**Indonesian Journal of Global Health Research**
Volume 8 Number 3, June 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

# THE INDUSTRIAL SECTOR USING THE HEART METHOD

**Hasanuddin[1], Husaini[2], Erida Wydiamala[3], Lenie Marlinae[2], Silvia Kristanti Tri Febriana[4]**
[1]Student Master of Public Health, Departement of Public Health, Faculty of Medicine and Health Sciences, Universitas Lambung Mangkurat, Banjarbaru, Jl. A. Yani No.160, Loktabat Selatan, Banjarbaru Selatan, Banjar Baru, Kalimantan Selatan 70714, Indonesia
[2]Departement of Public Health, Faculty of Medicine and Health Sciences, Universitas Lambung Mangkurat, Banjarbaru, Jl. A. Yani No.160, Loktabat Selatan, Banjarbaru Selatan, Banjar Baru, Kalimantan Selatan 70714, Indonesia
[3]Departement of Parasitology, Faculty of Medicine and Health Sciences, Universitas Lambung Mangkurat, Banjarbaru, Jl. A. Yani No.160, Loktabat Selatan, Banjarbaru Selatan, Banjar Baru, Kalimantan Selatan 70714, Indonesia
[4]Departement of Psychology, Faculty of Medicine and Health Sciences, Universitas Lambung Mangkurat, Banjarbaru, Jl. A. Yani No.160, Loktabat Selatan, Banjarbaru Selatan, Banjar Baru, Kalimantan Selatan 70714, Indonesia
*hasan.bkg@gmail.com

**ABSTRACT**
Occupational Health and Safety (OHS) is a fundamental aspect of the industrial world, playing a crucial role in protecting workers and ensuring operational continuity. Various reports indicate that the majority of workplace accidents in industrial sectors, such as mining, construction, and manufacturing, are still dominated by human error. Therefore, a comprehensive evaluation of the probability of human error is necessary to reduce the number of workplace accidents and improve safety performance. Objective to analyze and integrate research findings related to the implementation of the Systematic Human Error Reduction and Prediction Approach (SHERPA) and Human Error Assessment and Reduction Technique (HEART) methods in identifying, measuring, and reducing the risk of human error in various industrial sectors. This study is a systematic literature review compiled according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Articles were searched through Google Scholar and PubMed databases using the keywords "Human Error," "Occupational Health and Safety (OHS)," "HEART," "Human Reliability Analysis," and "occupational accident." Inclusion criteria included articles published between 2021 and 2025, with full text, and discussing human error analysis using the HEART method in the industrial sector. Of the 313 identified articles, nine met the criteria and were analyzed qualitatively. The HEART method produced varying Human Error Probability values, with the highest values for manual work in underground mining (0.89), manual valve operation in oil tank facilities (0.95), and cutting machine operation in the furniture industry (0.888). The dominant factors triggering errors included work fatigue, unclear instructions, time pressure, and lack of training. The HEART method is effective in providing a quantitative and holistic picture of human error risk.

Keywords: human error; lack of training; time pressure; unclear instructionsand; work fatigue

**How to cite (in APA style)**
Hasanuddin, H., Husaini, H., Wydiamala, E., Marlinae, L., & Febriana, S. K. T. (2026). Literature Review: Analysis of Potential Human Error Factors in the Industrial Sector Using the Heart Method. Indonesian Journal of Global Health Research, 8(3), 393–400. https://doi.org/10.37287/ijghr.v8i3.1361.

## INTRODUCTION

Occupational Safety and Health (OHS) is a crucial component in the industrial sector, playing a vital role in protecting workers, maintaining operational sustainability, and increasing organizational productivity. OHS serves as a primary instrument in creating a safe and healthy work environment to ensure the physical and mental safety of workers during work activities. The basic philosophy of OHS emphasizes worker protection by controlling all potential hazards in the work environment (Adiratna et al., 2022). The availability of adequate occupational safety facilities and support systems is directly proportional to the reduced risk of workplace accidents. A workplace accident is defined as an unexpected and undesirable event that can result in injury, equipment damage, material loss, or even loss of life (Gelisar & Sari, 2024). In line with the development of modern industry, companies' focus is no longer limited to achieving productivity alone, but also on operational efficiency based on ensuring the safety of every individual involved in the work process (Kasnawati et al., 2024).

The rapid development of automation systems and industrial technology has not necessarily eliminated the role of humans in the production process. The interaction between humans and machines remains an integral element. Although various risk control efforts have been implemented through engineering and safety policies, the number of workplace accidents in the industrial sector remains relatively high. Various studies have shown that workplace incidents are not solely caused by equipment failure or environmental conditions, but are also significantly influenced by human error.

Human involvement is often the weakest point in work reliability systems. Human error has been recorded as a significant contributor to workplace accidents in various industrial sectors (R. Cahyani & Susilawati, 2024). Statistically, approximately 70–80% of workplace accidents are reportedly triggered by human error. This situation demonstrates that even the application of advanced technology cannot guarantee optimal workplace safety if human behavior and reliability are not properly managed (S. N. Cahyani et al., 2022). Human error is defined as a human action or decision that deviates from established work procedures or standards, potentially leading to accidents or losses. Factors such as work fatigue, time pressure, excessive workload, lack of training, and unclear work instructions are key triggers for human error. In high-risk industrial sectors such as mining, manufacturing, and oil and gas, even small errors in equipment operation or decision-making can seriously impact worker safety and result in significant material losses (Zetli, 2021).

Conventional risk analysis approaches generally focus on technical aspects, thus failing to fully capture the contribution of human factors to workplace accidents. Therefore, an analysis method specifically designed to systematically identify and quantify the probability of human error is needed. One method widely used in human reliability analysis is the Human Error Assessment and Reduction Technique (HEART). This method allows for a quantitative assessment of Human Error Probability (HEP) by considering various Error Producing Conditions (EPCs) relevant to work activities (Sullyartha et al., 2023).

Analyzing potential human error factors using the HEART method is expected to provide a comprehensive overview of the sources of occupational safety risks. The results of this analysis serve as an important basis for formulating more effective occupational accident control and prevention strategies through strengthening standard operating procedures, improving workforce competency, and developing a sustainable OHS culture in the industrial sector. The purpose of this study is to analyze and integrate research findings related to the implementation of the Systematic Human Error Reduction and Prediction Approach (SHERPA) and Human Error Assessment and Reduction Technique (HEART) methods in identifying, measuring, and reducing the risk of human error in various industrial sectors.

## METHOD

The design used in this study is a literature review. This literature study uses the SPIDER model, which includes the Sample (S) category, which consists of adolescents with overweight or obesity; the Phenomenon of Interest (PI) category, which includes the use of digital media and technology, such as smartphone-based applications, social media (Instagram), and digital educational media (e-booklets and flipbooks) as tools for health promotion and nutrition education; the Design (D) category, which is a pretest-posttest control group design; the Evaluation (E) category, which is knowledge, attitudes, and behavioral changes (eating patterns, breakfast habits, and fast food consumption habits); and the Research type (R) category, which is qualitative and quantitative research conducted between 2021 and 2025. The keywords used are "Human Error," "K3," "HEART," "Human Reliability Analysis," and "Workplace Accidents." The selected articles meet the inclusion criteria: journal publication time within the last 5 years (2021–2025), research subjects are workers, and open access articles. Search for research articles published on the internet through

open access channels, namely Google Scholar. Of the 313 identified articles, nine met the criteria from keywords and were analyzed qualitatively. The following is an overview of the literature search results:

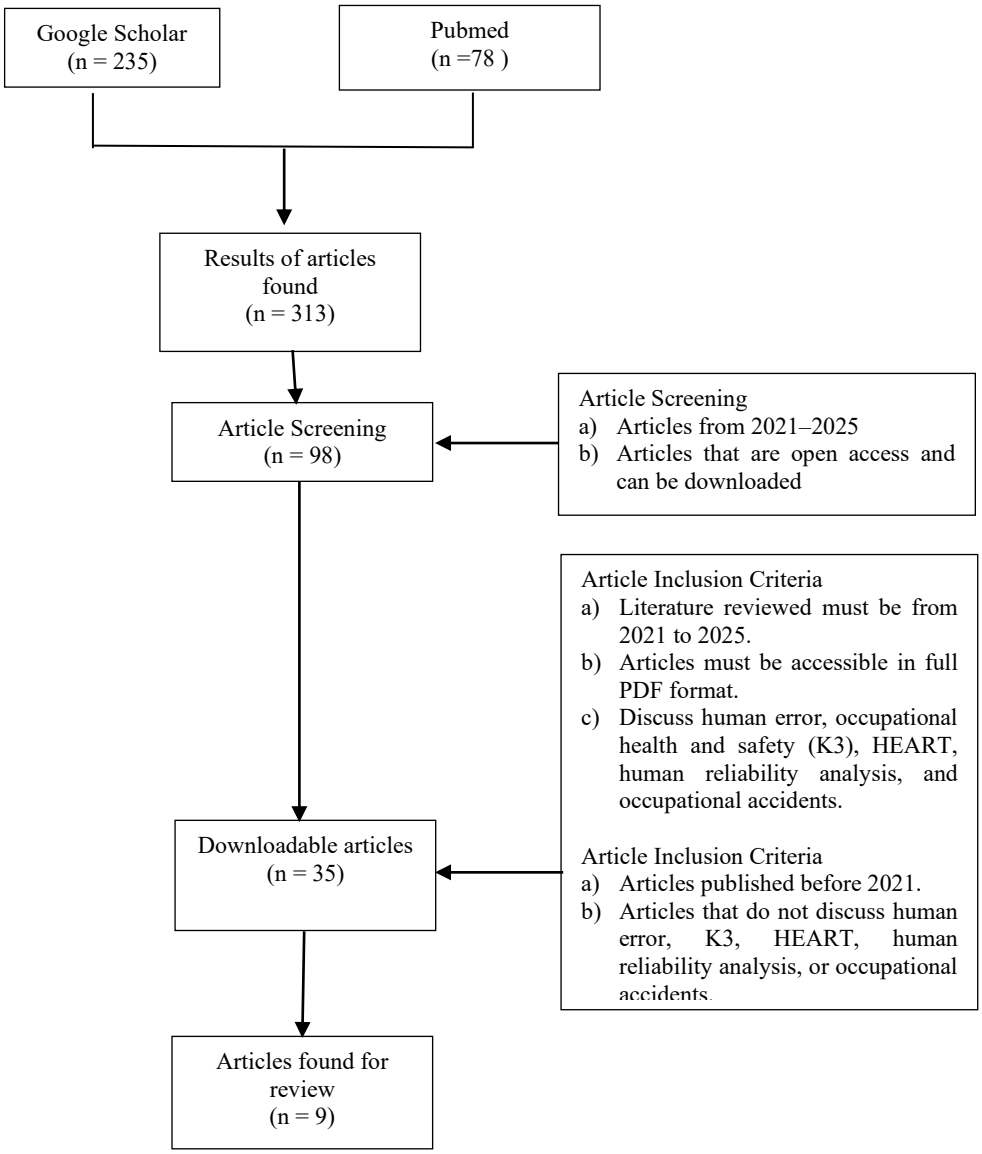


Figure 1: Literature search results

## RESULT

Table 1.
Characteristics of the Analyzed Articles

| Author Name | Title | Research result | Findings | Implications |
|---|---|---|---|---|
| Alfarabi et al., (2024) | Risk Management Optimization in Mineral Processing: Evaluation of Human Error Probability with SHERPA and HEART Methods at PT. Bumi Mineral Sulawesi. | Risk identification in the conveyor area shows that Checking Error is the most dominant type of error (codes C5 and C2). The highest HEP values were found in operators in the control room (0.256) and coal conveyor operators (0.544). | The main errors occurred due to lack of concentration due to inaccurate instructions and fatigue, which has the potential to stop the entire production process. | The company needs to conduct routine inspections and special periodic training for each operator to reduce the number of operational errors. |
| Putra & Wahyuningsih, (2024) | Human Reliability using the Fuzzy-HEART Method in Underground Mining | Research on ground support, drilling, mucking, and hauling activities shows that manual | Human error contributes to 85% of accidents in the mine. The most | The need for a transition from manual to mechanical work |

| Author Name | Title | Research result | Findings | Implications |
|---|---|---|---|---|
| | Material Handling Work. | handling methods have a lower human reliability value (HEP 0.89) compared to mechanical handling (HEP 0.61). | critical activities are moving the boom truck and drilling with very high HEP values (above 0.4). | and tightening supervision during critical hours to reduce the potential for fatal accidents. |
| S. N. Cahyani et al., (2022) | Human Error Analysis to Minimize Workplace Accidents Using the HEART and SHERPA Methods at PT. Wonojati Wijoyo. | 22 potential errors were found from 12 sub-tasks. The highest HEP value (0.888) occurred in the activity of cutting wood slabs using a circle machine. | The main causes are repetitive cycling factors and low quality of information/work instructions that cause workers to rush. | Recommendations include providing sufficient rest hours to maintain focus and updating SOPs that are easier for field workers to understand. |
| A. D. R. Putra et al., (2024) | Human Reliability Assessment using the HEART Method in Lifting and Rigging Work in a Construction Company. | Analysis of the lifting work shows a high HEP value in the lifting equipment installation sub-task (0.931). | Accidents occur because workers often ignore the lifting plan and there is a lack of communication between the rigger and the crane operator. | Emphasis is placed on mandatory competency certification for lifting personnel and strict supervision of the use of PPE and communication equipment. |
| Febriansyah et al., (2025) | Human Error Analysis of Oil Transfer Activities at the Department of Tank Farm Specialty Fats Using the HEART Method at PT. X. | In the oil transfer process, errors in opening/closing manual valves have the highest HEP value of 0.950. | The biggest triggering factors are time pressure and noisy environmental conditions that disrupt coordination between operators. | The need for an automation system on the valve or improvement of a more reliable two-way communication system to minimize fatal errors (oil spills). |
| Fadlurrohman, (2024) | Implementation of the HEART Method for Human Error Analysis in Dump Truck Operators at a Mining Services Company. | The highest HEP value was found in hauling activities with a score of 0.432, especially when maneuvering in narrow areas. | Fatigue and forgetting to lower the vessel (truck bed) were the main causes of dangerous incidents (near misses). | Companies are advised to implement a fatigue management system and conduct a brief health check (fit to work) before operators start their shifts. |
| Ma'aarij & Nugraha, (2022) | Human Error Analysis to Minimize Workplace Accidents Using the SHERPA and HEART Methods (Case Study: CV Sarana Sejahtera Tehnik). | The highest HEP value was 0.594 in the task of using a hammer. | The main cause of accidents is workers who are not focused and do not use complete PPE when performing basic mechanical work. | Even though the company is small in scale, providing standard OHS facilities and hazard education remains an absolute obligation to prevent hand injuries. |
| Rosyidah, (2023) | Human Error Analysis of Head Truck Operators at a Manpower Services Company using the HEART Method. | Eight potential errors were identified with a high HEP category. Errors in brake checks and trailer locking were the most critical points. | Many operators neglected unit checks at the start of the shift due to the delivery deadline. | Regular refresher training and the implementation of a reward and punishment system related to compliance with vehicle inspection SOPs are needed |
| Aliabadi et al., | Human Error | This study uses a hybrid | Expert assessments | The development of |

| Author Name | Title | Research result | Findings | Implications |
|---|---|---|---|---|
| (2022) | Probability Determination in Blasting Process of Ore Mine Using a Hybrid of HEART and Best-Worst Methods. | method to improve the accuracy of HEART. Detonator installation activities have a significant probability of error. | indicate that environmental conditions (temperature and lighting) greatly affect the accuracy of blasting operators. | a decision support system and strict standardization of blasting operations are essential to prevent fatal premature explosions. |

## DISCUSSION

Human error is a dominant factor contributing to workplace accidents, operational disruptions, and decreased productivity in various industrial sectors (Rahma & Tranggono, 2025). Human error is defined as an individual's actions or decisions that deviate from established procedures or standards, potentially leading to safety risks, material losses, or environmental impacts (Maulidya et al., 2023). Despite continuous technological advancements, the role of humans in industrial work systems remains irreplaceable, thus the potential for human error remains a major challenge in the implementation of Occupational Safety and Health (OHS) (R. Cahyani & Susilawati, 2024).

Meanwhile, in the energy and mining industries, human error is often associated with failure to adhere to safety procedures, errors in controlling heavy equipment, and inappropriate decision-making in high-risk situations (Nazeer Ahamed & Mariappan, 2023). The complexity of technology, extreme working conditions, and the potential for significant hazards make human error a critical factor that can trigger major accidents and industrial disasters (S. N. Cahyani et al., 2022). Overall, human error in various industrial sectors cannot be viewed solely as an individual failure, but rather as the result of interactions between humans, work systems, the environment, and the organization (Ren et al., 2024). Therefore, efforts to prevent human error need to be implemented comprehensively through improving safety culture, worker training and competency, improving work system design, and strengthening supervision and risk management (Naji et al., 2021). This systemic approach is expected to reduce the number of workplace accidents and improve safety performance across all industrial sectors (Zetli, 2021).

The Occupational Safety and Health (OHS) approach positions humans as an integral part of the work system, interacting with equipment, the environment, and the organization. In the context of human error, OHS focuses not only on individual errors but also emphasizes risk prevention through hazard identification, risk assessment, and systematic control. This approach aligns with the principles of safety management systems, which emphasize continuous improvement and a safety culture as key factors in reducing the number of workplace accidents due to human error (Sullyartha et al., 2023).

In practice, the OHS approach utilizes various risk analysis methods, one of which is Human Reliability Analysis (HRA). The HRA method is used to assess the likelihood of human error and its impact on the work system. Two HRA methods frequently used in high-risk industrial contexts are HEART (Human Error Assessment and Reduction Technique) and SHERPA (Systematic Human Error Reduction and Prediction Approach) (Alfarabi et al., 2024).

The HEART method focuses on quantifying the probability of human error (HEP) based on the type of task being performed. HEART classifies work activities into Generic Task Types (GTT), then identifies Error-Producing Conditions (EPCs) that can increase the likelihood of errors, such as time pressure, fatigue, inexperience, or poor interface design. In occupational health and safety (OHS) discussions, HEART is particularly useful for identifying critical tasks with a high risk of human error, allowing for the design of controls in the form of training, improved work procedures, or modifications to the work environment (O. A. Putra & Wahyuningsih, 2024).

Meanwhile, the SHERPA method is qualitative and focuses on predicting the types of errors that may occur at each stage of the work process. SHERPA begins with a Hierarchical Task Analysis (HTA) to map work steps in detail, then identifies potential errors based on action categories, such as action errors, checking errors, communication errors, and selection errors. Within the OHS approach, SHERPA plays a crucial role in evaluating the suitability of work procedures and supporting the design of safer work systems (Febriansyah et al., 2025).

The integration of the HEART and SHERPA methods within the OHS approach provides a more comprehensive overview of human error risk (Rammadaniya & Mahbubah, 2022). HEART provides a quantitative estimate of the likelihood of errors, while SHERPA provides a deeper understanding of the types and mechanisms of errors that can occur. The combination of these two methods enables organizations not only to identify risk levels but also to formulate more targeted prevention strategies.

Overall, the implementation of an OHS approach supported by the HEART and SHERPA methods has proven effective in controlling the risk of human error across various industrial sectors (Puspitasari et al., 2025). This approach emphasizes that reducing human error requires a systemic strategy encompassing human, technological, and organizational aspects. Therefore, efforts to improve occupational safety depend not only on individual compliance but also on the design of safe, prevention-oriented work systems.

Based on a comprehensive analysis of nine reviewed literatures, the Human Error Assessment and Reduction Technique (HEART) method consistently demonstrates its ability to measure risk levels across various industrial sectors, from mining and manufacturing to construction and logistics transportation (La Fata et al., 2023). In general, the findings indicate that the probability of human error (HEP) tends to increase significantly in tasks characterized by manual, complex, and high-risk characteristics (A. D. R. Putra et al., 2024a).

Synthesis of data from all journals revealed that the highest HEP values are often found in activities involving direct human interaction with critical equipment without automated control systems. For example, in the oil processing and construction industries, HEP values reached above 0.90, theoretically indicating that errors are almost certain to occur if triggering factors are not promptly controlled. This is heavily influenced by poor work environment conditions, also known as Error Producing Conditions (EPC). The most dominant EPC factors appearing throughout the literature are time pressure, worker fatigue, and poor quality work instructions (Permatasari, 2020).

In the transportation and heavy equipment operations sector, HEART revealed that repetitive tasks combined with workers' poor physical condition were the primary triggers for incidents. Meanwhile, a comparison of manual and mechanical work in the mining sector demonstrated that mechanization can drastically reduce the HEP value, confirming that reliance on human physical and mental abilities alone has a very fragile reliability limit. Overall, the use of the HEART method throughout this paper provides a strong quantitative basis for companies to determine risk mitigation priorities, where activities with HEP values close to 1 should be the primary focus for procedural improvements, increased training, and technological updates.

## CONCLUSION

Literature analysis indicates that the HEART method produces varying Human Error Probability values, with the highest values for manual work in underground mining (0.89), manual valve operation in oil tank facilities (0.95), and cutting machine operation in the furniture industry (0.888). The dominant factors triggering errors include work fatigue, unclear instructions, time pressure, and lack of training. Based on these results, the HEART method is effective in providing a quantitative and holistic picture of human error risk.

## REFERENCES


Adiratna, Y., Astono, S., Fertiaz, M., Subhan, Sugistria, C. A. O., Prayitno, H., Khair, R. I., Brando, A., & Putri, B. A. (2022). *The Indonesian National Occupational Safety and Health Profile in 2022* (S. Astono (ed.)). Kementerian Ketenagakerjaan Republik Indonesia. https://satudata.kemnaker.go.id/satudata-public/2022/10/files/publikasi/1675661836215_The%2520Indonesian%2520OSH%2520Profile%25202022_Compiled%252020230124_compressed.pdf

Alfarabi, M., Alisyahbana, T., Wahyuni, A. D., Fole, A., & Safutra, N. I. (2024). Optimasi Manajemen Risiko dalam Pengolahan Mineral: Evaluasi Probabilitas Human Error dengan Metode SHERPA dan HEART di PT. Bumi Mineral Sulawesi. *Scientica Jurnal Ilmiah Sain Dan Teknologi*, *3*(1), 181–193. https://jurnal.kolibi.org/index.php/scientica/article/view/3513

Aliabadi, M. M., Mohammadfam, I., Soltanian, A. R., & Najafi, K. (2022). Human Error Probability Determination in Blasting Process of Ore Mine Using a Hybrid of HEART and Best-Worst Methods. *Saf Health Work*, *13*(3), 326–335. https://doi.org/10.1016/j.shaw.2022.03.010

Cahyani, R., & Susilawati, S. (2024). Analisis Faktor Human Error Terhadap Kejadian Kecelakaan Kerja Pada Pekerja Konstruksi. *Gudang Jurnal Multidisiplin Ilmu*, *2*(7), 10–14. https://doi.org/https://doi.org/10.59435/gjmi.v2i7.669

Cahyani, S. N., Safirin, M. T., Donoriyanto, D. S., & Rahmawati, N. (2022). Human Error Analysis to Minimize Work Accidents Using the HEART and SHERPA Methods at PT. Wonojati Wijoyo. *Prozima*, *6*(1), 48–59. https://doi.org/http://doi.org/10.21070/prozima.v6i1.1569

Fadlurrohman, H. A. (2024). Implementation of the HEART Method for Human Error Analysis in Dump Truck Operators at a Mining Services Company. In *Repository Politeknik Perkapalan Negeri Surabaya*. http://repository.ppns.ac.id/6018/

Febriansyah, S., Silviana, N. A., Zulvatricia, R., & Banjarnahor, M. (2025). Analisa Human Error Terhadap Kegiatan Transfer Minyak Pada Department Tank Farm Speciality Fats Menggunakan Metode HEART di PT. X. *JOURNAL OF INDUSTRIAL AND MANUFACTURE ENGINEERING*, *9*(1). https://doi.org/10.31289/jime.v9i1.12999

Gelisar, R., & Sari, N. R. (2024). Penerapan Fasilitas Pendukung Kesehatan dan Keselamatan ( K3 ) Service dan Operation di Bandara Sultan Aji Muhammad Sulaiman Sepinggan pada Maskapai Garuda Indonesia. *JETBUS Journal of Education Transportation and Business*, *1*(2), 140–154. https://doi.org/https://doi.org/10.57235/jetbus.v1i2.3384

Kasnawati, K., Sampe, R., Kusdiah, Y., & Sriwati, M. (2024). Pengembangan Teknologi Mesin Otomatis Untuk Peningkatan Produktivitas Dalam Industri Manufaktur. *Jurnal Review Pendidikan Dan Pengajaran*, *7*(4), 15300–15306. https://doi.org/https://doi.org/10.31004/jrpp.v7i4.36459

La Fata, C. M., Adelfio, L., Micale, R., & La Scalia, G. (2023). Human error contribution to accidents in the manufacturing sector: A structured approach to evaluate the interdependence among performance shaping factors. *Safety Science*, *161*, 106067. https://doi.org/https://doi.org/10.1016/j.ssci.2023.106067

Ma'aarij, M. R. Al, & Nugraha, A. E. (2022). Analisis Human Error Guna Meminimalkan Kecelakaan Kerja Dengan Menggunakan Metode SHERPA dan HEART Studi Kasus: CV Sarana Sejahtera Tehnik. *Jurnal Ilmiah Wahana Pendidikan*, *8*(5), 99–104. https://doi.org/https://doi.org/10.5281/zenodo.6408870

Maulidya, A., Oginawati, K., & Suharyanto, S. (2023). Analysis of Human Error Potential as a Cause of Work Accident using Sherpa and Heart Method in The Cement Industry. *Journal of World Science*, *2*(9), 1387–1397. https://doi.org/https://doi.org/10.58344/jws.v2i9.408

Naji, G. M. A., Isha, A. S. N., Mohyaldinn, M. E., Leka, S., Saleem, M. S., Rahman, S. M. N. B. S. A., & Alzoraiki, M. (2021). Impact of Safety Culture on Safety Performance; Mediating Role of Psychosocial Hazard: An Integrated Modelling Approach. *International Journal of Environmental Research and Public Health*, *18*(16). https://doi.org/10.3390/ijerph18168568

Nazeer Ahamed, M. F., & Mariappan, M. (2023). A study to determine human-related errors at the

level of top management, safety supervisors & workers during the implementation of safety practices in the construction industry. *Safety Science*, *162*, 106081. https://doi.org/https://doi.org/10.1016/j.ssci.2023.106081

Permatasari, W. (2020). Factors Related To Work Fatigue: Literature Review. *Ealth Safety Environment Journal*, *1*(1). https://ejournal.upnvj.ac.id/HSE/article/view/1994

Puspitasari, A., Safitri, G., Efionita, Y., & Halim, M. I. (2025). Human error analysis to reduce production defects with Sherpa method and Heart method in PT XYZ. *Journal of Sustainable Community Development*, *3*(3), 120–128. https://doi.org/https://doi.org/10.60036/yxdr8458

Putra, A. D. R., Amrullah, H. N., & Handoko, L. (2024a). Human Reliability Assessment dengan Metode HEART Pada Pekerjaan Lifting dan Rigging di Perusahaan Konstruksi. *8th CONFERENCE ON SAFETY ENGINEERING AND ITS APPLICATION*, *2581*.

Putra, A. D. R., Amrullah, H. N., & Handoko, L. (2024b). Human Reliability Assessment dengan Metode HEART Pada Pekerjaan Lifting dan Rigging di Perusahaan Konstruksi. *8 Th CONFERENCE ON SAFETY ENGINEERING AND ITS APPLICATION*. https://files01.core.ac.uk/download/pdf/642639292.pdf

Putra, O. A., & Wahyuningsih, A. S. (2024). Human Reliability menggunakan Metode Fuzzy-HEART pada Pekerjaan Material Handling Tambang Bawah Tanah. *Higiea*, *8*(2), 198–212. https://doi.org/https://doi.org/10.15294/higeia.v8i1.77854

Rahma, D. L., & Tranggono, T. (2025). Human Error Analysis to Reduce the Risk of Work Accidents at PT XYZ Using HEART and Fuzzy FMEA Methods. *Indonesian Interdisciplinary Journal of Sharia Economics (IIJSE)*, *8*(3), 11977–11988. https://doi.org/https://doi.org/10.31538/iijse.v8i3.7059

Rammadaniya, P., & Mahbubah, N. (2022). Integration of the HEART and SHERPA Approach to Evaluating Human Errors in the Refinery Salt Production. *Jurnal Sistem Teknik Industri*, *24*(2), 177–193. https://doi.org/https://doi.org/10.32734/jsti.v24i2.7755

Ren, X., Terwel, K. C., & van Gelder, P. H. A. J. M. (2024). Human and organizational factors influencing structural safety: A review. *Structural Safety*, *107*, 102407. https://doi.org/https://doi.org/10.1016/j.strusafe.2023.102407

Rosyidah, U. (2023). *Analisis Probabilitas Human Error Pada Operator Head Truck Dengan Metode Heart Dan Sherpa Di Perusahaan Jasa Tenaga KerjA* [Politeknik Perkapalan Negeri Surabaya]. http://repository.ppns.ac.id/5460/

Sullyartha, E. R., Santoso, P. N., & Sihombing, L. M. (2023). Penerapan Human Error Assessment and Reduction Technique (HEART) Pada Penentuan Human Error Probability Teknisi Maintenance Mesin 350F di PT. XYZ. *Jumantara Jurnal Manajemen Dan Teknologi Rekayasa*, *2*(2), 55. https://doi.org/10.28989/jumantara.v2i2.1683

Zetli, S. (2021). Analisis Human Error dengan Pendekatan Metode SHERPA dan HEART pada Produksi Batu Bata UKM Yasin. *Jurnal INTECH Teknik Industri Universitas Serang Raya*, *7*(2), 147–156. https://doi.org/https://doi.org/10.30656/intech.v7i2.3934**.**