
Analysis of the Correlation of MSDS Literacy and Occupational Safety Implementation on Incident Rate Reduction in the Plantation Industry

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ABSTRAK

Work accidents in the industrial sector are a problem that often occurs and has the potential to cause major losses, both in terms of worker safety and company productivity. One of the main factors contributing to the occurrence of accidents is low compliance with chemical handling protocols. In this context, understanding the Material Safety Data Sheet (MSDS) is very important because it serves as the main guide in the safe use, storage, and handling of chemicals.

This study aims to analyze the relationship between the level of understanding of MSDS, the effectiveness of implementing procedures in the field, and the number of work accidents. The method used was Pearson correlation analysis involving 40 observational samples. The data obtained showed that the average level of understanding of MSDS was 73.5 and the implementation of procedures in the field was 73.1.

The results of the study revealed a very strong negative correlation between the two variables and the number of work accidents, with a coefficient value of -0.938. This shows that the higher the level of understanding and compliance with the MSDS procedure, the lower the number of work accidents. Therefore, increasing education and supervision of the implementation of MSDS is an important step in creating a safer work environment.

Keywords: MSDS, Occupational Safety, Risk Management, Plantation Industry.

INTRODUCTION

Occupational Safety and Health (K3) is a major pillar in the sustainability of industrial operations, especially in sectors that involve the use of hazardous chemicals such as the plantation and processing industries. One of the vital instruments in chemical risk mitigation is the *Material Safety Data Sheet* (MSDS) [1]. However, the main challenge that often arises is the gap between the theoretical understanding of employees and practical implementation in the field [2].

The implementation of K3 in the industrial environment does not only depend on written policies, but also on a work culture that is formed consistently [3]. Many companies already have standard procedures in place regarding the use of chemicals, but these procedures are often not thoroughly understood by workers [4]. This causes the potential risk to remain high even if safety documents are available. MSDS is actually designed to provide detailed information about the properties of the material, hazards, as well as proper handling measures [5]. However, without adequate training, the document becomes just an administrative formality. Workers tend to ignore the content of the MSDS because it is considered too technical or difficult to understand [6]. Therefore, it is important for companies to simplify information without compromising the essence of safety [7]. Visual approaches such as symbols and diagrams can help improve understanding. In addition, regular training needs to be carried out so that workers are accustomed to accessing and using MSDS [8]. Active involvement of workers in safety discussions can also raise awareness. Thus, the gap between theory and practice can be minimized [9].

In addition to individual understanding, the supervisory factor also plays an important role in the implementation of K3 [10]. Field supervisors must be able to ensure that each procedure is carried out to standards. However,

in practice, supervision is often limited due to the number of supervisors that are not proportional to the number of workers [11]. This leads to many minor violations that are overlooked but have the potential to become big problems. MSDS should be the primary reference in any activity involving chemicals [12]. Without close supervision, workers may use the material without regard to the listed risks [13]. Therefore, there is a need for an effective and sustainable monitoring system. Digital technology can be used to facilitate supervision and reporting. For example, the use of applications to quickly access MSDS in the field. In addition, regular internal audits can also help identify weaknesses in implementation. With good supervision, the risk of accidents can be significantly reduced.

Another factor that affects the effectiveness of K3 is the level of literacy and educational background of workers [14]. In the plantation industry, workers often come from a variety of backgrounds with different levels of education [15]. This is a challenge in conveying technical information as contained in the MSDS. The language used in documents is often inconsistent with the understanding of workers in the field [16]. Therefore, there is a need for a simpler and more communicative language adaptation. Hands-on practice-based training can be a solution to improve understanding [17]. Simulated chemical handling can also help workers understand the risks in real life [18]. In addition, the use of audiovisual media can increase the absorption of information [19]. Companies can also appoint senior workers as mentors for new workers. This approach can create more effective knowledge transfer. Thus, the understanding of MSDS can be more evenly distributed across workers [20].

Work safety culture is also heavily influenced by management's commitment. If management does not show concern for K3, then workers tend to consider it unimportant

[21]. Conversely, if management is actively involved, then worker awareness will increase. MSDS should be part of the work culture, not just the documents that are stored. Management needs to ensure that every worker has easy access to MSDS [22]. Additionally, rewards for workers who adhere to safety procedures can be an added motivation. Open communication between management and workers is also important in creating a safe work environment [23]. Every incident should be used as a lesson, not just a punishment mistake. With this approach, employees will be more proactive in maintaining safety. Periodic evaluation of the implementation of K3 also needs to be carried out. This aims to ensure that all policies are effective. With a strong commitment, a culture of safety can be built sustainably.

Finally, the integration between theory and practice is the main key to the success of the implementation of K3. MSDS as an important instrument must be optimized for use in the field. This requires synergy between training, supervision, and work culture. Without proper integration, the risk of accidents will remain high even if procedures are in place. Companies need to develop a holistic strategy in managing work safety. Innovation in training and communication methods is also urgently needed. In addition, the involvement of all parties, from management to workers, must be increased. Continuous evaluation and improvement are an integral part of this process. With a systematic approach, the gap between theory and practice can be bridged. In the end, the main goal of K3 is to protect workers and maintain operational sustainability can be achieved optimally.

Preliminary data showed fluctuating variations in accident rates across different work units. This research is important to prove empirically the extent to which literacy regarding safety data sheets can significantly reduce the number of work accidents.

The fluctuating variation in the rate of work accidents indicates the existence of

factors that have not been optimally controlled in each work unit. Differences in work characteristics and work environment are one of the main causes of these inconsistencies. In addition, the level of compliance with safety procedures also varies between workers. In this context, literacy of safety data sheets is a very important aspect. The MSDS not only serves as a complementary document, but as the ultimate guide in handling hazardous materials. However, without a good understanding, the available information will not have a significant impact. Therefore, this study focuses on the relationship between literacy level and the rate of work accidents. Fluctuating initial data became the basis for conducting more in-depth analysis. An empirical approach is needed to ensure the validity of such relationships. The results of the study are expected to provide a clearer picture of the effectiveness of safety literacy. Thus, the strategy to improve K3 can be formulated in a more targeted manner.

This study also considers internal and external factors that affect the rate of work accidents. Internal factors include workers' knowledge, attitudes, and behaviors towards safety. Meanwhile, external factors include company policies, work environment, and supervisory systems. MSDS literacy is a bridge between these two factors in daily practice. If workers have a good understanding, then they can respond to risks more quickly and appropriately. On the other hand, low literacy can increase the potential for errors in handling chemicals. Therefore, it is important to measure the level of understanding of workers objectively. Survey methods and field observations can be used to obtain accurate data. Statistical analysis was then carried out to see the relationship between the variables studied. With this approach, the results of the study become more credible. It also allows companies to make data-driven decisions.

In addition, fluctuations in the rate of work accidents can be an indicator of inconsistencies in the implementation of K3. This shows that the safety program has not been

run evenly across all work units. MSDS literacy can be one of the key indicators in evaluating the effectiveness of the program. If there is a significant correlation, then improving literacy can be made a top priority. Structured and continuous training is one of the solutions that can be applied. Training materials must be adjusted to the conditions and needs of workers in the field. In addition, post-training evaluation is also important to measure the success of the program. The use of technology such as e-learning can increase access to safety materials. Thus, the dissemination of information becomes more even. This is expected to reduce the number of accidents gradually.

This research also has the potential to contribute to the development of K3 policies at the corporate and industrial levels. The empirical results obtained can be the basis for the preparation of more effective operational standards. In addition, this research can identify weaknesses in the system that is already running. By knowing these weak points, companies can make specific improvements. MSDS literacy not only impacts individuals, but also on overall team performance. Employees who understand the risks will be more cautious at work. This can reduce the

likelihood of accidents caused by negligence. In addition, a culture of safety can also be formed more strongly. This research is expected to be a reference for further studies in the field of K3. Thus, the development of science in this field can continue. The long-term impact is an overall improvement in occupational safety.

Ultimately, it's important to emphasize that safety literacy is not an instant process. It takes a long-term commitment from all parties to achieve optimal results. This research is the first step in understanding the relationship between literacy and work accidents. The data obtained will provide a real picture of the conditions in the field. With an empirical approach, the results obtained can be scientifically accounted for. This is the basis for formulating a more effective strategy. The company is expected to integrate research results into its K3 policy. In addition, workers also need to be actively involved in the process of increasing literacy. Collaboration between management and workers is the key to successful implementation. With continuous efforts, the number of work accidents can be significantly reduced. Ultimately, the ultimate goal of creating a safe and healthy work environment can be achieved.

METHODOLOGY

This study uses a quantitative approach by utilizing secondary data. The sample consisted of 40 observation points that included three main variables, namely MSDS comprehension score, work procedure implementation score, and frequency of work accidents. Both scores are measured in a range of 0 to 100 to describe the level of understanding and compliance of workers. Meanwhile, the frequency of accidents shows the number of incidents in a given period. This data is used to objectively see the pattern of relationships between variables. This approach allows the analysis to be carried out efficiently without direct data collection. The main focus

of the research is to examine the relationship between safety literacy and the risk of work accidents.

The analysis was carried out using a correlation matrix to measure the strength and direction of the relationship between variables. The correlation results indicate whether the relationship is positive, negative, or insignificant. If a negative correlation is found, then increased understanding and implementation of procedures tends to reduce the number of accidents. On the other hand, the weak correlation suggests the presence of other factors that need further investigation. This

method provides a systematic and data-driven initial picture. Thus, the results of the research

can be the basis for decision-making related to improving occupational safety.

RESULTS AND DISCUSSION

The results of the analysis showed that the level of employee understanding of MSDS was in the category of quite good, with an average score of 73.5. This figure reflects that in general, employees already have adequate basic knowledge regarding the use and importance of MSDS in the work environment. However, this average score does not show an optimal level of understanding, so there is still room for improvement through more intensive training and socialization programs.

A fairly wide range of scores, from 50 to 95, indicates a gap in understanding among employees. Some employees have demonstrated an excellent level of understanding, which means they are able to interpret and apply the information in the MSDS correctly. However, on the other hand, there are employees with a relatively low level of understanding, which has the potential to pose risks in the implementation of occupational safety procedures. This gap is an important concern for management to ensure equal knowledge across the workforce.

This variation in levels of understanding confirms that understanding is the main foundation in the implementation of effective occupational safety procedures. Without adequate understanding, employees tend to be unable to implement procedures correctly, which can ultimately increase the potential for

work accidents. Therefore, companies need to design continuous learning strategies, such as regular training, periodic evaluations, and the provision of easy-to-understand educational materials, in order to improve and harmonize the level of understanding of all employees.

In terms of implementation, the average implementation of MSDS procedures was recorded at 73.1, which shows that in general employees have carried out safety procedures quite well in the field. This value reflects the awareness of the importance of implementing MSDS in daily work activities. However, these achievements are still at a medium level, indicating that the implementation of procedures is not fully optimal and still needs improvement in order to achieve higher safety standards.

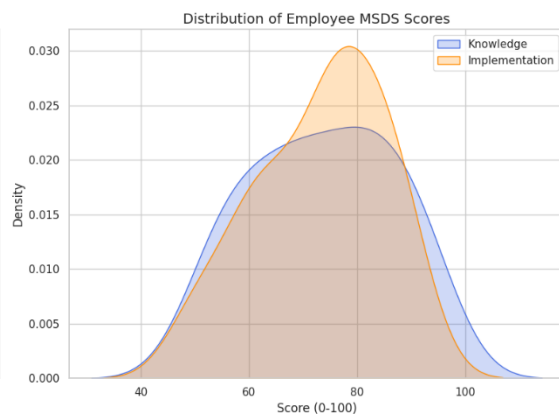
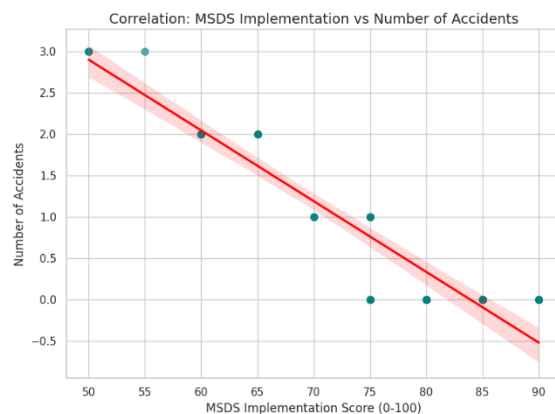
The relationship between understanding and implementation was very strong, with a positive correlation value of 0.908. This indicates that employees who have a better understanding of MSDS tend to be able to implement procedures more appropriately and consistently. On the other hand, limited understanding can have a direct impact on the lack of optimal implementation in the field. Thus, understanding not only plays a role as a cognitive aspect, but also has a real effect on work behavior and compliance with safety standards.

Table 1. Correlation Matrix

Variabel	Understanding	Implementation	Accidents
Understanding MSDS	1.000	0.908	-0.889
Implementation of MSDS	0.908	1.000	-0.938
Total Accidents	-0.889	-0.938	1.000

These findings confirm that improving the quality of training and education is a key factor in improving the implementation of MSDS procedures. A structured, ongoing, and easy-to-understand training program will help employees internalize important information related to occupational safety. In addition, there is a need for periodic evaluation and supervision in the field to ensure that the knowledge possessed is applied consistently. With this approach, it is hoped that the implementation of the MSDS procedure can be significantly improved and have a positive impact on overall occupational safety.

Furthermore, correlation analysis revealed a very strong negative relationship between the implementation of MSDS and the number of work accidents (-0.938), as well as between understanding and accidents (-0.889). These findings confirm that improving the quality of implementation of safety procedures significantly contributes to a decrease in the number of accidents. This means that investment in improving understanding and compliance with MSDS procedures not only has an impact on the administrative aspect, but also significantly improves work safety in the operational environment.



This graph provides an analytical overview of the effectiveness of occupational safety policies.

Left correlation shows a significant inverse relationship between MSDS implementation and the number of accidents. The red regression line makes it clear that improving implementation discipline effectively reduces the number of work incidents.

Right correlation Comparing the density of knowledge scores (*Knowledge*) and implementation (*Implementation*). It can be

seen that although employee knowledge is quite widespread, its implementation is more concentrated on certain values, indicating the existence of practice standards that are beginning to take shape in the field.

These results show that any improvement in the implementation aspect of the MSDS procedure will be followed by a drastic decrease in the number of accidents. The positive correlation between understanding and execution (\$0.908\$) also proves that good education is an absolute prerequisite for safe work behavior.

CONCLUSION

This study shows that literacy and compliance with MSDS procedures have a strong and linear relationship with the level of occupational safety. The value of the correlation coefficient of -0.938 indicates that the better the understanding and application of the procedure, the lower the rate of accidents that occur in the work environment. The factor of implementing procedures has proven to be the most dominant predictor in reducing the number of accidents. This emphasizes the importance of not only

understanding the content of the MSDS, but also ensuring that its implementation is carried out consistently and according to the standards that have been set. Therefore, companies are advised to continue to strengthen routine training programs and increase supervision of the use of personal protective equipment (PPE) and chemical handling. This effort is expected to be able to support the achievement of the zero accident target and create a safer and more controlled work environment.

REFERENCES

- [1] S. Di, P. T. Tasma, and P. Kamar, "Volume 2 Issue 2 2025 Page 49-56 KESELAMATAN DAN KESEHATAN KERJA (K3)," vol. 2, no. 2, pp. 49–56, 2025.
- [2] R. Kartika *et al.*, "Meningkatkan kesadaran dan budaya K3 melalui strategi pendekatan edukasi praktis di sektor industri kelapa sawit," vol. 5, no. 2, pp. 267–277, 2025.
- [3] M. Yuliana, "Pengaruh Kompensasi , Literas Keselamatan Dan Kesehatan Kerja (K3), Dan Work Monitoring Terhadap Kinerja Karyawan Perkebunan Kelapa Sawit (Studi Kasus PT . Sinar Dinamika Kapus-1)," vol. 3, pp. 5829–5836, 2023.
- [4] W. I. Kurnia, M. I. Zainal, and D. Harits, "Peningkatan Kesadaran Terhadap K3 Melalui Penggunaan APD Bagi Pekerja di Perkebunan Kelapa Sawit Desa Sesulu , Penajam Paser Utara," vol. 8, no. 1, 2024.
- [5] P. T. Hasnur and C. Terpadu, "ANALISIS PENGARUH PENERAPAN KESELAMATAN DAN KESEHATAN KERJA (K3) TERHADAP KINERJA KARYAWAN," vol. 5, no. 1, pp. 75–85, 2019.
- [6] V. N. Juli, A. Jl, L. Golf, K. Tengah, K. P. Batu, and K. D. Serdang, "Analisis Penerapan K3 di Pabrik Perkebunan Sawit (Literatur Review) Nur Elviyani Sinaga Tri Rahma Sintia Rizka Aulia Sri Hajjah Purba lebih baik mengenai variabel-variabel yang mempengaruhi risiko kecelakaan kerja karyawan," vol. 2, no. 3, 2024.
- [7] R. A. Damanik and L. P. Pamardi, "Masalah dan Penanganan Kesehatan dan Keselamatan Kerja (K3) Pada Proses Panen diperkebunan Kelapa Sawit," vol. 2, no. 01, pp. 37–50, 2024, doi: 10.55180/aei.v2i1.857.
- [8] F. Indarwati, H. Zaki, and I. Akhmad, "Pengaruh Penerapan Disiplin Kerja Dan Keselamatan Kesehatan Kerja (K3) Terhadap Produktivitas Kerja Karyawan PT . Kelapa Sawit Sewangi Sejati Luhur Kabupaten Kampar," vol. 1, no. 1, pp. 343–352, 2021.
- [9] A. N. Hidayat, R. K. Agusti, and J. Prasetyo, "Evaluasi Risiko Kesehatan Kerja Akibat Pestisida Dan Pupuk Di Industri Kelapa Sawit Occupational Health Risk Evaluation from Pesticide and Fertilizer Use in Palm Oil Industry," vol. 2, pp. 51–60, 2026.
- [10] S. Tarigan, "Penerapan sistem manajemen keselamatan dan kesehatan kerja (SMK3) pada industri

- pengolahan minyak kelapa sawit,” vol. 03, no. 1, pp. 1–5, 2021, doi: 10.34012/jpms.v3i1.1469.
- [11] J. Pengabdian, U. Mu, Z. Hamzah, T. P. Sari, F. A. Islam, and U. I. Riau, “UPAYA PENINGKATAN KESEHATAN DAN PEREKONOMIAN PETANI SAWIT DI KOPERASI KARYA MENTULIK (KSU-KM),” vol. 3, no. 2, 2019.
- [12] A. Z. Vagas, I. Ruwana, and H. G. W, “UNTUK MENGURANGI RISIKO KECELAKAAN KERJA MENGGUNAKAN METODE JOB SAFETY ANALYSIS (JSA),” vol. 6, no. 2, pp. 153–156, 2023.
- [13] N. I. Mardlotillah and I. Artikel, “HIGEIA JOURNAL OF PUBLIC HEALTH Manajemen Risiko Keselamatan dan Kesehatan Kerja Area Confined Space,” vol. 4, no. Special 1, pp. 315–327, 2020.
- [14] G. Jantung, I. Obat, K. Lingkungan, and P. K. Sawit, “Jurnal Lantera Ilmiah Kesehatan Gambaran Kesehatan Lingkungan dan Kesehatan Pekerja di Perkebunan Sawit,” vol. 3, no. 1, pp. 48–56, 2025.
- [15] D. Y. Lubis, P. Rahayu, Y. S. Nasution, and A. Hasibuan, “Elastisitas : Jurnal Manajemen Akuntansi Keuangan Yayasan Salmiah Education Global International (YSEGI) Peningkatan Perilaku Penggunaan Alat Pelindung Diri Pada Pekerja Perkebunan Kelapa Sawit,” vol. 1, no. 1, pp. 1–9, 2025.
- [16] H. M. Denny, “Persepsi Pekerja Perkebunan Kelapa Sawit Tentang Recognition (Pengenalan) Bahaya pada Perkebunan Kelapa Sawit di Kabupaten Bengkulu Tengah,” vol. 15, no. 2, pp. 1–9, 2023.
- [17] A. P. D. Pemanen, K. Sawit, and P. T. X. Rokan, “Hubungan pengetahuan dan sikap dengan perilaku penggunaan apd pemanen kelapa sawit pt. x rokan hulu,” vol. 5, no. 1, pp. 1–6, 2022.
- [18] W. A. Aji, M. A. Nugraha, H. Setyawan, and R. Nurjanah, “Impact of Charcoal Husk and NPK Fertilizer on The Optimization of Palm Seedlings (*Elaeis Guineensis* Jacq) in Marginal Land,” vol. 4, no. 2, pp. 11–17, 2025.
- [19] W. A. Aji and B. Nugroho, “Taxation of Palm Oil Production Results Using on Regression Model (PT . Menthobi Makmur Sustainable),” vol. 2, no. 1, pp. 1–6, 2023.
- [20] W. A. Aji, H. Setyawan, I. Kurniawan, and I. S. Santi, “Determinants of Labor Productivity in Palm Oil Harvesting , Central Kalimantan,” vol. 2, no. 2, pp. 51–59, 2023.
- [21] W. A. Aji, A. D. Utami, and B. Nugroho, “FERTILIZATION EFFECTIVENESS ON THE PRODUCTIVITY OF FRESH FRUIT,” vol. 4270, 2020.
- [22] M. J. Suhartono, H. Setyawan, and W. A. Aji, “Identifying Plant Age to Determine Production Trend of Oil Palm Fresh Fruit Bunches,” vol. 6, no. 2, pp. 378–384, 2023.
- [23] W. A. Aji, S. A. Saloko, I. Kurniawan, and M. A. Nurcahya, “The Effect of Rainfall and Rain Days On Palm Oil Production,” vol. 1, no. 1, 2022.