

Time Schedule On The Performance Of Dar ES Salaam Port

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ABSTRACT

This study aims to assess the role of time scheduling in shaping the operational performance of Dar es Salaam port. The purpose of this research was to assess how the time related factors influence the performance of Dar es Salaam port. The main objective was to assess the time schedule factors on the overall performance of Dar es Salaam port. The study employed cross sectional research design with various approaches. Primary data were collected through structured questionnaires and interviews of 68 port stakeholders were selected through purposive sampling due to the fact that the study seeks participants who possess an understanding of matters pertaining to port management and operation at Dar es Salaam port. Data collected through SPSS 20 software and analysed by descriptive statistics and econometric analysis, whereby the researcher involved the use of frequency distribution tables. For the case of econometric analysis, multinomial logistic regression model was employed to show the magnitudes and direction for determine the time schedule factors influencing performance at Dar es Salaam port. The study finding shows that Docking time, port operating hours, Availability Handling equipment on schedule, Frequency of port congestion Event, Truck scheduling Efficiency, customs clearance time, Weather related scheduled delays was statistically significant on influencing port performance at Dar es Salaam port. Descriptive analysis revealed the effects of ship waiting time on the performance at Dar es Salaam port such as port congestion increase turnaround time, high operational cost, reduce throughput and efficiency, loss of competitiveness, customer dissatisfaction, strain on infrastructure and negative economic impact. Also revealed the impact of port operational time schedule on the efficiency of cargo handling at Dar es salaam port such as minimization of turnaround time, improve resources allocation, reduce congestion and delays, enhance coordination and communication and increase customer satisfaction and throughput. In conclusion, the findings suggest that efficient time schedule is critical determinant of port performance operations. The study recommends that Dar es salaam port should streamline docking and cargo handling procedures by implement real time tracking and berth allocation systems, ensure availability of handling equipment as per schedule by maintain strict equipment servicing schedules to avoid breakdowns during critical periods, implement weather responsive scheduling mechanisms by install advanced weather monitoring systems to predict weather related delays and plan accordingly.

Keywords: Port Performance, Time Scheduling, ship waiting time Management, Cargo Handling Efficiency

1. INTRODUCTION

Efficient port operations are a cornerstone of global trade, underpinning the smooth flow of goods across international supply chains. Ports serve as critical nodes for import and export activities, and their performance significantly influences trade competitiveness, logistics costs, and economic development (International Chamber of Shipping, 2020; UNCTAD, 2020). In this context, time has emerged as a decisive factor in port efficiency, affecting vessel turnaround, cargo handling, and overall operational flow (Rodrigue, 2020). Technological advancements such as automation, predictive analytics, and real-time port management systems have revolutionized port operations globally. However, many African ports, including Dar es Salaam Port, continue to struggle with delays, congestion, and outdated infrastructure, leading to reduced efficiency and economic losses (Asariotis et al., 2017).

The Port of Dar es Salaam, managed by the Tanzania Ports Authority (TPA), is one of East Africa's busiest and most strategically significant seaports, serving not only Tanzania but also landlocked neighboring countries such as Zambia, Malawi, Rwanda, Burundi, and the Democratic Republic of Congo (World Bank, 2020). Despite its strategic importance, the port suffers from prolonged vessel

waiting times, inefficient cargo clearance procedures, and logistical bottlenecks that negatively impact its performance and regional trade competitiveness (Benamara et al., 2019; Kombo & Mhando, 2020). The World Bank's 2022 port performance index ranked Tanzania's efficiency among the lowest globally, placing Dar es Salaam 150th with a median ship stay of 6.48 days—far behind global leaders such as Japan and Germany, with average stays of less than one day (UNCTAD, 2022).

The problem addressed in this study centers on the inadequate time scheduling and its impact on port performance. Poor time management at the port leads to increased turnaround times, higher operational costs, and reduced competitiveness. A World Bank report estimated financial losses of over \$252 million to shippers and shipping lines, and over \$157 million in revenue losses to TPA and TRA due to delays and inefficiencies in port operations (World Bank, 2020). These challenges highlight the urgency of adopting effective time management frameworks that align with global standards.

The main objective of this research is to assess the impact of time scheduling on the performance of Dar es Salaam Port. Through addressing this objective, the study aims to contribute to the improvement of time-based decision-making in port operations. It also seeks to bridge the existing research gap by integrating both theoretical and empirical insights specific to the Dar es Salaam context. Ultimately, the study is intended to support port authorities, policymakers, and stakeholders in enhancing operational efficiency, promoting competitiveness, and facilitating smoother trade flows in the region.

2.0 METHODOLOGY

This study employed a cross-sectional research design to evaluate the influence of time scheduling on the performance of the Dar es Salaam Port. This design facilitated the collection of data at a single point in time, enabling the researcher to capture a comprehensive snapshot of time schedule-related factors affecting port operations efficiently and cost-effectively.

The research was conducted at the Tanzania Ports Authority (TPA) in the Dar es Salaam region Tanzania's principal port and a strategic hub for both national and regional trade. The target population comprised TPA and TRA employees, clearing and forwarding agents, and port users. A purposive sampling technique was adopted to select 68 respondents with direct knowledge and experience in port operations and cargo management, ensuring relevance and reliability in the data collected.

Primary data was obtained through a combination of structured questionnaires (including both open- and closed-ended items) and semi-structured interviews. These tools enabled the collection of both quantitative and qualitative insights. Data was analyzed using SPSS version 20 for descriptive statistics and STATA 15 for econometric analysis. The latter involved the application of multinomial logistic regression to assess the influence and predictive power of various time schedule factors on port performance.

Key independent variables included: docking time, port operating hours, cargo handling time, weather conditions, port infrastructure, vessel traffic, workforce availability, regulatory environment, and technological adaptability. The dependent variable, port performance, was measured through three indicators: vessel turnaround, cargo handling rate, and cargo dwell time.

To ensure validity, the study utilized statistical tests such as the Hosmer-Lemeshow goodness-of-fit test, while reliability was measured using Cronbach's Alpha, with acceptable thresholds set above 0.7. Ethical considerations were rigorously observed, including informed consent, confidentiality, and voluntary participation, in accordance with academic research standards.

Overall, this methodological approach ensured the generation of robust, valid, and actionable findings that contribute meaningfully to understanding and improving port performance through enhanced time schedule management.

3.0 RESULTS AND DISCUSSION

3.1 The impact of port operational time schedule on the efficiency of cargo handling at Dar es salaam port.

Table 3.1 impact of port operational time schedule on the efficiency of cargo handling at Dar es Salaam port

Impacts	agree	Disagree	Total
Minimize turnaround time	72.1%	27.9%	100%
Improve resource allocation	79.4%	20.6%	100%
Reduce congestion and delays	89.7%	10.3%	100%
Enhance coordination and communication	83.8%	16.2%	100%
Increase customer satisfaction and throughput	63.2%	36.8%	100%

3.1.1 Minimize turnaround time

Turnaround time is considered as the effects of congestion at Dar es Salaam port, means port operational time schedule on the efficiency of cargo handling at Dar es Salaam port results to reduces turnaround time. Finding from Table 4.13 display that the majority of the respondents 72.1% agreed that port operational time schedule on the efficiency cargo handling at Dar es salaam port results to reduce turnaround time and the findings indicate that 27.9% disagree that port operational time schedule are not impact to reduce turnaround time.

3.1.2 Improve resources allocation

Findings of the study from Table 4.13 indicated that 79.4% agreed that port operational time schedule on the efficiency of cargo handling at Dar es salaam results to improve resources allocation, also findings indicate that 20.6% were disagree that port operational time schedule does not impact on the improve resources allocation on the efficiency of cargo handling at Dar es salaam port at Dar es salaam port.

3.1.3 Reduce congestion and delays

Congestion is considered as one of the challenges that reduce port operational at Dar es Salaam port, thus port operational time schedule on the efficiency of cargo handling at Dar es salaam port results to reduces congestion and delays. Finding from Table 4.13 display that the majority of the respondents 89.7% agreed that port operational time schedule on the efficiency cargo handling at Dar es salaam port results to reduce port congestion and delays and the findings indicate that 10.3% were disagree that port operational time schedule are not impact to reduce port congestion and delays.

3.1.4 Enhance coordination and communication among stakeholders

Findings of the study from Table 4.13 indicated that 83.8% agreed and agreed that port operational time schedule on the efficiency of cargo handling at Dar es salaam results to enhance coordination and communication among the stakeholders, also findings indicate that 16.2% disagree that port operational time schedule does not impact on enhance coordination and communication among stakeholders on the efficiency of cargo handling at Dar es salaam port at Dar es salaam port.

3.1.5 Increase customer satisfaction and throughput

Findings of the study from Table 4.13 indicated that 63.2% agreed that port operational time schedule on the efficiency of cargo handling at Dar es salaam results to increase customer satisfaction and throughput, also findings indicate 36.8% were disagree that port operational time schedule does not impact on the increase customer satisfaction and throughput.

Table 3.2 Summary of the impact of port operational time schedule on the efficiency of cargo handling at Dar es Salaam port

Impacts	N	Mean	Std. Deviation	Rank
Minimize turnaround time	68	1.28	0.452	1 st
Improve resource allocation	68	1.21	0.407	2 nd
Reduce congestion and delays	68	1.10	0.306	3 rd
Coordination and communication	68	1.16	0.371	4 th
Increase customer satisfaction	68	1.37	0.486	5 th

3.2 The time schedule factors influencing performance at Dar es Salaam port.

3.2.1 Hosmar- Lem show (HL) test for multinomial logistic regression

Number of observations= 68

LR chi2 (133) = 39.11

Prob > chi2= 0.0476

Log likelihood= -55.09324

The goodness of fit of the model tested by using Hosmar-Lem show (HL) test for multinomial logistic regression. Stata result shows that p value is 0.0476, which is significant at ($p < 0.05$), suggesting that the predictors as a whole related to the outcome variable. The rule of thumb is that when p value is less than 0.05 the model fit.

In addition, the negative log likelihood value indicates the overall fit of the model to the data. A lower log likelihood value suggests a better fit.

3.2.2 Multinomial logistic Regression results

The multinomial logistic regression analysis done to assess the relationship between dependent variable and independent variables. The model adopted to analyse the relationship between port performance as a dependent variable and (port operating hours, cargo handling time, docking time, port infrastructure, whether condition, vessel traffic, workforce availability, regulatory environment, technological adaptability) as independent variables. Generally, the results show that the model was appropriate with Pseudo R Square of 0.2620 implying that the variation in explanatory variables (predictors) explains port performance by 26.20%

Table 3.3 Multinomial logistic regression on the time schedule factors influencing performance at Dar es salaam port.

Variables	Multinomial logistic regression model	
Port performance	Coefficients	Coefficients
Pp	vessel dispatched	Duration at which cargo stay in a port
Docking time (ref. not impact)		
Moderate	2.600305** (1.231015)	0.9068378 (1.064217)
Significant	1.80249 (1.387166)	-0.0149435 (1.367475)
Port operating hours (ref. not important)		
Very important	2.038044** (0.9588146)	0.8017539 (0.9158856)
Cargo handling time (ref. small extent)		
Moderate	-0.9443788 (0.9691751)	0.1595711 (1.085535)
Large extent	-1.131543 (1.007443)	0.2972413 (1.119094)
Availability Handling equipment on schedule (Ref. not available)		
Available	1.83505 (1.299263)	2.678584** (1.255968)
Frequency of port congestion Event (Ref. high)		
Medium	3.514949** (1.438244)	2.750286** (1.31278)
Low	3.961918** (1.663604)	3.606722** (1.549341)
Truck scheduling Efficiency (Ref. low efficiency)		
High efficiency	1.058036 (1.072925)	2.479725** (1.033334)
customs clearance time (Ref. fast clearance)		
Moderate clearance	- 0.109374 (1.030335)	-2.180558** (1.048433)
Low clearance	-2.52194** (1.17744)	-2.615067** (1.165991)

Shift schedule of port workers (ref. day)

Night	0.4917071	-0.6317522
	(0.9505694)	(0.9583478)

Weather related scheduled delays (Ref. no)

Yes	1.971953*	2.323578**
	(1.080492)	(1.077719)

Model Strength	
Number of observations	68
R-square	0.2620

*p<0.1, **p<0.05, ***p<0.01

Standard error in parenthesis

Source: Stata output, (2025)

Table 3.3 above show the changes of probability of each outcome of categorical dependent variable due to the change of independent variable within a model. In addition, the table including p-value that used to show the significant of each independent variable towards the outcome, where by all p-values with one star (*) was significant at 10%, others having double star (**) was statistically significant at 5% and the remaining having three stars (***) was statistically significant at 1% where all others with no star are statistically insignificant.

Therefore, multinomial logistic regression model showing the following results. The regression shows that Docking time, port operating hours, Availability Handling equipment on schedule, Frequency of port congestion Event, Truck scheduling Efficiency, customs clearance time, Weather related scheduled delays are statistically significantly influencing port performance at Dar es Salaam port. Nevertheless, cargo handling time, Shift schedule of port workers, was statistically insignificant on influencing port performance at Dar es Salaam port.

4.4.3 Docking time and port performance

From the Table 4.5 of multinomial logistic regression, docking time was significant on influencing port performance at Dar es Salaam port at vessel dispatched thus indicating that docking time plays a crucial role in port performance.

The result from the table depicts that docking time when vessel is dispatched was statistically significant at 5% with value of (p=0.035) and positive correlation on influencing port performance, this indicates that a unit increase on docking time of ship at vessel dispatched will leads to the increase of log odds of choosing when vessel is dispatched over rate at which cargo is handled by 26%.

This supported in some others studies such as study by Zikomo, M. (2016), and Makarenko, M., et al. (2021). who studied the factors influencing port performance; found that docking time are strong determinants in port performance. From the study the coefficient of docking time, depict positive sign, which means that, as the time increase of docking increase increasing the probability of the port performance.

4.4.4 Port operating hours and port performance

From the Table 4.5 of multinomial logistic regression, port operating hours was significant on influencing port performance at Dar es Salaam port at vessel dispatched thus indicating that port operating hours plays a crucial role in port performance.

The result from the table depicts that port operating hours when vessel is dispatched was statistically significant at 5% with value of ($p=0.034$) and positive correlation on influencing port performance, this indicates that a unit increase on port operational hours at vessel dispatched will leads to the increase of log odds of port performance when vessel is dispatched over rate at which cargo is handled by 20%.

This supported in some others studies such as study by Faraj Kurniawan, S., et al. (2022), Daniel, S. (2021). who studied the determinants of port performance; found that port operating hours are strong determinants in port performance. From the study the coefficient of port operating hours, depict positive sign, which means that, as the port operating hours increase results to increasing the probability of the port performance.

4.4.5 Availability Handling equipment on schedule and port performance

From the Table 4.5 of multinomial logistic regression Availability Handling equipment on schedule was significant on influencing port performance at Dar es Salaam port when duration at which cargo stay in a port thus indicating that Handling equipment plays a crucial role in port performance.

The result from the table depicts that Availability Handling equipment on schedule when duration at which cargo stay in port was statistically significant at 5% with value of ($p=0.033$) and positive correlation on influencing port performance, this indicates that a unit increase on Available Handling equipment on schedule in the duration at which cargo stay in port will leads to the increase of log odds of port performance over rate at which cargo is handled by 28%.

This supported in some others studies such as study by. Buhari et al. (2017), Noteboom et al. (2022) who studied the factors influencing container terminal performance; From the study the coefficient of Availability Handling equipment on schedule, depict positive sign, which means that, as the available handling equipment in duration when cargo stay in a port result to increasing the probability of the port performance.

4.4.6 Frequency of port congestion Event and port performance

From the Table 4.5 of multinomial logistic regression, medium Frequency of port congestion Event was significant on influencing port performance at vessel is dispatched and duration at which cargo stay in port, thus indicating that medium Frequency of port congestion Event plays a crucial role in port performance.

The result from the table depicts that medium Frequency of port congestion Event when vessel dispatched was statistically significant at 5% with value of ($p=0.015$) and positive correlation on influencing port performance, this indicates that a unit increase on medium Frequency of port congestion Event when vessel is dispatched will leads to the increase log odds of port performance when vessel dispatched over the rate at which cargo stay in a port by 35%.

Also, Low Frequency of port congestion Event was significant on influencing port performance at vessel is dispatched, thus indicating that low Frequency of port congestion Event plays a crucial role on port performance. The result from the table depicts that low Frequency of port congestion Event when vessel dispatched was statistically significant at 5% with value of ($p=0.017$) and positive correlation on influencing port performance, this indicates that a unit decrease or low Frequency of port congestion Event when vessel is dispatched will leads to the increase log odds of port performance when vessel dispatched over the rate at which cargo is handled by 40%.

The result from the table depicted that medium Frequency of port congestion Event in duration when cargo stay in a port was statistically significant at 5% with value of ($p=0.036$) and positive correlation on influencing port performance this indicates that a unit increase on medium Frequency of port congestion Event will leads to the increase of log odds of port performance in the duration at which cargo stay in port over the rate at which cargo is handled by 28%.

The result from the table depicted that low Frequency of port congestion Event in duration when cargo stay in a port was statistically significant at 5% with value of ($p=0.020$) and positive correlation on influencing port performance this indicates that a unit decrease or low Frequency of port congestion Event will leads to the increase of log odds of port performance in the duration at which cargo stay in port over the rate at which cargo is handled by 36%.

The study supported by Ucheh; M. (2020) investigate on the impact of cargo management on port efficiency in Nigeria's South-South geopolitical zone. A multinomial logistic regression analysis reveals that Frequency of port congestion Event was statistical positive significant on influencing port performance.

4.4.7 Truck scheduling Efficiency and port performance

The findings from the Table 4.5 of multinomial logistic regression on Truck scheduling Efficiency showed it was statistically significant in explaining port performance at duration in which cargo stay in a port this suggests that port performance offered by Truck scheduling Efficiency.

The result from the table shows that Truck scheduling Efficiency at the duration in which cargo stay in a port was statistically significant at 5% with p value of (0.016) and its positive correlation on influencing of port performance, this implies that the increase in condition Truck scheduling Efficiency leads to increase the probability of port performance at the duration in which cargo stay in a port over the rate at which cargo is handled by 25%.

The study supported by Russo, F., et al. (2022) and Lam et al. (2015). Investigate the influence ship's port performance time schedule. The study utilizes a sample size of 150 participants, gathered through face-to-face interviews. A multinomial logistic regression analysis reveals that Truck scheduling Efficiency and weather condition are more important factors in operational port performance.

4.4.8 customs clearance time and port performance

The result from the Table 4.5 shows that customs clearance time was statistically significant in influencing port performance, at the duration in which cargo stay in a port and when vessel is dispatched suggests that customs clearance time play a role in influencing port performance at Dar es Salaam port.

The result from the table depicts that moderate customs clearance time in the duration at which cargo stay in port was statistically significant at 5% with p value of (0.038) and its negative correlation on influencing port performance at Dar es salaam port, this implies that as the increase of moderate customs clearance time results to decrease the probability of port performance at Dar es salaam port over the rate at which cargo is handled by 22%.

The result from the table shows low clearance time when vessel is dispatched was statistically significant at 5% with p value of (0.032) and its negative correlation on influencing port performance at Dar es salaam port, this implies that as the increase in low customs clearance time when vessel is dispatched results to decrease the probability of port performance at Dar es salaam port over the rate at which cargo is handled by 25%.

The result from the table shows that low customs clearance time at the duration in which cargo stay in a port was statistically significant at 5% with p value of (0.025) and its negative correlation on influencing port performance at Dar es salaam port, this implies that as the

increase of low customs clearance time at the duration in which cargo stay in port results to decrease the probability of port performance at Dar es salaam port over the rate at which cargo is handled by 26%.

The study supported by Mar, J., et al. (2024) and by Abdul, F. (2022). investigate the factors influence congestion on the port performance. The study utilizes a sample size of 80 participants, gathered through questioner and interviews. A multinomial logistic regression analysis reveals that customs clearance time negative influence in operational port performance.

4.4.9 Weather related scheduled delays and port performance

From the Table 4.5 of multinomial logistic regression, Weather related scheduled delays was significant on influencing port performance at vessel is dispatched and duration at which cargo stay in port.

The result from the table depicts that Weather related scheduled delays when vessel dispatched was statistically significant at 10% with value of ($p=0.068$) and positive correlation on influencing port performance, this indicates that a unit increase in Weather related scheduled delays will leads to the increase log odds of port performance when vessel dispatched over the rate at which cargo stay in a port by 20%.

Also, Weather related scheduled delays at the duration in which cargo stay in a port was statistically significant at 5% with value of ($p=0.031$) and positive correlation on influencing port performance, this indicates that a unit increase Weather related scheduled delays will leads to the increase log odds of port performance at the duration in which cargo stay in a port over the rate at which cargo stay in a port by 23%.

The study supported by Zikomo, M. (2016) and Ravelin, E. (2024) analysis on the effects of cargo handling factors on port performance in Tanzania. The study utilizes a sample size of 100 participants, gathered through questioner and interviews. A multinomial logistic regression analysis reveals that Weather related scheduled delays was statistical positive significant on influencing port performance.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

This study intended to examine the influence of various time related and operational factors on the performance of Dar es salaam port. Docking time, port operating hours, Availability Handling equipment on schedule, Frequency of port congestion Event, Truck scheduling Efficiency, customs clearance time, Weather related scheduled delays are statistically significantly influencing port performance at Dar es Salaam port. Nevertheless, cargo handling time, Shift schedule of port workers, was statistically insignificant on influencing port performance at Dar es Salaam port. Moreover, research finding revealed that, efficient time management is a critical determinant of port performance. Specifically, docking time and port operating hours showed the most direct impact on port performance, indicating that delays in these areas significantly disrupt the overall operational performance. The study concludes that optimizing time schedules and reducing inefficiencies across these operational variables is essential for improving the overall productivity and competitiveness of Dar es Salaam port. The study concludes that optimizing time schedules and reducing inefficiencies across these operational variables is essential for improving the overall productivity and competitiveness of Dar es Salaam port.

This study faced with limitation on methodology directly on design used were the study employed cross sectional design which is temporal contradiction since data are collected at one point in time, where it could not observe well the changes over time and create difficulty to examine the temporal sequence on port performance, also the study results may not apply to different port because respondents change in social behavior. Also, inaccuracies in data collection may happens during data collection, such as respondent bias or incorrect recording of the respondents, thus can impact the validity of the results. Then future researchers could address the limitations

of this study by employing longitudinal designs to overcome the temporal contradiction of cross-sectional studies, allowing for a better determination of the temporal sequence on the port performance. Also studying different port authorities on measure port performance differ due to changes in social behavior. Improving data collection methods like reducing respondent bias and errors which enhance the validity of the results.

4.2 Recommendations:

Dar es salaam port should streamline docking and cargo handling procedures by implement real time tracking and berth allocation systems to reduce docking delays and invest in modern cargo handling equipment and digital logistic platforms to speed up loading and unloading processes. Dar es Salaam port should increase truck scheduling efficiency by introduce or improve truck appointment systems to reduce challenges and turnaround times within the port, also promote better coordination between port operators and inland transporters using digital platforms, also enforce time slots and penalties for late or early arrivals to maintain scheduling discipline. Streamline customs clearance time by integrate customs processes with port and logistics systems to allow for pre-arrival clearance and reduce dwell time, also by expand use of risk-based inspections and digitize documentation to reduce manual processing and promote inter-agency collaboration and a one stop border post model to minimize bureaucratic delays. Monitor and manage port congestion events by develop a real-time congestion monitoring dashboard to alert stakeholders and trigger contingency plans and invest in predictive analytics to anticipate congestion based on vessel arrivals, cargo volumes and staffing levels, also implements port decongestion strategies such as temporary off-site container storage or night operations. Ensure availability of handling equipment as per schedule by maintain strict equipment servicing schedules to avoid breakdowns during critical periods and to Implement weather responsive scheduling mechanisms by install advanced weather monitoring systems to predict weather related delays and plan accordingly, also develop contingency plans such as flexible shift hours, priority handling for minimizing impact during adverse weather and improve communication of weather-related delays to all port users in real time.

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