UNIVERSITY OF KWAZULU-NATAL

An investigation into the Operational Challenges at the Durban Container Terminal

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A dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Business Administration

College of Law and Management Studies
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2016

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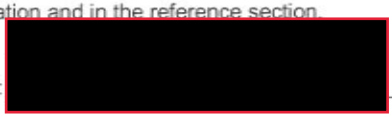
Signed: 

ACKNOWLEDGEMENTS

Foremost, I am grateful to God for carrying me through my years of university education.

I wish to express my sincere appreciation and gratitude to the following individuals, without whose assistance and crucial contribution, this study would not have been possible:

- My Supervisor, Dr Emmanuel Mutambara, for providing me with superior guidance
- My wife, Sanelisiwe Fortunate Dlamini, for her tolerance, encouragement, appreciation, and support
- My daughters, Andisiwe and Sinenhlanhla Dlamini, for their motivation and prayers
- My management at Transnet Port Terminals, for significant and unrelenting support through this journey
- To the University of KwaZulu-Natal Graduate School of Business staff
- To my MBA Block Group 3 members. I learnt a lot form each and every one of you
- My respondents, for helping me with the questionnaire and feedback

ABSTRACT

This study focused on the operational Challenges experienced by the Durban Container Terminal (DCT). It unpacked factors such as the design and layout of the yard, relationship of management with labour, strength of first line management, Operator Productivity, Terminal Planning, Terminal Incentive schemes and Terminal Equipment maintenance. The primary purpose of this study was to establish the nature of the challenges faced by the Durban Container Terminal, establish the factors hindering effective operations at the Durban Container Terminal, and asses the relationship between Operational factors and efficiency at the Durban Container Terminal. A Questionnaire was the major instrument used to obtain primary data from the respondents; while the secondary data were obtained through the perusal of documents such as company policies and standard operating procedures relevant to the study. The target population of the study was approximately 2000 people. The questionnaire that was designed used a Likert scale. A sample of 103 respondents was obtained through a stratified sampling technique of which 59 of the respondents participated in the survey. Data were analyzed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2013. The study found that the design of the yard is a challenge at DCT. It also found that equipment breakdowns are a hindrance for operations. The study also found that underutilisation of ship to shore crane capability is a setback for DCT. The study recommends an improved incentive Scheme that can have a positive spin off on Operation' efficiency; it also indicated that the Introduction of new Equipment Straddle carriers in particular can improve Operation's efficiency. The study further highlighted that Operation Supervisors have insufficient authority delegated to them to make decisions that can immediately influence Operation's efficiency. They further recommended for the empowerment of first line supervision to be able to make first line manager decisions, Management to look at ways to reach out to employees and to ensure that engagement platforms meant to improve and engage labour are effective and have positive influences on relations and Terminal Performance. There is however scope for further research as the study focused on Pier 2 and not Pier 1, which a sizeable section of Durban container terminal.

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LIST OF ACRONYMS

DCT - Durban Containers Terminal

TPT - Transnet Port Terminals

CTOC - Condition of Trade Contract

GCH - Gross Containers per Hour

OLE - Operator Lifting Equipment

STH - Ship to shore

SWH - Ship working Hour

ITZ - Interchange Zone

TEU's - Twenty Foot equivalent Units

SOP's - Standard Operating Procedures

KPI's - Key Performance Indicators

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CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

Durban container terminal is the biggest and busiest container terminal in the African continent. The terminal has a throughput capacity of 2.9 million TEU's per annum. The terminal has six berths and uses ship to shore cranes to handle container across the quay. For neighboring countries, DCT serves as a gateway for many land logged regions of southern African countries. DCT is the only terminal in Africa that has tandem lift capability on its vessels to shore cranes with a carrying capacity of 80tons (Nagurney, 2012).

Recently, DCT has come under tremendous amount of pressure from the industry due to its inability to meet targeted shareholder key performance indicators. The main shareholder to DCT is the Department of Public Enterprise (DPE). The decline in performance targets has led to the loss of business to container terminals in neighboring countries. The terminal has also failed to attract and grow transshipment volumes in recent years. This is not a sustainable position for any shareholder. Therefore, DCT needs to urgently turn the situation around to avoid any possible radical intervention by the Shareholder (Kim & Lee, 2015).

The study therefore aimed at investigating the operational challenges that may have led to the drop in performance at DCT. This chapter seeks to give a thorough background of the study. It articulates the aim and objectives of the study. The chapter explains the research methodology used; the limitations as well as the organisation and structure of the study (Kim & Lee, 2015).

1.2 Background

A container terminal is a section of the port in which vessels berth and containerised cargo is handled. A terminal is generally segregated into three operational sections, the quayside operation, yard operation, and the hinterland operation, hinterland is made up

of Road and Rail operations. The Quayside section has Berths and Quayside cranes. The yard section on the terminal is used for short-term storage of containers before they loaded onto or offloaded from a vessel. It is also a short term storage of containers before they are collected by Road or Rail Transport. The equipment used at the DCT yard is straddle carriers. The land-side operation has Cartage operation and the rail Terminal. Cartage consist of gate and Interchange zones where trucks are loaded and offloaded containers from and onto their trailers, these trucks enter gates, proceed to the interchange zones and exist the terminal via gates (Vacca, Bellaire and Salani, 2010).

1.3 Operational Challenges

The Durban Container Terminal has a number of Operational challenges that have an impact on the terminal's productivity. The following are some of the major challenges experienced by the two operational areas:

1.3.1 Berth Depths

Berths are docking stations which vessels use to station at the terminal for the loading and offloading of containers. DCT berths were designed for the old generation of vessels. Vessels have since evolved, getting longer, wider and deeper. This is to a point where some of the DCT berths can no longer accommodate some of the new generation vessels.

This scenario results in berths requiring high maintenance. Dredging is a form of maintenance. This activity involved digging out sand from berth pockets and dumping the sand deeper into the ocean. This form of berth maintenance is not sustainable as large vessels keep bringing the sand back when coming into berth on future calls. Sea sand is also moved around by tugs, tugs are smaller but powerful vessels used to pull large container vessels in and out of berths. Some vessels are unable to berth when the berth is not deep enough and often have to wait for a high tide to berth, and leave the berth

before the tide moves out.

1.3.2 Yard Capacity and Configuration

A container yard is consists of stacking areas, often called blocks. Stacks are used when either a vessel is discharging or a vessel is loading. Stacks become the short term storage areas for both imports and exports. Imports are normally stored temporarily for a period of three to five days for the industry to evacuate thereafter. Any storage above the three to five days period attracts storage fees thereafter. Because of the design of the terminal, some blocks are larger than others. Blocks are linked to interchange zones (ITZ's). Interchange zones are areas where the exchange of imports and exports takes place, in these areas, straddles are offloading containers from back of truck trailers, and containers loaded onto truck trailers. Because some blocks are larger, sometimes the volume to be exchanged in a tower can be larger than the capacity of the straddles deployed, creating a backlog and ultimately congestion.

- Ship to shore Cranes-The Durban Container Terminal has invested millions of Rands in the procurement of new Ship to shore cranes (STS cranes). The main challenges with the cranes are as follows:

1.3.2 Crane Breakdowns

The crane break-downs often impact on operational performance, each crane has a KPI named Gross Crane moves per hour. (GCH) that contributes to Ship Working Hour (SWH). When a crane breaks, the gross container movement per hour is affected, as well as the ship working hour, consequently impacting negatively on the total amount of time the ship spends on its call in the container terminal.

1.3.4 Underutilised Crane Capability

DCT North Quay Ship to shore cranes have twin-lift, tandem and quad lift capabilities. The design capability of these quayside cranes were meant to enhance the output of each crane; however, DCT cranes have not yet fully explored or utilised these capabilities to the fullest due to a number of reasons, as a result the terminal has not reaped the benefits of these design features. The challenge is that the operational processes applied in the

blocks or stacks behind the cranes are not in line with the crane capabilities and the ship stow plans.

1.3.5 Ship to Shore Crane Maintenance

The quality of the maintenance process is questionable at this stage, judging from the equipment breakdown statistics. The technical department itself admits that the quality of the maintenance performed on the cranes is sometimes sub-standard. This could be because of a shortage of skills and time. Substandard equipment maintenance is currently one of the major courses of breakdowns.

1.3.6 Stack Windows – Uneven Traffic Flow

The container terminal has limited resources and capacity. Berthing slots for vessels are agreed upfront for customers with container terminal operating contracts. The challenge is that the volume agreed to exchange on the waterside cannot always be exchanged on the landside due to the landside infrastructure. The Terminal Operator has to then find means to handle the landside volume exchange, sometimes resulting in congestion on the roads within the DCT precinct. This issue is exacerbated by transporters avoiding transacting on weekends resulting in volume that should be handled on a seven week being handled in four to five days of the week, creating a spike and ultimately congesting Bayhead Road.

1.3.7 Equipment allocation

Each operational area of the terminal gets allocated a certain number of Equipment (straddle carriers) to use for a particular shift. Because the traffic flow into the terminal is unpredictable, it often happens that a particular area of the operation is suddenly under pressure, which then requires the re-allocation or redeployment of equipment to match the actual demand for each operational area. The challenge that is often experienced is that the reaction time to this volume shift is not quick enough, the second problem is that there is not a single body within the terminal that has the authority to perform the re-allocation exercise in a real time fashion. This results in one area that is under resourced

while other areas keep their equipment idle. This has a negative impact on the terminal as a whole.

1.3.8 Customer Requests and Discrepancies

Shipping lines" customers" often supply inaccurate or sometimes insufficient information to the terminal. The one common problem is the delay in the submission of loading plans. Delays in loading plans cause a delay in the commencement of ship loading operations. Inaccurate volume results in inaccurate operational plans. The challenge is, therefore, either insufficient resources allocated to handle the volume or underutilisation of equipment, resulting in wasteful expenditure in overtime. Shipping lines often make unplanned requests to accommodate their trade routes, the customer requests amongst others are , extension of export stacks, changes in berths while stacks are running, ship lay-byes impacting follow on vessels negatively. Such requests introduce a great deal of complexity for the terminal, putting pressure on operational resources.

1.3.9 Stack Inaccuracy" Dumping of boxes"

Export containers are pre-assembled into a block/stack, import containers are discharged into a block for Imports. Operators rely on the terminal operating system strategies to instruct the equipment operator of the container location in which the containers needs to be positioned in the yard. The responsibility of the operator is to simply adhere to the system recommended position and place the container where the system advises it to be placed. The challenge experienced is that operators (Operators of Lifting Equipment) do not always adhere to the yard position/location recommended by the Terminal Operating system. They simply place the containers in a position where they find closest or convenient. The behavior is possibly driven by operators chasing incentive targets which are focused on servicing a crane as opposed to accurately positioning the container in the correct location. This is a problem for the next operator as he has to search for the container that has been misplaced to service a truck or another ship.

1.3.10 Equipment Breakdowns

The following factors affect performance and productivity at the terminal:

- *Straddle Carriers*- DCT has a number of straddle carriers that have reached the end of their useful life. Due to the replacement cost of the equipment and the required capital outlay, the replacement is deferred. These pieces of equipment are, therefore, redeployed to a lesser critical area being landside and rail operations. These out- of- useful- life straddles, break down often and operators have to climb on and off the straddles throughout the shift, thereby impacting negatively on productivity on the landside.
- *Ship to shore Cranes* - DCT has a total of 17 Ship to Shore Cranes. At any point in time, one crane in each quay is out on preventative maintenance. Therefore, 14 cranes should ideally be available to operations on any day. However, due to ongoing breakdowns the number of gangs deployed averages between eleven and twelve gangs at any point in time.

1.3.11 Workforce

The following factors affect performance and productivity at the terminal:

Unionised workforce- The Durban container terminals workforce is unionised and affiliated to two major Union bodies. Similarly with any other organization with organised labour, when employee demands are not met, the terminal is bound to experience either a go slow or a complete work stoppage. This has a negative impact on operations.

Skills shortage- Due to an ageing workforce at DCT, there is a challenge of skills and experienced drivers to man the different types of terminal equipment. The new employees introduced are slower in executing tasks. The organization does not have an effective skills replacements strategy and this becomes and operational challenge as there is sometimes insufficient employees in the form of “gangs” to man the equipment, resulting in delayed performance of on operations.

High absenteeism- There is generally high absenteeism at DCT, the unavailability of labor sometimes results in the shortage of employees to man the gangs required to handle the volume throughput.

1.3.12 Adverse Weather Conditions - Wind

The equipment used at the terminal is highly sensitive to wind. Once the wind speed gets to 75kilometers per hour. Some equipment cannot be operated at the terminal. The terminal is declared to be wind bound. This is simply because all the equipment at the terminal is characterised by height. Therefore, handling containers at such heights in windy conditions is unsafe. This becomes an operational challenge as container volumes cannot come in and out of the terminal. There is currently not an effective wind mitigation strategy.

1.4 Aim of the Study

This study aims to thoroughly investigate the Operational Challenges at the Durban Container Terminal. The study aims to obtain the employees opinion on the operation challenges currently prevailing at DCT. The challenges investigated include; berth depths, workforce terminal planning, customer influence, incentive payouts, and impact of weather. Recommendations will be made based will be made based on challenges uncovered

1.5 Problem Statement

The operational challenges experienced by the Durban Container Terminal affect its ability to perform at its optimum level. This is evident in the terminal's inability to achieve its Key Performance Indicators both on the landside and on the waterside. The challenges range from people related issues to equipment and Infrastructural related challenges. Some of the challenges seem to be unique to the Durban Container Terminal, while others are common to other terminals found globally.

1.6 Objectives of the Study

The objectives of the study are:

- To establish the nature of the challenges faced by the Durban Container Terminal
- To establish the factors hindering effective operations at the Durban Container Terminal
- To assess the relationship between operational factors and efficiency at the Durban Container Terminal
- To recommend appropriate strategies that can be adopted to overcome the challenges experienced

1.7 Research Questions

The research questions posed are:

- What is the nature of the challenges faced by the Durban Container Terminal?
- What are the factors hindering the effective operations at the Durban Container Terminal?
- What is the relationship between operational factors and efficiency at the Durban Container Terminal?
- What are the recommended strategies that can be adopted by the Durban Container Terminal to overcome the challenges experienced?

1.8 Significance of the Study

The study is hoping to surface all of the challenges experienced by the Durban Container terminal. The findings from the research will then give the terminal an educated opinion in the form of recommendations on how to address the Challenges identified. The implementation of the recommendations will lead to the achievement all terminal Key performance Indicators (KPI's).The achievement of Key performance Indicators not only satisfies the stakeholders but it will also give Durban Container Terminal a competitive edge over its rivals.

Learnings from the study will be passed on to other Transnet port terminals in the container sector. There are however other challenges that could also be across sectors, for an example, challenges relating to management and labour relations which is a common phenomenon across all sectors. Therefore, any solutions implemented by DCT can be replicated across Transnet port Terminals throughout the country.

1.9 Assumptions of the Study

The study focuses on investigating the challenges experienced by the Durban Container Terminal. This study is conducted at the Durban container terminal. The Researcher is based at the terminal and is an employee of the terminal. The researcher has been given permission by management to conduct the study. It is assumed that the participants will be honest and truthful when answering the research questionnaires.

1.10 Brief Research Methodology

The Study is approach from a mixed method in which both the qualitative and Quantitative approaches are used. The Qualitative approach covers the use of questionnaire as primary source of data, while the Quantitative approach does not use interviews but rather the perusal of Company documents such as Company policies and standard operating procedures. These documents have a non-numerical basis upon which quantitative expressions could be based, making this approach more on the Qualitative side. Utilising both approaches (mixed method) has benefits as the limitation of one type of data can be balanced by the strength of another type of data (Creswell, 2009).

1.11 Limitations of the Study

Interviews did not form part of the qualitative data. Company policies and the researcher's experiences and observations on the subject matter form part of the qualitative research. Indirect personnel e.g. Administration and some other Terminal supporting activities are not a part of the study, because most action occurs in operational areas; and not a lot of information directly related to the study comes from support areas and their staff. A possible argument could that indirect activities that support the core functions of terminal operation are a crucial sub-system that also needs to be unpacked, the results of which

can positively contribute to the body of knowledge. Nevertheless, in the researcher's opinion it was deemed to be unrelated to the problem under investigation.

1.12 Organisation and Structure of the Study

The study comprises of five Chapters that cover the following:

Chapter One: - The Chapter presents a contextualised introduction and background to the study, outlining the problem statement, research objectives and the questions the study seeks to answer. Additionally, this chapter provides an overview of the research methodology.

Chapter Two: - The Chapter delivers a detailed presentation of the obtainable literature on the subject area of the study, increasing the body of knowledge on the topic for both the reader and researcher.

Chapter two covers the definitions of key concepts, literature related to the nature of challenges faced by the Durban Container Terminal, literature related to factors hindering effective operations, literature related to the relationship between Operational factors and efficiency.

Chapter Three: The Chapter discusses the research methodology, research design, research philosophy, location of the study, population, sampling and the data collection strategy. It further covers validity and reliability, administration of the questionnaire and data analysis.

Chapter Four: The Chapters focusses on the results; its presentation, analysis and discussion. It also shows how the results agree or disagrees with the theory

Chapter Five: The Chapter covers results presentation, analysis and discussion of the results presented. It also shows how the results agree or disagrees with the theory

Conclusion

This chapter has introduced the topic being researched. It has explained the relational behind investigating the Operational Challenges at Durban Container Terminal. This

chapter contextualized the problem under investigation. Further it has given a background to terminal operations and also explains the different components of the terminal and how these components link to each other. The aim of the research and the research problem has been unpacked. Research questions that the chapter aims to answer were formulated. The research methodology was introduced. The limitations of the scope of the research as a well as the organisation and structure of the research are presented in this chapter.

The next chapter focuses on the literature review. It reviews all the literature that has been written on the challenges similar to that of DCT.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The previous chapter covered the introduction and background to the study. It further explained the rationale behind doing the research on Operational Challenges at Durban Container Terminal. It has given background to terminal operations and also explained the different components of the terminal and how these components link together. It presented the research problem. It presented Research questions and the limitations of the scope of the research.

This chapter seeks to present the literature related to the study. The following sections are discussed in this chapter: definitions of key concepts, literature related to the nature of challenges faced by the Durban Container Terminal, literature related to factors hindering effective operations at the Durban Container Terminal, literature related to the relationship between operational factors and efficiency at the Durban Container Terminal. The chapter further presents the theoretical framework related to the study.

2.2 Definitions of Key Concepts

2.2.1 Operations Management and Supply Chain Management

Operations focus on the functions of the organisation which is about transforming a number of inputs into the desired outputs with desired quality standards (Kumar & Suresh, 2009). Management is that function that co-ordinates a number of resources with the objective to produce value adding products or services governed by the organisations policies (Kumar & Suresh, 2009). Therefore, operations management is a set of management activities aimed at producing goods and services (Kumar & Suresh, 2009).

Operations management is about a coordination of sub-systems and how to make them more effective, cost efficient, high quality and environmentally friendly using an industry recognised criteria or that of the organization (Nagurney, 2012).

Supply chain management can be seen as either an emerging field or a new academic domain. None of the two perspectives are completely mature but each of them has a considerable promise (Storey and Emberson, 2006).Within an organisation, Supply chain management includes a number of functional areas, and these are inbound and outbound logistics, warehousing and inventory management. Sourcing, purchasing fall under the same umbrella, (Zigiaris 2000).

2.2.2 Container Terminal Resource Outputs

Many Container terminal operation perform at moves of around 28 up to 35 moves per crane hour, (Murphy 2006). The move rate can increase to 40 per hour if the terminal is chasing specific agreed time for the vessel stay at the terminal. In operations theory, crane productivity depends on the number of lifts per each ship being serviced. If labour regulations pertaining to manning a ship are considered fully, a rate of 28 to 35 moves per hr is acceptable, (Murphy 2006). Four gangs per vessel is normally an acceptable rate, a gang deployment of more than four gangs can start to diminish the returns on the investment made. Alternatively, the higher rate could be achieved through the use of tandem or twin lift crane capability, (Murphy 2006).

2.2.3 Challenges in Container Terminals

According to Kim and Lee (2015), container terminals are facing a struggle with the ever increasing volume and throughput targets. Due to space being generally a limiting factor, container terminals are always in search of how they could increase the capacity of their throughput without having to make investment in the expansion of the physical land that is occupied. The shipping line still under the circumstances have an expectation for the terminals to handle bigger parcel sizes in the same amount of time as they did before, and or even improve. The Operating systems used by the terminal then plays a big role as it then supports the planning, scheduling and equipment control. Because of this complexity, the solution is generally to introduce emulated virtual terminals where plans are simulated virtually/artificially, piloted and adjusted to arrive at the best execution approach.

2.2.4 South African Container Terminal Challenge

According to Fraser (2012), there are now 5 different ports which form the southern African port system. A total 40% of the African market's import and export volumes are handled by these ports. There is competition that is growing amongst the southern African ports. Together with this rivalry, to order larger and deeper vessels, more efficient vessels with the object to co-load and economies on scale. This trend means these ports with the Infrastructure that can handle the newer generation vessels will have an advantage over those that don't. Durban is geared and continues to gear up for this trend (Fraser, 2012).

2.2.5 Container Terminal Logistics

According Nyema (2014) container logistics can be explained as integrated activities which include coordination, planning, execution and control of all movements of standardised ISO (international organization for standardisation) steel boxes and of the supporting information from source to the final destination. In comparison to the old bulk transportation, using containers as cargo handling equipment has advantages of less packaging, less damage and being more productive from a handling point of view, the movement of fast moving consumer goods is almost always carried out in these standardised steel Boxes on deep-sea container vessels, (Nyema 2014).

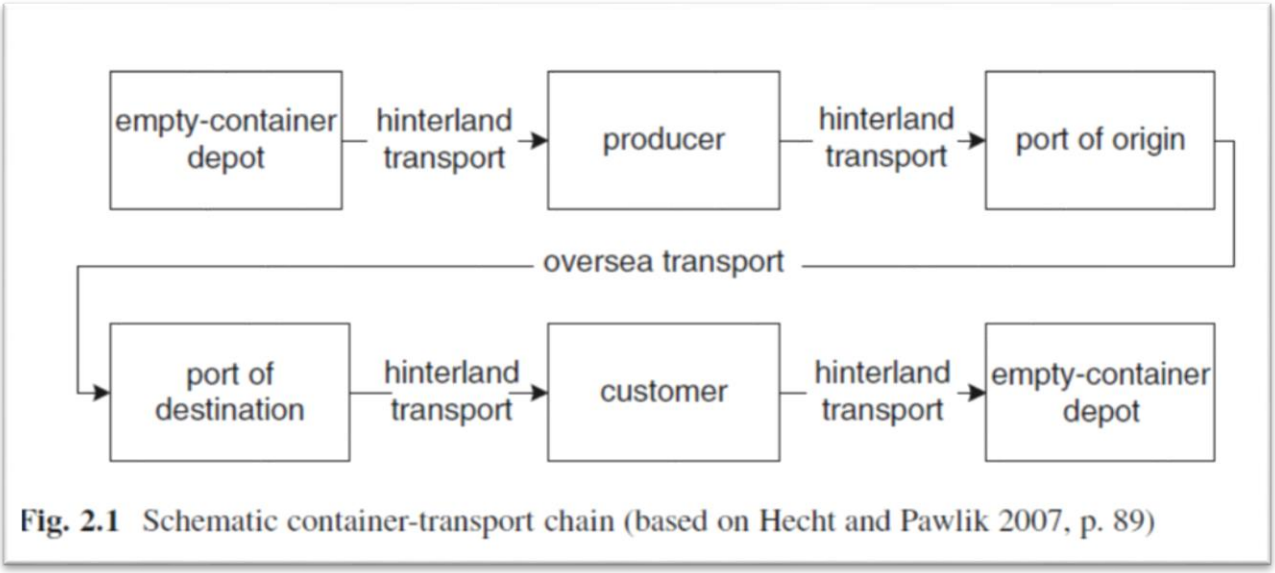


Fig. 2.1 Schematic container-transport chain (based on Hecht and Pawlik 2007, p. 89)

2.3 Nature of the Challenges faced by the Durban Container Terminal

2.3.1 Berth Depths/Draught

Ports infrastructure cannot be developed as quickly as the industry demands, and capacity ahead of demand is eventually exhausted and congestion becomes a reality even in the most efficient of terminals. This calls for a continuous and phased effort of expanding the container terminal infrastructure (Nyema, 2014).

Terminals are not only affected by the call sizes but also by the number of larger and deeper vessels. Container vessels of over 15000 TEu's are increasingly becoming a norm even though they are only able to access fewer larger hubs. This trend will eventually concentrate flows on a few mega ports in turn impacting on crane and berth productivity. This will add a great deal of pressure on the hinterlands links, (Nyema, 2014).

Berth depth or draught is an important aspect of the container terminal capacity. It determines the size of the vessel that can call in at the terminal, the draught further determines the extent to which the terminal is used. At DCT the advertised berth depth for berth 200 to berth 205 is a maximum operational berth depth of 12.2 meters. The terminal can handle bigger vessel on tides or not fully laden (Ports Regulator, 2016).

According Rodrigue 2000, the accessing of ports is a challenge for many vessels that are not designed to handle deep sea vessels. Some examples of these ports are river ports. Bringing in the new generation vessels in such ports introduces the requirement for continuous dredging of berths pockets and entrance channels to accommodate these vessels. This subject is however not as black and white as it seems, the needed depth depends on the tides and the load factors of the vessels. A vessel can have lower draught if it is not fully loaded, (Rodrigue 2000). The load factor of a vessel also depends on the configuration of the route. When a ship is not fully loaded, it has a lower draught compared to a ship that is fully loaded. Because of this, some ports with not sufficient water depth are still able to accommodate mega-ships as along as these vessels are within a port section that accommodates low loads. The terminal berth planning offices and the harbor master's office usually need to do a lot of pre-planning to accommodate tidal vessels, (OECD 2014).

2.3.2 Yard Design and Layout

The yard is temporary storage facility in which containers are stored for a short while within the area of the terminal. The containers in the yard can either be blocked stacked or where the space permits they are stored up to a height aligned to that of the yard gantry.e.g.1 over 3 or one over four high. The stacking depends also on the type of gantry used. Where a liner stacking method is used, carriers are yard gantries(Sun, Tan, and Lee & Chew, 2013). Where a block stack method is used. Rail mounted or rubber tyre gantries are used. Import and export containers are segregated and presorted for the different hinterland transport modes, road or rail (Sun, Tan, and Lee & Chew, 2013).

Due to the geological conditions, many container yards take on various different shapes (Sun, Tan, and Lee & Chew, 2013).

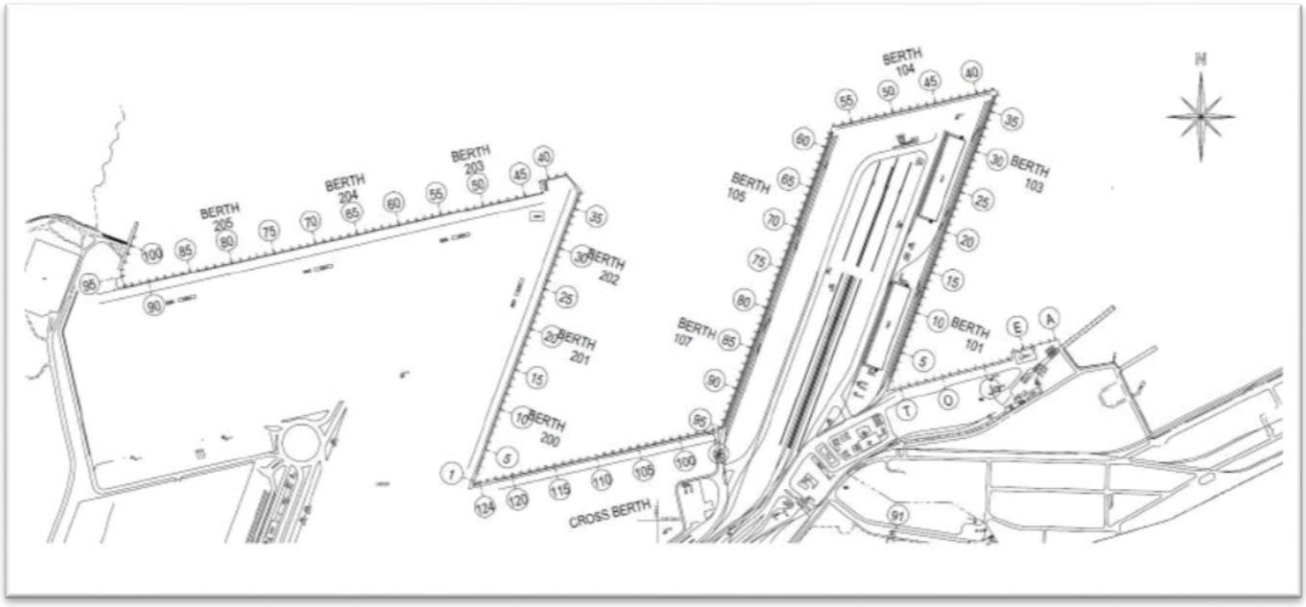


Figure 1: Detailed layout of DCT, Naicker & Allopi 2015

2.3.3 Underutilised Crane Capability

Transnet Port Terminals has invested in superstructure across the system; according to public reports, about R510m was invested at the DCT Pier 2 for seven tandem lift cranes and R438million in container handling equipment (mobile cranes, trucks, trailer and reach stackers) and bought 4 Ship to shore (STS) cranes and 18 Rubber Tyre Gantry (RTG) for Ngqura Container Terminal. This investment places South African terminals at the same level with many terminals around the world that handle similar volumes and vessel sizes. The use of the cranes must still yield similar outputs though, (Benchmarking Report, 2015).

Research shows that over the period 2010 to 2015, South African Container terminals have not been able to best utilise the crane capability they have. CPT is the only terminal performing better than others Quay cranes or Ship to shore cranes are one important pieces of equipment in a container terminal (Nyema, 2014). These carry out loading container from a hauler to a ship or unloading containers from a ship to a truck. A number of sub-systems in a container terminal influence the efficiency of the container terminal; these include vessel berthing, the quay crane loading and unloading. The feed to the crane from the yard as well as the evacuation of containers under the quay crane are other operations that determine the efficiency of the terminal operation. The quay crane, however, is the main factor that determines the efficiency of a container terminal, (Nyema, 2014).

Quay crane allocation to a vessel must be sufficient to complete the work load within the desired ship working hour or the desired time window. The time lost because of crane clashes needs to be also taken into account and avoided, (Vacca, Ilaria, Matteo and Bellaire, 2010).

Ship to shore cranes are the most expensive pieces of equipment in a container terminal. As a result, best of utilisation has a direct positive impact on the cost per container handled.in order to reduce the costs per container handled, a new generation of spreaders has been invented as well as the use of double cycling technique to avoid empty spreader moves. Recent technology used nowadays is the twin and tandem lift

capability. This technology means the number of containers handled adjacently can be four 20ft containers or 2 forty foot containers, lifted at once, (Gadeyne & Verhamme, 2011.

2 3.4 Operator Performance (DAV and OLE)

Due to the distribution of power between management and labour in the public sector, the strikes and industrial actions taken by labour have shifted power significantly in favour of labour. The interruption can basically cut of the delivery of service to customer completely particularly where the public organisations are monopolies. Unlike in the private sector where employees need to consider the consequences of their actions and how such strike could impact job security, (Newman, 2013).

The port of Durban does achieve the target of 28 moves per hour. The issue surfacing from the research is the inconsistency across the shifts, (Kgare, Raballand, & Ittmann, 2011). It is reported that some shift perform better than other shifts. The possible reason for the inconsistency in performance is the lack of staff motivation and supervision. The introduction of performance bonuses linked to performance contracts was one way to encourage staff to meet the specified targets, (Kgare, Raballand, & Ittmann, 2011). Research shows that only 5% of the staff have committed to the 28 crane moves per hour. This number indicates that the contracts must have not been designed correctly as a result they need to be reviewed, (Kgare, Raballand, & Ittmann, 2011).

Stability of labour in container terminals is key for stakeholders as this is perceived to have an impact on operations. The high turnover of management is also recognised to be one of the major causes of incontinency and instability in Durban container Terminal, (Kgare, et al., 2011).

2.4 Factors Hindering Effective Operations at the Durban Container Terminal

2.4.1 Equipment maintenance

Recently, the trend around the world is manufacture and design ship to shore cranes that can operate at super high speeds when loading and offloading vessels. Often the operation who have invested in these super high speed cranes claim to have the newest

technology that is most advanced, however these operation often struggle to make use of this advanced technology of ship to shore cranes (Aguedo *et tal*. 2002). Having advanced cranes does not automatically result to efficiency in crane operation or maintenance. The simpler things are, the simpler it is maintain and operate. This does not mean containers operations should ignore technology but to simply consider needs (Aguedo *et tal*. 2002).

The main objective of the maintenance department is to keep the Ship to shore cranes operating efficiently with limited downtime. However this is not as simple put, there are many factors that affect crane efficiency (Aguedo *et tal.* 2002). It is important therefore to have a detailed maintenance plan which the maintenance team can follow and be able to deliver efficiently. Maintenance teams must be knowledgeable, well trained, and not re-active but rather proactive.it is critical that maintenance teams are ready to resolve a crane issues swiftly and efficiently (Aguedo *et tal.* 2002).

The workload in ports today requires the type of equipment that can withstand usage around the clock. Breakdowns and mechanical failures are not acceptable and are extremely costly, (Naicker & Allopi, 2015).

Employees in the public sector organisations have an attitude towards equipment. Equipment in the space is owned publicly and therefore does not belong to one individual, because of this it does not receive the attention deserved, (Naicker & Allopi, 2015). On the other hand, equipment in the private sector tends to be in better condition than that of the equipment in the public sector; therefore this equipment is like to produce quality outputs that keep customers happy (Naicker & Allopi, 2015).

2.4.2 Performance Management Tools

Measuring and understanding performance is a concept that is basic to any organization, whether it is measuring performance against company set target or against industry norms. Management of container terminals is complex process that requires a number of financial and operational decisions, (Esmer, 2013). Management must come up with sophisticated methods of measuring productivity and need to establish supporting

systems to ensure maintenance or even increase the productivity standards (Esmer, 2013).

Container terminals around the world have unique characteristics; the task of measuring performance can become extremely difficult. The challenge is the nonexistence of industry standards from which to benchmark the terminals against. This is made difficult by the fact that there is no one measure that can sum up all the important subsystems of a container terminal performance, (Esmer, 2013).

Measuring productivity performance is of vital importance to a terminal operator as they are performance is directly linked to the Revenue and costs of operating a terminal, (Esmer, 2013). Generally, there are seven productivity indicators which any container terminal needs to monitor and measure, these are:-

- **Ship Working Hr. (SWH**).This is the amount of containers that cross the quay in an hr. This is the measure that determines the amount of time a vessel spends on a berth on a particular call
- **Gross Container Hour(GCH**), this is calculated per crane, this is the amount of containers each crane handles in an Hr. When this measure is multiplied by a number of cranes or gangs, it converts to a ship working hour.
- **Truck Turnaround Time**-this measures the amount of time an external truck spends inside the terminal boundaries, from the time the truck enters the terminal gates to the time a truck exists the terminal gates.
- **Terminal berthing delays**, The average delay per vessel as a direct result of the terminal expressed in hours
- **Rail turnaround time,** The average service time of trains arriving and departing the terminal expressed in hours
- **Cargo Dwell time in terminal**- The average period that cargo stays within the terminal between the times of arrival to loading and vessel discharge until terminal gate exit expressed in hours or days.

According to Nyema (2014) the container Industry tends to agree however on a 3 to 4 dwell time is representative of the mean value. International standards are typically 1 – 3 days. On the other hand, gateway seaports are not only entirely gateway ports, they are also a place of integration in the form of being transshipments hubs, (Nyema, 2014).

Over and above the generally accepted productivity measures, Transnet introduced a strategy not only to improve productivity but to also manage the behavior of the private sector. It introduced Condition of Trade Contract. Condition of Trade Contract (CTOC) is a contractual agreement between Transnet Port Terminal and some shipping lines. This contract binds TPT to specific productivity targets for specific calls. The two parties agree on specific ship working hour on specific lines services, (Kgare, Raballand, and Ittmann 2011). On achievement of the set target, the containers terminal earns a bonus over and above the terminal handling fee. The contract not only is about paying a bonus, it guarantees a CTOC a berthing window, and CTOC vessels have preference over non-CTOC vessels, (Kgare, Raballand, and Ittmann 2011).

2.4.3 Management Style and Labour Relations

The competitive environment surrounding container terminals and ports in general is changing dramatically. More than ever, customers are beginning to choose between terminals based on their productivity and reliability. While the terminals are busy trying to position themselves against competitors, Challenges with labour introduce an additional complexity. When a terminal is faced with number of labour interruptions, it stands a risk of losing its competitive edge (Jordan, Cowman, Zellhoefer and Dragonish, 2015).

The relationship between management and labour in ports is often oppositional and characterised with conflict. For a number of ports, labour and management view the other as enemies rather than as a partners.

According to Turnbull (2005) the social associates within the industry have for a number of years determined that social dialogue which is merely a formalised continuous engagement between labour and management can lead to a stable work environment for management and labour: “Where these engagement efforts don’t exist, similar joint

platforms should be established with a view of creating a climate of self-assurance and collaboration between port workers and employers, in which social and operational changes can be brought about without strain and conflict and complaints swiftly addressed (Turnbull, 2005).

Dealing with enthusiastic, motivated and well-trained workers is key to productivity and reliability, but that level enthusiasm is difficult to attain if workers feel like they work for the union and not the employer. There needs to be a fundamental change in how employers and employees view one another and interact, (Turnbull, 2005).

The high turnover of management at DCT is seen to be the major cause of instability and the desired to reduce this has been expressed (Kgare, Raballand, and Ittmann, 2011).

2.4.4 Berth Planning

Berth planning is a crucial component of the terminal's planning function. Berth Planning is merely the assignment and scheduling of vessels to berths or to quay locations over a period of time. Limitations normally considered include among others factors, the vessel length, the depth of the berth, the arrival time window as well as the sailing times of vessels, the sequence of arrival at anchorage, and the commonly used berths. Berth planning can be done to cover a period of a week or up to a period of a month, (Cubillos, Díaz, Urra, Cabrera-Paniagua, Cabrera & Lanfranc, 2013).

The first main objective of berth planning is to minimise the delay of the sailing time of vessels beyond their agreed departure times. Every vessel is important to the terminal operator. The second most important objective is a reduction in the total flow time of vessels, this means the total vessel stay of all vessels (Kim & Lee, 2015).

The vessel's arrival into the container terminal triggers a process that involves a number of components and decision makers. The system built in berth planning function allows for an integration of different actors involved in the overall planning process. Therefore, a centralized berth planning systems that works outside of the Terminal operating system is unrealistic, (Cubillos, 2013).

To maintain their global schedules, most shipping lines want to berth on arrival. These shipping lines general have special contracts with terminals that give them preferential treatment. On the other hand the terminal is measured on berth and cranes availability. (, Dai, Moorthy, Chung-Piaw and Teo 2011).

2.4.5 Yard Planning

Congestion in the container terminal limits the efficiency of the port and its throughput rate. The one way a terminal could be congested is visible through the difficulty of finding space for discharging of vessels, the difficulty in finding space to open new stacks for export vessels, (Zhen, Jiang, Lee & Chew, 2013).

Congestion in container terminal is an important problem which reduces the productivity of the yard location. The common practice, therefore, to distribute the volume over a wide area of the yard. Another goal of good yard planning is to minimize the possibility of shuffles during retreival.to maintain stability of the vessels, heavy boxes are stowed under deck which means they need to be retrieved earlier than the light boxes in the yard (Kim & Lee, 2015).This means these boxes need to be stacked in a higher tier when stored in the yard to avoid shuffles during retrieval. Unlike any other operational area of the container terminal, decision making rules in the yard are customized to the configuration of the yard; therefore, each terminals can has its .own set of rules in a far as the yard strategy is concerned (Kim & Lee, 2015).

A number of studies in the area of yard Management show that strategies deployed are based on the forecasted number of containers and their commodity types. However, the international maritime logistic market has a lot of variabilities that are built in from the number of containers that need be handled on a particular vessel call to the type of hinterland transportation that that would move the container upstream, and a lot of unforeseen situations or events that occur during a vessel voyage, (Zhen, Jiang, Lee, Peng, and Chew 2013). Some shipping lines call at a terminal periodically whereas others call regularly or repetitively. For a particular call the container exchange varies and the amount of time spent on a berth also varies. All of these uncertainties needs to be

considered when planning a container yard for a single or multiple vessels calling simultaneously, (Zhen, Jiang, Lee, Peng, and Chew 2013).

2.4.6 Equipment Allocation

The Ship to shore crane allocation problem aims to ensure that cranes are efficiently assigned to vessels. The objective is to meet a specific time frames. The crane intensity must be adequate enough to ensure the job is completed within the given time period (Vacca, et al., 2010). Crane clashes need to be taken into account in the allocation and deployment of cranes. Furthermore, Ship to shore cranes are usually one of the scarcest resources in a container terminal as they are extremely costly. The Ship to shore scheduling problem is more operational, planners need to allocate cranes to specific quay specific jobs (set of containers)and produce a clear schedule of the loading and unloading moves for each crane (Vacca, et al., 2010).

One of the most important reasons for a terminal's low efficiency levels is traffic congestion for example the Terminal's throughput rate. Congestion can be caused by a number of yard cranes, straddle carriers queuing in small area under a crane that is discharging or loading containers, (Zhen, et al., 2013). The traffic congestion can also be situations that straddles carriers stop along a row when another straddle runs along a lane simultaneously. Based on a number traffic congestion models, the existing studies on allocation of straddles carriers, stack space management, etc. (Zhen, et al., 2013).

Due the growing traffic of containerised cargo, more and more containers would need to be stored in the ports. According Zhen, Jiang, Lee, Peng, and Chew (2013), Ports are often constrained by the scarcity of land, particularly those situated in urban areas like Singapore and Shangai. To remain efficient and competitive, we are therefore seeing more and more of these ports beginning to adopt automated container terminals with green considerations (Zhen, Jiang, Lee, Peng and Chew, 2013).

The type of container terminals, however, requires large investments, and the return on this investment is still questionable. Improvement on the existing system is still more

practical versus the adoption of Automated Container Terminals, (Zhen, Jiang, Lee, Peng and Chew, 2013).

2.4.7 Incentive Bonuses Payments and Overtime

Newly, employee salaries packages for many organisations include incentive pay schemes that are connected to employee and company results. Incentives schemes are expected to increase the employee's attachment to the organisation which ultimately translates to job satisfaction, efficiency, low absenteeism, lower staff turnover and reduction of waste. This results in good performance for the organisations as a whole (Bryson, Freeman, Lucifora, Pellizzari & Perotin, 2011).

However, some companies prefer to stick with not paying incentives when they could perform even better if they adopted incentive pay that is linked to performance.

Adopting an incentive pay linked to performance could be a way for organsiations to share risks and benefits with employees. There evidence that shows that incentive schemes do not always improve performance in all contexts and situations. For example, organisations often introduce share ownership schemes for reasons that do not have anything to do with pay incentives, (Bryson, Freeman, Lucifora, Pellizzari and Perotin, 2011).

It is important to gain an in-depth understanding of the character of individuals and the work that they do in order to clearly appreciate what motivates them. It could be remuneration, verbal praise or even a simple sign of recognition. Motivation comes in a number of forms, the following could forms of remuneration to name a few, financial rewards, bonuses, verbal praise. What is important is not much the form of motivation used, but rather the deliverables, it must produce improved efficiency and better results (UNCTAD 2013).

It is completely impossible to satisfy all the demands of the workforce, particularly because the question of money is always not present due to the pressure of increase maritime traffic flows. Terminal operations have been extended beyond a normal workweek to weekends as well (Beškovnik, 2008).

2.4.8 Customer Demands

Shipping lines often use transshipments as a service offering to their clients. Terminals regard transshipments as a value added to their customers (shipping).The handling of transshipments is usually priced way below the normal container handling fee. This arrangement introduces complexity for the terminal.it is an additional Revenue stream and a high cost for operations. Besides the low handling fee, transshipments absorb a lot of yard space. When a terminal is busy, transshipments can lead to congestion and traffic, (Vacca,Ilaria, Matteo, Bellaire,2010).

The abuse of dominance such as the imposition of the exclusive dealing requirements by certain customers can have a negative impact on the competitiveness of any business in general (DAF/COMP, 2011).

The container industry is a highly competitive sector. The success of competitors no longer depends on their competitive edge but also depends on the chain in which they belong to, (DAF/COMP, 2011).

In general, if inefficiency exists in public sector business environment, the situation creates a vicious cycle of inefficiency and corruption. Transnet, in general, has the responsibility to provide an inefficient service and thereby reducing and eliminating the room for customers to introduce corruption in the system, (Kgare, et al., 2011). Large shipping lines will make an effort to dominate, (DAF/COMP 2011).

Customers do not generally make a financial investment but can have a strong influence and indirect power, given they have the right to demand a particular standard of service. Their businesses are highly correlated with that one of the terminal. Activities in the terminal influence their business results (Vacca,Ilaria, Matteo, Bellaire, 2010).

2.5 The Relationship between Operational Factors and Efficiency

2.5.1 Equipment Utilisation and Efficiency

According to Esmer (2008), the equipment used in a container terminal is very costly, therefore equipment utilisation is of extreme importance. The effective utilisation of a piece of equipment is measured by the time it was effectively deployed over a specific period of time. Efficiency of the port is of vital importance, especially in this highly competitive environment. Under utilisation will result increasing no return on the investment made, but simply increasing the operating expenditure of running the port (Esmer, 2008).

2.5.2 Shift Patterns and Efficiency

Employee wellbeing is associated with health and wellness. It is up to an employer to create an environment that promotes employee wellbeing. Research suggest that physical wellbeing leads to psychological wellbeing. It is important achieve work life balance (Shagvaliyeva & Yazdanifard, 2014).

There is a great deal of assumption and speculation that says prolonged shift work can lead to chronic insomnia, however, to date very few studies deal with this issue. The reason for the lack of study is due to the difficulty of tracking a large number of groups, keeping track of those who leave work etc. (Åkerstedt, 2003).

It seems obvious that the business trend and organisational practices are set to continue. It is important that companies take note of the possible consequences and begin to take the necessary steps minimise the effects on employee's health, safety and the welfare of the labour force. One preventative solution could be to create platforms for greater engagements which will ensure that more robust feedback is received from the labor force (Walters and Wadsworth, 2016).

2.5.3 Performance Bonus and Efficiency

Employees work to earn an income to fulfill their needs. They appreciate incentive payments based on the business performance (UNCTAD 2013).The performance of

employees is affected by a number of factors in the workplace. Performance measures are there to assess if the employees perform well or not. Employee performance is a significant deciding factor as to whether the company meets its goals or not.

Performance incentives can also drive the wrong behavior. For an example, rising wind speeds can lower productivity of crane moves per hour at some wind speed that does not necessarily compromise safety. When this happens, operators stop operations in an effort to protect their performance bonuses, instead of accepting lower productivity and lower or no bonus payments (OECD, 2013).

3. Conclusion

This chapter reviewed literature relating to the Operational Challenges experienced in many national and international ports. The information selected, highlighted similar problems and challenges being experienced the Durban Container Terminal Pier 2. With reference to nature of the challenges faced by the Durban Container Terminal, factors hindering effective operations at the Durban Container Terminal and the relationship between operational factors and efficiency. The next chapter presents the Research methodology that was used to collect the primary data for the study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research approach and methods used to collect the primary data. The chapter evaluates the strengths and weakness related to the research technique; explains the design and procedure used for the collection of data. It highlights information on the population, sample selection, questionnaire design, data collection strategy and ethical considerations. The chapter further covers reliability and validity, administration of questionnaires, data analysis and offers a concluding paragraph.

3.2 Research Objectives

The objectives of the research are as follows:

a) To establish the nature of the Challenges faced by the Durban Container Terminal
b) To establish the factors hindering effective operations at the Durban Container Terminal
c) To assess the relationship between Operational factors and efficiency at the Durban Container Terminal
d) To recommend appropriate strategies that can be adopted to overcome the challenges experienced

3.3 Research Philosophy

According to Schindler and Cooper (2011), a research philosophy is the general method followed in the discovery of new knowledge. There are two common approaches of research philosophy. These opinions are known as the positivism and phenomenological views, (Schindler & Cooper, 2011). Both approaches are used for this study. The mixed method research approach is referred to as the third methodological research movement, (Roslyn, 2011).

3.3.1 Qualitative Research

In a qualitative study, the research is mainly focused on the approach to get to the facts. The key style of the positivist scholar is the experiment, which provides the ability to evaluate a cause and the result of the cause relation vessels through observation (Sekaran & Bougie, 2013). Qualitative research can be described as a set of informative activities that aim to discover the precise meaning behind the behaviour and actions of others. These activities rely on the researcher to become an exclusive interpreter of the information received from the participants in the study (Alfoldi and Sinkovics, 2012).
According to Alfoldi and Sinkovics (2012), the advantages of qualitative research are as a follows:

Advantages

- It can determine how participants interpret constructs
- It provides information that is relevant to the individual case
- It is useful for explaining complicated Phenomena
- It is useful for an in-depth study of a number of cases

Disadvantages

- It takes more time to collect data
- It is difficult to make quantitative predictions
- are biased by the researcher's own Objective
- Analysing data can be time consuming

3.3.2 Quantitative Research

According to Sekaran and Bougie (2011), Qualitative research is non-generalisable, particular and is dependent on unrestrained observations during the data collection

activity. The Quantitative Research approach believes that the universe is guided by rules and laws of cause and effect (Schindler & Cooper, 2011). A quantitative study is normally used with a rational approach where data is collected to check a theory. In the positivist approach, hypothesis are established and confirmed through the data analysis method to enable the researcher to draw critical conclusions (Sekaran and Bougie, 2013). According to Sekaran and Bougie 213, following advantages and disadvantages of secondary data,

Advantages

- Has lesser supply requirements and results save costs.
- Normally, it is not expensive
- less time consuming to utilise secondary data than it is to collect the data directly
- The data collected readily available and it allows the researcher much more time to think about research aims and issues of substance.
- It also gives the researcher much more time and to focus analysing and interpreting the data.
- Secondary data is unhindered. Therefore, secondary data is likely to be of highly quality than data is collected directly by researcher
- Secondary data give one the opportunity to place their own finding within a more general background

Disadvantages

- Secondary data may be collected for a different purpose and study as result it may only partially answer the research question.
- Accessing secondary data may be difficult and costly,
- The relevant reports and articles may not be always be available as a result may require secondary data purchased on-line through internet sources, which can be costly.
- The definitions of the data may not fit the topic being researched,
- Definitions and the interpretations thereof may be representative of the views of the researcher and therefore not objective.

3.4 The Research Methodology Used

The mixed approach chosen for this study subscribes to Sandelowski (2000), the argument made states that “Grounded theory strategies make the method explicit, and their open-ended qualities foster the development of emergent conceptual analyses. Grounded theory methods prompt early analytic thinking and keep researchers interacting with their research data and emerging analyses”. The study is regarded as very important hence; the advantage of mixed methods research was seen as the most relevant approach in an attempt to close the gap that could have been created by opting for either a qualitative or quantitative research approach.

According to Bryman (2012) mixed methods research gives the Researcher an advantage because the Researcher can arrive at a more complete reason of the issues under investigation than could not have been achieved if either a qualitative or quantitative research approach was used independently.

The rise of mixed methods was counter to the incompatibility thesis but consistent with the typical viewpoint of realism, which asserts that quantitative and qualitative methods are not only like-minded, but possibly better suited to answer some explicit research questions (Tashakkori & Teddlie, 2003).

3.5 Research Design

The research design can be defined as a strategy used in the gathering, evaluation and analysis of the gathered data in relating to the research questions for the study (Sekaran and Bougie, 2013). Research design is not limited to any specific technique of research data collection or even any specific type of data. In principle, any data collection techniques can be used for research design. The data used can either be quantitative or qualitative. Research design refers to the structure of an investigation, it is a logical matter and not in any way a logistical matter (Sekaran and Bougie, 2013).There have been arguments that the main reason for research design is to reduce the chances of incorrect causal inference from the data, design is a rational task done to ensure that the evidence

gathered enables the researcher to respond to questions or to test theories as unequivocally as possible (Sekaran and Bougie, 2013).

3.6 Location of the Study

The study was conducted at the Durban Container Terminal (Pier 2).The study covered all the critical departments involved in the Durban Container Terminal Operations.

3.7 Population

The study is limited to the Durban Container Terminals (Pier 2). The container Terminal has 2055 employees. The terminal has 12 departments. Because of the size of the organisation, the researcher took a sample of 5% of each department. A sample size of 200 has 7.1 margin of error (Robert *et tal.* 2006). The departments covered in the study are Planning, Operations, Commercial, Risk, Technical, Procurement, Documentation Centre, IT, MIS Department, Security, Fleet and Finance.

3.8 Population Sample

Acharya, Prakash, Saxena and Nigam (2013) stated that the most important feature of a study is its sample size. In their definition, a sample is a component of a population, which represents a larger population, sampling is done because in some cases it is not possible to cover the entire population. Purposive sampling is commonly the most used sampling technique in a qualitative and quantitative research since the participants chosen are the right target to achieve the research objective. The procedure used for the selection of respondents was random sampling. In this type of sampling, all the elements of the population have an equal opportunity of being selected as a subject (Sekaran and Bougie, 2013).

For the purpose of this research, the sample size is realistic to provide valuable qualitative information to answer the research question. The study targeted 103 participants. The response rate was over 100%; however, only 55 participants completed the survey, the remainder exercised their right to abandon the survey.

3.9 Strategies for Data collection

Research strategies include experiments, surveys, observations, case studies, grounded theory, action research and mixed methods (Sekaran and Bougie, 2013). Data collection is a systematic practice through which the researcher collects pertinent data to accomplish the research purpose and objectives (Creswell, 2008) .There are usually two types of data available during data collection. Gauri and Grauhaug (2010) further supports the view and also asserts that data collection takes a form of qualitative or quantitative approach, depending on the nature of research problem and its objectives.

According to Gauri and Grauhaug (2010), research data is divided into primary data and secondary data. Primary data is data that is collected first hand by the researcher while secondary data are obtained by others on behalf of the researcher (Both data collection approaches were used for the study). In addition, Kothari (2004) states that primary data collection is best achieved through observing or directly communicating with respondents. These methods include but unlimited to, observations, interviews, and questionnaires and through schedules. In this study, questionnaires were used.

The strategies for data collection ensured a neutral approach and covered the following areas:

- Protection of respondent's privacy
- Confidentiality of data
- No mandatory obligation to participate in the survey
- Opportunity for every employee to participate from junior staff to senior management

The study considered the advantages and disadvantages of different data collection approaches. E-mail questionnaires was selected as the best data collection method because the majority of employees and management work shifts. The targeted sample had access to email.

The following approach was used to collect the data:

1. A formal application for the intention to conduct a study at DCT was submitted to the CEO of Transnet Port Terminal. The application was subsequently approved. The one condition or comment by the office of the Chief Executive is that the result of the survey needs to be reviewed by the relevant General Manager prior to being distributed.

2. The questionnaire was then compiled and distributed electronically via a web link. The respondent's response remained confidential since the identity of the respondent had no influence on the feedback received. The choice to participate or not to participate was also made clear to the respondents, such that they had the freedom to abandon the survey at any stage.

3.10 Questionnaire Design

The questionnaire was designed considering the objectives of the study and the literature related to the questionnaire**.** The questionnaire was divided into four sections, the first part dealt with only personal information about the respondents. The second, third and fourth sections of the questionnaire dealt Research questions.

3.10.1 Construction of the Instrument

The questionnaire was made up of closed ended questions, which reduced the propensity of misunderstanding the feedback. The second part containing research questions were divided into three areas ranging from the nature of the Challenges faced by the Durban Container Terminal, factors hindering effective operations at the Durban Container Terminal and the relationship between operational factors and efficiency at the Durban Container Terminal. The starting page of the questionnaire had an informed consent from the respondents. The data collection instrument was the Likert Scale. It was used because it is usually constructed to evaluate how strong the respondents agree or even disagree with the statements made on a five-point scale (Sekaran and Bougie, 2013). Based on a likert scale between strongly agree and strong disagree, participants gave their responses.

3.11 Pilot Study

Pre-testing and validation are very important requirement for the questionnaires, (Sekaran and Bougie, 2013).

For the purpose of this study, Piloting was done for the purpose of the following:

- The questions were not ambiguous
- The respondents understood the questions
- The web based questionnaire functions accordingly

The Pilot was done only with a few people form part of the final study who did not form part of the actual study. Upon receiving feedback from the pilot group. There was not need to make amendment to the questionnaire.

3.12 Administration of the Questionnaire

Upon creation of the questionnaire on QuestionPro, an email was sent to each department by the researcher attaching a weblink to the questionnaire. The email was sent to each department's group email list to reach the individual respondents with the departments. The first email was sent on the 29th of September 2016. On the body of the email was an official invite as a well a letter detailing the objectives of the study. Attached to the email is an ethical clearance letter from the Graduate school of Business and Leadership (UKZN), as well as an official letter of permission to conduct the study duly signed and approved by the Chief Executive. Follow up emails were sent every week after encouraging the participants to complete the survey. The respondent's responses were kept confidential throughout the survey. They were also constantly reminded of their right and freedom to abandon the survey at any time they wished.

3.13 Ethical Considerations

According to Sekaran and Bougie (2013), it expected that the researcher would maintain ethical conduct during the research process. Ethical considerations are very vital in research as they promote the research objectives like knowledge, truth, and evasion of inaccuracies (Akwensivie, 2015). Ethics in research means certain rules or expected norms of conduct while undergoing a research (Sekaran and Bougie, 2013). Questions

on pending contentious issues within the terminal were not asked in the survey. Throughout the research, the researcher did not unethically entice the employees to compete the survey. The questionnaire itself encouraged the participants to participate of the own will, their names and identity were kept confidential. The Research Tools adopted address a potential ethical Dilemma due to Researcher being an employee. The tools are objective and have no room for manipulation

3.14 Validity

Validity is important in the sense that the research tool used is an accurate measure of what it is intended to measure. This is to ensure the researcher gets results that are relevant to the desired outcome. There are a number of measures of validity that provide proof of the quality of the research. Internal and external validity relate to the overall study design. Internal validity is about the extent to which the design of a research study is suitable for the research question (Knapp 2002).on the other hand, external validity relates to whether or not research findings can be generalised.

According to Gill and Johnson (2010) validity is the extent to which the questionnaire generates consistent results. According to Sekaran and Bougie (2013) validity is the degree to which a research is accurate in presenting the study in questions. The questionnaire was designed in line with the objectives of the study in order to ensure validity.

According to Sekaran and Bougie (2013), there are three widely accepted forms of validity testing.

- Content validity- this refer to the degree to which the questionnaire covers the exploratory questions
- Criterion related validity-this is referring to how much the questions are able to make accurate predictions.
- Construct Validity- this is referring to how much the questions the researchers questions measure the existence of those constructs the researcher intends them to measure

3.15 Reliability

Reliability is important as it relates to the strength of the questionnaire and it is meant to test whether or not the tool will produce findings that are reliable at different times and under different situations, (Saunders.*et al*, 2009). The weaker the research, the more chances of incorrect findings being concluded.

Reliability concerns are internal, external, content, criterion and construct related, (Sekaran and Bougie 2013). There are also special “sub-kinds” of reliability, e.g., “test-retest” reliability, “parallel forms” reliability, “inter-rater” reliability, and other. But the common feature in all of them is consistency of measurement (from time to time, from item to item, from measurer to measurer, etc., (Knapp, 2002).

The questionnaire was distributed to the whole population of 2000 respondents to eliminate selection and possible sample bias in the survey. Testing partiality was also removed during the piloting of the questionnaire. To exclude bias in the analysis, SPSS and QuestionPro were used, as the data analysis is free of researcher’s interference.

3.16 Data Analysis

According to Mouton (2009), data analysis is defined to be the outcome of spreading a complex whole into a number of parts. According to Sekaran and Bougie (2013),
Obtaining a visible summary or checking the central tendency and dispersion, the researcher get an understanding of the research data. The mean, median, mode and standard deviation all give the researcher an understanding of the participants’ reaction to the interview questions. After the participants completed the completion of the questionnaires on the online survey database (QuestionPro), the results were downloaded on an SSPS application.

All the responses from the questions were coded and analysed by the themes that emerged from the questions. A quantitative approach is used to for the data analysis. The analysis of the data began with a reliability analysis, followed by in depth descriptive

statistics such frequency distribution, Normality test and Spearman's rho correlation test to name a few. Bar charts were used to display the results.

3.17 Conclusion

This chapter presented the research methodology utilised to collect the primary data. It defined the two main research approaches and further explained the mixed method approach, which was chosen for the research. It articulated the benefits of the use of a mixed method approach. The population of the study is employees of Transnet Port Terminals based at Durban Container Terminal. The design of the questionnaire was aligned with the Research Objectives. The questionnaires were piloted to ensure that there is no confusion. The questionnaire was done and administered on QuestionPro. Once the questionnaire was completed, the data was downloaded onto the SSPS application for the purposes of statistical analysis. The next chapter presents the analysis and discussion of the collected data.

CHAPTER 4

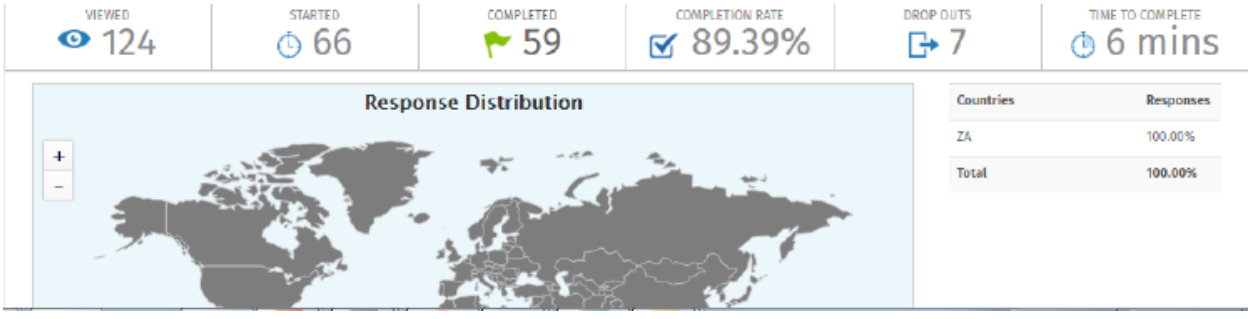
DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

The previous chapter covered the Research methodology adopted. For the data to make sense the research process recommended the grouping of information into themes that will ease the presentation, interpretation and analysis. The content that flowed from the individual questionnaires in relation to the subject of the study were all processed and analysed. These analyses are represented in a number of graphical techniques. Over and above the graphical representation of the data, the results were further linked to the literature reviewed.

4.2 Response rate

The response rate for the survey was fairly adequate, 124 participants of which 66 started the survey. Because participants had an option to abandon the survey, 59 participants only completed the survey. The original sample size targeted for the study is 103 participants.59 out the targeted 103 completed the survey. The completion rate of the overall survey was 89, 4%.



4.3 Cronbanch's Alpha

It is expressed as a number between 0 and 1. An Alpha that is low appears if these assumptions are not met. A high value of alpha (> 0.90) suggests redundancies and show that the length of the test should be shortened. In this study, The Alpha outcome

is high but less than the 0.90, which inclines that the assumptions are and the test length is not too long.

A total of 59 participants completed the self-administered questionnaire. The reliability analysis showed that the data were reliable as the Cronbach's Alpha value was 0.827 (Table 4. 1).

Table 4.1: Reliability analysis output

Reliability Statistics	
Cronbach's Alpha	N of Items
0.827	21

4.4 Establish the Nature of the Challenges faced by the Durban Container Terminal

To establish the nature of the Challenges faced by the Durban Container Terminal seven statements were asked to the participants. All the statements were five points' likert type statements. One point for strongly agree and five points for strongly disagree. Figure 1 shows the participants response to all the statements regarding the challenges faced by DCT. Results showed that the majority a significant number participants are of the view that the design of the Yard is a major Challenge for DCT (74%). This view could be influenced by the fact that DCT is Z-shaped and therefore not conducive for the type of operation, this view is aligned to the literature in that Due to the geological conditions, many container yards take on various different shapes (Sun, Tan, and Lee & Chew, 2013).

With regards to Crane and SC Breakdowns, almost all the participants reported it as a major challenge (96%).Research shows that Employees in the public sector organisations have an attitude towards equipment. Equipment in the space is owned publicly and therefore does not belong to one individual, because of this it does not receive the attention deserved (Naicker & Allopi, 2015).there is a strong alignment with literature.

When asked if the underutilised Crane capability is a setback for DCT, 84% of the participants agreed or strongly agreed to the statement. This view is aligned to the literature in the sense that Research shows that over the period 2010 to 2015, South African Container terminals have not been able to best utilise the crane capability they

have. CPT is the only terminal performing better than others Quay cranes or Ship to shore cranes are one important pieces of equipment in a container terminal (Nyema, 2014). Most of the participant (89%) reported that Equipment Maintenance is a major Challenge at DCT. It also found that Yard and Berth Planning are major challenges at DCT as 82% of the participants agreed or strongly agreed to this statement. This view could be triggered by the fact that not all planning functions at DCT are under one roof and therefore influencing the response to the question, research shows that he system built in berth planning function allows for an integration of different actors involved in the overall planning process. Therefore, a centralized berth planning systems that works outside of the Terminal operating system is unrealistic (Cubillos, 2013).

Participants were asked if Equipment Allocation is a contributor to Operational Inefficiencies at DCT, 91% of the participants positively responded to this statement as a challenge for the company. This view is agreement to the view by literature which states that the objective is to meet a specific time limit. The crane intensity must be sufficient enough to ensure the workload is completed within the given time period (Vacca, et al., 2010). The present study found that Operator performance is a major Challenge at DCT as 87% of the participants agreed or strongly agreed to it. These findings are consistent with the views of Nyema (2014) who identified that the cranes were the main factors that determines the efficiency of a container terminal. So it stands to reason if the cranes are not functioning or if there are a limited supply of functional cranes, it will definitely hamper performance and productivity. Similar findings were echoed by, Vacca, Ilaria, Matteo and Bellaire, (2010).

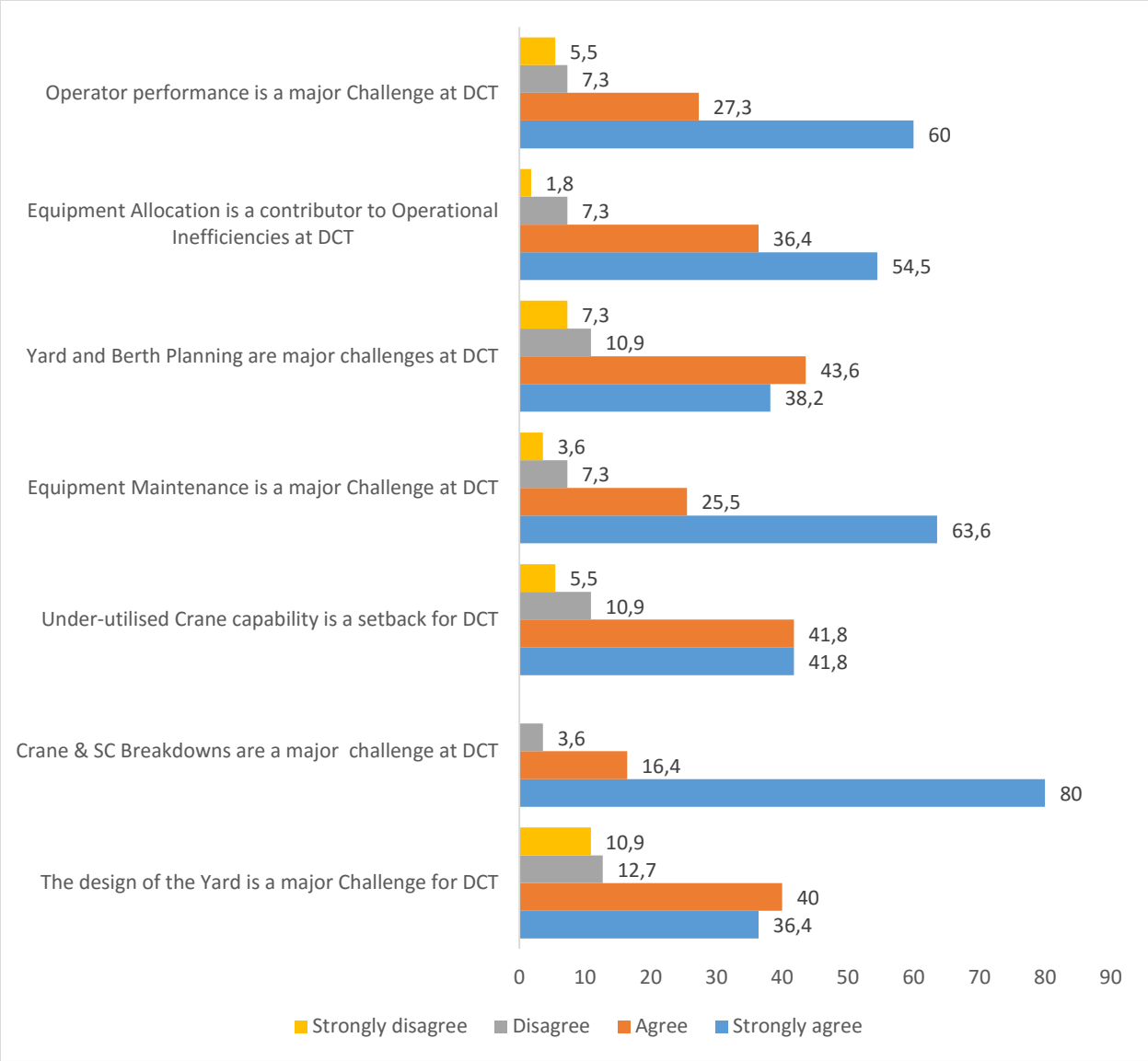


Figure 4.1: Distribution of statements regarding the nature of the challenges faced by the Durban Container Terminal

The frequency distribution of the overall scores from all the seven statements showed that 74.5% scored 13 or less indicating three quarters of the participants agreed or strongly agreed to all the statements (Table 2). Therefore, it could be concluded that all the challenges mentioned were supported by the majority of the participants.

Table 4.2: Frequency distribution of overall scores for challenges faced by DCT

Overall scores	Frequency	Percent	Cumulative Percent
7.00	5	9.1	9.1
8.00	2	3.6	12.7
9.00	9	16.4	29.1
10.00	8	14.5	43.6
11.00	5	9.1	52.7
12.00	7	12.7	65.5
13.00	5	9.1	74.5
14.00	5	9.1	83.6
15.00	5	9.1	92.7
16.00	1	1.8	94.5
19.00	2	3.6	98.2
20.00	1	1.8	100.0

4.5 Establish the factors hindering effective operations at the Durban Container Terminal

To establish the factors hindering effective operations at the Durban Container Terminal, seven statements were asked to the participants. Participant's responses are summarised in Figure 2. Almost all the participants (84%) strongly agreed that equipment breakdowns impact negatively on operations efficiency. According Naicker & Allopi, 2015 the workload in ports today requires the type of equipment that can withstand usage around the clock. Breakdowns and mechanical failures are not acceptable and are extremely costly. This stresses the fact that equipment rates at DCT are unacceptably high as it is not in line with globally accepted standards. The results are aligned to the literature.

When asked if the management style and relationship with labour impacts negatively on operations efficiency, most of the participants responded positively (82%).This view is aligned to that of Jordan, Cowman, Zellhoeferb and Dragnichc(2015), which states that Labor-management relations in ports typically are oppositional and conflict ridden. In

many areas of the world, each views the other as an opponent rather than as a strategic partner. According to Turnbull (2005), the perception that there is inherent misalignment between management and labour in ports is an old school of thought. His view is that Dealing with enthusiastic, motivated and well-trained workers is key to productivity and reliability, but that level of enthusiasm is difficult to attain if workers feel like they work for the union and not the employer. There needs to be giant leap of change in how employers and employees see one another and engage (Turnbull, 2005).

With regards to current shift pattern, more than half of the participants (58%) mentioned that the current shift pattern impacts negatively on Operation's efficiency. This view is aligned to that of Shagvaliyeva and Yazdanifard (2014) in that physical wellbeing leads to psychological wellbeing. It is important achieve work life balance.it must be noted that there is a rather significant portion of the participants who seem to not have a problem with the current shift patters. The course of this group not responding positively to the question could be due to the fact that the current shift work at DCT is accompanied by overtime pay which almost doubles the employees pay. Physical well-being is therefore not first priority.

It was found that 84% of the participants indicated that incentive payouts impact negatively on operations efficiency. This view is aligned to the literature in the sense that Performance incentives can also drive the wrong behavior. For an example, rising wind speeds can lower productivity of crane moves per hour at some wind speed that does not necessarily compromise safety. When this happens, operators stop operations in an effort to protect their performance bonuses, instead of accepting lower productivity and lower or no bonus payments OECD, 2013).an opposing from literature states Employees work to earn an income to fulfill their needs. They appreciate incentive payments based on the business performance (UNCTAD 2013), this means incentive payout needs to guided by the overall business performance results. This means incentives should not be completely at the hands of the operators even if the business is not doing well.

Most of the participants (86%) positively indicated that equipment distribution and allocation is a major contributor to operational inefficiencies at DCT. This view is aligned to that of Zhen, Jiang, Lee, Peng, and Chew (2013), which states that one of the most

important reasons for a terminal's low efficiency levels is traffic congestion, e.g., the Terminal's throughput rate.

The present study also found that vessel and yard planning impact negatively on the performance of operations as 80% participants agreed or strongly agreed to the statement. This view is aligned that of Zhen, Jiang, Lee, Peng, and Chew (2013), which states Congestion in container terminal is an important problem which reduces the productivity of the yard location. The common practice, therefore, to distribute the volume over a wide area of the yard. When asked if the unrealistic customer demands impact negatively on the performance of operations, 64% indicated positively. According to the literature, In general, if inefficiency exists in public sector business environment, the situation creates a vicious cycle of inefficiency and corruption. Transnet, in general, has the responsibility to provide an inefficient service and thereby reducing and eliminating the room for customers to introduce corruption in the system (Kgare, et al., 2011).

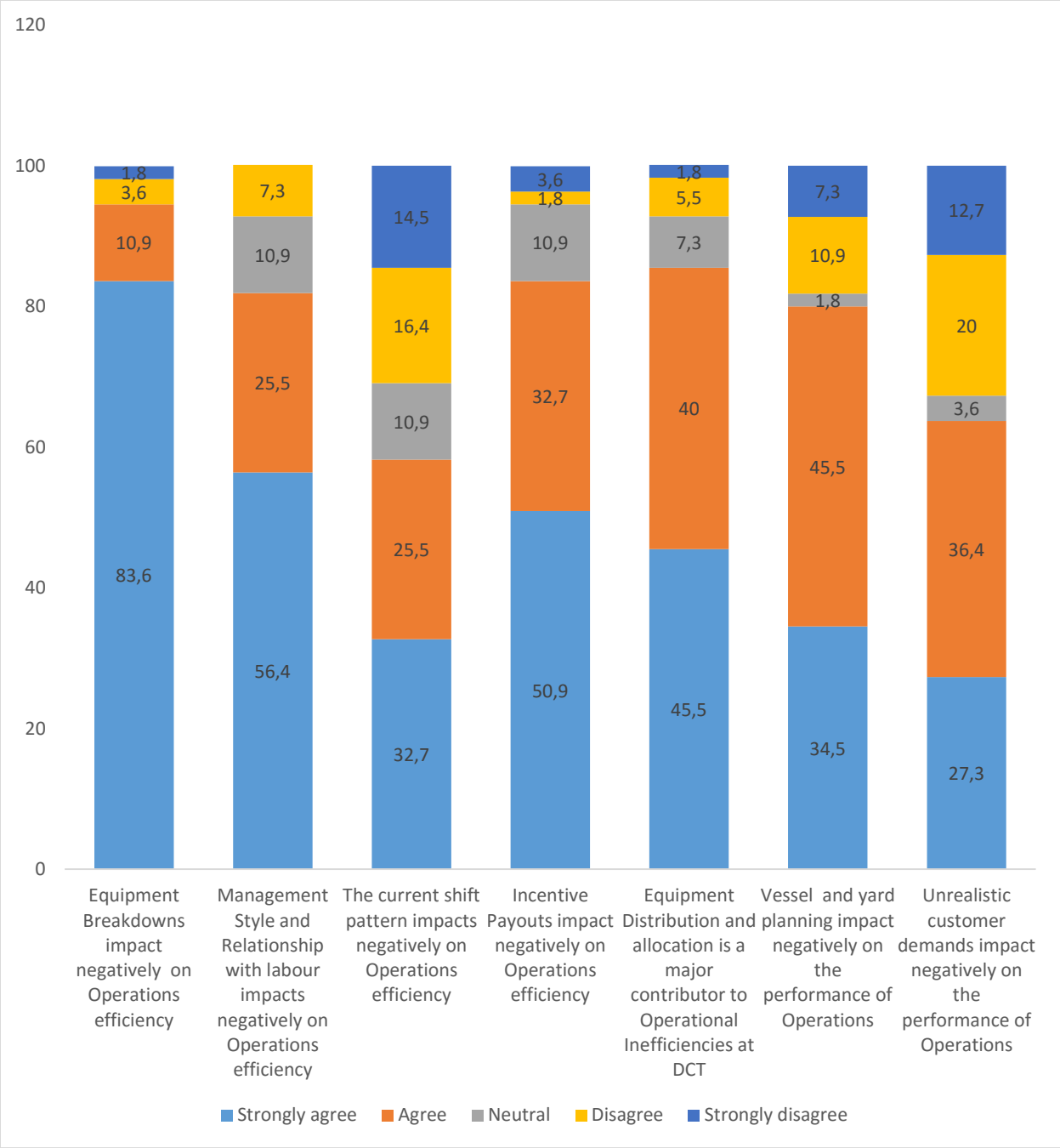


Figure 4.2: Summary of responses regarding the factors hindering effective operations at the Durban Container Terminal

The frequency distribution of the overall scores from all the seven statements for responses regarding the factors hindering effective operations at the Durban Container Terminal showed that 78% scored 17 or less indicating more than three quarters of the

participants positively responded to all the statements (Table 3). Therefore, it could be concluded that all the factors mentioned were indeed hindering effective operations at the Durban Container Terminal

Table 4.3: Frequency distribution of overall scores for responses regarding the factors hindering effective operations at the Durban Container Terminal

Overall scores	Frequency	Percent	Cumulative Percent
7.00	2	3.6	3.6
8.00	2	3.6	7.3
9.00	9	16.4	23.6
10.00	3	5.5	29.1
11.00	5	9.1	38.2
12.00	3	5.5	43.6
13.00	7	12.7	56.4
14.00	3	5.5	61.8
15.00	4	7.3	69.1
16.00	2	3.6	72.7
17.00	3	5.5	78.2
18.00	5	9.1	87.3
19.00	2	3.6	90.9
20.00	1	1.8	92.7
21.00	2	3.6	96.4
22.00	1	1.8	98.2
34.00	1	1.8	100.0

4.6 Assess the relationship between Operational factors and efficiency at the Durban Container Terminal

To assess the relationship between Operational factors and efficiency at the Durban Container Terminal, participants had to respond to seven statements. The summary of the statements is shown in Figure 3 below. It was found that two-thirds (66%) of the participants agreed that the Design of the Yard contributes negatively to Operations efficiency. More than a third (37%) of the participants strongly agreed that shipping lines are getting too involved with Berth/Yard planning resulting in the formation of unrealistic plans for operations to execute (Landside and Waterside). Most of the participants (82%) positively reported that an improved incentive scheme can have a positive spin off on Operations efficiency, and 83% indicated that the Introduction of new Equipment (straddle carriers) can/will improve Operations efficiency. When asked if the change in the current shift pattern can improve Operations efficiencies, 50% agreed to the statement. The present study found that almost all the participants (94%) positively mentioned that maximum utilisation of crane capability can improve Operations efficiency, and 72% positively highlighted that Operations Supervisors have insufficient Authority delegated to them to make decisions that can positively influence Operations efficiency.

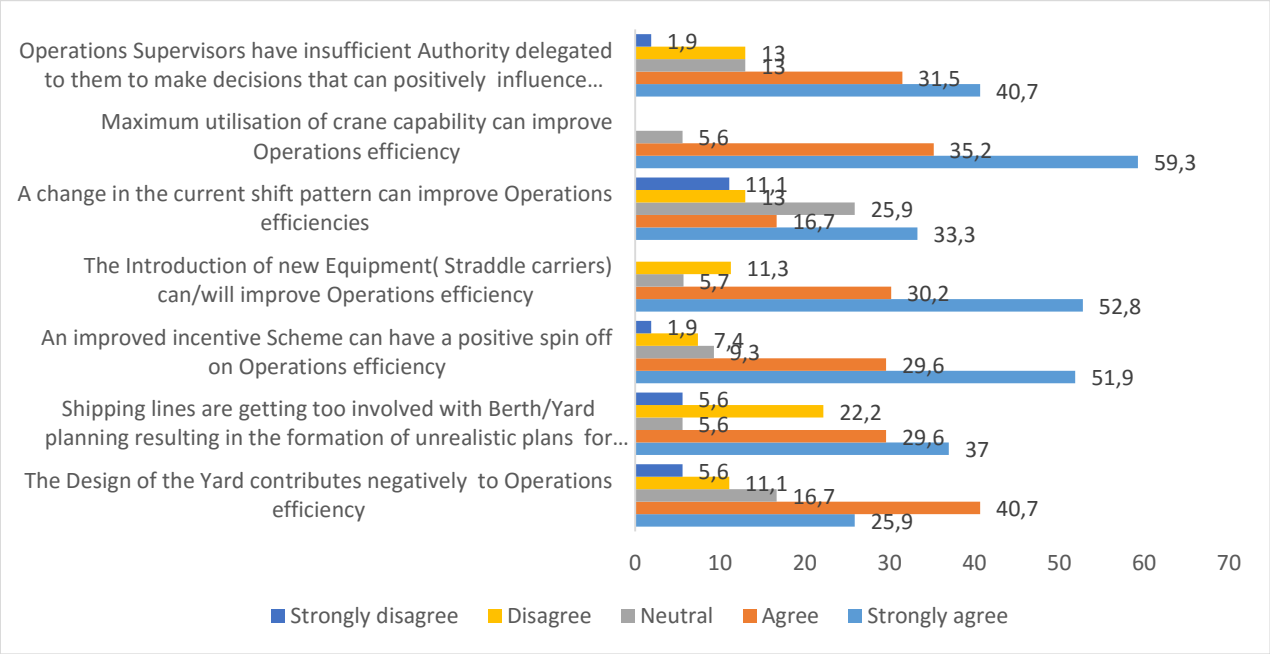


Figure 4.3: Summary of statements regarding the relationship between Operational factors and efficiency at the Durban Container Terminal

The frequency distribution of the overall scores from all the seven statements regarding the relationship between Operational factors and efficiency at the Durban Container Terminal showed that 72% scored 17 or less indicating about three quarters of the participants positively responded to all the statements (Table 3). Therefore, it could be concluded that there was relationship between Operational factors and efficiency at the Durban Container Terminal.

Table 4.4: Distribution of overall scores regarding the relationship between Operational factors and efficiency at the Durban Container Terminal

Overall scores	Frequency	Percent	Cumulative Percent
8.00	1	1.9	1.9
9.00	4	7.5	9.4
10.00	8	15.1	24.5
11.00	3	5.7	30.2
12.00	7	13.2	43.4
13.00	3	5.7	49.1
14.00	5	9.4	58.5
15.00	2	3.8	62.3
16.00	3	5.7	67.9
17.00	2	3.8	71.7
18.00	3	5.7	77.4
19.00	6	11.3	88.7
20.00	3	5.7	94.3
22.00	3	5.7	100.0

To conduct further analysis, Normality test was done to see if the overall scores were normally distributed for all the different dimensions. Kolmogorov-Smirnov test showed that the data were not normally distributed (Table 5). Therefore, further analysis was conducted using non-parametric test.

Table 4.5: Normality test output

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
section1	.126	53	.036	.943	53	.014
section2	.124	53	.040	.892	53	.000
section3	.146	53	.006	.931	53	.004
a. Lilliefors Significance Correction						

Spearman's rank correlation test was conducted to determine if there is any relationship between the constructs. It was found that all the three constructs were significantly moderately positively correlated ($p<0.05$) (Table 6). This meant that participants scoring high in one construct will also score high in other constructs.

Table 4.6: Spearman's rho correlation output

Correlations					
			section1	section2	section3
Spearman's rho	section1	Correlation Coefficient	1.000	.575**	.656**
		Sig. (2-tailed)	.	.000	.000
	section2	Correlation Coefficient	.575**	1.000	.621**
		Sig. (2-tailed)	.000	.	.000
	section3	Correlation Coefficient	.656**	.621**	1.000
		Sig. (2-tailed)	.000	.000	.
**. Correlation is significant at the 0.01 level (2-tailed).					

4.7 Conclusion

Chapter four presented the results of the study, the analysis was focused on the research objectives which are to establish the nature of the Challenges faced by the Durban Container Terminal, establish the factors hindering effective operations at the Durban Container Terminal and assess the relationship between Operational factors and efficiency at the Durban Container Terminal.

It has been established that in all instances, the management of DCT needs to make a concerted effort to improve the status quo if it wants to enhance performance, improve productivity and reduce staff turnover and absenteeism. The following Chapter presents the Conclusions and Recommendations.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The previous chapter presented the results of the study. This chapter presents the conclusions and recommendations of the study. The researcher also makes reference to literature reviewed to support the recommendations of the study. The research questions that guided the discussion are as follows:

5.2. Findings from the Study

The findings of the study are discussed under two main research questions; the questions are as follows:

- What is the nature of the challenges faced by the Durban Container Terminal?
- What are the factors hindering effective operations at the Durban Container Terminal?

What is the nature of the challenges faced by the Durban Container Terminal?

Yard Design and Layout

The literature surfaces the fact that the design of the yard differs from port to port. This is often influenced by the history of the port. Because of this reason, the terminal choses the best stacking method to ensure best utilisation of stack Capacity. According to the literature, there is not one solution fits all.

Underutilised Crane Capability

According to the literature, cranes are the most expensive pieces of equipment, equipment planning plays a big role is ensuring there are no crane clashes. Crane clashes means a lot time and a potential loss of Revenue. According to the literature, the speed at which the cranes are breaking down determines productivity as well. Research shows that South African Container Terminals have not been able to fully utilise the equipment

capability they have. Cape Town Container Terminal is the only terminal to have managed to achieve best utilisation of their cranes.

The literature makes mention of the fact that cranes are the most expensive pieces of equipment in a container terminal, therefore bets utilisation therefore ensures a drop in the cost per container handled.

Equipment maintenance and Breakdowns

The literature shows that there is growing trend in container terminals purchasing the most sophisticated and fastest pieces of equipment by design, however these pieces of equipment are not easy to maintain as the maintenance personnel are not generally adequately skilled to maintain the new technology introduced. The literature also makes mention of lack of thought out maintenance plans and the execution thereof to ensure effective maintenance of equipment to support operational demands. The literature mentions that the simpler things are kept at the procurement stage of the equipment, the least amount of problems that one will encounter later during operating and maintaining the piece of equipment. According to the literature, equipment in the public space is not owned by any particular person but by the public in general and therefore does not always get the attention deserved.

Yard and Berth planning

According to literature, a berthing system that works outside the terminal operating system impacts negatively on the overall system strategies and algorithms built into the system, this has an overall negative on all the other areas of the business. According to literature, the best planning method is that ensures minimal vessel berthing delays.

The literature relieves that Congestion in stack is an important obstacle which lowers the productivity of the yard location. The rule of thumb is therefore to spread the volume over a broad area of the yard. Another goal of good yard planning is to minimise the possibility of shuffles/Shifters. The literature further confirms that different terminals have different physical yard layouts and therefore yard strategies are generally unique or customised to

a specific terminal. Yard management is an important component in terminals operations, poor management thereof can cripple terminal operations.

Equipment Allocation

According to the literature, the crane intensity must be sufficient enough to ensure the workload is completed within the given time period. Planners need to allocate cranes to specific quay and specific jobs (set of containers) and produce a clear schedule of the loading and unloading moves for each crane. Research shows that allocation of cranes determines the amount of time a ship spends in container terminal. The quicker the vessels stay in a port the more attractive the port. The longer the vessels stay in a port, the less attractive the port is.

Operator Performance

According research, the port of Durban does achieve the target of 32 moves per hr. The issue surfacing from research is the inconsistency across the shifts.it is reported that some shift perform better than other shifts. The possible reason for the inconsistency in performance is the lack of staff motivation and Supervision. The literature shows that despite the introduction of incentive pay, operator performance is still below the targeted results rendering the incentive ineffective as only a few operators achieving the desired targets.

What are the factors hindering effective operations at the Durban Container Terminal?

Incentive Bonuses payments and overtime

According to literature, Incentives schemes are in theory expected to increase the employee's attachment to the organization which ultimately translates to job satisfaction, efficiency, low absenteeism, lower staff turnover and reduction of waste. The literature further shows that even though incentive schemes exist at DCT, the agreed and desired KPI targets are still not yet met.it is important that to understand why the incentive that in general is supposed to be a motivator is actually infective.it could be that the incentive

that not make a difference financially or it value has deteriorated over time.it could that the mechanism is flawed or obsolete and requires a review.

Management Style and labour Relations

The literature shows that in the public sector, power has shifted from management to the labour force, it also shows that the two parties generally see each other as enemies as opposed to seeing each other as strategic Allies. However, the literature makes mention of a tool named “social dialogue”, this a platform that encourages continuous dialogue between the two parties to ensure that issues between the two parties are surfaced and dealt with as quickly as possible.

Customer demands

The literature shows that customers are generally concerned about themselves and not so much worried about the profitability of the container terminal. They will use every opportunity that exists to benefit themselves and will go through extreme measures to retain their competitive advantage. Big customers will use their dominance over competitors and will push the container terminal and even the port system to the limits.

Shift patterns and efficiency

According to research, working long hrs. is unhealthy for the wellbeing of employees. There is speculation that it could lead to long term chronical illness. According to literature, it is the employer’s responsibility to ensure the wellbeing of employees. Generally employees who do not have sufficient rest do not perform at optimum levels

5.3. Conclusions from the Study

The Conclusions of the study are discussed under two main research questions, the questions are as follows:

- What is the nature of the challenges faced by the Durban Container Terminal?
- What are the factors hindering effective operations at the Durban Container Terminal?

What is the nature of the challenges faced by the Durban Container Terminal?

Yard Design and Layout

The Terminal does not have a yard suitable for a container operation and the type of equipment utilized in the operation. However DCT is not the only terminal with a strange yard design, the terminal has to try and manage under the circumstances, with limited yard capacity to service the cranes.

Underutilised Crane Capability

DCT is underutilising its crane capability in comparison to other terminals locally and around the world. This situation has to change

Equipment maintenance and Breakdowns

Equipment breakdowns at DCT, particularly on straddles have a negative impact on operations performance. The current equipment maintenance regime at DCT is questionable, at least according to the findings of this research. The reliability of equipment does not support operations.

Yard and Berth planning

DCT planning in all areas is problematic and seems not structured to operations best practices. There is deviation from best practice and some components of it work in isolation.

Equipment Allocation

Equipment Allocation at DCT is flawed, Equipment control which falls under planning is meant be the key custodian of equipment and allocation therefore. Currently Operators in the main decide on equipment distribution allocation, impacting negatively on the flexibility of its usage.

Operator Performance

Operator performance at DCT is below generally accepted international norms due to poor relationship between management (at all levels) and labour. This finding is backed by bot the primary and secondary data.

What are the factors hindering effective operations at the Durban Container Terminal?

Incentive Bonuses payments and overtime

The current incentive scheme at DCT is not as effective as it probably was in the past, it does not motivate employees to increase productivity outputs. The fact that the productivity scores are low in the presence of an incentive scheme renders the scheme ineffective.

Management Style and labour Relations

DCT Management style and the relationship between management and labour is found to be an area that requires most attention. The primary data backs this finding.

Customer demands

Some customers at DCT dominate and use their purchasing power to gain advantage over their rivals. This behaviour would not be the case if DCT was efficient enough. Customers would not see a need for special arrangements or extra ordinary requests if the terminals service level met their expectation.

Shift patterns and efficiency

The current shift pattern at DCT seems to be enjoyed for its financial benefit but not so much for its impact on operator performance and or operator wellbeing. The shift pattern put the safety of employees at risk due to employees being fatigue.

First line Management/Supervision

Supervisors are seen as operators and as part of labour rather than being first line management, Supervisors are therefore currently unable to drive efficiencies in operations. Because of this gap, the organisation loses control as there no effective management representation on the ground.

5.4 Recommendations from the Study

The Recommendations of the study are discussed under two main research questions, the questions are as follows:

- What is the nature of the challenges faced by the Durban Container Terminal?
- What are the factors hindering effective operations at the Durban Container Terminal?

What is the nature of the challenges faced by the Durban Container Terminal?

Yard Design and Layout

DCT has operated for a number of years with its current layout and yard design, the one way of going forward is to maintain and sustain the current operating model. A Significant change in the Operating model could have a negative impact on the productivity of the terminal.

Action plan

- Subtain the current operating model. Ensure number of gangs deployed do not compromise safety and efficiency. DCT Management is to support the strategy of establishing a green fields facility, which is the new Durban port dig out operation.

Underutilised Crane Capability

Primary data shows that there is room to improve the capability of the cranes to levels beyond what the cranes are currently operating at.

Action plans:-

- Management needs to work towards realising the desired utilisation levels. Together with the marine school of excellence, DCT needs to embark on a training program that talks to all crane drivers being given training on all crane capabilities.
- An increase in crane output needs to be supported by increased in the number of equipment to support the crane, this is to ensure that the increased crane output does not go to waste due to cranes hanging.

Equipment maintenance and Breakdowns

The current equipment maintenance regime needs to be looked at closely. The skills required to accurately diagnose and fix the equipment need to be acquired and retained. The maintenance teams need to have contribution in the acquisition of new equipment, ensuring that new equipment are less complex, have features that simple to maintain.

Action plans:-

- The maintenance department leadership is to ensure that the next piece of equipment purchased by the Terminal has involved a formal process of evaluating the equipment's fitness for purpose, whether the basic operational features exist and whether the technicians have the skills set to maintain the piece(s) of equipment.
- Where a piece of equipment has additional features, research from other similar type operations should be done to ascertain the pros and cons of using the additional features of the use or utilisation of the added feature, as well as return on the investment related to the additional feature. Over and above researching other areas, operators need also form part and parcel of the evaluation process to ensure operators can quickly adapt to the technology.

Yard and Berth planning

The planning department needs to be pulled together, all components needs to be under one roof at DCT. Adoptions of best practice planning methods need to be implemented immediately.

Action plans:-

- Experienced planners need to draft Planning Standard operating procedures and modules that will ensure future planners adopt best planning practices. This exercise is to be championed by the Terminal manager and the Chief Planning Manager.
- Terminal leadership needs to further investigate the impact of Terminal Berth planning being decentralised. Upon receiving results, motivate for centralisation of all planning functions or components. Thereafter, management should do a

comparison of the before and after state guided by specific departmental Key Performance Indicators

Equipment Allocation

Equipment allocation is identified to be an operation that does not have a custodian at DCT. The movement of machines is mainly at the discretion of labour.

Action plans:-

- Management needs to identify a single point of contact for the allocation and redeployment of equipment at the terminal.
- This single point of contact however needs to be efficient and have the ability to respond swiftly to equipment redeployment needs
- Operators need to be educated and reminded of who the custodian of the equipment is a terminal wide awareness campaign is to be embarked on.

Operator Performance

Operators need to be reminded of what the organisation expects of them. The tone of this message should be in a manner that encourages partnership between management and labour. Operators need to own their productivity levels and supervision needs to simply equipped with the tools required to perform at their optimum levels.

Action plan-

- DCT already has established weekly platforms between labour and operations. The management team in this platform should ensure that operator performance is being discussed and constructive action steps are taken to ensure deviations are corrected.
- This is not to be done in a provocative manor but in a tone that encourages unity and cohesion.in these platforms, all next steps should be formally recorded and followed through consistently.

What are the factors hindering effective operations at the Durban Container Terminal?

Incentive Bonuses payments and overtime

The current incentive scheme needs to be reviewed, it needs to ensure that it is a sustainable motivator, it needs to be aligned to company financial objectives.it needs to be constructed such that it encourages job satisfaction. It needs to be all-inclusive such that not only certain areas of the business benefit from it, but all operational areas of the business benefit from it i.e. waterside and landside.

Action plans:-

- Terminal management needs to propose to senior management in principle, the type of incentive scheme that supports the achievement of Terminal Key performance indicators (KPI's). Find records that talk to the amount of money paid to incentives versus the return on the investment. Share this information with labour.
- An educational process or engagement process is required to ensure labour and its representing unions buy into the new approach and the change does not have a negative spin off on operations. This process could even include an external subject matter who is impartial in the process.

Management Style and labour Relations

DCT management need to look at ways to reach out to the employees, ensure that platforms that are meant to improve engagement with labour are effective. Both management and labour need to work towards being strategic partners versus seeing each other as enemies.

Action Plans: -

- The Social Dialogues need to be annual events, every year management and labour need to use this platform to look back and the progress made on previous agreements between management and labour. This platform is to be used as a

strategic platform to ensure labour understands the company's strategic objectives.

- During the engagement sessions, both parties to set new goals and targets for the year ahead. After these sessions, both parties need to be given time to robustly engage their constituency on the strategic direction of the business. Management needs to further create similar platforms for junior management teams and all other supporting teams who are not players in the social Dialogue, to share with them what has been agreed in the social dialogues

Customer demands

To discourage the negative behaviour of some customers, DCT needs to rollout the following action plans

Action plans:-

- DCT needs to go on a Company and Industry awareness campaign that aims to discourage anti-competitive behaviour
- Even lower level employees need to be educated about anti-competitiveness, bribery and corruption.
- DCT management must continue to engage with customers through partnership initiatives aimed at improving the customers experience and service levels at all times.

Shift patterns and efficiency

The current shift pattern benefits the terminal as terminal as there is continuity in operations.

Action

- Management needs to invite an industry expect that can help the terminal establish a shift pattern that benefits both the employees as well as the organisation
- Management needs to get more than one industry expect through formal request for information process
- Employees to be involved in through the process to eliminate anxiety and fairness

First line Management/Supervision

Some DCT supervisor are both first line manager while also appointed to be shop stewards. At this point, Supervisors are often caught between the two roles, and it is often left to the supervisor to choose which hat to have on in particular scenario.

Action plans

- First line Supervisors need to be empowered and equipped to make first line manager decisions, delegated the appropriate levels of Authority.
- Senior management needs to create an environment that encourages Supervisors to view themselves as management. This can be done through involving supervisors in strategic decisions of the organisation.
- Supervisors being a part of management should not be affiliated to a union or be allowed to become union representatives. This is avoid conflict of interest.thefore, DCT management can achieve this through embarking on process of converting superiors from being shop stewards to being fully fledged management representatives. This is a journey that requires a lot of consultation and energy.

5.5 Conclusion of the study

This Chapter presented findings following the analysis of the primary data and the secondary data. Conclusions were then drawn from the analysis and Recommendations were also made in line with the Objectives of the Study.

5.6 Scope for Further Research

The Study focused only on the Durban Container Terminal. It is suggested that further research should be done on other Transnet Port Terminals. There is room that there are operational changes facing other terminals need to need to be investigated to help improve or further enhance their performance levels.

5.7 Research Conclusion

The purpose of the Study was to do an Investigation into the Operational Challenges at the Durban container Terminal. The study had the following objectives, to establish the nature of the challenges faced by the Durban Container Terminal, establish the factors hindering effective operations at the Durban Container Terminal, and assess the relationship between operational factors and efficiency at the Durban Container Terminal, recommend appropriate strategies that can be adopted to overcome the challenges experienced. To achieve this, the relevant literature was reviewed followed by a mixed method approach. In Chapter 4, results were presented followed by an in depth analysis. Finally conclusions were drawn. Based on the conclusions, it may be possible that the objectives of the study have been achieved. It is however critical to note that the overall Recommendations made are merely means to an end which need to be tested by the proposed framework

REFERENCES

Alfodi.E, Sinkovics, R., 2010. *Progressive Focusing and Trustworthiness in Qualitative Research*. Manchester Business School, Manchester. 52(6) 817-845.

Acharya. A, Prakash. A., Saxena, P. and Nigam,D. 2013. *Sampling Methods in Cardiovascular Nursing Research*: Indian Journal of Perioperative Practice .24 (3)15-18.

Aguedo, E. 2002. *Gantry crane maintenance: Proactive or reactive?* [Online] www.cranemgt.com [Accessed 19 October 2016].

Akwensivie.D 2015 *Growing Concerns over Moral and Ethical Issues in Research. Research on Humanities and Social Sciences*, Methodist University College Ghana.5 (1)40-45.

Åkerstedt, T. 2003. *Shift work and disturbed sleep/wakefulness, In-Depth Review: Shiftwork, Occupational Medicine*, University of Verona, and Italy. 53(2) 89-94.

Beškovnik, B. 2008. *Measuring and increasing the productivity model on maritime*. Pomorstvo. 22 (2) 171-183.

Bryman, A. (2012). *Social Research Methods (4th Ed.).* New York: Oxford University Press

Bryson, A., Freeman, R., Lucifora, C., Pellizzari, M. and Perotin, V.*Paying for Performance Incentive Pay Schemes and Employees*. London School of Economics and Political Science.Discussion Paper No 1112.

Creswell.J.W. (2009) .*Research Design, Qualitative, Quantitative, and Mixed Methods Approaches*, University of Nebraska-Lincoln. (3rd Ed). SAGE

Cubillos. C, Díaz. R, Urra. E, Cabrera-Paniagua. D, Cabrera.G, Lefranc. G. 2013. An *Agent-Based Solution for the Berth Allocation Problem*. Pontificia University of Católica de Valparaíso. 8(3) 384-394.

Dai. J, Lin. W, Moorthy. R, Chung-Piaw.T, 2011. *Berth Allocation Planning Optimization in Container Terminals*. National University of Singapore. 6(1)1- 43.

Esmer, S. 2008. *Performance Measurements of Container Terminal Operations*, Dokuz Eylul University, Dokuz Eylul University, Maritime Business and Administration School.10 (2) 238-255.

Fraser, D. 2015. *Institutional Development Paths in Seaports*: The Southern African Case. University of Antwerp.15 (4) 506-535.

Gadeyne, B. and Verhamme, P. 2011. *Berth planning and resources optimisation at a container terminal via discrete event simulation*. European Journal of Operational Research.133 (3) 537-547.

Gauri, P. and Grauhaug, K. 2010. *Research Methods in Business Studies (4th Edition*), Pearson Education Ltd, Essex SCM 20.

Gill, J. and Johnson, P. 2010. *Research Methods for Managers*. 4th Edition. SAGE Publications Inc, London.

Jordan. W, Cowmana.M, Zellhoeferb. J,Dragnichc, G. 2015.*Positive Labor Relations as a key Component of Seaport Competitiveness*. Ass/Area/Lera Annual Meeting,Sherato.Boston.

Kemme, N. 2013. *Design and Operation of Automated Container Storage Systems*, Contributions to Management Science, Physica.

Kgare, T., Raballand, H., and Ittmann, W. 2011. *Lessons for Sub-Saharan African Ports*, Cargo Dwell Time in Durban. The world Bank Africa Region Transport Unit

Kim, H. and Lee, C. 2015. *Container Terminal Operation: Current Trends and Future Challenges*. A Handbook of Ocean Container Transport Logistics,Inter. national Series in Operations Research & Management Science. 84(3) 283-292.

Knapp, T. R. 2002. *The Reliability of Measuring Instruments (2nd Edition*). The University of British Columbia, Vancouver, Canada.

Kothari, C.R. 2004. *Research Methodology*: Methods and Techniques. New Age International Publishers. New Delhi, India.

Kumar, A. and Suresh, N.2009 .*Operations Management*, New Delhi : New Age International. New Delhi, India.

Mouton, J. 2009. *Understanding Social Research. 6th ed. Pretoria*: Van Schaik Publishers, Pretoria.

Murphy, S. 2006. *Container Terminal Productivity, Experiences at the Ports of Los Angeles and Long Beach*. International Journal of Business and General Management. 3 (4) 17-36.

Nagurney, A. 2012.*Operations Management and Supply Chain Network Theory, Theoretical Perspectives in Contemporary Business Administration Research*, International Journal of Production Economics.135 (4) 532-540.

Naicker, R. and Allopi, D. *Evaluating Straddle Carriers and Rubber Tyred Gantry's To Determine Which Would Be The Most Suitable Container Handling Infrastructure Between The Quay And Stack Area At The Durban Container Terminal Pier 2*.International Journal of Innovative Science, Engineering & Technology, Durban.2(5) 134-142.

Nyema. S, 2014, *Factors Influencing Container Terminal Efficiency: a case study of Mombasa entry port*, European Journal of Logistics Purchasing and Supply Chain Management. 2 (3) 39-78.

OECD 2011: *Country-Specific Policy Analysis*- The Competitiveness of Ports in Emerging Markets, The case of Durban, South Africa.

OECD/ITF 2014, *the Competitiveness of Ports in Emerging* Markets - The Case of Durban, South Africa.

OECD 2015: *The Impact of Mega-Ships*- Case-Specific Policy Analysis, France: Paris

Robert. N, 2006.Sample Size: *How Many Survey Participants Do I Need?* [Online] http://www.sciencebuddies.org/science-fair-ojects/project_ideas/Soc_participants.shtml [Accessed 11 October 2016].

Ronald, C. 2011. Ten Steps for Conceptualizing and Conducting Qualitative Research Studies in a Pragmatically Curious Manner. The Qualitative Report. 16(6)1715-1732.

Roslyn, C. 2011. *Mixed Methods Research: The Five Ps Framework"* The Electronic Journal of Business Research Methods. 9 (2) 96-108.

SA Port Terminals (2014/15), *capacity and utilisation review, Port Regulator State Owned Enterprises and the Principle of Competitive Neutrality*. Organisation for Economic Co-operation and Development.

Sandelowski, M. (2000). *Combining qualitative and quantitative sampling, data collection and analysis techniques in mixed-method studies*. Research in Nursing & Health. 23(3) 246-255.

Saunders, S., Lewis, M. and Thornhill, A. 2009. Research Methods in Business. [Online] Available at: www.avyg86.dsl.pipex.com/researxh/BookPowerPoints.ppt [Accessed 10 October 2016].

Schindler, D.C. and Cooper, P.C., 2006. *Business Research Methods*, McGraw-Hill, New York.

Sekaran, U. and Bougie, R., 2013. *Research methods for business*: A skill-building approach, Chichester, West Sussex, Wiley.

Shagvaliyeva. S, and Yazdanifard, R. 2014. *Impact of Flexible Working Hours on Work-Life Balance*, American Journal of Industrial and Business Management. 4(8) 20-23

Storey. J, Emberson.C., 2006. *Supply chain management: theory, practice and future challenges.* International Journal of Operations & Production Management. 26 (7)754-774

Tashakkori, A. & Teddlie, C. (2003). *Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks: Sage.

Turnbull, P. 2005. *Social dialogue in the process of structural adjustment and private sector participation in ports*: International Labour Office, Geneva.

UNCTAD (2013) *Review of Maritime Transport 2013 New York and Geneva* : United Nations Conference on Trade and Development.

Vacca, I., Salani, M., & Bierlaire, M. (2010). *Optimization of operations in container terminals: hierarchical vs integrated approaches*. 10th Swiss Transport Research Conference. Ascona, Switzerland.

Walters, D., Wadsworth, E.J.K. and Quinlan, M. (2013) *Analysis of the determinants of workplace occupational safety and health practice in a selection of EU Member States. Research Report*. European Agency for Safety and Health at Work.

Zhen. L, Jiang. X, Lee. H, Peng. E Chew. A. 2013, *A Review on Yard Management in Container Terminals*. Industrial Engineering & Management Systems .12 (4) 289-305

Zigiaris. S, 2000. *Dissemination of innovation and knowledge management techniques*, Supply Chain Management. Inneregio project.