

# **ANALYZING THE CAUSES OF SHIP CONGESTION AT DAR ES SALAAM PORT, TANZANIA**

**Sylvester N. Joka, Benjamin Mbeba Meli and John K. Mwita**

<sup>1</sup>Tanzania Port Authority, P.O. Box 9184, Dar es Salaam, Tanzania, East Africa

<sup>2</sup>Department of Science and Management, Dar es Salaam Maritime Institute, P.O. Box 6727, Dar es Salaam, Tanzania, East Africa

<sup>3</sup>Department of Transport and Nautical Sciences, Dar es Salaam Maritime Institute, P.O. Box 6727, Dar es Salaam, Tanzania, East Africa

## **Abstract**

This paper utilizes data from a study which was conducted at Dar es Salaam Port in Tanzania on evaluation of procedures for ship congestion. The paper employed a descriptive research design to show the contributing factors for ship congestion at Dar es Salaam port. In the first phase, data were collected from a sample of 80 respondents by using purposive and simple random sampling. Data were collected through interviews, observations, documentary review, questionnaires, and focus group discussions to show the major factors for ship congestion. The findings of the study revealed there were several problems which to a large extent contributed to ship congestion at Dar es Salaam port. The paper ends by providing recommendations that must be taken into consideration by the Tanzanian government in order to improve the ship congestion and to bring good health to both local and foreigner investors.

**Keywords:** Risk Management, Ship Congestion, vessels traffic, terminal overbooked and Decongestion process.

## **1. Introduction**

Ship congestion is one of the serious problems of many ports around the world. This problem hinders efficient trade facilitation and economic development (Lobson, 2019). However, because of the increase of international trade, ships are bigger in size and volume which become more challenging to many ports around the world. Furthermore, many ports failed to handle many ships of different size due to nature of infrastructure available as explained by (Bryan, 2021). Hence this study evaluates the causes of ship congestion at Dar es Salaam port as well as assessing the nature of infrastructure availability on accommodating ships of any large size at the port. Shipping is the key elements in international carriage of goods, thus international trade is highly depending on shipping as means of moving cargo from one place to another. Large percent of the world volume of international trade in goods carried by sea is transported by ships and is even higher in most developing countries (UNCTAD, 2020). The development of international trade has created high demands of shipping which has leads to new specialization economic of scale to accommodate different types of cargo and transport them faster over a long distance with minimal cost per tonnage (Michael, 2017).

The increase of international trade and shipping goes hand to hand with the development of sea ports for efficient loading and unloading of cargo from the ship's ports (Gyan, 2017). The ports must operate in an efficient way by having enough space to accommodate many ships at a time including having quality berth, modern technological handling equipment, enough skilled manpower, storage facilities, good infrastructure and efficient handling of documentation process (Mike, 2019). The efficiency operations of a port is important for port performance as well as for competitive advantages, it is expressed by the theory of providing good services that are expected by the customer and ship owners (Petter, 2018). The number of ships saved at the port should be directly with quality of port facilities including quality of port infrastructure including railway, roads, berth capacity (James, 2020). Ships congestion in African ports are associated with delays, queuing and long dwell time of ships and cargo at the port, which always have problems in transport, logistics and supply chain (Claire, 2018). These issues often cause extra cost, loss of trade and disruption of trade and transport agreements, in some cases the causes of ship congestion in African port like Dar es Salaam port in Tanzania, Mombasa in Kenya, Durban in South Africa, Lagos in Nigeria, the notable indicators include cargo dwell time, operational dwell time, storage dwell time and documentation process (McGrew, 2018). However, the type and dimension of causative for ship congestion differ from port to port, typically causes of ship congestion in African ports includes bad weather that stops ships or cargo operations, accidents that could suddenly damage port equipment as well as the nature of the entrance channel that determines the size and volume of the ships to enter the port (Steve, 2017). In some African port like Dar es Salaam port has a narrow entrance channel that leads to limit only ship with small and middle size to enter the port by requesting berth space and resulting in queuing at the anchorage for berths request (Michael, 2018). The Dar es Salaam port is located in Tanzania and is established by the Tanzania ports authorities Act of 2004. It is the main port of the united republic of Tanzania, handling cargo from landlocked countries and lake regions including Zambia, Malawi, Burundi, Democratic republic of Congo and Rwanda. Currently the port handles about 16 million of tons of cargo per year (TPA handbook, 2019). Due to the interconnections of many nearby countries that depends on Dar es Salaam port, mostly ships enters Dar es Salaam port even though cargoes are transported to another countries, hence the port needs to have high performance in order to ship congestion, avoiding

accumulations of ships at the port due to delay of cargo loading and unloading at the port (Lena, 2017).



Figure. 1.1: Shows congestion at Dar es Salaam Port (Source: *TPA handbook*, (2019))

Ship congestion differs in levels due to different in geographical locations, weather conditions, ports facilities and their government policies (Drainer, 2016). Examples Mombasa port accommodate largest ship of any size and any volume to enter the port compared to Dar es salaam port where there is a narrow entrance channel which only allow small and middle ships to enter the port and limited of berth, with this reasons Dar es salaam port suffers mostly with ships congestions compared to Mombasa port since mostly ships accumulates at the anchorage requesting for berth positions (Harnold, 2019).

Dar es Salaam port faced with ship congestion due to delay of documentations process, emergence of narrow entrance channel, berth capacity and poor of port facilities (Technological equipment, transport and communication system, poor cargo handling equipment) ships turnaround time and berth waiting time (TPA handbook, 2018). Currently the port lunch the program of widening and deepening of the entrance channel in order to allow most ships of any size and any volume to enter the port and also to solve the challenges of ships congestion. (TPA handbook, 2019).

According to Green (2017) describes several factors leading to ship congestion by looking on the availability of port facilities including enough berth, operations equipment's, infrastructure availability as well as presence of skilled port workers and automated system for enhancing operations by looking on those factors, the current study evaluate the availability and efficiency operation at the port of Dar es salaam on avoiding ship congestion.

By evaluating causes and the impacts, the researcher address on the appropriate solutions on how port of Dar es Salaam improves on those identified factors that leads to ship congestion at the Dar es Salaam ports and providing

recommendations on what should be done to avoid ship congestion (Bryan, 2021). From the current situation at the Dar es Salaam port regarding ship congestion, there is need for studying more the contributing factors towards ship congestion at Dar es Salaam port in Tanzania.

## **2.1 Definitions of the Key Terms**

### **2.1.1 Port**

Port means a maritime facility comprising one or more wharves or loading areas, where ships or vessels load or discharges cargoes and passengers (Wayne, 2017). Although usually situated on seacoast, ports can also be found far in land, these access the sea via river or canals.

In this study port means a place where ships and other marine vessels berth for loading or unloading of cargoes comprising facilities like storage and warehousing, transportation facilities and other operations regarding cargo handling activities.

### **2.1.2 Congestion**

Congestion refers to a state of excessive demand for port services and infrastructure that surpasses the available capacity. It can result in delays, inefficiencies, and disruptions in the movement of vessels, cargo, and goods within the port. (Calder, 2017).

In this study ship congestions is a major challenges facing Dar es Salaam port and can occur due to various reasons port terminal is booked to more than its capacity, delays caused by bad weather which results in vessels lining up at the anchorage, shortage of port handling equipment, shortage of yard space and complications of documentations process. (Alderton, 2020).

### **2.1.3 Congestion Avoidance**

Congestion avoidance refers to the practices and strategies implemented to mitigate or prevent congestion at ports, which occurs when the volume of goods arriving or departing exceeds the port's capacity to handle them efficiently, this includes infrastructure improvement, optimizing operations and efficiency management of cargo operations (Johnson, 2020).

This study involves evaluations of the strategies and measures taken to prevent or manage congestion-related challenges, specifically at the port of Dar es Salaam. Since the Port of Dar es Salaam is a major gateway for trade in the East African region and handles a significant amount of cargo, making congestion a potential issue that can impact efficiency, turnaround times, and overall port operations (Darton, 2019).

### **2.1.4 Procedures**

Procedures are established sets of actions, steps, and protocols that guide various activities within a port, including vessel handling, cargo processing, customs clearance, and documentation. Effective procedures contribute to streamlined operations and congestion avoidance (James, 2018).

This study involves evaluations of procedures on efficiencies implementations of ship congestions at the port of Dar es Salaam, the Port of Dar es Salaam proactively address congestion challenges and ensure the smooth and efficient movement of goods and cargo, contributing to improved trade flows and economic growth.

## **2.2 Theoretical Review**

According to Johnson (2020), defines a theory as a formulation of the causal relationship between two or more variables, which may or may not have undergone testing. A literature review, also known as a critical literature review, describes benefits and drawbacks of the literature in a particular field that shows familiarity with the state of the field as it relates to the research topic. (Dowd, 2021)

### **2.2.1 Queuing Theory**

Queuing theory is a mathematical framework that studies the behavior of queues or waiting lines. In the context of port congestion, this theory help to analyze the relationship between vessel arrivals, berth utilization, and waiting times. By analyzing queuing systems, the port identifies potential bottlenecks and assess the impact of different congestion avoidance procedures on reducing waiting times and improving efficiency by addressing on the improvement of infrastructure, efficiency cargo handling equipment and availability of berth capacity (Chung, 2021).

In this study, queuing theory explores the dynamics of queues and waiting lines. When it comes to port congestion this theory allows us to delve into the connection, between vessel arrivals, utilization and waiting times. By studying and analyzing queuing systems the study evaluate the challenges and the needs on how various methods to avoid congestion help to reduce waiting times and enhance efficiency.

### **2.2.2 Risk Management Theory**

Risk management theory was introduced in the late 1970 by John Meyer and Brian Rowan deals with identifying, assessing, and mitigating risks. In the context of ship congestion, various factors such as weather disruptions, labor strikes, or unexpected vessel delays can contribute to ship congestion (Gyan, 2017).

On this study, regarding ship congestion avoidance at the port of Dar es Salaam, risk management theory guides port authorities and stakeholders in understanding and addressing the dynamic and uncertain nature of congestion. By systematically identifying, assessing, and mitigating risks, the port can enhance its ability to respond to challenges effectively, minimize congestion-related disruptions, and maintain smoother operations even in the face of uncertainties.

### **2.2.3 Change Management Theory**

Change management theory focuses on how organizations and individuals adapt to new processes or procedures (Barne, 2016). In the context of this study, understanding how port personnel and stakeholders respond to changes in ship congestion avoidance procedures is important. Applying change management principles can help ensure smooth transitions and effective implementation of the chosen strategies (Gyan, 2017).

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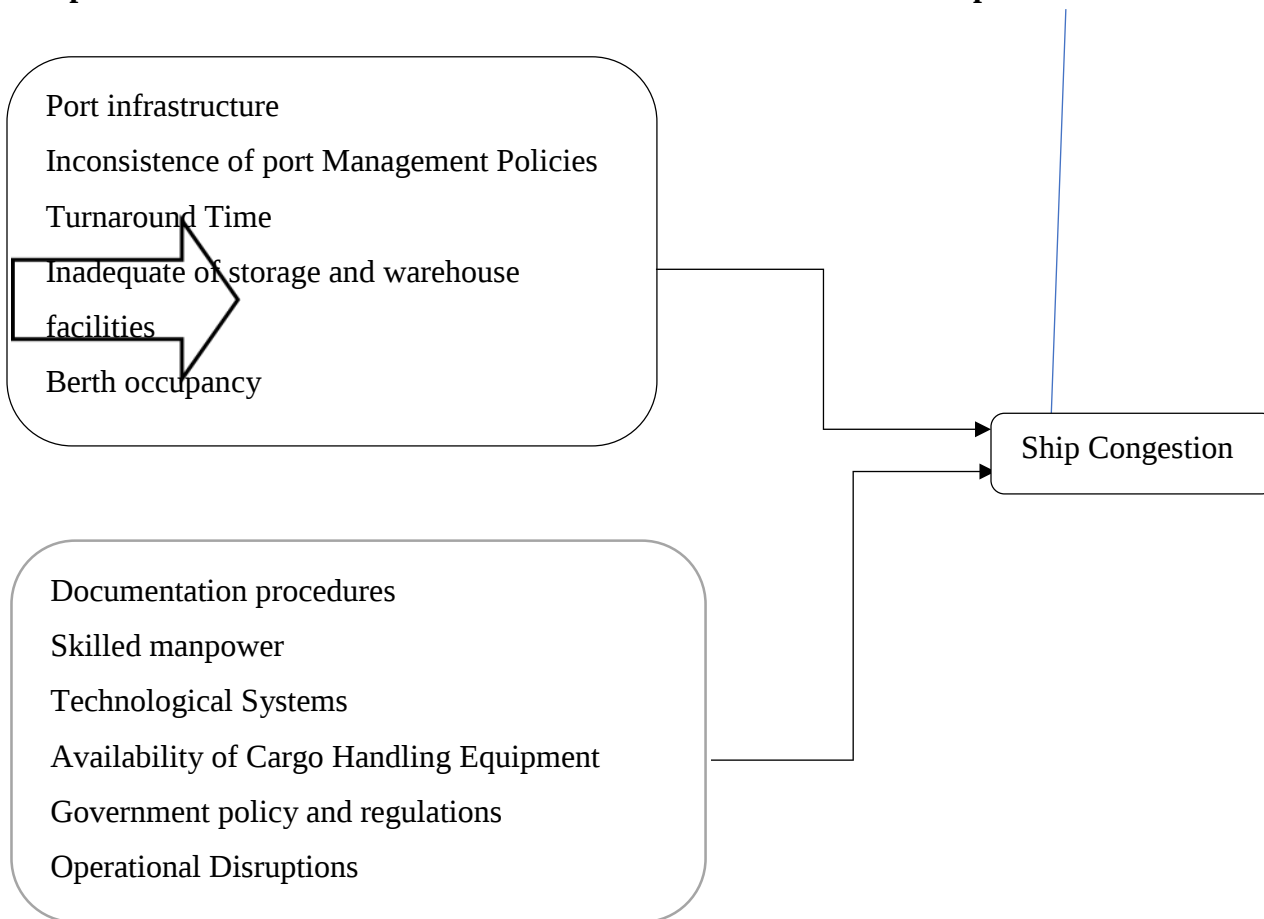
In this study, applying change management theory to ship congestion avoidance at the port of Dar es Salaam helps overcome resistance and ensures a smoother transition to new procedures. By focusing on effective communication, engagement, and collaboration, change management maximizes the likelihood of successful adoption and integration of congestion avoidance strategies.

### 2.3 Conceptual Framework

The projected relationship between variables is portrayed in the conceptual framework of the study, which might be written or visually. Variables are the characteristics or data that you want to study (Braise, 2021).

#### Independent variables

#### Dependent Variables



Source: Researcher, (2024)

### 3.0 Methodology

Primary data were collected using both qualitative and quantitative methods, where secondary data obtained from literature search and review of relevant official documents. The literature review further highlighted the various theories used from the previous study. Two phases of data collection and analysis were conducted. In the first phase, qualitative data based on the contents of the factors contributing to ship congestion at Dar es Salaam port. The second phase of data collection focused on quantifying some variables pertinent issues discussed during the in-depth interview, observation and focus group discussion in order to reveal those factors which acted as a catalyst for ship congestion at Dar es Salaam port.

### 4.0 Findings of the Study

Based on the previous study conducted at Dar Es Salaam port, the paper comes up with the following findings:

#### 4.1 The shortage of skilled manpower

The study revealed that shortage of skilled manpower for cargo operations at ports can significantly contribute to ship congestion by slowing down operations, increasing turnaround times, creating bottlenecks, and limiting overall port capacity. Respondents argue that addressing this shortage through training programs, workforce development initiatives, and strategic planning is essential for mitigating congestion and improving port efficiency.

Table 4.1: Shows the shortage of skilled manpower for cargo operations is among the causes of ship congestion at the port.

| Response        | Number of Respondent (f) | Percentages (%) |
|-----------------|--------------------------|-----------------|
| Strong Disagree | 6                        | 7.5             |
| Disagree        | 10                       | 12.5            |
| Neutral         | 16                       | 20              |
| Agree           | 29                       | 36.3            |
| Strong Agree    | 19                       | 23.7            |
| <b>Total</b>    | <b>80</b>                | <b>100</b>      |

**Source:** *field data, 2024*

Table 4.1 indicates 7.5% of respondents strongly disagree that the shortage of skilled manpower is a cause of ship congestion. This indicates a small but notable proportion of respondents who believe that there is no direct correlation between the shortage of skilled manpower and ship congestion at the port. 12.5% of respondents disagree that the shortage of skilled manpower is a cause of ship congestion. Similar to those who strongly disagree, this group also holds the belief that the shortage of skilled manpower is not a significant factor

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contributing to ship congestion. The largest proportion of respondents, comprising 20%, remain neutral. They neither agree nor disagree, suggesting a lack of strong opinion or uncertainty regarding the impact of skilled manpower shortage on ship congestion. 36.3% of respondents agree that the shortage of skilled manpower contributes to ship congestion. This indicates a significant portion of respondents who acknowledge the correlation between skilled manpower shortage and ship congestion and 23.7% of respondents strongly agree that the shortage of skilled manpower is among the causes of ship congestion. This group represents a respondents who firmly believe in the relationship between skilled manpower shortage and ship congestion.

## Interpretations

It's notable that a combined 60% of respondents either agree or strongly agree that the shortage of skilled manpower contributes to ship congestion. This indicates a belief among a majority of respondents regarding the impact of skilled manpower shortage on port congestion. However, it's also essential to recognize that a notable proportion, totaling 20% (neutral), neither agree nor disagree, indicating some uncertainty among respondents. Overall, the data suggests that while there is acknowledgment of the issue among a significant portion of respondents, there may be varying perspectives on the extent of its impact. Inadequate of berth for ship operations causes ship congestions at the port.

Inadequate berths for ship operations can lead to ship congestion at the port by limiting docking space, increasing waiting times, prolonging turnaround times, disrupting port operations, and imposing economic costs. Respondents argue that addressing this issue requires investments in port infrastructure and expansion projects to increase berth capacity and improve efficiency in ship handling operations.

#### 4.2 Inadequate of berth for ship operations cause's ship congestions at the port

The study showed that inadequate of berth for ship operations cause's ship congestions at the port contributed much to the problem of ship congestion. (See table 4.2 below).

**Table 4.2 Inadequate of berth for ship operations cause's ship congestions at the port**

| <b>Response</b> | <b>Number of Respondent (f)</b> | <b>Percentages (%)</b> |
|-----------------|---------------------------------|------------------------|
| Strong Disagree | 1                               | 1.3                    |
| Disagree        | 4                               | 5                      |
| Neutral         | 3                               | 3.7                    |
| Agree           | 36                              | 45                     |
| Strong Agree    | 36                              | 45                     |
| <b>Total</b>    | <b>80</b>                       | <b>100</b>             |

**Source:** *field data, 2024*

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From Table 4.2 indicates strongly disagree of about 1.3%, a very small proportion of respondents strongly disagree inadequate of berth for ship operations causes ship congestions at the port. This suggests that they believe that inadequate berths are not a significant factor contributing to ship congestion at the port. They may hold the opinion that other factors have a more substantial influence on congestion issues.

About 5% of respondents disagree, a small percentage of respondents disagree that inadequate of berth for ship operations causes ship congestions at the port. While they acknowledge the relationship between inadequate berths and ship congestion, respondents do not believe it to be a significant contributing factor. Respondents argue that there are other primary causes of congestion that need to be addressed.

About 3.7% of the overall respondents are neutral, a small number of respondents remain neutral that inadequate of berth for ship operations causes ship congestions at the port. They neither agree nor disagree with the statement that inadequate of berth for ship operations cause's ship congestions at the port, suggesting a lack of strong opinion or uncertainty regarding the impact of inadequate berths on ship congestion.

Agree 45%, a significant portion of respondents agree that inadequate berths for ship operations cause ship congestion at the port. They recognize the correlation between inadequate berths and congestion issues, indicating that they consider it a significant contributing factor to congestion.

Strongly Agree 45% an equal percentage of respondents strongly agree that inadequate of berth for ship operations causes ship congestions at the port. This group believes that inadequate berths are a primary cause of ship congestion at the port. Respondents emphasize the importance of addressing this issue through investments in port infrastructure and expansion projects to improve efficiency in ship handling operations.

Interpretations.

It's notable that a combined 90% of respondents either agree or strongly agree that inadequate berths for ship operations cause ship congestion. This indicates a belief among a majority of respondents regarding the impact of inadequate berths on congestion issues. However, it's also essential to recognize that a small proportion either disagree or strongly disagree, suggesting some variation in opinion among respondents. Overall, the data suggests a widespread acknowledgment of the significance of addressing inadequate berths to mitigate ship congestion at the port.

Respondents argue that the lack of advanced technological equipment for cargo handling and operations can contribute to ship congestion at the port by reducing efficiency, limiting space utilization, increasing the risk of errors, lack of efficiency communication and coordination. Respondents argue that addressing technological issues for cargo handling and operations at the port requires investments in modernizing port infrastructure and adopting advanced technologies to improve efficiency and reduce congestion.

### 4.3 Poor technological equipment for cargo handling and operations

It was revealed that Poor technological equipment for cargo handling and operations was viewed as the contributing factors to wards ship congestion at Dar es Salaam port. See table 4.4 below.

**Table 4.3: Inadequate of advanced technological equipment for cargo handling and operations**

| Response        | Number of Respondent (f) | Percentages (%) |
|-----------------|--------------------------|-----------------|
| Strong Disagree | 2                        | 2.5             |
| Disagree        | 1                        | 1.3             |
| Neutral         | 3                        | 3.7             |
| Agree           | 39                       | 48.8            |
| Strong Agree    | 35                       | 43.7            |
| <b>Total</b>    | <b>80</b>                | <b>100</b>      |

**Source:** *field data, 2024*

From Table 4.3: Strongly Disagree 2.5%, a small proportion of respondents strongly disagree with the statement. This suggests that they firmly believe that the lack of advanced technological equipment does not significantly contribute to ship congestion at the port. They may argue that other factors play a more dominant role in causing congestion.

Disagree 1.3%, a smaller percentage of respondents disagree with the statement. They hold the opinion that the lack of advanced technological equipment does not contribute to ship congestion. However, their disagreement may not be as strong or definitive as those who strongly disagree.

Neutral 3.7%, small number of respondents remain neutral on the issue. They neither agree nor disagree with the statement, suggesting a lack of strong opinion or uncertainty regarding the impact of inadequate advanced technological equipment on ship congestion. They may require more information or further analysis before forming a definitive stance.

Agree 48.8%, a significant portion of respondents agree that inadequate advanced technological equipment for cargo handling and operations enhances ship congestion at the port. They recognize the correlation between the lack of advanced technological equipment and congestion issues, indicating that they consider it a significant contributing factor to congestion.

Strongly Agree 43.7%, an almost equal percentage of respondents strongly agree with the statement. This group firmly believes that inadequate advanced technological equipment is among the primary causes of ship congestion at the port. They emphasize the importance of addressing this issue through investments in modernizing port infrastructure and adopting advanced technologies.

Interpretation,

A combined 92.5% of respondents either agree or strongly agree that inadequate advanced technological equipment for cargo handling and operations enhances ship congestion. This indicates a prevalent belief among a majority of respondents regarding the impact of inadequate technological equipment on congestion issues. However, it's also essential to recognize that a small proportion either disagree or strongly disagree, suggesting some variation in opinion among respondents. Overall, the data suggests a widespread acknowledgment of the significance of addressing technological issues to mitigate ship congestion at the port

Presence of narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage.

The presence of a narrow entrance channel at the port can lead to ship congestion due to limitations on access, waiting of ships at anchorage areas, increased waiting times, impacts on turnaround times, and navigational challenges. Respondents argue that addressing this issue may require investments in dredging and widening the entrance channel, improving navigational aids, and implementing efficient traffic management strategies to reduce congestion and enhance port operations.

#### 4.4 Narrow entrance channel

The presence of narrow entrance channel within the Dar es Salaam port was revealed in this study as a causal factor for ship congestion. See table 4.4 below.

**Table 4.4 Narrow entrance channel**

| <b>Response</b> | <b>Number of Respondent (f)</b> | <b>Percentages (%)</b> |
|-----------------|---------------------------------|------------------------|
| Strong Disagree | 10                              | 12.5                   |
| Disagree        | 17                              | 21.3                   |
| Neutral         | 10                              | 12.5                   |
| Agree           | 28                              | 35                     |
| Strong Agree    | 15                              | 18.7                   |
| <b>Total</b>    | <b>80</b>                       | <b>100</b>             |

**Source:** *field data, 2024*

Table 4.4 indicates respondent's responses where 10 respondents strongly disagree equal to 12.5%, a proportion of respondents strongly disagree that narrow entrance channel cause's ship congestion at the port due to limitations and waiting of ships at the anchorage. This suggests that respondents believe that the presence of a narrow entrance channel does not significantly contribute to ship congestion at the port.

17 respondents equal to 21.3% disagree, a significant percentage of respondents disagree with narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage. Respondents

hold the opinion that the presence of a narrow entrance channel does not cause ship congestion. However, their disagreement may not be as strong as those who strongly disagree.

Neutral 12.5% equals to 10 respondents remain neutral that narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage. Respondents neither agree nor disagree with narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage, suggesting a lack of strong opinion or uncertainty regarding the impact of a narrow entrance channel on ship congestion.

28 respondent's equals to 35% agree that narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage. The largest portion of respondents agree that the presence of a narrow entrance channel causes ship congestion at the port. Respondents recognize the correlation between the narrow entrance channel and congestion issues, indicating that they consider it a significant contributing factor to congestion.

15 respondents equal to 18.7% strongly agree that narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage. A significant percentage of respondents strongly agree with that narrow entrance channel causes ship congestion at the port due to limitations and waiting of ships at the anchorage. This group believes that the presence of a narrow entrance channel is among the primary causes of ship congestion at the port. They emphasize the importance of addressing this issue through investments in dredging, widening the entrance channel, improving navigational aids, and implementing efficient traffic management strategies.

#### Interpretation

A combined 53.7% of respondents either disagree or strongly disagree that the presence of a narrow entrance channel causes ship congestion. This suggests that there is a significant proportion of respondents who do not believe in the correlation between the narrow entrance channel and congestion issues. However, a majority of respondents either agree or strongly agree, indicating a belief among them regarding the impact of a narrow entrance channel on congestion. Overall, the data suggests some variation in opinion among respondents, but a considerable number recognize the importance of addressing this issue to mitigate ship congestion at the port.

Availability of quality berth Capacity reduces ship congestion at the port.

Respondents argue that availability of quality berth capacity reduces ship congestion at the port by providing sufficient docking space, facilitating efficient turnaround times, optimizing port operations, enhancing port productivity, and attracting shipping lines. Investing in and maintaining quality berth infrastructure is essential for mitigating congestion and ensuring efficient port performances.

#### **4.5 Lack of quality technology and information systems**

Quality technology in shipping industry is the corner stone for shipping success. The study revealed that there was outdated technology at Dar s Salaam which to a large extent contributed to ship congestion. See table 4.5 below. From table 4.5 indicates a significant majority of respondents, totaling 76 out of 80 (95%), either agreed or strongly agreed that lack of quality technology and information systems reduces ship congestion at the port. This indicates a belief among the respondents that the availability of quality technology and information systems indeed reduces ship congestion at ports. Where only 4 respondents (5%) expressed disagreement, this suggests a minor opposing opinion among the respondents. A portion of respondents (45%) strongly agree that Availability of quality technology and information systems reduces ship congestion at the port, indicating a strong agreement on the relationship between technology and information systems and congestion reduction. 2 respondents (2.5%) remained neutral, indicating a small number of respondents who did not have a strong opinion.

##### **Interpretation**

The majority of respondents agree or strongly agree that the availability of quality technology and information systems reduces ship congestion at ports. This aligns with the understanding that modern technology plays a crucial role in optimizing port operations, enhancing efficiency, and mitigating congestion.

While the majority of respondents agree that availability of quality technology and information systems reduces ship congestion at the port, there are still a few who express disagreement or neutrality. This could be due to various factors such as the effectiveness of technology, concerns about implementation challenges, or limited experience with advanced technology solutions in port operations.

Overall, the data suggests a strong opinion among the respondents regarding the positive impact of quality technology and information systems on reducing ship congestion at ports. This shows the importance of investing in technological advancements to address congestion issues and improve overall port efficiency.

Efficiency and condition of cargo handling equipment increases performance of the port and hence reduces ship congestion.

The efficiency and condition of cargo handling equipment are critical factors in determining the performance of a port and its ability to reduce ship congestion. Investing in modern equipment, maintenance, technology integration, and operational optimization can significantly enhance port efficiency, increase throughput capacity, and mitigate congestion effectively.

Furthermore, the study also showed several factors which played a major role for ship congestion. These factors are summarized as follows:

- Management bureaucracy
- Lack shipping training among the workers and ship owners
- Lack of infrastructure

- Poor dredging system
- Corruption for releasing ship luggage
- Lack of political will and vision of government leaders.

These factors above were causing at large ship congestion at Dar es Salaam port. It was revealed in this study that Respondents agree that insufficient infrastructure results in ship congestion, such as inadequate berths, limited quay lengths, or shallow water depths, can restrict the port's ability to accommodate a large volume of ships simultaneously. Respondents argue that this limitation leads to congestion as vessels may have to wait in line for available berths.

Inefficient cargo handling processes, including slow loading and unloading operations, can contribute significantly to congestion. Factors such as manual cargo handling, outdated equipment, or insufficient manpower can prolong the turnaround time of ships, leading to delays and congestion at the port.

Ineffective port management and operations, ineffective port management practices, such as inadequate planning, scheduling, and coordination among terminal operators, shipping lines, and other stakeholders, can exacerbate congestion. Lack of proactive measures to manage vessel arrivals, optimize berth utilization, and streamline port operations can result in bottlenecks and congestion.

Port access and connectivity issues, challenges related to port access and connectivity, such as inadequate road and rail infrastructure linking the port to inland destinations, can contribute to congestion. Delays in cargo movement to and from the port due to traffic congestion, poor road conditions, or limited rail capacity can result in vessels waiting to be serviced.

Administrative and regulatory framework, administrative and regulatory framework, including complications in customs clearance procedures, and regulatory compliance issues, reduces the smooth flow of cargo and vessels through the port. Delays in obtaining necessary permits, inspections, or documentation can prolong processing times and contribute to congestion at the port.

Respondents suggests that addressing these causes of ship congestion requires comprehensive strategies, including investments in port infrastructure, optimization of cargo handling processes, improvements in port management practices, enhancement of port access and connectivity, and streamlining of administrative and regulatory procedures.

## **5. Recommendations**

Based on this study, the paper ends over by providing the following recommendations to be done seriously by the Tanzanian government in order to improve the situation as follows:

- To increase channel Depth and Width in order to facilitate ship movement
- To increase navigational Aids to safe guard ship movement
- Improvement of Port Equipment and Technology to enhance ship performance

- Establishment of supportive regulatory framework • Implementations of quality technologies
- Environmental Considerations.

Regarding the appropriate measures for Tanzania Port Authority to avoid ship congestion at the port of Dar es Salaam. Infrastructure Development involves expanding and improving the physical infrastructure of the port, including berths, terminals, storage facilities, and transportation networks (roads, railways). By investing in infrastructure development, the port can accommodate more vessels and handle larger cargo volumes efficiently, reducing congestion.

Establishment of supportive regulatory framework, creating a regulatory framework that supports efficient port operations is crucial. This framework should include clear guidelines, regulations, and standards for port activities, customs procedures, and maritime safety. It helps to streamline processes, ensure compliance, and facilitate smooth operations, thereby minimizing congestion.

Implementation of quality technologies, utilizing modern and high-quality technologies such as port management systems, cargo tracking systems, and automated handling equipment can significantly improve operational efficiency. These technologies streamline processes, reduce human error, and optimize resource utilization, ultimately contributing to congestion avoidance.

Environmental Considerations, ports have a significant environmental impact, including pollution, habitat destruction, and ecosystem degradation. Implementing environmentally sustainable practices such as waste management, pollution control measures, and habitat conservation helps minimize these impacts. By prioritizing environmental considerations, the port can operate responsibly and maintain its long-term viability while avoiding congestion due to environmental issues.

Implementation of affordable investment strategies, port development and expansion require substantial investment. Implementing affordable investment strategies involves prioritizing projects based on their cost-effectiveness and potential to reduce congestion. This may include phased development, public-private partnerships, and seeking funding from international development agencies. By choosing cost-effective investment strategies, the port can maximize its capacity and efficiency while minimizing financial problems.

Overall, these measures aim to enhance the capacity, efficiency, and sustainability of the port of Dar es Salaam, minimizing ship congestion and ensuring smooth and reliable operations.

## **6. Conclusion of the Paper**

In conclusion, the factors contributing to ship congestion are multifaceted and interconnected, involving issues ranging from infrastructure limitations and operational inefficiencies to regulatory challenges and market dynamics. Addressing ship congestion requires a holistic approach that involves collaboration among stakeholders, investment in infrastructure upgrades, implementation of efficient port operations, and adoption of

innovative technologies. By mitigating these factors collectively, the maritime industry can effectively manage and reduce ship congestion, ensuring smoother and more efficient global trade operations for the future.

## 7. References

- Alderton, R. (2020). Application of Queuing theory to ship congestion problem in Nigeria. *European Journal of Business and Management*, 3(8). ISSN 2520-2979 *Journal of Sustainable Development of Transport and Logistics*, 3(1), 2018 < 82 >
- Amole, B. (2017). The productivity of Multipurpose Seaport Terminals, *Transportation Science*, 38: 224–234 10.
- Adebiyi, K. (2017). Port system simulation facility with an optimization capability. *International Journal of Computational Intelligence and Applications*, 3(4): 395-410.
- Andersen, A. (2018). Ship-berth link performance evaluation: Simulation and analytical approaches. *Maritime Police & Management*, 33(3): 281- 299.
- Bichou, N. (2018). Simulation modeling of ship berth link with priority service. *Maritime Economics & Logistics* 7:316 – 335.
- Brian, M. (2017), The terminals of Dar es Salaam port were expanded through maritime gate way projects that involve deepening and expansion of berth and channels.
- Braise, H. (2020). Approximate Queuing Models for Analyzing Terminal Operations”, *Transportation Research*, 21(4), 269 – 286.
- Braise, H. (2018). *Concept and principles of research design and development*, 3<sup>rd</sup> Ed, McGraw publishers. USA.
- Banadies, B. (2017). *Data collection methodologies-Introduction of documentary review*, 2<sup>nd</sup> Edition. Nairobi Kenya publishers.
- Bougie, E. (2019). Congestion, port expansion and spatial competition for US container imports. *Transportation Research Part E: Logistics and Transportation Review*, 48(6), 1121-1136.

- Calder, P. (2017). Consequences of ship congestion on logistics and supply chain in African ports. *Developing Country Studies*, 5(6), 160-167.
- Cohen, F (2019). *Concept of research design and its methodologies*. 3<sup>rd</sup> Ed, Kenyan publisher Nairobi.
- Chung, K. (2021). Analysis of marine container terminal gate congestion, truck waiting cost, and system optimization.
- Chang, J. (2018). Structure and operations in the liner shipping industry. *Handbook of transport modeling*. Pergamon-Elsevier Science, 761-775.
- Calder, J. (2016). A topographical approach to infrastructure: Political topography, topology and the port of Dar es Salaam. *Environment and Planning D: Society and Space*, 35(6), 1076-1095.
- Dowd, I. (2021). Internalization of ship congestion: strategic effect behind shipping line delays and implications for terminal charges and investment. *Maritime Policy & Management*, 44(1), 112-130.
- Draney, B. (2017). Investigation of port capacity under a new approach by computer simulation. *Computers & Industrial Engineering*, 42(2-4), 533-540.
- Golders, G. (2017). A simulation framework for optimizing truck congestions in marine terminals. *Journal of Maritime Research*, 7(1), 55-70.
- Harnold, Y. (2019). National Reports of Measurement of Port Proper Handling Capacity, the Ministry of Oceans and Fisheries
- Hamster, J. (2019). *Research Methods for Business students*, London: Pearson Education
- Hamad, S. (2018). Measuring and analyzing terminal capacity in East Africa: The case of the seaport of Dar es Salaam. *Maritime Economics & Logistics*, 16(2), 141-164.
- Isik, C. (2018). An efficiency / effectiveness approach to Logistics Performance Analysis, *Journal of Business Logistics*, 12(1): 33 62.
- Johnson, U. (2020). Simulation of a multiterminal system of container handling. In *Container Terminals and Cargo*, pp. 15–36, ISBN 978-3-540-49549-9, Springer, New York.

- Janos, H. (2020). Impact of privatization on port efficiency and effectiveness: results from Panama and US ports. *Maritime Policy & Management*, 40(2), 100-115.
- Jansson, E. (2019). Intermodal container flows in a port system network. Analysis of possible growths via simulation models. *International journal of production economics*, 97(1), 75-88.
- James, H. (2020). *Port Handbook for Estimating Marine Terminal Cargo Handling Capability*, U.S. Department of Transportation Maritime Administration.
- Jean, O. (2019). Why does cargo spend weeks in subSaharan African ports: lessons from six countries? World Bank, Washington, U
- Jones, R. (2020). The terminalization of supply chains: reassessing the role of terminals in port/hinterland logistical relationships. *Maritime Policy & Management*, 36(2), 165-183.
- Konrad, T. (2017). Governance mode for ship congestion mitigation: A transaction cost perspective. *NETNOMICS: Economic Research and Electronic Networking*, 19(3), 159-178.
- Kothari, O. (2018). *Fundamental concepts on Data Processing and Analysis*. Research guide 3<sup>rd</sup> Edition. Nigeria.
- Kaplan, O. (2018). Correlate of Port Productivity components in Tin Can Island Port, Apapa, Lagos. *European Journal of Business and Social Sciences*, 4(01), 227-240.
- Lena, L. (2017). A competitive analysis of Chinese container ports using the analytic hierarchy process. *Maritime Economics & Logistics*, 6(1), 34-52.
- Maxwell, K. (2018). Consequences of ship congestion on Logistics and supply chain in African ports. *Developing Country Studies*, 5(6), 8-28.
- Michael, A. (2017). A study on the estimation model of the proper cargo handling capacity based on simulation in port - port cargo exclusive pier example-,” *Journal of the Korea Institute of Information and Communication Engineering*, pp.2454-2460
- Mike, B. (2019). Research Report of Calculation of Proper Handling Capacity per Item on Specialization Berth, Tong Myung University.

- McGrew, R. (2018). Congestion and Port Development: Issues and Challenges. Leadership Newspaper, Nov7. UNCTAD - Port Performance Indicators – TB/B/C.4/131/Supp.1/Rev 1. Retrieved from [www.freshfruitportal.com](http://www.freshfruitportal.com)
- Michael, T. (2018). Consequences of ship congestion on Logistics and supply chain in African ports. *Developing Country Studies*, 5(6),8-28
- Oyaloye, (2018). Application of Queuing theory to ship congestion problem in Nigeria.
- Okoyee, D. (2021). A review of port authority functions: towards a renaissance?. *Maritime Policy & Management*, 37(3), 247-270.
- Rigot, Z. (2018). Urban road congestion, capacity expansion and port competition: an empirical analysis of US container ports. *Maritime Policy & Management*, 40(5), 417-438.
- Samson, L. (2020). Tanzanian coastal and inland ports and shipping: crises and policy options. *Maritime Policy & Management*, 31(2), 157-171.
- Smith, D. (2017). *Validity and Reliability concepts of data analysis*. University press publishers, Bangladesh.
- Shnearson, G. (2019). Evaluation of the marine traffic congestion of north harbor in busan port. *Journal of waterway, port, coastal, and ocean engineering*, 133(2), 87-93.
- TPA handbook, (2019). A simulation model for container-terminal operation analysis using an object-oriented approach. *International Journal of Production Economics*, 59(1-3), 221-230.
- The National Bureau of Economic Research (2019). Congestion and Port Development: Issues and Challenges. Leadership Newspaper, Nov 7. UNCTAD - Port Performance Indicators – TB/B/C.4/131/Supp.1/Rev 1. Retrieved from [www.freshfruitportal.com](http://www.freshfruitportal.com)
- The World Bank, (2020). *Reeds Sea Transport Operations and Economics*, 5<sup>th</sup> Ed. London: Thomas Reed Publications.
- United Nations, (2019). *A logistics and supply chain approach to port performance measurement Maritime policy Management, Maritime Policy and Management*, 31(1): 47–67.

- UNCTAD, (2020). *Ports operations performance in transport and cargo handling services*. 2<sup>nd</sup> Ed, University press publishers, Kampala.
- Wayne, A. (2017). *Effects of globalization on port facility improvements in ports*. 1<sup>st</sup> Ed, Mombasa publishers.
- World Bank, (2019). *Analysis of Marine Container Terminal Gate Congestion, Truck Waiting Cost and System Optimization*. New Jersey Institute of Technology.