

ESTABLISHING BERTH SUFFICIENCY FOR CONTAINER HANDLING AT DAR ES SALAAM PORT

Sophia Grace Nyanduga

Dar es salaam Maritime Institute P. O. Box 6727 Sokoine-drive, Dar es Salaam-Tanzania.

Abstract

This study established the level of adequacy of berths on container terminal at the port of Dar es salaam. The study used qualitative and quantitative approach where questionnaires, interviews, observations and documentary reviews are employed. A populace of 50 respondents were chosen to answer the research questions of this study to meet the targeted objective. Purposive sampling used to select participants regards to their area of field and required information. Results shown that 37.8% of respondents said the level of adequacy of berths on container terminal at the port of Dar es salaam is normal, this contributed by container terminal II which consisting berth number 8, 9, 10 and 11 which have some modern terminal equipment's while 31.1% of respondents said the level of adequacy of berth is low because there is continuous problem of congestion at the container terminal and this contributed due to the scarce of terminal equipment at container terminal I which consisting berth number 5, 6 and 7 where operated by TPA. 60% of respondents agreed that there are some challenges affected the level of adequacy of berths on container terminal such as outdated terminal equipment's/facilities, outdated technology installed, weak hinterland connectivity, limited cargo spaces and sufficiency of operators. The research concludes that the level of adequacy of berths on container terminal at port of Dar es salaam is normal with seven (7) berths. There is a need of serious investment of terminal infrastructure in order the terminal or berths to be more adequate as well as to eliminate the problem of congestion at terminal area.

Keywords: Container terminal, berths, Adequacy, Equipment's, ports

1. Introduction

Container terminals are simple systems of material movement with three different areas: the berth area, where vessels are berthed for services; the storage yard area, where containers are stored as they temporarily wait to be exported or imported and the terminal receipt and delivery gate area, which connects the container terminal to the hinterland. Operations in a container terminal can be broken down into three functional systems: seaside operations consist of the vessels berthing operations at the quay, the unloading of containers from the vessel and the loading of containers onto the vessel. The seaside operations interact with the yard operations through the internal transport equipment's used to move containers from the vessel to the storage yard and from the storage yard to the vessel. The yard operations manage the containers during the transfer between the landside and the seaside (Sislioglu, 2018).

These operations include functions such as the internal transport of containers from the vessel to the trucks or rail and from the trucks or rail to the vessel and the storage operations in the storage yard. The landside operations deal with activities of receiving and delivering inbound and outbound containers to and from the storage yard. According to Maneno (2019) the throughput that can be achieved per berth at a particular terminal will increase with the size of the average container exchange, the average size of ships visiting the port and the level of adequacy of terminal equipment's/facilities. Global hub ports tend to handle large ships loading/unloading high number of containers at well-equipped berths, local ports tend to handle small ships often semi-container ships loading/unloading modest volumes of containers at multi-purpose berths.

Berths at major hubs need to provide extensive land backing, deep water alongside the berth and sufficient equipment's to handle large volumes in a short period of time, and the cost of providing an additional berth at such port is generally higher. The performance of container terminal it depends on the level of adequacy of berths and terminal equipment's/facilities at a particular port if the berth is more adequate with well-equipped facilities resulted to the good port performance and vice versa is true (Bank of Tanzania, 2018).

2. Methodology

This study used qualitative method to investigate on established the level of adequacy of berths on container terminal at the port of Dar es salaam. The study was done on a sample of participants from different organizations and maritime stakeholders in the city of Dar es salaam. The study targeted participants from maritime organizations based and a sample of 50 participants from public and private organizations as shown in the table 1.

Table 1 sample size of the study

S/N	Study units	Sample Size	Sampling Techniques
1	TPA	5	Purposive sampling
2	TASAC	10	Purposive sampling
3	TRC	3	Purposive sampling
4	TRA	5	Purposive sampling
5	Seafarers	10	Purposive sampling
6	Stakeholders	12	Purposive sampling
7	Shipping line	5	Purposive sampling
Total		50	

Source: Researcher, 2024.

In data collection, different approaches were applied including questionnaire, interview, observation and documentary review. The study used questionnaire for gathering data focusing on the objective of the study, the questionnaire consists both open and closed ended questions on the issue of adequacy level of berths on container terminal at the port of Dar es salaam and the questions were the same to all categories of participants.

An interview and observation method used to generate data which would supplement primary data from questionnaires to seek for clarification on key matters. In the same scenario documentary review used in gathering background material, gives out information's in developing other data collection tools for analysis and document review guides the system of compiling documents relevant to the analysis of the study.

Data analyzed to obtain descriptive data such as frequency, percentage and cumulative percentage through statistical package for social sciences (SPSS). The research applied inductive phenomenological analysis of which data from specific to general so that exact case is observed and then combined into a larger whole or general statement in a meaningful way. This study followed inductive steps as follows; first step is open coding, second was coding sheet, third was grouping, fourth interpretation and last step was writing stage.

3. Literature Review

3.1 Theoretical Review

This study investigates on established the level of adequacy of berths on container terminal at the port of Dar es salaam. Containerization was first introduced in 1956, aiming to cut down the costs of maritime transport by reducing cargo handling costs. Instead of loading/unloading each piece of transport item to or from a ship in a labor-intensive manner, containerization increases the efficiency and speed of transport by reducing the packing requirements and handling processes at all transfer points. That is between port, rail and road at the end of 2005 (Akakura, 2023).

According to (UNCTAD, 2018) the world container fleet was expected to have increased to 21.6 million TEUs (Twenty-foot Equivalent Units), thus countries without adequate unitized transport facilities will affect their international trade. In order to achieve economies of scales new ships are built with much greater capacity. The deployment of larger ships demands huge investment in providing greater depth alongside the berth of the calling ports as well as more powerful quay cranes with long outreach and lift height. For efficient operation ports also require a large storage yard and a better road and rail infrastructure in order to satisfy the growing demand of container berths.

The study of Akakura (2023), attempts to estimate the number of berths that would be required. Estimating port capacity is a complex and often contentious issue, and precise estimates require the application of detailed simulation models and data on vessel arrival patterns and service times. Such detailed analysis is clearly beyond the scope of the present study. However, this study on establishment the level of adequacy of berths on container

terminal at the port of Dar es salaam, in the concentrate all partners engaged with the port activities shall get an improved answer on how the level of adequacy of berths on container terminal are

3.2 Conceptual framework

The conceptual framework is explanation in the form of a diagram with basic elements about the study of the establishment of the level of adequacy of berths on container terminal at the port of Dar es salaam. The conceptual framework has collected some factors which used to determine or establish the level of adequacy of berths on port areas, these factors are like terminal handling equipment's, cargo space, technology used, speed of terminal equipment operators and documentation procedures. However, the study guided by level of adequacy of berths as an independent variable whereas level of adequacy of berths identified by looking total number of berths available in the terminal and container terminal as a dependent variable.

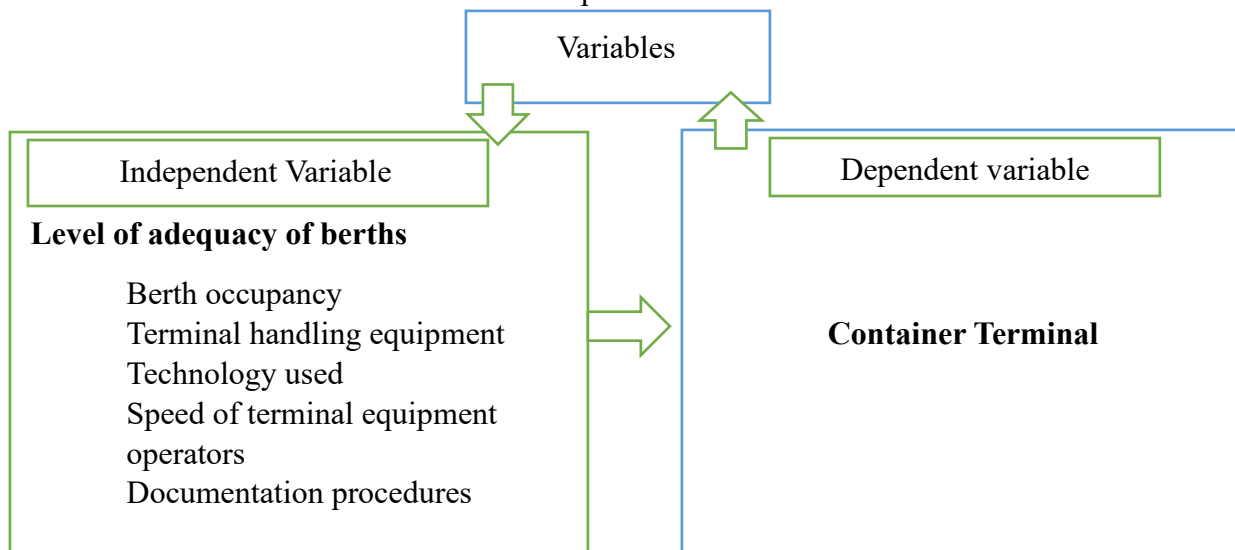


Figure 1 Conceptual framework Source: Researcher, 2024

Through literature reviews shown that there is a gap to be filled due to the absence of specific studies which analyses and established the level of adequacy of berths on container terminal at the port of Dar es salaam and the aim of the study was established the level of adequacy of berths at the container terminal and to understood if the berths are adequate or inadequate with causative factors.

4. Results and Discussion

4.1 Introduction

This sub-section presents results on the Level of adequacy of berths on container terminal in term of numbers. Firstly, the total number of berth available on container terminal, the berth occupancy, the level of adequacy of available berths in the terminal and some challenges affected the level of adequacy of berths on container terminal. At the Dar es salaam port there are two (2) container terminals namely; container terminal I consist berths number 5 to 7 with a quay length of 554m and container terminal II consist berths number 8 to 11 with a quay length of 725m, both container terminal I and terminal II consist a total number of seven (7) berths, generally the intrinsic capacity of container terminals of the port of Dar es salaam is to handle 6.8 million tons

Berth occupancy rate from January to March 2024

The data collected specific from container ships with length overall (LOA) between 200M to 230M

$$\text{Berth occupancy rate} = \frac{\text{total ship time at berth} \times 100}{\text{Number of berth} \times \text{ND}}$$

Note: ND is number of days in reporting period

Time at berth= 5 days

Number of berths= 3 berths

$$\text{BOR} = \frac{5 \times 100}{3 \times 5}$$

BOR = 33.3% for container terminal I,

Equation 1

$$\text{Berth occupancy rate} = \frac{\text{total ship time at berth} \times 100}{\text{Number of berth} \times \text{ND}}$$

Time at berth =4 days

Number of berths= 4 berths

$$\text{BOR} = \frac{3 \times 100}{4 \times 3}$$

BOR = 25% for container terminal II

4.2 The level of adequacy of berths on container terminal

The figure 4.1 shown the level of adequacy of berths on container terminal as data collected and analysed from the feedback or information's provided by respondents and 37.8% of respondents said that the level of adequacy of berths on container terminal is normal and the nearest attributes shown that 31.1% of respondents said that the level of adequacy of berths on container terminal is low.

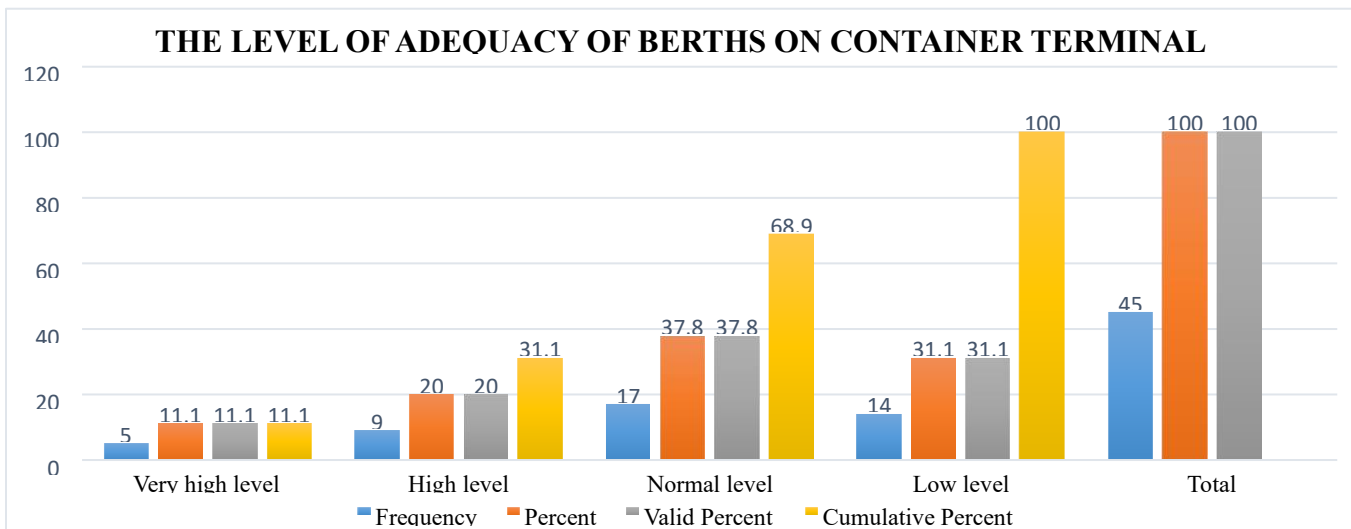


Figure 2 Level of adequacy of berths on container terminal Source: Field data, 2024

The figure 4.2 shown that 60% of respondents their agreed that there some challenges affected the level of adequacy of berths on container terminal at the port of Dar es salaam and those some challenges are increased demand for container shipping, limited space for berth expansion, infrastructure constraints, low level of technology applied in the port of Dar es salaam, limited cargo space, low speed of operators, poor handling equipment's, lack qualified personnel, improper documentation procedure and customs delay.

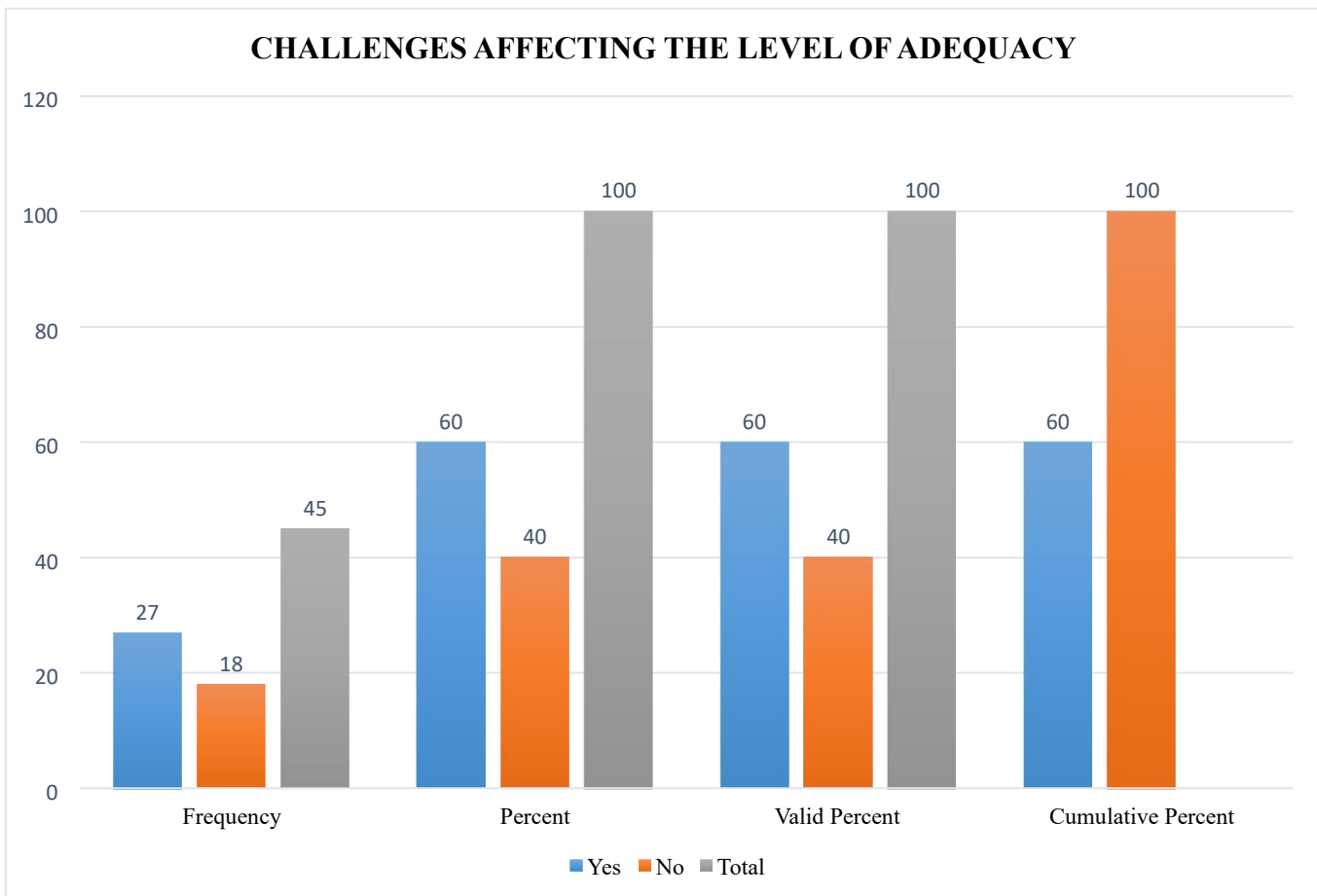


Figure 3 Challenges affecting level of adequacy of berths Source: Field data, 2024

4.3 Discussion on the level of adequacy of berths at the container terminal

In general, any berth on container terminal to be more adequate depends on availability of modern ship berth handling equipment's and berth container handling equipment's in order the berth to be more efficient and accommodate a large cargo as expected and the level of adequacy of berth cannot only be measured in terms of total numbers of berths in the terminal shall also measure the efficiency of berth in terms of berth occupancy and accommodation of cargo at a given time.

In the container terminal there are seven (7) berths which categorized into two terminals; namely container terminal I consist three berths (3) from berth number 5 to 7 with a quay length of 554m and container terminal II consist four (4) berths from berth number 8 to 11 with a quay length of

725m, through this information's indicated that the total number of berths cannot only be a criterion to measure the level of adequacy of berth and berth productivity. There are some criteria to consider in measuring the level of adequacy of berths such as modern terminal equipment's/facilities, sufficient of terminal equipment operators and installation of new technologies.

The findings in the figure 4.1 shown 37.8% of the respondents said that the adequacy of berth on container terminal is normal due to that the berths are still handling the cargo coming in/out as we know always the seaport is the gateway of cargo from inn/outside of the country so berths on container terminal it still performed the key role of cargo gateway and researcher observed that the normal level of adequacy at berth is contributed by a container terminal II which previous was operated by TICTS and currently operated by new company due to presence of modern terminal equipment/facilities and terminal operators compared to container terminal I which operated by TPA.

31.1% of respondents said that there is a low level of adequacy of berths on container terminal at the port of Dar es salaam they argued that the container terminal it's not performed well as expected due to long ship turnaround time, ship anchorage congestion, cargo congestion, less container handling equipment's and underperformance of terminal equipment's. This contributed by lack of enough terminal equipment/facilities at container terminal I which consisting berth number 5, 6 and 7 were operated by TPA compared to container terminal II which consisting the berth number 8, 9, 10 and 11 which have a reasonable terminal equipment's where previous and currently operated by private entity.

The findings in the figure 4.2 shown 60% of respondents agreed that there some challenges affected the level of adequacy of berths on container terminal at the port of Dar es salaam and those challenges are increased demand for container shipping, limited space for berth expansion, infrastructure constraints, low level of technology applied in the port of Dar es salaam, limited cargo space, low speed of operators, poor handling equipment's, lack qualified personnel, improper documentation procedure and customs delay all those challenges they affected the level of adequacy of berths and terminal productivity.

researcher observed that those challenges are more facing the container terminal I which operated by TPA due to absence of serious terminal investment in terms of terminal equipment/facilities and installation of new technologies which leads to inadequate of berths as well as causing container terminal congestion.

5. Conclusion

Based on the results of the study it can be concluded that the level of adequacy of berths on container terminal at the port of Dar es salaam is normal as findings shown in the figure 4.1 and the container terminal had seven (7) berths but also the equation 1 shows a berth occupancy rate of terminal I is 33.3% and terminal II is 25% which

indicated that the berths are more efficient due to that is less than 60% as per Tanzania maritime transport regulator benchmark.

The adequacy of berths cannot only be measured in terms of total number of berths instead of that there are some factors to be considered in establishing the level of adequacy of berths such as terminal equipment's/facilities, applied technology, terminal equipment/facility operators, documentation procedures and hinterland connectivity from the terminal area.

The study recommends that in order the berths to be more adequate there is need of serious investment of new technology in terms of terminal equipment's/facilities, improved hinterland connectivity, proper documentation procedure with full automated system and sufficient of terminal equipment operators because the level of adequacy of berths cannot only measured in terms of higher total number of berths on container terminal.

Acknowledgement

The author wishes to acknowledge a supervisor Dr. Lucas Pastory Mwisila for his good contribution of ideas and academic supports as well as Dar es Salaam Maritime Institute (DMI) for its readiness in publishing this work.

References

- Akakura, Y. (2023). Analysis of offshore waiting at world container terminals and estimation of CO₂ emissions from waiting ships. *Journal of Asian transport studies*.
- Bank of Tanzania. (2018). the terminals of Dar es Salaam port were expanded through maritime gate way projects that involve deepening and expansion of berth and channels.
- Claudio, F, Alessio, T (2019). Economic Role of Transport Infrastructure.
- Fan, L., Wilson, W. W., & Dahl, B. (2019). Congestion, port expansion and spatial completion for US container imports. *Transportation Research Part E: Logistics and Transportation Review*, 48(6), 1121-1136.
- Gidado, U. (2015). Consequences of port congestion on logistics and supply chain in African ports. *Developing Country Studies*, 5(6), 160-167.
- Jeh, J., Nam, J., Sim, M., Kim, Y., & Shin, Y. (2022). A study on the efficiency analysis of global terminal operators based on the operation characteristics. *Sustainability*, 14(1), 536
- Jonas, W. (2016). Design Research and its Meaning to the methodological development of the discipline. *Design research now*, 187 – 206.

- Kiani, M., Sayareh, J., & Nooramin, S. (2017). A simulation framework for optimizing truck congestions in marine terminals. *Journal of Maritime Research*, 7(1), 55-70.
- Layaa, J., & Dullaert, W. (2014). Measuring and analysing terminal capacity in East Africa: The case of the seaport of Dar es Salaam. *Maritime Economics and Logistics*, 16(2), 141164.
- Magibho, M. (2017) *Analysis on the Effect of Port Congestion on Port Performance: Case Study of Dar es Salaam Port*. Master's thesis, The Open University of Tanzania.
- Maneno, F, H. (2019). Assessment of factors causing port congestion. Case study of Dar es Salaam port, *journal of Logistics and Management* 11(2), 45–57.
- Mlimbila, J., & Mbamba, U. O. (2018). The role of information systems usage in enhancing port logistics performance: evidence from the Dar es Salaam port, Tanzania. *Journal of Shipping and Trade*, 3(1), 10.
- Mwendapole, M. J. (2015). Analysis on the Factors Contributing to Poor Seaport Performance in Tanzania: Case Study of Dar es Salaam Port, Unpublished Doctoral dissertation, The Open University of Tanzania, Dar es Salaam Tanzania.
- Ngangaji, N, F. (2019). The study of assessing efficiency of the dedicated container terminals in major East African ports using Data Envelopment Analysis. World Maritime University.
- Onyema, H., Kelechi, O., Polycarp, O., Uchenna, M., Emeghara, G. C. (2015). The impact of port congestion on the Nigeria Economy. *International Journal of scientific research and management (USRM,)* 3(7) 3431-3437.
- Sislioglu, M. (2018). A simulation model proposal to improve the productivity of container terminal operations through investment alternatives. *Journal of maritime policy and management*.
- UNCTAD. (2018). Review of Maritime Transport 2018. United Nations Conference on Trade and Development.