Niger Delta Ports Performance Optimization Factors Assessment a Case Study of Warri Ports' Complex, Nigeria

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Abstract

Port performance optimization has always been a problem to be taken into consideration by port users especially shipowners and operators. Globally, port time had been the most utilized index for measuring port performance and acceptability by port users. The choice of queuing model to program performance especially ships time in port has become unfashionable and classical. This calls for the choice of a standard optimization technique that puts into consideration all constraints factors relative to their respective contribution to port time or delay. This will enable the port planner determine the critical factors responsible for performance or time in port. This article attempt to resolve port time reliability optimization problem by identifying the critical factors so as to channel resources towards solving them in the presence of budget resource constraints. The study is focused on the Niger Delta region's ports with their peculiarity. The methodology framework for solution is the application of Multiple Regression Programming which tries to assess the influence of each time or performance factors (the constraints) on the objective function time. In other words, the determination of the beta coefficients of the causative factors act as a sensitivity analysis to identify critical factors.

Keywords: *Port Performance Optimization, Port time, Multiple Regression Programming, Critical factors, Sensitivity analysis.*

BACKGROUND OF THE STUDY

Niger Delta region of Nigeria is made up of seven states of the country. It comprises of Delta, Bayelsa, Rivers, Akwa Ibom, Abia, Imo and Ondo states. The area is covered with swampy land and mangrove trees vegetation, rich in mineral resources especially hydro-carbons. The region is also characterized by many creeks and waterways through which the River Niger flows into the Atlantic ocean, consequently the area could also be described as a shipping zone.

No region of the world is said to be sufficient in terms of availability of resources to sustain human existence. Trade is an economic activity that enables resources to move from areas of surplus to areas of scarcity. Trade both local and foreign cannot take place without transport. Transport provides the necessary facilities to carry trading commodities from areas of plenty to the areas of scarcity. With the assistance of transportation facilities such as ship, rail, aircraft, road vehicles etc. the geographical gap between trading zones is closed. Transportation

which aids trading activities becomes a catalyst to economic growth. Shipping remains overwhelmingly the most important form of transportation relative to international trade. In other words, foreign trade could take place using the road, rail and the air modes but however, the volume of trade supported by these modes mentioned put together is very insignificant compared to the volume carried by shipping or maritime transport.

The port is a vital part of the global shipping industry. A port is not only a resting place for a ship but also provides all the necessary facilities and equipment for cargo transfer operations. Cargoes carried by ship means nothing until they are discharged in ports and transferred to an inland vehicle for onward journey to the shippers' warehouses. Here, it is often said that a master/servant relationship exists between the ship and the port. In other words, the survival of a port economically depends on its ability to service its customers, the calling ships and the shippers efficiently and cost effectively.

The master/servant relationship between the ships and the ports can also be described through the struggle by ports in a particular region to attract calling ships to the zone because ship traffic is the life-wire of the port. The ports are in constant struggle to provide berthing facilities and infrastructures to accommodate larger and more specialized vessels, newly designed and launched vessels which were not in operation at the time of the port's development and construction,. Ports are constantly under pressure to provide berthing and cargo handling facilities required for fast loading and off-loading of vessels. Therefore, the need to assess port performances periodically cannot be over-emphasized. For any port to be relevant in the business of international trade, it must provide user's friendly services to its customers. In other words, it must be competitive relative to other ports in the region. The closest ports to Warri Ports' Complex is Port-Harcourt Ports' Complex as well as the Onne oil and gass port. According to Malchow and Kanafani, (2003), assessment of Port's periodic performance has become very necessary to identify necessary factors responsible for poor services rendered customers. The duo of Malchow and Kanafani is of the opinion that investment in facilities and equipment that will minimize port dwell-time by ships and shipments is very necessary in a competitive environment.

Statement of the Problem

Warri Ports Complex is an integral part of the entire Nigerian ports system. An aggregate study of Nigerian ports by Nigerian Shippers' Council in 2002 shows that the ports are not users' friendly in terms of vessels' dwelling time as well as cost of doing business compared to other global ports especially the ports in the West African sub-region.

Table I: Container Terminal Tariff (Total Charge Per Container Moved Including Ship to Terminal Gate in USD, 2002)

Ports	Amt in USD
Nigerian Ports (Warri)	168
Togo (Lome)	143
Benin Republic (Cotonou)	130
Cote' D' Voire (Abidjan)	152
Dakar (Senegal)	140

Source: Nigerian Shippers' Council Lagos 2002

Table II: A Comparative West African Sub-Region Port Traffic Due on Cargo

Charges in USD/mt	Nigeria	Benin Republic	Senegal	Ghana	CDV
Harbor Dues	2.50	-	-	-	-
Stevedoring	4.00	4.90	4.90	4.0	4.78
Extra Service	3.00	-	-	-	-
Total	9.50	4.90	4.90	4.0	4.78

Source: Report and analysis of NPA Operations and tariffs by Nigeria Shipping Community 2002 (Unpublished).

Table III: Freight rates on Containerized Cargoes from Far-East (Korea) to Nigeria and Benin Republic Ports (Warri and Cotonou) 2002

Container Size	Freight rate to Warri	Freight rate to cotonou
1x20	$9,000	$7,500
1x40	$16,000	$14,000

Source: Tom Line Shipping Company, Lagos 2002

Table IV: Freight Rates on Containerized Cargo from USA to Nigeria and Benin republic in 2002

Container Size	Freight rate to Warri	Freight rate to cotonou
1x20	$4,500	$3,000
1x40	$8,000	$6,000

Source: Tom line Shipping Company, Lagos 2002

Table V: Turnaround Time of Ship in General Cargo Berth, Warri, Nigeira 2000-2006

Year	Average Waiting Time in Days	Average Service Time in Days	Average Total Turnaround Time
2002	0.75	13.46	14.21
2003	0.87	14.53	15.40
2004	0.51	12.64	13.15
2005	0.62	15.45	16.07
2006	0.61	11.12	11.73
Total	3.36	67.20	70.56
Average	0.67	13.44	14.11

Source: NPA Annual Reports 2007

Table VI: Turnaround Time of Vessel at Container Terminal, Warri, 2002 –2006

Year	Average Waiting Time in Days	Average Service Time in Days	Average Total Turnaround Time
2002	0.32	2.22	2.54
2003	0.23	3.21	3.44
2004	0.22	2.93	3.15
2005	0.27	2.21	2.48
2006	0.25	2.11	2.36
Total	1.29	12.68	13.97
Average	0.26	2.53	2.75

Source: NPA annual reports 2007

Table VII: Turnaround Time of Ship in General Cargo Terminal Tema , Ghana 2002 – 2006

Year	AWT	AST	ATRT
2002	0.35	6.25	6.60
2003	0.43	4.53	4.96
2004	0.42	4.42	4.84
2005	0.51	4.76	5.27
2006	0.44	4.23	4.67
Total	2.15	24.19	26.34
Average	0.43	4.84	5.27

Source: Fair Shipping, Ghana Authoritative Maritime News Magazine 2007

Table VIII: Turnaround Time at Container Port, Tema Ghana 2002 – 2006.

Year	Average Waiting Time in Days	Average Service Time in Days	Average Total Turnaround Time
2002	0.25	2.10	2.35
2003	0.22	1.91	2.13
2004	0.26	2.32	2.58
2005	0.24	1.82	2.06
2006	0.24	1.94	2.18
Total	1.11	10.09	11.20
Average	0.22	2.02	2.24

Source: Fair Shipping, Ghana Authoritative Maritime News magazine, 2002 –2006

Table IX: The Cumulative Ranking of Delay Factors at Warri Ports Complex, Jan – Dec. 2007

Months	Delay/Turnaround Time in Days	IADB X_1	LCHE X_2	LMP X_3	SSMP X_4	ADBN X_5	DADP U X_6	LSF X_7	INDEC H X_8	TMPH S X_9	TMIDTEF X_{10}
Jan	5.30	125	173	173	178	273	289	147	161	140	113
Feb	6.40	116	187	125	180	215	260	130	120	180	170
March	7.31	122	169	120	175	180	200	131	125	215	190
April	4.52	120	148	95	170	205	180	125	119	240	180
May	5.52	115	175	90	165	260	270	118	120	220	200
June	6.22	180	125	100	146	190	215	120	115	189	156
July	5.64	160	120	80	127	230	190	116	110	160	140
Aug.	3.45	148	128	102	140	178	213	122	108	185	136
Sept.	6.66	150	144	100	136	238	190	120	100	195	130
Oct.	5.82	146	128	104	130	196	240	115	98	204	120
Nov.	5.74	156	120	98	116	208	198	112	102	196	122
Dec.	6.12	150	130	100	124	168	230	103	100	156	103
Total	68.70	1688	1747	1287	1787	2541	2675	1459	1378	2280	1765
Average	5.72 days	140.67	145.58	107.25	148.92	211.75	222.92	121.58	114.83	190.00	147.08
Grand mean = 155.06		7^{th}	6^{th}	10^{th}	4^{th}	2^{nd}	1^{st}	8^{th}	9^{th}	3^{rd}	5^{th}

Critical factors = X_6, X_5, and X_9

Table X: The Regression Statistics for Warri Ports Complex

					Change Statistics					
Model	R	R Square	Adjusted R. Square	Std. Error of the Estimate 1.37884	R Square Change	F Change	df1	df2	Sig. F. Change	Durbin-Watson
1	.910[a]	.829	-.882		.829	.484	10	1	.819	3.161

a. Predictors: (Constant), TMIDT3, DADPU3, LSF3, ADBS3, IABS3, TMPHS3, INDEC3, LCHE3, SSMP3, LMPW3

b. Department Variable: DELAY3\

NOVA[b]

Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.209	10	.484	.819[a]
	Residual	1.901	1		
	Total	11.110	11		

a. Predictors: (Constant), TMIDT3, DADPU3, LSF3, ADBS3, IABS3, TMPHS3, INDEC3, LCHE3, SSMP3, LMPW3
b. Department Variable: DELAY3

Table XI: Regression Results for Warri Ports Complex Delay Causative Factors

Model	Standardized Coefficients			T	Sig	95% Confidence Interval for B			Correlations	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part
1 (Constant)	2.257	.002		1016.583	.001	-708.047	796.383			
IADBS	-.553	.001	-.084	-1065.906	.001	-1.655	1.578	.021	-.296	-.128
X_1	5.552E-02	001	.006	51.083	.012	-5.014	4.585	.249	-.493	-.235
LCHE X_2	-.236	.000	-.041	-627.467	.001	-4.622	5.367	.088	.688	.392
LMPW	-1.252	.004	-.107	-324.256	.002	-2.571	2.793	.069	.466	.218
X_3	2.980E-02	.001	.005	39.782	.016	-1.247	1.420	-.016	.636	.341
SSMP X_4	11.141	.003	1.165	3890.508	.000	-.446	.364	-.007	-.788	-.530
ADBN X_5	-.866	.001	-.077	-947.970	.001	-5.291	4.508	-.036	-.712	-.420
DADPU	-.709	.001	-.094	-703.144	.001	-4.871	4.303	-.061	-.618	-.325
X_6	-.702	.001	-.070	-508.177	.001	-1.383	1.231	-.020	-.595	-.306

LSF X_7	-1.340	.001	-.168	1271.755	.001	-2.489	2.859	.125	.660	.364
INDEC X_8										
TMPHS X_9										
TMIDT X_{10}										

From the data presented, the cost of doing business in Nigerian ports is higher compared to Neighbouring ports of Ghana, Senegal, Republic of Benin and Cote D'voire, all in West Africa sub-region. The study so far has shown that the average waiting time of vessels is drastically reduced but however the problem of inefficiency in ports performance lies in time at ports. The average turnaround time of vessel in the ports of Nigeria remain high compared to the experiences in the other West Africa ports. This has consequently led to the high cost of doing business in the ports as presented in the data available, the Warri Ports Complex inclusive.

THE OBJECTIVES OF THE STUDY

Sayara and Razaee (2014) in an attempt to solve the problem of optimizing port performances in a container terminal in the Persian Gulf, used the technique of order preference (TOP), weighing most indentified port performance factors to identify most dominant critical factors in their decision making. Using also an Analytical Hierarchy Process (AHP) to aid TOP technique, they identified port working time, stevedoring rate, safety port entrance, sufficient draft, capacity to handle larger vessels, operating cost, number of berths, ship chandelling, information reliability as critical factors for selecting container ports in the Persian Gulf.

Saeed (2009) in an empirical study conducted through shipping agents working for foreign principals in Karachi, Pakistan discovered that service quality factors such as loading discharging rate, and handling charges were the most port selection factors. Emeghara (2008) assessing port performance factors in Nigerian ports at aggregate level identified lack of berths or insufficient berths, lack of cargo handling gears, lack of manpower, lack of skilled manpower, administrative bottleneck, fraudulent practices of the staff of the port operators lack of storage facilities, insufficient depth of the channels too much public holidays, too much idle time and others as port optimization factors. Out of these factors, the study identified administrative bottleneck, lack of cargo handling equipment and lack of storage facilities such as warehouses and inland container depot (ICDs) as the critical factors.

The main objective of this study is to look at port performance optimality at dis- aggregate level using Warri Ports Complex as the study location. With the believe that no two port locations are the same. There are other factors such as port location, or environmental factor that could determine performance relative to other ports in the region. Warri Ports Complex is very unique due to the presence of many oil exploration and exploitation companies doing business in the area. These companies prefer using the specialized oil and gas terminal at Onne near Port-Harcourt than shipping their consignment through Warri Ports Complex very close to their operational bases. The study's specific objectives includes (1) Identification of performance factors relative to Warri Ports' (2) Identification of the ports performance critical factors. (3) Using the Multiple Regression technique, the study intends to formulate a performance model that could be used to predict or project performance index the turnaround time of ships at the port.

RESEARCH QUESTIONS

The study using turnaround time of ships at the ports as performance index whose optimality depends on time or delay reduction or minimization, recognizes many performance constraint factors numbering ten (10) including others which could not be identified presented as error. In order to achieve the objectives of the study, an attempt shall be made to answer the following questions:-

(1) What is the relative degree of influence exerted by the various performance factors as perceived by the study?
(2) What is the relationship between the performance optimization index turnaround time of vessels at the port and the constraint factors?
(3) To what extend do these performance factors collectively determine the turnaround time of ships in the port under study?
(4) To what extent do each of these performance constraint factor determine the level of delay in the Warri Ports Complex.

HYPOTHESIS TESTED

To provide answers to the research questions, the following hypothesis were tested:

Ho_1: There is no relationship existing between the performance index turnaround time (T) and the Constraint factor X_1, X_2, X_3 …….. X_n

Ho_2: There is no difference between the degree of influence exerted by each of the performance factors on the turnaround time of ships. In other words, there is no significant difference in the mean scores of each of the performance constraint factors $\mu_1 = \mu_2 = \mu_3 \ldots . \mu_n$.

SCOPE, LIMITATION AND SIGNIFICANCE OF STUDY

The study is a preliminary and pioneering work in an attempt to seek for an alternative way of solving port performance problem using Multiple port performance Regression Technique (MRT) rather than the traditional queuing model. Data were gathered for five years 2002 to 2006 using Warri Ports Complex as a case study. The study did not consider other ports performance indices such as cargo throughput, ship traffic volume, Berth Occupancy Ratios etc.

This is due to the over-riding influence of turnaround time or delays which determine ports cost and patronage by both ship and cargo owners. The study is very significant in that the identification of the port performance critical factors will enable resources to be channelled straight to these constraint factors in solving port problem given yearly constraint budgets. The study result will avoid solving port performance problem by trail and error. The construction of the Multiple Regression Model (MRM) for the Warri Ports Complex will enable the adoption of a planning strategy which can forecast future performance index under a given constraint factors.

METHODOLOGY

Ha (2003), Lim *et al.*, (2004), Tongzone (2002), Clerk *et al.*, (2001), Koi Yu (2006) have all done studies on the assessment of port attractiveness to users in the various parts of the world. They all concluded that service quality delivery is a very important variable in determining port customer loyalty. Even where some of these studies were able to identify critical factors relative to performance indices none of the works tried to captures the relationship between the critical factors and the values of the port performance levels observed. The study followed Alpharlime (2005) study approach which assessed port attractiveness through soliciting the opinions of shipping lines agents that represent the major and direct port users. In this study, we targeted survey respondents consisting of Chief Executives Officers, general managers, operation managers, shipping consultants, labour managers in the Warri Ports Complex. First,

a workshop was organized where these experts identified some of the ports performance factors earlier mentioned in the write-up. A sample size of fifty respondents were taken from the population of port users and operators that attended the pilot survey workshop.

A questionnaire was drawn in which each of the fifty respondents that formed the sample size was asked to rank each of the performance factors according to their respective perception of the influence of the delay factors on turnaround time of ship observed at port. The pilot survey highlighted some of the performance variables from their long experience of using the port as well as operating in the ports by the respondents.

The survey proper lasted for twelve months by which the field officers were able to pay several repeat visits to the respondents. This actually helped in the achievement of high rate of questionnaire return. Out of fifty questionnaires, thirty seven (37) were duely completed and returned. The fifty questionnaires were distributed as follows:

Shipping Agents	=	10
Shippers or Cargo Agents	=	10
NPA Staff	=	10
Port Operators	=	10
Dockworker NINASA	=	10

The study was port location and operations conscious as terminal based approach was adopted in the gathering of statistical data at the point of operation where constraint factors influence port performance optimization. The individual respondent estimate of the performance factors were sort by asking them to rank each factor according to its strength e.g. the factor with the highest influence is ranked 10, the next 9 in that order of influence. With the track of respondents choice among the hypothetical options, one to ten presented in the questionnaire, it was possible to perform a correlation analysis of the relationship between the performance determinants or constraint factors and the performance index turnaround time of ships in the port.

The study actually recognized the importance of primary data vis-avis the reliability of data collected which ensured results reliability. However, the study also made use of secondary data gotten from Nigerian Ports Authority (NPA), international Journals, the Port operators records as well as data from Nigerian Maritime Administration and Safety Agency (NIMASA). Etc.

As regards tools for data analysis, the study deviated from the classical method of port evaluation which has become unfashionable – the queuing model which hovers on berth expansion or reduction. To calculate the relative degree of influence on the performance index (turnaround time) of ships by the determination factors, the choice of Multiple Regression method (MRM) was adopted. Also, MRM makes room for future prediction and planning which port management is all about.

Multiple Regression Method (MRM) believes that there are several port performance determinant factors. The list of these causative factors is

inexhaustible. You can add more and more factors according to the environment in order to build a port performance model, the contribution of the study.

To determine the values of a, b_1, b_2, b_3…. b_n which represent the coefficients of the independent variables, the performance factors, calls for the solving of the three Multi-regression equations simultaneously.

Another model used in the determination of the study results and inferences was the Cumulative Rankings of performance factors for Warri Ports January to December 2007. In other words, the cumulation of ranked votes approach was adopted. This approach was simple and yet very effective in illustrating the respondents degree of evaluating the weight of each performance factor. This is a modification of the likert scales. In a likert scale, each respondent is required to indicate the degree of agreement of each statement as each of the degree of agreement is given a numerical score and the summing these scores for example the cumulative ranked score for is 1688, etc. Realizing that assignment of values and cumulating them into absolute figures 1688, 1747 etc. will only show level of perception of the performance factors and not a basis for decision making called for modification. To aid decision making process visa-vis determination of the critical factors, the study adopted the Grand Mean Approach (GMA). Here the cumulative rankings of each independent variable were calculated and divided by twelve. The resultant means were summed up and divided by ten (10), the total variables to get the grand mean. The decision rule is that the independent variable mean greater or equal ( ) to the Grand Mean (GM) is significant and consequently a critical factor.

BRIEF REVIEW OF LITERATURES

With increasing day to day application of technological idea, time in transit of modern ships can be monitored and controlled with prescision. Faster ships are now in operation. However, investigations have shown that after saving time in transit, most ships spent most of their economic time in ports. Port time possess much challenges to ship operators that transit time in current period.

The choice of classical queuing model which through the provision of more berths to accommodate increase in vessel traffic is no more fashionable. There is the need to identify port performance factor through time spent in ports which are numerous. The choice of a sensitivity program to identify such port performance factors cannot be over-emphasized. Zhen and Chang (2012) used the classical queuing method to develop a robust schedule for berth allocation that incorporates a degree of anticipation of uncertainty e.g. vessel annual time and operation time during schedule execution.

Xu et al., (2012) studied a robust berth scheduling problem with uncertain vessel delay and travelling time while Clerk et al (2004) presented an approach for determining port efficiency via cost of vessels which translates into dwelling time in the port or ship delays. They developed two algorithms for resources allocation to optimize time in port. It if from Clerk et al (2004) that this study took a cue to develop a programme to identify factors responsible for ship delay in ports as well as identifying the critical factors responsible for performances. The article attempts to highlight the possibility of identifying critical factors responsible for delay in ports especially in the unique nature of the Niger Delta port zone. Port performance

factors include port cost, time safety, cargo throughout and ship volume etc. These are the output indices while infrastructural availability, port location, efficiency/productivity, reputation for quality service delivery, level of ICT usage, port charges, connectivity are the input factors. The most important output factor is the turnaround time of vessels in the port. Ng (2006) studied container transshipment in Northern Europe where he discovered that there are other important factors affecting ports users' decision. Other than monetary cost. These includes time efficiency, geographical location and service quality. Using port performance approach, Torgzon and Sawat (2007) found out that port cost and range of services are significant factors affecting port performances. Sayara and Razaee (2014) weighed the various factors affecting the selection of a container port using technique of order preferences in the Persian Gulf. They identified working time, Stevedoring rate, safety, port entrance, sufficient draft, port facilities capacity, as critical factors that influence decisions. Ha (2003) did a comparative evaluation of service quality factors categorizing some factors namely ready information available of port related activities, port location, port turnaround time, facilities availability etc as important factors. Saeed (2009) presented the results of an empirical study conducted through shipping agents working for foreign principles in Karachi Pakistan. The shipping agents' responses indicated that service quality loading/discharging rates and handling charges were the most important selection factors. The studies so far reviewed took an aggregate view of the region studied whereas the study of the Niger Delta ports took a disaggregate view by using Warri Ports complex as a case study.

DATA PRESENTATION AND ANALYSIS

The Warri Port complex is the largest port within the central ports zone and the second largest after Port Harcourt ports complex in the Niger Delta region. It is made up of the new and old ports. The discovery of oil in the oil rich Niger Delta region has made the port a major contributor to the economic development of Nigeria. The hinterlands of the port includes Delta state, Edo state, Anambra state, Imo state and beyond. The port is situated on the River Warri which is 25 miles from the entrance of river Forcados.

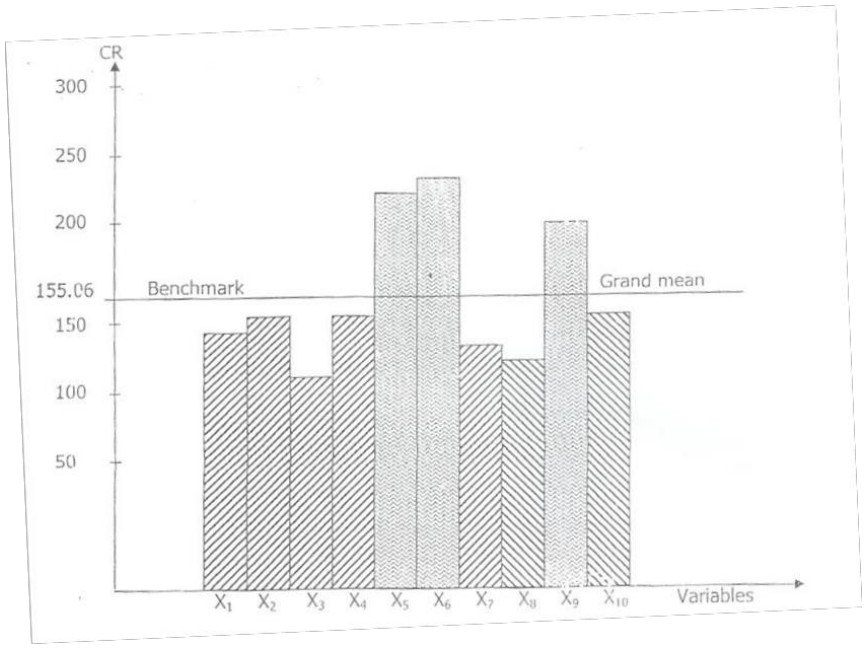
IDENTIFICATION OF THE CRITICAL DELAY FACTORS (PERFORMANCE FACTOR) FOR WARRI PORTS COMPLEX USING THE CUMMULATIVE RANKING APPROACH

From table IX, we display the descriptive statistics showing the influence of each time in port factor on the turnaround time of ships in Warri Ports Complex during the survey period. Note that the turnaround time signifies port performance. Port performance is rated high when turnaround time is low.

Using the cumulative ranking of the respondents perception of each delay factor, the grand mean which serves as the benchmark for decision making stands at
155.06. It can be seen from table IX that out of the ten factors used, only three factors namely deliberate attempt to defraud port users DADPU or X_6, administrative bottleneck ADBN or X_5, and too much public holidays TMPHS or X_9 had their respective mean above the grand mean the adopted bench mark. Here, X_6 which stands for deliberate attempt by port staff to extort money from port users is the most influential factor with mean value 222.92. This is followed by X_5 or administrative bottleneck whose mean value is 211.75. This shows that corruption is

the bane of port performance or operational efficiency in Warri Ports complex. The next time factor or performance factor that crossed the benchmark figure is X_9 which stands for too much public holidays. Its mean value stood at
190.0. The inclusion of X9 as a critical factor that influence port performance is not a surprise as the activities of militants which feature frequently at the Niger Delta region often disrupt port activities. The non inclusion of such factors as lack of cargo handling equipment, inadequacy of berth facilities, lack of manpower shows that the port is presently being under-utilized. Shippers around the region prefers using the Onne oil and gas port. The port workers therefore seek to make gain out of any ship that comes calling to the port since ships hardly use the port as a result of unfriendly environment.
See figure I.

Figure I: Cumulative Ranking of Delay Factors or Time in Port at Warri Ports Complex Jan – Dec. 2007.



DETERMINATION OF THE CRITICAL FACTORS USING THE REGRESSION ANALYSIS APPROACH

Using the regression analysis approach to identify the critical factors shows that a strong correlation relationship exists between the dependent variable turnaround time of ships in the port and the independent variables or the constraint factors X_1 to X_{10}. From table XII, the coefficient of correlation between Y and the constraint factors stood at 0.910 with a coefficient of determination of 0.829 or 82.9%. This shows that 82.9% of the delays observed at the port could be explained by the influences of the delay causative factors identified.

From table XIII, we can deduce from the Beta coefficient that X6 with the highest Beta coefficient 11.141 is the most critical factor. This is followed by X_2 whose Beta coefficient stood at 5.552-0.2. The inclusion of X_2 or lack of sufficient cargo handling facilities as a critical

factor instead of X_9 or too much public holidays as appeared in the cumulative ranking approach calls for further study. However the inclusion of factors X_6 and X_5 as critical factors validates the result gotten from the first approach Column 6 of table XIII shows that all the port performance factors identified are statistically significant at 95% confidence level. Using the Beta coefficient as obtained in table XIII, we built a port performance forecasting models for Warri Ports Complex as follows

$$AVTRAD/DELAY=2.257 - 0.553X_1 + 5.552E\text{-}0.2X_2 - 0.236X_3 - 1.252X_4 + 2.980E - 0.2X_5 + 11.141X_6 - 0.866X_7 - 0.709X_8 - 0.702X_9 - 1.340X_{10} + e$$

The equation suggests that delay will increase on an average by 0.553 of a unit increase in X_1, increase by about 5.52E – 0.02 with every unit increase in X_2, increase on average by 0.236 on a unit decrease in X_3, increase by 1.25 of a unit decrease in X_4, increase by 2.980E-02 of a unit increase in X_5, increase by 11.141 of a unit increase in X_6, increase by 0.866 of a unit decrease in X_7, increase by

0.709 of a unit decrease in X_8, increase by 0.702 of a unit decrease in X_9, increase by 1.340 of a unit decrease in X_{10} plus the error terms.

The study therefore concludes that factor X_6 (deliberate attempt by port workers to extort money from port users with the highest Beta Coefficient of 11.141 is the most critical factor. The next factor to be considered as a positive contribution to the high turnaround time recorded in Warri Ports Complex is X_2 (lack of Cargo handling equipment) whose Beta coefficient stands at 5.552E – 02. Consequently, the study suggest that to improve on the efficiency or performance of Warri Port operation, priority must be given to the problem posed by these critical factors which boils down to corruption.

The Port's staff as well as staff of the other service providers at the ports (the customs, the NDLEA, NAFDAC, the Marine Police etc) must be re-oriented to be more patriotic in discharging their duties to the port's users. Since marine transport services have strong relationship with port activities, it is therefore pertinent to state also that the survival of the economy of a coastal state like Nigeria and especially the Niger Delta region depend wholly on the efficient operations of the port industry. Therefore improvement on port performance of Warri ports complex will help attract high volume of vessel traffic to the area. This will consequently improve the economy of the Niger Delta region. The problem of the youth restiveness and the militants that vandalize oil pipelines in the region will be reduced.

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