

Analysis of Operational Logistics on the Inland Waterways of Delta state, Nigeria

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Abstract— This paper analyzed the operational logistics of inland waterways transport in Delta State, Nigeria. It relied on Secondary data sourced from the records of selected jetties in the study area, which was subjected to descriptive statistics. The results show noticeable troughs which is evident that on the Warri to Burutu route, passenger traffic peaked on the first, fifth, ninth, seventeenth, twenty-first and twenty-seventh day of the month. The results further revealed that on an average, an operator spends about N6089.10 per half capacity tank of boat and a maintenance cost of N351.39 per trip, giving a total average cost of N6440.49 to the boat operator. The user of the waterways thus spends an average transport fare of N1141.03 per trip, which implies that the user/ passenger and the operator spends an average of 47.36 minutes for a single trip on the Warri to Burutu route. It concludes that waterways of Delta State, Nigeria are constrained with logistics problems due to insecurity, impediments to navigation and poor maintenance dredging. The paper recommends that the National Inland Waterways Authority (NIWA) should regulate the waterways operations so as to reduce the travel times and cost to the users of the waterways.

Keywords— cost; inland; logistics; operator; waterway

I. INTRODUCTION

Inland waterways operational logistics could be perceived as an integrative process that seeks to optimize the flows of materials and supplies through the boat driver's organization and their operations and service to the customers which invariably are the users and as well passengers of the waterways [1]. According to the National Inland Waterways Authority, NIWA [2], inland waters remains natural bodies inland from the coastal zone and areas whose properties and use are dominated by the permanent, seasonal, or intermittent occurrence of flooded conditions. Nigeria's natural endowment in inland water transport system stretches across more than 10,000km of navigable waterways. This water wealth comprises of rivers, creeks, lagoons and Lakes, and intra-coastal waters. The main rivers are: Rivers Niger and Benue, both rivers form a confluence at Lokoja, in Kogi State. Records prove that River Niger is the longest river in West Africa and eleventh longest in the world. River Benue is the main tributary to the Niger. Consequently,

the navigable waters emanate from the delta creeks and the lagoons which border the coast of Nigeria. The navigable waterways are the major transportation routes linking Apapa, Tin Can, Warn, Port Harcourt, Onne and Calabar seaports and the numerous river ports and jetties. Through the lagoon and delta creeks a transport route is established between the hinterland and urban centres of Nigeria on River Niger. This goes as far as Niamey in the Republic of Niger and Garua in Cameroon on River Benue [3].

In order to regulate the activities on the waterways, the National Inland Waterways Authority (NIWA) was established by Decree No. 13 of 1997 with a clear mandate to manage Nigeria's vast inland waterway resources. The Decree vests in NIWA the power of exclusive management direction and control on the Nigerian inland waterways. This power is exercised on Nigeria's 3000km of navigable waterways from the Nigeria/Niger and Nigeria/Cameroon-borders to the Atlantic Ocean. Nigeria is blessed with a river configuration very suitable for North-South movement of people and-goods. It is therefore the responsibility of NIWA to ensure that there is safe navigation.

A. Statement of Problem

The complexity in societies and economies have necessitated the need for transport of goods and services within and outside the shores of a nation. No doubt inland waterways transport is adjudged to be the earliest mode of transport available to fishermen and the agrarian society. The inland transport network provides a link to the seaborne international trade through which nations bridge the gap in space and time for international trade and commerce. The generation of economic activities generated from the services at port terminals is significantly felt by her adjoining communities. These supporting services include distribution-based activities such as a multimodal and intermodal freight transport systems composed of modes, infrastructure and terminals. The implication is that the lack of or insufficient provision of adequate infrastructure has limited the scope of extending the navigability of the inland waterways in Nigeria, and hence the problems militating against lean operational logistics on the inland waterways which include:

- Lack of locks, gates, cross dams, groins to overcome high gradient challenges as well as retain water flow downstream;
- Lack of regulation-based activities which are needed such as the customs procedures, tariffs, regulations and handling of documentation optimally at river terminals.
- Poor cost efficiency of these services which affect the trade and environment.

B. Aim And Objectives

The aim of this paper is to analyze the operational logistics of the waterways of Delta State, Nigeria. The specific objectives include to:

- determine the trend of traffic on the waterways
- evaluate the average cost and time of travel on the waterwayson the waterways.

C. Research Questions

The following questions would lead to empirical discussion and solutions to the problem of the paper and as well address the set objectives:

- To what extent is the traffic trending on the waterways?
- What is the average cost and time of travel on the waterways?

II. Literature Review

Transportation is defined by [4] as a system in which a large number of people are moved from one place to another at a time. Its effective operation requires trains, trams, buses, and ferries are used to move people and goods in urban areas with waterways or where settlement is separated by water. [5] concentrates his argument around the issue of tradeoff between freight- cost-time and timely delivery to build his model. Using the Japanese Census of Logistics, his paper examines the cost influence of distance and time across shipping modes. Tanaka in her view, found the results "puzzling because business enterprises are likely to pay more for shout-distance shipments and travel by truck, ship and railroad transportation". The implication is that the effect of short distances on rates as per-mile freight tends to decline with distance as the ratio decreases. In a related study, [6] investigated the operations of water-based transport in Lagos state and reveals that the safety of inland waterways transport has been compromised due to the operators' misbehaviors and government inattention. The study further indicates that water hyacinth, expensive safety materials and shallow waterways were key factors that affect inland water ways operations. Their findings indicate that the IWT operations are dominated by males with a frequency score of 71.2% which further revealed that most operators owned their vessels and hence tends to self-regulation rather than the requisite agencies of government. The study further revealed that about 60% of the operators hard spent only 1-5years in the

business which is an indication that most boat drivers were in experienced and thus a higher propensity or likelihood of accidents arising from human factor error. Their study thus suggested that immediate removal of water hyacinth, subsidy for safety materials and enactment of water-based transport policy would improve water transportation in Lagos state.

[7] conducted a study on ferry services route network in Lagos Lagoon Nigeria, and applied graph theory to develop a framework for efficient utilization of Lagos waterways system as a complement to other transportation mode such as the dominating road mode. The study further used passengers travelling distances, travel times, travel delay and speed variations on the road and water transportation systems in Lagos state to design a geographic information system (GIS) of waterways transport system. Results show that water transport is found to have caused a reduced journey time by an average of 46.33% and therefore, concludes that urgent attention is needed to arrest the total collapse of the entire modal system since significant journey time saving is derived by the use of inland water transportation.

In another development, [8] explore the prospects of inland waterways for freight traffic movement along Dhaka- Chittagong corridor and constraint analysis of full operation of the Pangaon Inland Container Terminal (PICT). They reveal that Chittagong Port handles about 75% of containers reaching Bangladesh of which 85% were carried via the Dhaka- Chittagong (DC) economic corridor. They assert that Bangladesh has one of the largest inland waterways network in the world and further exposes the various benefits of inland waterways over highways and railways.

III. MATERIALS AND METHODS

The method of data analysis adopted in this paper is descriptive. Table and graph are used to establish trends in passenger and boat traffic as well as journey time on the waterways of Delta State, Nigeria. Averages are derived from total summation with respect to the number of observations, considering the formula for computing arithmetic mean of ungrouped data as stated in [9]:

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

(1)

where \bar{X} is the arithmetic mean; x_i , the i th observation; and n , the total number of observations.

IV. RESULTS AND DISCUSSION

A. Data Analysis and Results

TABLE I.
 IWT OPERATIONAL LOGISTICS ON DELTA STATE (WARRI- BURUTU) ROUTE

DAY	NO OF BOATS	NO OF PASSENGERS	TRANSPORT FARE @ (#1,200)	FUEL COST (@ 1.5tank = #6,000)	OTHER COST(#)	JOURNEY TIME (Min)
1	9	125	150,000	66,500	16,600	45
2	8	91	109,200	48,000	0	47.5
3	6	67	80,400	24,000	3150	48
4	5	52	62,400	28,000	12,150	48
5	12	148	177,148	82,000	16,700	49
6	7	74	88,800	42,000	1,500	47
7	9	96	115,200	46,000	0	48
8	6	74	88,800	30,000	8,000	46
9	7	79	94,800	32,000	0	47.5
10	12	128	153,600	74,000	4,500	48.5
11	6	67	80,400	34,000	0	48.5
12	8	88	105,600	46,000	0	48.5
13	6	61	73,200	36,000	4,500	49
14	6	55	66,000	38,000	0	50
15	6	68	81,600	31,000	2000	50
16	4	44	52,800	28,000	0	48
17	8	77	92,400	48,000	0	46
18	12	142	170,400	74,000	500	45.5
19	5	54	64,800	28,000	0	45
20	8	93	111,693	57,600	1,500	47
21	17	195	234,000	113,200	5900	46
22	7	73	87,600	34,000	0	45
23	13	144	172,800	106,800	2,800	45
24	6	65	78,000	36,800	4,170	48
25	4	36	43,200	26,800	3,400	48
26	5	54	64,800	28,000	0	45
27	6	58	69,600	38,500	1,200	46
28	14	191	229,200	73,500	0	47
29	15	167	200,400	93,000	0	50
30	9	167	200,400	56,500	2000	49
31	5	60	72,000	28,500	2,500	46
32	7	70	91,276	46,500	0	50
33	8	78	93,600	44,000	0	46
TOTAL	266	3047	3,476,717	1,619,700	93,470	1563

Source: Computed from Field Survey, 2021

Table I shows the operational logistics of the Inland waterways of Delta state represented by the Warri-Burutu waterways. A total of 266 boats, 3047passengers used the waterways within a 33- day period of survey. A total of N3,476,717 was generated from fares and cost of fuel of about N1, 619,700 and other operational cost of N93,470. Total journey time was 1563 minutes for a one- way navigation. Hence, on an average, an operator spends about N6,089.10 per half capacity tank of boat and a maintenance cost of N351.39 per trip. The user of the waterways thus spends an average transport fare of N1141.03 per trip. Therefore, it implies that both the user/ passenger and the operator spend an average of 47.36 minutes for a single trip on the Warri to Burutu route sampled in Delta state as indicated in Table I.

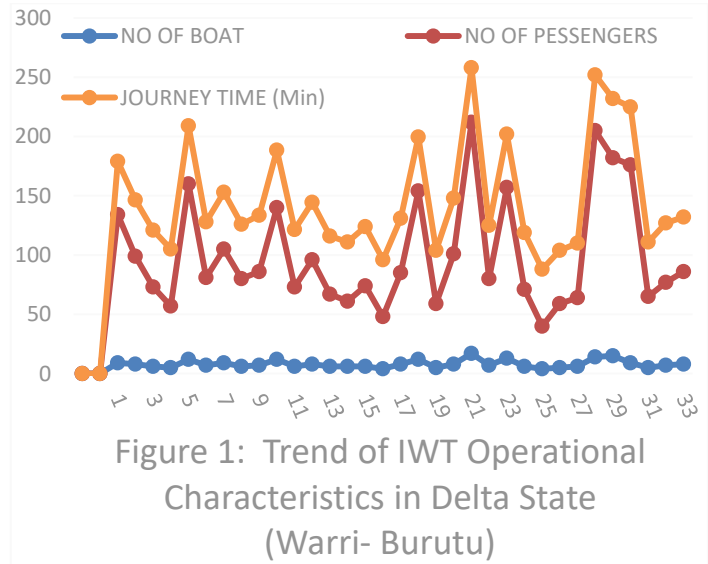


Figure 1: Trend of IWT Operational Characteristics in Delta State (Warri- Burutu)

Source: Computed from Field Survey, 2021

Figure 1 shows the pattern or trend of all the operational characteristics for the Warri- Burutu route. The trend reveals points of peak and through for the Warri- Burutu route. This further reveal that boat traffic seldom increased due to lack of investment on the infrastructure as there were no massive entrance into the market within the route. On the other hand, passenger traffic experienced a hike during the beginning and the third quarter of the month, possibly due to availability of income of users who may be wage earners and as well as weekend and month end trip makers. The peak in passenger traffic most often may be associated with increased journey times due to peak hour rush.

B. Discussion of Findings.

The trend of traffic on the selected inland waterways needs not to be overemphasized. The study recorded significant trends on the waterways for the survey period. Figure 4.1 gives a pictorial representation of the IWT operational performance over the survey period. It is evident that on the Warri to Burutu route, passenger traffic peaked on the first, fifth, ninth, seventeenth, twenty-first and twenty- seventh day of the month. This study utilized tables and graphs to establish these trends, as this outcome corroborates with the work of [10] that analyzed passenger vessel accidents in Bangladesh, which utilized graphical approach to showcase the operational characteristics and accidents on the waterways.

In an attempt to evaluate the average cost and time of travel on the waterways, it was revealed that on an average, an operator spends about N6089.10 per half capacity tank of boat and a maintenance cost of N351.39 per trip, giving a total average cost of N6440.49 to the boat operator. The user of the waterways thus spends an average transport fare of N1141.03 per trip. Therefore, it implies that the user/ passenger and the operator spend an average of 47.36 minutes for a single trip on the Warri to Burutu route. This outcome is in tandem with [5] concentrated his findings on tradeoff between freight- cost-time and timely delivery as factored into his model. Using the Japanese Census of Logistics, his paper examines the cost influence of distance and time across shipping modes.

V. CONCLUSION

Based on the results and findings, this paper concludes that the waterways of Delta State have viable operational characteristics that would enable optimal logistics network and supply chain management systems. More so, the trend of traffic on the waterways showed significant peaks and troughs in terms of passenger traffic, journey times and user costs, possibly due to increased boat ridership occasioned by the establishment of the College of Marine Technology at Burutu, the Maritime University at Okerenkoku, and the age long oil exploration, bunkering and related logistics at Escravos.

Therefore, to tap from the endowments of Inland waterways transport in Delta State; the paper recommends that the National Inland Waterways Authority (NIWA) in partnership with the State Ministry of Transport, should enforce strict regulations on the inland waterways of the Delta State considering the huge economic potentials of the area, through continuous, sensitization workshops for boat drivers, dredging of the waterways and the provision of adequate security and ferry service to increase efficiency and just- in- time logistics on the waterways.

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