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ANALYSIS OF PHYSICAL AND MENTAL WORKLOAD ON MECHANICAL EMPLOYEESAT PT. GLOBAL SAWIT SEMESTA

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Abstract.
Study analysis burden work physical and mental for employees mechanic at PT. Global PalmUniverse addressed for knowing is operator job required repair or no, as well as for knowing amount employee optimal mechanics for workers and also for knowing is burden mental workon employees mechanic is have optimal mental load for worker as well as knowing is burden employee mental work mechanic moment before and after work is have difference or no . Based on results study with Cardiovascular Load (CVL) method, found that all employee mechanic experience fatigue physical at the moment where do you work need repair work however nature no soon. So from that, proposed for company give training about use machines in accordance with useful procedure for repair machine factory moment machine currently in repair. Goal is so that the operator does not easy feel tired at the moment work. Temporary that, based on results the calculation of the sampling test is obtained amount optimal employeesof 7 people. This means the operator must added 1 helper mechanic so that all employee have burden even work, and for calculation burden mental work using NASA – TLX method, the most dominant aspect moment before work are mental demand and own performance, namely confidence mechanic will success at work. Temporary the most dominant aspect at the time measurement after work is mental demand and effort, i.e where mechanic feel that the work he does need focus for solution as well as need effort high mental and physical work

Keywords: *Workload Physical, Mental Workload, Cardiovascular Load (CVL), Sampling Test, NASA – TLX, Total Optimal Employees*

Introduction

A job will be said to be completed efficiently if the completion time is the shortest.The measure of success of a production system in an industry is usually expressed in terms of the amount of productivity or the amount of output *and* input *produced* (Wignjosoebroto,2003). Planning and management of human resources can be done through workload analysis. Workloads that are distributed unequally can result in an uncomfortable working atmosphere because employees feel that the workload they are doing is too excessive or even lacking (Moekijat, 2008).

PT. Global Palm Universe is company scale industry big focused to making or processing oil coconut palm for needs processing industry from fruit Becomes oil raw. Because of the machine factory with various constraint for system automation of aproduction line, machine or tool support production. Manufacturing process or assembly conducted from step design in accordance repair or request other until with commissioning stage, even until by monitoring the production process.

Based on results observation through observation by direct, found that many complaining mechanic because too many station repair work, mechanic others do too work outside *jobdesk* each for help other mechanics outside station work alone and there are also some idle mechanic during working hours. This thing normal occur because no equally his distribution burden work for every mechanic. See results observation it is required existence measurement burden work physically and mentally forknowing is each mechanic's job required repair or no, as well as for determine amount employee optimal mechanics for company.

Library Review

- Cardiovascular Load (CVL)
  The *Cardiovascular Load* (CVL) method through heart rate is able to observe heart rateor pulse rate variations as a cognitive function and balance the workload physically (Luque-Casado et al, 2016).
- Work Sampling
  Work Sampling is a technique for estimating the total time contributed by various activities on the job by taking a set number of observations at random intervals. *Work Sampling is* also an approach method that can be used to measure productivity easily. *Work sampling* can also be used to determine the operator's productive and unproductiveactivities. In addition, *Work sampling* can also be used for discrete observations.
- NASA – TLX
  The National *Aeronautics and Space Administration Task Load Index* (NASA-TLX) method was chosen to analyze

the mechanical mental workload. NASA-TLX is a subjective mental workload assessment technique to get an overall workload score based on the average calculation of 6 subscales; *mental demand, physical demand, temporal demand, performance, frustration level,* and *effort.* The usefulness of the 6 subscales is to calculate the overall workload score (Hart & Staveland, 1988).

Research Methods

Description of the Flowchart (Flowchart)

1. **Start**
   Is step beginning start research at PT. Global Sawit Semesta.
2. **Studies Introduction**
   Preliminary study is to find out the general description of the themes raised in research related to general conditions that occur in the company first, a preliminary study is carried out. In the study, the themes discussed were Physical Workload and Mental.
3. **Studies Field**
   Studies field conducted with see by direct state worker as well as the activities that take place on the mechanics at PT. Global Sawit Semesta. Based on interview and measurement by direct, there is problems that must be analyzed in the company that.
4. **Library Studies**
   Studies references conducted for find theory, reference and literature related with activity study among other things regarding draft burden work physical and mental, *cardiovascular load (cvl), work sampling,* and NASA- TLX. Literature study done for made base think in to do study for complete problem which has been identified accompanied with base theory supported by references and literature for get the best solution for company.
5. **Formulation Problem**
   After to do observation then is known problems that occur in the company that is many operators found to do work outside *jobdesk* each for help other operators outside station work alone.
6. **Destination Study**
   Destination could determined after knowing problems that exist in the company so that research this get results and something that will obtained for be delivered to company.
7. **Data Collection and Processing**
   At stage next is to do collection and processing of data concerning with research that will discussed. Data processing is based on the foundation existing theory. Collected and processed data is as following:
   1. Profile Company
   2. Plot Production
   3. Employee Data
   4. Working Hours Employee
   5. Pulse Data Pulse Employee
   6. Observation Data *Work Sampling*
   7. Previous NASA-TLX Questionnaire Work
   8. NASA-TLX Questionnaire After Work
8. **Analysis**
   Analysis of the stages of the results of data processing. Analysis of the results of this data processing will be used as consideration in problem solving, drawing conclusions and testing suggestions which are then carried out with steps and strategies that need to be done with problem solving.
9. **Conclusion**
   After processing data and analyzing data, steps next is conclude existing problems in accordance with destination from making report this. From result analysis the it is hoped that the company could notice burden work future employees for createenvironment comfortable and healthy work.

Results and Discussion

- Cardiovascular Load (CVL)
  Result of calculation Cardiovascular Load (CVL) method used for measure burdenwork physique with measurement pulse heart using an oximeter is as following:

***Table 1**. Comparison table %CVL*

Name	Age (year)	Gender	Place of Work	% CVL	Description
Bambang Suheri	43	Male	Mechanical	57.58	Need improve his work
Riki Andika	35	Male	Mechanical	50.00	Need improve his work
Berju Saraan	32	Male	Mechanical	43.36	Need improve his work
Derita Siketang	27	Male	Mechanical	51.85	Need improve his work
Jainudin Sitaka	28	Male	Mechanical	43.48	Need improve his work

Bambang Suheri have score by 58%, this caused because profession his that is as Coordinator the mechanic who becomes reference from servant mechanics and other mechanics, and come along work in repair or making which machine profession his use many power physical. Suryadi have score by 50%, this caused because her job that is as the 2nd mechanic coordinator who also became reference from servant mechanic, and also come work in repair or making which machine profession his use many power physical. While on the maid mechanic fight advice have score by 52%, this caused because her job that is help mechanics which are in dire need power physical, and do repair and manufacture of engine parts. Where as Riki andika and suffering Skewers have score by 43%, this caused because her job that is focus help in Thing repair and manufacture of machine parts many factories, to do taking engine parts from warehouse workshop. Jainudin Sitaka has a Value of 47%, this caused because her job that is to do repair, manufacture machine, and help mechanic other. The high % CVL is also caused because machine factory belonging to already old cause need alot repair machinery and manufacture machine new, and because around hot engine occur evaporation air that causes mechanic and assistant mechanic deficiency oxygen and trigger experience fatigue moment work.

- Work Sampling

Calculation result work sampling method is used for determine level productivity employee mechanic could seen as following:

a. Determination of Productivity Level Every Mechanic
   Calculation result work sampling method is used for determine level productivity employee mechanic could seen as following:

***Table 2.** Comparison of productivity levels mechanic*

Name	Place of Work	% Productivity	Description
Bambang Suheri	Mechanical	57.58	Very Productive
Riki Andika	Mechanical	50.00	Very Productive
Berju Saraan	Mechanical	43.36	Very Productive
Derita Siketang	Mechanical	51.85	Very Productive
Jainudin Sitaka	Mechanical	43.48	Very Productive

b. Determination Amount Optimal Employees
   The determination of the number of employees aims to determine whether the number of employees is in accordance with the type and workload being carried out. This can be used as a basis for adding or removing employees. Based on the calculation, the result of determining the optimal number of employees is 7 workers. Where there are currently 6 mechanics working in the workshop mechanic.

c. Impact Analysis Environment
   1. Temperature room
      Temperature room in workshop mechanic is ± 27°C, at place production not enough over 30°-32°C. While the temperature is comfortable for work or activity is between 24°-27°C (Sutalaksan, 1993). Then, temperature room workshop mechanic declared not enough good because rated too hot, so mechanic easy feel tired at the moment work.
   2. State Air Circulation
      Circulation air in workshop mechanic enough fine, because an open and shady room so that make mechanic work optimally at the time of the workshop mechanic. However, at the time work in the middle medium machine light up there is many steam hot from machines factory. This thing cause mechanic easy feel tired at the moment work.

3. Cleanliness
   Cleaning in the workshop mechanic not enough good because open stateand with used oil produced result in floor slippery, sandy. This thing cause mechanic feel not optimal at the moment work.
4. Lighting
   Lighting in the workshop mechanic enough good because workshop mechanic is room open, so light sun could enter to room with good.
5. Noise
   Noise in the workshop mechanic not enough good because at the time machine turned on, engine Secrete enough sound hard so that disturb concentration mechanic.
6. Color Room
   Room in the workshop mechanic colored green, which one could interpreted color green which symbolizes the safe zone, so make mechanic feel safe when work in the workshop mechanic and deliver impression more free at the moment work.

d. NASA - TLX

At stage this use rating and comparison on 6 indicators, namely Mental Demand, Physical Demand, Temporal Demand, Own Performance, Effort, and Frustration.

1. Clarification of Mental Workload Prior Work

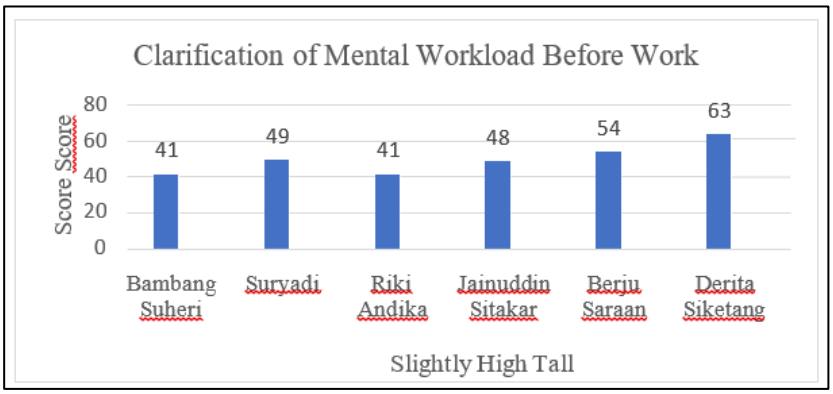

***Figure 2**. Recapitulation of NASA – TLX Before Working*

Can be seen in the graph above that there are 4 mechanic namely Bambang Suheri, Suryadi, Riki Andika, and Jainuddin Sitaka included in the category of rather high mental workload with scores of 41, 49, 41, and 48. Meanwhile, there are 2 operators, namely Berju Suffering and Suffering Skewers included in the category of high mental workload with a score between 5 8 and 63. Between 6 mechanic that, mechanic suffering Siketang has the highest mental burden fatigue with a score of 6 3, followed by the Berju operator advice with a mental load score of 54.

2. Comparison Weight Aspects of NASA – TLX Before Work

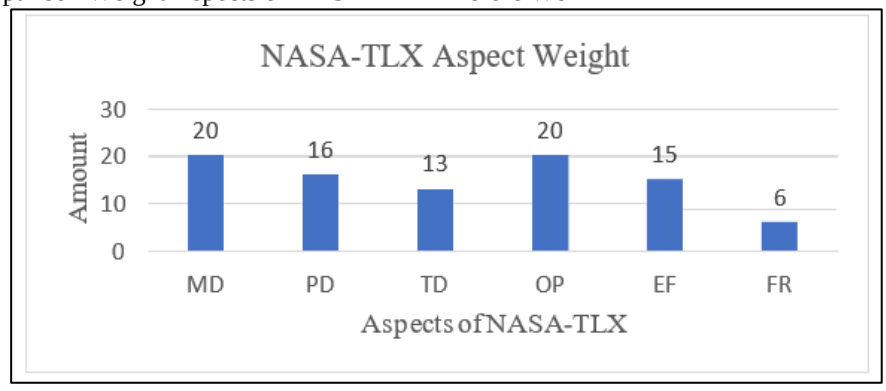

***Figure 3.** Comparison Weight Aspects of NASA – TLX Before Working*

Between The 6 NASA-TLX aspects above, the *Performance* and *Mental Demand aspects* have the highest number chosen by the operator before work, which is 0. This shows that the operators believe in success in their work and are satisfied with the results of their work and need a good mentality. While the *Frustration* aspect is the lowest aspect chosen by the operator before work, which is 6. This shows that the operators do not feel insecure, hopeless, offended, and disturbed before starting their work.

3. Mental Workload Clarification After Work

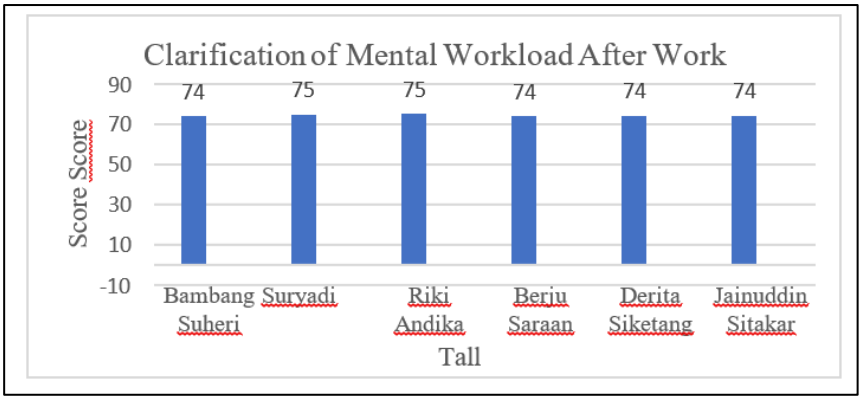

Figure 4. *Recapitulation of NASA – TLX After Working*

Picture above shows the classification of mental workload after work. Where are all mechanic included in the category of high mental load with a score between 50 – 70. Among 6 people worker, mechanic Riki Andika and Suryadi who have the highest mental burden fatigue when after working with a score of 7 5, then followed by mechanics Bambang Suheri, Berju Saraan, Suffering Siketang, and Jainuddin Sitakar with a score of 74.

4. Comparison Weight Aspects of NASA – TLX After Work

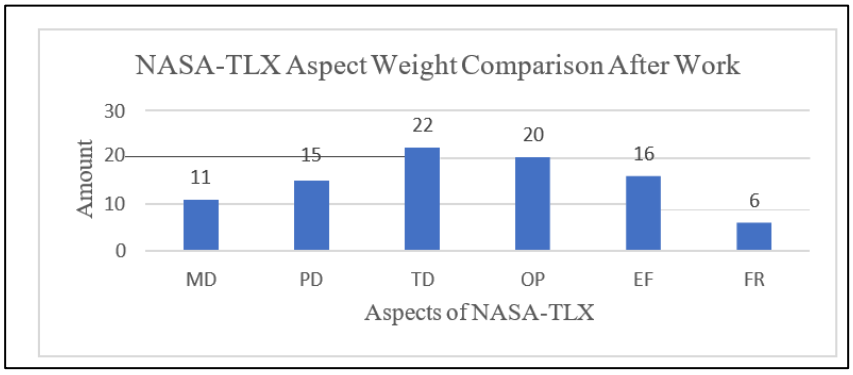

Figure 5. *Comparison Weight Aspects of NASA – TLX After Working*

Among the 6 NASA-TLX aspects above, the *temporal demand* and *effort aspects* have the highest number chosen by the operator after work, namely 22 and 20.This shows that the operators complete their work with time stressed by superiors and with high mental and physical labor effort. While the *frustration aspect* is the lowest aspect selected by the operator when after work is as much as 6. This shows that the operators did not feel insecure, hopeless, offended, and disturbed after finish his job.

5. Suggestion Repair

As for the proposal repairs in the workshop mechanics, including as following:

- M paying attention health mechanic with do medical check-up once a day a year. Destination his is for knowing is mechanic have disease certain or no. So that the work given can customized with condition

physique her

- Added 1 mechanic to the workshop in accordance with the results of the calculation of determining the optimal number of employees. The goal is that the operator does not have an excessive workload
- Add rule for wear PPE and always clean used spill existing oil, so that mechanicsand other workers always feel safe moment work
- For reduce fatigue eye mechanic looking for tool small. So required existence place (table) for arrange alignment. Who aims for make it easy mechanic look for tools especially tool small is used. Like eye drills, screwdrivers, weldingtools, and others. So that mechanic feel easy and not eat many time, so required existence addition table work for operators. Design table work this naturally with pay attention to anthropometric data so that the operator feels comfortable moment work. Anthropometric data used got from the Indonesian anthropometry website with range age started of 43 years. This thing done so that the design table work follow the average size of Indonesians for make it easy design.

The data selected for the proposed work desk design are as follows:

a. Hip height (P5) is 94.14 cm. Used for determine tall table work.
b. Range Length Hand To The front (W50) is 65.69 cm. used for determine wide table work.

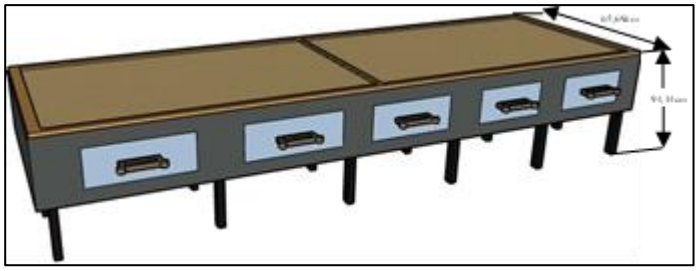

Figure 6. *Design Suggestion Table Work*

Conclusion

1. Based on results observations and calculations score burden work physical of each employee with use Cardiovascular Load (CVL) method, there are all mechanic needed repair work however nature no quick or in time short. Mechanic the is Bambang Suheri, Suryadi, Riki Andika, Berju Saraan, Suffering Siketang, and Jainuddin Sitakar, with each value (58%, 50%, 43%,52%, 43%, and 47%).
2. After observe activity employee mechanic and do calculation with Work Sampling method, obtained results amount optimal number of employees 7 people. Meanwhile, employees mechanic what's in the workshop mechanic at the moment this amount 6 people. So, company need addition employee as muchas 1 person.
3. Measurement subjective done with method measure burden mental work or psychological employee with use NASA-TLX method. Based on results measurement, suffering Skewers have score highest that is 63. This thing because mental and physical effort required for complete profession his belong to high. The performance aspect becomes aspect highest selected mechanic moment before work, thing this because mechanic convinced will success in to do profession her. Temporary aspect temporal is aspect highest selected mechanic moment after work because mechanic feel that need time high mentaland physical work in complete profession her.
4. After to do data analysis, suggestions that can given for company is do a medicalcheck-up at least once a week a year for ensure health mechanic, add 1 mechanic to the workshop, as well as add table storage tools in the workshop mechanic to mechanic no difficulty moment look for small tools that cause fatigue eye on mechanics.

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