DIAGNOSTIC PERFORMANCE IN PORT MANAUS – AM

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ABSTRACT

This paper seeks to identify the attributes of paralysis and its influence on the performance of port operations performed in the shipping cabotage in Manaus. The firms located in the Industrial Pole of Manaus - PIM demand for an efficient logistics system to ensure that their products are competitive in the global market. The performance of these enterprises logistics system is based on the ports that represent the main element of the supply chain. Operations examined in these charts represent on average 46% of gross operating the terminal. The results generated from the level of importance, pointed out that the owners are primarily responsible for stoppages of operation, then the terminal points with 32%, other 11% (or agent does not define) and finally the OGMO (9%).

Keywords: Water Transport, Amazon, Optimization and efficiency in harbours

CONTEXT

The transportation of cargo is the distribution of goods from one place to another through various methods for handling (Ballou, 2001). This movement of goods is directly related to the characteristics of economic activities and the potential logistical each region.

In recent years the productive activities have undergone important changes and the logic of global networks of suppliers requires the establishment of logistics systems able to put materials and components directly in the places of production and consumption in accordance with criteria of quality, flow and time period.

In this scenario, the ports are no longer just places of handling, storage and transhipment cargo, but rather represent a key link in the restructuring of the transport matrix, contributing to the increase in business competitiveness and increasing exports (CNT, 2006).

The Industrial Pole of Manaus (PIM) is the base of the economy in the Amazon and has the feature of importing inputs and exporting finished products, using its transport mainly long distance services and cabotage.

The transportation system in the northern region needs significant improvement, since in the distribution of the modalities for the Brazilian regions, the North stands out by concentrating 55% of waterways, only 20% of ports in total. Roads comprise a portion of 35% and 25% of unpaved roads.

The dependence of water transport takes the region to produce economic and social barriers to the operating systems of main ports do not perform efficiently load flow. It is believed that the social and economic growth is highly related to a positive situation of transport systems.

The study developed in the port sector is a tool to aid in the management, because it is directly associated with the construction and evaluation of results for the planning of actions aimed at achieving the best performance of the Brazilian port of Manaus.

The research aims to identify and prioritize a set of attributes that demonstrate the main reasons associated with performance of the operation in cargo container in coastal service. It is understood that the hierarchy of attributes, identified in the research, represents the reality of problems in the system of water transport cabotage in Manaus.

CHARACTERIZATION OF STUDY AREA

The Manaus city is installed in the area of the Free Zone or Free Trade Zone - MFZ, created to establish an economic base in the western Amazon through the construction of a pole of Industrial Development, Commercial and Agricultural. Currently the Industrial Pole of Manaus - PIM is composed of approximately 500 firms, which represent fixed investment around U.S. $ 7 billion (SUFRAMA, 2007).

The combined revenues of the companies encouraged in PIM in 2007 reached a value of around U.S. $ 26.0 billion, growth is 147.1% compared about 2000. The three subeditors responsible for 69.6% of total revenues were 29.4% electronics, motorcycle and represented 23.2% and 17.1% informatics sectors. The remaining 30% of sales is sprayed into segments

such as chemicals, thermoplastic, metal and mechanical, typically suppliers, among others (RIVAS, 2008).

These companies in PIM have the profile of importer and exporter, where the importer is because most companies acquire their components in other countries. Already the export profile occurs because the industrial hub sends finished products into the country. The transport network in the Amazon despite being established by a few alternative transport plays a key role within the context of economic, social and environmental. The region by their geographical features have a transport system with predominance in water transport (sea, river and road and river) and Airway.

According to INPE (1998), the Brazilian Amazon has a network of waterways around 24.000km, occupying a territorial extension of more than 3.6 million km2. The abundance of navigable rivers is of great importance on different aspects, from the subsistence, such as transporting people and small loads to the larger-scale, e.g. coastal and long distance.

The PIM uses mainly transportation services for long distance and coasters. The feature of long distance transport of food is the Industrial Pole with inputs such as: electronic components and raw material for the motorcycle components sector from Asia, mainly from China, Taiwan and others. Cabotage mostly takes the finished products of the PIM to the South and other countries, like Argentina and Uruguay, using the Brazilian coast ports for distribution (SILVA, 2008).

Vessels of shipping (cabotage and long course) make access by the mouth of the Amazon river in Amapá which shows two points where the draft is limited, they are: the farm located at the entrance passage by Barra North (Amapá) and the other in Itacoatiara (Amazonas). From the mouth of the Amazon River to the River Negro in Manaus is about 1,500 km of natural waterways. The stretch with about 15 km from the mouth of the River Negro to the ports offers, in its more restrictive conditions, width of 500 m and a depth of 35 m.

Manaus has a port and two Public Joint Private Use Terminals - TUP for loading and unloading of containers, both are located on the left bank of the river Negro, have a floating pier connected by an access bridge with pier, offering two positions dock, cradle inner and outer side of the crib. Table 1 summarizes some technical information of terminals an port.

Table I – Informations about containers terminals an port in Manaus

Parameters	Structure of ports		
	Public Port	TERMINAL - A	TERMINAL - B
Floating píer extension (meter)	268	-	431.5
Attraction capacity	2	3	4
Crane LIERBHERR	-	2	6
Dockland (m^2)	41.232	70.000	146.501
Production (Medium)	24	30	30

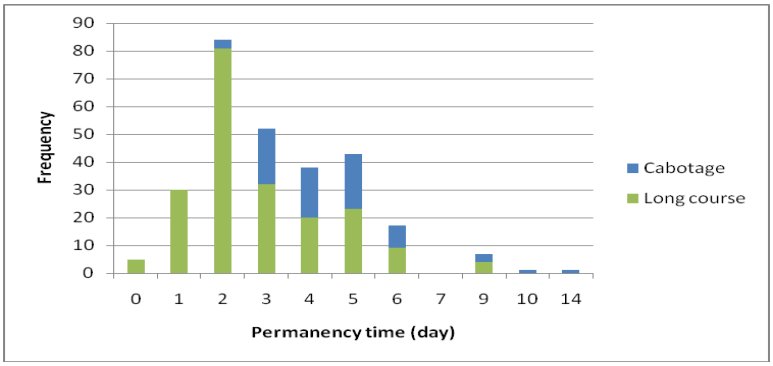
Source: (Superterminal Port Public and Chibatão Terminal, 2009).

The service includes the port infrastructure in the logistics chain supporting the national and international commerce, which requires loading and unloading of ships with quality to meet the demands sought so as not to impede the flow of cargo.

Despite the importance in the production flow from Manaus, in mid 2004 with the process of urbanization, the Public Port has become the subject of much speculation since the restrictions on operational capability and possible drop in performance. In 2005 the port began to show a decline of 28% in the movement, leading many experts to argue that this could be one of the biggest barriers to logistics in the North, as an indication of study COOPEAD in 2005.

The two mixed-use private terminals together handled 97% of containers in 2007, which confirmed the decline in operating performance of the public port. In 2008, Terminal B was responsible for the largest container handling (60%) of the State of Amazonas, with its "flagship" the cabotage service, and in Terminal A at greater movement is related to the long haul. The average annual growth of container handling for the city is around 17%.

As noted in NTCODAM (2009), the current status of operations in relation to waiting time is positive, the ships are not anchored waiting for the "windows" for operation, as happens in other ports in Brazil. However, cabotage vessels moored or have a time gross very high, ranging from 2 to 14 days showing an average time of berthing of four days, which does not occur in long-haul service where his average time at berth and reached two days. Figure 1 shows the time spent in terminals for service at 2008, it is possible to realize the prevalence at the time of high attraction of coastal vessels.



Source: (NTCODAM, 2009).

Figure 1 - Indication of time spent in boats

In the assessment of port performance one of the main variables on the criterion of efficiency in port operation speed is calculated by the number of containers handled per hour. In both Terminal A Terminal B presented as a moving average drive of 30 per hour while (cabotage) in Public Port, when in operation, had an average drive of 24 to move per hour.

It was observed in a survey by ABRATREC (2009), that the average productivity for the Brazilian ports in the evaluation was to move 38-hours, which shows that the terminals are in Manaus with productivity below average, even longer operating with the most modern cranes

a year. There are other variables that are directly related to the performance of the transaction terminals, and the research aims to identify them.

ANALYSIS OF CABOTAGE IN BRAZIL

Cabotage has been gradually growing in Brazil generating expectations that the transported volume will grow continuously. The expected increase in demand for the service follows a series of factors that should define a new reality for the carriage of cargo in the longer distances tend to be traveled by sea. (Candian, 2002).

The wide range of waterways along the Brazilian coast and the concentration of economic activities near the coast, due to the historical pattern of territorial occupation of space, which leverage a natural vocation for cargo transport through the coastal shipping (CRUZ, 2007).

But in 2005 the COPPEAD produced a diagnosis of the main causes of low efficiency in cargo transportation in Brazil, highlighting the imbalance of the matrix of transport legislation, inadequate supervision, the deficiency of infrastructure and insecurity of the roads. This imbalance in the system of freight Brazilian is evident, therefore, the highway mode appears with the largest share (61%) in the matrix, leaving the other modes a very small portion of cargo, where the waterway modal has 14% stake.

Based on research conducted by CNT (2006), the agents point out some negative aspects as the main factors to be revised to become more competitive cabotage, which were: the lack of regular lines, the large number of tariffs, inefficient port , the high cost of securing and excessive bureaucracy.

Fadda (2004) mentioned that main causes that are associated with low performance of cabotage in Brazil are: inefficiency and obsolescence of port system, the high costs of port operations, the anachronism of port labor legislation, the renewal of the merchant fleet, the excessive government intervention in the shipping industry (control freight), strong regulation and protectionism, the concentration of investments in road infrastructure and high rates of inflation.

Cruz (2007) assessed the barriers of cabotage by the look of the actors in the system, the results indicated that the owners consider that 70.3% of the principal barriers are assigned to ports as cargo owners 63% attributed these problems to the ports. The other actors do not consider the ports responsible for the largest barriers in the industry.

The two main aspects that hinder the development of coastal Brazil, are the excess port workers and low efficiency and productivity of container handling at terminals. In general, the environments have little port operational efficiency. It is necessary therefore that information is available about the operation of the port system that enables the assessment of their performance and, consequently, the allowance for decision making in port management.

As Bogossian (1983) is essential to know the operational indicators to assess the level of service provided by a port. The operational indicators constitute the most important assessment tool for port services. These indicators are generated from the parameters of quantitative, qualitative and economic.

Thus justifies the search for methodologies that allow the performance evaluation of port terminals, aimed at complementing the operational indicators recommended by the literature.

IDENTIFICATION AND CLASSIFICATION OF ATTRIBUTES

At this stage presents the attributes related to shutdowns of cabotage operation, and a partial presentation to the basement of the subsequent analysis. The operations examined by NTCODAM (2009) presented a motion that varied from 1079 to 1597 averaging containers handled 1411 containers. The berthing time equals the time to pull up the output of the vessel, it ranged from 2 to 6 days with an average of three days of stay.

The vessels are analyzed type container port in length from 192 m to 200 m, that are responsible for performing the cabotage service. The attendance of the vessels was performed on average by three cranes (resource). Given these aspects, the actual productivity performance was varied from 22 to 38 containers moved per hour, with an average production of 26 containers move per hour.

There are reasons associated with low productivity and high residence time of shipping terminals, and these were collected and classified by analysis of nine (9) operations provided by the Terminal and the shipowner.

Attributes was defined as the specific features of the strike, e.g., why the appeal to stop operation for a period of time, these attributes can be scheduled or unscheduled. The attribute set (normal) is understood as being a parade that was planned to happen, since the attribute is not set (abnormal) is a type of stop that occurs without the direct control of the agent, no prediction. The agent responsible is the one that has direct control of the attribute is can be the Terminal, the Amateur and OGMO (Body Manager Handheld workforce Avulsa). In some attributes we could not identify the agent responsible. Table 2 below shows the attributes ranked by agent and by the type attribute.

Table 2 - Classification of Attributes

AGENT	ATTRIBUTE OF DEADLOCK	Attribute
PORT	Preparation HATCHCOVERS Provisions	Programmed
	Wait for cargo	Not programmed

	Defect crane Want wagon Wait for inspection in crane Wait for maneuver of crane Wait for request cargo Defect Blackout Defect in spreader	
SHIPOWNER	Waiting release Deck preparative Container inaccessible in hold	Programmed
	Wait for ship Wait for maneuver of ship Waiting list embark	Not programmed
OGMO	Waiting stowage Crane in difficulty Crane-man in difficulty Crane-man without condition	Not programmed
OTHER	Rain	Not programmed
	Cargo transfered to another lance	

Source: (Authors).

Each attribute has a degree of influence on the performance of cabotage was obeisant from the frequency with time still observed in the operations. Operations examined in these charts represent an average of 46% of gross operating the terminal, being 67% of the attributes responsible for the stops are considered attributes regarding unscheduled stoppages. In 54% of the total time of operation is the loading and unloading of cargo. The weight (wi) for each attribute in operation is presented in Table 3.

Table 3 - Weight of the attributes of ceasing the operation of cabotage in Manaus

	Attribute	o_{oi}	o_{oii}	$o_{o...}$	o_{on}	**Importance index**
Programmed	A_1	w_i	w_{ii}	w_{iii}	w_{ix}	$IA_i = \sum w_i$
	A_2	w_{ii}				
	A_3	w_{iii}				
	A_4	w_{ix}				
	A_5	w_x				

Not Programmed	**A_6**	w_i				
	A_7	w_{ii}				
	A_8	w_{iii}				
	A_9	w_{ix}				
Operation index (IOi)	$IO_i = \sum w_i$					

Source: (Authors).

With the identification and classification of the main attributes associated with downtime the proposed method is based on a sequence of steps, which performs the first evaluation of the hierarchy of attributes by the frequency with which all the stops occur in the operation and in preparing the importance index therefore know the degree of importance will help to direct priorities if there's interest in reducing the length of stay of vessels or increase the productivity of the terminal.

The order of importance of attributes was done using the index (IA i) and was estimated based on the magnitude of the weights (wij) generated by the frequency in each operation (O1, O2, ..., On). This index is composed of the sum of the absolute values of the weights (wij). The logic of the method is based on the identification and the importance of the set of attributes that contribute to halt the permanence of the boats (productivity), treated and evaluated by staff in operations.

ANALYSIS OF ATTRIBUTES IN ORDER OF IMPORTANCE

The results of the importance index for the attributes identified an order of arrest and type of agent. In Table 4, shown below was sorted the answers that describe the impact of parades and general characteristics of the case study.

Table 4 - Degree of importance of the attributes of stoppage for the cabotage operations in Manaus

AGENT	ATTRIBUTE OF DEADLOCK	Importance
OTHER	Rain	1,841
	Cargo transfered to another lance	9,997
OGMO	Crane-man in difficulty	0,386
	Crane-man without condition	2,429
	Waiting stowage	3,275
SHIPOWNER	Deck preparative	0,128
	Wait for ship	0,194

	Waiting release	1,186
	Waiting list embark	1,316
	Wait for maneuver of ship	1,600
	Container inaccessible in hold	3,650
	In one's own benefit of Shipowner	44,982
PORT	Wait for request cargo	0,111
	Wait for inspection in crane	0,121
	Wait for maneuver of crane	0,132
	Defect crane	0,160
	Preparation	0,169
	Defect	0,273
	Blackout	0,406
	Defect in spreader	0,673
	Want wagon	1,639
	Wait for cargo	2,485
	HATCHCOVERS	3,639
	Provisions	22,444

Source: (Authors)

The output from the degree of importance the owners points (53%) as the most impactful for stoppages of operation, then the terminal (32%), other (11%) (or agent does not define) and finally the OGMO (9%).

The evaluation of attributes whose head is the Terminal, the stops were the meals program, and Hatchcovers Preparations. Thus the order of importance of attributes for the terminal is configured as: i) Provisions (22 449) and most importantly, ii) Hatchvores (3639), iii) waiting for cargo (2485), iv) Want wagon (1639) v) defect Spreads (0673), vi) blackout (0405), vii) default (0273), viii) Preparations (0169), ix) defect in the crane (0160), x) maneuver the crane (0131) xi) Inspection of the crane (0120) and xii) Wait for request cargo (0111) as less important.

In the case of attributes related to the owners, three stops are planned, namely: waiting for release of cargo, preparation of container deck and arrested. For the attributes, the order of importance was established as follows, the most important convenience of operator (44 982), container stuck in the basement (3.65), waiting maneuver the vessel (1.60), waiting list for boarding (1316), waiting release (1185), waiting for the ship (0194) and preparation of the deck (0127).

Finally, was presented the attributes and OGMO responsibility of those who do not have an agent defined (classified as others). For the attributes evaluated, except for going to boom

stowed aboard, all unscheduled stops are and their importance to the attributes whose agent is the most important OGMO was waiting for stowage (3274) second Crane-man without condition to operate (2428) and third place Crane-man with difficulty (0386). The attributes that the agent is not defined, the most important was going to stow the boom to the board (9996) and after rainfall (1841).

In order to analyze the correlation between rates applied to the attributes and gross productivity (moving / total hours of operation), assuming a weight for each operation (O1, O2, ... On) equivalent to the sum (Σ) of weight absolute of each attribute (w1, w2, ... wn). The operation that provide the lowest index (IOI) is the operation that has the least impact of the charts.

The correlation between the index (IO1) with the gross productivity can be explained by the linear relationship, where the value of adjusted R-squared is 0.516512 indicating a moderate relationship between the independent variables (productivity) and the dependent variables (IO1). The regression model used was Y = 32.7183 - 0.9164 Xi. As Table 5 shows that the hypothesis test H0 was rejected, assuming thus that the model can be considered adequate.

Table 5 - Results of Statistics

STATISTICAL REGRESSION	
Comments	9
Adjusted R-squared	0.516513
Standard error	6.244366
F signification	0.017574
P-value	0.017574

Source: (Authors).

Assuming the hypothesis that the error has a normal distribution and constant mean, linear trend shows how one can accept that the waste has a normal distribution. In this analysis was observed that the waste goes to zero, and apparently there are no outliers, so was acceptable that the average was zero and constant variance.

The interval with 95% confidence for the variable productivity (independent variable) showed lower limit of 15 728 and 49 708 being higher than α = 32 718, which is within the confidence interval. For the β (or IOi) range, with 95% confidence, presents a lower limit of -1618 and -0215 superior, the value of β is -0.9164, which is within the range. Therefore, the actual regression line is interpreted as the expected change in productivity associated with a change in IOi, that is, the model shows that the index attribute (stoppage) linearly changes the behavior of productivity of the terminal.

CONCLUDING REMARKS

The diagnostic evaluation of performance through the attributes applied to strike coastal shipping can help in the evaluations of managers and companies because it possible to measure outcomes and assist in making decisions. If control of this activity is not properly developed and monitored closely, result in increased length of stay of the vessel than expected. Thus, the activity will become more efficient if the stops are optimized by reducing the length of stay of vessels.

Despite the accessibility of Manaus to the container ships that have not yet reached a development that would allow operationally equal to other regions of the country, even with large industries and ports that are modernizing. However, it is essential that this goal is achieved in the medium term, because otherwise it may affect the process of establishment of industries in PIM, because they see not just one factor in tax incentives for manufacturing its products in the Cluster Industries of Manaus.

It is pointed out that to improve the efficiency of the Terminal any measures could be taken, namely: the use of cranes suitable for floating piers, larger bridges between the piers and courtyards, patios and docks make the same levels, providing a reduction in cost of stevedoring to drive on weekends, to establish arrangements for working hours to enable the ongoing work of 24 hours of the day, improving the operational management / administrative terminal for delivery of cargo allowing customers do not disrupt the operations of vessels energy independence and viability of the terminal.

The improvement in port infrastructure has been reflected in the performance of container operations, but there are other variables that are directly related to the performance of the transaction terminals, among them are: the aspects port relative to the size of the piers, location of container at different levels, simultaneous operation of ships with the receipt of cargo at the terminal and power outages.

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