PERFROMANCE MEASURES AND FACTORS INFLUENCING THE PERFORMANCES OF SEAPORT CONTAINER TERMINAL'S OPERATION EFFICIENCY: THE CASE OF NORTH BUTTERWORTH COINTAINER TERMINAL (NBCT)

BY

LINGAM S/O RAMACHANDRAN

Thesis Submitted to the Ghazali Shafie Graduate School of Government,

University Utara Malaysia

In Fulfilment of the Requirements for the Degree of Master of Science

PERMISSION TO USE

In presenting this research paper in partial fulfilment of the requirements for a postgraduate degree from University Utara Malaysia, I agree that the University Library make it freely available for inspection. I further agree that permission for copying of this research paper in any manner, in whole or in part, for scholarly purpose may be granted by my supervisor or, in their absence by the Dean of Ghazali Shafie Graduate School of Government. It is understood that any copying or publication or use of this research paper or parts thereof for financial gain shall not be given to me and to University Utara Malaysia for any scholarly use which may be made of any material from my research paper. Request for permission to copy or make other use of materials in this research paper, in whole or in part should be addressed to:

Dean of Ghazali Shafie Graduate School of Government

College of Law, Government and International Studies

Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman

ABSTRAK

Dalam dunia kini, semua pelabuhan adalah unik dan tugasan untuk mengukur dan menganalisis prestasi tidak begitu mudah. Ia menjadi lebih sukar apabila pelabuhan gagal menegenalpasti pengukuran atau petunjuk-petunjuk dalam menentukan prestasi secara keseluruhan pelabuhan. Sehubungan itu, kajian ini bertujuan untuk mengenal pasti ukuran atau petunjuk-petunjuk yang digunakan oleh NBCT untuk mengukur prestasi operasinya dan tujuan kedua adalah untuk mengenal pasti faktor-faktor yang mempengaruhi prestasi NBCT dalam menentukan kecekapan operasi. Ini adalah satu kajian kualitatif yang menggunakan kaedah temubual dan kaedah pemerhatian dengan pakar-pakar yang terlibat dengan Operasi, Kontena Yard, dan Jabatan Statistik, Kualiti & Syariah di NBCT. Hasil kajian daripada kaedah temubual dan pemerhatian, telah mengenal pasti terdapat empat jenis Petunjuk Prestasi (PI) yang sedang digunakan oleh NBCT iaitu ukuran pengeluaran, ukuran produktiviti, pengukuran penggunaan, dan pengukuran perkhidmatan. Hasil kajian ini telah menunjukkan bahawa pencapaian prestasi NBCT untuk tahun 2013 adalah lebih rendah daripada prestasi sasaran kerana faktor-faktor dalaman dan luaran yang mempengaruhi prestasi seperti sasaran prestasi yang tinggi terutamanya bagi jumlah sasaran mengendalikan TEU, kekurangan tenaga kerja di terminal adalah sebab utama untuk tidak mencapai sasaran, dan kurang ketersediaan peralatan teknologi canggih, kurang sokongan daripada pihak pengurusan dan lain-lain. Secara kesimpulan, faktor-faktor dalaman dan luaran telah mempengaruhi kepada penurunan prestasi operasi di NBCT.Akhir kajian telah mengenalpasti faktor-faktor dalaman dan luaran telah memberi kesan ke atas penurunan prestasi operasi di NBCT.

ABSTRACT

In the world today, all ports are unique and the tasks to measure and analyse the performance is not so easy. It becomes more difficult when a port failed to identify the measurements or indicators in determining the overall performance of the container port. This study aims to identify measures or indicators used by the North Butterworth Container Terminal (NBCT) to measure the performance of operations and the second purpose is to identify the factors influencing the performance of NBCT in determining its operational efficiency. This was a qualitative study with face to face interview and observation with experts' persons related to Operation, Container Yard, and Statistic and Quality & Syariah Department of NBCT. The findings from the interview and observation method, have identified there are four type of Performance Indicators (PI) is being used by NBCT namely are measure of production, a measure of productivity, utilization measurement, and services measurement. The findings of this study have shown that the performance achievement of NBCT for the year 2013 was lower than targeted performance because of the internal and external factors which have influenced the performances such as sets high performance targets especially for targeted total handles TEUs, lack of workforce in the terminal is a main reason to non-achievement of the targets, and less availability of new advanced technology equipment, less supports from the management. As a summary, the internal and external factors have influenced to the drop of the operation's performance in NBCT.

ACKNOWLEDGEMENTS

This research paper arose in part of the final requirement for Master in Science in International Business (MSc.IB). Along the way I have worked with a number of great people who are inspiring and dedicative. It is a pleasure to convey my gratitude to them all in my humble acknowledgement. I would never have been able to finish my dissertation without their help to the very least of their existence throughout this year.

I would like to express my deepest gratitude to my supervisor, Dr. Sabariah Yaakob, who is my leader and role model. Where her excellent guidance, caring, patience, favour and providing me with an excellent words of motivation to complete my research paper. Above all and at the most needed, she provided me unflinching encouragement and support in various ways. I am indebted to her more than she knows. Dr! Thank you so much, from bottom of my heart.

Many thanks go in particular to my college mates for invaluable discussions help during classes. Though we do not always come to census but those indifferences have made me more of a thinker than a doer and special thanks to Penang Port to give me a big opportunity to learn about your organization.

I gratefully thank to my parents and brother who have support in terms of finance and moral supports to complete my writing; and my friends Miss Nanthini Devi and Mr. Kartik, who is not just a friend but more of an angel sent above, who has been there, encouraging and supporting me all the way. Thank you so much for everyone.

TABLE OF CONTENTS

CHAPTER TWO: LITERATURE REVIEW

CHAPTER THREE: METHODOLOGY

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

USA- United States of America

AAPA- Association of American Ports Authorities

MIDA- Malaysian Investment Development Authority

NBCT- North Butterworth Container Terminal

QCs- Quay Cranes

SCs- Straddle Carriers

AGVs- Automated Guided Vehicles (AGVs)

TTUs- Truck-Trailer Units

XTs- external trucks

UNCTAD- United Nations Conference on Trade and Development

PI- Performance Indicators

ATB- Actual Time Berth

ATUB- Actual Time Unberth

MPH- Movement of Container in Per Hour

PM- Prime Movers

QGC- Quay Gantry Cranes

RTG- Rubber Tyred Gantries

RMG- Rail Mounted Gantries

OBH- Operation Breakdown Hours

MMBF- Mean Moves between Failures

SSC- Ship to Shore Crane

R & D – Research and Development

CHAPTER 1

INTRODUCTION

1.0 Introduction

This is a study discussing more onto the performance measurement of seaport container terminal's operation efficiency: the case of North Butterworth Container Terminal (NBCT). The first section of this part introduces the background of the study. The following section discusses the problem statement and outlines the research questions and followed by the research objectives of this study. The next sections explain the significance of the study and highlight the scope of the study. The last section presents about the definitions of the terms used that make up the conceptual model. The penultimate section outlines the organization of this research.

1.1 Background of the Study

The current booming of the international trade activity has becomes as a primary engine in gearing up the world economics' growth and developments for every countries. An overwhelming majority of these increasing international trade activities are conducted through sea transportation (Tahar & Hussain, 2012 & Lin & Tseng, 2007). Indeed, more than 90% of import and export cargoes are transferring with assist of seaports or seaports container terminal. For instance, in United States of America (USA), based on the reports of Association of American Ports Authorities (AAPA) (2012), nearly $3.2 trillion of total income from the annual economic activity were derived from seaports, and thus, seaports are vital for its country's economic growth and wealthier of the nations (AAPA, 2012).

Seaport or often abbreviated as port is defined as a place or terminal located near the sea shore where the ships will do activities of loading or unloading the various types of cargoes (Esmer, 2008) and all these seaports are using containers transport; a main steel box to store the cargoes and move its from one destination to another; thus, later the name 'container terminal' was emerged from this content (Iris et al., 2002). In addition, the common terms of 'container terminals' can be explain as an available system of material flow with two external interfaces which are the pier with loading and unloading of ships and next one is the landside where containers loaded and unloaded on or off trucks or trains (Steenken et al., 2004).

On the other hand, in recent decades, seaport container terminal form an essential component in modern economy. Since the mid of 1980s, the rate of the growth in world trade has been changed consistently and this have increased the world output level (Esmer, 2008). This rising trade is linked to the increasing economic integration among different nations across globe and the rising of internationalized production patterns (Park & De, 2004). These developments have greatly increased the problems of monitoring a seaport's or container terminal efficiency.

Therefore, assessing the seaport container terminal efficiency is an important requirement to port's authorities to determine on its performance level in order to survive and remain in the competitive world of shipping business (Bichou & Gray, 2004). Otherwise, poor performance of it could affect country's trade activity and finally attack the GDP's of the country.

For these reasons, Thomas and Monie (2000) have argued the seaports and containers terminals must measure their performance which means it is compulsory

for the port or container terminal managers to measure its performance, efficiency, set the performance targets and the regularly assess its performance against those targets. In effect, the poor performance of a seaports or container terminal could effects country's trade, therefore, according to Thomas et al., (2000) had listed a couple of reasons for why necessaries of measuring seaport or container terminal's performance (Talley, 2009).

They are first, to improve and maintain the effectiveness and efficiency in handling cargo movement, stakeholders in the business, machines, surface area etc. Second is to compare the present performance with past performance of port or container terminal. Third is to identify the production targets and the competitors. Finally, there is need to do Research & Development (R&D) to promote the port business and to attract more new customers in the future. For all these reasons, it is necessary for the port or container terminal managers to measure its operation efficiency.

With this in mind, the efficiency of container terminal is an important requirement to measure by the container terminal operators in order to strive and emerge as a competitive terminal in the competitive world of shipping business (Tahar et al., 2012). In relation with that, UNCTAD (1999), suggests two categories of container terminal performance indicators which are the firstly is macro performance indicators quantifying aggregate port impacts on economic activity and the secondly is micro performance indicators evaluating input or output ratio measurements of port operations (Bichou et al., 2004).

This research had focused on micro level where the performance indicators have chosen as main measures for the container terminals to benchmark their

operational performance. This was emphasized by Thomas et al., (2000) in their study; measures of containers terminal operational efficiency can be divided into four categories or more known as throughput. There are production, productivity, utilization, and service measure which are considered important in determining the terminal capabilities and future trend.

1.2 Problem Statement

The increasing competitiveness of the port container terminal industry has brought demands for container terminal to measure their performance on monthly or quarterly basis in order to retain and continues showing a friendly competes. Moreover, traders belief using container facilities to tranship the cargo or goods is consider safe and accurate and container terminals were becoming the main place for loading or unloading. This is the time for those ports authorities to prove to the traders the uniqueness and capability for them because the trader primarily considering on the fastness and accuracy of delivering the loads or cargoes.

In order to reach this purpose the container terminals are striving to prove its efficiency in operational processes. This can be achieved through measuring the performance of operational activities that taking place in container terminal. Traditionally, seaport or container terminal have measured their performance by comparing their actual and optimum throughputs. But in this contemporary era, seaports or container terminals also use performance indicators to evaluate its operations performance due the rising of containers and competitive environment.

Yet, the factors influencing the performance achievements still questionable and how long they are giving a reliable data in order to improve and maintain the efficiency of ports operations. Its mean that there are other factors influencing the

performances of a container terminal while benchmarking the performances by using those performance measures. In summary, apart from questioning the effectiveness of the measurement, but needs a study to identify the factors in determining a container terminal's efficiency. Ultimately, this study had turned its view to identify the measures used by NBCT in measuring its operation performance and identify the factors influencing the performance of NBCT in determining its operational efficiency.

1.3 Research Questions

The following research questions provide a more detailed outlook on the issues that focused in this study:

1. What are the performance measures used by NBCT in measuring the performance of its operational activity?

2. What are the factors influencing the performance achievements of NBCT?

1.4 Objective of the Research

The general objective of this study is to examine the measures for performance measurement of container terminal NBCT and its efficiency.

Specifically this study attempts to:

1. Identify the performance measures used by NBCT in measuring its operational performance.
2. Identify the factors influencing the performance of NBCT in determining its operational efficiency.

1.5 Significant of the Study

In Malaysia international trade, especially seaborne trade has traditionally been the lifeblood of Malaysia. According to the report of Malaysian Investment Development Authority (MIDA), (2013), more than 90% of the country's trade is conducting by sea via Malaysia's seven international ports namely Port Klang, Johor Port, Port of Tanjung Pelepas, Penang Port, Kuantan Port and Kemaman Port in peninsular Malaysia and Bintulu Port in Sarawak.

Therefore, the factors influencing the performance of the port or terminal operation is an aspect of important to know the effectiveness and efficiency in handling cargo movement, people involving in cargo movement, machines, and surface area, compare the present performance with past performance of port or container terminal, and identify the production target and the competitor. Finally, there is need to do R&D to promote port business and to attract the new customers (Esmer, 2008 & Iris & Koster, 2002).

1.6 Scope of the Study

In Malaysia international trade is becoming a bridge towards the country's economic development. Seaborne trade has traditionally been the lifeblood of Malaysia. With that aim, this study had been focused in one of the Malaysia's well known container terminal namely North Butterworth Container Terminal (NBCT). NBCT is under the governance of Penang Port. Previously it is a Government Linked Corporation but now it has been fully privatised and own by Penang Port Sdn Berhad. NBCT is a leading seaport containers terminal in trade activities both domestically and internationally.

Furthermore, NBCT now is geared up to welcome bigger ships and handling high volume of containers at a faster pace and striving to become an effective and efficient operations containers terminal. Thereby, assessing the performance of operations of NBCT is a vital part to the ports authority. In relations to this what are measure to measure the performance of it become next question to answer and how terminal operation authority measure their operation efficiency by using this measure.

1.7 Definitions of Terms

Associated of American Ports Authorities (AAPA): It has founded in 1912, is a trade association which represents more than 130 public port authorities in the United States, Canada, and the Caribbean and Latin American. AAPA is dedicated to serving deep draft public port by enhancing port management professionalism, and advocating issues critical to public seaports (AAPA official website, 2013).

Cargo/es: Which is equivalent to the terms 'goods', means anything carried or to be carried by using different modes transport, which is by vessel, trains, truck or aircraft (US Department of Transportation, 2008).

International cargo: The movement of the cargoes from different nations across the globe or border through land, air or sea transport (Eric ting, 2011).

Container: Steel or aluminium frame forming a box in which cargo can be stowed meeting International Standard Organization (ISO)- specified measurement, fitted with special castings on the corners for securing to lifting equipment, vessels, chassis, rail cars, or stacking on the containers. Containers come in many forms and types, including: ventilated, insulated, refrigerated, flat rack, vehicle rack, open top,

bulk liquid, dry bulk, or other special configuration. Typical containers may be 10 feet, 20 feet, 30 feet, 40 feet, 45 feet, or 53 feet in length, 8 feet or 8.5 feet in width and 8.5 feet or 9.5 feet in height (US Department of Transportation, 2008).

Container terminal: Its designated for the handling, storage and loading or unloading of cargoes into or out of containers and where containers can be picked up, dropped off, maintained, stored or loaded or unloaded from one mode of transport to another, that is vessel, truck, barge or rail (Eric ting, 2011).

Port authority: An entity whether or not integrates with other activities, has its objective under national law or regulation the administration and management of the port infrastructure and the co-ordination and control of the activities of the different operators in the port (Verhoeven, P. 2009).

Seaport transportation: Logistic transports such as vessel, truck or rail used by the port or terminal to transfer the cargoes from one place to another.

United Nations Conference on Trade and Development (UNCTAD): Established in 1964, as a permanent intergovernmental body, promote the development of friendly integration of developing countries into the world economy. UNCTAD has progressively evolved into an authoritative knowledge-based institution whose work aims to help shape current policy debates and thinking on development, with a particular focus on ensuring that domestic policies and international action are mutually supportive in bringing about sustainable development.

1.8 Organization of the Study

As overall, there are five chapters in this study. The first chapter provides comprehensive overview of the background of the study, followed by research

problems, research questions, research objectives, significant of the study, scope of the study and penultimate section is the definition of terms.

The second chapter discuss the literature an inclusively on the NBCT by reviewing its corporate profile, vision and mission, the future port development of NBCT. This chapter survey the literature of the definition and reviewing the terms of containers terminal and operation efficiency, performance measurement, of container terminal operation. This chapter looking into four primary performance indicator or measures areas from prior studies which is production, productivity, and utilization and service measures those contribute in performance measures of container terminal operation efficiency.

The third chapter covers on the research methodology. Basically, this study will conduct using qualitative research. Interviewing by semi-structured questions and observation method; should be the best instrument to identify the measures used in measuring the NBCT's performance and the factors influencing that performance in determining its operation efficiency.

The fourth chapter cover about the result of the study through reviewing on the literature review by using the data or information gathered through interview and observation. The chapter cover about the discussion of the study in order to reach the research objective of the study.

The fifth chapter present the final conclusion for the overall findings and discussion. Recommendation and proposal for future research are provided as the ending of this study.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this chapter had composed the literature review of this study and comprises of eight sections. The first section reviewing the seaports container terminal's operations and its efficiency and next section highlights performance measurement of seaport container terminal operation and efficiency. The following section discussed about North Butterworth Container Terminal and its operation and next section discussed on performance measurement of North Butterworth container terminal's operation efficiency.

2.1 Seaports Container Terminal's Operations and Its Efficiency

The stability and wealthier of a country is measured on the performance and circumstances of that country's economic, and thus, there are many factors or sectors would contribute in uplifting that country's revenue or put into another term which is for GDP growth. The primer contributing economic activities in most developing nations or GDP's were export, import, tax, FDI, currency exchange and more. More specifically, the export and import forces are an activity of transferring the domestic or international goods from a specific location to another border of a country. Normally, the modes being used by the most of company are local or overseas' logistic vehicles through ocean, air or land.

However, the prior study in the field of international logistics have stated that almost 90% of the international goods or cargoes are transit into the country made via seaports or container terminals (Tahar et al., 2012). Nowadays, seaport activities

are part of economic machines that gearing up the revenue of almost every country. Indeed, a seaport is defined as a terminal and an area within which ships are loaded and unloaded with cargoes and includes the usual places where ships wait for their turn or are ordered or obliged to wait for their turn no matter the distance from that area (Esmer, 2008).

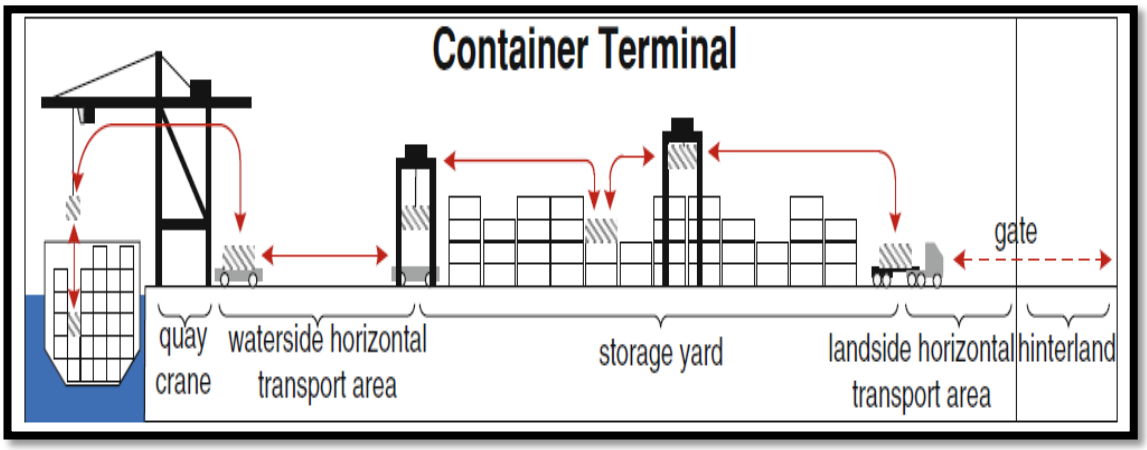
In other scholars view, seaports defined as a terminal where ships are loaded or unloaded cargoes (Esmer, 2008) and using transport containers to move the cargoes from one destination to another whereby this terminal also known as container terminal (Iris et al., 2002). In another words, container terminals are facilities for transferring containers loaded cargoes or empty containers between different modes of transport and conducting activities or services to handle and control container flows from vessel to railroad or road and vice versa (Esmer, 2008).

By the same token, according to Ting (2010), defined the seaport container terminals as a terminal designated for the handling, storage, and possibly loading or unloading of cargo into or out of containers, and where containers can be picked up, dropped off, maintained, stored, or loaded or unloaded from ships or vessels to another terminal. An another author, Kemme (2012), stated that a container terminal is a field in port where authorised vessels will operating loaded and unloaded activity and where the containers are temporarily stored.

In general, seaports have six main principles roles (Esmer, 2008). First of all, handling the consignor and consignee's cargoes, handling passengers, providing services for ships such as bunkering and repair, shelter for vessels in case of heavy sea and storms conditions, bases for industrial development and the last one terminals forming part of a transport chain.

Figure 2.1

The Operation Flow at a Seaport Container Terminal



To address the objectives of this paper, it is important to consider the literature that deals with the operation activities of seaports container terminals. As can be seen in figure 2.1, it is illustrated that a container terminal operation is subdivided into several sections which are quay, waterside horizontal transport, storage yard, landside horizontal transport and gate. At the quay, the vessel are loaded and unloaded by the quay cranes (QCs) which assisted by horizontal transport machines such as straddle carriers (SCs), automated guided vehicles (AGVs), or truck-trailer units (TTUs) whereby these machines carry the containers between QCs and storage yard. The storage yard usually consists of several container blocks which are assisted by fork lifts, SCs or gantry cranes. Besides, waterside transport machines and also, landside transport machines like external trucks (XTs) arrive at the storage yard. The XTs usually will enter the container terminal by the gate facilities and which connect the terminal with the hinterland. In addition, a container terminal may have its own railway station (Kemme, 2012).

Altogether, seaports container terminal play a major in the supply chain of most producing companies and in addition it is the most integrated nodes of the sea

transport process, since containers are the most frequent means of transport for the provision of door-to-door services (Mennis et al., 2008). Therefore this study mainly focuses on seaports container terminal operation activity.

Important to realize, seaports efficiency is an important requirement in order to survive in the contemporary competitive world of shipping industry since there are many new advance strategies being used by every seaports. In tandem with that, to maintain and attract more customers every seaport must maintain their operation efficiency and the most vital fact is they must always improve their operation performance.

2.2 Performance Measurement of Seaport Container Terminal Operation and Its Efficiency

As an old management proverb said "you cannot manage it if you do not measure it" that remains diachronic. Unless your measure something, you do not know if it is getting better or worse; this was what been emphasized in this proverb. Understanding the concept of performance is a very fundamental to any business in answering for the question, whether it is achieve its' goals and objectives that have been set before.

Performance is the result from activities, strategic choices, allocation of resources and ultimately operations running by an organization or company over the period of time that has been set before. Measuring an organization operation's performance provides a clear cut image on how effective this operations being handling comparing to its predefined targets and with its competitors (Pallis & Vitsounis).

Seaport container terminal of today are no exception because it is a complex dynamics business with many different sources of input and output relating in their operational activity. According to Thomas et al., (2000), in their study stated that the entire seaport must measure their operation performance in order to identify their operational efficiency and altered the related changes if found any pitfalls at the last of measurement process. They also have been agreed that the measurement of port or terminal efficiency is of particular crucial aspect because they are vital to the development of country's economy and to the success and welfare of its industries and citizens.

Traditionally, the performance of seaports has been variously measured by calculating the cargo handling productivity at berth, by measuring a single productivity, or by comparing actual with optimum throughput over a specific time period. But in recent years, tremendous changes happened in the entire activity or operation of a seaport container terminal such as containerisation, globalisation, and privatization, regionalization of activities, and concentration, technology advance in system and machines, competition have altered the traditional performance measurement (Pallis et al.).

Complexities of the different seaports container terminal operations have made different scholars come out with various performance measurements. Therefore, this study had chosen the performance indicators as the main determinants to analyse the role played by them in measuring the container terminal efficiency. According to the United Nations Conference on Trade and Development (UNCTAD) (1999), suggests two categories of container terminal performance indicators which are the macro performance indicators quantifying aggregate port

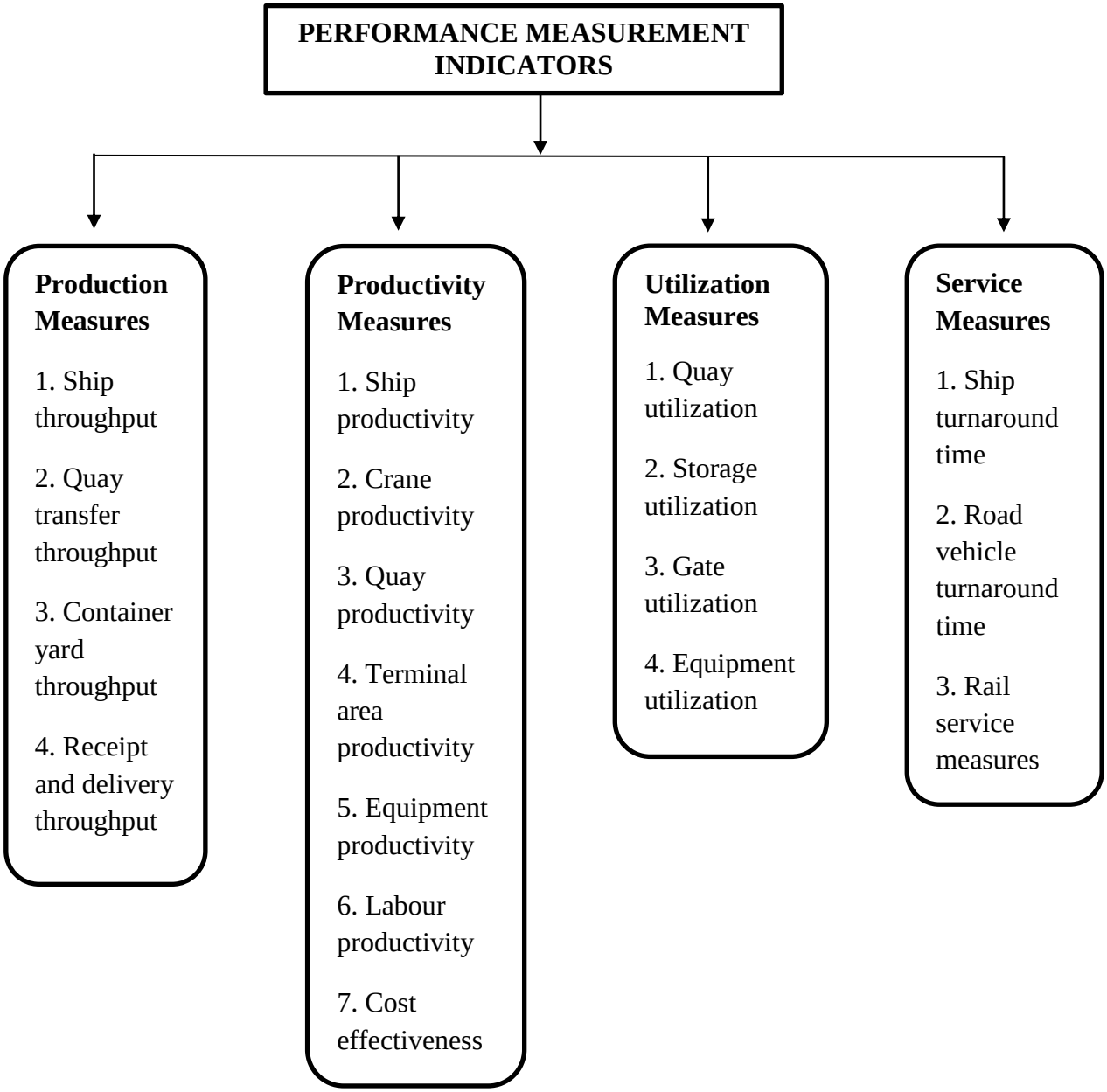
impacts on economic activity and micro performance indicators evaluating input or output ratio measurements of port operations (Bichou et al., 2004).

This research had focused on micro level because these performance indicators can contribute a more comprehensive performance measurement approach and it's more relevant for chosen case study. Refer to UNCTAD (1999), performance indicators (PI) refer as 'a variable where indicates the effectiveness and efficiency of a part or the whole process and operations those taking place in a seaports container terminal. In this vein, therefore this research turns its attention to identify and examine the measures or indicators that involve in the process of performance measurement of container terminal operation.

With this intention, this study primarily has chosen Thomos et al., (2000), approach as a guidelines and determinants in examining the objectives of this research. This is because they two have suggested an appropriate holistic approach which mainly focused on performance indicators for seaport container terminal's operation efficiency. In their study they have emphasized the measures of container terminal efficiency can be divided into four categories or more known as throughput. There are production, productivity, and utilization and services measures. The comprehensive illustration of these performance indicators shows in the figure 2.2.

Figure 2.2

The Illustration of Performance Indicators or Measures



2.2.1 Production Measures

These are the level of activity of the business. In the ports industry a number of different terms are used to represent this category such as ‘trade’, ‘traffic’, ‘throughput’ and ‘output’. Traffic measures, which indicate in various ways the quantity of cargo passing through gate in unit time, and throughput measures, which indicate the effort involved in moving that cargo, in terms of tonnes handled or containers movements per unit of time.

The throughput measures include:

1. Ship throughput	Measures the entire activity involved in loading and discharging vessels in a given time period such as a shift, day, month or year.
2. Quay transfer throughput	Measure of the number of tonnes or containers moved between the quay and the storage areas.
3.Container yard throughput	This is the sum of the movements that take place in the storage areas.
4.Receipt/delivery throughput	Measure of the activity relating to the delivery of outbound cargo or containers the port or terminal and collection of inbound cargo.

2.2.2 Productivity Measures

Productivity Measures calculate the ratio of output to input. Productivity measures are very important to the terminal operator as they are directly related to the cost of operating the terminal. There are seven different productivity measures which terminal operators need to compute, although they may wish to include others for monitoring their productivity. These core productivity measures are;

1. Ship productivity	The measures of ship productivity relate container handling rates for a ship's call to the time taken to service the vessel.
2. Crane productivity	Crane productivity is calculated per crane and can be expressed in gross and net values.
3. Quay productivity	The relation between production and quay resources. It can be measured by defining, for a given unit time, the length of a typical berth (which will then produce a ' berth productivity' figure) or by working on the basis of a particular length of quay or per meter of quay.
4. Terminal area productivity	Similar to the quay productivity indicator is the measure of 'terminal area productivity' which applies to the entire terminal and expresses the ratio between terminal production and total terminal area for a given unit time.
5. Equipment productivity	The value that is of interest is the number of container moves made per working hour, either for an individual machine or for the stock of a particular type of machine. The number of moves can be gathered from data collected.
6. Labour productivity	Labour costs still form a large part of total terminal costs and it is important to monitor labour well and know what the productivity per man-hour is over a measured period.
7. Cost effectiveness	The all- important element of cost into the equation and to measure a terminal's efficiency is evaluating the cost of handling its container traffic or throughput over a specified period (typically a month or a year).

2.2.3 Utilization Measurement

Utilization Measures allow management to determine how intensively the production resources are used. The most common and most relevant utilization measures are:

1. Quay utilization	This measure reflects the amount of time that the berth was occupied out of the total time available.
2. Storage utilization	It is calculated by comparing the number of storage slots occupied with the total number of available slots according to the yard's design capacity.
3. Gate utilization	The smooth and rapid processing of incoming and outgoing road vehicles at the gate is a very important factor in efficient terminal operations.
4. Equipment utilization	cargo-handling equipment is defined as the proportion of time that it was effectively deployed over a specified period

2.2.4 Service Measures

These measures indicate the satisfaction of the customers with the services offered to them in terms of reliability, regularity and rapidity. The principal external service measures include:

1. Ship turnaround time	This is the total time, spent by the vessel in port, during a given call. It is the sum of waiting time, plus berthing time, plus service time (i.e. ship's time at berth), plus sailing delay. Ideally, ship turnaround should be only marginally longer than ship ' s time at berth and thus waiting time in particular should be as near to zero as possible.
2. Road vehicle turnaround time	For shippers/receivers (and trucking companies) the most important measure of a terminal's service quality is the time required to collect a container from the terminal or deliver one.
3. Rail service measures	Train turnaround time would not be a useful measure for the service performance of a container terminal to the rail.

2.3 North Butterworth Container Terminal and Its Operation

Penang port Located in the north-west of Peninsula Malaysia. Penang Port is the oldest and longest recognised port in Malaysia. The port functions as the main entryway for shippers in the northern states of Malaysia and also the southern countryside of Thailand. The port is strategically situated along the Straits of Malacca, one of the full of activity shipping paths in the world. Penang Port is completely prepared to handle all types of cargo such as containers, liquid, dry bulk, break bulk and others; and offers many of services to satisfy for their safe and efficient transportation via the port's various stations and facilities.

In order to more recover the operational efficiency of the port and to further improve its service contributions, Penang Port was corporatized in 1994; and newly

privatized on 2014. The Port runs 24 / 7 and 365 days a year. In addition, Penang Port's is connection with containers happening back 1974 when the first container was discharged at Butterworth Wharves. From the annual report, the quantity of 2,994 TEUs then, Penang Port has developed little by little to achieve an output of more than 1.2 million TEUs in 2013. Starting with a single autarchy berth in a multi-purpose terminal, Penang Port today affords a modern dedicated container terminal to provide for the ever-growing capacity of container trade in the county.

And now Penang Port has a one way direction finding channel called the North Channel which called NBCT. It is 180m in wide and 18km long. It has a declared deepness of 11.0m (ACD). Furthermore, the tidal range in Penang Port is between 0.5m (Neap Tide) and 2.0m (Spring Tide).

Besides that, container operations are the main operations for Penang Port with the North Butterworth Container Terminal (NBCT) being the support for it. It is equipped with 6 berths (N1 to N6) that are 1.5kms in overall long and equipped with 13 Quay Gantry Cranes (QGCs). Out of these 13, 7 are post Panamax QGCs capable of control vessels with 18 rows of container across with a declared productivity rate of 27 moves per hour per crane currently. A berth measurement currently is at 2 million TEUs per annum.

NBCT is constructed to handle the following sizes of ships:

Table 2.1

The List of Length and Depth of NBCT's Berth

Berth	Length (In Meter)	Depth (In Meter)	Maximum Arrival Displacement (In Tonnes)
N1	200	11	70,000
N2	200	11	70,000
N3	200	11	72,600
N4	300	12	72,600
N5	300	12	135,000
N6	300	12	135,000
INNER BERTH	**120**	**7.5**	**6,000**

In further, 8 Rail Mounted Gantry (RMG) cranes service the 2,244 Ground Slots (GS) belong to the export floors placed on the wharf itself for quicker and efficient charging processes. On the landside, NBCT is equipped with 32 RTGs of which 10 units are e-RTGs (Electrified). This is in line with Penang Port's intention of becoming a greener port. A fleet of 60 Prime Movers and 124 trailers further expedite container operations at NBCT as well as a Reach Stacker used for empty container travels. A container yard with a land mass of nearly 59.24 Hectares offers for almost 7,104 Ground Slots as well as 1,000 reefer points. An On-dock storehouse offers the complete range of container services such as inspections, repairs, washing as well reefer correlated services like as pre-trip survey and so on.

Penang Port is serviced by almost 30 shipping ranks and agents. These ranks offer the connectivity to the world that Penang Port needs as an entryway port to its hinterland of North Malaysia and Southern Thailand in specific. Connectivity to the national railway grid and the national highways offers NBCT with excellent penetration to its hinterlands. This has allowed Penang Port to become the export

entryway of choice for the shippers in the South of Thailand. From NBCT, containers can be shipped straight to all the main seaports in the Far East.

NBCTs accessibility, flexibility, efficiency and sustainability are key essentials to its continued development. Operating 24x7x365 and joined with a state of the art container terminal management system with web access which called PELKON III, it's a port that always active and Keep concentration on adapting the change in NBCT's strategy plan to keep its growth in terms of container control. It offers services that are not only in terms of container shipping but also packages that can be customized for the maximum demanding of customers at compete rates.

2.4 Performance Measurement of North Butterworth Container Terminal's Operation Efficiency

The North Butterworth Container Terminal (NBCT) served as a prime outlet for cargo distribution, trading, consolidation, storage and transhipment in the northern Peninsula.

This research mainly focus to identify the performance indicator or measure of NBCT's those take into account when it's measuring their operation efficiency and how NBCT measuring those performance indicator to evaluate the operational performance of the terminal. To limit the study, this research only focuses on operational level. This is because measuring the seaports container terminal performance is a challenging part because seaport are more complex and multipart organization in which consisting of numerous institutions and function often interact at various level management (Esmer, 2008 & Bichou et al., 2004).

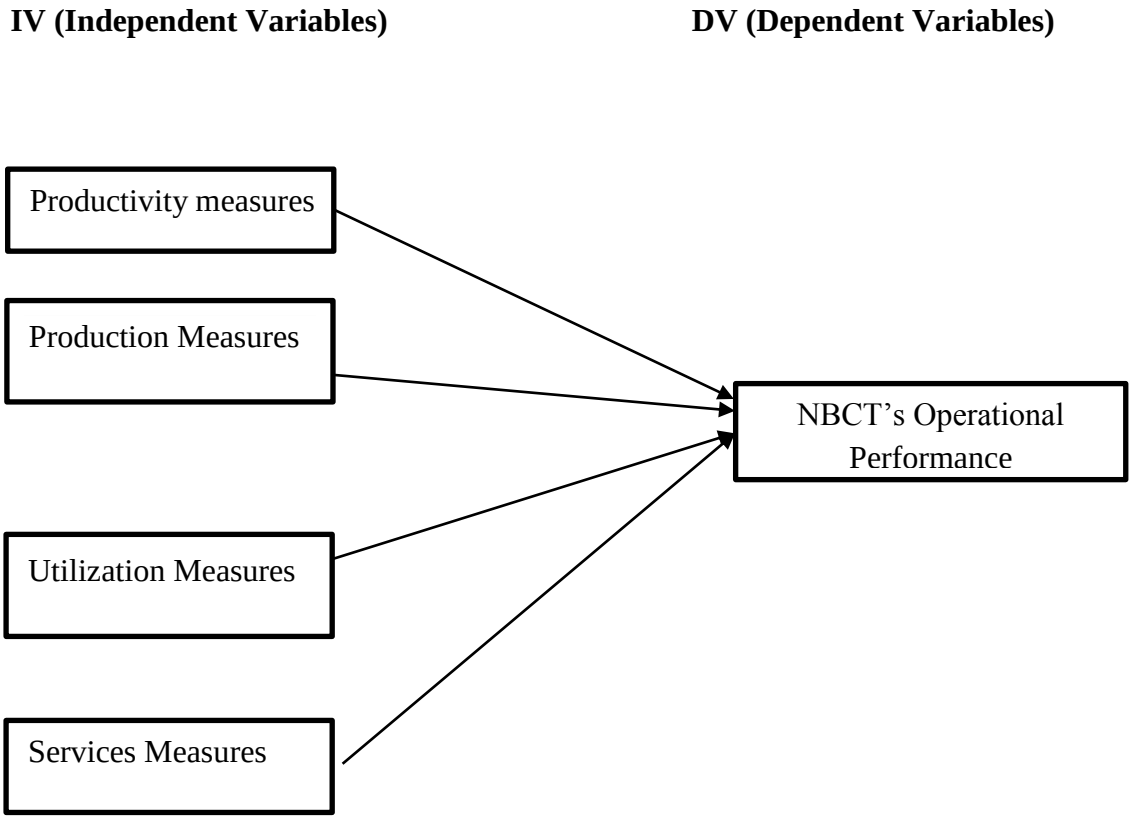
In answering this question, this study has chosen the performance indicator as suggested by Thomas et al., (2000) which is production, productivity, utilization and services as main indicator to measure the NBCT operational efficiency. Recently, however NBCT is being chosen famously by trader or shippers as main platform to do the business but there are still rising of some question in their poor performance in handling the operation activities especially there are less new changes.

2.5 Conceptual Framework

Figure 2.1 presents the theoretical framework which related on this study to give a clear picture on variables that have been chosen.

Figure 2.3

The Conceptual Framework of the Study



Based on figure 2.1, this study has identified the main four indicators namely production, productivity, utilization and service measures were chosen as independent variables of this study. And the operational performance of NBCT of container terminal was studied as the main dependent variables.

CHAPTER 3

METHODOLOGY

3.0 Introduction

The first section of this part explains about research design and next section explains about instrumentation that use in this research. The next section discusses on the data collection procedures and data collection analysis.

3.1 Research Design

3.1.1 Qualitative Method

In any research the data collection method playing a key role in providing a reliable data. In general there are two methods of data collection which are qualitative and quantitative. Quantitative methods rely on the ability of the researcher to measure the phenomena under investigation and the use of statistics to analyse the raw data (Cavana, 2001) and attain the research objectives. Usually, the quantitative methods that being used such as surveys and questionnaires, for example, researchers ask all participants identical questions in the same order.

In another vein, qualitative research is concerned with developing explanations of social phenomena such as opinions, experiences and feelings of individuals which mean is relating with the finding the answers to questions which begin with: why? how? in what way? (Flick, 2007). Qualitative methods include interviews, focus groups and observations, and areaimed at understanding the rich, complex and idiosyncratic nature of human phenomena. In order achieve the objectives and attain a reliable data, qualitative method was used in this study. For

better understanding of this method, the below detail more emphasized on the methods under qualitative research:

Types of qualitative methods:

Interview

The interview is one of the dominant methods in qualitative research (Flick, 2007). Interviews can be highly structured, semi structured, or unstructured. Structured interviews refer as a face-to-face interactive process where the interviewer asking each respondent the same questions in the same way. Besides, semi structured interviews involves a series of open ended questions based on the topic areas and the last one unstructured interviews known as interview where only focusing on a limited number topics and the questions based on the interviewee's previous response. Altogether, qualitative interview should be fairly informal where the interviewees should feel free and comfortable when in discussion or conversation rather than in a formal question and answer situation.

Observation

Observation is possible to gather data without asking questions of respondents. People use this method can be observed in their natural work environment or in the lab setting, and their activities behaviours or other points of interest recorded.

Focus group

Focus group discussions are another qualitative method that is commonly used to gather data especially when the researcher is interested in the outcomes of brainstorming sessions and is not focus about the effect of others in a small group influencing opinions (Levy). These discussions take place in small group of between

six to eight individuals representing the group of interest and are directed by a moderator who controls the flow of the discussion. But, focus group discussions are not an appropriate method for collecting data when the topic is sensitive and the participants who did not like to speak openly and frankly in the presence of others.

Secondary data

Secondary data is data used for research that was not gathered directly and purposely for the project under consideration (Hair, 2007). The classification of secondary data is being used in this study in order to reach the research objectives. It is because there are many advantages to the researcher when using this method because it may have fewer resource requirements, can provide comparative and contextual data as compared to other methods that have mentions above.

3.2 Sampling Method

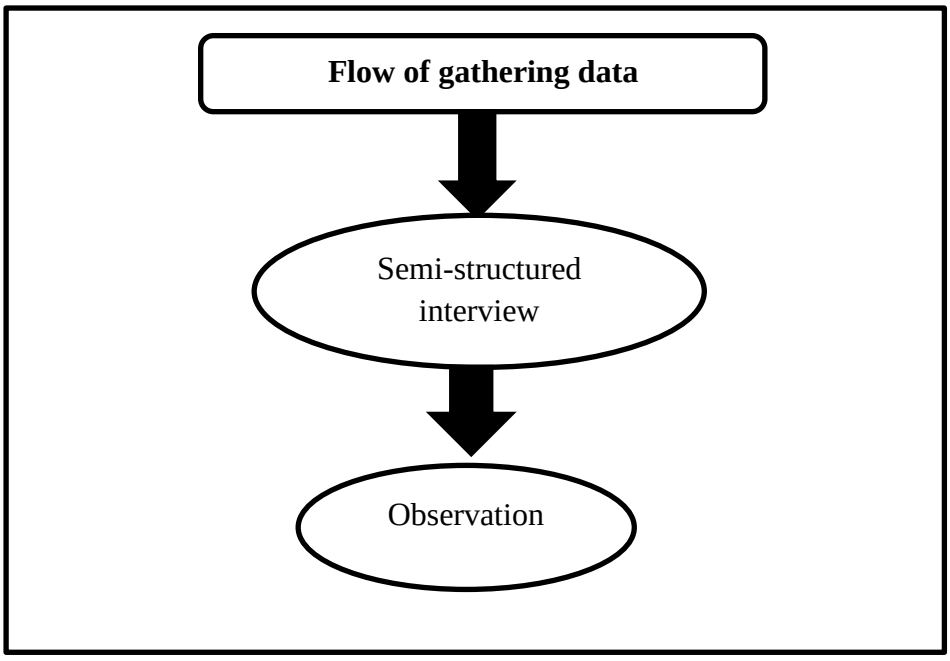
In qualitative study research, only a sample of a population is selected for any given study. In order to that, in this study purposive sampling method had been chosen in identifying the sample of respondents. Purposive sampling is one of the most common sampling strategies in qualitative research whereby the sample sizes, which may or may not be fixed prior to data collection but depend on the resources and time available. In the purpose of achieve the objectives of this study, based on purposive sampling method mainly a total of five officers were interviewed one by one. The first was the Operation Manager of NBCT, followed by Manger of Quality and Statistics and Syariah Officer, two Senior Executive Officers of Operation and lastly the observation process was explained very detail by Yard Operation Manager of NBCT and also the yard controlling officers and PELKON III officers.

3.3 Instrumentation

There is a multitude of different data collection techniques and these vary according to the extent of interaction between the researcher and the phenomena under analysis. Qualitative researchers typically rely on four methods for gathering information such as participating in the setting, observing directly, interviewing in dept, and analysing documents and material culture. The main data techniques used in this research were semi structured interviews and observation.

Figure 3.1

The Flow of Gathering Data



Based on figure 3.1, a complete a list of semi structured interview questions or fairly specific topics to be covered, often referred to as an interview guide were prepared. There are a total number of 13 semi structured questions or better known as a series of open ended questions were asked to the particular NBCT's operation side officers (Refer to appendix I). The individual managers or executives were chosen as the unit

of analysis in this study. The respondents are operation managers and executives working in NBCT, Butterworth.

To come out with better understanding during the data collection day, another qualitative technique was used which is observation. Not all qualitative data collection approaches require direct interaction with people. It is a technique that can be used when data collected through other means can be of limited value or is difficult to validate. In this study, in order to create a better understanding on the whole process of NBCT's operation, the observation technique was used to observe or look around the whole operation yard of NBCT.

3.4 Data Collection Procedure

This section describes in detail how the data were obtained and the timelines involved in collecting the data. As have been discussed in the previous part (3.2), the main data techniques used in this research study were semi-structured interviews, and observation.

At the beginning, the interviews were conducted in North Butterworth Container Terminal or commonly better known as Penang port by the Malaysians which is located in Butter worth. Initially, a permission letter and together with a set of interview questions was sent to the Public Relation officer of Penang Port and it was taken one and half month to get the permission for conducting the interview.

The interview sections were conducted for two days and a total of five officers were interviewed one by one. The first was the Operation Manager of NBCT, followed by Manger of Quality and Statistics and Syariah Officer, two

Senior Executive Officers of Operation and lastly the observation process was explained very detail by Yard Operation Manager of NBCT.

The questions were asked based on the list of semi structured questions that had been prepared before. Without any prejudices and disruptions the officers have given full supports when the questioning section was undertaking. All interviews were transcribed in 'word' format, and also had recorded through video and audio format and for evidence extensive notes, current statistics of performance indicators of NBCT's operation were also taken during the interview and observation session.

In the observation process, the researcher had observed the whole process of operation yard in NBCT to validate and support data been collected during the semi structured interview. In aim for that, the researcher permitted to enter into the yard operation terminal with assist of Yard Operation Manager. While inside the yard operation, the manager had explained the whole process of the NBCT's operation.

The data about the companies profile, types of services, current key projects and developments, previous performance throughput were gathered from company annual reports, magazines, corporate video and Internet web pages. The list of the internet below basically had played a significant role in completing the literature review part.

Table 3.1

List of Internet References

Websites	Related topics
http://www.btimes.com.my/Current_News/BTIMES/articles/hont/Article/	1
http://smartpenang.my/v2/index.php?option=com_content&view= article&id=82&Itemid=148	2
http://www.penangport.com.my/index.html	2
http://www.portsworld.com/ports/penangport.htm	2
http://www.penang.gov.my/index.php/en/2013-04-01-05-24- \ 50/kenyataan-akhbar-yab-km/2209-penang-port-commision-ppc	2

3.5 Data Collection Analysis

The information gathered from these interviews was subjective. Thus, the documentation process technique was used to analyse the data whereby interview transcripts, written notes, audio and video recording were analysed systematically through repeated re-reading of them. This made it possible to gain an increasingly deep understanding of each interviewee's viewpoint and perspective, of links and contradictions within and across interviews. Besides that, the technique of conceptualization also has been used in identifying and refining important concepts of complex contextual factors emerging from the above-mentioned interviews. Apart from that, examining the relationship technique was used to examine the relationships between the relevant concepts and objectives of this study.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

4.1 The Performance Measures or Indicators of NBCT's Operation Performance

The purpose of this chapter is to analyse and discuss the findings gathered from interviews with North Butterworth Container Terminal (NBCT) with ultimate purpose to validate and conceptualize the results that have been gathered through semi structure interview and also, observation method to illustrate more on the process of NBCT's operation. Through the reviews from chapter two which is literature review, the main four performance indicators (PI) as proposed by Thomas et.al. (2000) have been used namely production, productivity, utilization and services to generate the data and findings to achieve the objectives of this study which are first is to identify the performance indicators or measures of NBCT in measuring its performance achievements and the second is to the factors influencing the performance of NBCT in determining its operational efficiency.

4.2 The Performance Measures and the Factors Influencing the Performance of NBCT

4.2.1 Production Measures

These are the measures to identify the level of activity and 'total throughput' of NBCT's operation which indicate the total output effort to achieve through its container handling operation. This is because NBCT is the terminal which involve in handling the containers or TEUs for export and import. There are three core processes of operation in NBCT namely the first is receiving the containers for

export and import, the second is storing the containers in container yard or blocks and the third process is charging and discharging those containers through three mode of transport service which are road, vessel and rail.

In that vein, in benchmarking the performance of the total throughput of NBCT, four main production indicators being used by the Quality and Statistic Department which are ship throughput, quay or berth transfer throughput, container yard throughput and receipt or delivery throughput. To measure the performance or identify the efficiency of its operation a number of targets have been set, for instance vessel waiting time for berth is < 2hours, berth throughput is 85/TEUs/meter/month, dwell time is 2 to 4 days and so on. In reality, if NBCT could not these achieve these targets; it will indicate that its operations are not efficient. The notable point here is most of the company in the world are measuring their effectiveness often by conducting performance review. In relation with that in NBCT, the process how they measure each of the indicators and the list of targets were discussed in the first section and the factors influencing the performance achievements were argued in following section. In the purpose of giving a current status of NBCT, data for the year 2013 had been utilized in this chapter.

4.2.1.1 Ship Throughput

Based on literature review of Thomas. et.al. (2000) defined the ship throughput as the entire activity involved in container terminal for loading and offloading the containers through vessel or ship in a given time period such as a shift, day, month and year. Thus, ship throughput benchmarking is very crucial to identify the total output earned by a terminal through moving the containers or TEUs in one year.

In the case of NBCT, ship throughput is defined as the total containers handled by the terminal for export and import in per month through vessel mode. Indeed, NBCT is called as a 'containers terminal' because it is only handling containers with cargoes or empty containers since from 1978 and in mean time NBCT also known as transit terminal because the majority of cargoes moving through a port are not coming from or destined for the local market.

In relation with that, in NBCT ship throughput is consider as an important benchmarking to evaluate or calculate the total containers in TEUs that handled by the terminal through ship or vessel in per month. The types of containers handled by NBCT are divided into two categories namely unit and TEUs. In NBCT 'TEUs' defined as a unit of measurement equal to the space occupied by a standard twenty foot container and it's using in naming the capacity of container vessel or container yard. Therefore, to benchmark the total ship throughput, TEUs is being used by NBCT because it make more ease the process of planning container yard and also widely used by all ports in the world.

In benchmarking the total throughput of this key indicator NBCT had set 'performance target' which means set a monthly target or forecast of total TEUs for import and export that should handle by the terminal. This target or forecast planned by the Terminal's Marketing Department in order to make sure the terminal will achieve the total throughput and then the Quality and Statistic Department will assess its performance by weekly and monthly against those targets.

Therefore, for NBCT in order to measure the performance of this indicator or ship throughput the variance between targeted TEUs and actual achieved TEUs will be calculated. For more details, findings from interview indicate that in NBCT, the

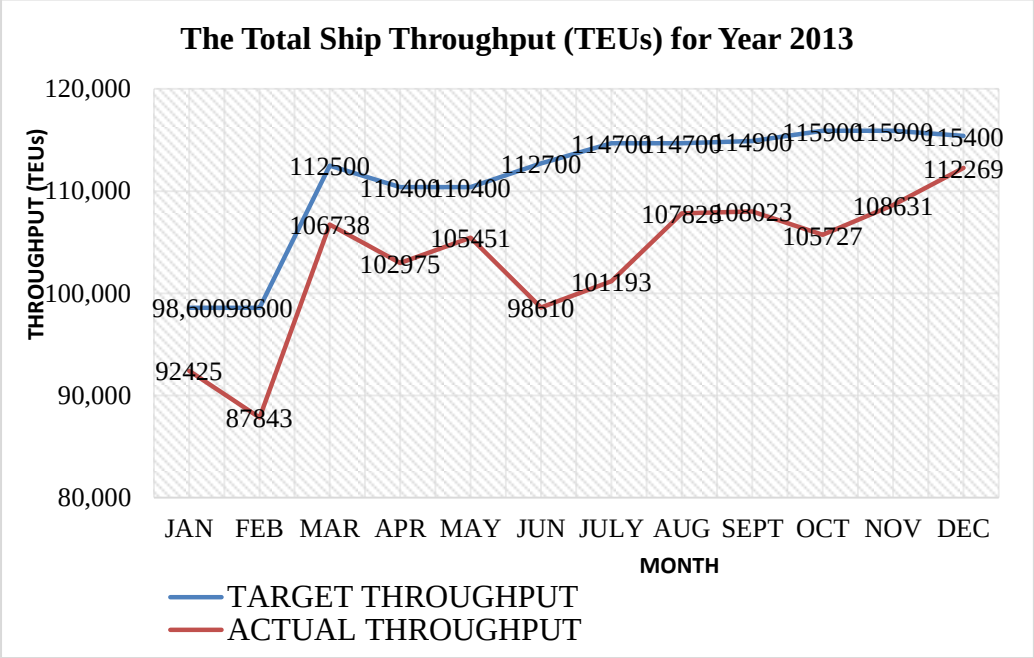
total targeted container handling for the year 2013 is 1,334,700 TEUs but the actual achieved amount for 2013 is only 1,237,713 TEUs and the variance between these two amounts is - 96,987 which mean they could not achieve their targets as what had been set early 2013. This mathematical formula presented in figure 4.1 which indicates about the steps to calculate or measure the throughput or performance of containers movement in per month.

Figure 4.1
Formula of Ship or Vessel Throughput

Ship or vessel throughput (TEUs) = Total target TEUs per month – Total actual TEUs per month

In addition, figure 4.2 presents the data for monthly targeted TEUs and actual achieved TEUs for the year 2013. In a glance, the chart clearly shows that the monthly containers handled in TEUs by NBCT is shows a drastic decreasing trend from January to December compare to the targeted container handle that had been set early year which indicating a stable trend.

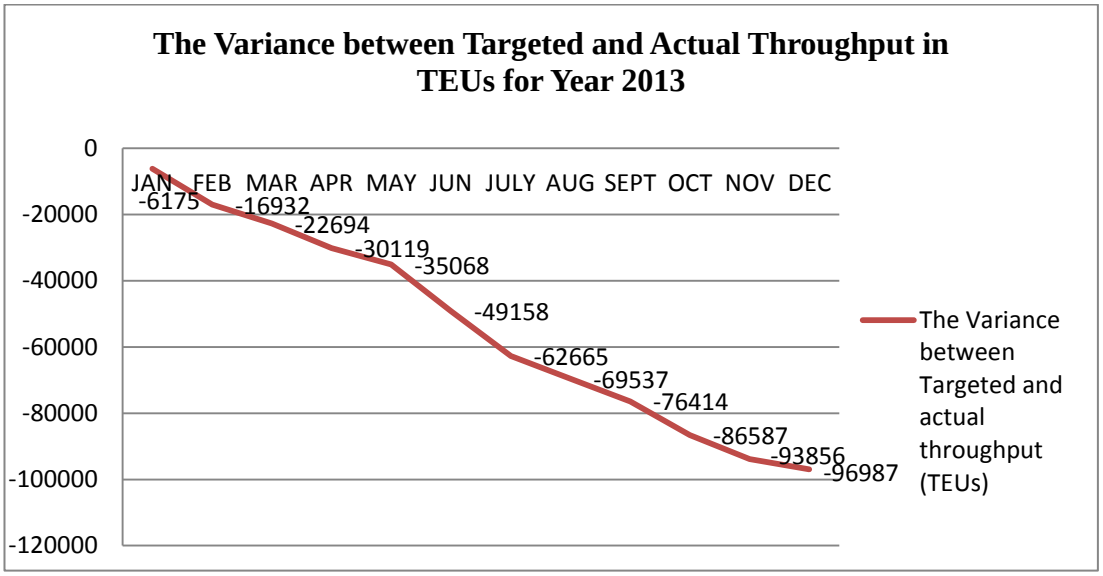
Figure 4.2
The Target and Actual Ship Throughput of NBCT



4.2.1.1.1 The Factors Influencing the Performances of Ship Throughput

Initially, discussion on the figure 4.2 and 4.3 are very important because both are related in the context of identifying the factors influencing the performance achievements of NBCT. In relation with that, figure 4.3 illustrating about the variance between targeted and actual throughput in TEUs. Obviously it is shows that NBCT did not achieve the targeted throughput or output even for every months the chart indicate that a drastic drop on the performance of this measure.

Figure 4.3
The Variance between Targeted and Actual Throughput (TEUs) of NBCT



However, the question remain is that is this because of non-effectiveness of the measurement or other factors are influencing the non-achievement of the performance. Yet, the literatures have shown that, majority of the container terminals are using the same measure and findings have shown that other container terminal elsewhere in the world could achieve the target or performance. For instance, a study on assessment of Alexandria container terminal efficiency by Mohamad Mustafa and Reda Farouk (2012) also have applied the same production measures to measure the total throughput or performance of the terminal and lastly the findings showed a slightly progressive performance trends for five years period namely 2007 until 2011 and end of this study had identified that the slight less performance of the terminal is not because of using a wrong measures but instead there are other internal and external factors or reasons which affected the slight drop of the performance.

Further investigation on the non-achievement of the target through the interview with the container terminal operation manager (for instance) showed that it's not question about the effectiveness of the measurement but there are the other

reasons or factors involved in non-achievement of target or throughput in NBCT. As evidence, one of the Managers from NBCT stated that:

"All the measures are equally effective but we are still finding the measures or ways that how can be very effective. Even though, there are some key indicators were not achieved the targets that has been set earlier but it is not reason that we have used wrong measures. I'm very confident in saying this because all the benchmarking that we are using is documented and internationally accepted whereby the paper known as 'Benchmarking Container Terminal Performance' and this benchmarking were presented in Container Port Conference at Rotterdam, on February 2003. So there are no words to say we are using wrong measures. So in conclusion, we couldn't achieve the targets because there other reasons as spine for this problem such as had set high target, water draft and also lack of worker in operation side". (Source: interview with Manager from Department of Quality and Statistic of NBCT)

The above statement is evidence from the interview and has proved that the ship throughput was drastically drop due to the internal factors had influenced the performance of NBCT. The first reason is the Marketing Team had set high throughput target because in aim to achieve or receive 2 Million containers by 2015. But in reality, the team failed to do the research before on the how the current global economy demand, the main industry players surrounding Butterworth and Penang, purchasing power of nations, the domestic's economic situation and etc. As evidence, one of the Managers from NBCT stated that:

"The marketing team should move their self to outside to do research and participate their self in market to know the current situation of economic. Not sit in office and do empty forecasting. Then the result will like this where low performance

because set high target". (Source: interview with Assistant Manager from Department of Quality and Statistic of NBCT)

Besides that, the insufficient of depth of water which caused callings from mother vessels were very less to the terminal. In line with the federal government strategy on 2010, the government had allocated 300 Million under The North Channel Dredging (2010-2011) plan to deepen the northern channel to 14.5 meters from the current 12 meters of water to attract more mainliners and larger vessel to call at Penang Port but at last the program was not success due to political transformation happened in Pinang from government to opposition which had made the plan become quite. In reality, NBCT more served for feeder vessels which generate very low throughput.

Last but not least, the lack of workers in operation side especially lack of drivers to drive the prime mover to carry the containers from storage to berth which caused the target move per hour is less than targeted. This has considered as one of important factor which had influenced a poor performance for ship throughput. However, in the beginning of the year 2014, new workforces have been recruited by NBCT to overcome this problem in its terminal.

In conclusion, the non-achievement of the target or performance for ship throughput is mainly caused by internal factors such as the NBCT'S marketing team had set high targets, insufficient of water depth and lack of prime mover drivers or workers.

4.2.1.2 Quay Transfer Throughput

This key throughput is defined as the movement between the quayside or berth and the storage or container yard. It directly influences ship loading and discharging rates. Refers to Thomas. et.al., (2000) have pointed out this is an important indicator that take concerned by every container terminals in the process of performance evaluation in measuring the number of tonnes or containers moved between the quay and the storage areas.

In the context of NBCT, this indicator is defined as the number of TEUs moved in per month from vessel's loading and discharging activity. To resume, benchmarking the total throughput or production of the terminal, TEUs is being used as main unit of measurement by NBCT because total containers handled by ship or vessel is calculating in TEUs. This indicator is being measured by take into account the timing and length of berth which has been set 85 TEUs moves per length of berth in one month (85/TEU/meter/month). In shortly, in one month the crane must complete 85 TEUs movements either loading or discharging activity. If the terminal failed to exceed 85 TEUs moves its performance is something debatable because could not achieve the target. This target 85 TEUs is calculated based total actual containers handled and length of meters which is 1500m. This mathematical formula presented in figure 4.4.

Figure 4.4
Formula of Quay Transfer Throughput

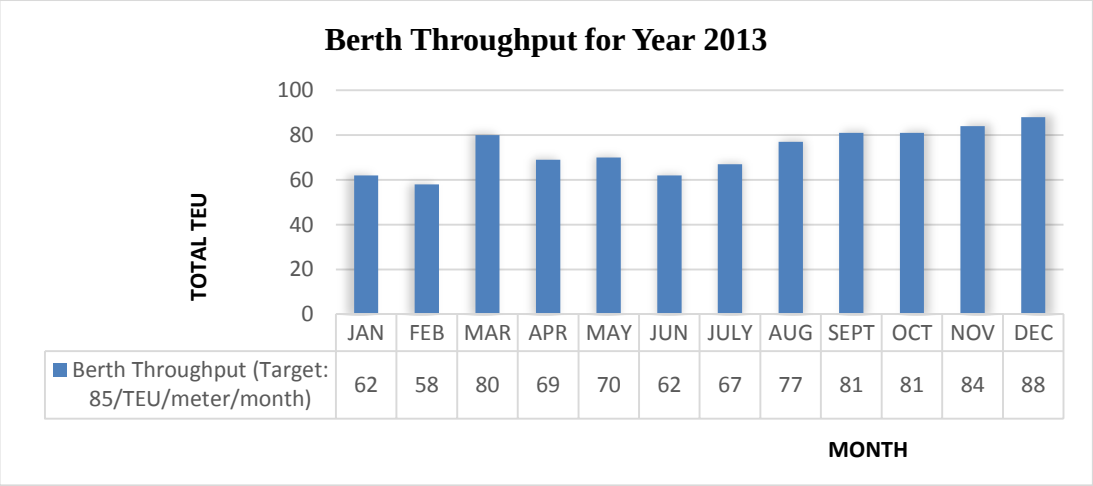
$$\text{Quay transfer throughput} = \frac{\text{Total actual TEUs per month}}{\text{Wharf length (1500m)}}$$

4.2.1.2.1 The Factors Influencing the Performances of Quay Transfer Throughput

Although, figure 4.5 has shown the NBCT did not achieve the targeted throughput for first half of the year but at the end of the year the terminal had close to achieved the targets which exceed more than 80 TEUs moves and however, on December it exceeds more than targeted performance. Hence, merely could not be saying that these fluctuation results occurred not because of the terminal has used a wrong or ineffective measurement, but there are other factors are influencing for non-achievement and achievements of the targets.

Figure 4.5

Quay Throughput of NBCT



In relation with that, the literatures have shown that the majority of world's container terminals are using the same measures to evaluate their performance especially for this quay transfer throughput. For instance, a study on assessment of Alexandria container terminal efficiency by Mohamad Mustafa. et.al., (2012) also has applied the same production measures to measure the total throughput or

performance of the terminal and lastly the findings showed a slightly progressive performance trends for five years period namely 2007 until 2011.

In the case of NBCT, as can be understood from the previous interviewee's coding text, the factors influencing for non-achievement of the targets in the first half of 2013 is a debatable part and it's very important to clarify here to avoid saying the ineffectiveness of the measurement as a main cause. The findings from interviews have proven that the first reason is NBCT had set high targets for total containers (TEUs) handling in terminal. Referring to the formula in figure 4.1, the actual TEUs handled in per month will be used to calculate or measure this quay transfer throughput. But throughout of the year for the actual throughput in TEUs is shows a drastic decreasing trend from January to December 2013 as what presenting in figure 4.5. So, this indirectly affects the performance of the tonnes or containers moved between the quay and the storage areas and this was emphasized by one of the manager from NBCT, said that:

"The target cannot be set only based on from the prior year's achievements or data but it must be set based on the current global economy demands, region's local industry demands, purchasing power of people and etc. The Marketing Team should participate in survey and research more before set any targets for terminal to achieve. If not, then the result will be like this where low performance because set high target". (Source: interview with Manager from Department of Quality and Statistic of NBCT)

The above statement clearly shows that terminal had set very high targets without concerning and analysing the other important factors which are contributing for achievement of the target and the same reason also led the terminal took a long

time to achieve the target as what can be interpret from figure 4.5, the target only tend to achieved on December. Besides that, the lack of workers to drive the prime movers also contributes to this non achievement of the targets. These prime movers are used to transfer the containers from storage area to berth area or versa.

On the other hand, figure 4.5 clearly shows that at the beginning of the year starting from January until July, the target achievement is slightly fluctuated and does not show a stable achievement. This is because of the half of wharf were occupied by the old cranes which are not function. These cranes latter were moved from wharf area and fully utilized the calling vessels to discharge and load the containers. As a result, the berth throughput started to show slightly increasing trend starting from August to December. On December terminal had achieved the target which the total TEUs was 88 moves.

In conclusion, the non-achievement of the target or performance for quay transfer throughput is mainly caused by internal factors such as set high targets for TEUs handles, failed of Marketing Team in analysing setting the performance target before its being implement, lack of workforce, and places utilized by old cranes.

4.2.1.3 Container Yard Throughput

This is an another indicator which is perceived as very crucial to measure the total production or throughput of a container terminal because it measured the temporary storage of containers while documentary, administrative and other formalities are completed. Reviews from the study of Thomas. et.al., (2000), have stated that this throughput is measured by calculating the total containers movements both, empty and cargoes filled containers that take place in the storage areas or yard which ready for export or import.

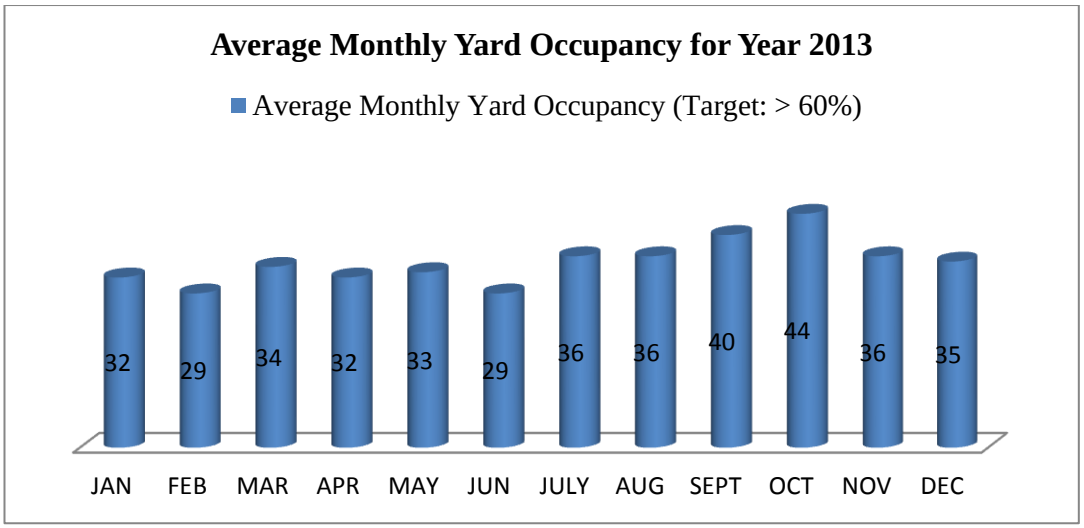
In the context of NBCT, this is one of the core indicators in terminal's benchmarking process in order to measure the sum of the containers movements that take place in storage or yard's blocks. Through the interview process have found that NBCT has big and daily yard capacity which means the storage areas for containers are divided into certain blocks which named as *block A to Z* and these blocks are fully utilizing to store more containers for import and export. In addition, at end of the year 2012, NBCT has added a new yard to facilitate or store more containers and increase their service to companies and hauliers in line with their vision to achieve 2 Million TEUs by 2015.

In relation with that, studying on the container yard throughput or performance is a vital part to measure the rates of yard capacity and dwell time. First of all, NBCT had set the target rate as 60% for maximum capacity of yard occupancy and this rates calculating in percentage. It means the total TEUs that occupied or stored in the yard should do not exceed more than 60% in per month. If this rate exceeds more than 60%; the terminal will face a heavy congestion or traffic jam in yard and gate. At the end, these will lead to drop the performance of container yard and also; the overall terminal's operation can be flop down. In practice, now NBCT handles 35% to 45% TEUs in per month and this clearly shown in figure 4 which depicts the average monthly yard occupancy of NBCT for year 2013.

As what presenting in figure 4.6, the total containers movements in the storage areas or yard is shows that a slight fluctuated trend but the rate was stable which means the rate was not exceeds more than 60%. It's clearly proved the terminal had striven to clear the container within the dwell time and achieved the target.

Figure 4.6

Monthly Yard Occupancy of NBCT



As can be understood from the above analysis, the performance measurement of NBCT's for container yard occupancy also measured based on dwell time in per month. Dwell time means the average storage time or days of containers in the yard area and the targeted dwell time for NBCT is 2 to 4 days in per month.

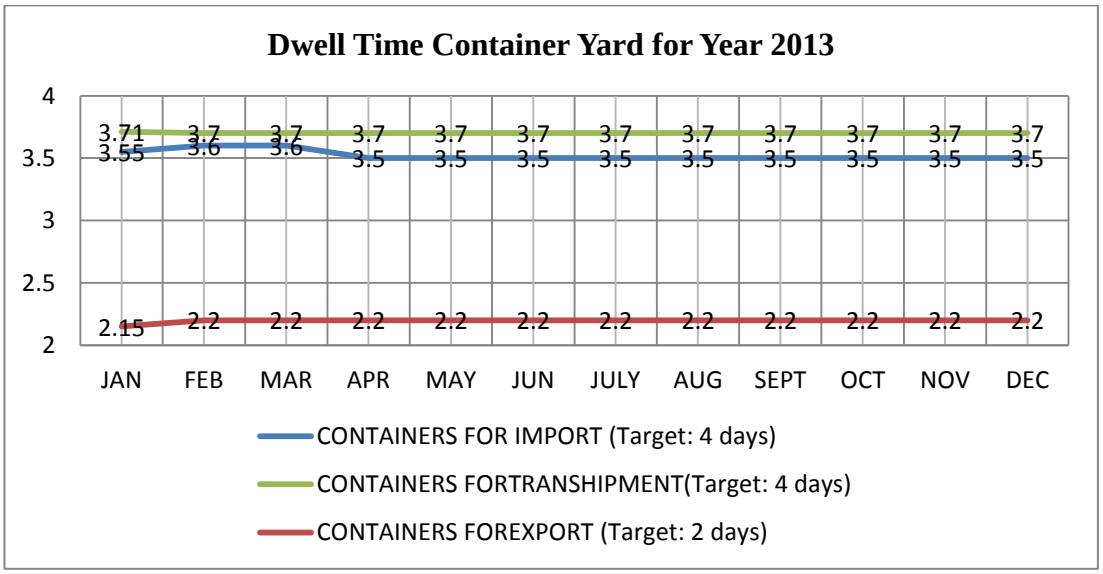
NBCT in intention to smooth the whole operation process in the yard and to ensure they could achieve the targets; the dwell time is being used as a key indicator to measure its performance. The dwell time in NBCT divides into three divisions and this clearly presents in figure 4.6. The first division is containers for import and the dwell time is within 4 days, and the second division is containers for export which has set the dwell time only for 2 days. The third division is transhipment and the dwell time is 4 days. Indeed, these two indicators; maximum capacity of yard occupancy and dwell time both are interdependent. This is because if the total yard occupancy is exceeds 60% it means there is something wrong with dwell time. In the role of maintaining smooth operation NBCT always ensure containers loaded in the morning should clear out before evening because NBCT is not a storage terminal but

it's a transit terminal despite, the terminal receives extra charges from the over days storage but NBCT is more emphasize on efficient performance.

Figure 4.7 depicts the total dwell time for container yard occupancy and in glance view, the chart clearly shows that the terminal had achieved the targeted dwell time which indicates that all the containers from blocks were moved within the targeted dwell time except dwell time for exports which shows the containers for export did not clear out or moved from within 2 days but instead of its took 2.2 days to load into ship.

Figure 4.7

Dwell Time of Yard Occupancy of NBCT



4.2.1.3.1 The Factors Influencing the Performances of the Container Yard Throughput

In aim to examine the second research question of this study which more concerned on the factors influencing the performance of this measure. Based on findings from the figure 4.6 and 4.7, the results show that NBCT had achieved their targets or throughput within the fixed dwell time except containers for export. Hence, it's

clearly shows the performance measurement for this indicator is effective; however the achievement and non-achievement of the targets were influenced by other factors.

First of all, the addition of a new yard had mainly contributed to the performance achievement. In the year of 2012, NBCT has only one yard to store the containers but after added a new yard the daily capacity to store the containers had increased, thus it had reduced the dwell time to clear the containers for import and transhipment. Despite, NBCT had achieved its targets because of the full supports from all the parties involved in container yard operation. As evidence, the manager from operation yard stated that:

"The roles played by the yard's operation planning officers had contributed to the achievement of the container yard throughput because they have done a good planning on the yard operation. Besides that, the other bodies like Hauliers, forwarders, custom, agents and etc. who indirectly have played their roles to achievement of the targets. ". (Source: interview with Manager from Department of Quality and Statistic of NBCT)

In different cases, even though the total container yard occupancy had shown a good performance, but the dwell time for export containers indicate a low performance whereby the terminal could not clear out the export containers within 2 days as what has been set in dwell time. This due to the external factor which beyond the control of operators include; the production companies failed to send their containers at accurate time which have given seven days to send their cargoes before vessel come to terminal. In reality most of the companies sent their cargoes 1 day before the vessel's schedule and this had contributed to heavy jam or congestion at

gate and also at container yard. This has made the delay of the time to move the containers to berth for loading into vessels.

In conclusion, the performance achievement of the container yard throughput of NBCT for year 2013 is mainly caused by internal factors such as addition of new container yard which have enable the terminal to store more containers and cooperation and supports from the operation planning officers in planning the placement and discharge of containers in yard. However, the non-achievements of the performance of dwell time for export containers is mainly influenced by external factor which is fails of production companies in sending their container with goods at accurate time which had lengthen the dwell time to more than 2 and half days.

4.2.1.4 Receipt and Delivery Throughput

This measure is defined as the activity relating to the delivery of outbound cargo or containers the port or terminal and collection of inbound cargo. In NBCT, there are three modes of receipt and delivery namely road, vessel and train and these three measures were taken into performance benchmarking. The main core process of NBCT is these three modes of delivery and receipt. The operation activities involving in the terminal are based on these three modes.

Through the interview process with one of the experts have shown that receipt and delivery by vessel and train for the year 2013, as the available data for the year 2013 were missing, thus data for receipt and delivery by road only were used to discuss in this study. Based on the data from NBCT (refer to appendix II) have identified the grand total of TEUs for delivery by road is 527, 459 and on the other hand grand total of TEUs for received by road is 454, 406. In a glance, the

delivery throughput is higher than receipt throughput which indicates that the import is over than export.

In conclusion, NBCT still could achieve the targets whereby delivered more containers by road and this had led to generate more income from other country but in reality seaports or container terminals are vital players for the developments of the nation and country's economic, thus, NBCT has failed to generate income for country.

4.2.2 Productivity Measures

Productivity is a summary measure of a quantity and quality of work performance with resource utilization considered. It involves doing a task or job in the best possible way and a criterion to be applied to individuals, groups and organizations. In order to achieve optimum productivity, it has to deal closely with performance where all the components must be applied especially effective and efficiency. Productivity is concern with the efficient utilization of resources (input) in producing goods and or services (output). Public likely confuse productivity with production terms, where the concerned is with the activity of producing goods and or services.

Based on the literature reviews, Thomas. et.al., (2001) have listed there are seven different productivity measures are examine by the container terminal in the process measuring its performance; which are ship productivity, crane productivity, quay productivity, terminal area productivity, equipment productivity, labour productivity and cost effectiveness. Through the interviews from NBCT, mainly five measures were asked and another two measures namely terminal area productivity and cost effectiveness were not discussed because these two measures were not used

by NBCT in the process of measuring its performance. The rest five measures were discussed and analysed in the following section.

4.2.2.1 Ship Productivity

Based on the review from the literatures, ship productivity measure is defined as the total container handling rates for a ship's call to the time taken to service the vessel. In brief, Bill Mongelluzzo (2013), defined that the total container handling rates based on average gross boxes or containers moves per hour with clock ticking during the entire time the vessel is in terminal or this clock ticking time also known as vessel turnaround time. It is the total time takes between the arrival of a vessel and its departure from port.

Through the interview with NBCT's operation manager said that ship productivity is examined based on the total container handling rates within berthing time. Its mean that the terminal charges start count when pilot on board for navigation vessel reaching out to berth until the last movement or loading the last containers onto that vessel. The berthing times' charge is calculated based on two circumstances. The first is calculating the actual time berth (ATB) of the vessel docked to the berth and the other one is actual time unberth (ATUB); the time for loading up the last container into vessel. These berthing time are main contributor to the vessel productivity of NBCT. (Refer to appendix II for the vessel productivity report of NBCT)

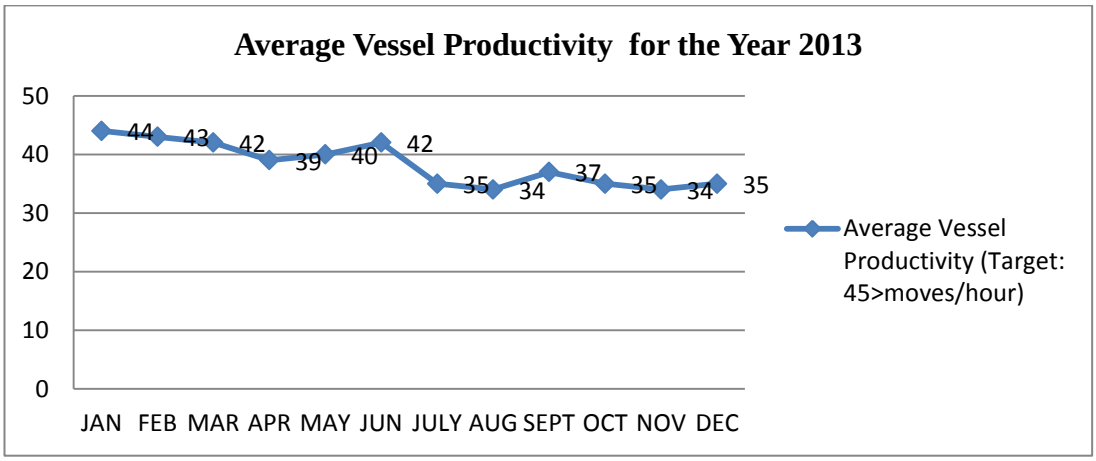
For the purpose to examine the overall performance of vessel productivity indicator, NBCT had measured its performance based on two key measures namely the total crane movement of container in per hour (MPH) and vessel turnaround time. In relation with that NBCT had set the 'performance target' for these both

measures are minimum 45 moves in per hour (MPH) and minimum 16 Hours for vessel turnaround time in order to measure the achievement of the target or productivity.

First of all, the figure 4.8 depicts the average movement of the containers in vessel per hour in one month. Based on the chart, the terminal do not achieved the targets as what had been set as minimum movements in vessel should be more than 45 moves. The graph clearly shows a fluctuated trend in moves per ship from the month January till December 2013.

Figure 4.8

The Average Movement of Containers for Vessel Productivity of NBCT

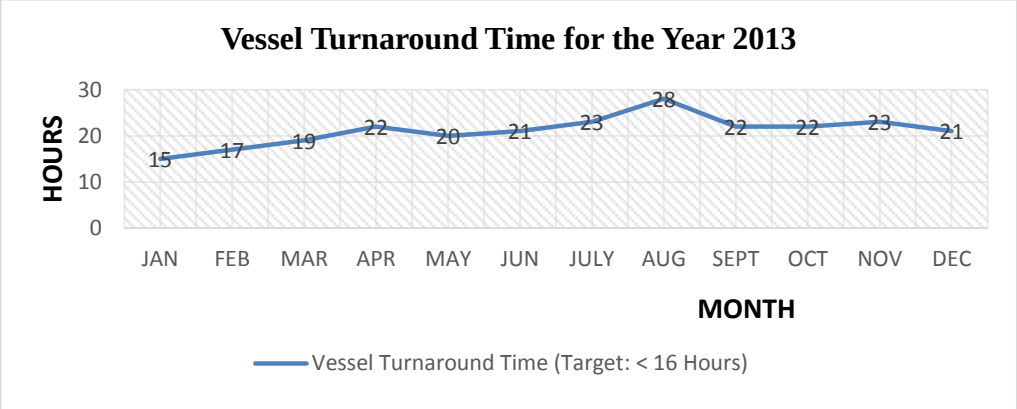


On the other hand, movement of goods via vessel needs to be arrived destination as soon as possible. That is why faster turnaround time in terminal could accelerate the voyage. Therefore, turnaround time is really a serious issue to be considered for container terminal. Shippers are looking for a port which could provide fast turnaround time, when they could reduce voyage as maximum as possible. For port container terminal, it is very vital to have fast turnaround time for vessel. In the case of NBCT, the terminal has set the vessel turnaround time for per vessel is below than 16 hour as main target to measure its performance.

Therefore the figure 4.9 presents the average vessel turnaround time in per month and it's clearly shows that in terminal is not showing any progress as it could achieve on the first month of the 2013 and the rest of the month the chart shows a fluctuation with an increasing trend which mean the vessel turnaround time is increasing than the target has been must be below than 16 hours. This has proven that the terminal could not provide fast turnaround time.

Figure 4.9

Average Vessel Turnaround Time for NBCT



4.2.2.1.1 The Factors Influencing the Performances of the Ship Productivity

As what we can be understood from previous analysis on the other measures, some indicators could turn to achieve their targets or never shows a good achievement not because of using wrong measures, yet it happened because of other related internal and external factors. The same issue goes to this ship productivity whereby the non-achievement of this measure not solely because NBCT had used wrong measures. In NBCT, all the measures those used in the benchmarking process has documented in the paper known as 'Benchmarking Container Terminal Performance' which have presented in Container Port Conference at Rotterdam, on February 2003 and these

benchmarking were accepted by all terminal in the world. Yet, there are other factors have contributed to this failure.

The first reason is in year 2013; NBCT had used low advance technology of cranes (one lift-crane) to move the containers to load into vessel. These cranes only can lift one container at one time. This has led to take more time to load the containers in vessel and this has made the cranes could not achieve the target minimum 45 MPH and also the total hours spent for vessel at berth more than targeted which intended to reduce serving time below to 16 hours per vessel. Besides that, the lack workers resource to operate the cranes also has contributes to this non-achievement of the targets.

In conclusion, the achievement and non-achievement of the targeted performance for ship productivity of NBCT is mainly influenced by internal factors such as the uses of low advanced technology of cranes in its vessel productivity and lack of workforce in handling the cranes.

4.2.2.2 Crane Productivity

A container terminal is a complex zone and its work under multiple operational objectives to complete the process. Hence, the crane activity is most crucial part in any terminals because the cranes is being used as middle-man (tools) to run and complete the whole operation process of a terminal, in short can be express that without the cranes the whole operation in container terminal might fail or turn off because the cranes is being utilized to move the containers from one place to another place especially to load and unload purpose. Therefore crane productivity gives a high impact to efficient of the terminal and to ensure the performance of this crane productivity is in stable condition the process of evaluation is very important.

Thomas. et.al., (2001) have stated the crane productivity is measured based on per crane and can be expressed in gross and net value.

In NBCT, measuring the crane productivity considers as vital part in examining its efficiency. Through the interview with NBCT had found that the performance measurement is measured based on the total movements of per crane in one hour and to achieve the performance target, the terminal had set the target for crane productivity which is 27 moves per hour which means while doing loading or discharging activity the cranes must do 27 moves per vessel in one hour and if load 26 containers plus 1 hatch cover (26+1) also will be consider as achieved the targets. In order to achieve this target, the supports from inbound logistic playing a significant roles. In relation with that in NBCT, prime movers (PM) or trailers playing an important key roles to move the containers from container yard to wharf or vice versa. The movements of the prime movers in terminal area are very crucial in order to achieve the targeted productivity because the fastness of the prime movers will determine to achieve the performance target of crane productivity; 27 moves in per hour.

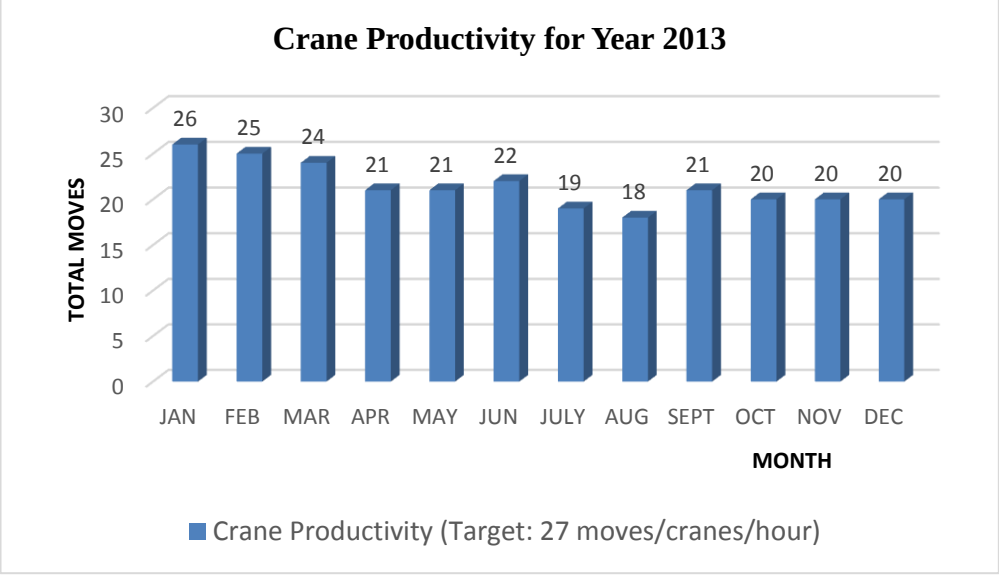
Apart from that all the operation activity cannot be done fully by machines but we need humans to run, operate and handle the machines. So that in NBCT each cranes requires a group or "gang" of dockworkers to complete the operation for that particular crane. Gang sizes differ on how many cranes used in a vessel for loading and unloading activity. For instance, if there is a main liner calling to terminal to drop and load the containers, three cranes were allocated to move the containers in a main liner. In this there will be three groups of gang with seven prime movers. In short for one crane there will be 10 dockworkers which comprised of 3 for operate the crane and the balance seven workers will move the containers via seven prime

movers from container yard to wharf and vice versa. Therefore the roles of gang are considered as highly vital to achieve the performance target for this crane productivity.

In evaluating whether NBCT had achieved or not their performance target for this crane productivity, the answer tend to be saying 'no' because the figure 10 depicts that a fluctuation trend with decreasing trend starting from January till December 2013. At the beginning of the year on January and February the target were near to reach namely 26 and 25 moves respectively; but starting Mac till December the chart tend to show a drastic decreasing.

Figure 4.10

The Total Crane Productivity of NBCT



4.2.2.2.1 The Factors Influencing the Performances of the Crane Productivity

Through the interviews had identified that there are a few factors influenced to the failure of performance for crane productivity which are the evolution of new types of vessels and the high cost for buying new cranes. This is because tremendous

developments in technology world now have made modifications in the vessels' production and this has led the vessels now emerging in various sizes and attached with high technology advances. Yet, in the case of NBCT the whole year of 2013, partially of the Quay Gantry Cranes (QGC) those used at berth are old and the QGC's beam are not suit to the vessels calling to NBCT because used to be say mainly the vessels calling to NBCT are mother vessels or main liners. In effect, these old cranes could not compete with these new vessels because these cranes only can do one moves in one time which takes a long hours to load or unload the containers. However, in the year 2014, new cranes have started to use in order to turn a vessel faster, the crane called as *twin-lift*. These *twin-lift* spreaders, aggregate the loading and unloading speed with well proven twin-lift technology combined with the flexibility to perform single-lift container handling as well.

Apart from that lack of drivers for prime movers were concerned as another reason for the drops in performance target because prior, the prime mover's drivers were promoted to handle the cranes or QGC at berth in order to run away from the high cost for training the new drivers because to train a new driver is cost RM 6000 to 7000 for three months. Hence, insufficient of drivers to carry the prime movers had took placed for the whole year 2013 which have given a high impact on target achievement of crane productivity and to avoid this problem becomes prolonging; a new groups of worker with licence E were recruited at the beginning of this year to carry the prime movers.

In conclusion, the non-achievement of the targeted performance for crane productivity is mainly caused by internal factors such as evolution and emerging of new types of vessels which have caused the old cranes being used in terminal could not supports or suit when containers are loads or unloads onto vessel, lack of drivers

to handle the prime movers to move the containers from storage to berth or vice versa.

4.2.2.3 Berth Productivity

Quay or berth productivity is defines as the relation between production and quay resources. The production and quay resources defined about the total actual TEUs achieved and length of the berthing quay in the terminal; respectively. In brief, Gordon (2003) in his port conference paper argued that this indicator is measured its performance target by take into consider the total actual TEUs handled by the terminal divided by the total length of the typical berth.

By the same token, in NBCT, the performance measurement of this indicator is measured as same what have proposed by Gordon (2003). Commonly, the benchmarks for berth throughput and berth productivity are using the same level measurement to evaluate the performance targets. Therefore, this indicator is being measured by take into account the timing and length of berth which has been set 85 TEUs moves per length of berth in one month (85/TEU/meter/month). In shortly, in one month the crane must complete 85 TEUs movements either loading or discharging activity. If the terminal failed to exceed 85 TEUs moves its performance is something debatable because could not achieve the target. This target 85 TEUs is calculated based total actual containers handled and length of meters which is 1500m. This mathematical formula presented in figure 4.11.

Figure 4.11
Formula of Quay Productivity

$$\text{Quay productivity} = \frac{\text{Total actual TEUs per month}}{\text{Length of berth (1500m)}}$$

4.2.2.3.1 The Factors Influencing the Performances of the Berth Productivity

In answering the question for whether the measurement is effective or not, the answer tend to say 'yes', this performance measurement is effective. Although, figure 4.5 had shown the NBCT did not achieve the targeted throughput at the half of the year but at the end of the year the terminal had close to achieved the targets which exceed more than 80 TEUs moves and however, on December it exceeds more than targeted performance. Hence, merely could not be saying that these fluctuation results occurred not because of the terminal has used a wrong or ineffective measurement, but there are factors involved in answering to the questions for non-achievement of targeted throughput.

In relation with that, the literatures have shown that the majority of world's container terminals are using the same measures to evaluate the performance measurement especially for this quay transfer throughput. For instance, a study on assessment of Alexandria container terminal efficiency by Mohamad Mustafa and Reda Farouk (2012) also has applied the same production measures to measure the total throughput or performance of the terminal and lastly the findings showed a slightly progressive performance trends for five years period namely 2007 until 2011.

As can be understood from the above analysis, the factors influenced for non-achievement of the targets in the half of year of 2013 is a debatable part. The findings from interviews have proven that the first reason is NBCT had set high targets for total containers (TEUs) handling in terminal. Referring to the formula in figure 4.11, the actual TEUs handled in per month will be used to calculate or measure this quay or berth productivity. But the actual throughput in TEUs of NBCT

shows a drastic decreasing trend from January to December 2013 as what presenting in figure 4.5. So this indirectly affects the performance of the tonnes or containers moved between the quay and the storage areas and this was emphasized by one of the manager from NBCT, said that:

"The target cannot be set only based on from the prior year's achievements or data but it must be set based on the current global economy demands, region's local industry demands, purchasing power of people and etc. but it's based on survey and research more before set any targets for terminal to achieve". (Source: interview with Manager from Department of Quality and Statistic of NBCT)

The above statement clearly shows that terminal had set very high targets without concerning and analysing the other important factors which are contributing for achievement of the target and the same reason also led the terminal took a long time to achieve the target as what can be interpret from figure 4.5 the target only tend to achieved on December.

Besides that, the lack of workers to drive the prime movers also contributes to this non achievement of the targets. These prime movers are used to transfer the containers from storage area to berth area or versa.

In conclusion, the non-achievement of the target or performance for quay productivity is mainly caused by internal factors such as set a high targets by marketing team and lack of workers.

4.2.2.4 Equipment Productivity

A notable statement here is the overall task of a container terminal is to manage vessel berthing, inbound discharging, outbound container charging and storage yards as efficiently as possible. In relation with that, such a goal can be obtained by organizing the resources needed for handling the workload efficiently with high intention to reduce the waiting time of customer trucks or hauliers and, at the same time, also can reduce congestion on the roads, at the storage blocks and docks. All these can be achieving if the overall equipment's have organized or managed effectively and efficiently.

In order to identify whether it's efficient or partially efficient, the measurement on equipment productivity is very crucial in any terminal. Equipment productivity is known as the accessibility and utilization of the terminal equipment such as Rubber Tyred Gantries (RTG), Rail Mounted Gantries (RMG), Quay Gantry Cranes (QGC), prime movers, straddle carriers, forklifts and etc. in the process of loading, unloading, move from one location to another location; the TEUs, containers, hatch covers and etc. The most essential issue here is exploitation of this equipment will be based on types of terminals, types of vessels and ships, types of cargoes, and types of services given by the terminal.

In the purpose of analyse the total productivity produced by this equipment, the benchmarking on the performance of it is very vital part in every terminal especially to a container terminal. Hence, in NBCT the equipment productivity is measured based on the number of container moves made per working hour. In detail, for the year 2013, NBCT calculates the productivity or performance of this measure based on these three indicators which are; the availability or uses of the equipment,

operation breakdown hours (OBH) and mean moves between failures (MMBF). There had been set the performance targets for each of these indicators which as shows in below table in aims to achieve the terminal productivity and performance.

Table 4.1
Indicators for Equipment Measurement of NBCT for the Year 2013

Equipment	**Indicators**	**Performance target**
Rubber Tyred Gantries (RTG)	Availability	90%
	MMBF	1400 Moves
Rail Mounted Gantries (RMG)	Availability	90%
	MMBF	4000 moves
Quay Gantry Cranes (QGC)	OBH	< 20 hours
	MMBF	4000 Moves

Based on the table 4.1, NBCT had only taken three types of equipment namely RTG, RMG and QGC in the process of performance measurement of the equipment productivity based on the three indicators as shows in the table. In brief, RTG is used at container yard area to carry or moves the containers. And the second on, RMG is used at decking area and NBCT is first and only container terminal using electrical functioned RMG at rail yard operation area to speed up the process of transferring the containers from rail road and the last but not least, QGC or another name is Ship to Shore Crane (SSC) is used at berth or quay area to load and discharge the containers and hatch covers from vessels.

Above all, the analysis part on the achievement of performance or target these equipment. In relation with, based on the figures 4.12, 4.13 & 4.14 and findings for the year 2013, in NBCT the overall targets achievements shows a decreasing trend for these three types equipment which means the terminal could not achieve the productivity.

Figure 4.12

Equipment Availability of NBCT

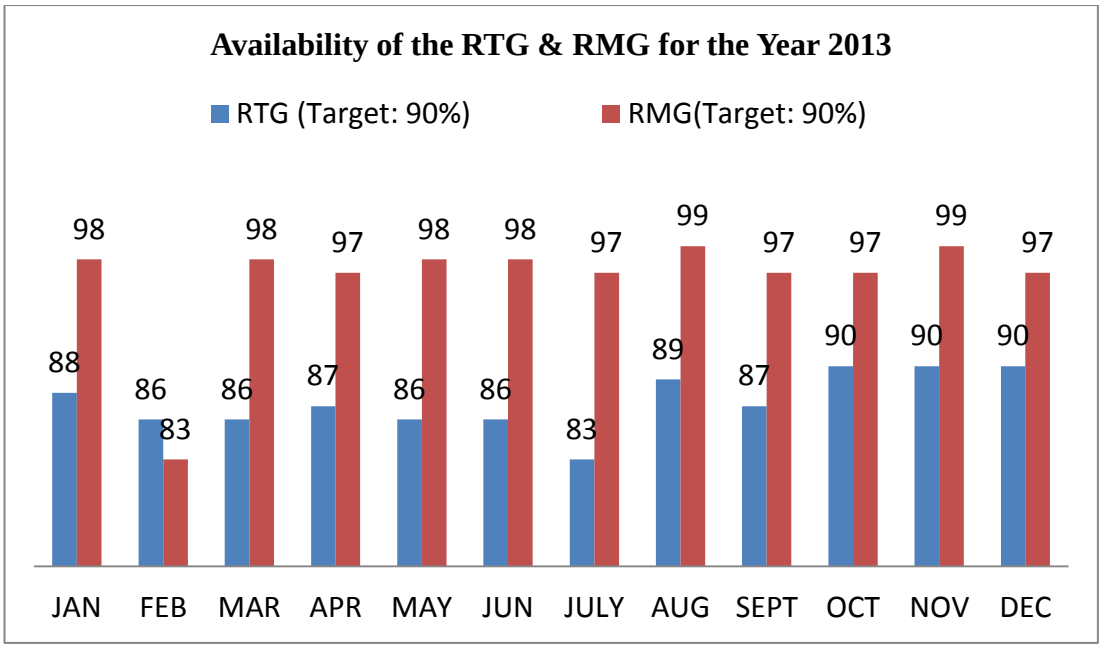


Figure 4.13

OBH of the QGC in NBCT

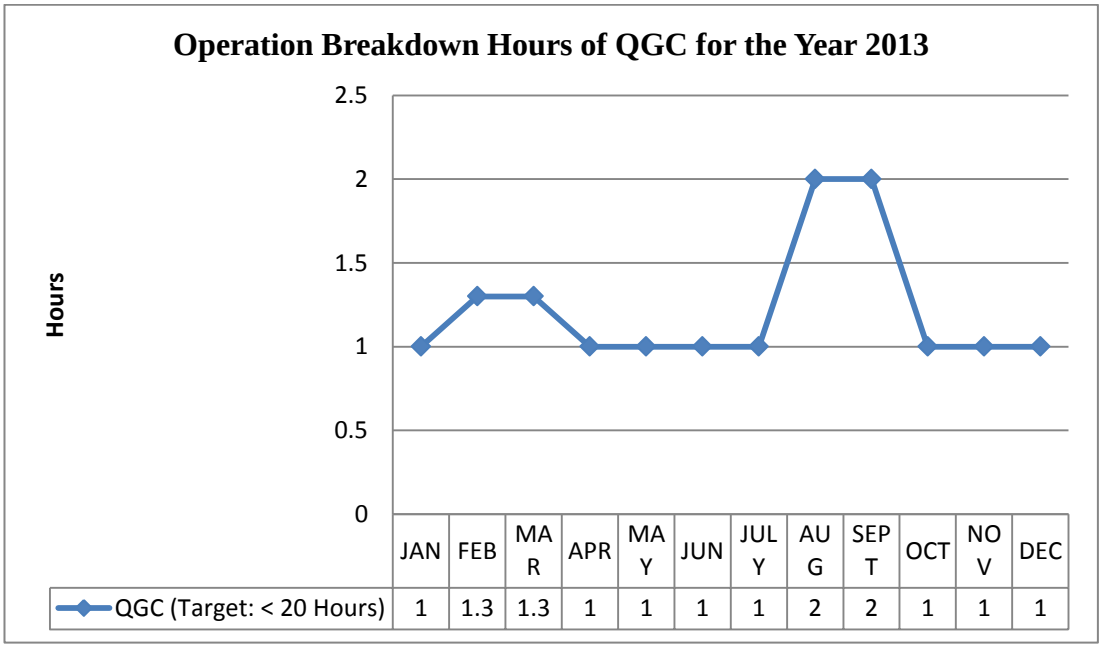
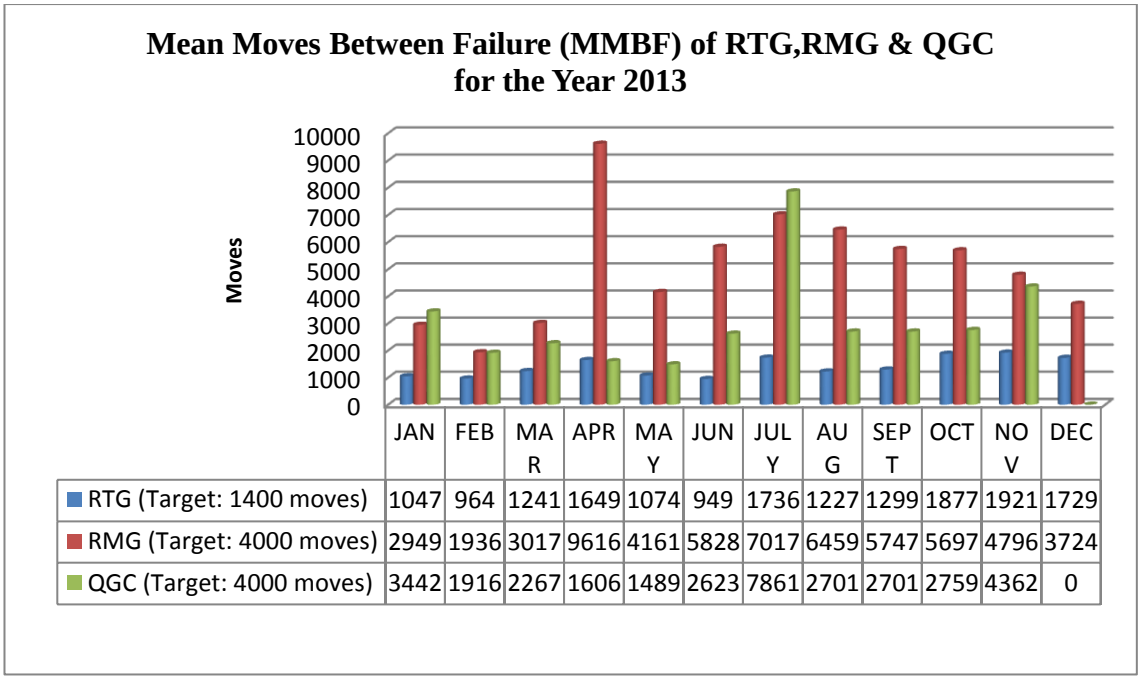


Figure 4.14

The MMBF of Equipment of NBCT



	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
RTG (Target: 1400 moves)	1047	964	1241	1649	1074	949	1736	1227	1299	1877	1921	1729
RMG (Target: 4000 moves)	2949	1936	3017	9616	4161	5828	7017	6459	5747	5697	4796	3724
QGC (Target: 4000 moves)	3442	1916	2267	1606	1489	2623	7861	2701	2701	2759	4362	0

4.2.2.4.1 The Factors Influencing the Performances of the Equipment Productivity

In this case, based on the findings from figures 4.12, 4.13 & 4.14, the measures used to evaluate the equipment productivity is obviously shows that the measurements are still effective because the data can be calculate and some indicators have shown that the terminal had achieved the targeted productivity or performance like availability and MMBF of RMG because the workshop had allocated sufficient gantries for rail road yard.

Besides the non-achievement of the targets is because set high performance targets. For instance, MMBF for QGC is 4000 moves before breakdown which is too high yet the majority of other ports in world have set less than this. Terminal has set this because over confidents from the top management upon the terminal's engineers that they can perform better but unfortunately the prediction is wrong. But this year 2014, this measure has been revised due to the changes of new equipment like advance technology based, revised the targets; so that it can be acceptable compare

to other ports, in the purpose achieve the targeted productivity. Through the interview one of the manager said;

"In path of benchmarking process, target setting is very crucial part to ensure the terminal could achieve and work against the targeted goals. But before set any targets the benchmarking to other ports is very important because the targets must be acceptable and follow international standard and apart from that; the essential part is must assure the capability level of the terminal and ability of the workers to perform efficiently against the targets'. (Source: interview with Manager from Department of Quality and Statistic of NBCT)

In conclusion, the non-achievement of the target or performance for equipment productivity is mainly influenced by internal factors such as set high movements of the cranes before the possibility of breakdown is much higher compare to other container terminals in the world. It means the NBCT less participative or looking into benchmarking process of other container terminals who are similar to its operation activity.

4.2.2.5 Labour Productivity

This is an important measure for any business or service organizations. The notable concept is without the labour forces the work or operation of the organization would not success and attains a good profits. In relation with that the manpower is like pillar for container terminals to support the overall operation's activities to complete the works against the targets and goals to attain desirable profits. Based on reviews from Thomas and Monie (2001), have pointed out that labour cost is considered as large part of terminal cost and thus, it's very important to measure or calculate the

labour productivity which means productivity per man-hour over is measured period. This can

NBCT is a transit terminal whereby it's only for first and last transaction of the cargoes or containers and this terminal operate for 24 hours in 7 weeks (24/7). In short can be said that the terminal is operates in 365 days and half of the operation activities run and managed by this man powers and the other half of the operation run by equipment and system which known as PELKON III (Pelabuhan Kontainer III). However, the need of human capital to NBCT is an important factor of production. Now, in NBCT the total man power are 692 workers including 53 officers from top level management till low level management (General Manager till Executives). The terminal operates in three shifts; morning, evening and night shifts and the overall operation activities in terminal conducted or depend on the 'Gang' namely a group of workers.

In the pace of performance measurement, NBCT had measured as the number of TEUs per shift divided by the total numbers staffs employed from the gangs. For instance in one shift there will be 10 to 15 gangs will work but it's depend on total vessels calling to terminal. In case, if mother vessel or main liner want to calling to terminal, then there will be allocate three gantry cranes for one mother vessel. In that case one gantry will allocates one gang and this gang will be comprised of three gantry's drivers and six or seven prime mover's drivers. The measurement of labour productivity for one shift will be based on how many TEUs handled by the gangs. This mathematical formula presented in figure 4.16;

Figure 4.16

Labour Productivity for NBCT

$$\text{Labour productivity} = \frac{\text{Total TEUs per shift}}{\text{Total workers employed from the gangs}}$$

4.2.2.5.1 The Factors Influencing the Performances of the Labour Productivity

The overall of labour productivities are not perform well and the figure 4.2 (refer to page 36) stand as evidence whereby it's indicate that the actual TEUs handled by the terminal is very low compare to targeted TEUs throughput for year 2013. This failure occurred due to internal factors where had set high targets for containers handles and in line with that the terminal's labour could not compete or reach the target. Besides that, lack of workforce at terminal had led to this low achievement of this labour productivity.

In conclusion, the non-achievement of the target or performance for labour productivity is mainly influenced by internal factors such as set high performance target without looking and concerned the issues like total workers, operators' skills, knowledge and less pay attention on the incentives payments since NBCT is operating 24 hours in a week which tend the workers more exhausted and stress.

4.2.3 Utilization Measures

The main operational activity of a container terminal is handling containers or TEUs and this activity divided into two major flows such as gate to storage, storage to berth. While in between of these process, utilization of the resources in these processes are very important. Thus, this measure mainly focuses on the management and operation level to determine how intensively the production resources are used.

There are four measures under this indicator which comprised of quay, storage, gate, and equipment utilization and each of these measures were used during the interview section with NBCT.

4.2.3.1 Quay Utilization

Frist of all, Thomas and Monie (2001) explained that this measure is being utilized to measure the amount of the time that the berth was occupied out of the time available. This measure also addressed in another term which known as berth occupancy. Overall, berth occupancy is the proportion of time that a vessel is occupying a berth. The evaluation of this measure is an essential component because this can become a balancing act between the shippers who highly intend to avoid or reduce waiting time to enter terminal's berth because if waiting for long hours can lead to high vessel parking charge.

In NBCT, this measure also paying high attention in order to reduce the utilization time of berth by a vessel. Through the interview section have identified, currently NBCT has six berths and the length of the whole berths or wharf is 1500m. Previously the terminal only has three berths and then latter have added 900m to attract more vessels calling and also to reduce the vessel occupancy percentage and vessel waiting time. This measure is being calculated based on length of overall of the vessel (LOA) divided by total length of wharf. This mathematical formula shows in figure 4.16;

Figure 4.16

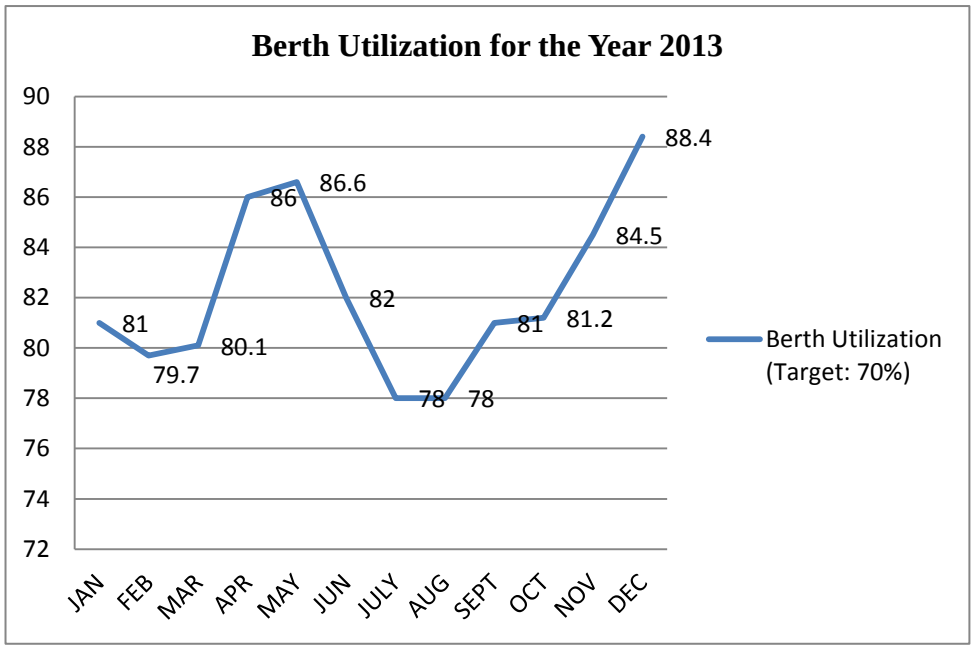
Rate of Effective Berth Occupancy

$$\text{Quay utilization} = \frac{\text{Total number of LOA}}{\text{Length of the wharf (1500m)}}$$

In order to benchmark the performance of this berth occupancy a performance target namely 70% had been set to ensure the terminal has done a good service and achieve the goals. Based on the figure 4.17, it's depict the berth occupancy rate is not effective for the year 2013. The chart shows a fluctuated style with increasing trend which means the berth utilization is more than 70% as what had been targeted.

Figure 4.17

The Rate of Effective Berth Utilization of NBCT



4.2.3.1.1 The Factors Influencing the Performances of the Quay Utilization

Based on the figure 4.17, the reasons why NBCT could not achieve the targets for this measure because insufficient of berth area for vessels to approach to the terminal because beginning of the 2013, half of wharf area were occupied by the old cranes which are not function. After that these cranes were moved from the wharf area in aim to allow more vessels can be utilize but in reality the figure 4.17 shows that terminal still could not achieve the targets for until the end of the year 2013.

In conclusion, the non-achievement of the target or performance for quay utilization is mainly influenced by internal factor which is insufficient of berth area due the less berths and occupied by the old cranes which are not in function in the beginning of the year. Besides that this had influenced the vessel turnaround time is more than expected which resulted the vessels have to wait for long hours to their turn.

4.2.3.2 Storage Utilization

This is another important measure in the process performance measurement and it is calculated by comparing the number of storage slots occupied with the total number of available slots according to the yard's design capacity. In the context of NBCT, this is a core indicator in terminal's benchmarking process in order to measure the sum of the containers movements that take place in storage or yard's blocks. NBCT's container yard has big and daily yard capacity which means the storage areas for containers are arranged into certain blocks which named as *block A to Z* and these blocks are fully utilizing to store more containers for import and export which comes from there different pace of modes which are vessel, road and train. In addition, at end of the year 2012, NBCT has added a new yard to facilitate or store

more containers and increase their service to companies and hauliers in line with their vision to achieve 2 Million TEUs by 2015.

In relation with that, the performance measurements for this measure is being evaluate based on the rates of yard capacity. First of all, NBCT had set the target rate as 60% for maximum capacity of yard utilization. It means the total TEUs that can be utilize by the yard should do not exceed more than 60% in per month. If this rate exceeds more than 60%; the terminal will face a heavy congestion or traffic jam in yard and gate. At the end, these will lead to drop the performance of container yard and also; the overall terminal's operation can be flop down.

In practice, now NBCT handles 35% to 45% TEUs in per month and this clearly shown in figure 4.6 (refer to page 45) which depicts the average monthly yard occupancy of NBCT for year 2013. As what presenting in figure 4.6, the total utilizations of the containers in storage areas or yard is shows a slight fluctuated trend with stable percentage which means the rate was not exceeds more than 60%. It clearly proves the terminal had striven to clear the container within the dwell time and achieved the target.

4.2.3.2.1 The Factors Influencing the Performances of the Storage Utilization

Based on findings from the figure 4.6, the results show that NBCT had achieved their targets by utilizing the storage within its target. Hence, it's clearly shows the performance measurement for this indicator is effective, however the achievement of the targets not solely cannot be said because of the effectiveness of the measurement; but besides it were influenced by other factors.

First of all, the addition of a new yard had mainly contributed to the performance achievement. Previous year NBCT has only one yard to store the containers but after added a new yard the daily capacity to store the containers had increased, thus it had reduced the dwell time to clear the containers from yard. Apart from that, NBCT had achieved its targets because of the full supports from all the parties involved in container yard operation especially good supports from yard operation manager and hauliers. This is because every day the yard operation manager will held a meeting with hauliers relating about clearance of their containers from yard. This had led to reduce the traffic congestion at yard and gate.

In conclusion, the achievement of the targeted performance for storage utilization is mainly caused by internal factors such as addition of a new container yard and the teamwork and skills of yard operation officers.

4.2.3.3 Gate Utilization

This gate utilization is consider as an important factor to measure in determining how effective are the container terminal in managing traffic congestion. Based on the study of Thomas et al. (2001), this measure is being defined as the smooth and rapid processing of incoming and outgoing of road vehicles at the gate of the terminals. Without a proper scheduling and clear communication with parties such as agents, hauliers, export and import companies and etc. this factor cannot be fully utilize more efficiently.

In the case of NBCT, the measure is being measured by evaluating how the gates for in and out are managed and utilizing to reduce the roads and terminal congestion. In practice, NBCT has three gates or lines (A+B+C) to allow the trailer to enter the terminal to discharge and load the containers and another three gates or

lines (D+E+F) to out for trailers. But the line A is only will be used by empty trailer to load out the containers.

4.2.3.3.1 The Factors Influencing the Performances of the Gate Utilization

Overall, NBCT had fully utilized the terminal gates in order to maintain the good performance of the terminal by reducing the traffic congestion. This has proven the performance measurement of NBCT is effective. As evidence the gate B+C has 'weighbridge' which placed at down of the road to weigh the weight of the containers; then latter will auto generate all the information about that containers into system and will spread the information to all terminal system for ship planning. This is the system called as PELKON III. While the system measure the weight of the container, if found the container is overweight than normal weight that had been set, have to reverse from the gate and will not allow entering into terminal. This is because overweight containers can give high risk while the gantry cranes do moves it from one place to another place because overweight containers may fall from the holds of crane and the situation will be very dangerous if port workers are at down. In summary, this system has made the flow of the operation more smooth and reduce the loads of officers, errors, mistakes and risks.

Apart from that, in case if terminal facing heavy traffic congestion to enter into terminal for discharge or load; the officers in charge at gate will open the gate D as a solution to allow the trailers to 'in' into terminal. Gate E+F will utilize to allow the trailers to 'out' from terminal. This is how the terminal reacts if facing a heavy congestion. In conclusion, the strategy handles by NBCT in lights of reducing the road and terminal was very effective for the year 2013.

4.2.3.4 Equipment Utilization

Utilization of the terminal equipment such as Rubber Tyred Gantries (RTG), Rail Mounted Gantries (RMG), Quay Gantry Cranes (QGC), prime movers, straddle carriers, forklifts and etc. in the process of loading, unloading, move from one location to another location; the TEUs, containers, hatch covers and etc. The most essential issue here is exploitation of this equipment will be based on types of terminals, types of vessels and ships, types of cargoes, and types of services given by the terminal.

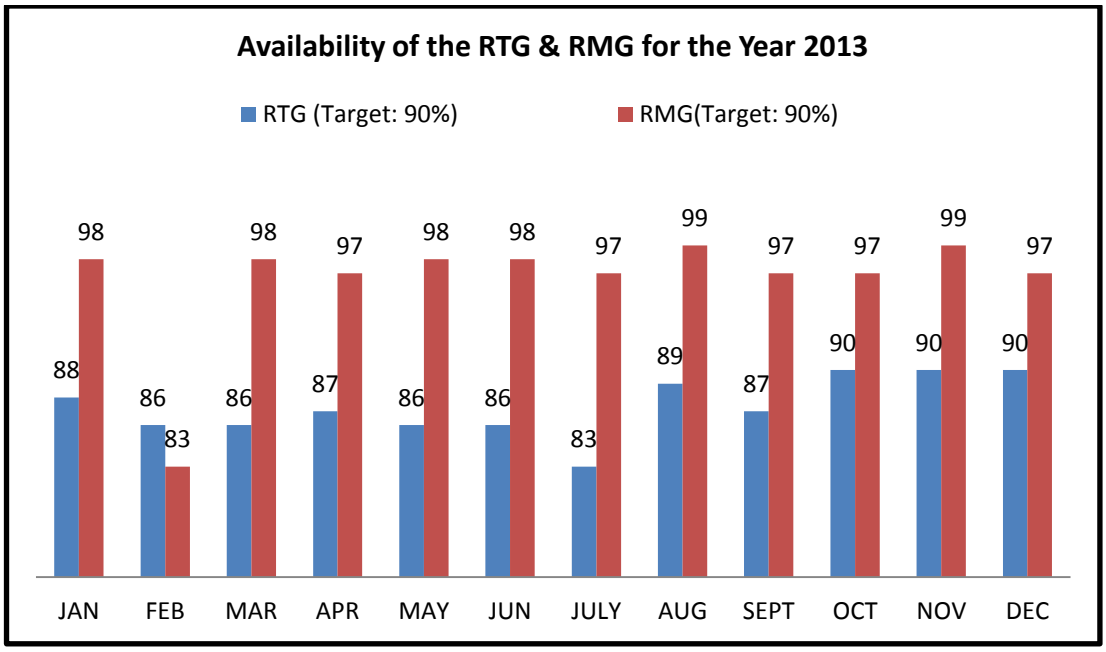
In the case of NBCT, it had only taken two types of equipment namely RTG and RMG in the process of performance measurement of the equipment utilization measure. In brief, RTG is used at container yard area to carry or moves the containers and there are total of 32 units in the terminal. And the second on, RMG is used at decking area and NBCT is first and only container terminal using electrical functioned RMG at rail yard operation area to speed up the process of transferring the containers from rail road and there are total of 7 units in the terminal.

NBCT in lights of achieve its performance, equipment utilization is being evaluated based on the availability or uses of the equipment in terminal areas. The 'performance targets' has been set for both equipment is 90% in aim to achieve the overall efficiency of the terminal. Based on the figure 18, RMG had been fully utilized by the terminal at decking to move the containers from train to yard or vice versa but however; RTG has shown that a fluctuation results which mean the utilization of this equipment were less at container yard. Yet, the last three months stared from October till December the container yard had achieved it's the targets

which mean yard have utilized the RTG to load and discharging the container from prime mover to blocks.

Figure 4.18

The Rates of Availability or Utilization of the Equipment for NBCT



4.2.3.4. The Factors Influencing the Performances of the Equipment Utilization

In this case, based on the findings from figure 4.18, shown that the measure used by Statistic's Department of NBCT to evaluate the equipment utilization is obviously shows that the measurements are still effective because the performances have shown that the terminal had achieved the targeted productivity or performance like availability of RMG because the workshop had allocated sufficient gantries for rail road yard to move the containers from train to rail container yard or vice versa. But for RTG the issue is different because at the beginning of the year 2013 terminal yard had face insufficient of workers to drive the RTG and a new staffs but at the end of the year, last three months RTG could achieve the targets because the

incentives given by the terminal to staffs such as RM 200 Boucher, bonus, and pushes from the high management.

4.2.4 Services Measures

These measures indicate the satisfaction of the customers with the services offered to them in terms of reliability, regularity and rapidity. The principal external service measures included the following three measures;

4.2.4.1 Ship Turnaround Time

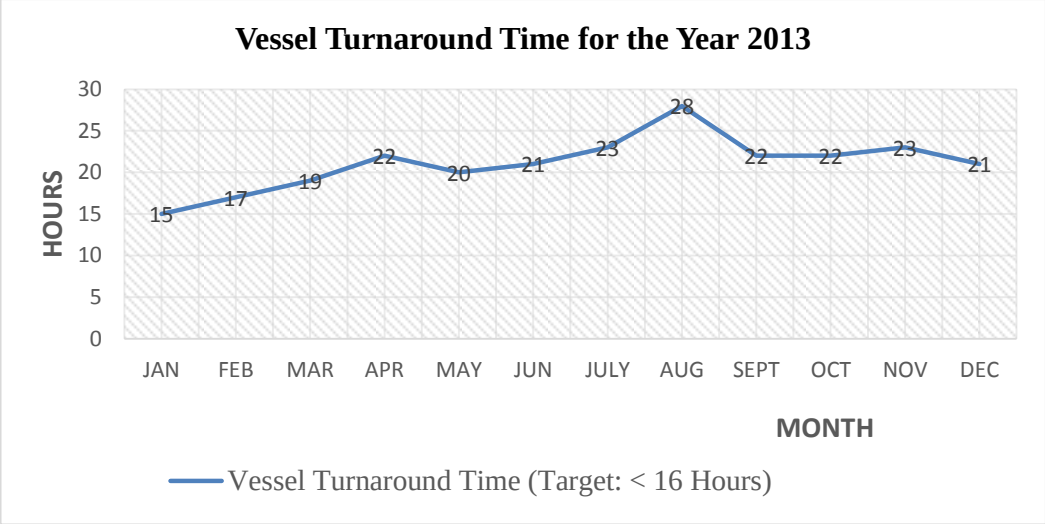
Kasypi. et al., (2010) pointed out that most of consignees and consignors expected that their movement of goods via vessel needs to be arrived destination as soon as possible. This is the reason why some consignee intended for faster turnaround time in terminal could accelerate the voyage. Therefore, turnaround time is really a serious issue to be considered for container terminal. Shippers are looking for a port which could provide fast turnaround time, when they could reduce voyage as maximum as possible. For port container terminal, it is very vital to have fast turnaround time for vessel. According to Thomas. et.al., (2001), defined that it is the sum of waiting time, plus berthing time, plus service time (i.e. ship's time at berth), plus sailing delay.

The measurements of turnaround time as given by the authors are similar when taken into consideration the process involves at the container terminal NBCT. In the case of NBCT, the terminal has set the vessel turnaround time for per vessel is below than 16 hour as main target to measure its performance.

Therefore the figure 4.9 (refer to page 52) presents the average vessel turnaround time in per month and it's clearly shows that in terminal is not showing any progress as it could achieve on the first month of the 2013 and the rest of the month the chart shows a fluctuation with an increasing trend which mean the vessel turnaround time is increasing than the target has been must be below than 16 hours. This has proven that the terminal could not provide fast turnaround time for vessels and this has made the vessel waiting time is more than expected by the shippers.

Figure 4.19

The Vessel Turnaround Time for NBCT



4.2.4.1.1 The Factors Influencing the Performances of the Ship Turnaround Time

The first reason is in year 2013; NBCT had used low advance technology's cranes (one lift-crane) to move the containers to load into vessel. These cranes only can lift one container at one time. This has led to take more time to load the containers in vessel and this has made the cranes could not achieve the target minimum 45 MPH and also the time spent for vessel at berth more than targeted which had increased more than 16 hours per vessel and this indirectly will increase the vessel waiting

time more than 2 hours. Besides that, this is an external reason which could not predictable by the terminal whereby in some situation the ship or vessel has reached to terminal or approach liner earlier or delay their schedule. In this case the terminal will serve for two vessels first, after that only the early or delay vessels will allow to the berth. These are reasons or factors influenced directly to the weak performance of the vessel turnaround time.

In conclusion, non-achievement of the targeted performance for ship turnaround time is mainly influenced by internal factors such as low advance technology equipment like using old cranes and the external factor is vessel liners either mother or feeder liners reach or approach to the channel of the NBCT earlier or delay the schedule.

4.2.4.2 Road Vehicle Turnaround Time

For a container terminal measuring the road vehicle turnaround time is very crucial in order to avoid any possibility to create traffic jam. In the relation with that for trucking companies the most important measure of a terminal's service quality is the time required to collect a container from the terminal or deliver one.

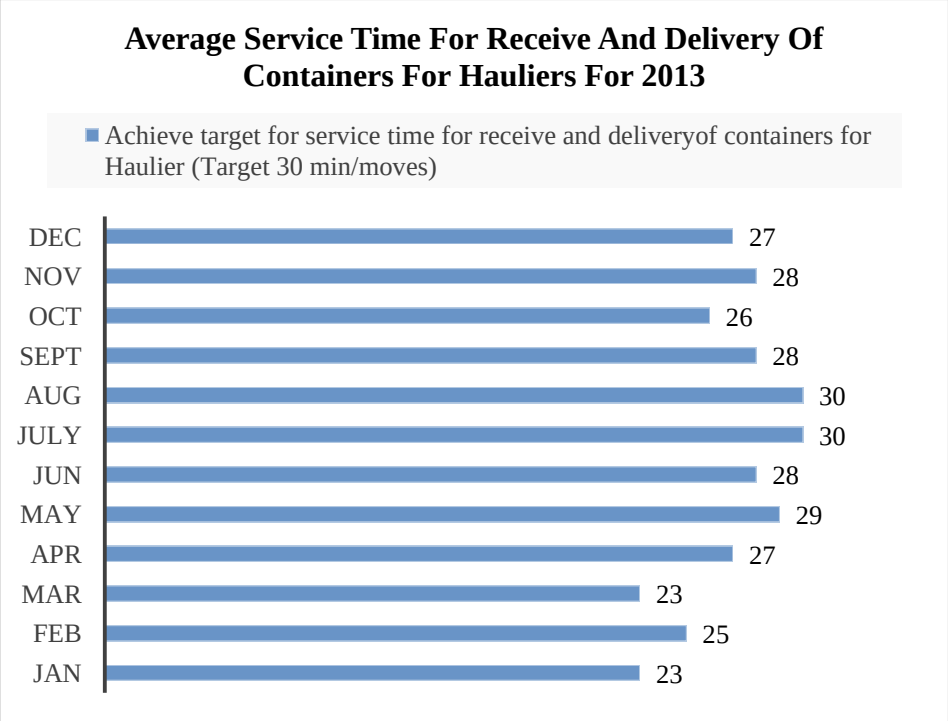
In the case of NBCT, average service time for receive or delivery of containers for haulier is being used to evaluate the performance of the terminal and performance target for this measure is 30 minutes per transaction which means one trailer is only given 30 minutes to do their one transaction and within this 30 minutes the trailer should offload the containers in container yard and move out from terminal. In different case if the same trailer wants to pull out the container from yard, another 30 minutes will be given to complete its process and out from terminal,

however a warning light will appear at system if that trailer takes more than 30 minutes to complete per transaction.

Based on the figure 4.20, its can be understood that, NBCT could achieve the target by giving service to the haulier or trailer within 30 minutes. The chart have shown that the trend is more tend to fluctuated achievements but it made within 30 minutes which mean the terminal had succeed in reducing the traffic congestions.

Figure 4.20

Road Vehicle Turnaround Time for NBCT



4.2.4.2.1 The Factors Influencing the Performances of Road Vehicle Turnaround Time

The results from figure shows that the terminal has managed its service at good level and it has proven the performance measurement for this measure is effective but it doesn't mean NBCT could achieve this target solely because of the measure is effective, yet there are factors influencing this achievement. Besides that the addition

of a new yard had mainly contributed to the performance achievement for this measure. Previous year on 2012, NBCT has only one yard to store the containers but after added a new yard the daily capacity to store the containers had increased and decreased the time to service for hauliers and at last this have reduced the traffic congestion at gate and terminal and this also have contributed to the achievement of monthly yard occupancy. In summary, the contribution for success of this measure is still influenced by internal factors as discussed on above.

4.2.4.3 Rail Service

The last part of this measure is train turnaround time and according to Thomas. et.al, (2001) have stated that this measure would not be a useful measure for the service performance of a container terminal to the rail. But in the case of NBCT this measurement playing an important roles in performance measurement process whereas explained by one of the manager from NBCT;

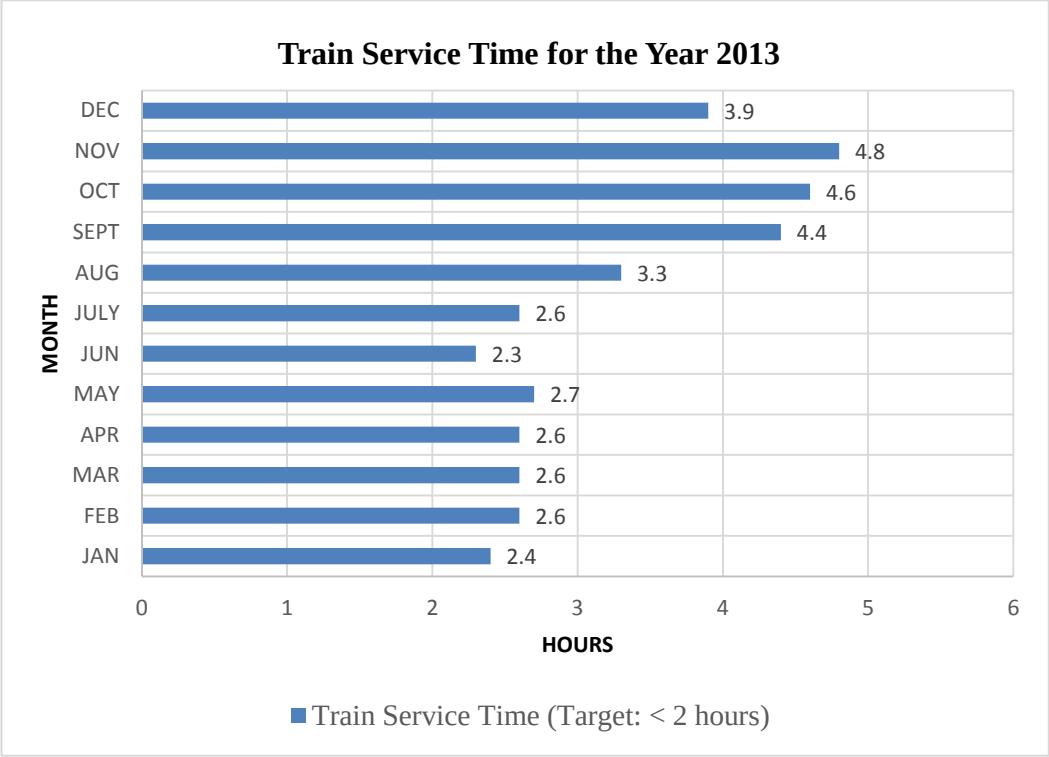
"Offering train containers service is very less in Malaysia and NBCT is one of the container terminal offering a good train container services same like Port Klang. We are offering a long rail road service from Penang to Padang Besar, Padang Besar to Thailand and vice versa". (Source: Interview with Manager of operation department)

In order to achieve its performance, NBCT has set the performance target as 2 hours to delivering a good service. This means the movement of the containers for the train must complete within two hours in per transaction. In effect, the figure shows that NBCT could not give its service within 2 hours due to lack of workforce at rail decking because mostly all the 'gangs' will work at yard and berth. Once the train approach then only they will move to decking and do start work because the rare

service of train. Apart from that, the RMG is an electric based machine and need high skills and time to manage and operate that equipment. In summary, this measure is still effective and the failure of the achievements not solely can be blame the measures used but, yet the other internal reasons as what mentioned on above.

Figure 4.21

The Total Train Service for NBCT



CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter have discussed the conclusion part based on the research questions and research objectives and the last part will be end with limitation of the study and recommendation.

5.2 Discussion Based on Research Questions and Research Objectives

This part mainly focused on the discussion about two research questions (RQ 1 & RQ 2) of this study. A comprehensive analysis on these two research question have completed and discussed one by one.

RQ 1: What are the performance measures used by NBCT in measuring the performance of its operational activity?

North Butterworth Container Terminal (NBCT) is a leading seaport container terminal in Malaysia. They main operation activity is handling containers for loading and unloading activity through three modes of transport vessels, roads and rails. In relation with that the performance measurement of the overall operation activities is very crucial aspect for every port in order to identify the efficiency of the terminal.

In that case NBCT had taken this issue as serious and measured the each one the activity occurred in the port. Hence, four main related performance indicators (PI) as suggested by Thomas and Monie (2001) were chosen as main independent variables (IV) to examining the objectives of this research. Their studies have chosen as main references to complete this study. The four indicators are production,

productivity, utilization and services. In addition, each indicator divided into few measures.

In summary, in NBCT there are mainly four performance indicators or measures are being used which are production measures, productivity measures, utilization measures and services measures in order to assessing the terminal's performance achievements.

RQ 2: What are the factors influencing the performance achievements of NBCT?

The second research question that was used in this study is what the factors influencing the performances of NBCT in determining its operation efficiency. In this issues, this study has aim to identify the factors influencing the performances of NBCT by using the measures identify in RQ1 in order to measure the terminal performance. To identify the answers for this research questions, the data and findings for each of the measures were asked during the interview process. These performance data were representing for the year 2013. These data for each of indicators were analysis in charts form to identify the performance achievement against the targets that have been set for every year.

At the end of the analysis, the study has identify there are mainly two factors which are internal and external factors have influenced the performance achievements of NBCT. Furthermore, the internal factors mean the achievement and non-achievement of the NBCT's performance is caused or influenced by the problems or issues occurred within the terminal. On the other hand, external factors mean the issues or problems were raised or occurred outside from the terminal.

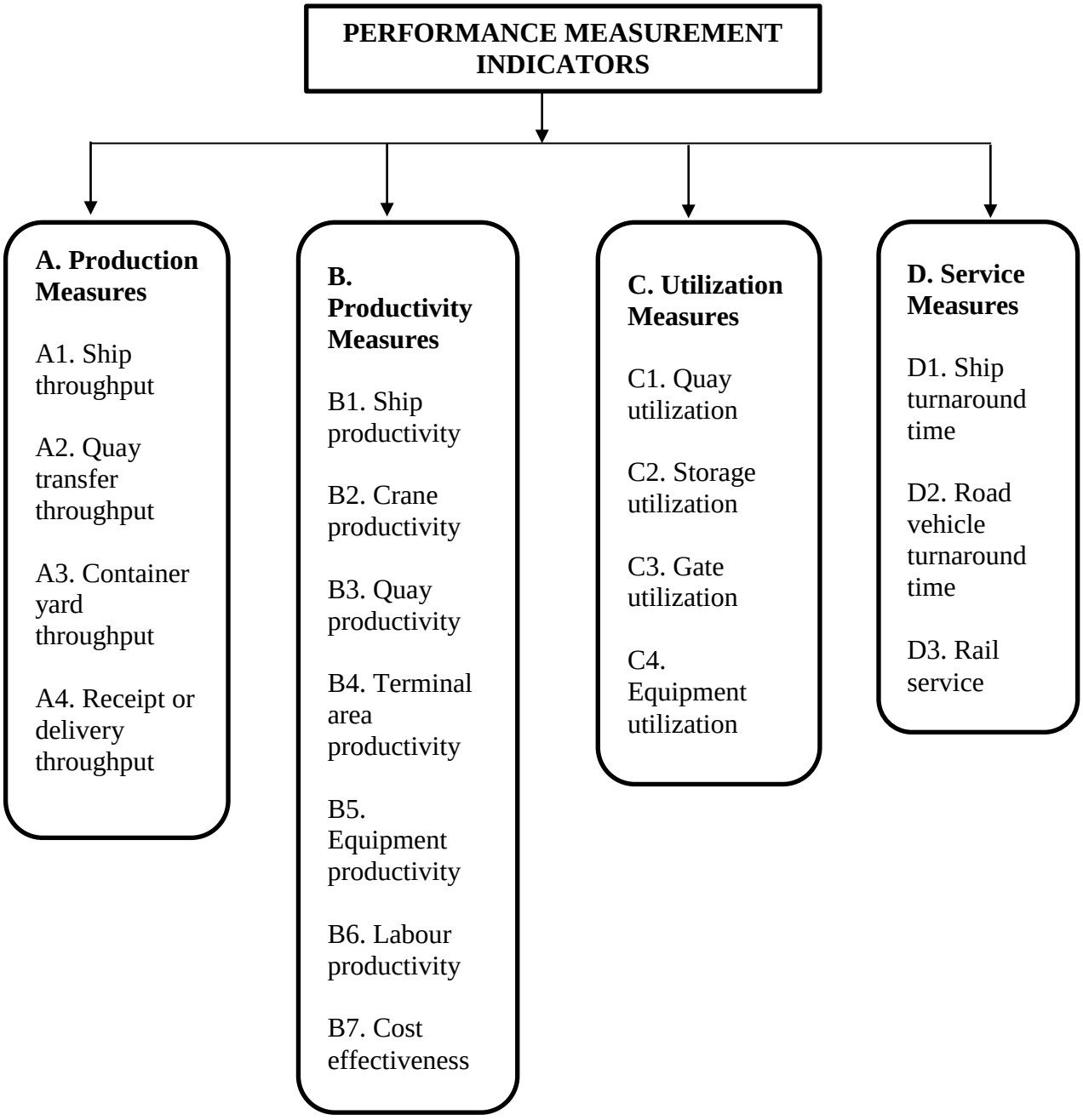
RO 1: To identify the performance measures or indicators of NBCT operation

In aim to examine and achieve the objectives of this study, a series of interview has been exploited to identify the indicators or measures used by NBCT in its terminal. A semi structured interview and observation method had been used to identify and illustrate the performance measures is being take into account to evaluate the performance of NBCT. Through the reviews from chapter two which is literature review, the main four performance indicators (PI) as proposed by Thomas and Monie (2000) namely production, productivity, utilization and services have been used to generate the data and findings to achieve the objectives of this study.

Through the interview section has been identified, NBCT is utilizing these four indicators as its main key indicators or measures to evaluate the performance targets that take into account all the operation activities take place in terminal area. To recapture the figure of measures again, it has been illustrate in the figure 5.1. Based on the figure 5.1, there are main four indicators were used which production (A), productivity (B), utilization (C) and services (D). Refer to the figure 5.1 and prior literature reviews of Thomas and Monie (2001), there are eighteen measures have been identified (A1-A4. B1-B7, C1-C4 and D1-D3) and take into consideration to examine the first objective (RO1) of this study. In order achieve RO1, all these measures were kept as guidelines during the interview section with NBCT and the questions were designed based on these measures.

Figure 5.1

The Illustration of Performance Indicators or Measures



In the case of NBCT, the main four key indicators (A-D) are being used as main indicators to measure the performance of the terminal. The first key indicator is production throughput (A) and the measures under this indicator are still same as what had been proposed namely; ship throughput (A1), quay transfer throughput (A2),

container yard throughput (A3) and lastly, receipt and delivery throughput (A4). In NBCT, all these measures are being used to measures the performance throughput in terminal in the process of benchmarking the terminal efficiency.

Apart from that, the measures for second indicator that being used in NBCT are ship productivity (B1), crane productivity (B2), quay productivity (B3), equipment productivity (B5), and labour productivity (B6). Measures of B4 and B7 are not taking into consideration to evaluate the performance of the terminal's productivity.

Besides that, the third indicator for this study is utilization. There are four measures are being take into consider by NBCT to evaluate overall the terminal's operation utilization which are quay utilization (C1), storage utilization (C2), gate utilization (C3) and equipment utilization (C4). Lastly, the fourth indicator is service measurement and three measures were identified under this indicator namely ship turnaround time (D1), road vehicle turnaround time (D2) and rail service time (D3).

RO 2: Identify the factors influencing the performance of NBCT in determining its operational efficiency

In this study NBCT have chosen to identify the measures used by them in the process of benchmarking their terminal operation efficiency and the most crucial part answer here for the question what are the factors influencing the performance achievements and these has been identified based on the data and findings from the interview to review. In the process of examining RO2, the NBCT's statistic data for the year 2013 which shows about the achievement and non-achievement of the terminal's operation performance was utilized to answer this RO2 by using data analysis techniques which are documentation process, conceptualization, relationship between RO1 and RO2.

At the end of the analysis has found that the measures used by NBCT in the process of measuring the terminal performance are not wrong; however, NBCT could not achieve its performance targets for the year 2013 due to influence of internal and external factors which are under the control of terminal officers and beyond the control of the terminal.

There are few internal factors have been identified in influencing the performance achievements of NBCT which are; the first is the marketing team of NBCT had set high targeted throughput for the year 2013 without analysing and assessing the surrounding issues rather than it has been set based on previous year achievements and assumptions. Besides that, insufficient of water depth is another internal factor which influencing the performance of NBCT whereby it has resists the mother vessel to approach into the channels of NBCT because in the reality approach of mother vessels could bring high revenues.

On the other hand, lack of workforce in the operation terminal has given high influence to the performance of NBCT. This is because NBCT operates for 24 hour in a week where the demands or numbers of worker in the terminal is vital to run the overall of the operation activity. More specifically, lack of drivers to operate the prime movers has turned low performance achievement in berth production and vessel productivity.

Apart from that, uses of low advance technology equipment like cranes have given high impact on the performance of NBCT especially to the measures like crane productivity, vessel productivity and ship turnaround time. This due to the evolution happened in the size of vessels inventions in now days have required the terminal must have updated technological equipment to support the vessels in order to reduce extra hour's consumption and improve the efficiency in providing services.

Furthermore, there are also few external factors which have influenced the performances of NBCT such as geographic issues which mean the location of NBCT which has low depth of ocean and this avoid more panama max to approach in. Other than that, political issue which mean less supports from the government in providing money for dredging purpose. Last but not least, the less supports and roles played by the third parties such as vessels liner, pilots, hauliers, consignee and consignor and etc.

The most prominent result that have to mention here namely the overall performance or efficiency of the NBCT shown less achieved the targeted performance or throughput and the charts and data shown a fluctuated trend for the year 2013. In addition, the fundamental part for every measure is set a 'performance targets'; so that the terminal workers have to strive to achieve these targets. Through the discussion from the chapter 4, has been defined in some measures the terminal could not achieve performance targeted. Table 5.1 have illustrate the list of measures achieved and not achieved the targeted performances for year 2013.

Table 5.1

The achievement and non-achievement of the targeted performances for NBCT

Indicators	Measures	Achieve the target	Not achieve the target
Production	1. Ship throughput		✓
	2. Quay transfer throughput		✓
	3. Container yard throughput	✓	
	4. Receipt/delivery throughput		✓
Productivity	1. Ship productivity		✓
	2. Crane productivity		✓
	3. Quay productivity		✓
	4. Terminal area productivity	Not Measure	Not Measure
	5. Equipment productivity	✓	✓
	6. Labour productivity		✓
	7. Cost effectiveness	Not Measure	Not Measure

Utilization	1. Quay utilization		✓
	2. Storage utilization	✓	
	3. Gate utilization		✓
	4. Equipment utilization	✓	✓
Services	1. Ship turnaround time		✓
	2. Road vehicle turnaround time	✓	
	3. Rail service measures		✓

5.3 Recommendation of the Study

Now Malaysia becomes very popular country for the containerized trade, which has offering the container terminal a unique competitive advantage with better competitive positions. Thus, NBCT's performance measurements with production, productivity, utilization and service measures categories showed a low average performance trends in most indicators for year 2013. Many internal factors such as sets high targeted performance or throughput, insufficient of water depth, less supports from NBCT's marketing team in setting the targets, low advance technology based equipment, lack of workers to move the prime movers, and for the external factors such as political issues, geographical issues, and less supports from the third parties (3P), have been identified as main factors which have influenced the low performances of NBCT. It would be better rather than saying the performance measurement was weak and NBCT had using the wrong measurement.

First of all, the Marketing Team must play essential roles in setting up the performance targets and 'set high targets merely to achieve targets or to boost the energy'; is not acceptable and it shows that the team is not updated their self with current developments raising in the world. In a fully competitive world now, the marketing team must avoid practicing this idiom. In relation with that analysing and conducting a market survey or benchmarking is very crucial strategy to implement in NBCT.

In the case of the gantry crane analysis, the terminal's management knows the reliability of these systems and can schedule better maintenance programmes, which will minimise breakdowns and delays and the most important the terminal must give a proper training programs.

Moreover, a strong co-operation between the terminal operation departments and different governmental units represented, by the customs immigration, quarantine should be performed in order to reduce the vessels turnaround time. Finally, NBCT could play a better role in enhancing the national commercial and economic situation if optimization of human, financial and geographical resources took place.

Apart from that, container throughput represented by number of TEUs handled shows a heavy decreasing during the study period because of set high much on targets in order to achieve the company objectives and push the worker. Setting high much of targets should avoid for the moments because NBCT still has many things to learn and in the future they could uphold their targets.

Nevertheless, additional work needs to be carried out in order to examine in more detail additional reasons that cause delays in port operations, along with their financial consequences. Such factors can be bad weather conditions, other machinery breakdowns apart from gantry cranes, etc. Finally, investment alternatives among different types of equipment and expansion strategies could be examined, with the aim of improving of port terminals' productivity and eliminating congestion. Such an approach could lead to a more holistic study providing more insightful information. It is recommended that the port operators adopt better management and operation policy to improve the terminal productivity performance in order to optimize.

In conclusion, improving terminal productivity is becoming more urgent, in large part because vessels are getting ever larger. It is intended to provide more prominence to ports, carriers and cargo interests into productivity at one of the global supply chain's most important service sector. The roles from every department are very crucial in order to maintain a better performance in the terminal. Identifying the weakness in the operation terminal and also from management sides is very important in giving a continuous service to the NBCT's customers.

5.4 Limitation of the Study

There are very few research have studied on this Performance Indicators (PI) which mainly by applying the main for Performance Indicators in assessing the operational efficiency because of the different activity is being carried out by different ports. The measures are differing based on the ports operation activity. So this has limited the researcher to found the journals and studies on this PI. Apart from that, two measures which are terminal area productivity and cost effectiveness were not taking into performance measurement by NBCT since these two measures are very important to identify the factors influencing these measures.

5.5 Contribution of the Study

Performances measurement is an essential part for every ports and container terminal. Thus, when saying the performance measurement, the next question that will be rise is what are the performance measures need to apply to assess the operational efficiency. Through this study have identified that the performance of a container terminal could be evaluate by applying the main four PIs and at the end of the study had identified the poor performance of the container terminal's operation efficiency is not solely resulted because of using wrong measurements but there are other internal and external factors

which are contributing to this poor efficiency of the seaports container terminal. Therefore, by assessing more intensely the each of the factors can identify and recognize the exact problems occurring in the terminal and finally can come out with the solution or policy to overcome those problems. This will continuously assure the efficiency of a container terminal.

REFERENCES

Bichou, K., &Gray, R. (2004). Logistics and Supply Chain Management Approach To Port Performance Measurement.*Journal of Maritime Management*.Vol. 31 (1).47-67.

Cavana, R. D. (2001). *Applied Business Research: Qualitative and Quantitative Methods*. New York: John Wiley & Sons Australia, Ltd.

Deutshe Bank Research. (April 25, 2006). *Container shipping: International topics Current Issues*. Retrieved on March 20, 2013, from

Flick, U., (2007).Designing Qualitative Research. California: Sage Publications Ltd.

ISBU. (2010). all_about_shipping_containers @. Retrieved March 27, 2013, from http://www.isbu-info.org/all_about_shipping_containers.html

JabatanLaut Malaysia. (2013, March 23). Maritime Communication Centre Malaysia. Retrieved on March 23, 2013, from http://www.marine.gov.my/jlmeng/Contentdetail.asp?article_id=346&category_id=1&subcategory_id=23&subcategory2_id=34

Jung, H. (2010). Competitiveness of Asian Container Terminals.*The Asian Journal of Shipping and Logistics*.Vol. 26 (2).225-246.

Levinson, M. (2006).Container Shipping and the Economy.Stimulating Trade and Transformations Worldwide.Tr News 246 September–October 200. Retrieved on March 20, 2013, from

http://www.worldshipping.org/pdf/container_shipping_and_the_us_economy.pdf

Lin, L. C., & Tseng, C. C. (2007). Operational Performance Evaluation of Major Container

Ports in the Asia-Pacific Region.*Maritime Policy & Management: The Flagship*

*Journal of International Shipping and Port Research.*34:6, 535-55.

Kasypi, M., & Shah, M.Z. (2010).A Productivity Analysis of Medium Seaport Container

Terminal, Malaysia.

Kemme.N. (2013).*Design and Operation of Automated Container Storage Systems:*

*Container-Terminal Logistics.*Heideberg: Springer.

Kemme, N. (2014). Effects of storage block layout and automated yard crane

systems on the performance of seaport container terminals. *OR Spectrum*,

34(3), 563-569.

Malaysian Investment Development Authority (MIDA), (2013, March 18). Why Malaysia:

Developed Infrastructure. Retrieved on March 10, 2013, from

http://www.mida.gov.my/env3/index.php?page=developed-infrastructure

Mennis, E., Platis, A., Lagoudis, I., & Nikitakos, N. (2008). Improving Port Container Terminal Efficiency with the use of Markov Theory. *Maritime Economics & Logistics, 10*(3), 243–257. doi:10.1057/mel.2008.3

Mi, Z., &Hanbin, X. (2009).Research on Port Logistics Development Model Based on Supply Chain Management. *School of Logistics Engineering, Wuhan University of Technology*.

Pallis, A., &Vitsounis, T. K. towards Alternative Measurement of Port Performance: Externally Generated Information and Users' Satisfaction. Department of Shipping Trade and Transport, University of the Aegean, Greece.

Port and logistics: Power to move. Retrieved on March 13, 2013, from www.ttsgroup.com. http://www.ttsgroup.com/PageFiles/2955/TTS_PortLogistics_brochure_LR.pdf

Tahar, R. M., &Hussain, K. (2012). Simulation and Analysis For the Kelang ContainerTerminal. Logistic Information Management. Vol. 13 (1). 14-20.

Talley, W.K. (2009). Port Economics. Abington: Routledge.

World Trade WT 100. (September 04, 2012). *Port Group Emphasizes Economic Importance of Ports*. Retrieved on Mac 09, 2013, from http://www.worldtradewt100.com/articles/88855-port-group-emphasizes-economic-importance-of-ports

Interview Questions

1. Interviewer self-introducing. Next, introducing the research objectives. The research objectives are:
   a) To find out what are the performance measurements used by NBCT in its operation activity to measure their performance and
   b) How effective are the measurementsin measuring the performance of their company.
2. Interviewee self- introducing.

   Before we go further to our main questions, tell me about yourself sir/madam. (i.e. about your name, position, department and the role that you play in the department/organization).
3. Thanking. Well sir/madam, as we know, in accomplishing a company's or organization's missions, objectives of each department in an organization isa vital part. With this in mind, could you explain what are the objectives of your department and in summary, explain what are the activities carried out by your department

   (i.e. what department is in charge of and what are the activities performed by the department).
4. More specifically, could you explainthe overall operations activities of NBCT (etc. from the context of loading and unloading the containers/loads via ships or other hinterland transports, resources used to carry out these activities, delivery/receipt activity).
5. Thanking.Come to the body of interview whereby in terms of measuring NBCT's operation performance, what are the measures/indicators/elements that are being used.
6. Why are these measures chosen? How are they chosen? Who chooses the measures?
7. In terms of "production", what are the measurements used? (or, to put it in another way: "how do you measure NBCT's production?". Could you please explain the measurements of production in detail?

(If the interviewee did not mention any of the indicators for the production measures that have listed before, will ask them gently about those measures (Attachment 1)

8. In terms of production performance, in the scale of 1 to 5, 1 being "not effective at all" and 5 being "very effective", could you tell me the effectiveness of the production measurements that you mentioned just now?
9. Have you encountered any problems when using these production measurements? If yes, which one? How does it cause the problem?

   (Repetition of questions: Question 7, 8 and 9 will ask again but substitute "production" with a) "productivity", b) "utilization" and c) "services"

10. Do you plan to use other types of measurements besides the ones that we have already discussed, to measure NBCT's performance? If so, what are they? Why choose the measurement?
11. In view of the competition with other ports similar to NBCT (whether domestic or international), what changes have you made, in terms of performance measurements, to better measure the port's performance?
12. Would it be possible to provide details i.e. numbers, percentage etc. of the performance elements i.e. production, productivity, utilization and services mentioned just now?
13. Conclusion. Thanking the interviewee and offer to send a copy of the executive summary of the research if they need it.

ATTACHMENT 1

This table will be a guide line to assure the interviewee has answering or mention all the measures (for questions 7, 8, & 9)

Indicators or Measures		*Tick (/), if the interviewee stated*
Production	1. Ship throughput	
	2. Quay transfer throughput	
	3. Container yard throughput	
	4. Receipt/delivery throughput	
Productivity	1. Ship productivity	
	2. Crane productivity	
	3. Quay productivity	
	4. Terminal area productivity	
	5. Equipment productivity	
	6. Labour productivity	
	7. Cost effectiveness	
Utilization	1.Quay utilization	
	2. Storage utilization	
	3. Gate utilization	
	4. Equipment utilization	
Services	1.Ship turnaround time	
	2. Road vehicle turnaround time	
	3. Rail service measures	