CONTAINER STACKING YARD OPTIMUM UTILIZATION ANALYSIS OF OPERATOR AND USER ORIENTATION (CASE STUDY PT. PELABUHAN INDONESIA IV)

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ABSTRACT

Stacking yard is one of seaport's main facilities to store containers and to prevent from ship's delay risk which affects in decreasing of loading and discharging productivity and increasing of ships and cargoes time in seaport. One of the indicators used for Port development plan is by using stacking yard utilization level (YOR).

PT (Persero) Pelindo IV manages 19 seaports in Indonesia East Region which serve 10 provinces such as 5 provinces in Sulawesi, one province in east of Kalimantan, and 4 provinces in Maluku and Papua Island. Total area for those provinces are 865.284 km2, equal with 45.76% from Indonesia total area or almost half of total area of Indonesia. During 1999-2010, containers' traffic rate of PT (Persero) Pelindo IV has increased 15,61% per year (average). During period 2000-2010 general cargo type is decreased from 33.9% in 2000 became 7.16% in 2010, as for container type is increased from 11.18% in 2000 became 41.91% in 2010.

The purpose of this research is to analyze optimum stacking yard's level of utilization based on operator and user. This research carries out optimization methods by minimizing total cost expenses for operator and user. The result of this research shows that the average of stacking yard's level of utilization in 2010 is 58%, while the average of optimum stacking yard level of utilization is 85%.

Keywords, stacking yard, level of utilization, optimum.

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1. INTRODUCTION

Sea port is one of the main components of sea transportation system for archipelagic state such as Indonesia. As a point of convergence of inland and coastal transportation systems, port has essential functions not only to support the economic system but also to be the main gate of trading commodities, the area for loading and unloading cargoes, and embarking and disembarking passengers. In order to plan an effective coastal transportation system, ships service aspect, port's infrastructure, region potential, and integrated and coordinated planning of transportation systems between land and hinterland area are needed.(Yamin Jinca, 2011)

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The problems in coastal transportation system are infrastructure condition and relatively low service, as a result it will increase ships and cargoes time in seaport. On the other hand port's operator capability to provide investment fund is limited. The purpose of this research is to analyze optimum stacking yard's level of utilization of PT Pelindo IV based on operator's cost (port administrator) and user (ship and commodity's owner).

2. OVERVIEWS THE LITERATURE REVIEW

2.1. CONTAINER PORT

Seaport is considered as a turning basin (a safe area for vessels' maneuvers), area for anchorage, area for loading and unloading cargoes, and area for embarking and disembarking passengers. (Soedjono, 2002). Based on Government Regulation of the Republic of Indonesia Number 61 of 2009 concerning port management, port is a delimited area consists of mainland and/or waterfront as an area for government and economic activities. Port is used as an area for seagoing vessel's anchorage, embarkment and disembarkment of passengers, and/or loading and unloading of cargoes such as terminal and area for ship's anchorage equipped with safety and security facilities for shipping and other supporting activities and as a place for shifting between intra and inter transportation system.

Stacking yard is one of the main facilities of container's port for storing container into and out of the vessel, minimizing ship's delay risks, and consolidating cargoes. Stacking yard is located on mainland completed with concrete pavement on its surface to restrain container and crane's load. When

the containers are stacked up to 2 or 3 levels, the load could arise. (Triatmodjo, 1996)

There are two ways in handling container on the stacking yard. First, by putting on the chassis and second, by stacking on the ground. Chassis system could be accessed easily but this system needs more spacious area. On the other hand, stacking on the ground system couldn't be accessed directly and spacious area is not needed. Nowadays, stacking on the ground system are preferred because the area of the container yard is limited. (Iris F.A. Vis, Rene de Koster, 2002)

2.2. YARD OCCUPANCY RATIO

Port facilities utilization level is one of port functions as an important analysis instrument for management in managing seaport, deciding and developing planning, also setting the policies related with seaport. Storage Occupancy Ratio (SOR)/Yard Occupancy Ratio (YOR) is a ratio between stacking area utilization (ton day or M3 day) and effective stacking capacity.

$$\text{SOR/YOR} = \frac{\text{Number of container x Dwelling Time (Day)}}{\text{Effective stacking capacity (Ton)}} \text{ x } 100\ \%$$

2.3. OPTIMIZATION OF STACKING YARD UTILIZATION LEVEL

Optimization method is used to find required condition to attain the best result from the recent situation. In order to solve practical problems on board, optimization techniques are developed to deal with those problems. Generally, there are various solutions for a problem. But by determining the purpose, only the best solution will be chosen. There are various purposes may appear, but mostly regarding technical and economics matter. From economic side, the purpose could be either maximisation or minimisation.

Queue cost optimization model is used to find optimum level of service in terms of quality and quantity of service. This result is achieved by balancing between cost of service with cost of waiting as a result of service provided by port's administrator. (Taha, 1987)

Cost of service included in operation of facilities while cost of waiting means customer's waiting cost. Increasing service means decreasing customer waiting-time. Figure 1.1 shows the higher the level of service, the more the cost is needed. On the other hand, If the level of service increases, cost of waiting customer will decrease. Optimum level of service occurs when cost of level of service and cost of customer reach minimum level.

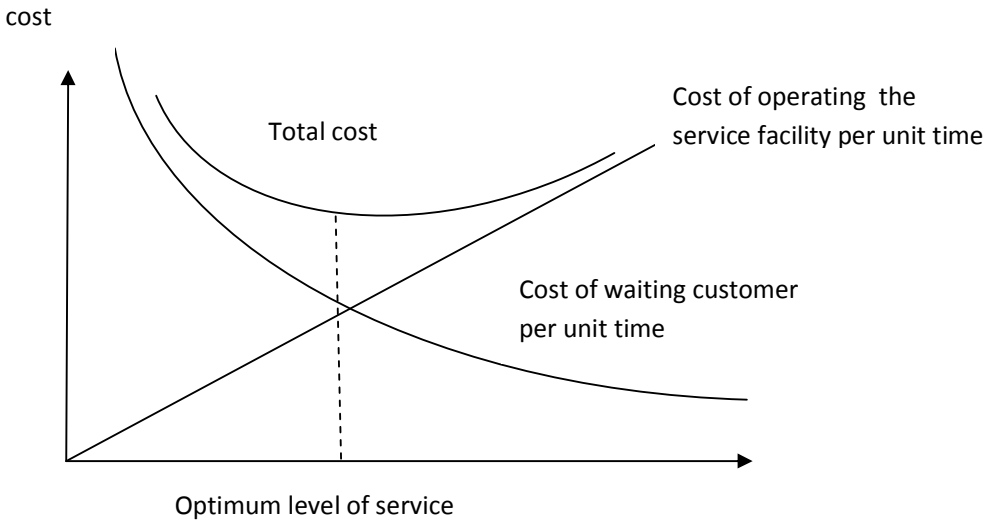

Figure 1. Service and cost parameterization.

3. RESEARCH METHODS

These stages are conducted in this research, as follows:

3.1. Sample selection.

For this research, strategic ports within PT. Pelabuhan Indonesia IV scope are chosen because these ports have great opportunities to be developed. There are 25 strategic ports in Indonesia. Eight of them are located in Pelindo IV scope of area, such as : Port of Samarinda, Port of Balikpapan, Port of Makassar, Port of Bitung, Port of Biak, Port of Sorong, Port of Jayapura, and Port of Ambon.

3.2. Data collection.

Primary data are taken with inspecting or surveying on the chosen ports such as duration of containers stacked, how containers are stacked, and Yards' procurement and maintenance cost. Secondary data are taken from the document of the chosen ports such as cargoes traffic data and stacking yard area.

3.3. Data analysis method.

1. Stacking yard capacity per year (Teus/year) can be calculated using formula

$$\text{Capacity} = \frac{(\text{Effective area}/\text{Container area}) \text{x Number of stacking}}{(\text{Number of days in a year}) \text{x duration of stacking})}$$

2. Utilization capacity is measured on sample ports. It is measured with analyzing a number of cargoes/containers that utilize stacking yard facility in a certain period of time (per month or per year) either they enter the ports through the sea (unloading) or they enter from the mainland (loading). Container's flow researched is the flow of loading and unloading container during 2010.

3. Level of utilization of container stacking yard's sample is determined using YOR formula. YOR is a ratio between stacking area utilization (in Teus) and effective stacking capacity.

$$\text{SOR/YOR} = \frac{\text{Number of container x Dwelling Time (Day)}}{\text{Effective stacking capacity (Ton)}} \text{ x } 100\ \%$$

4. Analysis of optimum level of utilization of stacking yard is determined using optimization techniques which consider port operator and cargoes' owner (user). Yard level of utilization is optimum when total cost of port operator and cargoes' owner (user) is minimum.

4. RESULTS AND DISCUSSION

1. LEVEL OF UTILIZATION OF CONTAINER STACKING YARD

Level of utilization of container stacking yard in 2010 is low, 80% of stacking yards have YOR percentage below 100%, while 20% of stacking yard (Port of Balikpapan and Port of Samarinda) have YOR percentage above 100%. Averageof yards' level of utilization is 56%, it means that the facilities are more than the capacity. Data of stacking yards capacity and calculation result for each ports are shown in table 1.

Table 1. Level of utilization of container stacking yard (YOR) of all sample ports in 2010

No.	Name of ports	Stacking yard's area (m^2)	CFS area (m^2)	Stacking duration (day)	Capacity (Teus/year)	Cargoes in 2010 (Teus)	YOR in 2010 (%)
1	Makassar	59.203,00	19.200,00	7,00	370.442	4.824	1,30
2	Balikpapan	20.172,00		12,00	92.035	95.302	103,55
3	Samarinda	38.600,00	1.200,00	10,00	169.068	188.861	111,71
4	Bitung	61.475,87		7,00	384.663	72.267	18,79
5	Ambon*	16.335,00	6.360,00	10,00	71.635	51.875	72,42
6	Sorong*	14.394,00	1.950,00	15,00	42.030	32.316	76,89
7	Jayapura*	15.400,00	2.200,00	10,00	67.452	54.631	80,99
8	Biak*	10.000,00	4.760,00	10,00	43.800	8.837	20,18
9	TPM	126.400,00	4.000,00	4,90	1.129.861	442.550	39,17
10	TPB	30.000,00		5,30	247.925	94.031	37,92

2. OPTIMUM LEVEL OF UTILIZATION OF CONTAINER STACKING YARD

Calculation result for optimum level of utilization of container stacking yard are shown in table 2.

Table 2. Optimum level of utilization of container stacking yard based on minimum total cost of user and operator

No	Name of Ports	YOR Opt (%)	Yard area (m^2)	Stacking duration (day)	Yard capacity (Teus/year)	Numbers of cargoes (Teus/year)
1	Ambon	93.26	12,700	10.00	55,626	51,875
2	Balikpapan	94.95	22,000	12.00	100,375	95,302
3	Biak	63.05	3,200	10.00	14,016	8.837
4	Bitung	85.55	13,500	7.00	84,471	72,267
5	Jayapura	83.15	15,000	10.00	65,700	54,631
6	Makassar	70.09	1,100	7.00	6,883	4,824
7	Sorong	88.54	12,500	15.00	36,500	32,316
8	Samarinda	95.82	45,000	10.00	197,100	188,861
9	TPM	95.21	52,000	4.90	464,816	442,550
10	TPB	81.27	14,000	5.30	115,698	94,031

Table 2 shows average optimum level of utilization of container stacking yard is 85% with average stacking yard capacity is 114.119 Teus/year.

5. CONCLUSION

1. Most of seaports managed by PT Pelindo IV are conventional ports, only 20% of the ports are container ports. Average capacity of stacking yard is 130.134 Teus/year.
2. Utilization of stacking yard in 2010 is quite low. Utilization level for most of the ports (80% of the ports) is below 100%. Average level of utilization of stacking yard is 56%.
3. Average optimum level of utilization based on operator and user is 85%, with average capacity 114.119 Teus/year.

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