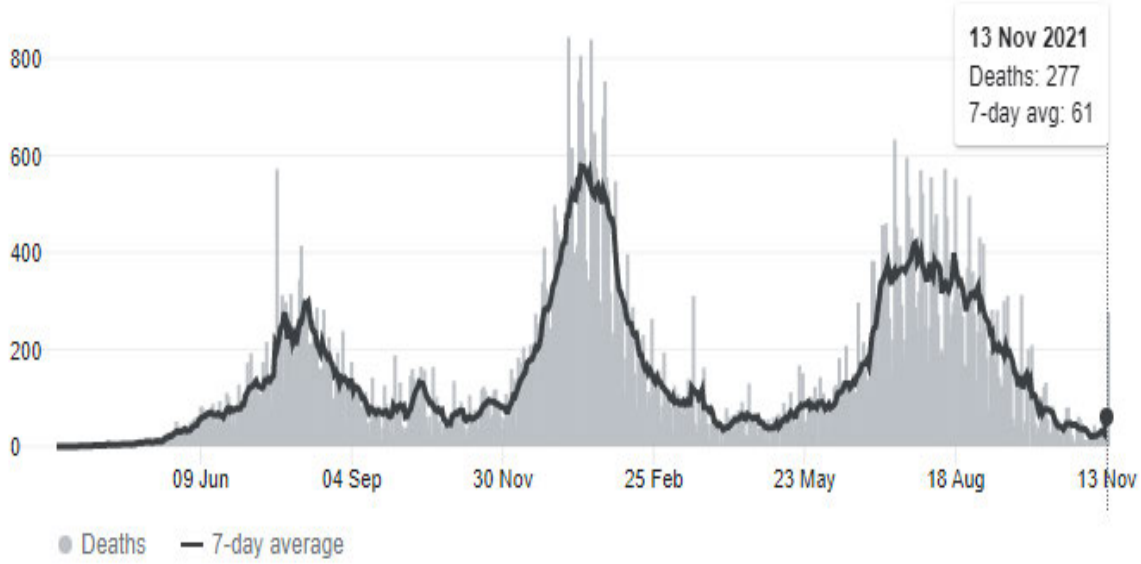

Figure 2.8 Daily recorded COVID -19 deaths, South Africa, March 2020-November 2021

Source: South African Department of Health (2021, p.21)

Since the first case was reported, COVID-19 infections have been registered every day, as shown in Figure 2.7. The restrictions imposed at the start of the lockdown were less severe, but they were tightened as infections spread and hospitals became overburdened (Asmal *et al*., 2021). South Africa moved from a lower to a higher restriction level, as it did in December 2020 (Asmal *et al*., 2021).

Table 2.4 below explains what each degree of restriction entails and the dates that various limitations were put in place throughout the pandemic.

Table 2.4 COVID -19 alert levels and related restrictions, March 2020 –March 2021

Source: Asmal *et al*. (2021, p.2.)

Date	Level	Description of restrictions
March 27, 2020 - initially for 3 weeks, extended for two further weeks	Alert level 5[1]	Only essential services and businesses are operating. No alcohol or cigarette sales are permitted, and citizens may not travel or attend any form of gathering (Turner, Le Grange & Nkgadima, 2021).
May 1, 2020	Alert level 4	Borders remain closed. No travel between provinces, except transportation of goods and under exceptional circumstances. Public transport capacity limitations. Range of goods allowed to be sold widened. Restrictions remain in place in certain sectors such as bars, conference and convention centers, and entertainment venues. No gatherings allowed (South African Government News Agency, 2020a).
June 1, 2020	Alert level 3	Opening of most economic sectors subject to health protocols and social distancing. High-risk activities remain prohibited. These include: restaurants, bars, and taverns (except for delivery or collection of food); accommodation and domestic air travel (except for business travel); conferences, events, entertainment, and sporting activities; and personal care services, including hairdressing and beauty services (South African Government News Agency, 2020b).
July 12, 2020	Alert level 3, adjusted	Restrictions adjusted to ban alcohol sales to alleviate pressure on the healthcare system. A 9pm to 4am curfew is also introduced, and family visits are prohibited (Turner, Le Grange & Nkgadima, 2021).
August 18, 2020	Alert level 2	Inter-provincial travel restrictions lifted. Ban on alcohol and tobacco products lifted. Family visits allowed. Gyms reopened. Gatherings limited to 50 people. Curfew between 10pm and 4am (Qukula, 2020).
September 20, 2020	Alert level 1	Most normal activity can resume, with precautions and health guidelines followed at all times.
November 11,2020	Alert level 1, adjusted	Relaxation of international travel and alcohol trading restrictions eased (ENCA, 2020).
December 28, 2020	Alert level 3, adjusted	Curfew extended from 9pm to 6am; non-essential establishments to close by 8pm; masks mandatory in public; alcohol sale banned; 22 additional hotspot areas declared—beaches, parks and pools in hotspot areas to be closed. Limitations on gathering numbers (Davis, 2020).
March 1, 2021	Alert level 1, adjusted	Most normal activity can resume, with precautions and health guidelines followed at all times. Limitations on gatherings. Curfew 12am – 4am (Madisa, 2021).

2.19 The economic impact of the Coronavirus pandemic in South Africa

South Africa's economy was already having problems prior to the COVID-19 outbreak (Asmal *et al*., 2021). Early in 2020, the economy experienced a technical recession due to two consecutive quarters of negative GDP growth in Q3 and Q4 of 2019. (Asmal *et al*., 2021). South Africa's economic woes have been blamed on a variety of factors, including uncertain

energy supply, low business and consumer confidence, state-owned enterprise bailouts, and insufficient structural changes (Asmal *et al*., 2021).

2.20 The economic impact of the Coronavirus pandemic on South Africa's Gross Domestic Product

The COVID-19 pandemic has had a significant impact on numerous sectors of the South African economy, owing to two factors: individual behaviour in preventing virus transmission and state-imposed limitations, both locally and globally, to prevent virus spread (Asmal *et al*., 2021). However, the effectiveness of the intensity of the control measures and lockdowns is still being debated (Savulescu, 2020). Without a doubt, these regulations, as well as individual actions, have had a significant impact on global economies (Asmal *et al*., 2021). A virus that spreads through human contact emerged, and because so many sectors depend on human connection, this had a negative effect on people's behaviour and consequently, on economic activity (Asmal *et al*., 2021).

Externally imposed controls had negative consequences for other sectors. It is possible to argue that the impact of COVID-19 rules on economic growth is proportional to the severity and duration of the control measure. If the expected negative impact on GDP will be larger, the more difficult the restriction and the longer the time of application.

The economy is experiencing a supply shock as a result of the pandemic and the implementation of COVID-19-induced regulations. As the virus spreads, the labour supply decreases, causing employees to take sick leave and quarantine themselves, lowering productivity. Depending on the severity of the outbreak, supply chains involving the import and export of goods are also disrupted. To that end, at the start of the pandemic, in order to maintain an adequate supply for its territory, the European Union forbade the export of particular medical protective equipment (Asmal *et al*., 2021).

Figure 2.9 depicts the quarterly GDP growth rate in South Africa from Q4 2019 to Q4 2020. Prior to the COVID-19 pandemic, economic growth was stagnant, indicating an already subdued economy and poor economic growth.

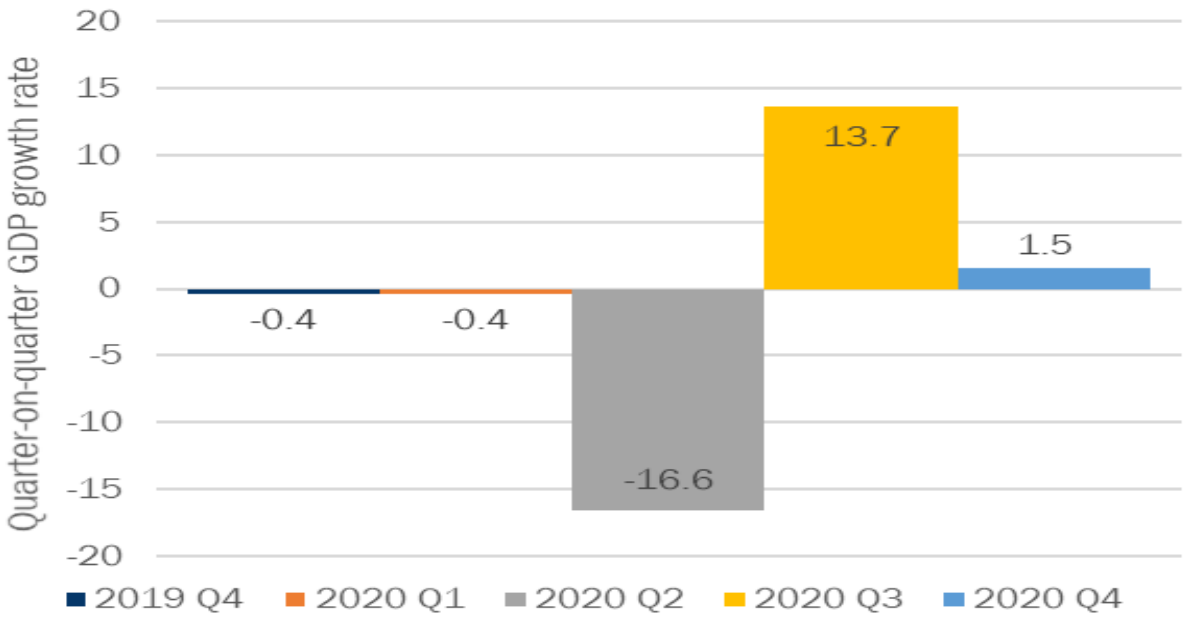

Figure 2.9 Quarter-on-Quarter GDP growth rate In South Africa, Q4 2019 –Q4 2020

Source: Asmal *et al*. (2021, p.4)

As previously stated, South Africa's economy was in a technical recession in early 2020, and this economic stagnation continued in Q1 2020, with an economic growth rate of -0.4%. The GDP numbers for Q2 2020 reveal a 16.6% decline in economic activity compared to the prior quarter, the largest decline in GDP in South Africa since 1960, demonstrating the scope and severity of the lockdown (Stats SA, 2020). There was a corresponding recovery in economic activity as constraints began to ease at the start of Q3. Nonetheless, the magnitude of the gain in Q3 was less than the magnitude of the decline in Q2 (Asmal *et al*., 2021), indicating persistent weakness in the South African economy. In Q4 2020, the economy grew by 1.5%, indicating that recovery has been significantly slowed.

Figure 2.10 depicts the changes in GDP over the last two years. The graph emphasises GDP changes between the fourth quarters of 2018, the fourth quarters of 2019 (pre-pandemic represented by blue bars), and the fourth quarters of 2019 (pre-pandemic represented by blue bars) and the fourth quarters of 2019 and 2020 (during the pandemic, as indicated by the orange bars).

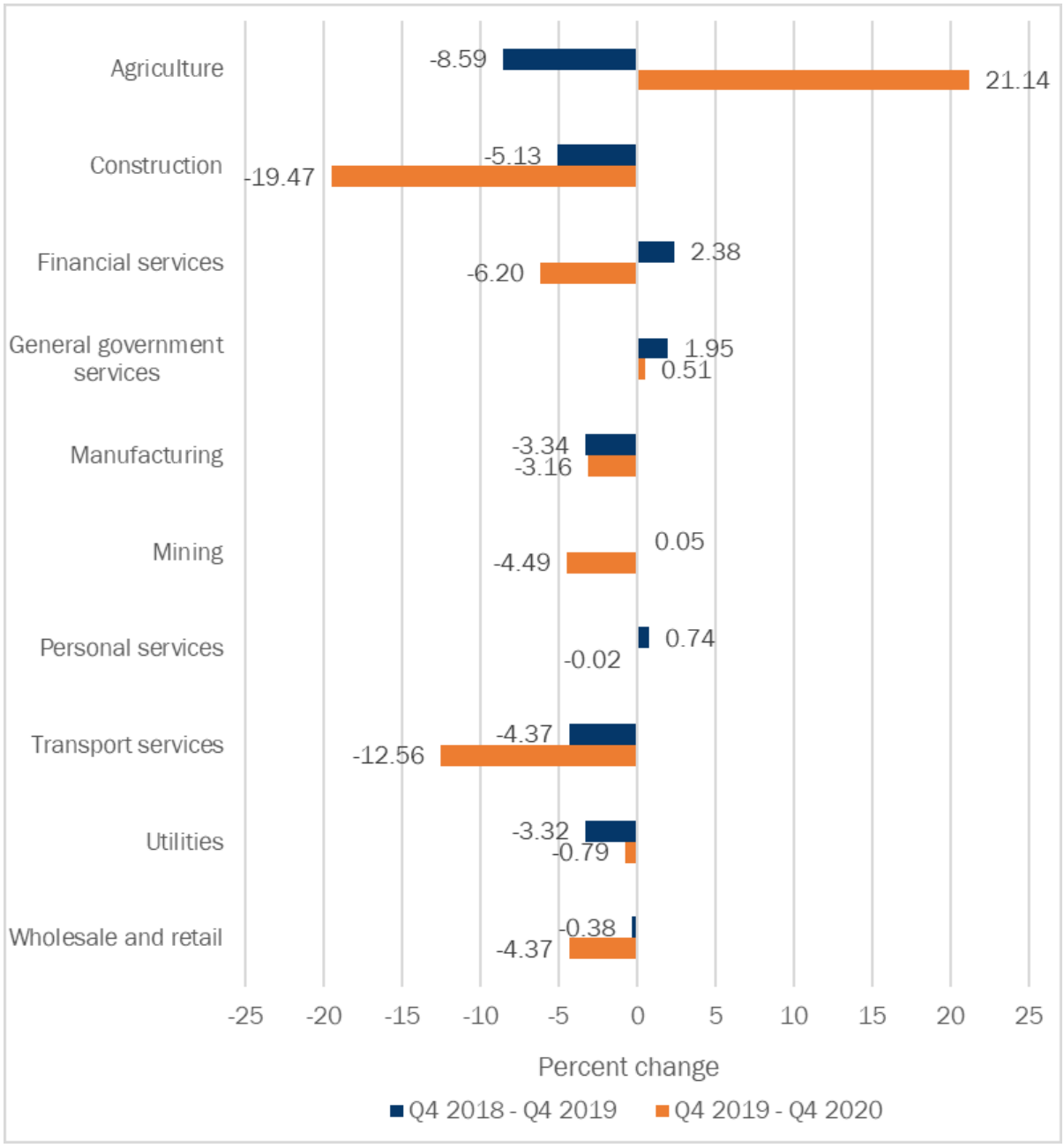

Figure 2.10 Sectoral change in GDP, Q4 2018 –Q4 2020

Source: Asmal *et al*. (2021, p.5)

Notably, the degree of fluctuation varied significantly between the two periods In the first period, GDP fluctuations were in the low single digits (Asmal *et al*., 2021). Nonetheless, three sectors (agriculture, construction and transportation) experienced double-digit GDP fluctuations in the second period. Secondly, several industries were already in decline prior to the pandemic, including manufacturing, transportation and construction (Asmal *et al*., 2021). As a result, the pandemic hastened declines in those sectors, but growth in other sectors, such as finance and personal services, has been reversed during the period (Asmal *et al*., 2021).

Unlike other sectors, the agricultural industry experienced significant GDP growth between 2019 and 2020 after experiencing negative GDP growth in 2018 and 2019 (Asmal *et al*., 2021). Larger harvests, the sector's ability to operate under all restrictions, and strong export demand in South Africa's primary export markets, Asia and the European Union contributed to this increase (Sihlobo, 2020). However, the decline in manufacturing in the sector is due to a drop in agro-processing. According to Asmal *et al*. (2021), despite no significant impact on the agriculture sector, there was less disruption in agro-processing supply chains. The impact on agriculture may have been negative for the manufacturing industry (Asmal *et al*., 2021).

Lockdown legislation had a significant impact on the logistics industry (Asmal *et al*., 2021). The sector lost more than 12% of its value between 2019 and 2020. Given the long-term effects of international air travel and port closures, this reduction was anticipated (Asmal *et al*., 2021). Furthermore, as previously stated, some countries-imposed export restrictions, resulting in a decrease in global trade volumes (Asmal *et al*., 2021). Locally, however, road and rail freight were unaffected due to less stringent lockdown requirements than other modes of transportation (Asmal *et al*., 2021). Consumers did use the internet to shop during the lockdown, which could have boosted economic activity in the trucking industry (Asmal *et al*., 2021). The tourist industry includes a wide range of businesses, from retail to wholesale to personal and transportation services (Asmal *et al*., 2021). While it is difficult to pinpoint the exact nature of COVID-19's impact on tourism, it is clear that the industry bore the brunt of the pandemic. Domestic lockdown laws from March to September 2020 prohibited international leisure travel to South Africa, as well as global lockdowns, particularly in South Africa's European markets (Asmal *et al*., 2021). Since visitors were unable to travel to South Africa and natives were similarly constrained in their mobility, it is logical to assume that the COVID-19 epidemic had a detrimental effect on the tourism industry (Asmal *et al*., 2021). In order to highlight these detrimental consequences on the tourism industry, Page (2021) predicts that economies that rely heavily on tourism, such Cabo Verde (-6.6%), Mauritius (-14.9%) and Seychelles (-12.0%), would see slower GDP growth in 2020.

2.21 The Coronavirus Pandemic's Impact on Employment

Employment is linked to GDP growth because growth in a sector necessitates human capital input (Asmal et al., 2021). As a result, increased output will directly impact increased employment, and vice versa (Asmal et al., 2021). The COVID-19 pandemic and related economic activity control measures exacerbate an already strained economy (Asmal et al.,

2021). In its pre-pandemic budget speech, the National Treasury predicted 0.9% economic growth in 2020 (National Treasury, 2020). However, the nationwide lockdown and restrictions imposed in mid-March, which severely restricted activity, rendered this assessment meaningless (Asmal et al., 2021). However, the relaxation of COVID-19 restrictions in 2020 resulted in a second-half economic recovery, with quarter-on-quarter growth of 13.7% and 1.5% in Q3 and Q4 of 2020, respectively (Asmal et al., 2021 ; Statistics South Africa, 2020). Despite this improvement, major financial institutions such as the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), and the South African Reserve Bank (SARB) forecast a 7 to 8% decline in GDP in 2020 (Asmal et al., 2021). In contrast to 2020, the SARB and the IMF predict that South Africa's GDP will grow by 3.6% and 2.8% in 2021, respectively (SARB, 2021; IMF, 2021).

South Africa's unemployment rate in the third quarter of 2021 was 34.9% (Stats SA, 2021), up from 29.1% in the third quarter of 2019. When compared to Q3:2020, South Africa's unemployment rate increased by 1.7% to 32.5% in Q4:2020 (Stats SA, 2020).

Figure 2.11 compares South Africa's official unemployment rate to its expanded unemployment rate. As of Q4 2020, the official rate was 32.5%, while the expanded rate was 42.6%.

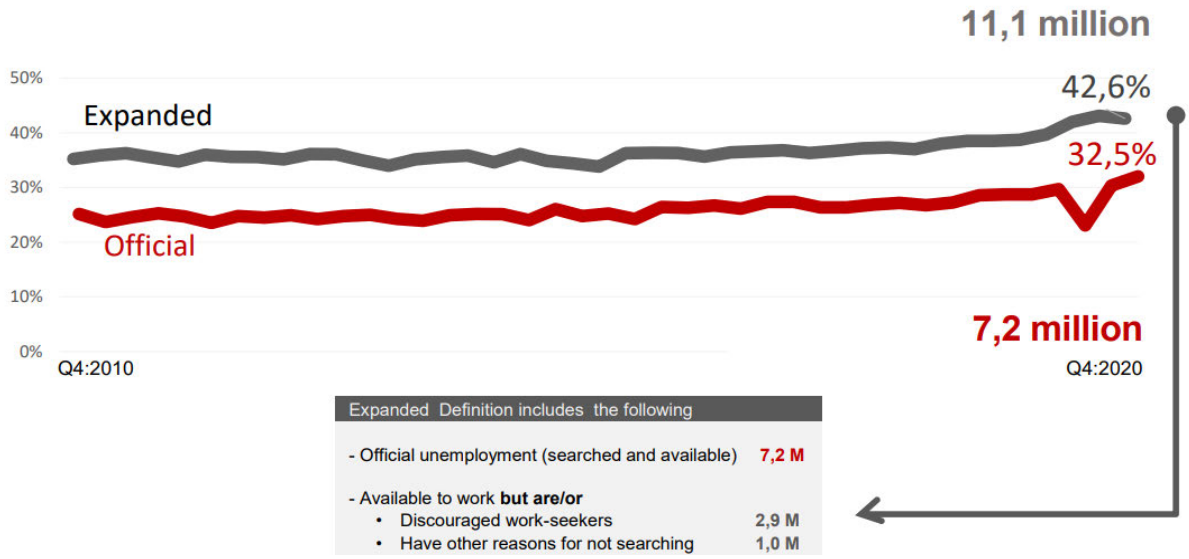

Figure 2.11 South Africa's official unemployment rate versus expanded unemployment rate

Source: StatsSA (2020, p.8)

Figure 2.12 depicts two graphs: The right panel shows the absolute change in employment over the same time period, while the left panel shows the percentage change in employment between Q4 2018 and Q4 2020. Prior to the pandemic, five of the eight sectors saw positive job growth, with horticulture (9.79%), commercial agriculture (8.21%) and tourism (8.21%) (6.17%) recording especially robust employment growth. However, there was only a slight increase in the number of jobs in commercial agriculture (17 000) and horticulture (33 000). Contrarily, the tourism industry produced the same number of jobs as the preceding two sectors put together, demonstrating the industry's considerable employment potential.

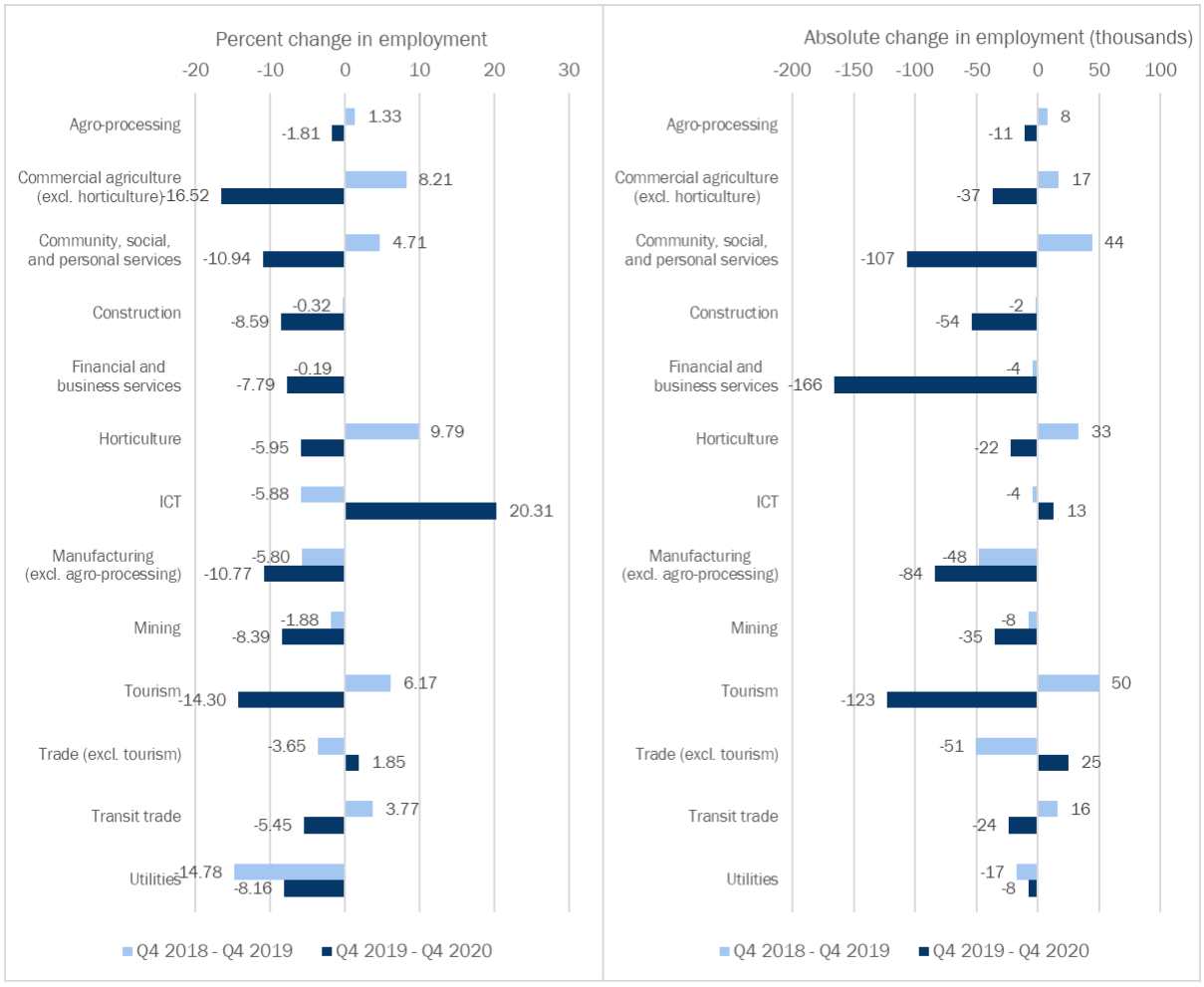

Figure 2.12 Percentage and absolute employment change, Q4 2018 - Q4 2020

Source: Asmal *et al*. (2021, p.7)

Positive employment growth was observed prior to the pandemic, with agriculture (8.21%) and tourism (6.17%) in particular showing significant development (Asmal *et al*., 2021). In contrast, the pandemic slowed growth, .Despite double-digit declines in employment in the

commercial agriculture and tourism sectors (Asmal *et al*., 2021), these industries experienced a more than two-fold growth in unemployment between Q4 2019 and Q4 2020, indicating the country's dire economic situation.

Despite the fact that many white-collar professionals (consultants, researchers and bankers) can work from home in this industry, finance and commerce services saw the most job losses. This industry, according to research, attracts people who work for temporary job agencies (Asmal *et al*., 2021). This type of work has low job security, and many industries rely on the services of other companies (Asmal *et al*., 2021). With so many businesses in financial distress, it is reasonable to assume that external agencies were amongst the first to be cut, as many employees were forced to work from home and no longer required external services, such as cleaning services until they returned to work (Asmal *et al*., 2021).

South Africa's economic forecast remains uncertain as the pandemic continues to affect numerous aspects of the economy, and related restraints have yet to be lifted for as long as the pandemic continues (Asmal *et al*., 2021). The Coronavirus has also mutated several times, leading to variations. These are rapidly spreading around the world, causing more uncertainty, disruptions and challenges (Asmal *et al*., 2021). As long as the pandemic ravages the country, it will be difficult to predict how the economy will recover and what challenges will arise (Asmal *et al*., 2021). The aforementioned reasons for the country's poor economic performance prior to the pandemic are unlikely to be resolved anytime soon, and they are probably likely to make it more difficult for the nation to recover from the economic disruptions caused by the pandemic (Asmal *et al*., 2021). While new harsh lockdowns are unlikely, based on the economic implications outlined above, it is expected that sectors most affected by the COVID-19 pandemic and subsequent control measures will be further restricted to some extent for the duration of the pandemic (Asmal *et al*., 2021).

2.22 The impact of the Coronavirus pandemic on the South African tourism industry

With 10.23 million international visitors in 2019, South Africa is one of Africa's most popular tourist destinations, trailing only Morocco's 12.93 million visitors during the same period (Asmal *et al*., 2021). South Africa's international appeal is enhanced by its game parks, historical monuments, pleasant weather, natural scenery, Tourism has grown to be an important industry in South Africa's economy, accounting for more than 7% of GDP and creating 860 000 jobs in 2019 (World Tourism and Travel Council, 2020). However, the COVID-19

pandemic-related international travel restrictions put in place globally in 2020 put an end to the growth of the tourism industry (Asmal *et al*., 2021). Despite the fact that South Africa's borders opened to international travellers on October 1, 2020 (Business Insider, 2020), travel restrictions in the United Kingdom and Germany, two of the country's most important tourist source markets have had no positive impact on the tourism industry (Asmal *et al*., 2021).

According to Asmal *et al*. (2021), the COVID-19 pandemic has significantly impacted the tourism industry. According to the United Nations World Tourism Organisation (2020), international arrivals in October 2020 were 91% lower than in October 2019. The tourism industry grew by 50 000 people between 2018 and 2019, indicating a 6.2 % increase. Moreover, 15 000 new jobs were created in the following quarter (January to March 2020), accounting for just under one-third of all new jobs (Asmal *et al*., 2021).

Employment in the tourism sector peaked in Q1 2020, with the total number of jobs in the sector peaking at 875 000. However, due to international and domestic travel restrictions, the sector shed 154 000 jobs in the second quarter of 2020 (Asmal *et al*., 2021). This is a 21.4% decrease from the previous quarter. Nonetheless, tourism jobs improved marginally in the third and fourth quarters of 2020. Nonetheless, the gains were significantly less than the decreases seen in the first and second quarters of 2020 (Asmal *et al*., 2021).

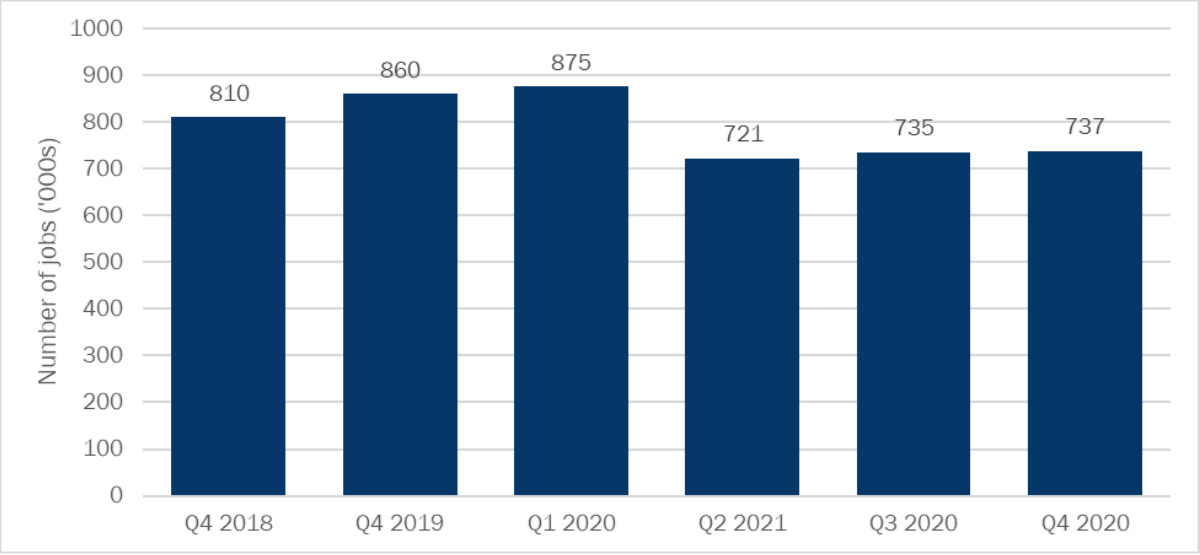

Figure 2.13 Tourism sector jobs, 2018 – 2020

Source: Asmal *et al*. (2021, p.10)

2.23 The impact of the Coronavirus pandemic on the South African cruise tourism industry

One of the most severely impacted areas of the tourism industry is the cruise industry, and the economic consequences of the COVID-19 pandemic are devastating. Data points to a bleak future for the cruise industry, especially given the sector's current reputational damage (Sucheran, 2021). Numerous cruise liners have suspended operations due to border closures and reduced operations at non-essential terminals at ports (Notteboom and Pallis, 2020). According to Sucheran (2021), the lockdown resulted in, amongst other restrictions, a ban on cruise ships landing at South African seaports, with the travel and tourist sector suffering as a result of the restrictions on cruise liners (Sucheran , 2021).

On March 18, 2020, South Africa's Transport Minister, Fikile Mbalula, issued a blanket ban on all cruise ships entering South Africa's eight seaports in an effort to stop the COVID-19 epidemic from spreading (Sucheran, 2021). Seaports all across the world blocked cruise ships from docking and shut down entire cruise terminals out of concern for the spread of the disease, forcing infected ships to navigate between ports while managing new cases on board. The suspension of cruise operations as a result of the COVID-19 pandemic caused economic and social harm all over the world. MSC Cruises announced on March 30, 2020, that it will suspend all new cruise departures fleet-wide, due to the world's continued extraordinary circumstances in connection with the Covid-19 virus global health emergency (Mediterranean Shipping Company, 2020).

2.24 The impact of the Coronavirus pandemic on the Logistics sector in South Africa

Imports and exports are both necessary for economies to function normally (Asmal *et al*. (2021). Commodity transportation necessitates a dependable logistics system that allows cargo to be delivered quickly to the appropriate locations (Asmal *et al*., (2021).Due to the crucial role that logistics plays in the supply chains of goods and services, any disruption in the logistics business affects other industries because it is so crucial to facilitating international trade (Asmal *et al*., 2021). To put this into context, South African vehicle manufacturers rely on international markets for vehicle components. Thus, if these components are unable to be shipped to South Africa for any reason, the vehicle cannot be assembled, jeopardising the domestic vehicle assembly industry's ability to meet production targets (Asmal *et al*., 2021). According to the International Finance Corporation (2020), findings from a study on the logistics sector in

Chinese ports found that as a result of the COVID-19 pandemic, ports experienced backlogs, and cargo vessels were unable to enter or exit regional ports (International Finance Corporation, 2020).

The COVID-19 pandemic has had a negative impact on the South African logistics sector (Asmal *et al*., 2021). The logistics industry employed 424 000 people in the fourth quarter of 2018, but this figure declined to 8 000 in the fourth quarter of 2020 (Asmal *et al*., 2021). Despite initial shocks in the logistics industry, China's trucking industry quickly recovered, with the industry running at 92 % of its 2019 volume by April 2020 (International Finance Corporation, 2020).

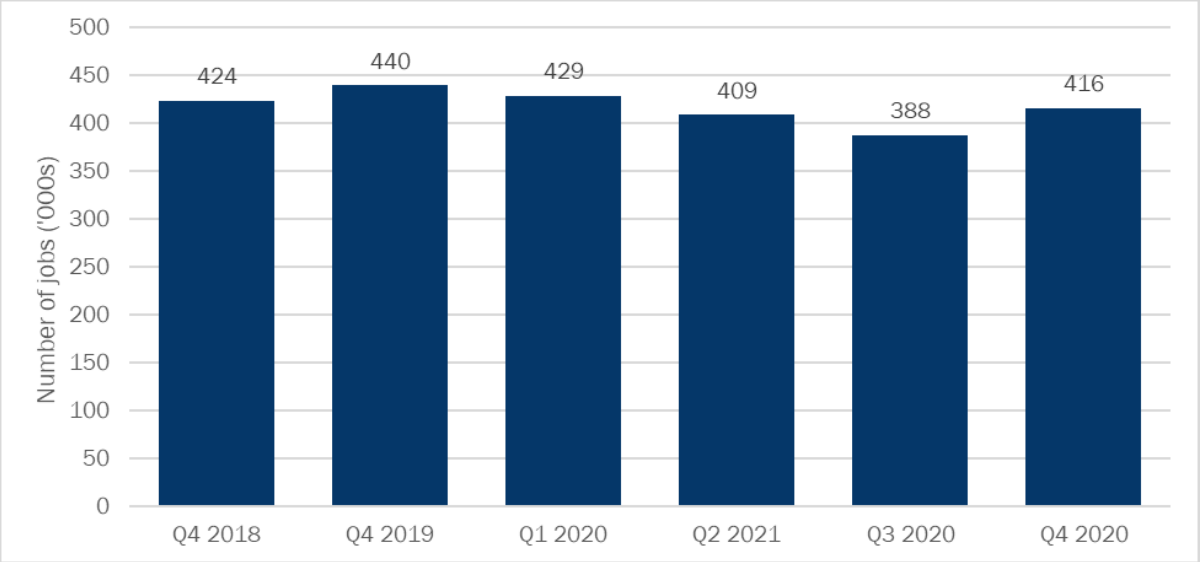

Figure 2.14 Logistics jobs, 2018 - 2020

Source: Asmal *et al*. (2021, p.16)

The last quarter without shutdown limitations, Q1 2020, saw 429 000 individuals employed in the logistics sector. When lockdown measures were implemented in Q2, however, this number fell by 20 000 (-4.6%) (Asmal *et al*. (2021). Despite the relaxation of restrictions in the third quarter of 2020, another 21000 jobs (5.1%) were lost. In comparison to Q3 2020, Q4 saw a significant increase, with 28000 jobs added (Asmal *et al*. (2021). If the pandemic ends and restrictions are lifted locally and internally, the industry can be returned to pre-pandemic levels (Asmal *et al*. (2021). However, the pandemic may have accelerated existing and predicted industry trends, such as increased reliance on e-commerce and delivery, as well as increased technological usage (Asmal *et al*. (2021). Despite the fact that the logistics industry remained

operational throughout the pandemic, personal capacity restrictions were implemented at South Africa's ports (Naidoo, 2020).

2.25 The impact of the Coronavirus pandemic on the South African Maritime sector

COVID-19 had a vast and negative impact on the maritime trade-related sector (SAIMI, 2020), with port operations and employment in numerous trade sectors linked to the export and import industries being negatively impacted by slowing trade growth (Maritime executive (2020). South Africa forecasted moderate trade growth during the COVID-19 pandemic, owing to increased demand from its primary exporting countries and lower domestic consumption (TNPA, 2020). Exports are expected to rise by 3.2% on average over the next five years, while imports will rise by 2.9%. The increasing volumes of cargo handled at ports will significantly impact South Africa's economic outlook (TNPA, 2020). The maritime industry is critical to economic growth, with port efficiency critical to ensuring goods delivery (Mthembu and Chasomeris, 2020). The global impact of the COVID-19 pandemic was felt not only in the movement of people, but also in the movement of commodities (SAIMI, 2020). Global disruptions have been shown to significantly impact port operations and trade (SAIMI, 2020). Exporters and importers saw a sharp drop in trade, which negatively impacted total port output (SAIMI (2020).

2.26 Transnet National Ports Authority

The Transnet National Ports Authority is the property owner and operator of South Africa's eight commercial seaports (TNPA, 2020; Meyiwa and Chasomeris, 2020). It is a division of Transnet SOC Ltd, which is wholly owned by the South African government (Meyiwa and Chasomeris, 2020). The TNPA is responsible for ensuring that South Africa's commercial ports are operated in an effective, safe and cost-effective manner (Meyiwa and Chasomeris, 2020). Its mandate is to stimulate economic growth and lower the logistical costs of doing business while contributing to economic growth (Meyiwa and Chasomeris, 2020). As the landlord of commercial seaports, TNPA provides port-related infrastructure and marine services in the port system (TNPA, 2020; Meyiwa and Chasomeris, 2020).

2.27 Ports in South Africa

Ports play an important role in promoting international supply chain trade (International Transport Forum Report, 2013). Efficient port operations support employment in both the upstream and downstream value chains, and any disruption could have a significant impact on

South Africa's corporate confidence (Gov, 2021). Furthermore, a poorly managed port has a direct impact on economic growth and international trade (UNCTAD, (2018). As the backbone of the nation's commercial port system and a vital sector of the marine industry, South African ports play a significant role in the world's nautical community (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Commercial ports in South Africa are essential to the country's economic success (TNPA, 2020). Since the majority of products transit through South Africa's seaports, the country's economic development is entirely dependent on a well-functioning port infrastructure (TNPA, 2020). Since the lockdown started, South African ports have been operating at 60% of their capacity (SAIMI) (2020). Direct economic effects result from decreased cargo quantities passing through South African ports (TNPA, 2020). The port's operations were in disarray (TNPA, 2020). As a result of the pandemic, terminal operations were scaled back to single berths for handling vital break-bulk goods and skeleton crews for marine services (TNPA, 2020).

2.28 Port of Durban

According to the TNPA (2020), the Port of Durban is a leading port in Africa and the Southern Hemisphere, with a reputation as one of the country's busiest ports. It handles the most seagoing traffic amongst South Africa's commercial seaports (TNPA, 2020; Gumede and Chasomeris, 2017; Meyiwa and Chasomeris, 2016). Each year, approximately 4 000 vessels pass through the Port of Durban (TNPA, 2020). The Port of Durban is the TNPA's main container and breakbulk port, handling the majority of containers and breakbulk cargo (TNPA (2020). The Port of Durban is critical to South Africa's regional trade (Gumede and Chasomeris, 2016; Meyiwa and Chasomeris, 2016) and plays an important role in the country's economy (Mokone, 2016).

It is known as the Gateway to Africa because it is located on a major international maritime travel route (Mokone, 2016). The Port of Durban handles a wide range of commodities, exports and imports, including liquid bulk materials, automobiles, breakbulk, and containerised cargo (TNPA, 2020). South Africa's geographical location on international maritime routes (Mokone, (2016) places the country in an ideal position to profit from its coastlines and drive the country's blue economy (UNCTAD & OECD, 2021; Gov, 2021). The Port of Durban operates 24 hours a day, seven days a week, ensuring that goods are transported to South Africa's hinterland (TNPA) (2020).

The Port of Durban is crucial to the functioning of the South African government, and any disruption has a detrimental effect on the economy of the nation (Gov. 2021). With 39 million tons of cargo moving through the Durban-Gauteng corridor each year, the Port of Durban is crucial to the movement of goods into the hinterland (DOT, 2020). One of the port's key performance indicators is the ability to service vessels that call at the port as quickly as possible, from navigating the vessel from sea to docking the vessel (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Hence, longer vessel waiting times at anchorage or berths can reduce ship liners' motivation to call at the Port of Durban. The turnaround time of a vessel can be used to assess the efficacy of a port's marine service (Mthembu and Chasomeris, 2020). This metric is frequently studied in the marine industry (Mthembu and Chasomeris, 2020 and Mthembu and Chasomeris, 2023b).

2.29 Marine Services at the Port of Durban

TNPA's marine services department includes marine pilots, tugboats, berthing, vessel traffic control, and water services. All of these departments are critical to the servicing of vessels in TNPA's commercial seaports located along South Africa's coastline (Khuzwayo, 2019; Mthembu and Chasomeris, 2020). At the Port of Durban, Marine Services employs approximately 600 marine employees, including a Harbour master, deputy harbour masters, marine pilots, tug masters, marine engineers, marine shore-hands (mooring staff), vessel traffic controllers, watermen, shift managers, operations managers, and deckhands (Mthembu and Chasomeris, 2020). These departments work together to ensure that vessels arrive at the port safely and on time, 24 hours a day, seven days a week (Khuzwayo, 2019) .

Marine services also operate a fleet of marine craft (tug boats, launches, pilot boats, floating cranes, and other marine crafts) to assist the marine pilot in safely navigating vessels into the port, where berthing services safely moor the vessel along the quayside (Mthembu and Chasomeris, 2020). The marine services have complete control over vessel scheduling and allocating marine resources for vessel maintenance (Mthembu and Chasomeris, 2020). Marine services in the Port of Durban do not stop under any circumstances since their function in the port has a direct impact on South Africa's GDP and any disruption to the department has a detrimental effect on the port and, as a result, the South African economy and GDP (Trade, 2020).

South Africa therefore needs a strong marine service to facilitate the flow of imports and exports at the Port of Durban because it has a developing market economy and is a part of the international trade community (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Through the efficient flow of goods in a nation, a continuous and effective marine service affects the effectiveness of value chains (Moon *et al*., 2014).To be a port of choice for shipping lines and international trade, the Port of Durban's marine services must be fully complemented with the necessary marine personnel to efficiently service vessels that call at the port (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). As a result, for the Port of Durban to function optimally, marine services must run smoothly (Mthembu and Chasomeris, 2020). Inefficiencies in port operations can have a negative impact on the economy, import and export businesses, as well as downstream employment opportunities (Hsu, 2012).

2.30 Conclusion

According to the literature, the marine industry and ports are critical to global logistics. Seaports handle approximately 90% of international trade and serve as international gateways and commercial conduits to international markets. This chapter presents a topical and thematic review of the literature on the global and domestic impact of the COVID-19 pandemic. The COVID-19 pandemic, adversely impacted the global maritime industry. According to the literature, the Covid-19 Pandemic and its associated lockdown had a detrimental effect on the global economy, international trade, and maritime commerce. The pandemic and its associated safety measures regressed global economic activity, employment, and economic development. Ports that serve as conduits to international markets were imposed with strict measures which limited free trade.Additionally, as a result of the Coronavirus pandemic, global ports faced a variety of challenges and disruptions to port operations. Due to the COVID-19 pandemic, ports experienced severe interruptions, such as increased absenteeism of key marine personnel, increased uncertainty, and disruptions to normal port operations. Additionally, the COVID-19 pandemic regressed the progress that was made in economic development and trade liberalisation. As a result of the COVID-19 pandemic, South Africa's GDP fell significantly and unemployment increased. Sub-Saharan Africa experienced similar declines to international ports, with ports in the region reporting a -9.7% drop in port operations. Ports encountered significant delays and, due to safety constraints, were unable to handle vessels as usual in several cases.The following chapter describes the study's research design and methodology.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter aims is to provide an overview of the research method used in this study and how data was gathered. The literature in Chapter 2 highlighted several concerns caused by the COVID-19 pandemic, including port disruptions, reduced vessel calls, and absenteeism among marine staff at ports. The existing literature was unable to address these concerns. As a result, COVID-19 and its implications for marine services in South African ports remain unknown. The research design had to be created in such a way that port marine experts could adequately address the research questions about the impact of COVID-19 on marine operations at the Port of Durban.

This chapter explains the research approach, design, and procedure used in the study. The target population and sampling technique for the subset sample are addressed. Furthermore, the steps for obtaining informed consent, as well as data analysis and ethical issues, are described.

3.2 Study Aim

The study aims to examine the impact of the COVID-19 pandemic on marine operations at the Port of Durban. The study will determine what disruptions marine operations experienced and their consequences in order to learn from them. As a result, recommendations for mitigating the impact of COVID-19-related disruptions on marine services at South African seaports can be made.

3.3 Study objectives

The main objective of the study is to determine how the COVID-19 pandemic has affected marine operations at the Port of Durban. In order to prevent further interruptions, it is essential to ascertain how the COVID -19 pandemic impacted marine operations at the Port of Durban. In this study, the following research objectives are covered:

1. To investigate how the Coronavirus pandemic affected port marine operations in the Port Durban from January 2020 to December 2020.

3.4 Research Design

3.4.1 Research Approach

The purpose of the study is to investigate how the COVID-19 pandemic affected marine operations at the Port of Durban. As a methodology, a mixed-method approach was utilised to look into this phenomena. Since the objective is to obtain accurate and palpable empirical evidence in order to analyse and identify concerns and their influence on marine services, this approach is the most suitable research strategy to explore and evaluate the research problem. The mixed methods approach allows for the use of qualitative and quantitative methodologies to address the study problem appropriately (Denscombe, 2010).The findings of this study's literature review revealed issues with both comprehensions of COVID-19's effects and qualitative research methods. Because these concerns necessitate both qualitative and quantitative research methodologies, the mixed methods approach was selected as the best study strategy.

According to Du Plooy (2014), qualitative research is an exploratory technique used to develop a more in-depth understanding of the problem scenario under study. There are no limitations to make sure that responses are not limited by established constraints. Open-ended questions were utilised during the interview to let individuals express opinions freely. Quantitative research is concerned with component control and is numerical in nature (Newman, 2014). For this investigation of marine operations, a statistical method sufficed. Secondary data on marine operations operational performance data , such as tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism, and the number of vessels water services attended to were also examined to determine what disruptions marine operations experienced during the Coronavirus pandemic.

The researcher conducted fifteen open-ended semi-structured interviews lasting 15 to 30 minutes with marine operations employees. A Microsoft teams meeting invitation was sent to four employees, along with an informed consent letter (Annexure 2). This was followed by a phone call, in which the employee was given information about the study, and the interview schedule. Employees who accepted the meeting invitation were interviewed online through Microsoft Teams; interviewees were informed that the meeting would be recorded and transcribed, and that their anonymity would be maintained.

Eleven face-to-face interviews were conducted at each interviewee's depot in a large boardroom while maintaining privacy. At all times, interviews were conducted in strict

accordance with Coronavirus safety measures such as social distancing, sanitisation, and face mask protocols. Throughout the interview, both the interviewer and the interviewee wore face masks. Prior to and after the interview, the boardroom surfaces where the interviewee sat were sanitized. Interviews were recorded and transcribed, and the resulting qualitative data was thematically analysed using thematic analysis to identify, analyse, and interpret the data.

Secondary data from marine service's operational performance on tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism, and number of vessels water services attended to were obtained from the Transnet National Ports Authority's database and analysed using descriptive statistics. Data was examined to identify trends in the data over the study period, specifically between January 2020 and December 2020. The secondary data collated was compared to the qualitative data. The aim of utilising multiple data sets was to corroborate the findings and enhance the validity and credibility of the data. Data was presented graphically, providing a visual representation of the quantitative data collected.

Triangulation in research is the use of more than one approach to researching a question. The objective is to increase confidence in the findings through the confirmation of a proposition using two or more independent measures (Heale and Forbes, 2013). The combination of findings from two or more rigorous approaches provides a more comprehensive view of the results (Heale and Forbes, 2013). Triangulation is the use of multiple sources of data within the study of a single phenomenon to eliminate any biases caused by the use of a single approach (Heale and Forbes, 2013). This technique is intended to corroborate suggested findings, but it may also be used to verify the completeness of data research, which may involve two separate data-gathering methods: qualitative and quantitative (Heale and Forbes, 2013).Triangulation is commonly used to describe research that employs two or more methods, sometimes known as mixed methods. Using both quantitative and qualitative methodologies to answer a specific research question (Heale and Forbes, 2013). This allows the limits of each approach to be overcome by comparing data from several angles.

3.4.2 Research Methods

The tools used to ensure data collection and their applicability in light of the selected study plan are referred to as the research methodologies. To ask the individuals questions more consistently, the researcher employed a standardised open-ended questionnaire (Storey *et al.*, 2015). The purpose of the standardised open-ended questionnaire was to collect participants'

experiences, opinions, and attitudes on the phenomenon under investigation in order to help the researcher better understand how COVID-19 has affected marine services and related issues. Four employees were interviewed online using Microsoft Teams at the Port of Durban, and 11 face-to-face interviews with experienced mariners were conducted due to limited computer access.. The interviews were recorded, transcribed, and analysed for themes and trends. Secondary data on marine operations such as tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism, and number of vessels serviced by water services were also examined to see what trends or disruptions marine services experienced during the COVID-19 pandemic.

3.4.2.1 Critical Paradigm

Ontology, epistemology, and methodology are the three components of the research process. According to Bryman (2012), the research paradigm is a comprehensive process of interrelated behaviour and cognition that captures the core of inquiry. Ontology presupposes many realities, which can be investigated and created by interactions between people. According to ontology, multiple human experiences, such as people's knowledge, viewpoints, and experiences, result in reality as we know it (Davis, 1998). According to epistemology, events are the outcome of a mental interpretation process that is impacted by social relationships. In an interactive process, the inquirer and the inquired-into are closely linked. The term "methodology" describes the procedure for acquiring data through group discussions, interviews, and statistical data analysis. Bryman (2012) defined a paradigm as a research tradition or global perspective that serves as a way to simplify the complexity of the real world. These insights on social, organisational, and managerial concerns come from recent research. Critical elements of these three viewpoints include the worldview, the type of information sought, and the techniques for acquiring and processing data within paradigms. When a researcher chooses a paradigm, they choose a certain method for examining pertinent events. Due to its interpretive nature and the depth of the data it produces, the mixed method qualitative research paradigm was chosen for this study.

3.4.3 Target Population

According to Simpson and Lord (2015), the group or community from which one seeks to gather information and draw conclusions is the target population. A target population, according to Kayton (2011), is the total group of units that possess the traits or qualities that the study needs. It alludes to the collection of information that will be utilised to make

judgements. A target population, according to Cox (2013), is the entire collection of groups or entities from which survey data will be gathered.

The creation of objectives continues to be the first step in survey design (Mthembu, 2014). Understanding and deciding who or what would best help in gaining the answers needed during the population determination process are assisted by research objectives (Mthembu, 2014). Prior to setting study objectives, a target population must be identified (Mthembu, 2014). The examination focused on the almost 650-person marine services division of the Transnet National Ports Authority's Port of Durban (TNPA, 2021).These marine service employees, as well as the department's management, have knowledge and experience in maritime-related subjects (Mthembu, 2014).Workers in the marine services department were in charge of towage boats, mooring, vessel traffic management, and navigating ships into Durban's port (Mthembu, 2014).

3.4.4 Sampling Strategy

The purpose of sampling, according to Cox (2013), is to draw broad conclusions about the entire population. In accordance with available time and resources, Du Plooy (2014) defines sampling as the capacity to decrease a big population to a manageable number. The study used a judgmental, purposive sampling method. Participants in the study were not chosen at random; rather, those chosen had expertise, knowledge, and experience in marine operations. The ability of the researcher to contact participants determined whether or not they were included in the study. Representativeness was not a consideration when the researcher began the qualitative portion of the study (Starr, 2014). The researcher was interested in interviewing a large number of people and learning as much as possible about the issue at hand.

The approach of purposive sampling was employed in this inquiry. Based on a set of qualities relating to knowledge, skill, and experience in marine services, the subset was chosen. It was a requirement for participants to engage in marine-related activities. Using a sample approach called "purposeful sampling," a researcher might choose study participants based on a set of criteria (Boddy, 2016). The fifteen participants in the study were chosen using a technique known as purposeful sampling. The advantage of using purposeful sampling is that it ensures that all participants will contribute to the research. The researcher is responsible for ensuring that participants followed the population specifications. The study enlisted the participation of fifteen marine workers.

3.5 Research Process

3.5.1 Data collection

Henning (2013) asserts that interviews, questionnaires, and observations serve as the main methods for gathering data. The author claims that periodicals and corporate studies are examples of secondary sources for the data stream. Data for the study was gathered through interviews and document reviews. In semi-structured interviews, respondents had greater freedom of expression. Interviews were recorded and transcribed in order to further evaluate and identify patterns and themes.

3.5.2 Data Analyses

According to De Vos Strydom *et al*. (2011), qualitative data analysis is the process of adding order, structure, and meaning to data acquired. To analyse qualitative data, the researcher can employ a variety of strategies. Most approaches to qualitative data analysis have been shown to follow similar patterns which include data reduction, organisation, interpretation, and subtraction (Storey *et al*., 2015). As part of the analysis, the researcher conducted interviews with participants. All interviews were recorded after participants gave their permission. The recordings were transcribed to hard copy for easy analysis. The transcripts were then thematically analysed for themes that emerged from the participant transcripts.

Data on tug availability, tug utilisation, tug deployment, berthing deployment, marine employee absenteeism, and the number of vessels attended to by water services were sourced from Transnet's database and analysed using descriptive statistics. Data was examined to identify trends in the data over the study period, which was January 2020 to December 2020. Triangulation was used in the study to corroborate suggested findings, and to verify the completeness of data research, which involves two separate data-gathering methods: qualitative and quantitative, with the aim to corroborate the findings and enhance the validity and credibility. The combination of findings from two or more rigorous approaches provides a more comprehensive view of the results. The data was presented graphically, allowing for a visual representation of the quantitative data collected.

3.5.3 Ethical Clearance and Informed Consent

The protocol was submitted to and approved by the University of KwaZulu-Natal Ethics Committee (HSSREC/00003595/2021) (See Appendix 4). The investigator made sure that moral guidelines were observed at all times. The researcher took into account the fact that

interviews were a part of the study's data collection process. Confidentiality was upheld and data protection was properly implemented throughout the process.

To achieve this, participants were not addressed by name (Mthembu, 2014). No one was permitted to access any written materials, including the transcripts of the interviews. The recordings were stored on a computer that was password-protected and only the researcher could access it. The last tangible copies were all destroyed. The study report is comprehensive and well-organised, and anonymity is assured (Mthembu, 2014). Participants are referred to by a number (Respondent 1) rather than by their position, title, or names.

To guarantee that participants' right to privacy is upheld, the informed consent process' four components—formal notification, information, understanding, and decision-making capacity—were used (Mthembu, 2014). These elements make certain that participants are adequately informed about the study and that their comprehension of the inquiry is improved (Mthembu, 2014). To make sure that they can make judgements like whether to join, they also evaluate the participants' decision-making skills. The last requirement to make sure that everyone participates voluntarily is voluntarism (Snelson, 2016).

Each participant in this study received information about their part in the investigation. Email and phone confirmation were utilised to officially notify the participant. Each participant's obligations were spelled out in detail, and the degree of protection was addressed with them. The participants were also informed of the study's objective. To make sure that participants were informed about the study, copies of the informed consent letter (See Appendix 2), ethical clearance protocol number HSSREC/00003595/2021, and ethical clearance certificate (See Appendix 4) were given to them. All those who participated in the study gave their consent.

The participants were to be chosen based on their awareness, knowledge, and competence in marine operations at the Port of Durban and the Coronavirus pandemic. This method ensured that participants were informed about the study's topic.

During the screening procedure, participants' capacity to render sensible assessments was taken into account. All marine services personnel perform at a level that demonstrates their capacity to make wise decisions. Participants in the study were selected based on their expertise, level of decision-making, and understanding of the marine services portfolio. Participants had the choice of taking part in the study or not in order to maintain voluntariness. Participants were asked to sign an informed consent form to affirm their desire to take part (See Appendix 2). According to Mayer (2015), ethical behaviour involves making sure that the study does not

conflict with the interests of the participants. The above ethical considerations were used to protect participants.

3.5.4 Limitations of the Research Process

Limitations are study restrictions that are outside of one's control, according to Du Plooy (2014). Time, money, and access to essential information are a few examples of these limitations. These limitations can necessitate changing the research's focus. For the sake of simplicity, the investigation was only conducted at the Port of Durban. The sample was carefully chosen from the nautical services offered by the Port of Durban. Although the study's findings and suggestions are obvious and appropriate for the Port of Durban, they shouldn't be applied to all South African ports as a whole. Even though the marine services infrastructure in every port in South Africa is the same, vigilance should be taken.

3.5.5 Validity and Reliability

Using a mixed method approach, the researcher investigates how the COVID -19 pandemic has affected port operations in Durban. Snelson (2016) claims that in qualitative research, trustworthiness is utilised to gauge the degree of dependability and validity. Validity refers to the process of assessing whether a study accurately measured what was supposed to be measured (Mthembu, 2014). Internal and external validity were the two types of validity that this study examined. Internal validity is the study's capacity to respond to the research questions, whereas external validity is the study's capacity to extrapolate its results to a larger population (Mthembu, 2014).

It is essential that the research study produce comparable outcomes and be applicable to the wider community. Researchers are certain that if the study is duplicated elsewhere, similar results will be found because of the consistency of research findings (Mthembu, 2014).The researcher establishes credibility by obtaining statements from individual and document citations. The elements of trustworthiness listed below are used to establish trustworthiness.

- Credibility is defined as one's confidence in the veracity of the findings. The interviews were recorded, and a transcript was produced to achieve this (Mthembu, 2014).
- Data saturation, according to Mthembu (2014), is the practise of questioning participants until they repeatedly mention the same themes and offer no new information.

- Both the target population and the method of participant selection were employed to assure dependability (Mthembu, 2014).The participants were chosen based on their field knowledge and experience, as well as their expertise. Participants were chosen who were highly qualified and knowledgeable (Mthembu, 2014).
- To ensure conformance to the findings of the literature review, thematic analyses of qualitative data were used.

It is crucial to take into account the accuracy and dependability of the tools used to collect data (Heale and Twycross, 2015). Validity describes the precision with which a notion is tested in a quantitative study, whereas reliability describes the consistency of a measure (Heale and Twycross, 2015). When a measurement tool consistently yields results that are close to the same during testing, reliability has been attained. Instrument dependability, or the degree to which a research tool consistently yields the same results when employed in the same situation several times, is the second criterion for the quality of a quantitative study (Heale and Twycross, 2015).

Heale and Twycross (2015) identify three main categories of validity. The first is content validity, or how well a research tool captures every facet of a construct. Criterion validity describes how well a research tool compares to other tools that assess the same variables. Lastly, concept validity describes how effectively a research instrument measures the desired construct (Heale and Twycross, 2015). Any other instrument that measures the same variable can serve as a criterion. Additionally, correlations can be carried out to ascertain how well different tools assess the same variable (Heale and Twycross, 2015).

Three different sorts of evidence can be utilised to show the construct validity of a research instrument, according to Heale and Twycross (2015). First, homogeneity means that just one construct is measured by the instrument. Second, when a research instrument assesses ideas that are similar to those that are measured by other tools, convergence is said to have occurred; however, this is reliant on the availability of other similar tools (Heale and Twycross, 2015). Last but not least, evidence theory is seen when behaviour reflects hypotheses of the construct tested by the instrument (Heale and Twycross, 2015). There are three techniques to evaluate criterion validity (Heale and Twycross, 2015). For instance, convergent validity shows a strong correlation between two instruments assessing the same variables. Second, a tool has low correlation with instruments that measure other variables when it has divergent validity (Heale

and Twycross, 2015). Last but not least, a tool's predictive validity denotes a strong link with future standards.

Reliability, as previously stated, refers to a measure's consistency; nevertheless, while exact reliability may not always be feasible, an estimate of reliability can be established using a variety of metrics (Heale and Twycross, 2015). One of the traits of reliability is homogeneity or internal consistency, which refers to the amount to which all of the items on a scale assess the same construct (Heale and Twycross, 2015). Equivalence refers to the consistency of replies acquired by numerous users of a tool or other forms of an instrument, whereas stability refers to the consistency of results gained by utilising a tool with repeated testing.

To find trends in the secondary data, the secondary data was compared to the source data. The tendencies from the secondary data were contrasted with the original data's themes. This made it possible for the research to find connections between established trends and the topics that came out of the interviews.

3.6 Conclusion

The primary goal of Chapter 3 was to provide a description of the research methods and design that were used in this study. The research plan was presented, along with the justification for choosing a mixed method approach as the research methodology. This chapter served as a guide for analysing how the COVID-19 pandemic affected port operations in Durban. It described the steps that were taken throughout the investigation. The purpose and objectives of the study, the research design, the methodology, the demographic and sampling plan, validity and reliability concerns, data analysis, and the scope of the study were all covered in this chapter. The study's data interpretation, results presentation, conclusions, and discussion in relation to the study's goals are elaborated in the next chapter.

CHAPTER 4

PRESENTATION AND DISCUSSION OF DATA

4.1 Introduction

The previous chapter discussed the research methodology and data collection and analysis techniques used in this study. The findings of semi-structured interviews with participants, as well as an examination of marine operational performance data, are presented in this chapter. The researcher recorded, transcribed, and analysed fifteen interviews. Thematic analysis was used to identify the common disruptions that emerged during the coding of transcribed data. The themes and sub-themes that emerged during coding will be presented in some detail to outline the study's overall findings, and direct quotes will be used to illustrate the views being presented. Secondary data will be graphically presented, providing a visual representation of the quantitative data collected.

4.2 Response Rate

All of the participants chosen took part in the study by answering questions via interviews, resulting in a 100% response rate. A fair response rate is crucial, say Saunders *et al*. (2012), because data obtained from a sufficient sample is more likely to be recognised as being generalisable to the full population. An effort was made to clarify double-barreled statements in order to shorten participant narratives and discussions and address all of the interviewer's concerns.

4.3 Details of participants

Purposive sampling was used to select the research participants for this study. Fifteen mariners from the Port of Durban's marine operations were chosen and interviewed. These individuals work full-time in marine operations and have experience and knowledge in marine services at South African commercial seaports; they were chosen because the researcher believed they would provide rich data to answer the research questions.

4.4 Results based on the primary study

The following section presents and analyses the findings regarding the study's objectives based on thematic content analysis of data gathered through interviews. Manual thematic analysis was performed on each question, and various themes emerged.

4.5 Analysis of data

The data was analysed using thematic analysis, and the researcher identified seven major themes that emerged from the coding process. The table below summarises the seven main themes and sub-themes identified by the analysis.

Table 4.1 Themes and sub-themes

Themes	Sub-Themes
Employee staffing disruptions	Increased employee absenteeism
	Increased unjustified sick leave
	Critical marine personnel were in short supply.
	Staffing levels in working gangs have been reduced.
	Employees rotated between shifts.
Employee training and development disruptions	Employees were unable to attend training
	Expired training certificates
	Understudy programs had been disrupted.
	Trainee pilots are not doing understudy jobs.
	Employees working in silos
Health and safety compliance issues	Use of additional PPE
	Employees over the age of 60 and those with comorbidities were removed from operations.
	Operational PPE restrictions
	Additional risks associated with the use of COVID-19 PPE
Marine craft maintenance disruptions	Marine contractors were unable to access the site.
	Increased layup time due to dry dock disruptions
	Marine craft spares are unavailable to maintenance teams.

	Reduced contractor staff on-site- resulting in longer job completion times
	Spares could not be shipped from abroad.
	Technical staff shortages at Workshop24 and the drydock department
Challenges posed by health and safety measures	Delays in berthing crew deployment
	Delays in tug deployment
	Staff quarantine for extended periods of time
	Employees in berthing gangs had been reduced in number.
	Reduced employee count in tug fleet shifts
	Administrative and support personnel who worked from home
Marine resource availability and deployment	Reduced number of tugs in service
	Tugs were deployed late.
	Tugs were not allowed to transport pilots, which sometimes caused shipping delays.
	Employees were exhausted from working overtime to cover for employees who were in quarantine.
	There was a limited supply of marine pilots with specific licenses (Shortage of open licence pilots).
Inherent difficulties in marine operations	Breakdowns in tugs
	Aging marine personnel
	Procurement challenges in obtaining tug spares on time
	Contract administration is centralised.

4.5.1 Objective one: To examine the impact of the Coronavirus pandemic on maritime operations at the Port of Durban over the period January 2020 to December 2020

According to interviewees, the Coronavirus pandemic severely disrupted marine operations. Some of the concerns raised about the impact of the Coronavirus pandemic on marine operations at the Port of Durban between January and December 2020 were quite intriguing.

R5:*"Marine Services at the Port of Durban were severely disrupted; every department that provided marine services was adversely affected and experienced some sort of delay, disruption and adverse scenario due to the Covid -19 pandemic".*

According to interviewees, marine operations had slowed. Sucheran (2021) concurs, stating shipping restrictions had a negative impact on the industry. Several interviewees mentioned critical staff shortages of marine employees, which is confirmed by Notteboom *et al*. (2020) and Mannan *et al*. (2021) who state that ports experienced significant shortages of employees at port globally, negatively impacting employees. According to respondents, tug breakdowns hampered marine operations, resulting in decreased marine service activity. TNPA (2020) backs this up by stating that port operations were in disarray. Because of the pandemic, terminal operations were reduced to single berths for vital break-bulk goods and skeleton crews for marine services (TNPA, 2020).

R6: *"The Port of Durban did experience a disruption to nautical services, mainly due to shortages of critical staff, who were getting infected and re-infected, and going on long periods of quarantine; shortages of critical staff such as tug masters, berthing crews and marine pilots was a big issue", furthermore shipping was quieter than usual, shipping was taking place but slower than previous years".*

R3: *"At one point, we did experience a shortage of open licence pilots; two were off shift, so we were short of senior pilots, which had to go into quarantine."*

The COVID-19 pandemic had a negative impact on maritime trade-related sectors (SAIMI, 2020). According to Mannan *et al*. (2021), the Coronavirus pandemic had a negative impact on commercial seaports, corresponding with the majority of participants who had negative views on Coronavirus pandemic-related disruptions; several participants acknowledged that the Coronavirus pandemic had a negative impact on the provision of marine services at the Port of Durban. Maritime Executive (2020) concurs that pandemic affected both cargo volumes and port marine services.

R6: *"We did see tugs go out of operation during the pandemic, which put a strain on the available resources, not only on the side of the tug, but berthing services as well. When these resources were scarce, it disrupted the whole operation and created delays in shipping; from*

a vessel traffic planning perspective, we did not have much of an issue because we always had pilots available even though the number of pilots dropped, we still had a pilot to bring in vessels."

Employee training and development were disrupted, according to interviewees. (Vitenu-Sackey *et al*., 2021) agrees that the COVID-19 pandemic harmed human development. According to interviewees, training academies were closed, and employees were unable to attend mandatory training in order to maintain their certification. According to interviewees, while marine services at ports were deemed essential, a number of marine industry service providers were not, negatively impacting marine employees at ports.

According to respondents, many mariners would not have been able to service vessels if SAMSA had not granted a waiver regarding employee and craft certification. Many interviewees also claimed that the pandemic harmed their personal development by preventing them from working as understudy tug masters and marine pilots. This point of view is supported by (Vitenu-Sackey *et al*., 2021), who claims that the COVID-19 pandemic had a negative impact on human capital development. Participants stated that understudies were not performing understudy duties. Marine pilotage understudy programs were ineffective and added little value, so junior employees were unmotivated to do additional understudy work.

R1: *"The COVID -19 pandemic adversely affected employee training, development and career progression; staff would've had more job opportunities had the pandemic not been around. Furthermore, the company couldn't hire staff due to the pandemic because hiring was not a priority back then. Service providers were closed, and we could not attend auxiliary courses. This resulted in employees being unable to attend their mandatory training courses, resulting in outdated employee certifications. Some of the training we could not attend was statutory and mandatory, creating a skills gap that greatly disturbed employee development. If we never had the COVID -19 pandemic, many employees would have attended much-needed training to develop themselves*

Respondents stated that administrative support departments did not adequately support them during this time because many were working from home, and that this lack of support harmed Marine operations. This point of view is supported by Asmal *et al*. (2021), who claim that many employees had been forced to work from home due to the Coronavirus. Furthermore, the lack

of training and skills to deal with such a large disruption, particularly in the marine environment, exacerbated the situation.

R5: *"Administrative staff were working from home and did not support marine operations as much as we needed them; they were unreachable most of the time, and support functions like human resources, finance and training departments placed additional strain on the operations. We lacked the training to deal with such a pandemic; as people who managed others, we didn't know how to engage employees to ease their concerns".*

According to interviewees, the Coronavirus pandemic hampered marine operations, causing shipping delays and backlogs. This is supported by the International Finance Corporation (2020), which states that ports experienced backlogs. This viewpoint is supported further by Mannan *et al*. (2021) and Notteboom *et al*. (2020), who state that disruption to port services resulted in severe berthing delays and longer vessel turnaround times. Comments from interviews show that marine operations were forced to reduce the number of tugs deployed per shift due to health and safety regulations, putting a strain on available resources.

R5: *"We experienced most of our delays in level 5, where we had to cut down the number of crafts and our crews; this led to a decrease in the provision of marine services. However, operational expenditure increased drastically, as we had to provide additional PPE, implement additional safety measures, pay employees overtime, and implement new operational means measures to continue operations, such as providing employees with transportation for that period when they were called in odd hours."*

According to interviewees, the health and safety measures implemented during the Coronavirus pandemic limited maintenance activity. Notteboom *et al*. (2020) concurs, stating that the ability of some harbors to operate efficiently was limited. According to interviewees, tug dockings were disrupted and delayed because suppliers and service providers were unable to come out and repair tugs and provide much needed spares at the time, resulting in tugs being taken out of service for minor issues that could have been resolved.

R5: *"The COVID-19 pandemic disrupted scheduled maintenance of crafts; due to a lack of maintenance, we saw a high rate of out-of-commission marine crafts."*

R7: *"Workshop 24, who services our tugs, were affected negatively as most workshop 24 staff and technical teams were working from home. They worked on skeleton staff, which increased the time to get crafts repaired or maintained. Our dockings were disrupted and delayed because maintenance staff at workshop 24 staff had COVID -19 and were put into quarantine, which impacted the progression of tug maintenance works. Due to the lack of staff at the drydock, most of our marine crafts couldn't go into a layup for repairs and maintenance. Normal layups and routine maintenance work were disrupted and delayed. This led to some of our tugs being out of commission, and they ended up staying out of commission longer than planned because of these disruptions."*

R7: *"Additional disruptions we encountered due to the COVID -19 pandemic was a lack of suppliers, suppliers or services were unable to provide spares, and this caused a significant disruption to the supply of much-needed maintenance materials and services."*

Because of social distancing and a resource-stressed operation, as well as the culture that prevailed at the time, interviewees indicated they did not want to interact with other employees if they did not have to. Marine pilots who understudy with senior pilots to advance to higher license levels avoided doing jobs that would improve their skill set because many felt it was too risky to advance to the next licence, while others claimed they received no mental support. Due to illnesses and age-level restrictions, many senior mariners were quarantined, resulting in a senior mariner shortage in the operation. Notteboom *et al*. (2020) agrees, stating that COVID -19 safety regulations prohibited individuals with comorbidities from being present on site.

R3: *"Some pilots did not want to do understudy jobs; if it was not my licence, I don't want to go onboard the vessel". Yet we had understudies as well; I had put that on hold. If I am going to do a job, I do it for myself only and for that licence only".*

According to UNCTAD (2020), COVID -19 health and safety measures caused significant port disruptions. Procedures put in place to control the spread of COVID-19 at ports reduced the number of marine personnel on hand (Notteboom *et al*., 2020). The COVID -19 pandemic, according to interviewees, has had a negative impact on the deployment and utilisation of marine resources. Tugs were decommissioned at level 5 lockdown to reduce on-site personnel.

Later, increased employee absenteeism, health and safety regulations, and the inability to maintain marine vessels all contributed to a reduction in the number of tugs in operation.

R4: *"Management reduced the number of tugs in operation to comply with safety protocols; moreover, with reduced shipping, we saw fewer tug movements".* This is supported by Respondent 5 who stated that marine operations had to reduce the number of tugs deployed per shift, which caused so many delays; additionally, shipping companies reduced the number of ships that docked.

According to interviewee comments, the issue of irregular marine operations came up frequently, with staff shortages being the most common disruptions; this viewpoint is supported by research (Notteboom *et al*., 2020). A lack of training, a lack of craft maintenance, a reduction in marine craft availability, late deployment of marine crafts, and delays in servicing vessels all contribute to an abnormal marine operation.

4.5.1.1 Workplace changes caused by the Coronavirus pandemic

According to interviewees, coronavirus health and safety measures hampered the deployment and use of marine resources. Mannan *et al.* (2021) states that port call procedures implemented to control the spread of COVID-19 hampered port productivity. In addition, Notteboom *et al*. (2020) posits that only critical cargo was processed at some ports. Furthermore, interviewees reported that marine operations had been hampered. Mannan *et al*. (2021) agree that economic activity at several ports around the world has been stifled. Personal protective equipment and the implementation of new safety measures altered how vessels were serviced.

R4: *"COVID-19 pandemic led to many shortcuts in marine operations; not everything got done as usual because of the pandemic. Some things got cut off or were not prioritised. COVID -19 pandemic brought varying changes; we had to wear masks and sanitise the tugs on arrival. When someone felt sick, we had to report it immediately to management; even flu symptoms were treated so seriously, tugs were put out of commission, and the crew were sent home to quarantine; this led to crafts being put out of commission and this put strain on employees and marine craft tugs that were operational.*

R6: *"Normally, we used to start operations at 6:15 am; however, due to the pandemic, we had to add an additional 30 mins because employees had to screen, sanitise the tugs and conduct*

compliance checks before marine resources were deployed; this was valuable time we could have used to service vessels."

Respondents stated that significant changes in staffing, and maintaining an adequate number of employees to crew shifts and man crafts, occurred in marine operations. Participants reported a decrease in key marine personnel on site, which is supported by Notteboom *et al*. (2020), who stated that ports worldwide reported a shortage of key marine employees. Employee absenteeism increased, with many taking unjustifiable sick leave, and health and safety measures forced employees over the age of 60, as well as employees with commodities, to be sent home, according to interviews and Notteboom *et al*. (2020) . Furthermore, according to Notteboom *et al*. (2020), global ports experienced moderate to severe shortages in the provision of nautical services, as a majority of the decreases were attributed to the Harbour Master Nautical Services Department

R1:*"The COVID-19 pandemic decreased marine operations a lot. Marine operations slowed down, shipping movements decreased, port activity decreased, because the cruise vessel was not working, even the cruise operator stopped, and so did tourism that visited our port.*
Staff were absent, and crews were not working normally. Usually, we worked for five (5) berthing gangs; because of the pandemic and employees staying at home more often, we did not have enough marine shore-hands in a gang; we worked four (4) berthing gangs, which slowed berthing operations", Furthermore the COVID -19 pandemic forced administrative staff to work from home, which made it difficult for those of us at work to access information and support when we needed it".

R4: *"The Covid-19 pandemic did affect shipping; people got sick, which resulted in short staff, fewer crews on tugs and berthing gangs, which delayed shipping" when one person tested positive, the whole gang would go into quarantine, this resulted in changing of shipping schedules, and allocation of resources and employees had to be transferred from other shifts to fill for those that were out. Everything was just unsettled from a routine operation".*

According to interviewees, marine operations were severely disrupted in terms of staffing and maintaining an adequate number of employees to crew shifts and man crafts. According to interviewees, marine management was forced to roster employees to work overtime to cover all shifts due to increased employee absenteeism, which is confirmed by Mannan *et al*. (2021)

who states that shift work had to be implemented in some ports. Unjustifiable sick leave had increased, according to interviewees. As a result, critical marine personnel were scarce. According to Notteboom *et al*. (2020), ports experienced moderate to severe shortages in the provision of nautical services, with the majority of the decreases attributed to the Harbour Master Nautical Services Department. Respondents indicated that on several occasions, shifts worked with fewer people, deviating from the norm. Employees were also moved between shifts to cover shortages.

R1: *"We noticed a change in staff absenteeism, which increased drastically."*

R3: *"We experienced serious mental fatigue due to a lack of information about the vessels we were servicing. Some pilots had to work overtime because they had to come in from other shifts to relieve pilots who were in quarantine or sent home because of being over 60 years"*

R6: *"During the pandemic, marine management granted marine pilots' permission to do any job; for example, if a pilot had a 35 000 GT licence, if the pilot was comfortable, they could do a 55000 GT vessel, due to the pandemic, the pilotage department sometimes lacked senior pilots and this new permission that was given is not the norm, but management had to do it."*

The Coronavirus had a significant impact on marine operations, according to interviewees, in terms of how marine employees collaborated, communicated, and planned jobs. Employees were compelled into working in silos and avoiding interaction with one another.

R3 "The pandemic changed how pilots interacted; we didn't socialise anymore and discuss jobs; we hardly saw each other due to the safety limitations at work. This has negatively affected working relationships and communication. The working environment became hostile, there was no more comradery amongst pilots, everyone worked in silos, which took us backwards in terms of a lot in the marine environment".

The Coronavirus, according to interviewees, has significantly hampered marine operations in terms of how marine employees collaborate, communicate, plan, and camaraderie. This created a hostile working environment, which occasionally resulted in incidents.

R4: *"Communication amongst mariners had declined severely, negatively affecting comradery and limiting our ability to engage as a team; this sometimes led to incidents while on a job".*

The Coronavirus pandemic, according to interviewees, impacted internal employee transportation arrangements, causing resource deployment challenges and shipping delays.

R4: *"Tugs masters were scared to transport pilots on the tugs; we didn't allow pilots on the tugs as per normal operations because they were in contact with the ships, Tug crews were uncomfortable receiving pilots on the tug out of fear of infection, tug crews also did not want to assist pilots, and pilots had to assist themselves, which is dangerous in this operation. ; so, this caused some delays in moving pilots to different jobs because the pilot boat was also busy; so, pilots had to wait a more extended period to be transported for jobs in the port".*

According to respondents, COVID-19 health and safety measures had a negative impact on marine operations. The interviewees stated that these measures consumed operational time and limited maintenance activity. This caused delays in the deployment of marine resources.

R1: *"We had to use additional PPE, which also increased PPE costs in the business. We had to change the seating arrangements and add extra accommodation for employees to maintain social distancing. Additionally, we had to sanitise vehicles, and employees were asked to clean vehicles after each shift so that the next shift was ready for work on arrival; this took additional time, and we sometimes had to stop jobs early so that we could complete the sanitising in time for shift change".*

R5: *"Confusion amongst employees about health pratique protocols led to internal challenges amongst employees, our onsite clinic had a drastic change in their ways of working, we couldn't walk into the clinic, without making an appointment first and this led to delays and interrupted the operations. As tugs had to come out of operations when someone was sick, we operated with lesser tugs, and we ran the risk because if those tugs broke down, we had nothing.*

Employee marine training and craft certification were disrupted as a result of the Coronavirus pandemic, according to interviewees. The interview participants further stated that disruptions in training led to employees operating with expired craft licenses, putting them at risk of fines from SAMSA.

R4 "Compliance levels decreased or changed, such that marine craft and marine employees' certification had expired, SAMSA issued a notice giving TNPA an extension for certifying crafts and employees tickets, so we had to apply to SAMSA for a waiver, that's how we were allowed to operate marine crafts in 2020".

Situated along the coast of South Africa, the Port of Durban is an important port of call for vessels traveling around the world; according to interviewees, the Port of Durban has seen a significant increase in vessel traffic over the years. Interview participants further stated that port shipping activity is a reliable indicator of marine activity and reflects the port's efficiency and dependability in marine operations.

Shipping movements from April 2019/2020 to March 2022/2023 are shown in Figure 4.1 below. Shipping movement was significantly higher prior to the pandemic (2019/2020), with Marine Operations handling a total of 7244 vessel movements compared to 2020/2021, when the department handled a total of 5884 vessel movements during the pandemic-related lockdowns that were implemented. Ship movements in the Port of Durban decreased significantly in 2020, coinciding with decreased local and global trade and marine activity. The Port of Durban's post-hard lock down levels have improved slightly, with 6075 vessel movements.

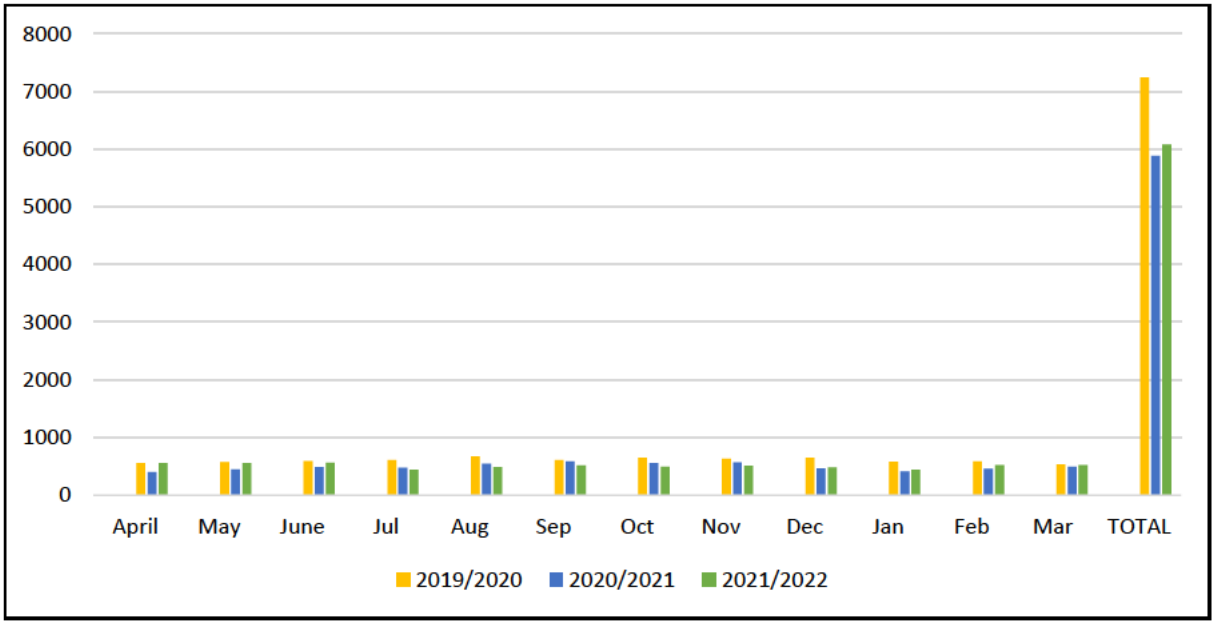

Figure 4.1 Vessel Movements (April 2019 to March 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.2 depicts the number of vessels attended to by the Water Services Department from April 2019 to September 2022. Prior to the Coronavirus pandemic, demand for freshwater was clearly higher, with the department attending to 946 vessels compared to 770 vessels in 2020. In 2020, the Water Services Department serviced fewer vessels in the Port of Durban, coinciding with fewer vessel calls at the Port of Durban. This decrease corresponds to a decrease in global maritime trade (Grater and Chasomeris, 2022), as well as the prioritisation of cargo movements at the Port of Durban.

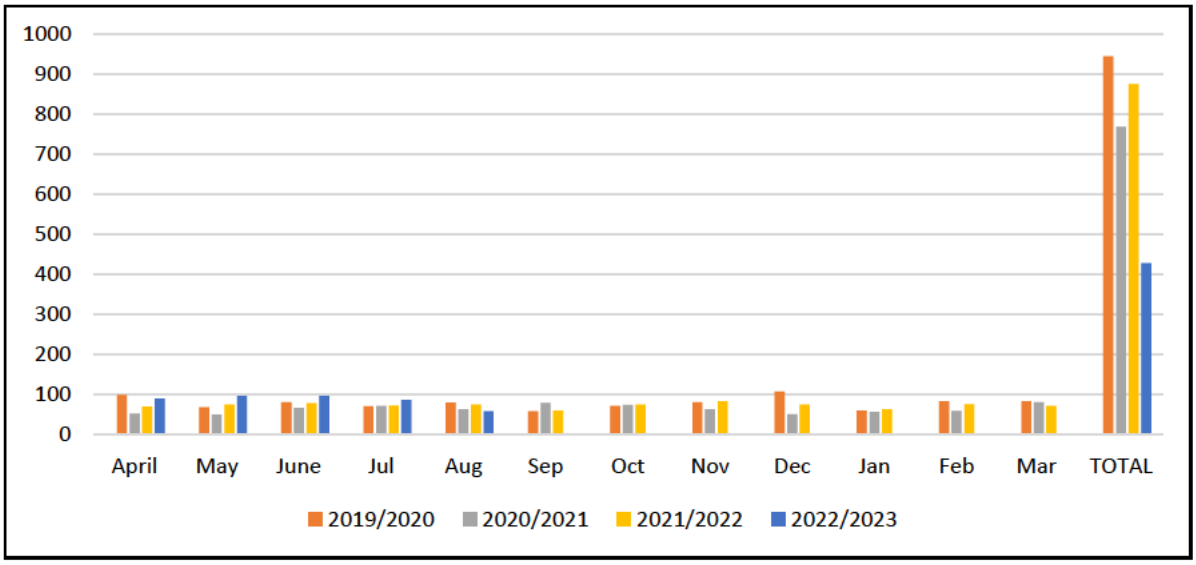

Figure 4.2 Number of vessels attended to by the Water Services department (April 2019 to September 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.3 depicts the amount of freshwater provided by the Water Services Department to vessels calling at the Port of Durban from April 2019 to September 2022. Prior to the Coronavirus pandemic, demand for freshwater services was significantly higher, with the department providing 301 415.84 KL (106444.00 Tons) of fresh water in comparison to 225 993.92 KL (79809.00 Tons) in 2020, with a moderate increase to 252722.19 KL (89248.00 Tons) in 2021. The 2020 Water services department clearly served fewer vessels and provided less fresh water to vessels in the Port of Durban, which coincided with fewer vessel calls.

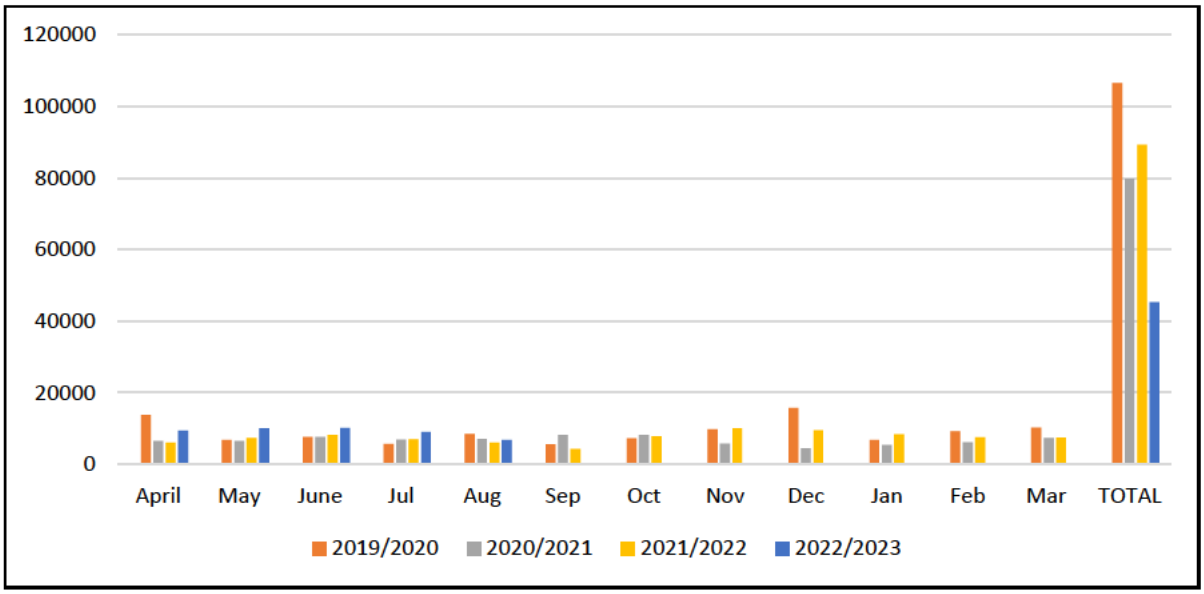

Figure 4.3 Fresh water provided to vessels per Ton (April 2019 to September 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.4 depicts the revenue generated by the Berthing Services department from April 2019 to September 2022. Berthing services revenue is generated through the provision of mooring services; the fee is determined by the Transnet National Ports Authority, approved by the Ports Regulator of South Africa, and published in the annual port tariff book. Figure 4.4 depicts how the Coronavirus pandemic affected the Berthing service's operations and revenue. Moorings services were clearly in higher demand prior to the Coronavirus pandemic, with the department generating R40.25 million in 2018 and R40.97 million in 2019 in response to increased vessel calls at the Port of Durban, before declining to R36.22 million in 2020.coinciding with reduced vessel calls as shown in Figure 4.4.

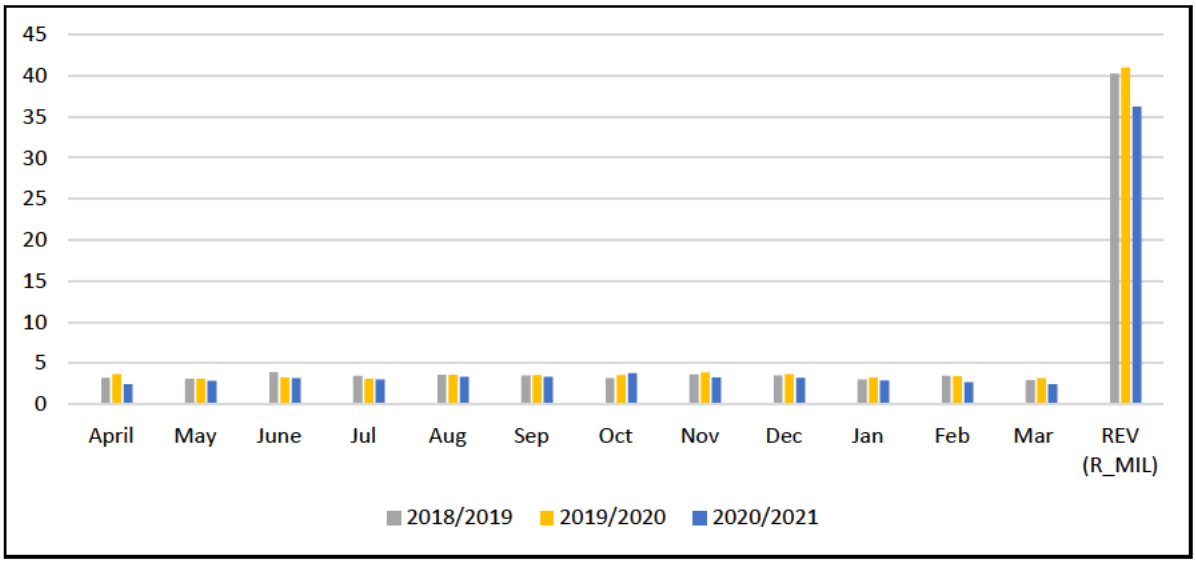

Figure 4.4 Berthing Services revenue (April 2018 to March 2021)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.5 depicts the revenue generated by Marine Fleet services between April 2018 and March 2021; this revenue is generated by the provision of tug services (towage) and related marine craft services. The graph below depicts the impact of the Coronavirus pandemic on Marine fleet operations and revenue. It is clear that demand for marine craft was significantly higher prior to the Coronavirus pandemic, with the department generating revenue of R255.17 million in 2018 and R267.03 million in 2019, before declining to R233.77 million in 2020, which can be attributed to reduced shipping and the unavailability of marine craft resources during the period.

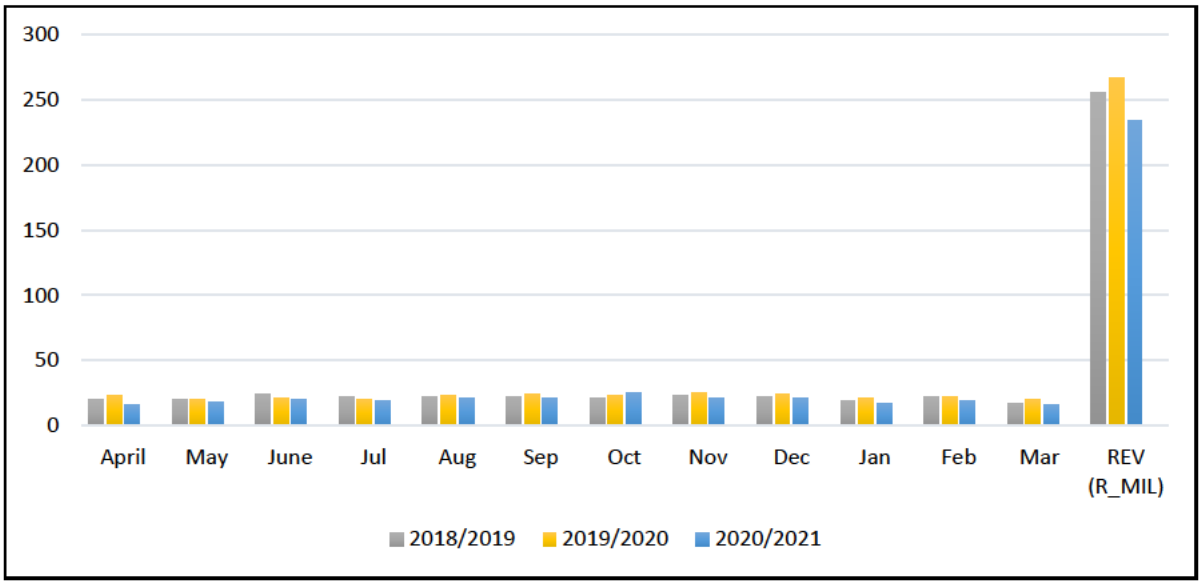

Figure 4.5 Marine Fleet Services revenue (April 2018 to March 2021)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.6 depicts the deployment of berthing service gangs between April 2019 and March 2022. It is worth noting that the Coronavirus pandemic had only a minor impact on the deployment of berthing crews. Prior to the Coronavirus pandemic, berthing crew deployment was clearly higher, with the department deploying crews averaging 99.33% to the operation in the 2019/2020 fiscal year, only decreasing to 97% in March of 2020 and continuing with 100% deployment in the 2020-year, then declining again to an average of 99.17 in 2021. Figure 4.6 shows that, in contrast to respondents who indicated a high level of absenteeism during the pandemic, berthing services deployed berthing gangs 100% of the time in most of 2020. Respondents indicated, however, that management moved employees between shifts and paid employees overtime to ensure gang capacity.

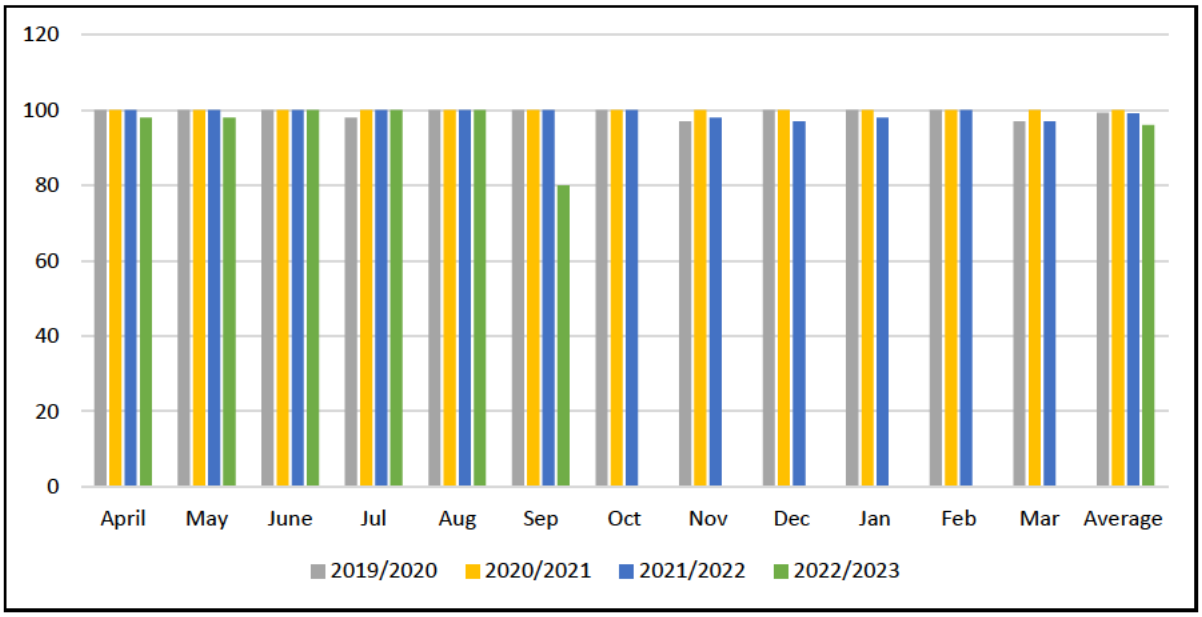

Figure 4.6 Deployment of berthing gangs (April 2019 to September 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

The responses presented above demonstrate that the Coronavirus pandemic drastically altered a once thriving and dependable operation. The operation, according respondents, has slowed. They also attribute the slowdown to reduced port activity and, in some cases, the cessation of operations. This demonstrates that the pandemic and its subsequent measures caused port operations to change their usual operating procedures. Respondents reported increased absenteeism at work as well as a decrease in the number of marine crafts they operated during that time period. Increased workplace health and safety measures resulted in numerous reports of crew shortages to man crafts. Respondents expressed both positive and negative sentiments about the changes caused by the Coronavirus pandemic, with the negative outweighing the positive.

4.5.1.2 Challenges brought about by COVID-19 health and safety measures.

While health and safety measures are implemented to control workplace health and safety hazards, interviewees indicated that the measures must be reasonably practical for businesses and, as such, should not reasonably impede a service or operation. According to interviewees, the Coronavirus pandemic health and safety measures implemented to control the spread of the Coronavirus had a significant impact on the ability of marine operations to operate normally.

R3: *"COVID -19 health and safety protocols made it much harder to work, especially using face masks and gloves; it created additional hazards and made working uncomfortable for employees working on the tugs and marine piloting. We had to do additional administration work to ensure health and safety compliance".*

R3: *"Tug crews restricted marine pilots onboard due to fears of COVID -19 infection, resulting in delays in servicing vessels; ships were delayed for a few hours because they had to do COVID -19 tests while at anchorage; this caused many disruptions of marine operations as some of these checks were done by third parties like port health."*

R6: *"There were delays due to the pilot boat master being absent; this delayed the time it took to get a pilot to their next job. Marine fleet used to bring in employees from other shifts or make them work overtime when they had staff shortages*

According to interviewees, marine operations faced numerous challenges in complying with health and safety measures, such as requiring employees to wear additional Personal Protective Equipment, which increased operational risks. Furthermore, interviewees stated that health and safety measures resulted in high-risk employees being sent home, resulting in a mariner shortage on the job.

R3: *"The strict health and safety measures resulted in the nautical services department experiencing a shortage in staff complement of marine pilots because if one pilot tested positive, the whole shift would go into quarantine. Some pilots tested positive multiple times, so we had delays in serving vessels. Furthermore, pilots over 60 or had comorbidities were sent home, resulting in a shortage of senior pilots."*

Respondents lamented how safety and health requirements caused delays in the deployment of marine craft. Entire crews were quarantined, employees from other shifts were brought in to fill the gaps, or employees were brought in on overtime to ensure the operation was fully staffed. Respondents stated that tugs were taken out of service on numerous occasions due to a lack of maintenance personnel and delays in servicing crafts.

R1: *"Thiers was a massive behaviour change; we had to work using additional PPE. Sanitising crafts all the time, additionally it restricted management from being able to bring all the*

employees together in groups to perform safety symposiums; we had limited engagement with employees".

R4: *"Social distancing created disruptions for us on the tug because it's not big enough to social distance". Sanitising the craft before and after each shift added additional time and a different daily maintenance task. Additionally, when someone tested positive for COVID -19, the whole crew would go into quarantine, and the tug was put out of commission. That means one less tug in operations which creates delays in shipping".*

R3: *"The use of face masks made it harder to communicate and hear people, our jobs require clear and concise communication, and we had to shout to give the command to tugs and vessels, furthermore, we had pilots who were over the age of 60 years, who had to stay at home ".*

Employee comradery was further eroded by health and safety measures; respondents cited a lack of employee engagement, restrictions on employee movement, and support services working from home as all affecting their ability to service vessels on time.

R6: *"The health and safety measures introduced restricted us from working in close contact; we had to sanitise and use masks constantly. The rapid tests that vessels had to do did delay shipping."*

4.5.1.3 Inherent challenges facing Marine operations

Interviewees stated that marine services face inherent challenges on a daily basis, and that the pandemic only exacerbated these challenges; respondents stated that it was difficult to blame the Coronavirus pandemic, as marine operations in the Port of Durban do face regular staff shortages, and that maintenance of marine craft is a common challenge.

R6: *"Marine services in the port of Durban experience day-to-day disruptions and challenges; there are challenges in marine operations that have been pre-existing in operation before the COVID-19 pandemic; however, the COVID -19 pandemic exacerbated the challenges .Staff shortages exist in marine services. I would say it's an inherent challenge for marine operations in the port ".*

R4: *"Berthing services experienced delays in deploying gangs, but it's hard to say what the challenges were at the time; we can't assume it was covid-19 pandemic related. It could be that they were called late.*

4.5.1.4 Impact on staffing

The COVID-19 pandemic, according to IAPH (2020), had a negative impact on port staffing worldwide, with many experiencing shortages of key marine personnel (Notteboom *et al*., 2020). Ports were forced to remove high-risk employees and limit onsite personnel due to rapid infections and health and safety measures (TNPA, 2020).

R4: *"We saw high absenteeism rates in marine. We ran at a minimum crew at times. However, we always ensured the safe manning of crafts. We moved staff around from other shifts or crafts, and some staff worked overtime to fill the shortages. Some of our crews had to go work in other ports. Due to shortages on their tugs, even though we were short, we had to support other ports as well at the same time".*

R1: *"Sick leave increased significantly, and the operations did experience a shortage of staff due to people getting sick and quarantining. There was a limited number of berthing gangs, which made it difficult for employees to take leave and rest because of the shortage of shore hands. Normally there would be eight shore hands in a gang, allowing for two shore hands to take leave. Due to COVID -19 pandemic, we had to operate with 6 or 7 shore hands per gang, only allowing one to take leave at a time; this resulted in staff being tired because they could not take their annual leave. We had to call employees to come work overtime, which cost the department; we ran at a loss. Crews had to work extra hours to cover for employees that were not at work."*

R5: *"It was not easy staffing marine operations. Staffing in the maritime sector was very bad .Staff complement was not adequate for the operations; we had many infected staff in quarantine at times, staff was not optimal for the operation, when someone was infected, the whole crew had to be sent home; when staff isolated, we had to bring in staff for other shifts or sometimes pay overtime , A lot of staff were brought in on overtime; we mainly used overtime, furthermore, Employees abused leave; some employees would be out of work for fourteen days when they came into contact with someone but refused to disclose their medical certificates."*

R6: *"In the nautical department, some Marine pilots were sent home, others were infected or in quarantine for long periods, and we had to bring in pilots from another shift to fill in the shortages, bringing in staff from other shifts to make up for the shortages was common at the time but was risky."*

R3: *"There was increased absenteeism amongst pilots; because open licence pilots are more in demand, if an open licence got sick and the other two on shift went into quarantine, we ran the risk of not having open licence pilots on the shift."*

R5: *"Marine resources were brought in from other marine departments when we were short, marine pilot trainees came from the Harbour Master's department to assist in tug operations, and some qualified pilots were even sent back to support the marine fleet department because when our tugs masters got sick or quarantined we ran short of tug masters, so pilot trainees were brought in to operate tugs."*

R6: *"From a port control planning, we did experience times where a shortage of tugs was reported in the mornings, and on several occasions, the marine department reported shortages of staff, where they reported shortages of GPRs or tug masters, we had challenging situations, however it's difficult to say if it was covid-19 or due to other factors. Berthing services there was a time when the operation ran on a bare minimum; they reported employee shortages to absenteeism."*

According to interviewees, absenteeism in marine operations was high during the pandemic; Figure 4.7 shows that absenteeism in marine operations was high. While it may not have been significant, there is evidence that the operation was strained due to a staff shortage. However, respondents stated that management moved employees between shifts and paid them overtime to ensure the operation was adequately capacitated.

Figure 4.7 below depicts absenteeism rates in Marine Operations from April 2019 to June 2022. According to the graph below, Marine Operations experienced varying rates of absenteeism over the period, averaging 1.93% in the 2019/2020 fiscal year. In 2020/2021, the absenteeism rate rose to 2.05%. However, absenteeism rates fell to 1.70% in 2021/2022. Absenteeism rates were found to be significantly higher in February and March 2020, at 2.7% and 1.8%, respectively, peaking at 3% in May 2020, coinciding with the onset of the Coronavirus

outbreak and the subsequent health and safety measures implemented to combat the virus's spread. In the fiscal year 2020-2021, marine operations absenteeism averaged 2.05%, far higher than the 1.5% averaged in 2018/2019.

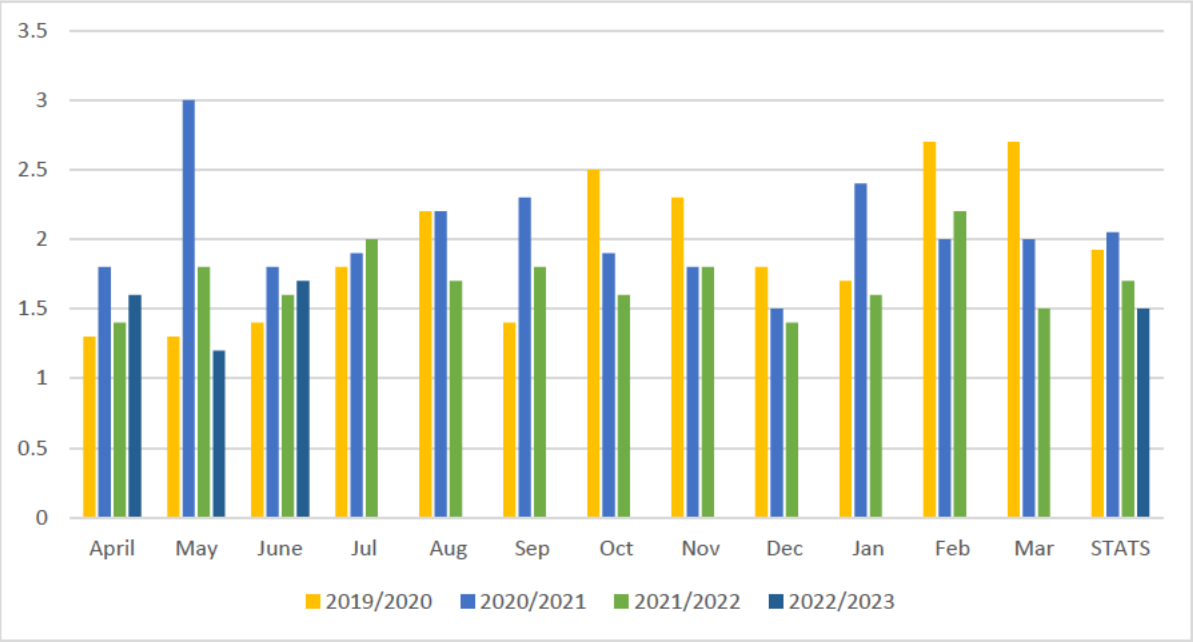

Figure 4.7 Marine Absenteeism (April 2019 to June 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

According to interviewees, staffing the operation at the time was difficult, highlighting high levels of absenteeism in marine services. Employees were required to work extra hours to compensate for the employee shortage, as there were a limited number of employees in berthing gangs, which is a significant variation from the average number of employees in gangs. Employees were moved between shifts to ensure critical staff were available and gangs followed safe manning rules for tug operations; even though bringing in employees from other shifts was risky, the marine pilotage department had to do so when senior pilot shortages were an issue. Employees' use of sick leave had increased, resulting in staff shortages, increased overtime, and, eventually, increased labour costs.

4.5.1.5 The impact of COVID-19 on marine resource deployment and utilisation

The Coronavirus, according to interviewees, significantly reduced marine operations. The pandemic slowed the deployment and utilisation of marine resources. Tug shortages were reported by participants, and tugs were sometimes deployed late. During the fifth level of the Coronavirus pandemic, marine operations had to reduce the number of tugs in operation to ensure less on-site personnel, which caused shipping delays and reduced operational efficiencies.

R1: *"The COVID -19 pandemic adversely affected the deployment and utilisation of marine resources."*

R4: *"When COVID -19 pandemic started, we experienced disruptions to tug operations, specifically the number of tugs that were in operations on some shifts, "Not all five tugs operated, as usual .We had to take tugs out of commission to reduce staff numbers on-site in level 5, and on some days, we only had two tugs operating. Instead of having five tugs .Therefore, tugs were underutilised and not deployed, as usual; putting one tug alongside minimised the number of people on-site to comply with the social distancing requirements."*

R5: *"In the port of Durban, we have ten tugs; of the 10, we did not utilise all at once, we would rotate tugs to cater for breakdowns and infected crews. Lockdown level 5 negatively affected the utilisation of tugs severely, and during 2020, tug utilisation and deployment were under par; for a while, I don't think we met the demand for fleet resources; we did not deploy tugs as per normal or utilising our resources fully. We experienced most operational challenges to tug utilisation after level 5 because there was no tug maintenance and craft surveys during the height of the pandemic; after level 5, all the craft surveys came back; we had to take crafts out of commission one after the other to do maintenance and get them recertified, that was a major disruption to tug utilisation. This was further exacerbated by lack of procurement support, which took longer than usual."*

R3: *"Tugs were delayed because in the mornings, Tug crews had to sanitise tugs, and we had to start sometimes shipping at 7 am instead of 6 am."*

R4: *"When tugs were in a layup for repairs or maintenance, and someone tested positive, the whole workshop got shut down, which extended the anticipated time the tugs would be in operations; this affected operations because the tug was not back at the expected time".*

R5: *"With reduced staff on the shift, this impacted marine operations because we had to cut down the number of people, which means we had to cut down the number of tugs we deployed. When we cut down to 4, we ran the risk of going to 3 tugs. This affected the types of vessels we handled; as ships get bigger, they require bigger tugs".*

According to interviewees, employees had to be rostered to work overtime to staff its operations and remain compliant with safe manning of tugs, which significantly increased the wage bill at the time

R1:*" Staff had to be paid overtime, so we could deploy berthing gangs as we used to".*

R5: *"We did not change our quad shift pattern; even though we cut down on staff numbers, the shift pattern was not changed. We stayed on the quad shift but with a reduced number of employees; however, we complied with the safe manning of the crafts.*

According to respondents, the deployment of marine resources was significantly delayed during the period. According to interview participants, late deployment of marine resources such as marine pilots and tugs has a negative impact on vessel planning, shipping movements, and the port's reputation. Late deployment of resources, according to interviewees, had a negative impact on customers, terminal operators, and cargo movement.

R6: *"From a VTS planning perspective, marine operations usually run five tugs and the default beings 4; however, during the pandemic, there was a significant change in tug utilisation and deployment, there were times we requested tugs, and they were deployed late. we did experience a shortage of tugs, berthing gangs, and pilots. Which are key marine personnel for this operation. There were numerous delays in the deployment of tugs when requested; this was mainly due to staff shortages; there was never a case of no tugs available; it was just short or late. It might not have been optimal, but we tried to utilise our marine resources as much as possible."*

Figure 4.8 depicts the availability of tugs at Marine Operations from April 2019 to August 2022. Tug availability denotes the availability of port tugs to assist vessels entering port waters; availability can also be deduced as tugs in service and on standby awaiting the pilot's request. The graph below shows that tug availability has been constrained in recent years, with an average of 91.42% over the previous three years. Prior to the Coronavirus pandemic, tug availability in 2019/2020 averaged 91.67% across the fiscal year; however, tug availability dropped to as low as 85% in April and November of 2019. Throughout the fiscal year 2020/2021, tug availability fell to an average of 89.92%, with a significant drop to 84% in July 2020. As mentioned by respondents, this decline could be attributed to a number of factors, including a lack of human capital to man these crafts or maintenance issues that could not be addressed due to a lack of contractors. Tug availability improved slightly in fiscal year 2021/2022, reaching an annual average of 92.67%. What is clear is that tug availability is a major issue, with availability varying over time.

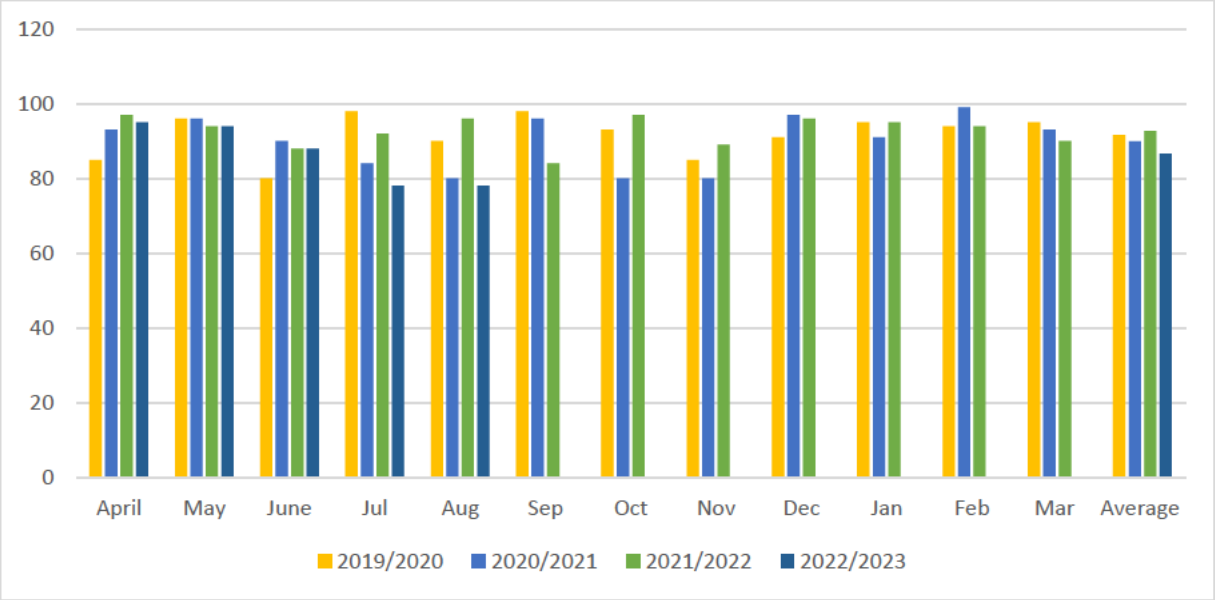

Figure 4.8 Tug Availability (April 2019 to August 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.9 depicts the deployment of tugs at Marine Operations from April 2019 to August 2022. Tug deployment refers to Vessel Traffic Services allocating tugs to assist pilots in incoming or sailing vessels. Tug deployment is contingent on Tug availability. Figure 4.9 shows that tug deployment has been severely constrained in recent years, with tug deployment averaging 60.50%. Tug deployment in 2019/2020 averaged 71.58% during the fiscal year

preceding the Coronavirus pandemic. During the same time period, however, tug deployment fell to as low as 23% in February 2020 and 12% in September 2021. This reflects a strained operation in which the availability of critical resources to service vessels and provide marine operations fell below 50% on multiple occasions. Tug deployment fell to 57.17% on average during fiscal year 2020/2021, with deployment levels falling below 60% from October 2020 to June 2021, a nearly nine-month period. While the coronavirus pandemic occurred in 2020, marine operations clearly suffered long after the hard lockdowns, with a tug deployment average of 52.75% in the fiscal year 2021/2022, significantly lower than the tug deployment average of 82.50% in 2018/2019.

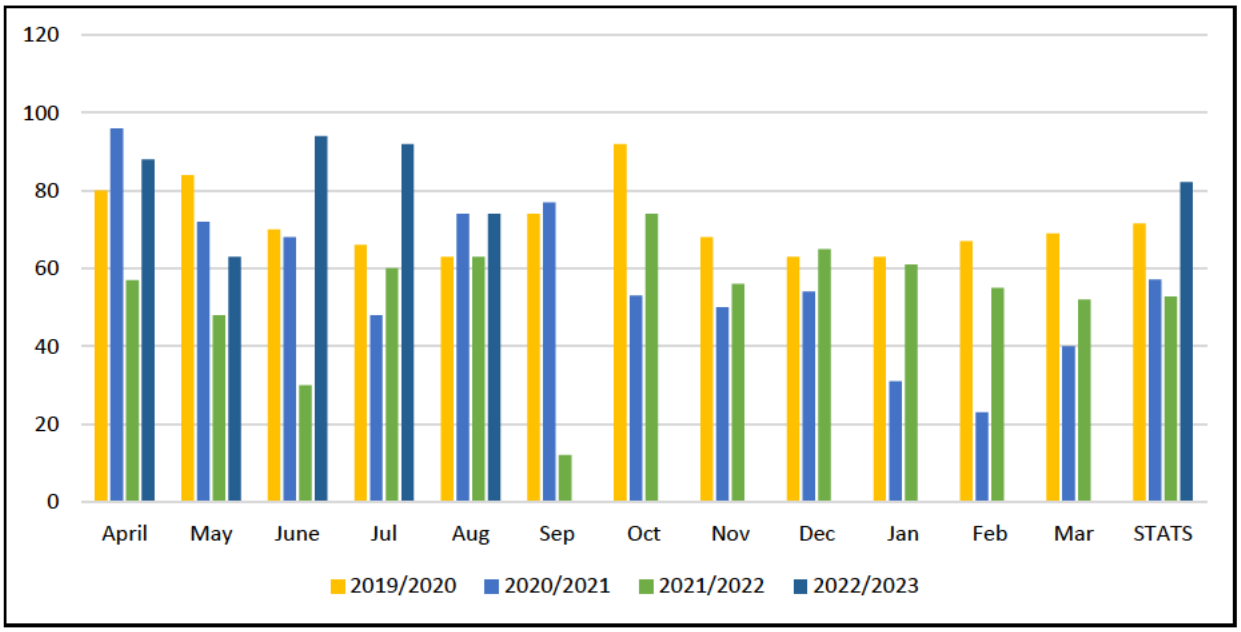

Figure 4.9 Tug Deployment (April 2019 to August 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

Figure 4.10 depicts tug utilisation at Marine Operations from April 2019 to August 2022. The actual use of tugs by marine pilots to assist incoming or sailing vessels in the port is referred to as tug utilisation. Tug utilisation is influenced by both Tug availability and deployment rates. Figure 4.10 shows that tug utilisation had been severely strained in recent years, averaging 34.44% in the previous three years (April 2019 to March 2022); it is worth noting that utilisation peaked at 44% in March 2022. Tug utilisation averaged 33.58% in the 2019/2020 fiscal year. During this time, however, tug utilisation fell to as low as 24% in January 2020 and 23% in April 2020.This is an indication of a stressed operation, as the utilization of critical marine resources to service vessels and provide marine operations has frequently fallen below

40%. Tug utilisation fell to an average of 32.42% throughout the fiscal year in 2020/2021, with lows of 28% (May 2020) and 29% (June 2020). While the Coronavirus pandemic began in 2020, marine operations clearly suffered long after the hard lockdowns were implemented; however, tug utilisation has a history of poor performance. As a result, it is reasonable to conclude that the coronavirus's impact exacerbated the difficulties associated with tug utilisation

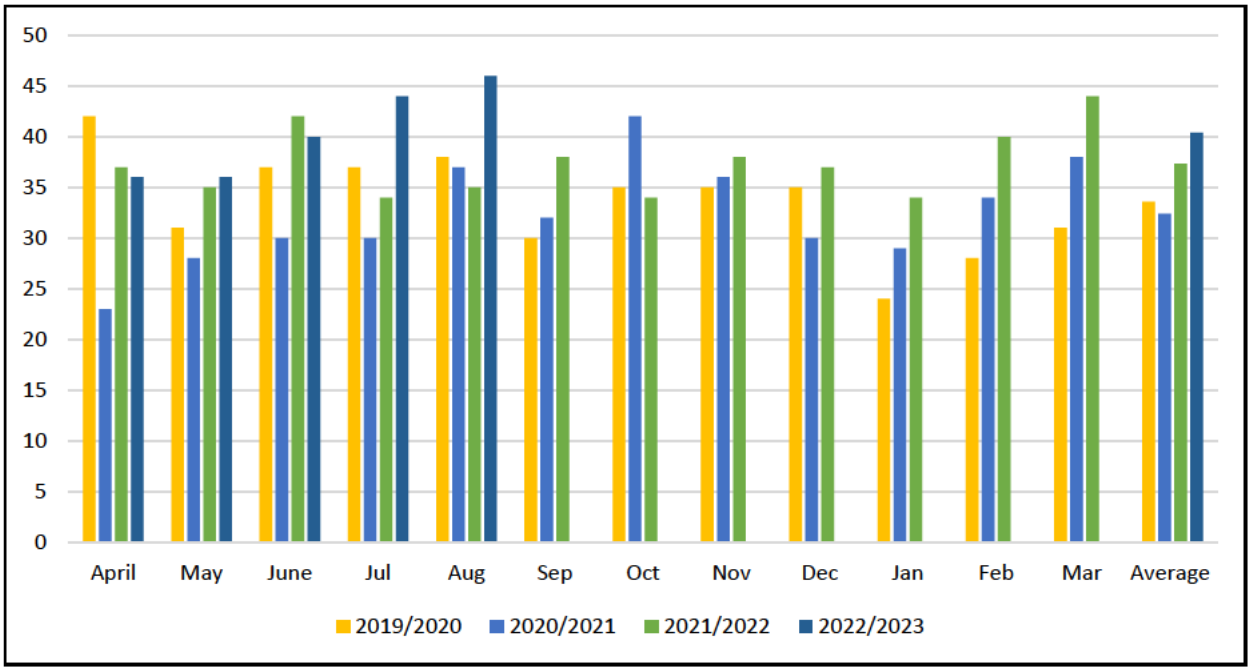

Figure 4.10 Tug Utilisation (April 2019 to August 2022)

Source: Author compiled from Transnet National Ports Authority, 2022

The COVID-19 pandemic had a negative impact on the availability, deployment, and utilisation of marine resources, according to the responses presented above, with several respondents indicating delays due to staff shortages and compliance measures. While the operations had tugs, marine services did not operate all marine resources during the pandemic because employees were sent home to reduce the number of staff on site, resulting in tugs being taken out of service in lockdown Level 5. Craft maintenance issues were also identified as a contributing factor, with tugs experiencing maintenance issues being taken out of service and unable to be repaired on time due to delays in obtaining spare parts and contractors. Respondents also stated that a lack of critical personnel strained the operation because many employees were absent. Respondents indicated that berthing gangs had been reduced and

employees were brought in to replace those who had been quarantined. It was not a routine operation, according to respondents.

4.5.2 Recommendations for mitigating the effects of the Coronavirus pandemic's disruptions.

The researcher inquired about the methods used by marine operations to ensure the provision of marine services. The interviews yielded the following results:

R4: *"We made sure we came to work early and left on time, as well as worked according to our schedule. We made sure our crafts were ready as quick as possible on every shift; we arrived early to sanitise our tugs, so by the time the shipping list was out, the tug was ready."*

R4:*"We got involved in ensuring tugs were repaired timelessly and reported faults immediately so that the tugs wouldn't be put out of commission and create delays."*

R4: "*The company did a lot to ease our anxiety; they came and spoke to us and provided PPE and sanitisers".*

The researcher also asked the participants for suggestions on how to mitigate the impact of pandemic-related operational difficulties on marine services at South African commercial seaports. The mariners' responses were varied:

R1: *"I would say we need more staff, so if something like this happens again, we have enough staff to fill gaps so that other crews can rest and train staff to play different roles in such situations. Multiskilling staff, because multiskilling gives you the ability to play the role of shore hands, berthing master, or senior berthing master if the need arises, so if someone is unavailable, an employee can fill the position immediately. Maintaining health and safety protocols, even though they were challenging, the safety protocols helped, and we should train more HSE reps in the department so that they can report health and safety issues to management for addressing, Additionally, I would say have more engagements with employees and continue issuing the COVID-19 PPE."*

R2: *"Keep employees aware of what's happening and maintain the hygiene standards we have in place; COVID taught us to be clean all the time."*

R5: *"Never stop training; we must continue upskilling our workforce because our profession is deemed a scarce skill. This pandemic showed us how we desperately need more mariners in South Africa. It takes time to train as a GPR, Tug master or CMEO. We should continue to train and boost our staff, complement and multi-skill them, allowing us to draw from this pool of marine resources. We should be able to pull from berthing, marine fleet, pilots, and VTS when we need people. We should also be able to draw from shipping lines, such as deckhands; this shouldn't be limited to just TNPA staff. What normally happens is other ports draw staff from the Port of Durban, sometimes, they take our staff, and we run short; they take from the Port of Durban to fill up other ports. We need more marine resources, more trainees."*

R6: *"The health and safety measures that was put in place was effective, we social distanced, reduced staff on site, the use of face masks and sanitiser did help employees. The measures did disrupt VTS operations, but it was very minimal. Being multi-skilled allowed VTS staff to be better prepared for several challenges and disruptions during the COVID-19 pandemic."*

4.6 Discussion

According to interviewees, marine operations in the port system are labour-intensive, with a heavy reliance on staff and marine resources to provide an efficient marine service. Respondents indicated that staffing marine operations experienced significant disruption, which is acknowledged by Notteboom *et al*. (2020), which indicated that ports globally experienced a shortage of port employees. Supporting this notion Mannan *et al*. (2021) deduced that ports were disrupted due to labour issues. Health and safety measures implemented to control the spread of COVID-19, according to interviewees, created additional challenges in providing marine services. The use of PPE made working in a marine environment more difficult and caused shipping delays (UNCTAD, 2020). According to Notteboom *et al*. (2020), health and safety restrictions caused significant port disruptions, limiting port employees. Respondents claimed that the pandemic made it difficult for them to attend mandatory training required to keep their certification to operate marine vessels. Respondents also emphasised the plight of the vessels they operated, which could not be serviced or maintained due to contractors' inability to come out on-site and ensure their seaworthiness.

According to interviewees, tug operations and vessel navigation are heavily reliant on well-trained and experienced mariners. In this regard, it appears that marine operations did not foresee such a disruption affecting its employees. Interviewees stated that despite the fact that

marine services were provided throughout the pandemic, it is clear that they were done under significant strain, both on employees and on hard resources. From the responses above, it is clear that marine services were subjected to a slew of challenges, both inherent and caused by external factors. Some participants stated in their responses that marine operations were already facing challenges, which the Coronavirus pandemic exacerbated. Comments from interviewees show that given such scenarios, it may be past time to put in place programs and policies to ensure that marine operations are prioritised and given the attention they require in terms of financial and managerial intervention.

According to interviewees, marine services lack policies addressing craft maintenance and servicing. Marine Fleet management programs, according to interviewees, should be more than just rhetoric; they should be implemented to ensure that marine services reap their benefits. Furthermore, interviewees suggested that the Transnet National Ports Authority look into incorporating private tug operators and external mariners into the operation to supplement the number of tugs and marine personnel in the ports system. According to respondents, allowing private tug operators would also allow marine services to maintain their tugs in accordance with maintenance plans. Private tug operators, as stated by interviewees, will also provide additional marine resources, reducing the strain on marine operations teams during such disruptions. From the responses above, there is more room for growth in marine services at the Port of Durban.

According to interviewees' comments, multiskilling marine employees should be prioritised in order to prepare them for disruptions. The interviewees were of the view that marine operations should increase its staff complement to reflect the size of the port and the scope of the operation. Furthermore, respondents stated that continuous training of marine personnel for the operation is critical, as the pandemic highlighted pre-existing issues of aging personnel. Respondents also stated that marine crafts should be prioritised more, and investment in marine crafts should be prioritised to ensure the marine operations department has adequate resources to service vessels. Respondents also stated that dedicated spares stores should accompany this, so that marine services can easily access spares when needed, rather than waiting long periods of time and being delayed by bureaucratic procurement processes.

4.7 Conclusion

This chapter presented and discussed the findings of the study, which were based on the methodology described in the previous chapter, as well as the study's objectives. Surprisingly, very insightful evidence about the experiences of the participants emerged. The COVID -19 pandemic, amongst other things, was unanimously agreed to have had a significant negative impact on marine operations. The findings of the study also revealed that marine operations at the Port of Durban face numerous operational challenges, such as a shortage of trained and experienced marine professionals, an ageing marine fleet, procurement delays in sourcing needed spares for tugs, rapidly changing international trade practices, and that the pandemic exacerbated these issues. Given the growing demand for international trade and the importance of ports in facilitating local and regional economic growth, identifying and addressing these challenges is critical for developing marine services that can withstand future challenges and disruptions. Based on the findings presented and discussed, the following chapter will elaborate on the study's conclusions and recommendations.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Maritime operations play an integral part in a port's functioning (International Transport Forum Report, 2013). It is a service that facilitates international trade by leveraging specialised marine skills to manoeuvre cargo-carrying vessels into harbours and berthing them at terminals, ensuring local and national economic development through efficiently handling cargo vessels (Mthembu and Chasomeris, 2020). Uninterrupted maritime operations are the objective of any port (Moon *et al*., 2014; Mthembu and Chasomeris, 2020). The service's key performance indicators are the efficient response to marine operations, such as marine resource deployment, quick vessel movements, faster turnaround times, and safe operations in a port (Mthembu and Chasomeris, 2020 and TNPA, 2022). The main aim of this study was to examine the impact of the Coronavirus pandemic on marine operations at the Port of Durban. The purpose was to investigate the disruptions caused by the Coronavirus and its associated implications on marine operations at the Port of Durban, as well as make recommendations on how these disruptions can be mitigated so that marine operations at South African ports can provide uninterrupted and efficient marine service.

To accomplish the aim of the study, clear objectives were set and applied as guidelines for conducting the study. To reiterate, the objectives of the study were: To examine the impact of COVID 19 pandemic on marine operations at the Port of Durban over the period January 2020 to December 2020; and To make recommendations directed towards mitigating the impact of COVID-19 related disruptions on marine services at South African seaports. The investigation focused on the Transnet National Ports Authority's maritime services sector at the Port of Durban. The study employed a judgmental, purposive sampling approach. Participants in the study were not chosen at random. Rather, those chosen had expertise, knowledge and experience in marine operations. In this investigation, purposive sampling strategy was used.

The subset was selected based on a set of characteristics related to knowledge, expertise, and experience in marine services. Participants were required to be involved in maritime-related activities. The study enlisted the participation of fifteen permanantly employed marine operations employees.

The fifteen participants were chosen using a technique known as purposeful sampling. These marine service department employees, have knowledge and experience in marine-related subjects (Mthembu and Chasomeris, 2020). Workers in the marine services department are in control of towage boats, mooring, vessel traffic management, and navigating ships into Durban's port (Mtembu, 2014). As a methodology, a mixed-method approach was used to collect precise data. This method was the most effective research technique to examine and assess the study problem since it combined theoretical analysis with concrete empirical information to interpret and identify problems and their influence on marine services.

The mixed methods approach allows for the use of both qualitative and quantitative methodologies (Denscombe, 2010). Primary data was collected using a standardised open-ended questionnaire to elicit participants' experiences, views, and attitudes regarding the phenomenon under investigation, enabling the researcher to ask individuals questions in a more consistent manner (Storey *et al*., 2015). During the interview process, open-ended questions were used to collect primary data and allow participants to express themselves freely.

The researcher conducted fifteen open-ended semi-structured interviews lasting 15 to 30 minutes each with marine operations employees. At all times, interviews were conducted in strict accordance with Coronavirus safety measures such as social distancing, sanitisation, and face mask use protocols. The primary data collected through interviews were recorded and transcribed, and the resulting qualitative data was thematically analysed using thematic analysis to identify, analyse, and interpret the data.

Secondary data about marine services operations on tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism, number of vessels attemded to, and the number of vessels water services serviced were also examined to see what disruptions marine services experienced during the COVID-19 pandemic. Data on tug availability, tug utilisation, tug deployment, berthing deployment, employee absenteeism, number of vessels water service services were sourced from Transnet national Ports Authourity’s database and analysed using descriptive statistics. Data was examined to identify trends in the data over the study period, which was January 2020 to December 2020. The data was presented graphically, allowing for a visual representation of the quantitative data collected. The investigator ensured that ethical guidelines were observed at all times.

The researcher took into account the fact that interviews were a part of the study's data collection process. Confidentiality was upheld and data protection was properly implemented

throughout the process.This was accomplished by not addressing participants by name (Mthembu, 2014).

This chapter provides a summary of findings, makes recommendations, highlights areas for further research, as well as the limitations of the study.

The next section provides a summary of the main findings of the study.

5.2 How the Study's Objectives Were Accomplished

A literature review was done based on the goals of the study to determine how the Coronavirus pandemic affected marine operations. Open-ended semi-structured interviews were used to obtain the thoughts of the employees on the subject. The major themes that emerged from the literature research, data gathering, and interview processes helped the study accomplish its goals. The methods used to address each study objective are discussed in the section below.

5.2.1 Objective One: Disruptions to marine services

The primary data from the interviews revealed that marine operations experienced significant disruptions in providing marine services. Respondents indicated that the Coronavirus pandemic disrupted marine operations at the Port of Durban. This is supported by research on the effects of the Coronavirus pandemic on global trade, shipping, and port operations (UNCTAD, 2020 and Mannan *et al*., 2021). Furthermore, secondary data from the Port of Durban's marine operations showed a decline in key performance indicators such as staff availability, marine craft availability, marine craft deployment and utilisation, and vessel movements (TNPA, 2022). Marine operations are a labour-intensive operation that necessitates on-site personnel (Khuzwayo, 2019).

Comments from respondents showed that one of the most significant challenges faced by marine departments collaborating to provide marine services at the Port of Durban was high employee absenteeism (TNPA, 2022). According to the primary data, respondents' comments indicated that marine operations were significantly disrupted in terms of staffing and maintaining an adequate number of employees to crew shifts and man crafts.

Respondents indicated that that marine operations experienced a significant decrease in on-site staff, with many employees taking unjustifiable sick leave. During this period, marine operations experienced shortages of critical marine personnel such as marine pilots, tug masters, berthing crews, chief marine engineers, and vessel traffic controllers, which is

consistent with Notteboom *et al*. (2020) who stated that ports reported staff shortages and that the majority of the decreases were attributed to the Harbour master nautical services department.

According to the primary data, respondents' comments showed that health and safety measures were the most disruptive to marine operations; even though these measures were intended to save lives, the measures caused additional disruptions. Respondents indicated that some of the measures led to employees being sent home, resulting in reduced operational employees. Comments of respondents revealed that due to limited space on marine crafts, bakkies and buildings, social distancing was impractical. As a result, management had to purchase park homes to separate berthing crews, which drove up operational expenditure. Primary data from interviews show that social distancing isolated teams and reduced employee communication, creating a hostile work environment. According to respondents, to ensure a limited number of on-site employees, some tugboats had to be decommissioned at the height of the pandemic. Responses from respondents show that this led to reduced marine activity and delays in port operations.

According to primary data gathered through interviews, health and safety measures introduced to protect vulnerable employees resulted in employees over 60 and those with comorbidities being removed from marine operations. Respondents indicated that many of these employees were critical staff who provided specialised skills in key marine departments; the removal of these employees resulted in delays and disruptions in the deployment of marine resources and in turn led to shipping delays.

Secondary data and responses from respondents revealed that marine crafts, which are critical marine resources for service vessels, were frequently decommissioned. Respondents indicated that health and safety restrictions limited maintenance activity, primarily because contractors and service providers were unable to come out on-site and service tugs or deliver critical spares, causing significant disruptions to craft maintenance.

Secondary data and comments from respondents showed that marine craft maintenance and servicing programs were disrupted, resulting in a chain reaction of craft failures. Respondents revealed that craft maintenance suffered, and marine operations saw higher-than-usual vessel breakdowns. Secondary data indicates that as a result of this, tug deployment and utilisation were severely hampered during this time. Comments from respondents showed that marine operations did not receive adequate support from supporting departments; Respondents

revealed that training and development lagged during the period, and as a result, employees missed out on valuable training. Furthermore, the Coronavirus pandemic hampered recruitment, resulting in insufficient marine operations staffing.

Primary data shows that critical marine technical positions went unfilled for long periods, causing operations to suffer. Respondents revealed that finding suitable candidates during the period was identified as a challenge due to the lockdown measures. Primary data further indicates that that recruiting new employees took longer, resulting in marine operations requiring more staff to work overtime to fill crews. According to comments from respondents and the organisational structure of Marine operations, the Marine Fleet department requires an optimum resource capacity of 492 employees to operate marine crafts and provide uninterrupted towage services, as shown in the Table 5.1. This resource complement is ideal for running 6 Tugs.

Table 5.1 Optimal Marine Fleet Resources

Department	*Tugs*	*Pilot Boat*	*Launch*	*Floating Cranes*	*Berthing*	*Admin*	*Water Services*	*Technical Support*	*Ops Management*
To Operate 6 Tugs	196	32	20	10	198	6	11	11	8
Total						**492**			

Source: TNPA (2022)

According to respondents, the department currently employs 410 people. Due to current resource capacity, the marine fleet services operate five tugs rather than the optimal six tugs, as shown in the Table 5.2.

Table 5.2 Deficit Marine Fleet Resources

Department	*Tugs*	*Pilot Boat*	*Launch*	*Floating Cranes*	*Berthing*	*Admin*	*Water Services*	*Technical Support*	*Ops Management*
To Operate 5 Tugs	157	32	19	7	166	4	9	9	7
Total						**410**			

Source: TNPA (2022)

According to respondents, employees operating marine crafts with expired licenses risked being fined by SAMSA; additionally, training disruptions impacted employees' ability to operate crafts as well as their internal promotion. Comments from respondents show that grading and compensation of internal maritime training, development, and understudy programs were hampered by the Coronavirus pandemic. Respondents indicated that many trainee understudy programs did not go as planned, forcing employees to work in silos. Primary data show that the pandemic disrupted understudy jobs; comments from respondent's show that understudies were not doing all of the jobs they would normally do and that in-house training was performed under high stress. Primary data shows that understudying was not prioritised, and senior employees were hesitant to take on understudies. Respondents indicated that the pandemic limited mariners' training and advancement, limiting their job opportunities.

Comments from respondents showed that that using additional COVID -19 PPE made working in marine operations more difficult; marine operations also spent significant amounts of money to source and purchase PPE. Respondents indicated that disruptions in the delivery of marine services were frequently caused by vessel sanitation, screening, and the completion of administrative processes. Comments from respondents show that internal transportation arrangements were disrupted as a result of the Coronavirus pandemic, such that tugs no longer transported marine pilots because tug masters were afraid of infecting their crew; this resulted in shipping delays and backlogs because it took longer for marine pilots to board vessels if the pilot boat was not crewed or out of service.

Secondry data shows that marine operations face inherent challenges daily. Respondents indicated that the Coronavirus pandemic, on the other hand, exacerbated these challenges, causing marine operations to regress and eroding their progress made over time. Respondents' comments showed that the most common operational disruptions included an ageing workforce, an ageing marine fleet, a lack of investment in marine operations, and systemic and bureaucratic constraints.

The Coronavirus pandemic caused several issues, including a shortage of marine employees to man crafts, berth vessels, and pilot vessels (TNPA, 2022). To provide an efficient service, marine operations require a full complement of staff (Mthembu and Chasomeris, 2020). Respondents' comments indicated that the Coronavirus pandemic resulted in high employee absenteeism rates, which caused staffing disruptions, negatively impacting service levels (TNPA, 2022).

Respondents' comments showed that tugboats were taken out of service due to labour shortages, reducing tug availability, deployment, and utilisation. Seconday data shows that several service level indicators have declined. Respondents' comments indicated that marine operations had to shift employees between shifts to ensure adequate resources to provide services on multiple occasions. While berthing services had a 100% deployment rate (TNPA, 2022) during the study period, respondents indicated that the department was forced to pay employees overtime, roster them to work longer hours, and move employees between shifts to compensate for shortages.

According to respondents' comments, health and safety precautions were deemed the best bet for halting pathogen spread while adhering to national legislation and company policies. Health and safety measures were implemented consistently across the economy. Comments from respondents show these measures did not exempt marine operations; many were unfamiliar with them and had never been implemented in the history of this operation. Respondents indicated that COVID -19 health and safety measures were implemented to prevent the spread of the Coronavirus, including using face masks, social distancing, and removing high-risk employees from the operation. Respondents' comments showed that many of these had adverse outcomes. Respondents indicated that some measures were impractical for the industry and exacerbated existing issues. Comments from respondents showed that health and safety measures put in place to combat the spread of the Coronavirus caused delays in the deployment of marine resources. Respondents indicated that sanitising crafts and vehicles before and after each shift required operational time.

Comments from respondents showed that using COVID-19 PPE in marine operations increased the risks to employee safety; COVID-19 PPE, such as face masks, made communicating with crews and issuing commands or instructions more difficult. Breathing through face masks while performing strenuous tasks became significantly more difficult, resulting in numerous health and safety incidents. Comments from respondents showed that COVID-19 PPE was found to cause dizziness in many employees when combined with extreme weather conditions and strenuous activities, which is extremely dangerous when climbing a pilot ladder or operating a tug boat, as indicated by respondents. Secondary data and comments from respondents showed that because marine operations had to conduct checks and sanitise crafts before and after shifts, health and safety measures took time away from providing marine services and hampered resource deployment and utilisation.

Respondents' comments indicated that maintenance of tugs and other marine crafts was hampered on numerous occasions due to limited on-site personal rules, as marine contractors were unable to conduct maintenance on tugs or deliver critical marine craft spares; this drastically reduced tug utilisation levels (TNPA, 2022) and the department's ability to service vessels as indicated in comments from respondents. This further hampered the number of vessels handled (TNPA, 2022), potentially leading to port delays and congestion. Comments from respondents indicated that there was a backlog of ships and longer waiting times at anchorage. Primary data shows that respondents lamented having to put in more effort and work to provide marine services, such as sanitation procedures and completing the administrative process to ensure compliance with company policies and national legislation.

Respondents' comments revealed that some of the daily challenges faced by marine operations as a result of health and safety measures included sanitation of vessels before and after each shift, employee screening before, during, and after each shift, and COVID -19 administration. Respondents comments also indicated that, ensuring the operation had enough employees on site, and moving employees between shifts was made more difficult by a lack of support from administrative support departments. Respondents revealed that marine administration also had to deal with an increase in unjustifiable sick leave, resulting in a constant shortage of critical marine personnel. According to the comments of respondents, this was exacerbated by employees over the age of 60 or those with comorbidities who were required to stay at home. As a result, gangs and craft crews were occasionally deployed in short supply (TNPA, 2022).

Respondents revealed that because of the coronavirus pandemic, marine operations employee development and training lagged behind previous years, resulting in employees operating with expired certificates and craft licenses, which is illegal and punishable by a severe fine imposed by the South African Maritime Safety Authority. Primary data shows that employees were unable to attend mandatory training, which is required for personal development and to remain compliant in providing marine services to vessels visiting the port. As a result of the Coronavirus pandemic, marine training programs lagged. Respondents' comments revealed that understudy programs fell by the wayside because many senior mariners felt it was not in their best interest to take on and train understudies; additionally, trainees were not motivated to do additional understudy jobs or, at times, do a job that would upgrade their position or grade. Coments from respondents reveal that many felt that it was too risky to do understudy jobs as their health was more important. Respondents comments indicated that this could result in a significant shortage of developed and trained marine employees. As a result, respondents

comments showed that employees may need to catch up on critical training and development to advance to their next license and career. Respondents' comments revealed that while marine operations were declared essential services, support services were not, making it difficult for marine employees to access supporting departments on demand. Primary data revealed that employee contracts, promotions, and career advancement were jeopardised consequently limiting port employees' opportunities for advancement within the company.

Primary data shows that the Coronavirus significantly regressed marine operations in terms of how marine employees collaborate, communicate, and plan jobs. According to the comments of respondents, many marine workers worked in silos and avoided interacting with one another. As indicated in comments from interviews, the operations became hostile, and the camaraderie that had been ingrained in the operation regressed; respondents indicated that this is dangerous in the marine industry because constant planning, communication, and comradery amongst the marine department are critical in ensuring a safe and efficient marine service.

Comments from respondents showed that several normal activities were hampered as a result of the Coronavirus pandemic. Respondents indicated that marine crafts are serviced in accordance with a maintenance schedule, and performing non-routine maintenance is critical in marine operations. However, comments from respondents showed that due to the pandemic, marine contractors and critical spare suppliers were unable to come on-site to service the tugs. Respondent comments indicated that this hampered both scheduled maintenance and emergency repairs. Not being able to service and maintain tugs efficiently resulted in tugs being out of commission or in layup for longer periods. Respondents indicated that lay-ups are the time a craft is put in the dry dock to conduct maintenance, and every day a tug is in layup is lost income for the department. Comments from respondents showed that when a tug is decommissioned, one less tug is available to deploy and use to provide towage services and, more importantly, to service vessels.

According to respondent comments, due to decreased global maritime trade activity for non-essential cargo (Notteboom and Pallis, 2020), marine operations had difficulty obtaining spares for tug service. Respondents' comments showed that getting spares for the tugs was difficult because several spares had to be shipped from overseas, and spares that were sent had longer lead times before reaching the technical teams at the Port of Durban; if and when they arrived, external technical support services could not come on-site and provide technical support to fit those spares. Primary data shows that as pandemic-induced lockdown levels were gradually

lifted, many contractors reduced on-site staff due to fear of infection; contractors staggered workers, which resulted in longer time frames for repairing and commissioning tugs, and as a result, there were reduced tugs in operations on some occasions, leading to reduced marine towage service levels (TNPA, 2022).

Respondents' comments revealed that the Port of Durban's marine operations rely on an in-house dry dock facility to service and maintain their tugs and other marine crafts; the service provided to marine operations consists of a dry dock facility and a team of millwrights who service marine crafts with contractors; according to the comments of respondents the drydock team was negatively affected by the Coronavirus pandemic. The primary data revealed that a number of millwrights were sent home due to health and safety measures implemented throughout TNPA, such as social distancing and age restrictions, resulting in a drydock facility operating on skeleton staff. Comments from respondents showed that millwrights were scarce during this time, and many had to be brought back from home on an as-needed basis; available teams were frequently understaffed and lacked essential spares and equipment to service tugs, resulting in service delays and tugs sitting in a layup for far longer than planned.

According to the responses, marine operations face challenges, which the Coronavirus exacerbated. Respondents' comments revealed that prior to the pandemic, there were issues such as an ageing workforce, a lack of financial investment in marine craft, and slow progress in training more marine employees to staff the operation. From the interviewee comments, marine operations continue to operate with a staffing structure that is below the approved level. The comments of respondents furthet reveal that, given the complexity of the Port of Durban and the nature of the operations it serves, this puts a strain on marine operations. Responses from respondents showed that many senior employees who left during the pandemic did not return, taking with them the skills and knowledge required for the Port of Durban's marine operations to remain efficient. According to the comments of respondents , bureaucracy and a lack of investment (Meyiwa and Chasomeris, 2020; Grater and Chasomeris, 2022) in marine operations are to blame. Comments from respondents revealed that , despite being deemed an essential service, marine operations and its staff recieved sub-optimal support required to provide an efficient marine service.

5.2.2 Objective Two: Recommendations for mitigating the impact of COVID-19-related disruptions

According to respondent comments, the Coronavirus pandemic had a negative impact on marine operations, causing them to operate under strain and provide services that fell short of the department's goals. Comments from respondents showed that high employee absenteeism (TNPA, 2022), marine vessel breakdowns, a lack of support, reduced vessel movements (TNPA, 2022), uncertainty, and health and safety measures all harmed the operation. Respondents indicated that employees continued to work in potentially hazardous conditions, which may have hampered their job performance and, as a result, reduced productivity (TNPA, 2022). According to respondent comments, TNPA should work to increase financial investment in marine operations by removing systematic and institutional barriers and providing necessary support. Further recommendations are discussed below.

5.3 Recommendations

Given the above findings and conclusions, the researcher recommends the following.

According to comments from respondents, long-established industries are rapidly changing as a result of globalisation. Respondents indicated that the maritime industry is one that has experienced numerous disruptions. New viruses and diseases are likely to emerge (Piret and Boivin, 2021). This implies that future disruptions to marine operations may be similar. Comments from respondents showed that South African ports' marine operations are unlikely to be affected if precautionary measures are taken. Respondents' comments revealed that, while marine operations provided services during the pandemic, they have some built-in resilience to external interruptions. Responses from respondents imply that South African marine operations are built to withstand disruptions in the future, as well as to mitigate external disruptions. However, marine operations can weather future disruptions with minimal loss with technological and research advancements.

5.3.1 Dissemination of information

There should be increased dissemination of marine information to communities through education, awareness, and research. According to respondent comments, the South African government should gain a better understanding of the industry and its significance to the South African economy at the local, regional, and national levels. Respondent comments show that , this will ensure that the sector receives sufficient attention and financial investment. Comments from respondents further indicate that the TNPA should hold roadshows to raise awareness

about the marine sector; providing a better understanding of the significance of marine operations in South African ports as a standalone function of the logistics process. Primary data show that to address the industry's skills shortage and to help communities understand the value of marine services in ports, TNPA should increase the number of marine learnership and trainee programs in South Africa , which will significantly increase the number of trained and qualified mariners available to meet local and international demand. Interviewee responses show that to support the marine industry, a long-term investment plan to increase skill capacity should be developed at the national level. Comments from respondents indicate that educational institutions and training academies should work to attract more students to maritime studies and to develop programs related to marine operations and related activities. According to respondent comments, there is a need to create specialised programs to support the maritime industry, such as marine engineering and naval architecture. High schools and technical colleges should offer nautical studies. As stated by the comments of respondents, during the pandemic, the marine industry struggled to find trained and competent mariners. In line with interviewees, having more mariners in the country will enable South Africa to become a supplier nation to the country's port system as well as the global maritime industry. The TNPA should collaborate with higher education institutions to expand research on the South African maritime sector, according to primary data. More research in the field of marine operations and the ocean economy is needed, according to primary and secondary data, to gain a better understanding of the impact of external disruptions on port operations. The industry will improve and benefit South Africa as a result of research initiatives. Rather than keeping this study private, the TNPA should allow it to be made public, with all of the benefits that come with it. The study's findings should be disseminated for future research.

5.3.2 Investment in advanced technological systems

To improve productivity and competitiveness, the TNPA should increase its investment in and adoption of more advanced technological systems. Policies should be developed in conjunction with financial assistance for the marine operations. According to interviewees, in order to find a long-term solution, the port authority should address port issues through policy changes. Respondents believe that policies should be developed and implemented in consultation with the South African maritime industry, and that they should be beneficial to the sector in order to stimulate public-private investment. According to primary data, many disruptions occurred as a result of decreased industry investment. According to the comments of respondents, South

Africa's maritime industry's competitiveness has been further eroded by a lack of innovation. South Africa has lagged far behind other port nations that have made significant investments in port operations (The Africa Report, 2022), to the point where artificial intelligence and the internet of things have been integrated into port operations (World Bank Report, 2022; Bouhlal, Aitabdelouahid and Marzak, 2022). According to respondents, the TNPA has built new tugs with little technological advancement in recent years. According to respondents,, TNPA marine operations faced numerous challenges during the Coronavirus pandemic because the organisation needed to incorporate newer technologies and machine learning into new marine-related projects.

5.3.3 Public-Private partnerships

Using public-private partnerships to provide marine services in order to address the significant challenges affecting the availability, utilisation, and maintenance of marine craft, as well as the availability of marine employees. Private firms can provide these services in some ports, tugs and their operators are directly hired by the port authority (Trujillo and Nombela, 1999) . In many cases, traffic density allows for the operation of a private tugboat companies in the port area. The port authority, on the other hand, should regulate the service (PPIAF, 2022).

For TNPA marine operations, a hybrid operating model should be considered, in which private operators provide marine services in addition to TNPA's marine services. The Indian government is currently considering a new model for marine services at its busiest ports (infra.economictimes, 2022), where the government plans to outsource some select marin services. That model, however, will be based on an ehailing service design, in which vessels visiting the port can select which marine service provider they wish to use (infra.economictimes, 2022). In contrast to the recommended hybrid model, that model is entirely private. The hybrid model recommended ensures that the TNPA retains control of marine services while allowing third-party marine service providers to operate under their authority. Respondents indicated that this will supplement TNPA’s marine service with additional tugs and employees.

Respondent comments show that creating alliances and mutual agreements with private tug operators, who bring a wealth of knowledge and much-needed resources to the operation, will increase the number of marine crafts and personnel available in South African ports. According to the comments of respondents, marine operations at South African ports will be able to take

tugs out of service and maintain them accordingly by collaborating with private tug operators. Respondents indicated that if tugs fail, private operators will be able to fill the gaps and continue to provide marine services; Interviewee responses reveal that such agreements will relieve pressure on marine operations crafts and personnel, allowing them to develop employees, train employees, and ensure that when disruptions occur, there is a backup of both marine crafts and personnel to service vessels calling at the port.

5.3.4 Investment in marine operations

Short-term and long-term investments in marine operations will help TNPA deliver on its core functions, which are to provide an efficient and safe marine service, according to the National Ports Act (2005). Comments from interviews show that a long-term investment strategy for marine services must be developed and implemented to ensure a consistent flow of investment in innovative marine technologies. Primary and secondary data shows that South African marine operations should be given the financial independence they deserve. Respondents indicated that financial assistance for marine operations in South African ports should be proportionate to the services provided and the size of operations. According to respondent comments, TNPA should prioritise marine operations and devote dedicated attention to them in terms of adding more marine crafts and developing support services that can aid in marine operations efficiency. Primary data shows that developing and multiskilling more marine employees and relocating them to other business areas , create a pool of qualified and competent employees from which TNPA marine services can draw in times of disruption. According to respondent comments, this can be accomplished by identifying and developing employees who want to operate crafts and placing them in understudy programs; if they wish to continue after the training period, they can be sent for additional theoretical training to obtain marine craft operating licenses. One way to provide employees with new and relevant skills is to train those in the ship repair department , who repair crafts for marine operations to operate small crafts in the harbour, and provide technical expertise to the shipbuilding industry.

5.3.5 Dedicated support services and aligned procurement policies

Dedicated support services and procurement policies that are favourable to marine operations. According to primary data the inability to source spares and have marine contractors come on-site during the pandemic, harmed marine operations. As a result, respndents indicated marine operations should have backup spares or centralised spares stores from which marine services

across South Africa can order spares on demand, significantly reducing the time technical teams spend waiting for spares to tugs back in operation. According to the comments of respondents, marine contractors should be vetted and approved before being listed on a central database so that marine contractors can be found and appointed for emergency maintenance work as soon as possible. According to primary data, marine operations should be viewed as a specialised industry, with bureaucratic and systemic barriers removed to allow the operation to make maintenance decisions autonomously. This should apply to all sections of the port system that support marine operations. According to the comments of respondents, the procurement process was viewed as a hindrance rather than a means of mitigating problems during the pandemic. While this was a national issue according to respondents, marine operations should have more leeway in sourcing spares during emergencies rather than having to go through lengthy procurement processes.

5.3.6 Vigorous Business Continuity management

Implementing vigourous business continuity plans will strengthen marine operations resilience to disruptions. Respondents indicated that, while TNPA initiated business continuity plans during the pandemic, there were significant gaps, resulting in cascading disruptions and business loss. As a result, planning ahead of time is one of the most important ways for a company like TNPA to anticipate future disruptions to marine operations and make appropriate policy changes, according to respondents. Interviewee responses showed that major foreseeable disasters should be factored into the business continuity plans for TNPA marine operations. Primary data showed that regular and intrusive simulations will aid in identifying and exposing vulnerabilities in South African ports, allowing marine operations management to develop and test robust business continuity policies. Respondents indicated that third parties should evaluate and test policies and programs to determine their effectiveness, allowing the organisation to identify gaps in these programs and develop plans to fill them.

5.3.7 Adoption of Technology

Adoption of technology, Internet of Things and machine learning (Bouhlal *et al*, 2022) at South African ports, will ensure intelligent, resilient, and sustainable marine operations. Responses from respondents show that the TNPA should investigate the feasibility of implementing digital marine operational systems; using digitised strategies will significantly reduce human errors and the reliability of human inputs to achieve desired outcomes. Respondents indicated that adapting

technology to processes and challenges will significantly improve operational efficiencies (Bouhlal *et al.*, 2022) by incorporating both human and machine learning. Primary data shows that South African ports should consider new business models that include specialised employees and the use of technology. Comments from interviews indicated that the adoption of new technologies has the potential to alleviate the burden of a labour shortage. According to respondents' comments, South African ports should investigate the feasibility of implementing autonomous machine learning and a mixed mode of operation that allows both operated and remotely operated systems to be used in tandem to service vessels and perform associated activities. Primary data shows that this investigation must be carried out in order to identify a dynamic tugs management system capable of effectively deploying tugs to assist ships. Interviewee responses indicate that while organised labour may object, increased digitisation of marine operations processes for marine craft may quickly alleviate workforce issues (Bouhlal *et al*, 2022). Respondents indicated that this will also allow marine services to adapt to rapidly changing global marine operations by providing new skill sets and advancements in marine training to employees. Respondents indicate that during turbulent times, digitisation would enable continuous information sharing and timely reporting. According to respondent comments the TNPA should conduct global best practice research and implementation programs for marine operations. Tug maintenance, employee development, and marine resource deployment systems all contribute to the bottom line, according to respondent comments. Primary data show that they should be effectively applied to all marine port operations on a national scale where applicable, relevant, and adaptable. According to respondent comments, systems and processes that have proven resilient in difficult times should be studied and modelled for the South African ports system (World Bank, 2022).

5.4 Limitations of the study and areas for future research

Because the researcher is a risk specialist in marine operations, respondents may have been hesitant to share their full experiences. The respondents were drawn from the TNPA marine services at Durban's Port. Furthermore, the research was restricted to marine operations, with all participants restricted to the Port of Durban. Due to time constraints, the interviews and data gathering was conducted over a five-month period from August to December 2021. Respondents expressed concerns about working during the pandemic, being designated as essential services with no extra pay, and some became visibly emotional during in-depth interviews, which could have influenced the study's findings. Additionally, disseminating the research outside of Transnet without authorisation is prohibited under the gatekeepers' letter provided by the TNPA. This limits how much other people can learn from this study.

The impact of the Coronavirus pandemic on marine operations at the Port of Durban was the focus of this study. It highlighted some of the pandemic's disruptions and their consequences. To that end, future research should focus on thoroughly investigating marine service challenges, identifying them, and determining what can be done to mitigate them. According to respondent comments, other studies could focus on marine fleet challenges and obstacles impeding marine operations efficiencies, as the study's findings indicated, but were limited in examining the primary causes. Comments from interviews indicated that policy frameworks must be investigated, such as what international ports do to ensure a smooth marine operation at their ports; also, are the organisational policies in place and effective. Finally, research should concentrate on the lack of investment in marine operations, particularly in older marine craft, training and development, dedicated resources for craft maintenance and service, and the impracticality of Transnet procurement policies on the marine fleet department. This study only gathered data from TNPA; however, future studies may consider interviewing port users or port user representatives such as SASSOA for their comments and reflections on the challenges encountered during the period, as well as their recommendations to improve the situation in the future.

5.5 Conclusion

The Coronavirus pandemic, according to comments from interviewees, significantly disrupted and harmed marine operations at the Port of Durban (TNPA, 2022). It was claimed, amongst other things, that one of the reasons the operations were not optimal was a lack of planning for such a disaster, according to respondents. Another contentious issue was the inability of marine operations to perform vessel maintenance, which caused delays and disruptions in shipping (TNPA, 2022). Furthermore, according to respondent comments, health and safety regulations severely limited marine operations, and guidelines made working in marine operations difficult and stressful. Precautions for health and safety were not always possible, causing additional disruptions. The importance of marine operations in South African ports cannot be overstated, and efforts should be made to increase the resources available to meet the challenges (Mthembu and Chasomeris, 2020; Mthembu and Chasomeris, 2023a; Mthembu and Chasomeris, 2023b). Comments from intervieweess indicated that efforts should be made to invest in people and equipment to ensure the sustainability and efficiency of marine services in South African ports. South Africa must be able and ready to service the global marine community that will visit its ports in order to realise the economic potential of its vast coastline, according to comments from respondents.

References

Asmal. Z and Rooney, C. 2021. The impact of COVID-19 on industries without smokestacks in South Africa, Africa growth initiative, AGI is working paper.

Barton, H. and Turnbull, P. 2002. Labour regulation and competitive performance in the port transport industry: the changing fortunes of three major European seaports.

Beckman, R.C. 2007. PSSAs and transit passage-Australia pilotage system in the Torres strait challenge the IMO and UNCLOS, Ocean Development and International Law.

Binkley, A. 2017. Pilot review will undertake a broad examination of the service, Canadian Sailings, June 26.

Bouhlala, A., Aitabdelouahid, R. and Marzak, A. 2022. The internet of things for smart ports. The Second International Workshop on Edge IA-IoT for Smart Agriculture.

Brahmbhatt, M. and Dutta, A. 2008. On SARS Type Economic Effects during Infectious Disease Outbreaks. Policy Research Working Paper; No. 4466. World Bank.

Bureau for Economic Research (BER). 2020. Forecast Update. Stellenbosch. 28 August 2021.

Business Insider. 2020. SA's borders open on 1 October. Here is what we know about the rules for tourists. Available at https://www.businessinsider.co.za/international-travel-to-and-from-southafrica- reopens-on-1-October-with-caveats-2020-9 (Accessed 9 September 2021).

Capano, G., Howlett, M., Jarvis, D. S., Ramesh, M. and Goyal, N. 2020. Mobilising policy (in) capacity to fight COVID-19: Understanding variations in state responses. *Policy and Society.*

Chakrabarty A. 2017. How the brain of a Maritime Pilot Works. Available at: https://www.marineinsight.com/marine-navigation/how-the-brain-of-a-maritime-pilot. (Accessed 13 November 2021).

Cruise Sector: A Focus On South Africa. African Journal of Hospitality, Tourism and Leisure, 10(1):22-39. DOI: https://doi.org/10.46222/ajhtl.19770720-84

Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. Acta Biomed. 2020 Mar 19;91(1):157-160. doi: 10.23750/abm.v91i1.9397. PMID: 32191675; PMCID: PMC7569573.

Elgin, C., Basbug, G. and Yalaman, A. 2020. *Economic policy responses to a pandemic: Developing the COVID-19 economic stimulus index*. Columbia: Columbia University.

Fakir, M. and Chasomeris, M.G. 2022, 'Ports regulation in South Africa: An equitable tax rate approach, Journal of Economic and Financial Sciences | Vol 15, No 1 | a736 | DOI: https://doi.org/10.4102/jef.v15i1.736.

Gans, J.S. King, S.P. 2003. Contestability, Complementary input and contracting; The cause of harbour towage.VOL.36, No.4

Gautam, S. and Hens, L. 2020. *SARS-CoV-2 pandemic in India: What might we expect?* Berlin: Springer.

Gondwe, Grace. (2021). Assessing the Impact of COVID-19 on Africa's Economic Development. Available on : https://unctad.org/publication/assessing-impact-covid-19-africas-economic-development (Accessed 13 September 2021).

Grater, S. and Chasomeris, M.G. 2022. Analysing the impact of COVID-19 trade disruptions on port authority pricing and container shipping in South Africa. Journal of Transport and Supply Chain Management16(0), a772. https://doi.org/10.4102/jtscm.v16i0.772 (Accessed 13 November 2022.

Gumede, S. and Chasomeris, M. (2015). South Africa's Port Pricing Methodology and Financing Investments. Paper presented at the Economic Society of South Africa (ESSA) Conference, 2-4 September, Cape Town, South Africa. (Accessed 13 September 2021).

Gumede, S. and Chasomeris, M. 2015. Maritime Port Pricing and Governance in South Africa: Trends and Stakeholder Comments. Journal of Economic and Financial Sciences, April 2015 8(1), pp. 47-62. (Accessed 11 September 2021).

Gumede, S. and Chasomeris, M.G. 2017. Critique of South Africa's National Ports Authority's revenue required pricing methodology, international journal of transport economics: South Africa; Country specific analysis.

Haider, J., Katsogiannis, G., Pettit, S. and Mitroussi. 2013. The emergence of eco ship; Inevitable market segmentation? IAME, International association of maritime economists, Marcseille, France.

Heale R, Forbes D. Understanding triangulation in research. Evidence-Based Nursing 2013;16:98.

Helmick, J.S. and Glaskowsky, N.A.Jr. 1992.State and federal regulation of pilots, piloting and pilotage: A study in contrasts and conflict. Transportation journal.

Hsu, W. 2012. Port's service attributes for ship navigation safety. Safety Science.

Infraeconomic times. 2023. (Online). Government working on 'uber-like model' for outsourcing tugboat services at major ports. Available at https://infra.economictimes.indiatimes.com/news/ports-shipping/government-working-on-uber-like-model-for-outsourcing-tugboat-services-at-major-ports/95700282 (Accessed 16 January 2023).

International Finance Corporation. 2020. The Impact of COVID-19 on Logistics. Available: https://www.ifc.org/wps/wcm/connect/2d6ec419-41df-46c9-8b7b-96384cd36ab3/IFC-Covid19-Logistics-final_web.pdf?MOD=AJPERES&CVID=naqOED5 (Accessed 2 August 2021).

International Monetary Fund. 2021. Country: South Africa. Available: https://www.imf.org/en/Countries/ZAF (Accessed 26 September 2021).

International Trade Administration. 2021. South Africa - Country Commercial Guide. Available at https://www.trade.gov/knowledge-product/south-africa-port-and-logistics (Accessed: 19 July 2021).

International Trade Administration. 2021. South Africa - Country Commercial Guide. Available at https://www.trade.gov/knowledge-product/south-africa-port-and-logistics (Accessed: 19 July 2021).

International Transport Forum. 2014. The competition of port in emerging countries: the case of Durban, South Africa, OECD/ITF, 2014.

Investopedia. 2021. Discouraged Worker: Definition, Causes, Vs. Unemployed available at https://www.investopedia.com/terms/d/discouraged_worker.asp (Accessed: 19 July 2021).

Jones, T. 1997. The Port of Duran and the Durban metropolitan economy, Research monograph number 10 University of Natal, Durban.

Jones, T. 2000. The Port of Durban - Characteristics, User Perceptions and Growth Constraints. Durban Metropolitan Local Economic Development Study. Available at http://www.durban.gov.za/Documents/Invest_Durban/Economic%20Develop (Accessed: 17 July 2021)

Kavirathna, C., Kawasaki, T. Hanaoka, S. and Matsuda, T. 2018. Transshipment hub port selection criteria by shipping lines: the case of hub ports around the bay of Bengal. J Ship Trade.

Khuzwayo, S.N. 2019, The Retention Of Women In The Marine Operations, University of KwaZulu-Natal.

Kim, K. and Myung, L.K. 2018 .Deep learning-based caution are traffic prediction with automatic identification system sensor data—Department of computer science, Chungbuk National University, Cheognju.

Mannan, S., Shaheen, M.A. and Saha, R. 2021. COVID-19: Chittagong Port and aftermath. WMU Journal of Maritime Affairs.

Maritime Executive. 2020. (Online) The impact of covid 19 on south African maritime economy. Available: .https://www.maritime-executive.com/article/the-impact-of-covid-19-on-south-africa-s-maritime-economy. (Accessed 6 October 2021).

Mckinsey and Company. 2021. The coronavirus effects on global economic sentiment. Available at https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-coronavirus-effect-on-global-economic-sentiment (Accessed: 6 September 2021).

Meyiwa, A. and Chasomeris, M. (2016) Restructuring Port Governance in South Africa. Journal of Economic and Financial Sciences, October 2016 9(3), pp. 854-873.

Meyiwa, A. and Chasomeris M. (2020) South Africa's Port Doctrine: Dilemmas and the Way Forward. Maritime Studies, 19, pp. 179-191. DOI: https://doi.org/10.1007/s40152-020-00166-2.

Mokone, T. 2016. The impact of governance structure on the port performance: a case of Durban Port. World Maritime University.

Moon, D. and Woo, J. 2014. The impact of port operations on efficient ship operation from both economic and environmental perspectives. Maritime Policy & Management.

Mthembu, S. E. 2014. Systems Approach the operational challenges in marine services within the Port of Durban. University of KwaZulu-Natal .Graduate school of business and leadership

Research Space. https://researchspace.ukzn.ac.za/handle/10413/17323 (Accessed: 6 September 2021)

Mthembu, S. E. 2021. Transnet National Ports Authority, Port of Durban, Marine services operational performance data (Accessed: 8 September 2021).

Mthembu, S.E. and Chasomeris, M. (2020). Examining Productivity of Maritime Services in South Africa's Ports System. Paper presented at the International Association of Maritime Economists (IAME) Annual Conference, 25-28 June, Athens, Greece (Accessed: 8 September 2021).

Mthembu, S.E., Chasomeris, M.G. (2022). A systems approach to developing a port community system for South Africa. J. shipp. trd. 7, 26 (2022). https://doi.org/10.1186/s41072-022-00128-3

Mthembu, S.E. & Chasomeris, M., (2023a), An evaluation of the governance structure of marine services in South Africa's Ports System, Journal of Shipping and Trade, 8, article number 17. https://doi.org/10.1186/s41072-023-00148-7

Mthembu, S.E. & Chasomeris, M.G., (2023b). An assessment of the capacity and the performance of marine services in South Africa's ports, Journal of Transport and Supply Chain Management 17(0), a879.- pp. 1-13 https://doi.org/10.4102/ jtscm.v17i0.879 : https://jtscm.co.za/index.php/jtscm/article/view/879/1440

Naidoo, S. 2020. COVID-19's impact on logistics creates ripple effects in other industries. IT Web, 28 August. Available at https://www.itweb.co.za/content/JN1gPvOYPA2MjL6m (Accessed 11 July 2021).

National Ports Act. 2005. National Ports Act No. 12 of 2005. Available at http://www.portsregulator.org/images/documents/national_ports_act.pdf (Accessed 9 July 2021).

National Treasury. 2020. Budget Review: 2020. National Treasury: Pretoria (Republic of South Africa).Available on : https://www.treasury.gov.za/documents/national%20budget/2020/review/fullbr.pdf (Accessed on 26 September 2021).

Notteboom, T.E., Pallis, A.A., De Langen, P.W. and Papachristou, A., 2013. Advances in port studies: the contribution of 40 years Maritime Policy & Management. Maritime Policy & Management, 40(7), pp.636-653 (Accessed on 10 September 2021).

Notteboom, T. and Pallis, T. 2020. IAPH /WPSP Port Economic impact barometer, June 2020, Antwerp: International Association of Ports and Harbours (IAPH). Available on: https://sustainableworldports.org/wp-content/uploads/2020-06-08-COVID19-Barometer-Report.pdf (Accessed on 17 September 2021).

Notteboom, T. and Pallis, T. 2020. IAPH-WPSP Port Economic Impact Barometer Half Year Report: A survey-based analysis of the impact of COVID-19 on world ports in the period April to September 2020, International Association of Ports and Harbours. Available on : https://sustainableworldports.org/wp-content/uploads/2020-09-16-COVID19-Barometer-Report.pdf (Accessed on 3 October 2021).

Notteboom, T., Pallis, T. and Rodrigue, J.P., 2021. Disruptions and resilience in global container shipping and ports: the COVID-19 pandemic versus the 2008–2009 financial crisis. Maritime Economics & Logistics, 23, pp.179-210. (Accessed on 11 July 2021).

Notteboom, T., & Pallis, T. (2021). IAPH-WPSP Port Economic Impact Barometer One Year Report : a survey-based analysis of the impact of COVID-19 on world ports in the period April 2020 to April 2021. Antwerp: International Association of Ports and Harbours (IAPH). (Accessed on 11 July 2021).

OECD. 2021. Coronavirus policy responses: Covid-19 and Africa, Socioeconomic implication and policy responses. https://www.oecd.org/coronavirus/policy-responses/covid-19-and-africa-socio-economic-implications-and-policy-responses-96e1b282/ (Accessed: 9 September 2021).

OECD. 2021. Ocean economy and innovation. Available at https://www.oecd.org/ocean/topics/ocean-economy/ (Accessed: 19 July 2021).

Organisation for Economic Co-operation and Development (OECD). 2021. Quarterly national accounts: Quarterly Growth Rates of GDP in volume. Available: https://stats.oecd.org/index.aspx?queryid=33940 (Accessed 22 October 2021).

Organisation for Economic Co-operation and Development (OECD). 2021. Coronavirus policy responses: Covid-19 and Africa, Socioeconomic implication and policy responses. Available at https://www.oecd.org/coronavirus/policy-responses/covid-19-and-africa-socio-economic-implications-and-policy-responses-96e1b282/ (Accessed: 9 September 2021).

Ozbas, B. and Or, I. 2007 .Analysis and control of maritime transit traffic through the Istanbul channel: A simulation approach, Central European Journal of Operations Research 15 (3), 235 -252.https://doi.org/10.1007/s10100-007-0028-9

Page, J. 2021. Threats to job creation: Tourism and Covid-19. Available: https://www.brookings.edu/blog/africa-in-focus/2021/02/18/threats-to-jobcreation (Accessed: 14 July 2021).

Pallis, A.A., Vitsounis, T.K. and De Langen P.W. 2010. Port economics, Policy and Management: Management review of an emerging research field. Transport Reviews.

Piret, J. and Boivin, G. 2021. Pandemics throughout History. Frontiers in Microbiology, Volume 11. https://www.frontiersin.org/articles/10.3389/fmicb.2020.631736. 10.3389/fmicb.2020.631736 (Accessed: 16 July 2021).

Ports and ships. 2021. Transnet National Ports Authority. Available at https://ports.co.za/transnet-npa.php (Accessed: 14 July 2021).

Praetorius, G., Hollnagel, E. and Dahlman, J. 2015. Modelling Vessel Traffic Service to understand resilience in everyday operations. Reliability Engineering and System Safety. Elsevier, vol. 141(C), pages 10-21.https://ideas.repec.org/a/eee/reensy/v141y2015icp10-21.html. (Accessed: 14 July 2021).

Priyadarshini, I., Mohanty, P., Kumar, R., Son, L. H., Chau, H. T. M., Nhu, V. H., Thi Ngo, P. T., & Tien Bui, D. 2020. Analysis of Outbreak and Global Impacts of the COVID-19. Healthcare (Basel, Switzerland), 8(2), 148. https://doi.org/10.3390/healthcare8020148 (Accessed 26 January 2021).

Public-Private Infrastructure Advisory Facility (PPIAF). 2022. Alternative Port Management Structures and Ownership Models. Available at https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/Portoolkit/Toolkit/module3/marine_services.html (Accessed 16 January 2022).

Radišić, Z. (1) “Principal Types and Characteristics of Harbour Tugs”, Promet – Traffic and Transportation, 15(6), pp. 381-386. Available at: https://traffic.fpz.hr/index.php/PROMTT/article/view/905 (Accessed: 7 January 2022).

Review of maritime transport. 2018. United Nations Conference on Trade and Development. Available at :https://unctad.org/system/files/official-document/rmt2018_en.pdf (Accessed: 7 January 2022).

Sarkodie, S. A. and Owusu, P. A. 2020. Global assessment of environment, health and economic impact of the novel coronavirus (COVID-19). *Environment, Development and Sustainability, Jun 5*, 1-11 (Accessed: 8 January 2022).

Savulescu, J. 2020. Is lockdown worth the pain? No, it’s a sledgehammer, and we have better options. Available at https://theconversation.com/is-lockdown-worth-the-pain-no-its-asledgehammer-and-we-have-better-options-145555 (Accessed 28 October 2021).

Sihlobo, W. 2020. Agriculture exports hit record on large harvest and efforts to keep sector
South African Department of Health. 2021. Covid-19 daily cases. Available Covid-19 Daily Cases - SA Corona Virus Online Portal (Accessed 4 November 2021).

South African Department of Health. 2021. Update on Covid-19 (07 November 2021). Available: https://sacoronavirus.co.za/2021/11/07/update-on-covid-19-sunday-07-november-2021/ (Accessed 7 November 2021)

South African International Maritime Institute. 2020. (Online) COVID-19: The impact on global shipping and South Africa’s economy. https://www.saimi.co.za/news-saimi-22May2020.html (Accessed 6 October 2021).

South African Reserve Bank. 2021. Statement of the Monetary Policy Committee (21 January 2021). Available at: https://www.resbank.co.za/content/dam/sarb/publications/statements/monetarypolicy-statements/2021/statement-of-the-monetary-policy-committee-January(Accessed: 9 September 2021)

Statista. 2021. Share of Gross Domestic Product (GDP) lost as a result of the coronavirus pandemic (COVID-19) in 2020, by economy Available at Statista.https://www.statista.com/statistics/1240594/gdp-loss-covid-19-economy/ (Accessed: 9 September 2021).

Statista. 2021. Selected African countries with the largest number of international tourists Statistics South Africa. Available at Statista https://www.statista.com/statistics/261740/countries-in-africa-ranked-by-international-tourist-arrivals/#:~:text=The%20North%2DAfrican%20nation%20Tunisia,million%20and%20870%2C000%20arrivals%2C%20respectively. (Accessed: 9 September 2021).

Statistics South Africa. 2019. Quarterly Labour Force Survey P0211, 2018Q4. (Dataset). Available: http://www.statssa.gov.za/?p=13601(Accessed 17 September 2021).

Statistics South Africa. 2020. Quarterly Labour Force Survey P0211, 2020Q1. Statistics South Africa. Available: http://www.statssa.gov.za/?p=13601(Accessed 17 September 2021).

Statistics South Africa. 2020. The steep slump in GDP as Covid-19 takes its toll on the economy. Available: http://www.statssa.gov.za/?p=13601 (Accessed 17 September 2021).

Statistics South Africa. 2021. Quarterly Labour Force Survey P0211, 2020Q4. Statistics South Africa. Available: http://www.statssa.gov.za/?p=13601 (Accessed 17 September 2021).

Statistics South Africa. 2021. Quarterly Labour Force Survey: Q4 2020. Available:http://www.statssa.gov.za/publications/P0211/Media%20release%20QLFS%20Q4%20 2020.pdf (Accessed 17 September 2021).

Sucheran, R. 2021. Global Impacts and Trends of the COVID-19 Pandemic on the Cruise Sector: A Focus On South Africa. African Journal of Hospitality, Tourism and Leisure, 10(1):22-39. DOI: https://doi.org/10.46222/ajhtl.19770720-84 (Accessed 15 September 2021).

Tongzon, J.L. (1993). The Port of Melbourne Authority's pricing policy: its efficiency and distribution implications. Maritime Policy & Management 20 (3) : 197-205. Scholar Bank@NUS Repository. https://scholarbank.nus.edu.sg/handle/10635/134170 (Accessed 17 September 2021).

The World Bank. 2021. COVID-19 (Coronavirus) Response. Available at https://www.worldbank.org/en/region/afr/coronavirus (Accessed: 6 September 2021).

The World Bank. 2021. The African Free trade area. Available at https://www.worldbank.org/en/topic/trade/publication/the-african-continental-free-trade-area (Accessed: 6 September 2021).

The World Bank. 2021. The global economy is on track for strong but uneven growth as COVID-19 still weighs outlook during the COVID -19 pandemic: A changing world. Available at https://www.worldbank.org/en/news/feature/2021/06/08/the-global-economy-on-track-for-strong-but-uneven-growth-as-covid-19-still-weighs (Accessed: 6 September 2021)

Transnet National Port Authority. 2020. (Online) Port statistics. https://www.transnetnationalportsauthority.net/Commercial%20and%20Marketing/Pages/Port-Statistics.aspx/ (Accessed 2 October 2020).

Transnet National Port Authority. 2020. (Online) Port statistics.https://www.transnetnationalportsauthority.net/Commercial%20and%20Marketing/Pages/Port-Statistics.aspx/ (Accessed 2 October 2021).

Transnet National Ports Authority.2022.Marine services performanceperformance data, www.transnet.net (Accessed 2 October 2021).

Transnet National Ports Authourity. 2021. Marine Services Perfromance report.www.transnet.intranet.(Accessed 9 October 2021).

Travel Ground. 2021. Port of Durban. Available at https://www.travelground.com/attractions/port-of-durban (Accessed: 19 July 2021).

Trujillo, L. and Nombela, G. 1999. Privatization and regulation of the seaport industry, No 2181, Policy Research Working Paper Series, The World Bank, https://EconPapers.repec.org/RePEc:wbk:wbrwps:2181(Accessed: 19 July 2021)

Ugboma, C., Ogwude, I.C., Ugboma, O. and Nnadi, K. 2007. Service quality and satisfaction measurements in Nigerian ports: an exploration, Maritime Policy & Management, 34, issue 4, p. 331-346, https://EconPapers.repec.org/RePEc:taf:marpmg:v:34:y:2007:i:4:p:331-346 (Accessed: 19 July 2021).

UNCTAD. 2021. Global economy could lose over 4 trillion to COVID-19 impact on tourism. Available at https://unctad.org/news/global-economy-could-lose-over-4-trillion-due-covid-19-impact-tourism (Accessed: 2 September 2021).

UNCTAD. 2021. The blue economy is an ocean of opportunities to advance gender equality. Available at https://unctad.org/news/blue-economy-ocean-opportunity-advance-gender-equality (Accessed: 19 July 2021).

UNCTAD. 2021. The blue economy is an ocean of opportunity to advance gender equality. Available at https://unctad.org/news/blue-economy-ocean-opportunity-advance-gender-equality (Accessed: 19 July 2021).

UNCTAD. 2021. The global economy could lose over 4 trillion to COVID-19 impact on tourism. Available at https://unctad.org/news/global-economy-could-lose-over-4-trillion-due-covid-19-impact-tourism (Accessed: 2 September 2021)

United Nations Conference on Trade and Development. 2018. Power, platform and the free trade decision, United Nations, New York and Geneva, ISBN 978-92-1-112931-1. (Accessed: 2 September 2021)

United Nations Conference on Trade and Development. 2018. Power, platform and the free trade decision, United Nations, New York and Geneva, ISBN 978-92-1-112931-1(Accessed 21 July 2021).

United Nations Conference on Trade and Development. 2020. (Online) Transportation and trade facilitation, series no 15, COVID-19 and maritime transport, Impact and responses. Https https://unctad.org/ (Accessed 21 July 2021).

United Nations Conference on Trade and Development. 2020. (Online) Transportation and trade facilitation, series no 15, COVID-19 and maritime transport, Impact and responses. Https https://unctad.org/ (Accessed 21 July 2021).

United Nations Development Programme. 2020. Socio-economic impact of COVID-19. United Nations. Available at: https://www.undp.org/content/undp/en/home/coronavirus/socio-economic-impact-of-covid-19.html (Accessed 22 July 2021)

Van Hooydonk, E. 2014. Port Labour in the EU. Labour Market, Qualifications & Training, Health & Safety, Volume 2 - The Member State Perspective, Annexes. Portius. Available on : http://ec.europa.eu/transport/modes/maritime/ports/doc/2014-ec-port-labour-study-vol-2-update-21-11-2014.pdf (Accessed 22 July 2021)

Vitenu-Sackey, P. A. . and Barfi, R. 2021. The Impact of Covid-19 Pandemic on the Global Economy: Emphasis on Poverty Alleviation and Economic Growth, The Economics and Finance Letters, 8(1), pp. 32–43. doi: 10.18488/journal.29.2021.81.32.43(Accessed 12 July 2021).

World Tourism and Travel Council. 2020. South Africa 2020 Annual Research: Key Highlights. Available: https://wttc.org/Research/Economic-Impact/moduleId/704/itemId/204/controller/DownloadRequest/action/QuickDownload (Accessed 24 July 2021)

Appendix 1: Editor's certificate

EDITING LETTER

696 Clare Road
Clare Estate
Durban
4091

5 February 2023

To: Whom it may concern

Editing of **Master's thesis:** T Govender

Examining the impact of Coronavirus on marine operations at the Port of Durban

This letter serves as confirmation that the aforementioned thesis has been language edited. Requisite academic writing conventions have been adhered to.

Any queries may be directed to the author of this letter.

Regards

MP MATHEWS
Lecturer and Language Editor
Mercimathews4@gmail.com
083 676 4778

Appendix 2: Informed consent form

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL
For research with human participants

INFORMED CONSENT

Information Sheet and Consent to Participate in Research

Date:

Greeting:

My name is Thiruvasan (Donovan) Govender, a Master of Business Administration (MBA) student from the Graduate School of Business and Leadership at the University of Kwa Zulu-Natal.

You are being invited to consider participating in a study that involves research on examining the impact of the Coronavirus on marine operations at the Port of Durban. The aim of this research is to examine what impact the Coronavirus pandemic had on maritime operations at the Port of Durban during the period from January 2020 to December 2020. The study is expected to enroll 15 respondents representing all employment levels within marine services. Personal expected to be interviewed include, the Harbour master , Deputy harbour master (Nautical), Marine operations manager , Marine fleet resources manager , a Shift manager , a Marine technical manager, a Berthing manager, a Marine pilot , aTug master, a Chief marine engineering officer , a Senior vessel traffic controller , a General purpose rating (GPR -tug), a Senior berthing master , a Marine shore hand and a Waterman . It will involve open-ended semi-structured interviews. The duration of your participation, if you choose to participate and remain in the study, is expected to be 15 to 30 minutes.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number HSSREC/00003595/2021).

In the event of any problems or concerns/questions you may contact the researcher at (0834556306 or 217047390@stu.ukzn.ac.za) or my Supervisor (Professor Mihalis Chasomeris chasomerism1@ukzn.ac.za), or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Your participation in this research study is voluntary and by participating you are granting the researcher permission to use your responses.

You may refuse participation or withdraw at any point from the study with no negative consequences. There will be no incentives or reimbursements from participating in the study. Your name will not be used in this study and your responses will not be used for any purpose outside of this study.

All data, both electronic and hard copy, will be securely stored during the study and archived for 5 years. After this time, all data will be destroyed.

If you have any questions or concerns about participating in the study, please contact me or my research supervisor at the numbers listed above.

Sincerely

Mr Thiruvasan (Donovan) Govender

0834556306
217047390@stu.ukzn.ac.za

CONSENT TO PARICIPATE

I ---------- have been informed about the study entitled "examining the impact of the Coronavirus on marine operations at the Port of Durban" by Thiruvasan (Donovan) Govender.

I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

I have been informed that the discussion will be audio recorded for the purpose of data collection and transcription only, codes will be used to identify respondents and after that the audio record will be destroyed.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at (0834556306) or the Supervisor at (chasomerism1@ukzn.ac.za).

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

I hereby provide consent to:

Audio-record my interview YES / NO

_____ _____

Signature of Participant Date

Appendix 3: Interview schedule

INTERVIEW QUESTIONS

Topic: Examining the impact of the Coronavirus on maritime operations at the Port of Durban.

Objective No. 1: To examine the impact of COVID 19 pandemic on maritime operations at the Port of Durban over the period January 2020 to December 2020

1. What operational disruptions did marine services face because of the COVID-19 pandemic?
2. What changes did COVID -19 bring about in the workplace?
3. What operational challenges did maritime services face because of COVID-19 health and safety measures?
4. How did theses operational challenges affect maritime operations staffing?
5. How did theses operational challenges affect deployment and utilization of marine resources?

Objective No. 2: To make recommendations directed towards mitigating the impact of COVID-19 related disruptions on maritime services at South African seaports.

6. What means did maritime operations adopt to ensure the provision of maritime services?
7. What recommendations could be made to reduce the impact of the pandemic related operational difficulties on maritime services at South African commercial seaports?

Appendix 4: Ethical clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

21 December 2021

Thiruvasan Govender (217047390)
Grad School Of Bus & Leadership
Westville Campus

Dear T Govender,

Protocol reference number: HSSREC/00003595/2021
Project title: Examining the impact of Coronavirus on marine operations at the Port of Durban
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 26 October 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the 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.

This approval is valid until 21 December 2022.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd