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Analysis of Working Time Standard for Loading and Unloading Goods And Income for Loading Unloading Labor (Tkbm) at Traditional Shipping Quay of Sunda Kelapa Port

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Abstract: Sunda Kelapa Port is one of the largest ports in Indonesia that specifically handles traditional ships activities. The loading and unloading services of various commodities at this port are still not optimal in accordance with the complaints of service users. In this regard, this study is aimed at finding various root causes of suboptimal loading and unloading activities through measuring the standard time of loading and unloading activities and analyzing the income level of stevedoring workers (TKBM). This type of research is quantitative research to measure standard time against six commodities as a sample with time and motion study analysis methods. The results of the analysis showed that the standard time obtained in the six commodities sampled was unloading oilcake, sago and kaolin by 7 minutes, 8 minutes, 9 minutes and for loading salt, rice and fertilizer by 7.4 minutes, 7.3 minutes and 7.3 minutes with income levels for unloading work of 200%, 200% and 238% of payroll calculations with real time and for loading work of 205%, 200% and 200% of payroll calculations with real time. The productivity of unloading work is 20.88% and loading is 14.87%, meaning that loading and unloading work at Sunda Kelapa Port has not met the loading and unloading performance standards of non-container goods in accordance with the Regulation of the Director General of Sea Transportation.

Keywords: Harbor, Traditional Shipping, Time Motion Study, Productivity

INTRODUCTION

Indonesia is an archipelagic country, so transportation is very important for social life, economy, government, defense and so on. Transportation has several elements, namely facilities, infrastructure and service networks that interact with each other to form a service to serve the movement of people and goods from one place to another effectively and efficiently. The transportation sector, as a reference for the development of an archipelago-based

economy, is expected that people's shipping services can be provided optimally and be able to compete with more modern ships.

Sunda Kelapa Port is one of the ports in Indonesia that specifically serves people's shipping. The People's Shipping Pier has only one pier which is the forerunner of Sunda Kelapa Port.And all ships made of wood are directed to dock at the people's shipping pier. Traditional transportation in the form of phinisi ships is still used in the activities of the People's Shipping Pier (PelRa).

This port is visited by inter-island ships and people's shipping with the main commodities being wood, basic necessities, grocery goods, and building materials. Sunda Kelapa Port is a loading and unloading port for goods and containers. In this case, the loading and unloading process at the port is one of the dominant factors that affect the performance of a port. The length of the loading and unloading process at the port also has an impact on the length of a ship's turn round time which certainly makes the ship's operational costs more expensive (Rizky et al., 2018).

Optimization of time in handling the loading and unloading process is expected to improve loading and unloading performance so that the quality of logistics services and high logistics costs in Indonesia can compete with other countries. This high logistics cost causes the cost of raw materials to be more expensive and purchasing power to decrease, while the problem of loading and unloading is also related to dwelling time at the port, namely the usage time for loading and unloading exceeding the standard time carried out by other countries. Therefore, training on stevedoring workers is expected to shorten the loading and unloading work time or the so-called dwelling time duration (S. Gultom et al., 2022) so as to improve loading and unloading performance at the people's shipping dock of Sunda Kelapa Port.

Starting from the speed and smoothness of trade flows determined by the availability of adequate loading and unloading facilities and infrastructure. According to (Eni, 2019) Delays in loading and unloading work at ports often occur because something that has been arranged is not immediately carried out or delayed and can be caused by factors of trucks / loads that do not arrive on time, decreased loading and unloading labor performance (TKBM), inadequate / less optimal loading and unloading equipment and unfavorable weather such as the rainy season.

Loading and unloading activities on people's ships at Sunda Kelapa Port include unloading and loading goods from the dock to the ship or vice versa various types of conventional goods cargo. The number of goods that will be loading and unloading will require a certain amount of labor so that it requires costs that are often referred to as loading and unloading wages. The availability of skilled stevedoring workers will provide optimization of the number and time of loading and unloading implementation.

The income of migrant workers in Sunda Kelapa port is erratic due to lack of attention to the workers. Workers often work long hours and excellent physical demands with minimal income, impacting their health and well-being.

Based on the Regulation of the Director General of Sea Transportation No HK.103/2/1/18/DJL-16, a performance standard has been set at Sunda Kelapa Port of 20 Tons / Gang / Hour so that the process of loading and unloading activities can run well.

Based on the description above, this study is intended to answer the problems in the implementation of loading and unloading activities at the port of Sunda Kelapa, namely: 1) what is the standard time / standard time for loading and unloading activities at the People's Shipping Pier of Sunda Kelapa Port, 2) how is the difference in loading and unloading work time and a reasonable level of income for loading and unloading workers based on standard time with real time, and 3) how the level of loading and unloading productivity compares between the measurement results and non-container loading and unloading performance standards set by the Director General of Sea Transportation.

METHOD

This study aims to analyze the standard time carried out by TKBM where this standard time has been added various factors that affect TKBM performance such as fatiq factors and assessment adjustment factors to TKBM.

Time Motion Analysis

Motion study and time study is a study of the movements made by workers to complete their work. With this study can be obtained standard movements for the completion of a job, namely a series of movements that are effective and efficient. The study of this is known as the study of movement economics, which is the study that focuses on the application of movement economic principles. (Wignjosoebroto, 2003). Here are the steps or steps in conducting *time motion analysis* :

Standard time measurement of the downtime method

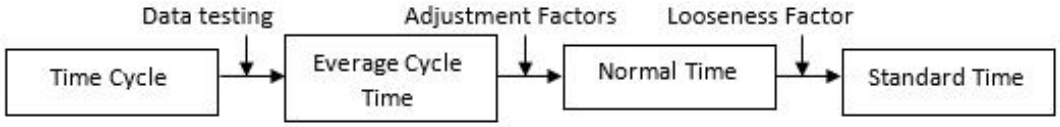
The steps in measuring standard time with the stop hour method:
Conducting initial research includes: selecting research objects, selecting workers, outlining work on work elements and preparing measurement tools
Perform measurement stages with element time data retrieval activities, and record and summarize measurement data
Stages Determination of standard time by collecting observation cycle time data (statistical testing), calculating the average cycle time (adjustment factor) and calculating Normal time and Standard Time

In the initial research, researchers will record and document the object of research. Information that must be known, for example, the condition of the work environment (lighting, temperature and so on), the condition of work equipment, how workers do their work, and so on. The data is useful for later determining adjustment factors and allowances in determining standard timing.

Stages of measurement

There are two methods in reading stopwatches, namely *the continuous time study method and snapback time study.* The *continuous time study* method is carried out by measuring the first element of work, the display on the stopwatch continues to run until the desired number of observations can be taken. To calculate standard time, the time data listed in *(reading)* must first be converted into the time of the working element by the gauge. While the *Snapback Time Study* method or *repetitive timing* method (Barnes, 1980) is intended to make the first measurement of the time of the first, second element and so on. And to calculate standard time, the time data listed on *the stopwatch* does not need to be converted first into the working element time by the meter

Stages set standard time



a. Set the average cycle time
   Summing all cycle times and dividing by the number of observations can be calculated according to the elements of the work .
b. Statistical Testing Phase
   In the statistical stages carried out, namely data uniformity tests and data adequacy tests.

Uniformity test step
Determine the Number of Sub Groups and calculate their average value
$\bar{x} = \sum xi / n$ Dimana $\bar{x}$ = Average value of subgroups
Xi = value completion time to-i
n = Lots of data in subgroups
Calculate the average value of a subgroup
$\bar{\bar{X}} = \sum \bar{X} / k$ Dimana $\bar{\bar{X}}$ = Average rating
k = Many sub groups
Calculate the actual standard deviation from the settlement time
$\sigma = \sqrt{\frac{\sum(Xi - \bar{\bar{X}})^2}{N-1}}$ Dimana σ = Actual standard deviation from completion time
N = Number of Observations
has been done
Calculate the standard deviation from the mean distribution of subgroups
$\sigma\bar{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ Dimana σx = Standard deviation of the distribution of subgroup means
n = number of subgroups
Define upper and lower Control Limits
$BKA = \bar{\bar{X}} + 3\sigma\bar{X}$ BKA = Upper Control Limits
$BKA = \bar{\bar{X}} - 3\sigma\bar{X}$ BKB = Lower Control Limit
If the subgroup's average data is within the Upper Control Limit (BKA) and Lower control limit (BKB) then the data is said to be uniform.

Sufficiency Test Steps

The more n measurements that can be taken, the better. A large number of n measurements can cause the cost and time to conduct time studies to be even greater. Therefore, the measurement must have the desired level of accuracy and confidence from the work being measured.

The level of accuracy shows the maximum deviation of the measurement result from the actual completion time (Iftikar Z. Sutalaksana, 2006). The level of confidence also shows the amount of confidence measuring the results that have been done and can meet the existing research requirements. So if the accuracy level is set at 5% and the confidence level is 95%, it can be interpreted that the meter has confidence in 95% of the data taken and the average measurement results deviate by 5%.

Here are the formulas to determine the number of measurements that must be taken. This formula is used for 95% confidence levels and 5% and 10% accuracy levels (Ngaliman, 2017).

Determining normal time

When determining the normal time then the average cycle time obtained in addition to the adjustment factor, the gauge can compare the performance of workers with the previous performance concept. At the stage of providing adjustment factors, osbservers give their own assessment of the performance of workers while performing the work. As for the formula for determining normal time

$$Normal\ Time = Average\ cycle\ time \times adjustment\ factor\ (p)$$

Determining Standard Time

To determine the standard time, there needs to be an additional allowance factor given for 3 things, including for personal needs (*Personal Allowance),* to relieve fatigue *(Fatique Allowance)* and for obstacles or activities that cannot be avoided *(Delay Allowance).* Here is the formula for determining the time standar.

$$Standard\ Time\ =\ Normal\ Time\ \times \frac{100}{100 - allowance\ (\%)}$$

Adjustment factors

When assigning an adjustment factor, the gauge must perform an assessment of the dexterity of a worker. This process is a rating or adjustment factor. When the observer factors adjustments to the work, there is the Westinghouse method. The *Westinghouse* method observers must observe based on four factors: *Skill , Effort*, *Conditions* and *Consistency*.

Looseness factor

After obtaining the normal time (by adding an adjustment factor to the average observation cycle time) the final step is to obtain the standard time. The addition of this relaxation factor is very important because when working, it will not be possible for workers not to be disturbed by natural things such as going to the toilet, drinking, talking, resetting the machine and so on (Ngaliman, 2017). There are 3 concessions given, among others, namely for personal needs, eliminating fatigue and obstacles that cannot be avoided.

a. Allowance for personal needs *(Personal Allowance)*
   Allowance is included in personal needs and is absolute. Based on research on the amount of leeway for male and female workers. For men 2 to 2.5% and women 2 to 5% of the time normal (Iftikar Z. Sutalaksana, 2006)
b. Allowance to relieve fatigue *(Fatique Allowance)*
   Giving this allowance is done by observing workers, the greater the demands of the work, the greater the fatigue felt. It can also be seen from the hot and noisy working environment conditions that can make workers feel fatigue faster. And other factors such as work attitude, work movement, eye fatigue, temperature and so on.
c. Allowance for inevitable things *(Delay Allowance)*
   This allowance is given to obstacles that may occur to workers such as receiving instructions from supervisors, machine damage, replacing equipment and so on. This can be seen by sampling the work.

Productivity in the use of time by workers

The work productivity of the labor gang is a ton of hours of goods that will be unloaded / loaded in one working hour by each labor alley (group). Differentiated according to the types of packaging of goods such as general cargo (break bulk, bag cargo, unitized), liquid bulk and dry bulk. (Barnabas &; Nirmalawati, 2005)

RESULTS AND DISCUSSION

Research on six commodities consisting of three loading commodities (salt, rice and fertilizer) and three commodities for unloading (oilcake, sago, kaolin) to find standard time using the same research steps.

Time And Motion Study Analysis

This analysis uses the *Snapback Time Study measurement method in* seconds for loading and unloading activities in several commodities in order to determine standard time in work and calculate job productivity. The results of the study are known various time performance in the process of loading and unloading goods. Then the results of the time motion calculation are obtained as follows:

Tabel 3. 1 Standard time work element for commodity load

Elements of Work	Commodity		
	Salt	rice	fertilizer
Preparation of commodities to the Ship Crane Net	268 sec	268 sec	269 sec
Transportation from the pier to Palka	40 sec	50 sec	40 sec
Commodity Drop from Crane Net to Hatch	94 sec	69 sec	90 sec
Crane Tools Back to dock	39 sec	48 sec	37 sec

Tabel 3. 2 Standard time work element for commodity unloading

Elements of Work	Commodity		
	Bungkil	Sago	Kaolin
Preparation of commodities to the Ship Crane Net	268 sec	268 sec	269 sec
Transportation from Palka to the pier	40 sec	50 sec	40 sec
Commodity Drop from Crane Net to Hatch	94 sec	69 sec	90 sec
Crane Tool Back to hold	39 sec	48 sec	37 sec

In the calculation of standard time in units (seconds) has been added an assessment of the adjustment factor to the condition of workers, the allowance factor in which consists of personal allowance, fatique allowance and delay allowance.

Meanwhile, loading and unloading productivity of the six commodities observed was in the range between 11.42 tons / gang / hour (lowest) and 21.66 tons / gang / hour (highest). In more detail can be presented in the following table.

Productivity of loading and unloading commodities

Table 3.3 Observed productivity of each commodity

Observation	Commodity					
	Salt	Rice	fertilizer	Bungkil	Sago	Kaolin
number of workers	24	24	21	18	24	24
effective hours	21 sec	21 sec	15 sec	12 sec	14 sec	20 sec
heavy	240 ton	300 ton	285 ton	260 ton	310 ton	400 ton
Productivity	11,42 T/G/H	14,2 T/G/H	19 T/G/H	21,66 T/G/H	20,6 T/G/H	20,19 T/G/H

Analysis of the difference in work time and reasonable income levels

From observations made with the time motion study method on loading and unloading activities in each commodity with 4 elements of work and 12 observation cycles, it can be concluded that the average data owned if tested for uniformity and adequacy tests is within the upper control limit (BKA), lower control limit (BKB) and standard deviation with a confidence level of 95% and a level of accuracy of 5% and 10%, which means that the data owned is sufficient (appropriate) or valid and additions to the looseness and adjustment factors are in accordance with field conditions or the author's observations so that standard time is obtained. From this standard time we can see the reasonable time received by workers according to the conditions or workload performed. Meanwhile, the income of stevedoring workers in the people's shipping of Sunda Kelapa Port has no difference with the existing situation or workload. Thus the standard time of employment research can be related to TKBM income as follows:

In salt loading work, the real time of work is 216 seconds or 3.6 minutes and the standard time is 442 seconds or 7.4 minutes on one work cycle with a difference of 228 seconds or 3.8 minutes. So this 3.8 minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable level of income for stevedoring workers at 205% of standard time divided by real time.

In the rice loading job, the real time of work is 221 seconds or 3.7 minutes and the standard time is 435 seconds or 7.3 minutes on one work cycle with a difference of 222 seconds or 3.7 minutes. So this 3.7 minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable income level for stevedoring workers at 200% of standard time divided by real time.

In fertilizer loading work, the real time of work is 230 seconds or 3.8 minutes and the standard time is 438 seconds or 7.3 minutes in one work cycle with a difference of 206 seconds or 3.4 minutes. So this 3.4 minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable income level for stevedoring workers at 200% of standard time divided by real time.

In oilcake unloading work, the real time of work is 212 seconds or 3.5 minutes and the standard time is 420 seconds or 7 minutes in one work cycle with a difference of 205 seconds or 3.4 minutes. So this 3.4 minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable income level for stevedoring workers at 200% of standard time divided by real time.

In the sago unloading job, the real time of work is 232 seconds or 4 minutes and the standard time is 458 seconds or 8 minutes in one work cycle with a difference of 232 seconds or 4 minutes. So this 4-minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable income level for stevedoring workers at 200% of standard time divided by real time.

In kaolin unloading work, the real time of work is 223 seconds or 4 minutes and the standard time is 531 seconds or 9 minutes in one work cycle with a difference of 308 seconds or 5 minutes. The time is greater because the work element from the crane net to the TKBM truck carries from the dock to the truck. So this 5-minute time is an increase in workers' salaries by considering existing factors such as TKBM work assessment, faim factors, allowances for personal needs and budgets for inevitable obstacles. And for a reasonable income level for stevedoring workers amounting to 238% of standard time divided by real time.

Comparative analysis of the productivity level of loading and unloading work of company data with observations and provisions of performance standards of the Director General of Sea Transportation

Regulation of the Director General of Sea Transportation No HK.103/2/1/18/DJL-16 stipulates that the performance standard at Sunda Kelapa Port is 20 Tons/Gang/Hour.

Tabel 3.4 Unloading productivity data for January-March 2023

MOON	REGION	HEAVY *TON*	HARI	EFFECTIVE HOURS	laborer
JANUARY	POK I	1780	14	84	140

	POK II	3226	22	148	220
	Amount	5006	36	232	360
	PRODUCTIVITY	21,58 Ton/Gang/Hour			
FEBRUARY	POK I	1748	14	87	140
	POK II	750	5	34	50
	Amount	2498	19	121	190
	PRODUCTIVITY	20,64 Ton/Gang/Hour			
MARCH	POK I	3845	28	202	275
	POK II	3795	24	172	240
	Amount	7640	52	374	515
	PRODUCTIVITY	20,43 Ton/Gang/Hour			
Average productivity		20,88 Ton/Gang/Hour			

Data source Pelindo Regional 2 Sunda coconut and has been processed

From the data above, on the unloading work in January, the unloading productivity level was 21.58 Tons / Gang / Hour, in February it was 20.64 Tons / Gang / Hour and March was 20.88 Tons / Gang / Hour. So it can be seen that productivity in February decreased and rose again in March which was not too significant. The average productivity level of unloading work in January-March 2023 is 20.88 Tons/Gang/Hour

Table 3.5 Productivity data Load January-March 2023

MOON	**REGION**	**HEAVY *TON***	**HARI**	**EFFECTIVE HOURS**	**laborer**
JANUARY	POK I	9895	105	705	1050
	POK II	17304	88	844	880
	Amount	27199	193	1549	1930
	PRODUCTIVITY	17,56 Ton/Gang/Hour			
FEBRUARY	POK I	6974	74	515	734
	POK II	10861	58	515	580

	Amount	17835	132	1030	1314
	PRODUCTIVITY	17,32 Ton/Gang/Hour			
MARCH	POK I	12098	129	910	1290
	POK II	18210	97	827	970
	Amount	30308	226	1728	2260
	PRODUCTIVITY	17,54 Ton/Gang/Hour			
Average productivity		17,48 Ton/Gang/Hour			

Data source Pelindo Regional 2 Sunda coconut and has been processed

From the data above, on loading work in January, the unloading productivity level was 17.56 tons/gang/hour, in February it was 17.32 Tons / Gang / Hour and March was 17.54 tons/gang/hour. So it can be seen that productivity in January-March did not increase significantly. The average productivity level of loading jobs in January-March 2023 is 17.48 Tons/Gang/Hour.

In table 4.17 it can also be concluded that loading and unloading goods for 2-3 days can be seen the level of productivity of work in each commodity. In kaolin unloading work, the productivity level is 21.66 tons / gang / hour with 2 days of work, effective hours of 12 hours, load weight of 260 tons with a total of 18 TKBM. In sago unloading work, the productivity level is 20.6 tons/gang/hour with 3 days of work, effective hours of 14 hours, load weight of 310 tons with a total of TKBM as many as 24 people. In the oilcake unloading work, the productivity level is 20.19 tons/gang/hour with 3 days of work, effective hours are 20 hours, the load weight is 400 tons with a total TKBM of 24 people. And the average productivity in the observation of loading work is 14.89 tons/gang/hour with a total amount of unloading of 970 tons, effective hours for 46 hours, a total of 66 workers.

In salt loading work, the productivity level is 11.42 tons/gang/hour with 3 days of work, effective hours 21 hours, load weight 240 tons with a total TKBM of 24 people. In the rice loading work, the productivity level is 14 tons/gang/hour with 3 days of work, effective hours 21 hours, load weight 300 tons with a total TKBM of 24 people. In the fertilizer loading work, the productivity level is 19 tons/gang/hour with 3 working days, effective hours are 15 hours, the load weight is 285 tons with a total TKBM of 21 people. And the average productivity in the observation of unloading work was 21.08 tons/gang/hour with a total load of 825 tons, effective hours of 57 hours, a total of 69 workers.

It can be seen in the loading and unloading work that the loading and unloading work has not met the loading and unloading performance standards because loading activities at the Sunda Kelapa People's Shipping Pier are more dominant than unloading activities. Then the loading work must be able to be improved both TKBM and crane tools used in the work.

CONCLUSION

From research using this time motion study, it can be stated that the appropriate turnaround time by workers must get the best time seeing the work conditions that are quite heavy for workers. Because if we do not see the appropriate turnaround time for workers, workers can prevent themselves from achieving at work because there will be long-term consequences such as their health. Time measurement is carried out by direct methods, namely with stop hours, measurement stages including goal setting, tools used, direct

observation, recording observation results, data adequacy tests, data uniformity tests, normal time calculations and standard time calculations. It can be concluded that :

1. In workers load for 3 commodities with the handling and situation of workers in doing the work, then on the job load salt, rice and fertilizer is obtained and the standard time is 7.4 minutes, 7.3 minutes, 7.3 minutes. And for the work of unloading 3 commodities with the handling and situation of workers in doing the work, the standard time of loading oilcake, sago and kaolin is 7 minutes, 8 minutes, 9 minutes.
2. In the comparison of standard time and real time *on loading 3 commodities of salt, rice and fertilizer, the difference is obtained by 3.8 minutes, 3.6 minutes and 3.4 minutes and an increase in salary or appreciation for TKBM by 205%, 200% and 200% of the payroll calculation with real time.* And for unloading work for 3 commodities loading and turning, sago and kaolin the difference is 4 minutes, 4 minutes and 5 minutes as well as salary increases or awards for TKBM by 200%, 200% and 238% of payroll calculations in *real time.*
3. If the observations and data obtained from the company are compared with the Regulation of the Director General of Sea Transportation which is a standard loading and unloading performance of non-container goods of 20 tons/gang/hour, then Sunda Kelapa Port which is carried out research on people's shipping docks is unloading with an average productivity level of 20.84 tons/gang/hour balanced with the average data from the company in January – March 2023 of 20.88 Tons / Gang / Hour which can be It is concluded that unloading activities at the people's shipping dock are in accordance with the performance standards set by the Regulation of the Director General of Sea Transportation. While observations on loading goods activities at the Sunda Kelapa People's Shipping Pier with an average productivity level of 14.87 tons/gang/hour are not relevant to the average data obtained from the company of 17.47 tons/gang/hour, it can be concluded that the standard of loading activities at the Sunda Kelapa People's Shipping Pier has not met the standards set by the regulation of the Director General of Sea Transportation.

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