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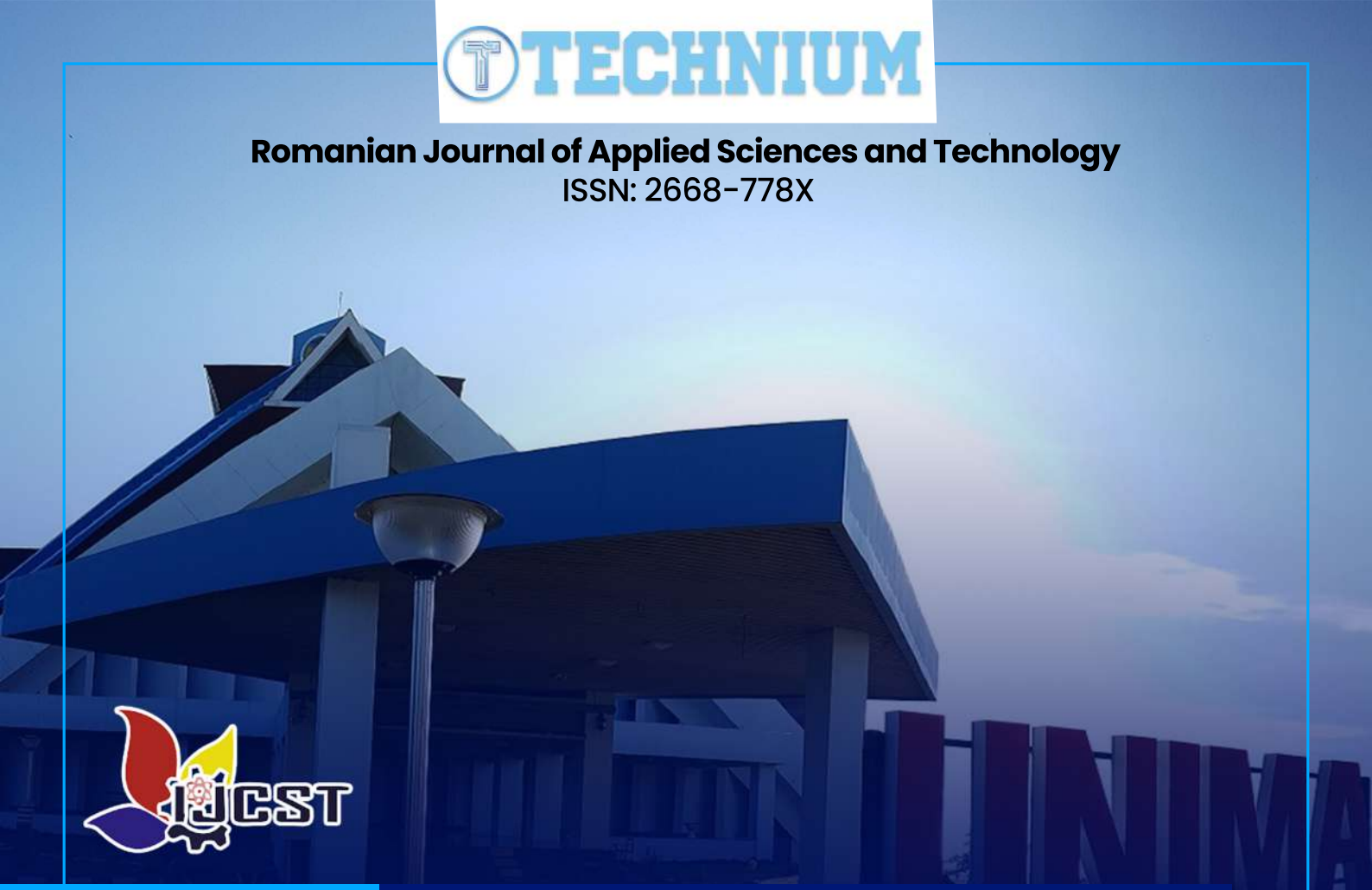

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Mental Workload Analysis of Workers Using the Swedish Occupational Fatigue Index (SOFI) Method at A Job Shop, Sheet Metal, And Pipe Metal Manufacturing Company in Surabaya

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Abstract. This study aims to determine the mental workload of 15 respondents at PT. X in the morning shift and night shift, as measured by the Swedish Occupational Fatigue Index (SOFI) method. The highest value of the morning shift fatigue index dimension is found in the lack of energy factor with a value of 3.97, while in the night shift, the highest value is in the sleepiness factor with a value of 3.13. The fatigue index of workers is considered to be still high and work system improvements are needed.

1 Introduction

The imbalance between the number of workers and excessive activity in a company can cause workloads, both physically and mentally [1]; [2]; [3]. PT. X is a job shop, sheet metal, and pipe metal manufacturing company that makes products made from sheet metal and metal pipes consisting of various types of materials from aluminum, zinc, stainless, and iron. PT. X in its main production uses machines, but not all machines are automatic, there is still a manual process carried out by the operator of each machine, such as in the cutting division, the operator must take the product that has been processed by hand and put the scrap in the place provided. This requires more physical strength because often the products and scraps that are taken are very heavy and difficult to carry [4]; [5]; [6], so sometimes two people have to lift them to carry them. Long Program, machine error is a mental burden faced by machine operators. Sometimes there are products that require a long time to cut, such as one plate that takes 2 hours to cut on a laser machine, the operator is very unemployed and can even feel tired or sleepy due to boredom waiting, the machine suddenly crashes and stops, the operator must find the source of the problem in the machine which sometimes leads to having to call an expert technician to fix it.

The bending process also requires a high mentality in logical thinking and precise calculations [7]; [8]; [9], this sometimes makes the operator think for a moment to digest the image and relate it to an existing program so that mistakes do not occur when bending the product. After doing the bending process continued with the welding process. The mental burden received by the welding operator is that when welding small products, the operator must adjust the gas pressure, heat pressure, and others to match the desired product, if an error occurs during welding it can cause product defects such as bent, melted, charred, even can be perforated and unwanted things happen if the product that has been welded enters the finishing process, there are often parts of the product that have holes. Especially in the weld joint, which makes the finishing operator bring the product with visible holes and ask the welding operator for a patch [10]; [11]; [12], which can sometimes interfere with work because they have to adjust the level of gas pressure, heat, etc. In addition, another problem is that if the gas cylinder from the welding has run out, the operator must replace it by rotating a tube that is heavy and tall enough to be carried to the empty tube holder and bringing a new tube to be installed in the welding machine [13]; [14]; [15]. The finishing process can be said as the last process of the production line [16]; [17]; [18]; [19], in this process objects or products that have been connected through welding will be ground to make them look smooth and neat and then polished and polished on the final surface according to the customer's requests. The problem is that when finishing with small products, high concentration is required because it is very risky for work accidents to occur [20]; [21]; [22]. With the above problems, the Swedish Occupational Fatigue Index (SOFI) method is used to measure the mental workload of production department workers [23]; [24]; [25].

2 Figures and tables

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2.1 Mental Workload

The occurrence of major accidents caused by human error is influenced by the mismatch between the tasks and capabilities of human operators in the socio-technical system design [26]; [27]; [28]. The existence of errors that occur is often caused by defects in mental processes such as distraction, low motivation, low alertness, mental overload, and fatigue in workers [29]. Errors made by control room operators have become one of the main causes of major accidents in the world, especially in the Indonesian work industry [30]; [31]; [32]. Because the effect is the effect on the intensity of human error and performance, the mental workload is a major emergency and an important problem in a complex work system to find a solution [33]; [34]. Mental workload is a complex construction, and multi-dimensional [35]; [36]; [37]. The idea of "what is mental workload" has been discussed by many researchers, but there is no definite definition because of its multidimensional and complex nature. Overall, the decline in company performance is caused by mental workload, especially on tasks that require shared resources.

2.2 Mental Fatigue

Mental fatigue is a psychobiological state caused by the demands of prolonged cognitive activity [38]; [39]; [40]. Mental fatigue is a psychobiological state that arises from engaging in prolonged cognitive activity, which can be mentally demanding and taxing. It is characterized by feelings of tiredness, reduced alertness, decreased ability to concentrate, and impaired cognitive performance. The brain consumes a significant amount of energy during cognitive tasks, and over time, the brain's resources can become depleted, leading to mental exhaustion. When mental fatigue sets in, it becomes harder to sustain high levels of cognitive performance, and individuals may experience a decline in their ability to think clearly, make decisions, and retain information. This situation greatly affects the performance of an individual negatively. Working on tasks that require a lot of cognitive activity over a long duration can lead to mental fatigue. Subjectively, individuals who experience mental fatigue will feel a feeling of reduced ability to carry out activities. If individuals already feel they have a sense of inability to do work due to mental fatigue, this will have serious consequences on the company's performance, not only decreasing results or profits but also the possibility of employees who have the potential to resign from the company. To counter mental fatigue, it's essential to take regular breaks during periods of intense mental activity and ensure an adequate amount of restorative sleep each night. Physical exercise, mindfulness practices, and engaging in enjoyable activities can also help alleviate mental fatigue and improve overall cognitive function. Additionally, maintaining a balanced and healthy lifestyle can contribute to reducing the impact of mental fatigue. This requires special attention from the company.

2.3 Work shifts

A work shift is a scheduled period of time during which employees work [41]; [42]; [43] . It is a way for organizations to manage working hours, especially when their operating hours exceed the standard 8 hours in a day or when they need to provide coverage for a full 24-hour period [44]; [45]; [46]. Work shifts consist of the morning shifts, day shifts, and night shifts. Every organization has a different work shift system. According to the International Labour Organization. the work shift system includes fixed shift and rotating shift systems [47]; [48]; [49]; [50]. Certain groups of workers who always work in the same shift get what is called a fixed shift. Meanwhile, the rotating shift will schedule varying working times over time, which lets a worker work from morning to evening shifts, from evening shifts to night shifts, or from night shifts to morning shifts.

3 Research Method

This research method is the Swedish Occupational Fatigue Index (SOFI) method. 15 Respondents/workers are given a questionnaire containing questions from the 5 dimensions of the SOFI method, namely lack of energy, lack of motivation, sleepiness, physical exertion, and physical discomfort which will measure mental workload subjectively.

4 Result and Discussion

4.1 Data Collection

Data collection was carried out on 15 production workers in one shift. There are 4 workstations in the production section, namely cutting, bending, upper welding, and lower welding. A recap of employee data based on years of service can be seen in the table below.

Table 1. Working period

Variable	Type	Number	Percentage
Working period	< 2 years	1	7
	2-5 years	5	33
	6-10 years	6	40
	11-15 years	3	20

Workers were given a Swedish Occupational Fatigue Inventory (SOFI) questionnaire to fill out. SOFI Questionnaire data is used to determine the average of each dimension in the morning shift and night shift, namely lack of energy, lack of motivation, sleepiness, physical exertion, and physical discomfort to determine the level of work fatigue.

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4.2 Data Processing

Based on the results of questionnaires by workers in the production sector on the morning shift at PT. X obtained the average of each dimension according to the Swedish Occupational Fatigue Inventory (SOFI) method as follows:

Table 2. Average dimensions based on the SOFI method

Dimensions	Average
Lack of energy	3,97
Physical exertion	2,66
Lack of motivation	1,78
Physical discomfort	1,53
Sleepiness	0,44
Sum average	2,08

Based on the table above, the dimension with the highest total average is lack of energy with an average value of 3.973. The dimension that has the smallest average is the sleepiness dimension with an average value of 0.44. Based on the SOFI questionnaire of 15 workers in the production sector on the morning shift, the results of the fatigue level in the low category were 0%, the medium category was 100% with 15 workers, and the high category was 0%. Thus, it can be concluded that the level of fatigue of production workers based on the SOFI questionnaire is in the medium category.

Based on the results of questionnaires by workers in the production sector on the night shift at PT. X obtained the average of each dimension according to the Swedish Occupational Fatigue Inventory (SOFI) method as follows:

Table 3. Average dimensions based on the SOFI method

Dimensions	Average
Lack of energy	2,84
Physical exertion	2
Lack of motivation	1,49
Physical discomfort	1,77
Sleepiness	3,13
Sum average	2,24

4.3 Recommendation

Recommendations for proposed improvements that can be used for PT. X, in the form of improvements to the work system, in order to add 1 division of workers who are tasked with only operating the fork-lift to move products that have been completed by the previous operator to the operator afterward, so that the machine operator production can work productively, it aims to reduce the physical activity of workers. The company is also proposed to give appreciation for the achievements/performance that have been done by employees such as giving bonuses, allowances, etc. As well as providing punishment if a worker does not do the work in accordance with the procedures that have been given by the company.

For suggestions for workers to take adequate rest, by doing power naps, namely sleeping for a while for 30-45 minutes before work, this is able to increase one's awareness. And maintain a normal sleep pattern of 7-9 hours per day. Workers are also advised to eat nutritious food and avoid eating spicy and high-fat foods too often because they can interfere with workers' digestion and sleep patterns. On the side lines of work activities, workers are advised to do ergonomic exercises and relaxation/neck stretching movements such as head drops, shoulder blade squeeze, prone extension, etc.

5 Conclusion

Based on the results of data processing as many as 15 respondents who did the morning shift and night shift, it can be concluded that the mental workload on the morning shift and night shift using the SOFI method is found in the medium category with a total of 100%. While the highest dimension in the morning shift with an average value of 3.97, namely lack of energy (lack of energy), then physical activity (physical exertion) with a total average of 2.66, then lack of motivation (lack of motivation) with a total average 1.78, then physical discomfort with a total average of 1.53. And for the highest dimension on the night shift with an average value of 3.13, namely sleepiness, then lack of energy (lack of energy) with a total average of 2.84, then physical activity (physical exertion) with a total average of 2, then lack of motivation with a total average of 1.73.

Work fatigue can occur due to external factors such as age, history of illness, hours of sleep, and distance from home to work. Determination of rest time through the calculation of the energy consumption needed during work which is converted into the need for rest time during the work process in all work divisions (Rt = 0), which means that the 60-minute rest period is sufficient.

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References

[1] Y. Xiao, B. Becerik-Gerber, G. Lucas, and S. C. Roll, "Impacts ofWorking from Home during COVID-19 Pandemic on Physical and Mental Well-Being of Office Workstation Users," *J. Occup. Environ. Med.*, vol. 63, no. 3,

pp. 181–190, 2021, doi: 10.1097/JOM.0000000000002097.

[2] O. Emre and S. De Spiegeleare, "The role of work–life balance and autonomy in the relationship between commuting, employee commitment and well-being," *Int. J. Hum. Resour. Manag.*, vol. 32, no. 11, pp. 2443–2467, 2021, doi: 10.1080/09585192.2019.1583270.

[3] M. A. Campbell and J. G. Gunning, "Strategies to improve mental health and well-being within the UK construction industry," *Proc. Inst. Civ. Eng. Manag. Procure. Law*, vol. 173, no. 2, pp. 64–74, 2020, doi: 10.1680/jmapl.19.00020.

[4] X. Liu and H. Chen, "Sharing Economy Mdpi," *Sustainability*, pp. 1–13, 2020.

[5] L. Pinotti *et al.*, "Recycling food leftovers in feed as opportunity to increase the sustainability of livestock production," *J. Clean. Prod.*, vol. 294, p. 126290, 2021, doi: 10.1016/j.jclepro.2021.126290.

[6] S. Jribi, H. Ben Ismail, D. Doggui, and H. Debbabi, "COVID-19 virus outbreak lockdown: What impacts on household food wastage?," *Environ. Dev. Sustain.*, vol. 22, no. 5, pp. 3939–3955, 2020, doi: 10.1007/s10668-020-00740-y.

[7] D. Mourtzis, F. Xanthi, and V. Zogopoulos, "An adaptive framework for augmented reality instructions considering workforce skill," *Procedia CIRP*, vol. 81, no. March, pp. 363–368, 2019, doi: 10.1016/j.procir.2019.03.063.

[8] D. Schnebelen, O. Lappi, C. Mole, J. Pekkanen, and F. Mars, "Looking at the road when driving around bends: Influence of vehicle automation and speed," *Front. Psychol.*, vol. 10, no. JULY, pp. 1–13, 2019, doi: 10.3389/fpsyg.2019.01699.

[9] H. L. Park, Y. Lee, N. Kim, D. G. Seo, G. T. Go, and T. W. Lee, "Flexible Neuromorphic Electronics for Computing, Soft Robotics, and Neuroprosthetics," *Adv. Mater.*, vol. 32, no. 15, 2020, doi: 10.1002/adma.201903558.

[10] C. Favi, R. Garziera, and F. Campi, "A rule-based system to promote design for manufacturing and assembly in the development of welded structure: Method and tool proposition," *Appl. Sci.*, vol. 11, no. 5, pp. 1–34, 2021, doi: 10.3390/app11052326.

[11] F. K. Konstantinidis, I. Kansizoglou, K. A. Tsintotas, S. G. Mouroutsos, and A. Gasteratos, "The role of machine vision in industry 4.0: A textile manufacturing perspective," *IST 2021 - IEEE Int. Conf. Imaging Syst. Tech. Proc.*, 2021, doi: 10.1109/IST50367.2021.9651459.

[12] W. Cai *et al.*, "A state-of-the-art review on solid-state metal joining," *J. Manuf. Sci. Eng. Trans. ASME*, vol. 141, no. 3, 2019, doi: 10.1115/1.4041182.

[13] S. Tabakov and L. Bertocchi, "' MODERN DIAGNOSTIC X-RAY SOURCES – Technology , Manufacturing , Reliability ' by ROLF BEHLING," vol. 10, no. 2, pp. 372–373, 2022.

[14] J. Hoster Veleuciliste Karlovcu VLADIMIR TUDIĆ, T. Kralj Veleuciliste Karlovcu, J. Hoster, V. Tudić, and T. Kralj, "Concept Design and Development of an Electric Go-Kart Chassis for Undergraduate Education in Vehicle Dynamics and Stress Applications," 2022.

[15] P. J. Withers *et al.*, "X-ray computed tomography," *Nat. Rev. Methods Prim.*, vol. 1, no. 1, 2021, doi: 10.1038/s43586-021-00015-4.

[16] M. Jiménez, L. Romero, I. A. Domínguez, M. D. M. Espinosa, and M. Domínguez, "Additive Manufacturing Technologies: An Overview about 3D Printing Methods and Future Prospects," *Complexity*, vol. 2019, 2019, doi: 10.1155/2019/9656938.

[17] J. Leng *et al.*, "Digital twin-driven rapid reconfiguration of the automated manufacturing system via an open architecture model," *Robot. Comput. Integr. Manuf.*, vol. 63, no. September 2019, 2020, doi: 10.1016/j.rcim.2019.101895.

[18] F. Psarommatis, G. May, P. A. Dreyfus, and D. Kiritsis, "Zero defect manufacturing: state-of-the-art review, shortcomings and future directions in research," *Int. J. Prod. Res.*, vol. 58, no. 1, pp. 1–17, 2020, doi: 10.1080/00207543.2019.1605228.

[19] J. He, N. M. Evans, H. Liu, and S. Shao, "A review of research on plant-based meat alternatives: Driving forces, history, manufacturing, and consumer attitudes," *Compr. Rev. Food Sci. Food Saf.*, vol. 19, no. 5, pp. 2639–2656, 2020, doi: 10.1111/1541-4337.12610.

[20] M. J. Hamlin, D. Wilkes, C. A. Elliot, C. A. Lizamore, and Y. Kathiravel, "Monitoring training loads and perceived stress in young elite university athletes," *Front. Physiol.*, vol. 10, no. JAN, pp. 1–12, 2019, doi: 10.3389/fphys.2019.00034.

[21] P. Adhikary, S. Keen, and E. van Teijlingen, "Workplace Accidents Among Nepali Male Workers in the Middle East and Malaysia: A Qualitative Study," *J. Immigr. Minor. Heal.*, vol. 21, no. 5, pp. 1115–1122, 2019, doi: 10.1007/s10903-018-0801-y.

[22] J. Min, Y. Kim, S. Lee, T. W. Jang, I. Kim, and J. Song, "The Fourth Industrial Revolution and Its Impact on Occupational Health and Safety, Worker's Compensation and Labor Conditions," *Saf. Health Work*, vol. 10, no. 4, pp. 400–408, 2019, doi: 10.1016/j.shaw.2019.09.005.

[23] R. Heidarimoghadam, H. Saidnia, J. Joudaki, Y. Mohammadi, and M. Babamiri, "Does mental workload can lead to musculoskeletal disorders in healthcare office workers? Suggest and investigate a path," *Cogent Psychol.*, vol. 6, no. 1, 2019, doi: 10.1080/23311908.2019.1664205.

[24] Z. Arman, M. Nikooy, P. Tsioras, M. Heidari, and B. Majnounian, "Mental Workload, Occupational Fatigue and Musculoskeletal Disorders of Forestry Professionals: The Case of a Loblolly Plantation in Northern Iran," *Croat. J. For. Eng.*, vol. 43, no. 2, pp. 403–424, 2022, doi: 10.5552/crojfe.2022.1639.

[25] M. Rostami, A. Choobineh, M. Shakerian, M. Faraji, and H. Modarresifar, "Assessing the effectiveness of an ergonomics intervention program with a participatory approach: ergonomics settlement in an Iranian steel industry," *Int. Arch. Occup. Environ. Health*, vol. 95, no. 5, pp. 953–964, 2022, doi: 10.1007/s00420-021-01811-x.

[26] T. Sawaragi, Y. Horiguchi, and T. Hirose, "Design of productive socio-technical systems by human-system co-creation for super-smart society," *IFAC-PapersOnLine*, vol. 53, pp. 10101–10108, 2020, doi: 10.1016/j.ifacol.2020.12.2734.

[27] T. Sawaragi, "Design of resilient socio-technical systems by human-system co-creation," *Artif. Life Robot.*, vol. 25, no. 2, pp. 219–232, 2020, doi: 10.1007/s10015-020-00598-3.

[28] C. Dominguez-Péry, L. N. R. Vuddaraju, I. Corbett-Etchevers, and R. Tassabehji, *Reducing maritime accidents in ships by tackling human error: a bibliometric review and research agenda*, vol. 6, no. 1. Springer Singapore, 2021. doi: 10.1186/s41072-021-00098-y.

[29] A. Suryadi, M. Cattleya, and P. Annissaa, "Proceeding Seminar Nasional Waluyo Jatmiko 2021 Analisis Tingkat Beban Kerja Operator Asc (Automated Stacking Crane) Dengan Metode NASA-TLX (National Aeronautics And Space Administration Task Load Index) Di PT. Terminal Teluk Lamong Surabaya Program ," 2021.

[30] M. Cattleya and P. Anissa, "Development of Big Five Personality Traits Moderation That Affecting Safety Leadership, Safety Knowledge, and Safety Culture on Safety Performance Models to Reduce Accidents in The Chemical Industry," pp. 3186–3195, 2023, doi: 10.46254/ap03.20220526.

[31] E. P. Widjajati, M. Cattleya, P. Annissaa, and E. Wahyudi, "Design of Ergonomic Work Facilities to Reduce Skuble Muscle Disorders with Quick Exposure Check (QEC) Method in CV . XYZ," vol. 2021, pp. 282–287, 2021.

[32] M. T. Safirin, Y. C. Winurseto, R. N. Sari, and M. C. P. A. Islami, "Performance Rating Analysis to Maximize the Working Time of Employees in The Packaging Department at a Soap Production Company," vol. 2022, pp. 46–50, 2022.

[33] D. S. Donoriyanto, P. Octaviana, M. C. P. A. I, and Y. C. Winursito, "Proceeding Seminar Nasional Waluyo Jatmiko 2021 Penilaian Kinerja Kasir Menggunakan Metode Analytical Hierarchy Process (AHP) Dan Objective Matrix (OMAX) DI PT . XYZ Program Studi Teknik Industri , Fakultas Teknik Universitas Pembangunan Nasional Vete," pp. 117–128, 2021.

[34] M. Islami, R. Sandora, and F. Rachman, "Analisis Pengaruh Faktor-Faktor Kerja terhadap Produktivitas Kerja pada Proyek Pembangunan Jalan Tol (Studi Kasus: Pekerjaan Pembuatan Kolom …," *Proceeding 1st Conf. …*, no. 2581, pp. 106–112, 2017, [Online]. Available: https://core.ac.uk/download/pdf/236670426.pdf

[35] H. Che, S. Zeng, Q. You, Y. Song, and J. Guo, "A fault tree-based approach for aviation risk analysis considering mental workload overload," *Eksploat. i Niezawodn.*, vol. 23, no. 4, pp. 646–658, 2021, doi: 10.17531/ein.2021.4.7.

[36] G. Jiang, H. Chen, C. Wang, and P. Xue, "Mental Workload Artificial Intelligence Assessment of Pilots' EEG Based on Multi-Dimensional Data Fusion and LSTM with Attention Mechanism Model," *Int. J. Pattern Recognit. Artif. Intell.*, vol. 36, no. 11, pp. 1–19, 2022, doi: 10.1142/S0218001422590352.

[37] K. Guan, Z. Zhang, T. Liu, and H. Niu, "Cross-Task Mental Workload Recognition Based on EEG Tensor Representation and Transfer Learning," *IEEE Trans. Neural Syst. Rehabil. Eng.*, vol. 31, pp. 2632–2639, 2023, doi: 10.1109/TNSRE.2023.3277867.

[38] S. Russell, D. Jenkins, S. Rynne, S. L. Halson, and V. Kelly, "What is mental fatigue in elite sport? Perceptions from athletes and staff," *Eur. J. Sport Sci.*, vol. 19, no. 10, pp. 1367–1376, 2019, doi: 10.1080/17461391.2019.1618397.

[39] J. Díaz-García, I. González-Ponce, M. Á. López-Gajardo, J. Van Cutsem, B. Roelands, and T. García-Calvo, "How mentally fatiguing are consecutive world padel tour matches?," *Int. J. Environ. Res. Public Health*, vol. 18, no. 17, pp. 149–150, 2021, doi: 10.3390/ijerph18179059.

[40] H. Sun, K. G. Soh, S. Roslan, M. R. W. N. Wazir, and K. L. Soh, "Does mental fatigue affect skilled performance in athletes? A systematic review," *PLoS One*, vol. 16, no. 10 October, pp. 1–18, 2021, doi: 10.1371/journal.pone.0258307.

[41] S. Ganesan *et al.*, "The Impact of Shift Work on Sleep, Alertness and Performance in Healthcare Workers," *Sci. Rep.*, vol. 9, no. 1, pp. 1–13, 2019, doi: 10.1038/s41598-019-40914-x.

[42] D. Schneider and K. Harknett, "Consequences of Routine Work-Schedule Instability for Worker Health and Well-Being," *Am. Sociol. Rev.*, vol. 84, no. 1, pp. 82–114, 2019, doi: 10.1177/0003122418823184.

[43] L. Kervezee, A. Kosmadopoulos, and D. B. Boivin, "Metabolic and cardiovascular

consequences of shift work: The role of circadian disruption and sleep disturbances," *Eur. J. Neurosci.*, vol. 51, no. 1, pp. 396–412, 2020, doi: 10.1111/ejn.14216.

[44] C. Bergroth, O. Järv, H. Tenkanen, M. Manninen, and T. Toivonen, "A 24-hour population distribution dataset based on mobile phone data from Helsinki Metropolitan Area, Finland," *Sci. Data*, vol. 9, no. 1, pp. 1–19, 2022, doi: 10.1038/s41597-021-01113-4.

[45] M. Glowacka, "A little less autonomy? The future of working time flexibility and its limits," *Eur. Labour Law J.*, vol. 12, no. 2, pp. 113–133, 2021, doi: 10.1177/2031952520922246.

[46] J. J. Baugh, J. K. Takayesu, B. A. White, and A. S. Raja, "Beyond the Maslach burnout inventory: addressing emergency medicine burnout with Maslach's full theory," *J. Am. Coll. Emerg. Physicians Open*, vol. 1, no. 5, pp. 1044–1049, 2020, doi: 10.1002/emp2.12101.

[47] V. Leso, A. Caturano, I. Vetrani, and I. Iavicoli, "Shift or night shift work and dementia risk: A systematic review," *Eur. Rev. Med. Pharmacol. Sci.*, vol. 25, no. 1, pp. 222–232, 2021, doi: 10.26355/eurrev_202101_24388.

[48] M. Di Muzio *et al.*, "Comparison of Sleep and Attention Metrics among Nurses Working Shifts on a Forward- vs Backward-Rotating Schedule," *JAMA Netw. Open*, pp. 1–12, 2021, doi: 10.1001/jamanetworkopen.2021.29906.

[49] T. Behrens *et al.*, "Impact of shift work on the risk of depression," *Chronobiol. Int.*, vol. 38, no. 12, pp. 1761–1775, 2021, doi: 10.1080/07420528.2021.1962903.

[50] D. Querstret, K. O'Brien, D. J. Skene, and J. Maben, "Improving fatigue risk management in healthcare: A systematic scoping review of sleep-related/fatigue-management interventions for nurses and midwives," *Int. J. Nurs. Stud.*, vol. 106, 2020, doi: 10.1016/j.ijnurstu.2019.103513.