



Influence of Work Factors, Emotional Demands, and Organizational Demands on Physical and Mental Fatigue in the Disaster Preparedness Workers

Bian Shabri Putri Irwanto

Departemen Keselamatan dan Kesehatan Kerja, Fakultas Kesehatan Masyarakat, Universitas Airlangga, Indonesia

Korespondensi penulis: bianshabri1234@fkm.unair.ac.id*

Abstract. Regional Disaster Management Agency (RDMA) workers must be on standby and respond for 24 hours, especially if there are emergency. This causes demands on workers and workers become fatigue. The aim of this study is to analyze the factors that influence work fatigue in Tuban Regency's RDMA workers. This research includes analytical and observational with a cross sectional design. The study was conducted on 56 workers with a simple random sampling system. The dependent variable studied was physical and mental fatigue, while the independent variables consisted of work factors (working hours and workload), emotional demands (responsibility), and organizational demands (work shifts). Data collection was carried out by direct measurement, questionnaires, interviews, documentation and observation then processed with Structural Equation Modeling-Partial Least Square (SEM-PLS). The factors that affect work fatigue are work factors (t statistics = 3.643 and p -values = 0.000) and organizational demands (t statistics = 3.086 and p -values = 0.002), while emotional demands have no effect (t statistics = 0.950 and p -values = 0.342). Loading factors of physical work fatigue (0.917) and mental work fatigue (0.916) are almost the same, so they have the same contribution as a measure of fatigue. Workers who experience work fatigue should conduct regular medical examinations, know the workload limit for one day, organize sufficient work time, regularly rotate work time, stretch in the middle of work activities, prepare work music and videos during breaks.

Keywords: Disaster Preparedness Worker; Emotional Demands; Fatigue Factors; Mental; Physical fatigue

1. INTRODUCTION

In every workplace there will definitely be occupational risks consisting of work accidents and occupational diseases. Research conducted by Dewi (2021) states from Employment Social Security Agency data that in 2018 in Indonesia there were 114,148 cases of accidents in the workplace and in 2019 there were 77,295 cases. This shows a decrease in workplace accidents by 33.05%. One of the occupational risks in every type of work is fatigue. The ILO states that almost every day 2 million workers die due to work accidents caused by occupational fatigue factors (Rio et al., 2020). Occupational fatigue is a complete criterion that does not only concern physical and psychological fatigue but has more to do with a decrease in physical performance, a feeling of fatigue, decreased motivation and decreased work productivity (Mardiana & Fachrudu, 2022). The causes of fatigue including work factors, emotional demands, and organizational demands.

Work factors consist of length of working time and workload. The length of time a person works properly in a day is generally 6-10 hours. Extending the working time more than the ability to work long, working with prolonged time there is a tendency for fatigue, health problems, diseases and accidents and dissatisfaction (Suma'mur, 2014). Meanwhile, workload

is the amount of individual work that must be done (Komarudin., et al., 2016). If the workload given to someone is not adjusted to the ability of the worker, it will risk the quality of health and the results of the work itself.

Emotional demands according to The Bucket Model theory consist of responsibility, worry, and conflict ^[6]. According to Alex (2006) responsibility at work is to do the job thoroughly, so the work is more improved, quality and can be accounted. Responsibility according to Yusuf (2018) affects employee performance. When workers get trust from organizations, they need to keep it as good as possible, and carry out what has been directed properly and correctly (Heryanto,2022). Meanwhile, organizational demands or work shifts are all hour arrangements, as a substitute for or in addition to working hours ^[10]. Work shifts can be permanent or temporary according to workplace needs recommended by company management which are often irregular (Ananda & Mustopa, 2023).

One type of work that can cause physical and mental fatigue is Regional Disaster Management Agency (RDMA) workers. RDMA workers have an obligation to provide services to the community and be on standby 24 hours. RDMA is formed in each city, and the RDMA of Tuban Regency has several fields in the implementation of its duties, consisting of the prevention and preparedness field, the emergency and logistics sector, and the rehabilitation and reconstruction. Therefore, researchers want to conduct research on the influence of work factors, emotional demands, and organizational demands on fatigue in RDMA workers in Tuban Regency with the aim of increasing worker productivity by minimizing the occurrence of fatigue.

2. METHODS

This research is a quantitative research, when viewed from the way data collection is included in the type of observational research and analytical research, namely explains why and how the influence or relationship between variables through hypothesis testing ^[12]. This study uses a cross-sectional research design, namely collecting data in one observation.

This research was conducted at the RDMA of Tuban Regency, Indonesia. The research was conducted using questionnaires, interviews, direct measurements, and observations. The total number of RDMA Tuban workers was 65, and the sample was 56 people with simple random sampling method. The independent variables in this study are work factors (length of working time and workload), emotional demands (responsibility), and organizational demands (work shifts). While the dependent variable in this study is physical and mental fatigue. The instruments used reaction timer, questionnaire KAUPK2 Work Fatigue Questionnaire,

stopwatch, pulse oxymeter, and questionnaire Chester I model by Barnard (2008) for responsibility. Inferential analysis in this study used SEM (Structural Equation Modeling) analysis to see the effect between the independent variables on the dependent variable.

3. RESULTS AND DISCUSSION

Table 1. Distribution of Mental Work Fatigue

| Mental Work Fatigue | n | % |
|----------------------------|----------|----------|
| Less Fatigue | 22 | 39.3 |
| Fatigue | 27 | 48.2 |
| Very Fatigue | 7 | 12.5 |

Measurement of mental fatigue used a questionnaire method and interviews conducted after work using the KAUPK2 questionnaire. Based on Table 1, it is known that the majority of RDMA workers in Tuban Regency experienced fatigue as many as 27 respondents or 48.2%. Workers in the tired category are dominated by office workers such as the secretariat division. However, there are field workers who also experience mental fatigue, this is because there is a sinking ship incident, while office workers also worked overtime.

Table 2. Distribution of Physical Work Fatigue

| Physical Work Fatigue | n | % |
|------------------------------|----------|----------|
| Normal | 39 | 69.6 |
| Light Fatigue | 16 | 28.6 |
| Fatigue | 1 | 1.8 |

Measurement of physical fatigue used reaction timer. From Table 2, it is known that the majority of Tuban Regency's RDMA workers experienced normal physical fatigue as many as 39 workers or 69.6%. These results are dominated by prevention and preparedness workers such as secretariats. Mild and moderate work fatigue in this study was dominated by field workers such as the Rapid Response Team (TRC) in emergency and logistics.

Table 3. Distribution of Work Factors

| | Work Factors | n | % |
|------------------------|---------------------|----------|----------|
| Length of Working Time | ≤ 8 hours in a day | 27 | 48.2 |
| | > 8 hours in a day | 29 | 51.8 |
| Workload | Light | 37 | 66.1 |
| | Medium | 19 | 33.9 |

Measurement of length of working time used questionnaires and interviews, while workload with pulse rate was measured using a pulse oxymeter. Based on Table 3, the majority of RDMA workers in Tuban Regency work > 8 hours a day as many as 29 respondents or

51.8%. Of these 29 workers, there were 20 workers (68.9%) who performed tasks in the emergency evacuation of sinking ships. As for workload, the majority of workers have a light workload, as many as 37 workers or 66.1%. This is because at the time of the research, there were only 15-20 workers who helped evacuate the sinking ship search.

Table 4. Distribution of Emotional Demands (Responsibility)

| Responsibility | n | % |
|----------------|----|------|
| Medium | 39 | 69.6 |
| High | 16 | 28.6 |

In this study, responsibility was measured using questionnaires and interviews. From the results of the study, it was stated that the majority of RDMA workers in Tuban Regency had high responsibility, namely 45 workers or 80.4% of the total respondents. In almost all divisions, workers have high responsibility, to balance the workload given by workers.

Table 5. Distribution of Shift Work

| Shift Work | n | % |
|------------|----|------|
| Morning | 39 | 69.6 |
| Afternoon | 6 | 10.7 |
| Night | 11 | 19.7 |

RDMA Tuban Regency consists of three work shifts, the results of the study state that the majority work in the morning shift, namely 39 workers or 69.6%, because in the first shift there are office and field workers. At the time of the research, many workers from other shifts were helping with the search for sunken ships which was carried out from morning to night and continued the next day.

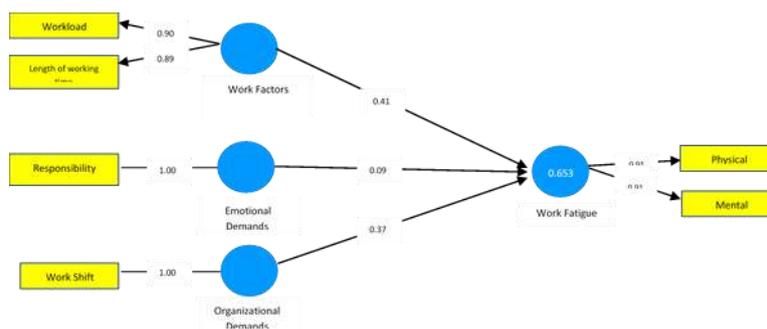


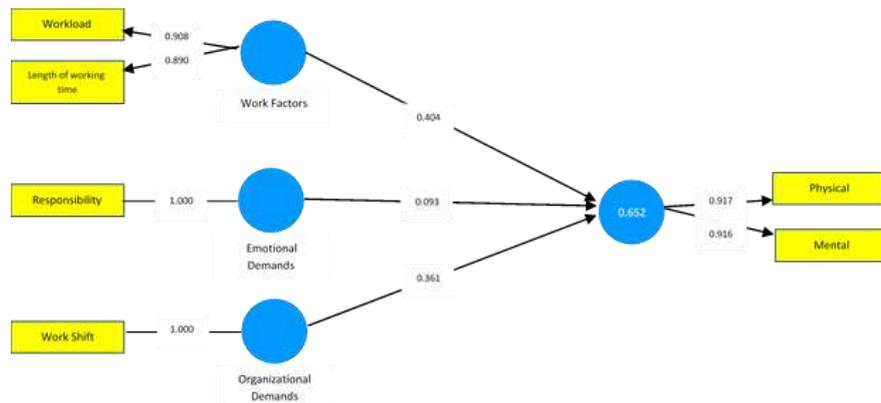
Figure 1. Path Diagram Inner Model Analysis

The results of data were processed using SmartPLS. (1) Outer model analysis is carried out to determine whether the indicator results can support latent variables or not. The outer model analysis shows the loading factor value and the AVE (Average Variance Extracted) value. If the resulting loading factor value is > 0.7 and the AVE value is > 0.5 , it can be said that the variable is valid.

Table 6. Distribution of Loading Factor and AVE's Variables

| <i>Latent Variable</i> | <i>Observed Variable</i> | <i>Loading Factor</i> | <i>t-statistic</i> | <i>p Values</i> | <i>AVE</i> |
|------------------------------|--------------------------|-----------------------|--------------------|-----------------|------------|
| Work Fatigue | Physical fatigue | 0.917 | 54.231 | 0.000 | 0.840 |
| | Mental fatigue | 0.916 | 43.121 | 0.000 | |
| Work Factors | Length of working time | 0.890 | 24.328 | 0.000 | 0.808 |
| | Workload | 0.908 | 28.507 | 0.000 | |
| Emotional Demand | Responsibility | 1.000 | | | 1.000 |
| Organizational Demand | Shift Work | 1.000 | | | 1.000 |

From the results of data processing, it is known that all items can be extracted perfectly and have a loading factor value > 0.7 , so the variables used in this study have a good ability to explain constructs. Latent variables all have an AVE value > 0.5 . Then all variables are said to be valid. It is concluded that from the outer loading and AVE values, this study has met the requirements for convergent value.

**Figure 2.** Path Diagram Outer Model Analysis

The next stage (2) inner model analysis, to see the direct and indirect effects between variables. The higher the R-square value, the better the prediction model of the proposed research model. In addition, the path coefficient value shows the level of significance in hypothesis testing. In this study, the t -statistic > 1.96 was used with a significance level of p -value 0.05 (5%) and the beta coefficient was positive.

Table 7. Distribution of Inner Model Analysis

| <i>Independent Variable</i> | <i>Dependent Variabel</i> | <i>Path Coefficient</i> | <i>t-Statistics</i> | <i>P Values</i> | <i>Result</i> |
|------------------------------|---------------------------|-------------------------|---------------------|-----------------|---------------|
| Work Factors | Work Fatigue | 0.405 | 4.669 | 0.000 | Accepted |
| Emotional Demand | Work Fatigue | 0.094 | 0.950 | 0.342 | Declined |
| Organizational Demand | Work Fatigue | 0.355 | 3.086 | 0.002 | Accepted |

The work factor has a beta coefficient value on fatigue of 0.405. The t-statistic value is 4.669 which means it is significant because it is greater than t table. In addition, the p-values of 0.000 are smaller than 0.05. So that the hypothesis is accepted, meaning that work factors affect the fatigue of respondents.

Emotional demands (responsibility) have no effect on work fatigue of RDMA workers. It is known that the beta coefficient value on fatigue is 0.094. The t statistics value of 0.950 means that it is not significant because it is smaller than the t table = 1.96, while the p-values of 0.342 are greater than 0.05. So the hypothesis is rejected.

SEM test analysis shows the beta coefficient value of organizational demands (work shift) on fatigue is 0.355. The t-statistic value of 3.086 is significant because it is greater than t table = 1.96. The p-values of 0.002 are smaller than 0.05. So the hypothesis is accepted, meaning that organizational demands have a significant effect on fatigue of RDMA workers in Tuban Regency. The next step in the data processing analysis is the stated R square result of 0.623. It is concluded that the influence of work factors and organizational demands on fatigue is 62.3%, while the remaining 37.7% is influenced by other factors.

Discussion

Based on a survey conducted by the National Safety Council (NSC) of 2,000 working, the report showed 97% had at least one risk factor for fatigue and 80% had two or more risk factors (National Safety Council, 2017). The results stated that 39 workers (69.6%) were normal. While workers who experienced moderate physical fatigue were only 1 TRC workers in the field of emergency and logistics, because at the time of the research the worker entered the morning shift until the night, even staying overnight at the office because he finished looking for ships at night and his house was quite far away, and entered the morning shift. Meanwhile, the majority of workers who experienced mild physical fatigue were also field workers, who were searching for sunken ships at the time of the study. In addition to office workers, because they had to work overtime to complete administration related to the sinking ship, and the majority of office workers were women, so they had to do homework before work. Moreover, there are many different demands by working mothers regarding their role in the family and their role in the workplace (Latif et al., 2018).

In addition, there are workers who experience mental fatigue indicated by a decrease in work power and endurance (Rusila & Kirana, 2022). There were 27 workers who experienced fatigue. Mental fatigue can occur due to work demands and accumulate tasks, so they must be

alert for 24 hours and move quickly. If workers do not move quickly, there is a high chance of injury (Muthmainnah et al., 2021). Workers are also asked to think about creating a disaster prevention and mitigation program. RDMA workers who experience mental fatigue in the tired category are mostly experienced by secretariat workers, due to the many tasks that must be done quickly and thoughtfully such as working on reports and administration.

Analysis of work factors in this study, it is known that the loading factor result on the length of working time is 0.890 and the workload is 0.908. The results show that workload has a greater effect than the length of working time on fatigue, because it has the highest loading factor value. In this study, there is an influence between work factors on fatigue, because RDMA Tuban workers have a long working time, the majority >8 hours a day. The majority of workers evacuate sinking ships, namely the emergency and logistics section including the duties of TRC and preparedness prevention officers, after the ship is found, workers must evacuate the office at night. Office workers have to organize field workers requirements, administrative papers, and equipments. This is why the majority of workers work >8 hours a day. If workers work overtime, they do not have the maximum rest time, resulting in physical and mental fatigue. Long working time can disturb employees' circadian rhythms and trigger a number of adverse psychological and physical changes (Peršolja, 2023). Rules related to the length of working time are regulated in Law No. 13 of 2003 concerning labor, specifically in article 77 to article 85 (Perdana, 2021).

Workload measurement by measuring the pulse rate. Performance assessment involves a double perspective: the evaluation of the “goodness” of the executed task and the modeling of the expected performance, considering different variable such as heart rate, workload level, task features (Masi et al., 2023). The majority of RDMA Tuban workers experienced light workload as many as 37 workers, because during the study only a few workers felt more workload. The majority of workers who experienced moderate workload in the emergency and logistics section were searching and evacuating sunken ships at the time of the study. The workers worked from morning until night and still had to continue in the next morning. The workload increases because they must be able to find the ship immediately and as much as possible there is no loss. This study is in line with research conducted by Syaputra & Lestari (2019) which states that there is an effect of working time on job fatigue in construction workers at the X Jakarta project. In addition, workload is one of the risk factors for fatigue, the greater the level of workload, the greater the risk of fatigue (Hermawan et al., 2017).

Emotional demands including responsibility do not have influence on fatigue. The majority of RDMA Tuban workers have high responsibility in carrying out their work. RDMA

Tuban's mission is to "improve the quality and quantity of disaster management resources". If workers already have a high responsibility in completing their work, it will reduce the burden on workers' minds on accumulating work, it minimizes the occurrence of mental fatigue due to great pressure. This result is in line with research that has been conducted, responsibility is not related to the physical fatigue of PT Trans Pacific Petrochemical Indotama Utility Unit workers (Irwanto, 2020), besides that Yusuf (2018) states that partially responsibility has a positive and significant effect on the performance and enthusiasm of the workforce.

Organizational demands (shift work) have a significant influence on fatigue. Shift workers employed may experience sleep loss, impaired alertness, and consequently negative health and safety outcomes (Maisey et al., 2022). Previous research shows that work performance is best when working in the morning to evening, while the worst work performance occurs when working too late into the morning (Irianti, 2017). There are 39 RDMA Tuban workers in the morning shift, 6 workers in the afternoon shift, and 11 workers in the night shift. The number of morning shift workers is higher because all office workers enter in morning shift, but field workers are divided into 3 shifts. The majority of workers who experienced moderate physical fatigue and very tired in mental fatigue were night shift workers. This is because night shift workers feel discomfort and decreased energy (Syafar & Aris, 2018). Night shift workers also have energy and focus naturally different from other shift workers, usually workers are asked to help on other shifts. Night shift workers experience disruptions in circadian rhythms because workers oppose natural changes in body rhythms characterized by sleep disturbances (Nursalam et al., 2020). There are a number of plausible mechanisms through which reducing working hours or night work could impact the risk of metabolic syndrome (Lee & Ichiro, 2022).

4. CONCLUSION

The results of the analysis of work fatigue experienced by Tuban Regency's RDMA workers, the loading factors of physical and mental work fatigue are almost the same, so they have the same contribution as a measure of fatigue. Workers who experience physical work fatigue are mostly in the light category as many as 16 workers and mental work fatigue is mostly in the tired category as many as 27 workers. Besides that, the majority of workers have a long working time > 8 hours a day, light workload, workers have high responsibilities, and the majority work in work shift morning. Factors that cause work fatigue of RDMA workers in Tuban Regency are work factors and organizational demands, while emotional demands do not cause work fatigue.

REFERENCES

- Alex, N. (2006). *Manajemen personalia* (Edisi kedua). Jakarta: Ghalia Indonesia.
- Ananda, D. E., & Mustopa. (2023). Hubungan shift kerja, lingkungan fisik kerja dan beban kerja dengan kelelahan kerja karyawan bagian produksi di PT. Medifarma tahun 2022. *Jurnal Kesehatan dan Kedokteran*, 2(1). <https://doi.org/10.56127/jukeke.v2i1.604>
- Barnard, C. I. (2008). *The functions of the executive*. Cambridge, MA: Harvard University Press.
- Dewi, F. S. (2021). Pengetahuan pekerja dan peraturan keselamatan kesehatan kerja terhadap *unsafe action* pada pekerjaan konstruksi. *Jurnal Kesehatan Ibnu Sina (JKIS)*, 2(1), 8–15. <https://doi.org/10.55606/juprit.v1i4.567>
- Fadli, M. (2021). Memahami desain metode penelitian kualitatif. *Humanika: Kajian Ilmiah Mata Kuliah Umum*, 21(1), 33–54. <https://doi.org/10.21831/hum.v21i1.38075>
- Hermawan, B., Widodo, H., & Soebjianto. (2017). Sikap, beban kerja, dan kelelahan kerja pada pekerja pabrik produksi aluminium di Yogyakarta. *Jurnal Kedokteran Masyarakat*, 33(4). <https://doi.org/10.22146/bkm.16865>
- Heryyanto, A. (2022). Bagaimana kelelahan kerja, tanggung jawab dan disiplin kerja mempengaruhi kinerja karyawan: Studi empiris. *Strategic: Journal of Management Sciences*, 2(1). <https://doi.org/10.37403/strategic.v2i1.35>
- Irianti, L. (2017). Pengaruh shift kerja terhadap kelelahan dan performansi pengendali kereta api Indonesia. *Jurnal Rekayasa Sistem Industri*, 6(2), 79–92. <https://doi.org/10.26593/jrsi.v6i2.2656.79-92>
- Irwanto, B. (2020). Analysis of mental and physical fatigue risk factors in utility unit of petrochemical company. *The Indonesian Journal of Occupational Safety and Health*, 9(1), 21–29. <https://doi.org/10.20473/ijosh.v9i1.2020.21-29>
- Komarudin, D., Kuswana, W. S., & Noor, R. A. M. (2016). Kesehatan dan keselamatan kerja di SMK. *Journal of Mechanical Engineering Education*, 3(1). <https://doi.org/10.17509/jmee.v3i1.3192>
- Latif, A., Juhaepa, & Megawati, A. T. (2018). Upaya buruh perempuan yang telah berumah tangga dalam membagi waktu antara keluarga dan pekerjaan (Studi di PT. Sultra Tuna Perikanan Samudera Kota Kendari). *Neo Societal*, 3(1).
- Lee, H.-E., & Ichiro, K. (2023). Impact of reduced working hours and night work hours on metabolic syndrome: A quasi-experimental study. *Safety and Health at Work*, 14(1), 59–65. <https://doi.org/10.1016/j.shaw.2022.11.001>
- Maisey, G., et al. (2022). Digging for data: How sleep is losing out to roster design, sleep disorders, and lifestyle factors. *Applied Ergonomics*, 99, 103617. <https://doi.org/10.1016/j.apergo.2021.103617>

- Mardiana, N., & Asj'ari, F. (2022). Pengaruh workload dan job insecurity terhadap work fatigue. *Journal of Management and Accounting*, 5(1). <https://doi.org/10.52166/j-macc.v5i1.2944>
- Masi, G., Amprimo, G., Ferraris, C., & Priano, L. (2023). Stress and workload assessment in aviation: A narrative review. *Sensors (Basel)*, 23(7), 3556. <https://doi.org/10.3390/s23073556>
- Muthmainnah, et al. (2021). Gerakan cipta relawan tangguh sadar psikososial pasca bencana. *Maspul Journal of Community Empowerment*, 3(2).
- National Safety Council. (2017). *NSC fatigue report*. <https://www.nsc.org/workplace/safety-topics/fatigue/fatigue-reports>
- Nursalam, A., Sunarno, A., & Rahmatul, F. (2020). The correlation between work roster with work stress and nurses's circadian rhythm. *Jurnal Ners Universitas Airlangga*.
- Occupational Safety and Health Service, Department of Labour. (2006). *Healthy work: Managing stress and fatigue in the workplace*. Wellington, New Zealand: Workinfo.
- Perdana, S. (2021). Comparison of government efforts in improving the welfare of Indonesian workers based on Law Number 13 of 2003 concerning manpower and Draft Law Number 11 of 2020 concerning job creation. *International Journal Reglement & Society (IJRS)*, 2(1), 35–44. <https://doi.org/10.55357/ijrs.v2i1.85>
- Peršolja, M. (2023). Effects of nurses' schedule characteristics on fatigue: An integrative review. *Nursing Management*, 54(4), 28–37. <https://doi.org/10.1097/01.NUMA.0000921904.11222.11>
- Rio, F. A., Batara, A. S., & Mahmud, N. U. (2020). Penerapan program keselamatan dan kesehatan kerja PT. Industri Kapal Indonesia. *Window of Public Health Journal*, 250–260. <https://doi.org/10.33096/woph.v1i3.115>
- Rusila, Y., & Kirana, E. (2022). Hubungan antara umur, masa kerja dan beban kerja fisik dengan kelelahan kerja pada pekerja di Pabrik Kerupuk Subur dan Pabrik Kerupuk Sahara di Yogyakarta. *Jurnal Lentera Masyarakat*, 1(1). <https://doi.org/10.69883/jlkm.v1i1.6>
- Suma'mur, P. (2014). *Kesehatan kerja dalam perspektif (HIPERKES)*. Jakarta: Sagung Seto.
- Syafar, S., & Aris, F. (2018). Pengaruh shift kerja terhadap kelelahan pekerja pabrik sawit di PTPN V Sei Galuh. *Jurnal Teknik Industri Terintegrasi*, 1(2). <https://doi.org/10.31004/jutin.v1i2.323>
- Syaputra, B., & Lestari, P. (2019). Pengaruh waktu kerja terhadap kelelahan pada pekerja konstruksi proyek X di Jakarta Timur. *Jurnal Binawan*, 1(2).

- Usmawati, S., Russeng, S., & Haeruddin. (2021). Analisis pengaruh stres kerja, beban kerja dengan kelelahan kerja terhadap produktifitas kerja karyawan PT. Eastern Pearl Flour Mills Makassar tahun 2020. *J Aafiyah Health Research*, 2(1), 53–67. <https://doi.org/10.52103/jahr.v2i1.340>
- Yusuf, N. (2018). Pengaruh kepemimpinan, tanggung jawab, kedisiplinan dan kerjasama terhadap kinerja pegawai di Universitas Gorontalo. *Jurnal Gorontalo Development*, 1(1). <https://doi.org/10.32662/golder.v1i1.111>