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Analysis of the Influence of Mental Workload on Employee Performance with the Subjective Workload Assessment Technique (SWAT) Method at PT. Bumi Jasa Utama (Kalla Group)

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Abstract

Purpose: This study aimed to measure the mental workload experienced by employees in the finance department and to analyze the effect of mental workload on employee performance.

Design/methodology/approach: This study used the Subjective Workload Assessment Technique (SWAT) method to measure the mental workload faced by employees who must perform various activities in their work.

Findings: The results of this study indicate that the time load factor (I) is the dominant factor affecting employee workload because employees are required in terms of time to perform each activity included in the work process quickly, precisely, and in large quantities every day. Mental workload has a direct and significant positive effect on employee performance.

Research limitations/implications: Data collection was only conducted on employees of the Finance Department of PT Bumi Jasa Utama.

Practical implications: Based on the results of this study, the company is expected to increase the number of employees in the finance department to streamline time and minimize the workload of each employee in the finance department. The company is also expected to improve service and service quality by considering employee comfort and performance.

Originality/value: The condition of employees who are given a high workload and ongoing causes stress and anxiety, so it is necessary to measure mental workload and the effect of mental workload on employee performance.

Keywords: Workload, Subjective Workload Assessment Technique (SWAT), Time Load

1. Introduction

Workload is several activities that require expertise and must be done within a certain period both physically and psychologically. The workload is work tasks that are a source of stress such as work that requires working quickly, producing something, and concentrating on work stress. Loading levels that are too high will cause overstress, while loading levels that are too low will cause boredom or stress. Stress is any influence that interferes with a person's mental and physical health. Stress also affects situations that cause pressure, change, emotional tension, and so on (Esthi & Marwah, 2020).

PT. Bumi Jasa Utama (BJU) is a subsidiary of the KALLA Group which is engaged in transportation and logistics operational vehicle supply services with the main office located in Makassar. In improving

performance, PT. Bumi Jasa Utama (BJU) requires human resources with high potential, motivation, creativity, and discipline to achieve good performance. In real conditions, especially in the finance department of PT. Bumi Jasa Utama (BJU), employees are burdened with heavy tasks in large quantities and are ongoing, excessive workload causes employees to be required to work beyond the limits of the worker operating hours affects employee rest time, stress and anxiety mental workloads that are a complaint the main employees of the finance department, job demands that use the brain are the main factors in the occurrence of mental workload, this results in delays in work processes. Therefore, the authors are interested in conducting research on the effect of mental workload on employee work performance in the finance department of PT. Main Service Earth. This company has also never conducted research on a mental workload that can affect employee performance.

The Subjective Workload Assessment Technique (SWAT) method or commonly called the SWAT method is a method used to analyze the mental workload faced by workers who must carry out various activities in their work. In addition, the use of the SWAT method to find out the mental workload received by employees can be categorized as high or low. Mental workload is a combination of related factors such as time load, mental effort load, and psychological stress load, with task demands, operator conditions, and time factors (Krisnaningsih et al., 2019). After knowing what factors are included in mental workload, then statistical tests will be carried out to measure the influence of the mental workload variable on work performance.

So, based on the explanation above, a study was conducted with the aim of measuring and analyzing the mental workload experienced by finance department employees

2. Literature Review

2.1. Ergonomic

Ergonomics comes from the Latin words Ergo and Nomos. Ergo means work and Nomos mean natural law. Ergonomics is an interdisciplinary science that involves several disciplines including anatomy, physiology, psychology, biomechanics, design, and management. Ergonomics is an effort in the form of science, technology, and art to harmonize equipment, work machines, systems, organizations, and the environment with human capabilities, abilities, and limitations to achieve a condition and environment that is healthy, safe, comfortable, efficient, and productive, through the utilization of the body optimally and humanly (Karwowski et al., 2003). (Mulyati, 2022) stated that ergonomics aims to reduce the level of discomfort or fatigue. To achieve conditions like this, equipment and the environment should be conditioned according to human capabilities and limitations, not the other way around humans are adapted to tools (Simanjuntak, 2010).

In ergonomics, it is necessary to study human work facilities and the work environment interacts with each other (Galih Pratama et al., 2020). With the following objectives:

- a) Adjusting the work atmosphere with humans.
- b) Improve human work performance.
- c) Reduce wasted time and minimize damage to materials caused by humans (human error).

2.2. Workload

According to (Dhania, 2010) workload is several activities that require expertise and must be done within a certain period in the physical or psychological form. The workload is work tasks that are a source of stress such as work requiring work quickly, producing something, and concentration from work stress. The period in carrying out work activities is in accordance with the abilities and capacities of employees without showing signs of fatigue. Excessive levels of workload can cause physical and mental fatigue, which often causes problems such as decreased employee motivation and achievement. Fatigue that crosses the threshold can make humans lose concentration, thus making it difficult to focus on carrying out their work (Wahyudi et al., 2018).

Calculation of workload can at least be seen from 3 aspects namely, physical, mental, and time usage. The physical aspect includes the calculation of workload based on human physical criteria. The mental aspect is the calculation of workload by considering the mental (psychological) aspect. Meanwhile, time users are more concerned with aspects of using time for work. In general, the physical workload can be seen from 2 sides, namely the physiological and biomechanical sides. The physiological side includes human work capacity from the physiological side of the body (body physiology), including heart rate, respiration, etc. Meanwhile, biomechanics looks more at aspects related to mechanical processes that occur in the body such as muscle strength and so on (Nino et al., 2023).

2.3. Mental Workload

The workload experienced by workers includes both physical and mental workload. Mental workload can be defined as an intermediary variable that is like attention. It must be inferred from performance changes. Performance decreases when the mental workload is too high or too low (Febrian et al., 2021). Mental workload is a combination of factors related to task demands, operator conditions, and time factors.

About mental workload, stress is one that is most often experienced by workers because of the high mental workload obtained by workers, signs of stress experienced are related to the level of workload, namely: if there is too little load, it will appear boring, pass absent-mindedness, apathy, erratic and disturbed sleep, irritability, decreased morale, changes in appetite, lethargy, negative attitude. However, if there is too much workload, high levels of stress, depression, or anxiety can result in strained relationships, insomnia (unable to sleep), poor judgment, increased mistakes, doubts, resignation, and reduced memory (Pertiwi et al., 2017).

2.4. Work Performance

Performance is part of the estimated level of achievement of task implementation to realize the vision, mission, goals, and objectives of the organization (Veronica & Koto, 2020). Performance is the result of work in quality and quantity that has been achieved by an employee in carrying out his duties in accordance with the responsibilities that have been given to him (Kristiana et al., 2021).

Good performance can benefit and progress companies and employees. The stronger the work motivation, the higher the employee performance will be; this means that any increase in employee motivation will provide a very significant increase in employee performance (Rivai, 2006).

2.5. Factors affecting Work Performance

An employee's high and low performance is, of course, determined by factors that influence it either directly or indirectly. (Akbar, 2018) states that: "Factors that influence performance achievement are ability factors (ability) and motivation factors (motivation)". Meanwhile, according to (Mangkunegara & Prabu, 2009), the factors that can affect performance are ability and motivation factors.

2.6. Productivity

Problems related to ergonomic factors are generally caused by a mismatch between work and the work environment (Rizalmi & Utami, 2020). Factors that affect work productivity are education, skills, discipline, motivation, nutrition and health, income level, social security, work environment and climate, industrial relations, technology, means of production, management, and achievement opportunities (Baiti et al., 2020).

2.7. Subjective Workload Assessment Technique (SWAT)

The Subjective Workload Assessment Technique method is workload measurement developed by Harry G. Armstrong Aerospace medical laboratory wright-Patterson air force base, Ohio, USA, SWAT was developed to answer the question of how to measure workload in a real environment (Xiao et al., 2005). Therefore, it has been defined for SWAT where basically the workload consists of time load, mental effort load, and psychological pressure load.

In its application, SWAT will provide a subjective scale that is simple and easy to do to provide a quantitative workload number of activities that must be carried out by workers. SWAT will describe the work system as a multidimensional model of workload, which consists of the three dimensions or factors themselves, namely time load, mental effort load, and psychological stress load (Basumerda & Sunarto, 2019). The use of the SWAT model requires us to carry out two (2) stages of work, namely, Scale Development (Scale Development Phase) and event scoring (Determination of Value).

3. Research Methodology [Heading 12pt, Garamond, Bold, Justified]

3.1. Types of Research

The research location which is the object of writing in data collection is carried out at PT. Bumi Jasa Utama which is located on Jl. Perintis Kemerdekaan, KM.16, No.24 (0411) 851842, Makassar City, South Sulawesi with a research period of 1 month, and data processing was carried out at the Design Analysis and Ergonomics Lab, Department of Industrial Engineering, Faculty of Industrial Technology, Indonesian Muslim University.

3.2. Data collection technique

The data collection technique used in this study consisted of two activities, namely direct observation (survey) and questionnaires. The following is an explanation of the data collection techniques in this study.

a. Direct Observation

Field research or direct research is carried out by conducting a survey of the finance department employees of PT. Bumi Jasa Utama as primary data and library research as secondary data.

b. Questionnaire Distribution

This study used a questionnaire to find out the opinions of the respondents

a. Swat questionnaire to find out the opinions of the respondents regarding the activities of employees in the finance department related to mental stress. The following are the steps in distributing the SWAT questionnaire.

b. Questionnaires were distributed to all respondents, especially employees of the finance department, where the questionnaires distributed included 27 SWAT cards as well as a questionnaire containing statements relating to all activities carried out by employees of the finance department.

c. Respondents ranked the 27 SWAT cards according to their perceptions starting from the lowest load value to the highest based on a combination of three descriptions, namely Time, Effort, and Stress. Furthermore, filling out questionnaires regarding the activities carried out by employees with the lowest to the highest level of workload scale (1-3) combined according to the existing dimensions

4. Result And Discussion

4.1. Scale Development

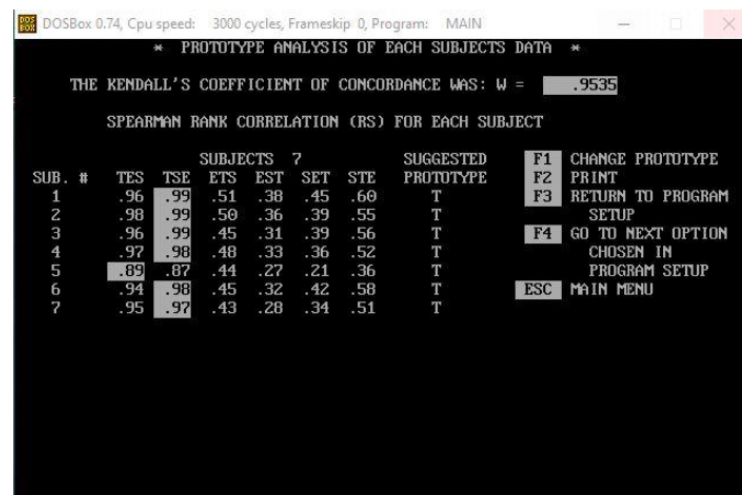


Figure 1. Prototype Results and Kendall Coefficients

Based on Figure 1, the Kendall Coefficient Value in research conducted using SWAT software is 0.9535, meaning that this value is more than 0.75, so the suitable method is a group data scaling solution. This states that the index of agreement in the preparation of cards among employees is the same and homogeneous.

Prototype correlation is used to group respondents into their respective typical groups based on the largest correlation value. Based on each employee prototype, it shows that employees 1, 2, 3, 4, 6, and 7 are included in the time prototype or Time (T). Based on the results of the prototype, shows that employees consider time burden to be the most important burden compared to mental and psychological burdens.

Based on the correlation of the respondent's prototype, the factor that greatly influences workload is time load. The time standard that has been set by the company turns out to be a workload for the employees of the finance department. The activities of making plans and realizing cash flow that must be carried out by employees are very complicated and require concentration as well as high accuracy in the work process, while the normal time given is only 7 hours of work per day. In addition to the time burden felt by employees of the finance department, there is also a mental effort (E) burden. The burden of mental effort

can be related to the burden of time, because if the time given is not enough to do a work activity, then many things can interfere mentally such as concentration, calculations, remembering information, and making decisions on problems that arise during work activities can be disturbed. The burden of psychological pressure or stress (S) is also felt by employees in the Finance department. the burden of psychological pressure can be associated with both burdens, namely the burden of time and the burden of mental effort because if the time given is not enough and the employee starts to lose concentration, the employee will experience fatigue or feel pressured and burdened.

4.2. Group Data Final Scale Value

Table 1. Group Data SWAT Final Scale Score

Number	Card	Workload Combination			Employee Scale Value (%)
		T	E	S	
1	N	1	1	1	0,0
2	B	1	1	2	8,8
3	W	1	1	3	13,5
4	F	1	2	1	7,5
5	J	1	2	2	16,2
6	C	1	2	3	21,0
7	X	1	3	1	8,4
8	S	1	3	2	17,2
9	M	1	3	3	21,9
10	U	2	1	1	41,1
11	G	2	1	2	49,8
12	Z	2	1	3	54,6
13	V	2	2	1	48,6
14	Q	2	2	2	57,3
15	ZZ	2	2	3	62,1
16	K	2	3	1	49,5
17	E	2	3	2	58,2
18	R	2	3	3	63,0
19	H	3	1	1	78,1
20	P	3	1	2	86,9
21	D	3	1	3	91,6
22	Y	3	2	1	85,6
23	A	3	2	2	94,4
24	O	3	2	3	99,1
25	L	3	3	1	86,5
26	T	3	3	2	95,3
27	I	3	3	3	100,0

Based on table 1 the final SWAT scale value can be seen the workload felt by employees with several jobs done every day. Activities carried out by respondents (employees) in carrying out their activities were given a value based on the rating given by the respondent when filling out the activity-based questionnaire sheet. The rating given by the operator is adjusted to the level on the final scale value that has been formed. The final scale value interval can indicate a mental workload that is low, normal, or high workload felt by the operator. Workload is declared low or low load if the value of the final scale is between 0 to 40. Workload is declared normal or moderate or medium load if the value of the final scale is between 41 to 60. Workload is declared high or overloaded if the value of the final scale is between 61 to 100

4.3. Event Scrolling

Table 2. Event Scoring value for each worker

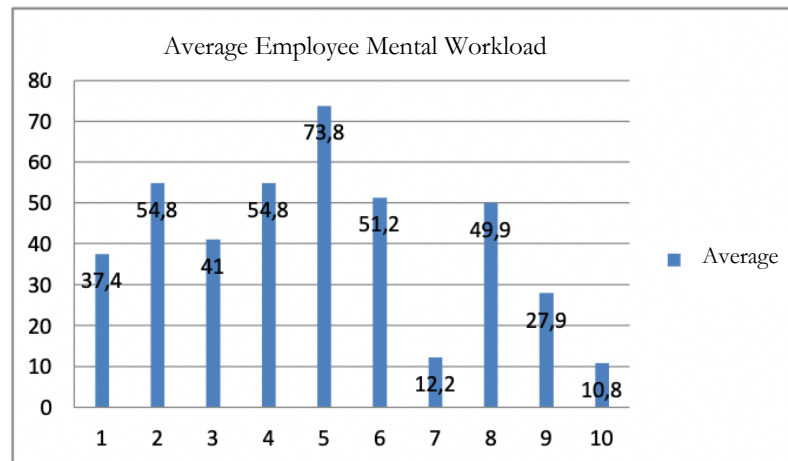
Activity	Employee																				
	1			2			3			4			5			6			7		
	T	E	S	T	E	S	T	E	S	T	E	S	T	E	S	T	E	S	T	E	S
1	2	1	1	2	2	2	2	1	1	1	2	2	1	2	1	2	2	2	2	1	1
2	2	3	1	2	3	2	2	2	1	2	2	2	2	2	3	2	3	2	2	3	1
3	2	2	1	2	3	2	2	1	1	1	3	2	1	3	3	2	3	2	2	2	1
4	2	2	2	3	3	2	2	1	1	2	3	2	1	2	2	2	3	2	2	2	2
5	2	3	2	2	2	2	3	2	2	3	2	3	1	1	3	3	2	3	3	3	2
6	2	3	2	2	2	3	2	2	2	2	3	2	1	2	1	2	2	2	2	3	2
7	1	1	1	1	1	1	1	1	1	3	2	1	1	1	1	1	1	1	1	1	1
8	1	1	3	2	2	2	2	3	1	3	2	2	1	3	3	2	2	2	2	1	3
9	2	2	1	2	1	1	1	1	1	2	3	3	1	3	3	1	1	3	1	2	1
10	1	1	1	1	1	1	1	1	1	2	2	3	1	1	1	1	1	3	1	1	1

Table 2 is the event scoring value of each job performed by the operator. For example, the first employee buys a value for the first activity of 211, meaning that the first employee considers the perceived time load to be normal or moderate, the mental effort burden is low, and the psychological pressure load is also low, while for the second activity, the first employee gives a value of 231, meaning the perceived time load is normal or moderate, high mental effort, and low psychological pressure.

Table 3. Workload Value of Each Activity

Activity	Activity						
	1	2	3	4	5	6	7
	TES	TES	TES	TES	TES	TES	TES
1	2 1 1 41,1 %	2 2 2 57,3%	2 1 1 41,1%	1 2 2 16,2%	1 2 1 7,5%	2 2 2 57,3%	2 1 1 41,1%
2	2 3 1 49,5%	2 3 2 58,2%	2 2 1 48,6%	2 2 2 57,3%	2 2 3 62,1%	2 3 2 58,2%	2 3 1 49,5%
3	2 2 1 48,6%	2 3 2 58,2%	2 1 1 41,1%	1 3 2 17,2%	1 3 3 21,9%	2 3 2 58,2%	2 2 1 48,6%
4	2 2 2 57,3%	3 3 2 95,3%	2 1 1 41,1%	2 3 2 58,2%	1 2 2 16,2%	2 3 2 58,2%	2 2 2 57,3%
5	2 3 2 58,2%	2 2 2 57,3%	3 2 2 94,4%	3 2 3 99,1%	1 1 3 13,5%	3 2 3 99,1%	3 3 2 95,3%
6	2 3 2 58,2%	2 2 3 62,1%	2 2 2 57,3%	2 3 2 58,2%	1 2 1 7,5%	2 2 2 57,3%	2 3 2 58,2%
7	1 1 1 0,0%	1 1 1 0,0%	1 1 1 0,0%	3 2 1 85,6%	1 1 1 0,0%	1 1 1 0,0%	1 1 1 0,0%
8	1 1 3 13,5%	2 2 2 57,3%	2 3 1 49,5%	3 3 2 95,3%	1 3 3 21,9%	2 2 2 57,3%	2 1 3 54,6%
9	2 2 1 48,6%	2 1 1 41,1%	1 1 1 0,0%	2 3 3 63,0%	1 3 3 21,9%	1 1 3 13,5%	1 2 1 7,5%
10	1 1 1 0,0%	1 1 1 0,0%	1 1 1 0,0%	2 2 3 62,1%	1 1 1 0,0%	1 1 3 13,5%	1 1 1 0,0%

Based on table 3, the workload values for each activity carried out by each employee of the finance department are included in the low, normal, or high categories. The example above is the first employee with the first workload percentage of 41.1%, meaning that the workload felt by the first employee with the first activity is normal or moderate. This can be caused because employees feel they understand enough about their work procedures.



Graph 1. Average Employee Mental Workload

Based on graph 1, the average value of workload for each work activity carried out by employees varies. The workload felt by employees in activities, second, third, fourth, sixth, and eighth is included in the optimal or moderate workload because the average workload felt by employees is between 40 and 60, meaning the second, third, fourth, sixth, and eighth activities the employees feel quite burdened in the activities they are doing, and their work can still be done properly. The workload felt by employees in the first, seventh, ninth, and tenth activities is low because the average value of workload is between 0 to 40, meaning that in the sixth, seventh and tenth activities, the workload is felt unencumbered, and finally the workload The work felt by employees in the fifth activity is included in a high workload because the average workload felt by employees is between 60 and 100, meaning that in the fifth activity, employees feel very burdened by this activity.

4.4. Scaling Solution

Group Scaling Solution is a method used to produce a SWAT scale for the group of respondents in this study. Based on the results of data processing that has been done, the value of importance for each factor is generated from data processing using SWAT software. The following is the value of importance for each factor.

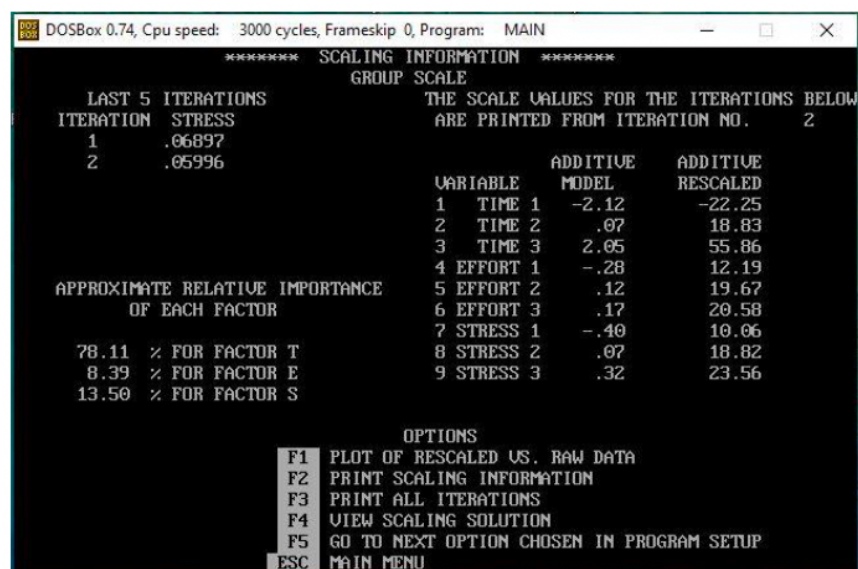


Figure 2. Workload Value Group Data

Based on the results of data processing using the DOSBOX 0.7 application, it is known that the value of workload is based on group data or the average of the respondents. The following is the workload value.

a) Time Load (T) of 78.11%.

- b) Mental Business Expense or Effort Load (E) of 8.39%.
- c) Psychological Pressure Load or Stress Load of 13.50%.

This shows that the workload that contributes the most to cognitive workload is time load. Time load is the main factor that is felt by employees because of job demands that require employees to be fast in carrying out each of their activities, because the activities carried out are related to calculating costs, in dire need of accuracy and accuracy so that time loads greatly affect this.

The stress load has quite an effect on workload, while the effort load is the least burdened on employees. A low mental workload does not rule out the possibility of not making mistakes in doing his job, this is because the lower the workload felt by employees, the faster employees will get bored. As a result of this boredom can cause employees indifferent to job descriptions because they feel used to their jobs. In the process of work activities taking place, there are several objectives that are not achieved due to a lack of employees in carrying out their work. Lack of time at work can also make employees make mistakes in carrying out work activities so that they can be completed properly.

5. Conclusion

The results of measuring Mental Workload using the Subjective Workload Assessment Technique (SWAT) Method for Employees of the Finance department of PT. Bumi Jasa Utama (KALLA GROUP), with the help of the DOXBox 0.7 application, it is known that the value of workload is based on group data or the average of the respondents. The following is the workload value.

- 1) Time Load (I) of 78.11%.
- 2) Mental Business Expense or Effort Load (E) of 8.39%.
- 3) Psychological Pressure Load or Stress Load of 13.50%.

This shows that the workload that contributes the most to cognitive workload is time load.

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