

**THE ROLE OF MENTAL WORKLOAD IN INVESTING QUALITY OF LIFE  
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**ABSTRACT**

**Introduction:** Every workplace has potential hazards, one of which is psychological hazards, namely work stress. The stress felt by workers can interfere with their work activities if not controlled immediately. In Indonesia, 11.6–17.3% of the 150 million adult population suffers from stress at work. Moreover, job stress can be caused by various factors. **Aims:** To assess workers' quality of work life by analyzing the relationship between mental workload and work stress. Moreover, this research investigates the individual characteristics, mental workload level, and stress level between workers. **Methods:** This research is a quantitative study using an observational design and a cross-sectional technique. The participants in this study were all 35 maintenance personnel. Mental workload and work stress are assessed using NASA-TLX and DASS-21 questionnaire, respectively. **Results:** The collected data are statistically analyzed using the Spearman correlation test and the Cramer contingency coefficient correlation test. The results showed that mental workload has a strong relationship with work stress which is in the strong category ( $r= 0,679$ ) and the direction of the relationship is unidirectional. **Conclusion:** The conclusion of this study is that the higher the mental workload possessed by workers, the higher the level of perceived work stress. Therefore, the company can reduce work stress by conducting both individual and organizational strategies.

**Keywords:** mental workload, emotional intelligence, work stress**INTRODUCTION**

In 2015, the United Nations (UN) officially approved the Sustainable Development Goals (SDGs), the 17-goal programs to be completed by 2030. World leaders who were members of the UN gathered to commit together in achieving this agenda, including Indonesia. The SDGs are designed in a collaborative manner, with all aspects of the nation contributing to the achievement of these goals. Point 3 of the SDGs states that the state ensures decent health and well-being for all citizens and ages, including employees. Every workplace is inextricably linked to psychological factors that can jeopardize worker safety and health. One of them is the quality of work life, which may be measured by their job stress. Work stress is the result from job demands that are incompatible with

workers' physical and intellectual capacities (Kamal, 2019). According to the Labour Force Survey, (2019a), 602,000 people experienced work-related stress, or approximately 1800 out of 100,000 workers at the end of 2019. This case meant 12.8 million working days were lost in the UK. According to Central Statistics Agency data from 2014, the degree of work stress in Indonesia is 11.6-17.4% of the 150 million adult population.

According to the National Safety Council, businesses lose an estimated \$200 billion annually as the result of employee stress. The amount of expenses the business must bear is utilized to find solutions to issues like absenteeism, boredom, low productivity, health costs, etc. (National Safety Council, 2003). The stress that employees face not only affects the business, but reducing it can up to 80% lower risk of disease and prevent illness

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(National Safety Council, 2003). Other sources estimate that the cost of work-related stress in Europe in 2013 was €617 billion. This total comprised absenteeism costs (€272 billion), lost productivity costs (€242 billion), health care costs (€63 billion), and social welfare expenditures in the form of disability benefit payments (€63 billion) (Hassard et al., 2014).

A "model of stress" by Robbin and Judge describes their idea regarding the elements that contribute to stress. According to them, workplace stress has three possible causes: environmental, organizational, and individual factors. According to a previous survey conducted by the American Psychological Association (2019), 6 out of 10 respondents stated that work-related psychosocial issues were the leading causes of stress. Based on the Minister of Home Affairs Regulation Number 12 of 2008, workload is defined as the amount of work that must be done by a type of job/position or organizational unit and is the product of the volume of work and time. The workload carried out by workers must be adjusted or balanced with their abilities, both physically and psychologically. As a result, the burden is split into two parts: physical workload and mental workload.

The burden felt by an individual as a result of the discrepancy between the workload needs of a task and the individual's maximal mental capability is referred to as mental workload (Rezvani and Khosravi, 2019). According to Made and Wulanyani (2015) mental workload is more directed at the perceived attention demands while working on cognitive tasks. Mental workload is defined as the interplay between task demands and the skills of individuals or resources as an external independent variable in task demands. Based on several definitions of the mental workload, it can be concluded that the mental workload is a mismatch between the demands of the task (cognitive tasks) and the mental abilities possessed by the

individual. The results of a survey carried out by the Labour Force Survey (2019a) from 2009 to 2011 reveal that psychosocial elements in the workplace as indicated by mental workload, are the primary cause of stress in workers. Tight deadlines, copious work, and too much pressure or responsibility are the examples of mental workload. According to Longo and Leva (2017), mental health problems in British workers were the most prevalent, accounting for 42% of all cases owing to occupational task strain. According to Hasan, Wahyuni and Kurniawan's (2018) research on the association between mental workload and work stress at PT. PJB Paiton Probolinggo Generating Unit, it shows that there is a correlation with a p-value of 0.029. Amir, Wahyuni and Ekawati's (2019) research on skeletal body employees at particular industry, found most workers who suffer work stress have a high mental workload.

Instead of workload, psychosocial aspects of the workplace can be examined through an examination of each employee's emotional intelligence (Sauter et al., 1998a). Stress is most closely associated to emotional stability (Ivancevich, Konopaske and Matterson, 2007). In accordance with this, Munandar (2008) proposes that stress is influenced by personal traits, specifically the capacity of the individual to perceive the circumstance as stressful. In order to recover more quickly, people with strong emotional stability will typically be upbeat and less overwhelmed by stress. Emotional intelligence, according to Basyit, Sutikno and Dwiharto (2020), is the capacity of a person to handle their emotions intelligently, maintain emotional balance, and express them through social, self-awareness, self-regulation, self-motivation, and empathy abilities.

The phosphoric acid plant is one of the basic inorganic chemical plants in Indonesia and has been operating since 2014 and is a business resulting from bilateral cooperation between Indonesia

and foreign countries. Shares owned by Indonesian and foreign parties have the same value, namely 50% each. The phosphoric industry's major output is phosphoric acid, which it produces with a capacity of 200,000 metric tons per year. A by-product of the primary product is gypsum, which has a production capacity of 1,100,000 metric tons per year and is used as a raw material in the cement industry, and fluosilicic acid, which is used in the manufacturing of aluminum fluoride. The phosphoric acid industry also manufactures sulfuric acid, with a capacity of 600,000 metric tons per year.

The field of professional and technical work in the phosphoric acid plant is a worker in the field of maintenance. Workers in the maintenance section are workers who have the responsibility and duty of maintaining all equipment, the process of using tools and tool utilities in a company or factory. Maintenance activities are aimed at maintaining or repairing existing equipment in the company so that it can be used to produce quality products effectively and efficiently (Kousha, Bagheri and Heydarzadeh, 2018)

Based on the foregoing rationale, the researchers aim to analyze the relationship between mental workload and work stress among maintenance workers. Moreover, this study also identifies the individual characteristics, mental workload level, and stress level among maintenance workers in the phosphoric acid industry.

## **METHODS**

Primary data are information gathered directly from the research. The basic data for this study came from the responses of questionnaires issued offline to phosphoric acid industry maintenance staff. The sample is a subset of the population in terms of size and features (Sugiyono, 2017). The total sampling technique was utilized to determine the sample size in this investigation. This involves taking a sample from the entire

population. This strategy was chosen because, according to Sugiyono (2017), the total sampling technique is utilized when the total population is less than 100. As a result, the sample size in this study was 35 participants. This research was carried out for a period of seven months, namely in December 2020 from the preparation of the thesis proposal to the thesis in June 2021. Primary data collection at PT X was carried out on 3-6 May 2021 then continued with the data processing process.

We used mental workload as an independent variable and job stress as our dependent variable. The NASA-TLX measuring device is used in this investigation to gauge mental workload (Nevid, Rathus and Greene, 2005). Workload is evaluated subjectively by NASA-TLX. The NASA-TLX measures six variables: performance, level of enterprise, mental and physical requirement, time requirement, and level of stress. Using the DASS-21 questionnaire, work stress is measured (Depression, Anxiety, and Stress Scale) (Luthans, 2011). The physical, emotional, and behavioral symptoms of stress are covered by the 21 statement questions that make up the DASS-21 measurement tool. This measuring equipment was chosen since it is simple to use in research and does not require any specific training to use. The questionnaire employed is the DASS-21 version of Dewi's (2017) translation into Indonesian, which has a validated degree of validity and a Cronbach's alpha coefficient of 0.902 indicating that this measuring instrument is valid and reliable. A strong test of the link and direction of the relationship between mental workload and occupational stress was performed in this study. The collected data have been statistically tested by using the Pearson-Spearman correlation test through the utilization of the Statistical Package for the Social Sciences (SPSS) ver. 25.0. The researchers chose the Spearman correlation test to determine the significance level and direction of the

relationship between the two variables. This research has been accepted by The Ethical Board in The Faculty of Dentistry, Airlangga University, Surabaya with the ethical clearance under the number 205/HRECC.FODM/IV/2021.

## RESULTS

### Individual Characteristics

In this study, age was grouped into 5 groups, namely 15-24 years, 25-34 years, 35-44 years, 45-54 years, and >55 years.

The results of the preliminary study that have been carried out have shown that the education level of maintenance workers in the phosphoric acid industry is grouped into three, namely high school graduates, D3 graduates, and S1 graduates. The years of service variable are grouped into three, namely workers with tenure <5 years, 6-9 years and >10 years. In this study, marital status variables were grouped into three, namely single, married, and divorced.

**Table 1.** Individual Characteristics

<b>Age</b>		
<b>Age (Year)</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
15-24	8	22.9
25-34	16	45.7
35-44	3	8.6
45-54	3	8.6
>55	5	14.3
<b>Total</b>	<b>35</b>	<b>100.0</b>
<b>Education Level</b>		
<b>Education Level</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
High School	24	68.6
Diploma	4	11.4
Bachelor	7	20.0
<b>Total</b>	<b>35</b>	<b>100.0</b>
<b>Working Period</b>		
<b>Working Period (Years)</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
<5 Years	20	57.1
6-9 Years	15	42.9
<b>Total</b>	<b>35</b>	<b>100.0</b>
<b>Marital Status</b>		
<b>Marital Status</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
Single	11	31.4
Married	24	68.6
<b>Total</b>	<b>35</b>	<b>100.0</b>

From the 35 respondents studied, the majority of maintenance workers in the phosphoric acid plant are between 25-34 years old, as many as 16 respondents (45.7%), while the smallest number is in the age range of 35-44 years and 45-54

years, each of which is three respondents (8.6%). In this study, the youngest respondent was 21 years old and the oldest was 62 years old. Furthermore, the majority of maintenance employees in the phosphoric acid plant have a high school

graduate education level of 24 workers (68.6%), with the least number being a diploma graduate, which is four workers (11.4%). In addition, it can be noticed that the majority of the workers in the plant's maintenance division have a working period of <5 years as many as 20 workers (57.1%). There are 15 workers (42.9%). The shortest working length of respondents in this study was one year and the longest was eight years. Finally, from the 35 research respondents, the majority

of maintenance employees at this phosphoric acid plant were married, as many as 24 workers (68.6%) and 11 respondents (31.4%).

### Workers' Mental Workload

The average mental workload dimensions of the phosphoric acid plant maintenance personnel are distributed as follows.

**Table 2.** Distribution Of Workers' Average Mental Workload Dimensions

NASA-TLX Dimensions of Mental Workload	Total Score	Average
Mental requirement	5890	168,285
Physical requirement	6010	171,714
Time requirement	7540	215,428
Performance	6230	178
Level of stress	2720	77,714
Enterprise level	7870	224,857

According to Table 2, the enterprise level dimension has the highest average score, with a value of 215.428, followed by the time requirement dimension, with a value of 215.428, and performance with a value of 178, while 77.714 is the lowest average score on the

dimension measuring level of stress. The table shows that the dimension of time requirement is where maintenance personnel in the phosphoric acid industry experience the most of their mental workload.

**Table 3.** Mental Workload Calculation Results with The NASA-TLX Method

Workload Dimension	Quality	Scale	Product
Mental Requirement	1	80	80
Physical Requirement	4	90	360
Time Requirement	5	90	450
Performance	1	80	80
Level of Stress	1	60	60
Enterprise Level	3	90	270
Score WWL (Product : 15)			86,67

Table 3 contains the results of the NASA-TLX calculation of one of the research respondents. The weight value is obtained from the frequency of choice of each dimension of the two paired dimensions that have been selected by the

workers. The rating value is the value chosen by the worker from a scale of 10-100 which describes each dimension of the mental workload as perceived by the worker. The product's value is then computed by multiplying the weight value

by the rating. The entire product values are summed together and then divided by 15 to generate the WWL (Weighted Workload) value, which is used to identify the category of mental workload of workers. NASA TLX mental effort is classified as

low (0-9), medium (10-29), moderately high (30-49), high (50-79), and extremely high (80-100). The WWL calculation results in Table 5.6 reveal a WWL value of 86.67, which falls into the extremely high group.

**Table 4.** Distribution of Maintenance Division Workers in the Phosphoric Acid Plant Based on Mental Workload Level

Mental Workload	Frequency (n)	Percentage (%)
Medium	3	8.6
Moderately high	3	8.6
High	16	45.7%
Extremely high	13	37.1%
Total	35	100.0%

According to Table 4, the majority of maintenance workers at the phosphoric acid plant have a mental workload level that falls into the high group, with as many as 16 workers (45.7%) falling into this category. At least three workers (8.6%)

have a mental workload that falls between the medium and high levels.

**The Worker Stress**

The frequency distribution of maintenance workers is shown in Table 5.

**Table 5.** Distribution of Maintenance Division Workers on Work Stress Level

Work Stress	Frequency (n)	Percentage (%)
Mild	8	22.9
Medium	10	28.6
Severe	17	48.6
Total	35	100.0

According to Table 5, the majority of workers in the plant maintenance division have a work stress level in the severe category, namely 17 people (48.6%), with only eight workers (22.9%) having a stress level in the mild category.

**The Relationship between Mental Workload and Work Stress in Workers**

According to Table 6, there is a link between mental burden and occupational stress among phosphoric acid industry maintenance staff.

**Table 6.** The Relationship between Mental Workload and Work Stress of Maintenance Division Workers in the Phosphoric Acid Industry

Mental Workload	Stress						Total	r
	Mild		Medium		Severe			
	n	%	n	%	n	%		
Average	2	66.7	1	33.3	0	0,0	3	<b>0.679</b>
Moderately High	2	66.7	0	0.0	1	33,3	3	
High	4	25.0	8	50.0	4	25.0	16	
Extremely High	<b>0</b>	<b>0.0</b>	<b>1</b>	<b>7.7</b>	<b>12</b>	<b>92.3</b>	<b>13</b>	

According to the cross-findings tabulation in Table 6, the bulk of the phosphoric acid industry maintenance staff—up to 12 personnel, or 92.3%—have extremely high mental workloads and severe levels of job stress. The correlation coefficient value of 0.679 indicates a strong relationship between mental workload and occupational stress. The correlation coefficient is positive, showing a one-way relationship between the two variables, which means that the higher the worker's reported mental burden, the higher the worker's experienced job stress, and vice versa.

## DISCUSSION

### Individual Characteristics

Based on the findings of previous studies, most of the maintenance workers at the phosphoric acid plant are aged between 25-34 years, namely 16 workers and a small portion are in the age range of 35-44 years and 45-44 years, namely three workers (8.6%). According to the Ministry of Health of the Republic of Indonesia in 2009 most of the maintenance workers fall into the category of early adulthood, namely 26-35 years.

Workers at the productive age level are considered to be more able to adapt quickly to new tasks and technology (Ukkas, 2017). Workers in non-productive age will experience a decrease in physical abilities and difficulty adapting to technology so that it will increase the perceived mental complaints because workers of non-productive age have to spend more effort when compared to workers of productive age.

According to Suci (2018), workers who are still relatively young have high morale and better energy performance when compared to workers who are of an old age. However, at an older age the ability to manage their emotions is better so they can cope with the stress they feel. At a mature age, workers will be able to make wise decisions based on the amount of experience they have gained.

The level of education in this study is based on the last formal education level that has been taken by the respondents. In this study, the level of education is divided into three levels, namely graduating from high school, graduating from D3, and passing S1. The results showed that most of the maintenance workers in the phosphoric acid industry had an education level of high school graduates as many as 24 workers (68.6%) and a small proportion were D3 graduates, namely four workers (11.4%). The knowledge and skills possessed by maintenance workers are very necessary in overcoming problems or obstacles that may occur in the work. The level of education possessed by a person will affect his ability to find solutions to any problems that occur. The higher is someone's level of education, so that they are better able to find appropriate solutions to the increasingly diverse problems faced (Febriandini, Ma'arufi and Hartanti, 2016). One of the values of education is that a person gets optimal awareness, knowledge, and abilities in order to get a better life.

The job responsibilities assigned by the company to maintenance workers in the phosphoric acid industry differ based on their education level. Workers with an undergraduate education level are given more difficult job responsibilities than workers with high school graduates. Research conducted by Basyit, Sutikno and Dwiarto (2020) shows that the level of education is positively correlated with work experience.

As many as 20 workers (57.1%) of the maintenance personnel have a working term of less than five years. Working periods of less than five years are considered fresh tenure. Research conducted by Supriyatna (2020) asserts that tenure has a major impact on worker performance. Workers with longer tenures are more adept at accomplishing their task. This occurs because the longer a worker works, the more and more diversified their experience becomes.

Workers with relatively new tenures are considered to be still in the process of adapting to new ways of working and the working environment. According to Sugiharto (2019), workers in the early years of work have a very large task load and pressure because workers still have to learn about the problems that exist in the workplace but at the same time get directly involved in dealing with these problems. Based on marital status, most of the phosphoric acid industry maintenance workers have marital status, namely married as many as 24 workers (68.6%). Marital status owned by workers can accelerate, inhibit or counteract the occurrence of stress in a person. Workers who are married can have additional responsibilities because they do not only think about personal needs but are also obliged to think about family needs (Suci, 2018) Marital status is a protective factor against stress, anxiety, and depression by having good mental health and emotional intelligence (Kousha, Bagheri and Heydarzadeh, 2018)

### **Mental Workload**

Based on the findings of averaging each NASA-TLX dimension, there are three dimensions with the highest average, namely the dimensions of the level of effort, time requirements and physical needs. While mental requirements, bodily needs, and frustration levels have the lowest average level, several maintenance workers stated that the perceived workload was high because every worker could be contacted at any time by the workplace. Workers must be ready to deal with problems that occur in the workplace, regardless of holidays or after overtime work. Coupled with the few workers who can take turns solving these problems, things like this that account for the mental workload on maintenance workers in the phosphoric acid industry.

The results of the frequency distribution of mental workload on maintenance workers at the phosphoric

acid plant (see Table 5) show that most workers have a high level of mental workload, as many as 16 workers (45.7%). A small number of workers have a mental workload level that is in the medium and rather high categories, each of which is three workers (8.6%). When viewed from the average value of WWL or mental workload as a whole, a score of 69.06 is obtained so that the average mental workload of maintenance workers in the phosphoric acid industry is in the high category. Research conducted by Sugiharto (2019) on aircraft maintenance workers shows the same thing, namely maintenance workers have a heavy level of mental workload. This happens because maintenance workers are not only required to have competent knowledge but are also required to have skills in solving damage or problems that occur in the factory.

According to Yurista, Bakar and Kunci (2017), mental workloads that are excessive or less than the body's ability can have a negative impact on workers. Mental workload that is smaller than the body's ability can have an impact on workers, namely experiencing boredom, lethargy, less productive, etc. When the workload is excessive or beyond the body's capacity threshold, it can lead to weariness (overstress), work accidents, illnesses, and so on.

### **Job Stress**

Job stress has the meaning of an imbalance between demands and available resources. The demands in question include the responsibilities, pressures, obligations, and uncertainties faced by workers while at work. Resources are everything that is within the control of workers that can be used for these demands (Robbins and Judge, 2017) Work stress that occurs in individuals can be positive or negative. Stress is considered positive when it is able to encourage individuals to improve the quality of their work in a heavy workload and few deadlines so that workers will get

satisfaction with the work that has been completed.

Work stress becomes negative when it hinders individual activities at work, for example increasing blood pressure which causes the individual to become uncomfortable, unable to think logically, have difficulty speaking, etc. (Labour Force Survey, 2019b). Measurement of work stress in this study used DASS 21 which consists of 21 statements that describe the symptoms of work stress which include autonomic nervous stimulation, skeletal muscle response, situational anxiety, and subjective feelings of anxiety (Panigrahi, 2018). Based on the research, it can be observed that the majority of phosphoric acid industry maintenance employees have a severe level of work stress, namely 17 workers, the minority of workers have a light level of work stress, namely eight workers, and there are as many as 10 workers who have a moderate level of work stress. The lowest score is 15 which is included in the category of mild work stress and the highest score is 32 which is included in the category of severe work stress (Jaafar, Hamid and Hamid 2017).

According to Fahamsyah (2017) stress experienced by workers can be prevented through good stress management. The importance of good stress management is to prevent the change of short-term stress into long-term or chronic stress. Good stress management is done by managing the factors that exist in the environment around workers so that they do not become stress triggering factors and increase the ability of the factors within the individual so that they do not feel stressed quickly (Sauter et al., 1998b).

### **The Relationship between Mental Workload and Job Stress**

According to the research findings, the majority of maintenance employees at the phosphoric acid plant have a high mental burden, with as many as 16 workers

having mild work stress levels, eight workers having moderate work stress levels, and four workers having moderate work stress levels. high levels of occupational stress. A small number of maintenance workers have a moderate and rather high mental workload, as many as three. The correlation coefficient value of 0.679 indicates that the link between mental workload and job stress is in the strong category, according to the findings of statistical testing. In terms of the direction of the link between the two variables, a unidirectional association suggests that the greater the mental burden felt by workers, the greater the reported job stress. This study supports prior research (Suci, 2017) that found a robust link between mental workload and occupational stress.

According to Fahamsyah (2017) there is a substantial association between mental burden and job stress on the CSSD installation personnel of the Haji General Hospital, where workers must finish work on time, be available at all times, and work quickly. The findings of interviews with maintenance workers at the phosphoric acid plant revealed the same thing: workers are expected to be ready and able to solve issues or damage in the plant even after overtime hours, which has an influence on work stress experienced by employees. According to Sugiharto (2019), there are several efforts that are possible to be implemented to reduce the impact of workload on work stress, namely that workers can do exercise or light exercise before or on the sidelines of work so that the body becomes more relaxed. With exercise, it is expected to increase blood circulation, the mind becomes fresher, and the muscles are not stiff. Another effort is that workers must be able to use their rest time well where workers do not carry their previous work to the next job. Efforts that can be done by the company is to increase the number of workers to reduce their workload.

## CONCLUSION

The mental workload of maintenance workers in the phosphoric acid industry is mostly in the high category. Moreover, the majority of the maintenance staff or workers in the phosphoric acid industry experience severe work stress. Inside the phosphoric acid industry, the association between mental workload and work stress is high and has a positive or unidirectional relationship. Furthermore, there are two strategies, namely individual and organizational strategies, that can be used to manage the stress experienced by employees. Employees must be able to manage their time effectively, enhance their physical activity, learn how to relax, and strengthen their social networks. Finally, according to the organizational strategy, the corporation should conduct activities such as training, goal planning, increasing organizational communication, developing health programs, and others. Discussions between the company and staff should be held to improve communication. Researchers believe that providing case studies during safety morning talks or other activities can help firms increase their employees' emotional intelligence.

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