



The Influence of Work Environment and Work Culture on the Fatigue of the MT. Sultan Mahmud Badaruddin II Crew

Agus Widodo^{1*}, Dedtri Anwar², Siwi Woro Herningsih³

¹⁻³ Politeknik Maritim Banten, Indonesia

Email: agusw020473@gmail.com¹, dedtri_32@yahoo.com², siwiworo83@gmail.com³

*Corresponding Author: agusw020473@gmail.com¹

Abstract: This research is motivated by the high risk of fatigue experienced by ship crews during voyages, which directly affects occupational safety and mental well-being. Fatigue arises from long working hours, inadequate rest time, heavy workloads, and extreme environmental conditions such as high temperatures, engine noise, and vessel vibrations. On the MT. Sultan Mahmud Badaruddin II, the problem becomes more complex due to the tight work rhythm, short berthing periods, and fast, repetitive loading–unloading activities. Harsh weather conditions, short but intensive sailing distances, and limited relaxation facilities make the crew increasingly vulnerable to both physical and mental fatigue. In addition, a work culture that tends to be authoritarian and lacks communication exacerbates psychological pressure, especially when crew members find it difficult to report their fatigue to superiors. This study uses a qualitative method through direct observation and interviews with all crew members in the deck and engine departments. The aim is to analyze the influence of the work environment and work culture on fatigue levels onboard. The results show that environmental factors such as high temperatures, narrow workspaces, and vessel instability significantly affect physical fatigue. Meanwhile, mental fatigue is triggered by ineffective communication, hierarchical pressure, and an unsupportive work culture. These findings align with the perspectives of Mathis and Jackson and comply with the provisions of the STCW 2010 and MLC 2006, which emphasize the importance of regulating working hours and fatigue management. Overall, optimizing rest hours, improving the work environment, and reforming organizational culture are required to reduce fatigue risks.

Keywords: STCW 2010; Tanker Vessel; Work Culture; Work Environment; Work Fatigue

1. INTRODUCTION

Maritime transportation is one of the main backbones of the mobility of goods and people in Indonesia, particularly due to its geographical characteristics as an archipelagic country dominated by vast waters. Indonesia's strategic position between two continents and two oceans makes the shipping sector vital in supporting both national and international economic activities (Bahri, 2018). Behind its significant role, the maritime industry holds various risks, especially those related to the safety and health of ship crews. One of the most common issues in shipping activities is work fatigue, which can have serious impacts on the operational safety of vessels. Fatigue not only disrupts work performance but also increases the risk of human error that may lead to accidents (Suma'mur, 2019). Fatigue onboard emerges from a combination of various factors, including long working hours, extreme work environment conditions, and psychological pressure experienced by crew members during voyages. In the case of the MT. Sultan Mahmud Badaruddin II, fatigue is heightened due to the dense work rhythm, fast-paced loading and unloading activities, and rest periods that are often disrupted by operational demands. This condition aligns with the findings of Mathis and Jackson (2020), stating that the imbalance between workload and rest time is a major trigger for physical and mental fatigue.

Physical work environment factors such as heat, noise, vibration, and confined spaces further exacerbate the crew's physical condition, particularly in the engine room and deck areas.

Work culture also has a significant influence on fatigue levels. The work culture onboard is generally characterized by strong hierarchy, rigid leadership styles, and high work demands. Differences in cultural backgrounds among crew members can also trigger communication conflicts that affect psychological comfort (Hartanto, 2019). The pressure to work quickly and accurately often leads crew members to push themselves to complete tasks even when their physical condition is not optimal. This is in line with Munie's (2015) view that a work culture that does not consider worker well-being can lead to long-term stress and burnout. International regulations such as STCW 2010 and MLC 2006 have actually established limits for working hours and rest periods for seafarers, which include at least 10 hours of rest within a 24-hour period. However, their implementation does not always run optimally, especially on ships with high operational intensity. Observations show discrepancies between regulations and actual practices, such as when crew members still have to remain on standby even while off duty to meet operational needs. Violations of mandated rest periods like these can reduce concentration ability and increase the risk of accidents (IMO, 2011).

Poor work environment quality and an unsupportive work culture also affect the physical and mental health of crew members. Various studies show that seafarers have higher levels of depression, anxiety, and suicide risk compared to workers in other sectors (Widarbowo, 2020). A monotonous work environment, psychological pressure from being far from family, and the lack of recreational facilities onboard are additional factors that worsen fatigue levels. In the context of the MT. Sultan Mahmud Badaruddin II, crew fatigue has led to several work incidents, such as injuries during deck operations caused by loss of focus and declining physical condition. These incidents strengthen the argument that fatigue should not be considered a normal condition in the maritime industry. Companies must conduct a thorough evaluation of work systems, organizational culture, and the work environment to ensure the safety and well-being of ship crews (Robbins & Judge, 2019).

Based on these conditions, this study is crucial to analyze the influence of work environment factors and work culture on the fatigue levels of the MT. Sultan Mahmud Badaruddin II crew. The findings are expected to serve as a foundation for improving operational management and developing more effective safety policies for all crew members.

2. PROPOSED METHOD

The research method used in this study is qualitative with a descriptive–interpretative approach, aimed at understanding the phenomenon of crew fatigue within the real context of maritime operations without manipulating variables. The qualitative approach was chosen because it allows the researcher to explore the meanings, attitudes, and experiences of the subjects in depth, as well as interpret social interactions and work culture occurring onboard (Herdiansyah, 2010). Within this framework, the researcher positioned themselves as a participant-observer to capture the nuances of work practices, rest patterns, and interpersonal dynamics that are often not recorded through quantitative instruments alone (Moleong, 2017).

The theoretical and methodological foundations refer to qualitative methodology literature so that the processes of data collection and analysis are designed to maintain the authenticity of field data and ensure the relevance of findings to the operational context of the vessel. The research location is the MT. Sultan Mahmud Badaruddin II tanker, with the research period lasting approximately one year to obtain a representative picture of operational conditions under various sailing situations, including short berthing and liner voyages (Ship Particular document of MT. Sultan Mahmud Badaruddin II). The research sample consists of all crew members relevant to the study focus—deck department and engine department personnel including the Master, Chief Mate to Third Mate, Chief Engineer, engineers, bosun, helmsmen, oilers, and ratings—selected through purposive/total sampling in line with the nature of qualitative research that prioritizes key informants to obtain rich and contextual data (Arikunto, 2002; Sugiyono, 2005). The scheduling of instrument administration and interviews was arranged so as not to disrupt critical operations (e.g., loading and unloading), ensuring that responses reflect actual conditions and minimizing situational bias.

The data collection techniques combined primary data (structured/in-depth interviews, participatory field observations, and rest hour record documentation) with secondary data (literature review, international regulations such as STCW 2010 and MLC 2006, and company documents) to strengthen data triangulation. Observations focused on daily work practices, the physical conditions of the workspace (temperature, noise, lighting, humidity), and interpersonal interactions; while interviews were directed toward subjective experiences of fatigue, rest patterns, and perceptions of work culture. Data analysis was carried out through the stages of data reduction, data display, and verification/conclusion drawing as recommended by Miles & Huberman—beginning with data reduction to filter and code key themes, followed by data

presentation in narrative and matrix forms to map relationships among variables, and final verification through cross-checking with informants to ensure accuracy of interpretations (Miles & Huberman, 1994; Usman & Akbar, 2000; Nazir, 2011).

3. RESULTS AND DISCUSSION

The Influence of Work Environment Factors on Crew Fatigue

The findings show that work environment factors have a highly significant influence on the fatigue levels of the MT. Sultan Mahmud Badaruddin II crew. Based on field observations and in-depth interviews, it was found that crew members—both from the deck department and engine department—face extreme workplace conditions, such as heat exposure, noise, inadequate lighting, and high humidity. These conditions serve as major triggers of physical and mental fatigue, especially for crew members who work long hours and perform repetitive tasks daily. Direct exposure to sunlight on the deck area causes rapid fluid loss, leading to dehydration and faster muscle fatigue. This condition becomes more severe when the crew must perform heavy tasks such as mooring operations, painting, and ship cleaning, particularly during extremely hot weather. The high temperatures inside the enclosed engine room also create additional heat stress, forcing the body to work harder to maintain internal temperature stability, which results in quicker onset of fatigue.

Noise originating from the main engine, generators, and deck equipment is a dominant source of mental fatigue. Crew members reported difficulty maintaining focus and concentration while working amid constant noise. This noise not only affects hearing but can also trigger sensory stress that influences emotional stability and decision-making accuracy. Several crew members also stated that noise disrupts the quality of their rest, particularly for those whose cabins are located near the engine room, thereby worsening cumulative fatigue throughout the voyage. Prolonged high noise levels also have the potential to cause microsleep during watch-keeping duties, as revealed in interviews, and this condition poses a serious danger to the ship's navigational safety. Another contributing factor is inadequate lighting, especially during night shifts or in enclosed areas such as the engine room, pump room, and certain accommodation spaces. Crew members reported that dim lighting causes eye strain, affects visual clarity, and reduces focus when performing technical tasks. This condition increases the risk of work errors and accidents, particularly in activities requiring a high level of precision. The issue of poor lighting becomes more critical when the vessel operates at night or during bad weather, where visibility is limited and the crew must rely on auxiliary lights to carry out critical deck operations.

High humidity also significantly contributes to fatigue, particularly in the engine room and deck areas frequently exposed to seawater splashes. Elevated humidity inhibits the evaporation of sweat, making it difficult for the body to lower its temperature, which ultimately causes excessive discomfort and accelerates dehydration. Deck crew also face additional challenges from the vessel's motion due to waves, forcing the body to continuously maintain balance. This doubles the physical workload and speeds up muscle fatigue, especially during daily tasks such as handling equipment and performing mooring operations. These findings indicate that the work environment on the MT. Sultan Mahmud Badaruddin II is strongly correlated with crew fatigue levels. A hot, noisy, humid, unstable environment with inadequate lighting imposes a significant physical burden. This aligns with Suma'mur's (2009) perspective that non-ergonomic work environments with high physical demands can accelerate the onset of fatigue. The results of this study are also consistent with international safety standards formulated by the IMO, which emphasize that exposure to hazardous environmental factors must be minimized to maintain crew health and readiness.

The Influence of Work Culture Factors on Crew Fatigue

The work culture on the MT. Sultan Mahmud Badaruddin II has proven to be one of the most dominant factors affecting crew fatigue levels. Work culture onboard is heavily influenced by a hierarchical organizational structure and work relationships that place superiors as the central command authority. In such a structure, all orders must be executed quickly, accurately, and without refusal. Crew members interviewed revealed that they often feel pressured to continue working even when their physical condition shows signs of severe fatigue. This aligns with Fathoni's (2006) view that organizational cultures emphasizing strict compliance can create psychological pressure and limit employees' ability to openly communicate their physical and emotional conditions. As a result, crew members tend to suppress their fatigue to maintain a professional image in front of superiors, which ultimately exacerbates cumulative fatigue. Another contributing factor to increased fatigue is the diversity in cultural backgrounds and work languages among the crew. The ship employs personnel from various regions of Indonesia, leading to differences in communication styles, expressions, and ways of giving instructions. Some deck crew reported frequently misinterpreting orders due to differences in intonation or harsh communication, especially from senior crew or officers. This situation creates the potential for small, recurring conflicts, generating an emotional burden often unnoticed by the crew. Hariandja (2007) explains that disharmonious communication within an organization can trigger psychological tension and reduce work comfort, ultimately increasing the risk of mental fatigue. When communication is ineffective, the work process becomes more

stressful, and crew members feel they must remain constantly cautious to avoid misunderstandings.

A work culture that demands unlimited dedication also contributes to increased fatigue. Crew members are often required to remain on standby even during off-duty periods. For example, during cargo operations, mooring position changes, or technical malfunctions, crew members are called upon to assist without regard for their need for physical recovery. This results in rest periods that fall far below the ideal standard, causing fatigue to accumulate and remain unresolved. Suma'mur (2009) emphasizes that insufficient rest prevents the body from undergoing physiological recovery processes, leading to faster and cumulative fatigue. When a work culture encourages crew to continue working despite being fatigued, safety risks increase significantly. Crew members also experience pressure in the form of fear of negative evaluation from superiors if they report fatigue. In a culture that overemphasizes discipline, crew members tend to avoid disclosing declining physical or mental conditions, fearing they may be deemed incapable or unable to handle the shipboard workload. Munie (2015) states that a repressive work culture can induce psychological stress, which ultimately exacerbates both mental and physical fatigue. When crew members choose to conceal their fatigue to maintain their professional image, the fatigue they experience multiplies and can compromise their ability to work safely.

The study found that crew members experience boredom and decreased motivation due to monotonous work routines, limited recognition, and a lack of supportive interaction from superiors. Crew members feel that their work is not always acknowledged, and interpersonal relationships onboard are often formal and distant. Gunawan (2016) emphasizes that workers' psychological conditions are strongly influenced by the organizational climate; an unsupportive work environment can accelerate emotional fatigue and reduce stress resilience. This situation is further exacerbated by a lack of empathetic communication in ship leadership. As Moenir (2010) explains, a non-humanistic leadership style can create a cold, high-pressure, and uncomfortable work atmosphere. A rigid, hierarchical, and non-communicative work culture that demands unlimited loyalty while providing little space for crew to honestly express their conditions is a powerful factor in increasing fatigue. If this work culture is not improved, crew members will remain in a cycle of fatigue that threatens both occupational safety and the overall quality of ship operations. Nazir (2011) stresses that a healthy organizational environment is crucial for human work effectiveness; without improvements in work culture, enhancing crew safety and well-being is difficult to achieve.

The Influence of Work Rhythm and Rest Hours on Crew Fatigue

Work rhythm and rest patterns on the MT. Sultan Mahmud Badaruddin II have proven to be the most significant factors contributing to both physical and mental fatigue. The study shows that most crew members do not receive rest periods in accordance with international standards, which require a minimum of 10 hours of rest within 24 hours. This situation is particularly common during intensive operations such as cargo handling, night watches, or mooring position changes. Crew members responsible for the deck and engine departments often have to break their rest periods into short, fragmented blocks that do not provide adequate recovery. This aligns with Suma'mur (2009), who explains that a work rhythm that is not balanced with recovery needs can lead to cumulative fatigue because the body does not have the opportunity to complete natural restorative processes. The fragmentation of rest exacerbates both physical and mental fatigue. In interviews, several crew members admitted that their rest periods last only 1–2 hours at a time before they must return to work to meet operational demands. A body that does not experience a full sleep cycle tends to lose cognitive stability, reducing focus, analytical accuracy, and motor responses. Supporting this, Hariandja (2007) emphasizes that irregular work rhythms can disrupt human biological clocks (circadian rhythms), leading to decreased work capacity and increased risk of errors. Crew members working night shifts face additional challenges, including extreme drowsiness, impaired focus, and mood changes due to misalignment between work schedules and the body's natural rhythm.

One of the most concerning phenomena identified in this study is microsleep, a condition in which an individual falls asleep for several seconds without realizing it. Crew members reported experiencing microsleep during night watches, particularly between 02:00 and 04:00, a critical period that, according to Suma'mur (2009), is the most vulnerable time for decreased alertness and severe drowsiness within the circadian cycle. Microsleep is extremely dangerous in the maritime context as it can lead to human error, especially for watch officers responsible for navigation and ship safety. Moenir (2010) states that work conditions demanding high alertness without adequate rest accelerate the onset of severe fatigue, which can ultimately result in occupational accidents. The rest environment also affects the quality of crew sleep. Crew members residing in cabins near the engine room reported sleep disturbances due to constant noise and vibrations. High temperatures, suboptimal ventilation, and engine noise are major factors that hinder quality sleep. This aligns with Gunawan's (2016) analysis that poor physical environments can impede the body's recovery processes and increase physiological workload. When crew members cannot sleep soundly, the body loses the opportunity to restore energy,

repair tissues, and balance central nervous system functions. Consequently, crew members are prone to severe fatigue even if their total sleep duration appears adequate.

An imbalanced work rhythm also impacts emotional and mental fatigue. Crew members reported experiencing emotional changes such as irritability, impatience, and loss of motivation because their bodies are continuously pressured between the need for rest and operational demands. Munie (2015) explains that mental fatigue can arise from inhumane work schedules, particularly when workers have no control over their rest periods. This situation is exacerbated by the ship's work culture, which demands high alertness without tolerance for crew members feeling fatigued. Such psychological pressure forces the crew to work under prolonged stress, which, according to Nazir (2011), can impair cognitive stability and reduce decision-making ability. Dense work rhythms, unmet rest periods, and non-conducive rest environments significantly affect crew fatigue levels. Crew members operate on schedules that are out of sync with natural biological clocks, causing physical, mental, and emotional fatigue to accumulate over time. Usman & Purnomo (2000) note that this type of fatigue is particularly dangerous as it can reduce productivity while increasing the risk of operational hazards. Therefore, work rhythm and rest hours are crucial factors that must be systematically improved to ensure maritime safety and the overall health of ship crews.

Strategies to Overcome and Reduce Crew Fatigue

Fatigue management strategies for the crew of the MT. Sultan Mahmud Badaruddin II must be implemented through a systematic approach that encompasses managerial, operational, work environment, organizational culture, and individual capacity aspects. Fatigue cannot be addressed merely by increasing rest hours or reducing workload; it requires a comprehensive change in work systems and communication patterns onboard. Nazir (2011) emphasizes that resolving fatigue issues requires a multidimensional approach because the human body operates within an interconnected system of physical, mental, and environmental factors. Therefore, the strategies in this study are designed based on real conditions observed in the field and supported by ergonomics and work management theories. The first strategy is the reorganization of work and rest schedules based on fulfilling the body's biological needs. The research findings indicate that crew members often lose ideal rest periods due to intensive operational activities such as cargo handling and mooring position changes. Fragmented rest—such as sleeping for one hour, then working, followed by another short sleep—proves insufficient for adequate physical recovery. Suma'mur (2009) explains that the body requires a complete sleep cycle to restore the central nervous system, normalize stress hormones, and repair cognitive functions. Therefore, the company must establish work-hour policies that allow crew members

to enjoy extended rest periods while preventing manipulation of rest hour records. Internal monitoring must be strengthened to ensure that recorded data accurately reflect actual conditions.

The second strategy is improving the work environment through optimized ventilation, noise reduction, regular engine maintenance, and enhanced lighting. The study found that high temperatures in the engine room and noise from generators increase the crew's physiological workload. Gunawan (2016) notes that exposure to extreme environments accelerates fatigue because the body is forced to work harder to maintain internal stability. Companies can address this by maintaining engine cooling systems, installing noise-dampening materials, and rearranging work lights to reduce eye strain, especially in enclosed spaces. Work environment improvements should also include providing proper personal protective equipment (PPE), such as earplugs, heat-resistant gear, and internationally standard helmets, to mitigate environmental stress. The third strategy involves reforming the work culture, which has tended to be authoritarian and non-communicative. Crew members often hesitate to report fatigue due to fear of being labeled undisciplined or incompetent. In a safety-oriented work system, however, any fatigue complaints must be treated as a top priority. Fathoni (2006) emphasizes that a healthy organization must provide a safe communication space where workers can honestly express challenges without fear of stigma. Therefore, ship leadership—from the Master to the Chief Engineer—needs to adopt a more humanistic and participative leadership style. Moenir (2010) explains that empathetic leadership can increase work motivation and reduce psychological stress, directly contributing to a decrease in mental fatigue.

The fourth strategy is increasing crew awareness regarding fatigue management. Many crew members reported lacking understanding of early warning signs of dangerous fatigue, such as microsleep, reduced focus, impaired coordination, and mood changes. Munie (2015) emphasizes that workers' lack of awareness about their own physical condition is one of the major contributors to severe fatigue. Regular education through briefings, safety meetings, and energy management training is essential so that crew members can detect fatigue at an early stage. Training may include breathing techniques, stress control, healthy sleep patterns, and understanding circadian rhythms. With strong knowledge of fatigue management, crew can take preventive measures before fatigue develops into a safety hazard. The fifth strategy is optimizing workload distribution and task rotation. Field observations indicate that certain tasks—such as mooring, deck cleaning, and engine maintenance—are frequently assigned to the same crew members day after day. This uneven distribution causes some crew members to

experience fatigue faster than others. Usman & Purnomo (2000) note that an unbalanced workload can create a backlog of fatigue for certain individuals and reduce overall team productivity. Therefore, a fair work rotation system should be implemented to ensure that every crew member receives a proportionate share of physical and mental workload according to their capacity. Task assignments should also take into account age, physical condition, experience, and health history.

Another approach that can be implemented is strengthening social support among the crew. A competitive and less harmonious work culture makes it difficult for crew members to receive emotional support when facing pressure. Hariandja (2007) explains that positive interpersonal relationships can serve as a mental buffer against work-related stress and fatigue. Therefore, activities that foster social bonds—such as team-building exercises, group-based work evaluations, and informal communication forums—are necessary to help crew members feel valued and accepted. Strong social relationships have been shown to significantly reduce the risk of mental fatigue. Fatigue management strategies must be designed in an integrative manner. Nazir (2011) asserts that successfully addressing work fatigue can only be achieved through the synergy of organizational system improvements, work culture changes, strengthening individual capacities, and creating a healthy work environment. With consistent implementation of these strategies, shipping companies can reduce crew fatigue, enhance maritime safety, and improve long-term operational performance of the vessel.

4. CONCLUSIONS

Based on the research findings on crew fatigue levels aboard the MT. Sultan Mahmud Badaruddin II, it can be concluded that the fatigue experienced by the crew results from a combination of three main factors: the work environment, work culture, and work rhythm and rest hours. First, the work environment significantly contributes to both physical and mental fatigue. Exposure to extreme heat, engine noise, inadequate lighting, and high humidity creates a demanding work setting and increases the risk of chronic fatigue. Observations indicate that crew members working in the deck and engine departments bear the heaviest physical workload, especially when facing hot weather and intensive operational activities such as mooring, engine inspections, and dense cargo handling operations.

A hierarchical, authoritarian, and non-communicative work culture plays a major role in triggering mental fatigue. Crew members feel compelled to follow work orders regardless of their physical condition due to fear of being perceived as incapable or undisciplined. Cultural

differences among crew members also create potential miscommunications, increasing psychological stress. Such a work culture causes crew members to frequently ignore signs of fatigue, which can lead to work errors due to unaddressed physical and mental limitations. Third, irregular work rhythms and rest periods that do not meet international standards are dominant causes of severe fatigue. Crew members often experience fragmented rest, preventing optimal physical recovery. Disrupted sleep, excessive workload, and the demand to remain on standby even during off-duty periods result in sleep debt, triggering microsleep during watch duties. This poses a serious threat to ship operational safety and underscores the importance of proper work-hour management and rest scheduling.

REFERENCES

- Adam Farhandika, G., & Modjo, R. (2025). Kelelahan Kerja di Kalangan Awak Kapal: Systematic Literature Review. *Jurnal Ilmiah Kedokteran Dan Kesehatan*, 4(3), 95–100. <https://doi.org/10.55606/klinik.v4i3.4336>
- Adela. (2019). *Analysis of the Implementation of MLC 2006 on Seafarers' Working Hours*. Jakarta: University of Indonesia.
- Agustin, D., & Sariah, A. (2018). *Occupational Health and Safety (OHS)*. Bandung: Alfabeta.
- Anwar Prabu Mangkunegara. (2016). *Work Performance*. Jakarta: Bumi Cipta.
- Asanka Rajapakse, Gholam Reza Emad, (2023) Fatigue, an unsolved puzzle that continues contributing to accidents at sea, *Marine Policy*, Volume 155, 105745, ISSN 0308-597X, <https://doi.org/10.1016/j.marpol.2023.105745>.
- Bahri, S. (2018). *Work Environment Management to Improve Productivity*. Yogyakarta: Graha Ilmu.
- Batti, Pieter. (2013). *Fundamentals of Maritime Safety Regulations and Pollution Prevention from Ships According to IMO Requirements*. Jakarta: PT Indo Asia.
- Baumler, R., Bathia, R., & Kitada, M. (2021). *Fatigue at Sea and STCW Amendments*. *Ocean Journal of Maritime Studies*.
- Cahya, A. J. (2022). ANALISIS PENERAPAN MARITIME LABOUR CONVENTION (MLC) 2006 JUDUL 3 TENTANG AKOMODASI, FASILITAS REKREASI, MAKANAN DAN KATERING DI KM. CAMARA NUSANTARA 3. *JPB : Jurnal Patria Bahari*, 2(1). <https://doi.org/10.54017/jpb.v2i1.48>
- Cecilia Österman, Carl Hult, Gesa Praetorius, (2020) Occupational safety and health for service crew on passenger ships, *Safety Science*, Volume 121, Pages 403-413, ISSN 0925-7535, <https://doi.org/10.1016/j.ssci.2019.09.024>.
- D. Okumus, S. Fariya, S. Tamer, S.A. Gunbeyaz, G. Yildiz, R.E. Kurt, B. Barlas, (2023), The impact of fatigue on shipyard welding workers' occupational health and safety and performance, *Ocean Engineering*, Volume 285, Part 1, 115296, ISSN 0029-8018, <https://doi.org/10.1016/j.oceaneng.2023.115296>.
- Dendy Novandi, Cletrisovi, C., Nawfa Kayla Kautsarani, & Nia Nahdiyah Septiani. (2025). Pengaruh Kelelahan Kerja, Kepuasan Kerja, dan Work Life Balance terhadap Kinerja

- Karyawan Perusahaan Alat Tulis. MAMEN: Jurnal Manajemen, 4(3), 473–485. <https://doi.org/10.55123/mamen.v4i3.5977>
- Febrianti, N., Yassierli, Y., & Mahachandra, M. (2016). *Fatigue Risk Analysis on Ship Crew*. Journal of Industrial Engineering, 18(2), 45–52. DOI : <https://doi.org/10.26593/jrsi.v5i2.2213.118-127>
- Ferdi Firmansyah, Am Maisarah Disrinama, & Farizi Rachman. (2025). Pengaruh Lingkungan Kerja terhadap Kelelahan Kerja, Tingkat Konsentrasi, dan Kualitas Tidur. Jurnal Ilmiah Kedokteran Dan Kesehatan, 4(3), 443–455. <https://doi.org/10.55606/klinik.v4i3.4772>
- Gaghiwu, L., Josephus, J., & Rompas, R. M. (2018). *Analysis of Work Fatigue Factors Among Dock Workers at Bitung Port*. Journal of Occupational Health, 5(2), 112–119.
- Gunawan, Imam. (2013). *Qualitative Research Methods: Theory and Practice*. Jakarta: PT Bumi Aksara.
- Guzman, J., Martinez, A., & Santos, R. (2021). *Crew Fatigue Risk Management on Ocean-Going Vessels*. Maritime Policy & Management, 48(6), 789–805.
- Hartanto, F. M. (2019). *Organizational Culture and Leadership*. Jakarta: Gramedia.
- Hasibuan, M. S. P. (2017). *Human Resource Management*. Jakarta: Bumi Aksara.
- International Labour Organization. (2006). *Maritime Labour Convention (MLC) 2006*. Geneva: ILO.
- International Maritime Organization. (2001). *Guidelines on Fatigue*. London: IMO.
- International Maritime Organization. (2010). *ISM Code and Guidelines on Implementation*. London: IMO.
- International Maritime Organization. (2010). *Standards of Training, Certification and Watch-keeping for Seafarers (STCW) Including 2010 Manila Amendments*. London: IMO Publishing.
- Japian, J., Karisoh, J., & Karamoy, H. (2021). *Workers' Rights in International Labour Conventions*. Manado: Sam Ratulangi University.
- Jepsen, J. R., Zhao, Z., & van Leeuwen, W. M. (2015). Seafarer fatigue: a review of risk factors, consequences for seafarers' health and safety and options for mitigation. International Maritime Health, 66(2), 106–117. <https://doi.org/10.5603/IMH.2015.0024>
- Kim, S.-J., Jeon, T.-Y., & Lee, Y.-C. (2024). Impact of Ship Noise on Seafarers' Sleep Disturbances and Daily Activities: An Analysis of Fatigue Increase and Maritime Accident Risk through a Survey. Applied Sciences, 14(9), 3757. <https://doi.org/10.3390/app14093757>
- Lloyd's Register. (2013). *Fatigue Risk Management for Seafarers: A Practical Guide*.
- Ma M and Liao R (2025) Factors affecting seafarers' fatigue: a scoping review. Front. Public Health. 13:1647685. doi: <https://doi.org/10.3389/fpubh.2025.1647685>
- Mangkunegara, A. A. P. (2015). *Corporate Human Resource Management*. Bandung: Remaja Rosdakarya.
- Manuputty, M. (2018). PENGARUH LINGKUNGAN KERJA DAN PERILAKU PENGGUNAAN ALAT PELINDUNG DIRI TERHADAP KESEHATAN AWAK

KAPAL IKAN TIPE POLE AND LINE. ALE Proceeding, 1, 50-56.
<https://doi.org/10.30598/ale.1.2018.50-56>

- Mathis, R. L., & Jackson, J. H. (2020). *Human Resource Management (14th ed.)*. Boston: Cengage Learning.
- Miles, M. B., & Huberman, A. M. (2004). *Qualitative Data Analysis: An Expanded Sourcebook*. California: SAGE Publications.
- Mudiyanto. (2021). The role of the ISM Code as Supporting Shipping Safety on Ships on Shipping Companies in Surabaya. JURNAL APLIKASI PELAYARAN DAN KEPELABUHANAN, 9(1). <https://doi.org/10.30649/japk.v9i1.37>
- Munie, S. (2015). *Factors Affecting Workers' Performance*. Jakarta: Graha Ilmu.
- Munie, S. (2015). *Performance Management and Leadership*. Jakarta: Ghalia Indonesia.
- Nasution, S. (2003). *Naturalistic Qualitative Research Methods*. Bandung: Tarsito.
- Nazir, M. (2011). *Research Methods*. Jakarta: Ghalia Indonesia.
- Papendang, R. Z. ., Maddusa, S. S., & Kalesaran, A. F. C. (2023). HUBUNGAN ANTARA KELELAHAN KERJA DENGAN KECELAKAAN KERJA PADA NELAYAN DI KELURAHAN BAHU LINGKUNGAN 1 KOTA MANADO. PREPOTIF : JURNAL KESEHATAN MASYARAKAT, 6(3), 2383–2388. <https://doi.org/10.31004/prepotif.v6i3.7624>
- Puspitawati, I. (2019). *Implementation of SOLAS 1974 in Ship Accident Mitigation*. Semarang: UNDIP Press.
- Raihan, A. Z., Hardiyono, H., & Setyawati, N. F. (2025). HUBUNGAN BEBAN KERJA TERHADAP KELELAHAN KERJA PADA KRU KAPAL PELAYARAN AGUNG SAMUDRA BALIKPAPAN. IDENTIFIKASI, 11(1), 92–98. <https://doi.org/10.36277/identifikasi.v11i1.419>
- Raphael Baumler, Bikram Singh Bhatia, Momoko Kitada, (2021), Ship first: Seafarers' adjustment of records on work and rest hours, Marine Policy, Volume 130, 104186, ISSN 0308-597X, <https://doi.org/10.1016/j.marpol.2020.104186>.
- Robbins, S. P., & Judge, T. A. (2019). *Organizational Behavior (17th ed.)*. London: Pearson.
- Sedarmayanti. (2017). *Human Resource Management and Work Productivity*. Bandung: Mandar Maju.
- Sugiyono. (2017). *Quantitative, Qualitative, and R&D Research Methods*. Bandung: Alfabeta.
- Suma'mur, P. K. (2019). *Corporate Hygiene and Occupational Health (Hiperkes)*. Jakarta: Sagung Seto.
- Tetemadze B., Carrera Arce M., Baumler R., Bartusevičiene I. (2021): Seafarers' Wellbeing or Business, a Complex Paradox of the Industry. TransNav, the International Journal on Marine Navigation and Safety of Sea Transportation, Vol. 15, No. 4, pp. 817-824 doi: <http://dx.doi.org/10.12716/1001.15.04.14>
- Usman, H., & Akbar, D. (2000). *Social Research Methodology*. Jakarta: Bumi Aksara.
- Wahyudin, D. (2006). *Work Environment and Productivity*. Bandung: Refika Aditama.
- Widarbowo, D. (2020). Analisis pemanfaatan waktu istirahat terhadap kelelahan (fatigue) pada awak kapal. Jurnal Venus, 8(1), 90-103. DOI: <https://doi.org/10.48192/vns.v8i1.276>

- Womack, J. P., & Jones, D. T. (2003). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Free Press.
- Zahlquist L, Hetland J, Skogstad A, Bakker AB and Einarsen SV (2019) Job Demands as Risk Factors of Exposure to Bullying at Work: The Moderating Role of Team-Level Conflict Management Climate. *Front. Psychol.* 10:2017. doi: <https://doi.org/10.3389/fpsyg.2019.02017>