ISSN 2807-5595
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Measurement Of the Maximum Workload of PT She Jong Sukses Abadi Klaten Employees

Alwan Fauzan Jauhari[1] Anita Oktaviana Trisna Devi[2*], Erna Indriastiningsih[3]

1 Faculty of Science Technology and Health, Sahid Univercity Surakarta, Indonesia
2 Faculty of Science Technology and Health, Sahid Univercity Surakarta, Indonesia
3 Faculty of Science Technology and Health, Sahid Univercity Surakarta, Indonesia

* E-mail: anita.otd@usahidsolo.ac.id

ABSTRACT

Maximum workload is one way to increase production output in a company. PT She Jong Sukses Abadi Klaten is a company in the textile industry whose production from January to May 2024 experienced an average production failure of 1.54%. This study is an experimental study with a population of 103 employees of PT She Jong Sukses Klaten. The treatment provided was a 10-minute decrease in workload, a 15-minute decrease in workload, a 5-minute workload increase, a 10-minute workload addition, and a 15-minute workload addition in the screen printing operator section for as many as 8 employees, with an additional workload time of 5 minutes, 10 minutes, and 15 minutes. The purpose of the study is to find out the maximum workload value of employees at PT She Jong Sukses Abadi Klaten. The indicator to determine the maximum workload is determined by two methods, namely cardiovascular load (CVL) and NASA TLX. The assessment data was carried out by comparing the value before the treatment with the value after the treatment. The Maximum Occupational Load based on Cardiovascular Load showed that before the treatment, there were 3 (35.5%) respondents who were in the category of need for improvement and as many as 5 (62.5%) respondents were in the category of no fatigue. The value after the crossing was 8 (100%) repondents did not experience fatigue. Optimization in the maximum workload was increased by increasing the workload time by 5 respondents who had not reached a score of 30. The 5 respondents were able to achieve the maximum workload after the workload was changed for 10 minutes for 3 respondents and 15 minutes for 2 respondents. NASA TLX values before treatment of 3 (37,5%) have a high workload and 5 (62,5%) have a moderate workload. As for after needing a few 8 (100%) respondents had a moderate workload . The maximum workload at PT She Jong Sukses Abadi Klaten can be achieved by increasing rest time and increasing employee workload

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KEYWORDS

workload; maximum work; employee measurement

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1. INTRODUCTION

Human resources (HR) is an important aspect of supporting the achievement of company goals. Companies are required to be wiser in making all decisions related to the company, considering that competition in the industrial sector is getting tighter. Individual abilities in a company influence the level of success of the company (Nurbaity, S., 2019). Through the availability of competent human resources, the company's future will have good prospects. Companies must have quality human resources and be able to keep up with developments in the industrial world to be able to compete with other companies. Competent human resources ensure that the company's productivity capabilities can be achieved optimally. Each job has a workload, the amount of which will be different. Workload is an effort that must be expended to fulfill all task requests given to workers Workload consists of physical workload and mental workload. (Purbasari & Purnomo, 2019).

A maximum workload of work must be done to get maximum results. The workload must be in accordance with the abilities possessed by the worker, so that the work is within the range of the worker's capabilities. The work demands (demand) received and work capacity must always be in a balance line so that high performance is achieved. This condition functions to minimize worker errors (human error), reduce work fatigue, and reduce injuries to the worker's musculoskeletal system. Workload to get maximum results in a company must pay attention to two things, namely physical workload and mental workload. (Yuliani et al., 2021)

Fatigue due to a lack of rest time affects the quality of employee performance, which results in less than optimal work. Workload can affect good production quality. Workload is the volume of work imposed on workers, both physical and mental, and is their responsibility. Every job is a burden for the perpetrator, and each worker has their own ability to handle their workload, which can be a physical, mental, or social workload. A heavy worker, such as workers loading and unloading goods at the port, carries more physical burdens than mental or social burdens. On the other hand, an entrepreneur has a relatively greater mental burden. As for social workers, they face more social burdens. A worker has his or her own abilities in relation to the workload. Maybe some of them are better suited to physical, mental, or social stress. The degree of accuracy of a job placement includes suitability of experience, skills, motivation, and so on. (Mahawati et al., 2021)

There are currently 103 employees at PT She Jong Sukses Abadi Klaten, divided into several sections, namely 78 sewing operators, 16 screen printing operators, 6 office employees, and 3 security personnel. This company is currently developing with huge market demand. Based on a preliminary study of screen printing operators, the production output of workers in January–May 2024 was 946,400 pcs, with the number of imperfect production results being 14,575 (1.54%) pcs. The average production of 1 operator in 1 day is 455 pieces, with an average imperfect production of 7 pieces (1.54%). Working hours for screen printing operator employees are 5 days, with work hours from 07.00 to 15.00 with a break of 30 minutes, namely from 12.00 to 12.30. An imperfect job result can be caused by fatigue. If someone experiences fatigue, then production results will not be optimal. (Fatimah Fauzi Basalamah et al., 2021) Mental load causes the work done to be less than optimal. Maximum results in a company can be achieved if employees are free from high mental burdens. (Adikarana et al., 2022)

Based on the above, the researcher wants to conduct research entitled measurement of the maximum workload of employees of PT She Jong Sukse Abadi Klaten. The aim of this research is to

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determine the maximum workload of employees at PT She Jong Sukses Abadi Klaten. The results of the measurements can be used as recommendations for increasing or decreasing workload in order to increase production.

2. METHODOLOGY

This is experimental research with a population of 103 employees of PT She Jong Sukses Klaten. The treatment given was the regulation of rest time for employees in the screen printing operator section for 8 employees. Previously, employee rest time was 30 minutes, from 12:00 WIB to 12.30 WIB. In this study, researchers conducted experiments by decreasing and increasing workload. The details of the experiment carried out were reducing the workload for 10 minutes, decreasing the workload for 15 minutes, increasing the workload for 5 minutes, increasing the workload for 10 minutes, and increasing the workload for 15 minutes. The operational definition in this study is that before and after treatment, cardiovascular load (CVL) and NASA TLX are measured. Cardiovascular load (CVL) is a method of measuring physical workload by looking at the average heart rate. A CVL value of ≤ 30% indicates that the maximum workload has been reached and no improvement is needed; a CVL value of > 30% ≤ 60% means that improvements need to be made; a CVL value of > 60 ≤ 80 is permitted to work for a short time; a CVL value of > 80 ≤ 100 requires action activities immediately; and values above 100% are not permitted (Oktavia, Rahmawati, & Uslianti, 2021). The CVL measurement procedure begins by measuring the DNI (resting pulse rate), working pulse rate (DNK), and maximum pulse rate (DNM). The procedure for measuring the pulse involves palpation of the arteries in the arm to determine the number of pulses. The second method to see the maximum workload is to take measurements using the NASA TLX method. This method is to determine the maximum workload based on mental ability. If the NASA TLX value is in the range of 50%–80%, then the maximum workload is achieved, which means employees do not need to increase or decrease work. The NASA TLX value is known from the assessment of six indicators consisting of mental demand (MD), physical demand (PD), temporal demand (TD), own performance (OP), frustration level (FR), and effort (EF) through a questionnaire. Questionnaire data assesses a weighting scale, rating scale 0–100, and weighted workload (Anugerah Mahaji Puteri & Nur Kamilah Sukarna, 2017). The next intervention is to reduce and increase workloads.

The sampling method used was random sampling by paying attention to the work unit location, namely the screen printing operator. The sample was taken from 8 respondents from a total of 16 screen printing operators, taking into account the inclusion and exclusion criteria. Inclusion criteria are criteria that must be met by members of the population to be used as a sample. The inclusion criteria in this research were all employees of PT She Jong Sukses as screen printing operators, aged 20–30 years, and willing to carry out the research process. Exclusion criteria are members of the population who cannot be used as samples. The exclusion criteria in this study were not employees of PT She Jong Sukses Abadi Klaten as a screen printing operator, unable to read and write, and uncooperative. The time for carrying out this research is September 2023 to June 2024, with the research location in the PT She Jong Sukses Abadi Klaten area. Data is processed by looking at the results by comparing data before treatment and after treatment.

3. RESULTS AND DISCUSSION

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The purpose is to understand the results and their implications for the field comprehensively.The initial assessment in this research was to measure the values of resting pulse rate (DNI), working pulse rate (DNK), and maximum pulse rate (DNM). Resting pulse rate (DNI) and working pulse rate (DNK) are measured by palpating the arteries of the arm for 1 minute at rest and while working. Maximum Pulse Rate (DNM) is assessed using the formula, namely DNM = 220 - Age.

Table 1. Screen printing operator's pulse rate

Category	N	Maximum	Mean
Age	8	30	25
DNI (Resting pulse rate)	8	95	81
DNK (working pulse rate)	8	127	115
DNM (Maximum Pulse Rate)	8	200	195

Based on the data above, it shows that the number of samples in the study was 8 respondents, all male, with a minimum age of 20 years, a maximum of 30 years, and an average age of 25 years. The maximum DNI (resting pulse rate) value is 95 x/minute, and the average is 81 x/minute. The DNM (maximum pulse rate) value is a maximum of 190 x/minute and an average of 195 x/minute. The order in which to determine the CVL value is as follows:

1. Calculating Working Pulse Rate (DNK) Working Pulse Rate (DNK) is calculated by calculating the average pulse rate while working.
2. Calculating Resting Pulse Rate (DNI)
3. Calculating the Maximum Pulse Rate The formula for maximum pulse rate is Maximum Pulse Rate = 220 - age.
4. Calculate % CVL
   Cardiovasculair Load (%CVL) is an estimate for determining workload classification based on the increase in working heart rate to the maximum heart rate. %CVL = (DNK - DNI) / (DNM - DNI) x 100.

   The results of the CVL calculation that have been obtained can be seen in

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Table 2. Table 2. Maximum Work Load Value based on Cardiovascular Load before treatment, after 10 minute and 15 minute workload reduction interventions

Name	Age	%CVL before treatment (rest 30 minutes)	%CVL 10 minute workload reduction (40 minute break) menit).	%CVL 15 minute workload reduction (45 minute break) menit).
X1	20	29,61	29,55	29,33
X2	21	29,65	29,45	29,38
X3	22	30,72	29,97	29,90
X4	24	29,14	29,04	29
X5	26	29	28,85	28,80
X6	30	30,28	29,96	29,88
X7	26	28,88	28,80	28,75
X8	27	33	32,87	29,97

The results of the cardiovasculair load (CVL) value in Table 2 show that the value before treatment was 3 (35.5%) respondents who were in the need for improvement category and 5 (62.5%) respondents were in the no fatigue category. The table also shows that in the Cardiovasculair Load (%CVL) value after the 10-minute workload reduction intervention, 1 (12.5%) respondent was in the need for improvement category and 7 (87.5) respondents were in the no fatigue category. After intervention to reduce workload for 15 minutes, the cardiovasculair load (CVL) value was 8 (100%) respondents who did not experience fatigue.

This shows that the intervention to reduce workload for 15 minutes is the best value in the CVL indicator, which shows that respondents do not need to make improvements, which shows that 8 (100%) respondents do not experience fatigue. Based on the data above, there are 5 respondents who have not reached the maximum workload. The maximum workload is achieved if the CVL value approaches 30%, meaning that 5 respondents can still improve their performance by increasing the workload. The increase in workload was carried out by increasing the work by 5 minutes, 10 minutes, and 15 minutes, with the result of work being 1 piece of production every minute.

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Table 3. Maximum Work Load Values Based on Cardiovascular Load After Intervention to Increase Workload by 5 Minutes, 10 Minutes, and 15 Minutes

Name	Age	%CVL Increase workload 5 minutes (rest for 25 minutes)	%CVL Increase workload 10 minutes (rest for 20 minutes)	%CVL Increase workload 15 minutes (rest for 15 minutes)
X1	20	29,70	29,87	30,01
X2	21	29,80	29,96	30,13
X4	24	29,33	29,76	30,22
X5	26	29,14	29,78	29,98
X7	26	29	29,68	29,98

Table 3. shows that 5 respondents can achieve maximum load with different workload additions. X1, X2, and X3 reach their maximum workload after increasing the workload for 10 minutes. The X5 and X7 reach maximum workload after a 15-minute workload increase. So for 8 respondents, the maximum workload can be achieved by increasing the workload for 5 (62.5%) respondents and reducing the workload for 3 (35.5%) respondents.

Table 4. Maximum Work Load Value based on Cardiovascular Load After Intervention

Name	Age	%CVL Maximum Work Load	Interventions carried out	Production result
X1	20	29,87	Increase the workload by 10 minutes.	468 pcs
X2	21	29,96	Increase the workload by 10 minutes.	468 pcs
X3	22	29,90	Reduced workload by 15 minutes	463 pcs
X4	24	29,76	Increase the workload by 10 minutes.	467 pcs

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X5	26	29,98	Increase the workload by 15 minutes.	469 pcs
X6	30	29,96	Reduced workload by 10 minutes	463 pcs
X7	26	29,98	Increase the workload by 15 minutes	469 pcs
X8	27	29,87	Reduced workload by 15 minutes	461 pcs
Average Production Results				466 pcs

Based on the data above, it can be concluded that the maximum workload for screen printing operator employees can be increased optimally by increasing and decreasing the workload. After intervention with additional workload, production results increased and production yields decreased. Maximum workload based on mental ability can be seen using the measurement method using NASA-TLX. The procedures carried out are as follows:

1. Eight respondents filled out the NASA-TLX questionnaire. The NASA-TLX questionnaire consists of six scales, namely mental demand (MD), physical demand (PD), temporal demand (TD), performance (P), effort (EF), and frustration level (FR). The questionnaire consists of two parts: the first is the pairwise comparison part between each scale, and the second is the assessment part for each scale. The scale contained in measuring mental workload can be seen in Table 5.

Table 5. NASA TLX measurement scale

No	Scale Type	Description
1	Mental Demand (MD)	Mental activities required to carry out activities, such as remembering, thinking, etc.
2	Physical Demand (PD)	The amount of physical activity required or carried out forcarrying out activities (e.g., pushing, lifting, walking, etc.)
3	Temporal Demand (TD)	The amount of time-related load felt while a work element is performed.
4	Performance (P)	How much success and satisfaction a person has with the results of their work.
5	Effort (EF)	Feelings of insecurity, anxiety, and distraction, compared to feelings of security and comfort when doing work.

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6	Frustration Level (FR).	The combination of mental work and physical activity required to complete a job.

2. Data calculation.

This stage consists of explaining mental load indicators, weighting, rating, product calculation, weighted workload (WWL) calculation, score calculation, and value interpretation. The details are as follows:

Product = weight x rating
Weighted Workload (WWL) = ∑ Products
Score = ∑ (weight x rating) / 15
Classifications in mental workload are
Score > 80 = Heavy work mental load category
Score value 50–80 = medium work mental load category
Score < 50 = light work mental load category

The maximum mental workload is achieved when the respondent gets a score of 50–80, namely the medium category. If the mental workload is above 80, then the mental workload is not achieved optimally, meaning improvements need to be made.

Table 6. Maximum workload value based on NASA-TLX before treatment

No	Range Value	Workload category	Number of Respondents
1	< 50	Light	0 (0%))
2	50 – 80	Currentyly	5 (62,5%)
3	> 80	Hight	3 (37,5%)

Table 7. Maximum workload value based on NASA-TLX after treatment with an additional 10 minutes of rest time

No	Range Value	Workload category	Number of Respondents
1	< 50	Light	0 (0%))
2	50 – 80	Currentyly	7 (87,5%)

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3	> 80	Hight	1 (12,5%)

Table 8. Maximum workload value based on NASA-TLX after treatment with an additional 15 minutes of rest time

No	Range Value	**Workload category**	Number of Respondents
1	< 50	Light	0 (0%))
2	50 – 80	Currentyly	8 (100%)
3	> 80	Hight	0 (0%)

Based on NASA-TTLX mearements in Table 6, it shows that the value before treatment was 3 (37.5%) with a high workload and 5 (62.5%) with a moderate workload. Meanwhile, after treatment with an additional rest time (table 7), 1 (12.5%) respondent had a high workload, and 7 (87.5%) had a medium workload. Based on table 8, it shows that the NASA-TLX value after the treatment of adding 15 minutes of rest time was 8 (100%) respondents who had a moderate workload. l This shows that the need for additional rest time of 15 minutes is the best value for applying rest time to achieve the maximum workload value in terms of NASA-TLX

Based on the data above, it can be concluded that the maximum workload for screen printing operator employees can be increased optimally by increasing and decreasing the workload.

Cardiovascular load (CVL) is an indicator to determine a person's physiological abilities. A person's level of fatigue at work depends on how the body is able to adapt to what is being done, especially physical work. The high workload affects the body's adaptation to fatigue levels. The higher the workload, the higher the level of fatigue experienced by the worker. A high workload is proportional to a person's time spent doing work; the longer the time spent working, the higher the workload, and the less time worked, the workload will also decrease. Workload and working hours have a significant positive effect on employee performance. This shows that the maximum workload can be achieved if you pay attention to time. Both time to rest and length of time to do work. The longer a person does a job, the higher the results achieved, or the longer a person takes a break from work, the more the work results decrease (Neksen et al., 2021). Maximum workload is a person's threshold between maximum work ability and excessive workload. An assessment of cardiovascular load (CVL) with a value of 30% to <60% indicates that the workload experienced by workers indicates a physical excessive load. Physical workload is work carried out relying solely on physical activity, which will result in changes in the function of the body's organs. The excessive load experienced by workers means that work results cannot be maximized. Physical workload is work carried out relying solely on physical activity, which will result in changes in the function of the body's organs. Physical workload can be reduced by increasing rest time.

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The maximum physical workload is also caused by the surrounding environment. Working environmental conditions are all conditions around the workplace, such as temperature, air humidity, air circulation, lighting, noise, mechanical vibrations, odors, colors, and so on, that have a significant effect on the results of human work. Discomfort and unhealthy environmental conditions cause worker fatigue to occur easily. Discomfort is also caused by a person's lack of rest time while working. (Faritsy & Nugroho, 2017)

Based on NASA-TTLX measurements in Table 6, it shows that the value before treatment was 3 (37.5%) with a high workload and 5 (62.5%) with a moderate workload. Meanwhile, after the additional treatment of 10 minutes of rest time (table 7), 1 (12.5%) respondent had a high workload, and 7 (87.5%) had a medium workload. Based on table 8, it shows that the NASA-TLX value after the additional treatment of 15 minutes of rest time is 8 (100%) respondents have a medium workload. This shows that the treatment of adding a 15-minute rest time is the best value in applying rest time to achieve the maximum workload value in terms of NASA-TTLX.

Maximum workload can be achieved if a person has a strong mentality and is comfortable when that person works. The NASA-TLX assessment shows the value or ability of a worker to adapt to the work environment related to mental or psychological aspects. A worker who cannot enjoy work will feel like he is in an uncomfortable environment. Work stress is directly proportional to the mental workload experienced by workers. The higher a person's stress level at work, the higher the mental workload they experience. Work stress can occur due to fatigue at work (Fahamsyah, 2017). The NASA TLX assessment is directly proportional to the cardiovascular load (CVL) assessment. This means that the higher the physical workload carried out by someone, the higher the chance of mental fatigue, or vice versa.

The maximum workload that is not achieved can be caused by several things. Basically, every human being has a different workload capacity, so it is not impossible that the workload felt by one worker and another worker is different because, of course, there are many factors that influence differences in each individual's workload capacity. One of the factors that causes this difference is the physical fitness of the workers involved. Physical fitness is influenced by fatigue at work which is related to lack of time for rest. The above affects the mental workload of each individual (Okitasari & Pujotomo, 2016).

The maximum mental workload is closely related to the worker's skill abilities. A worker who has advanced skills will find it easier and faster to complete the work assigned to him. A person who has low skills will find it difficult to complete the job well even in a longer period of time. It is this level of skill ability that needs to be considered in the company to improve and complete the work well. The skills of workers must be supported by physical fitness (Widiastuti et al., 2017)

4. CONCLUSION

Maximum workload is met by maximizing employee work, as assessed by CVL. The CVL value to get the maximum workload is 30%. Based on the data above, it shows that the maximum employee workload at PT She Jong Sukses can be carried out well by reducing and increasing the workload. Reduce workload by increasing rest time by 10 minutes or 15 minutes. Increase work load by reducing rest time by 5 minutes, 10 minutes, or 15 minutes. Each employee has a different maximum workload value. This depends on the resting pulse (DNI) and working pulse (DNK) values, which produce the

cardiovascular load (CVL) value. Employees must know the value of cardiovascular load (CVL) so that maximum workload can be achieved. Employees who have a cardiovascular load (CVL) value that is too high must be reduced by reducing the workload, namely increasing rest time. Employees who have a cardiovascular load (CVL) value that is too low must be increased to achieve maximum workload by increasing the workload, namely reducing rest time.

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