

## **Analysis of the Implementation of the SAP (Safety Accountability Program) Digital Reporting Application in Reducing Workplace Accidents at the PT Energi Batubara Lestari Coal Mine**

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**Abstract.** Hazard control in the mining industry has long been implemented to reduce the number of occupational accidents. One of the control measures is the Safety Accountability Program (SAP) reporting system. However, the effectiveness of the program was not optimal, which led to an improvement initiative by transforming the reporting method from manual to digital. This study aims to examine the increase in SAP (Safety Accountability Program) reporting and the reduction in workplace accidents after the transition to a digital application system, as well as to assess the effectiveness of the digital SAP application at PT Energi Batubara Lestari coal mine. This research employed a descriptive qualitative method with an analytical approach. Data were collected through document review, interviews, and observations involving key informants directly engaged in the implementation of the SAP application, including operators (2 persons), mechanics (2 persons), a group leader (1 person), a supervisor (1 person), and a manager (1 person). Data analysis was conducted using methodological triangulation. The findings show a significant increase in safety reporting, from 10.703 reports in 2024 to 27.103 reports in 2025. An increase of more than double. At the same time, the number of occupational accidents decreased from 16 cases in the first semester of 2024 to 4 cases in the first semester of 2025, representing a 75% reduction. These results demonstrate that the implementation of the digital SAP application is effective (75%) in enhancing worker participation in hazard reporting, accelerating response to risks, and strengthening the safety culture within the mining environment. The adoption of the digital SAP reporting system is a strategic step to improve safety performance and support safe and sustainable mining operations.

**Keywords:** Safety Accountability Program, digital reporting, hazard report, accident, coal mining

### **INTRODUCTION**

Coal mining is one of the industrial sectors that contributes significantly to Indonesia's economy, yet at the same time, it also presents high risks to occupational safety and health (OSH) (Kazanin et al., 2018; Widajati, 2025). Data from the International Labour Organization (ILO, 2021) indicates that the mining sector ranks highest in the number of fatal accidents compared to other industrial sectors. Recent studies show that mining activities are among the most dangerous jobs globally, with approximately 8% of fatal work accidents concentrated in this sector (Cruz-Ausejo et al., 2024). In Indonesia, there has also been an increase in severe respiratory illnesses, such as black lung disease among coal miners, coinciding with rising coal production (Akbar et al., 2024). Data from the Social Security Administration Agency (BPJS) recorded 234,370 cases of occupational accidents and work-related diseases in 2021, with the mining sector contributing 6,565 cases (Sultan, Setyadi, & Ramdan, 2023). Furthermore,

studies show that digitalization of hazard and accident reporting through applications such as SIKAP in East Kalimantan significantly improves OSH performance in the coal mining sector (Sultan, Setyadi, & Ramdan, 2025).

The Safety Accountability Program (SAP), which emphasizes worker engagement in reporting potential hazards, has been implemented by companies to reduce accidents. However, conventional paper-based SAP systems often encounter obstacles such as lost reports, delayed submission to management, difficulties in analysis, and lack of transparency. Advancements in digital technology offer solutions to these issues. Digital SAP reporting applications enable workers to report hazardous conditions quickly and accurately through smartphones, with automatic documentation in company databases. Studies in high-risk industries show that digital innovations (e.g., mobile applications, IoT, real-time communication) improve hazard identification and response times compared to manual systems (Dodoo, Al-Samarraie, & Alzahrani, 2024). A systematic review of smartphone applications designed for workplace health, safety, and well-being found that digital tools significantly reduce underreporting and delays inherent in paper-based systems (Karlsen, Svendsen, & Abildgaard, 2022).

Mobile-based reporting systems with user-friendly interfaces have been empirically shown to increase reporting rates and reduce delays between incidents and managerial notification (Ramacciati et al., 2021). Furthermore, conceptual models developed for digital incident reporting highlight structured data input, follow-up tracking, and alert mechanisms as key features that address traditional weaknesses in manual reporting (Badea, Darabont, Trifu, Ivan, & Ciocirlea, 2025). Investigations into the credibility and user experience of such applications reveal that real-time reporting of near misses and hazards enhances accountability and transparency within organizations (Naji & Hassan, 2024). In the mining industry and other high-risk sectors, early warning safety systems integrating IoT and real-time incident reporting have proven effective in detecting abnormal events and facilitating faster decision-making (Lu, 2025). Additionally, EHS software and mobile applications are increasingly adopted, offering more efficient workflows, real-time notifications, and analytics that improve OSH performance (NSC Report, 2022).

PT Energi Batubara Lestari, a coal mining company in Tapin Regency, South Kalimantan Province, is committed through its Occupational Safety, Health, and Environmental Policy to preventing workplace accidents and asset damage while ensuring mining operations that are safe, efficient, and productive. Research on safety, compliance, and productivity in Indonesian coal mining shows that companies adhering to robust OSH and environmental policies tend to have fewer accidents and higher operational efficiency (Ismail, 2025). Furthermore, environmental management studies in coal mining areas in Indonesia indicate that companies with integrated OSH and environmental policies reduce negative environmental impacts and maintain stakeholder trust (Nasir, 2023). Additionally, assessments of safety management system policies in Indonesia reveal that strong policy commitments supported by management and consistent enforcement play a central role in enhancing productivity and reducing accident rates (Anggoro & Simorangkir, 2023).

Throughout 2024, the number of accidents remained relatively high, with 28 recorded cases across various categories. Meanwhile, investigations into the causes of incidents in 2024 showed that incidents were predominantly caused by inadequate hazard mapping in work areas. Field observations also revealed that 60% of Unsafe Acts (UA) and Unsafe Conditions (UC)

conducted or experienced by workers were not properly documented, potentially leading to incidents if not addressed. Moreover, incidents contributed to increased property damage costs, environmental pollution, and disruptions to mining operations, which reduced productivity and eroded stakeholder confidence.

Before the implementation of the SAP Digital application, hazard reporting for hazard mapping was still conducted manually, resulting in unsafe conditions and acts being poorly recorded and followed up. In recent studies of the coal mining sector in East Kalimantan, the use of the SIKAP mobile application proved effective in preventing data manipulation of accidents and hazards, a common issue in manual reporting systems (Sultan, Setyadi, Ramdan, & Haviluddin, 2024). A global review of occupational accident reporting found that organizational failure to document unsafe acts and conditions is strongly associated with increased incident frequency (Cruz-Ausejo et al., 2024). Additionally, geo-hazard monitoring in Indonesian mining areas shows that many hazardous conditions are not well mapped or are detected too late (Kimijima et al., 2023). Safety performance analyses in nickel mining reveal issues in risk reporting and follow-up, especially in areas with manual systems and low worker participation (Amirudin, Sukwika, & Ramli, 2024).

Based on analyses of accident investigation reports within PT Energi Batubara Lestari's mining permit area, several factors contributed to incidents, with the primary cause dominated by personal factors particularly the lack of knowledge and awareness in hazard mapping during work activities. The most influential personal factors were inadequate hazard mapping and inappropriate motivation.

Several workplace issues may affect worker safety and performance. First, inadequate hazard mapping due to weak documentation systems and insufficient follow-up on hazards identified in the field. Second, inappropriate motivation, where individuals act contrary to Standard Operating Procedures (SOP). Third, lack of skills, occurring when employees force themselves to work despite lacking adequate competence or experience (Ministry of Manpower RI, 2018; ILO, 2020; Ridwan & Sari, 2021).

Additionally, psychological stress is a problem characterized by mental tension arising from job demands, work situations, or burdensome social environments (Robbins & Judge, 2019). Physical stress is also common, marked by fatigue due to excessive physical activity and inadequate rest (Sutarto et al., 2020). Lastly, mental incapacity refers to cognitive, emotional, or psychological limitations that impair an individual's ability to understand and respond to work situations (WHO, 2020).

The most significant personal factor in 2024 incidents was "Lack of Hazard Mapping," suggesting that the priority issue remains the large number of incidents caused by insufficient hazard identification in work areas. To address this, PT Energi Batubara Lestari implemented the Safety Accountability Program (SAP), which was previously based on manual reporting, but in early 2025 was improved through a web-based digital application accessible via Android and iOS (Dodoo, Al-Samarraie, & Alzahrani, 2024).

ONE-SAP is a platform created by PT EBL to support participation, consultation, and motivation among employees to increase awareness of mining safety. The Safety Accountability Program (SAP) is designed to enhance safety culture by making occupational safety and health the responsibility of every individual and group (Geller, 2001; Cooper, 2015; Ministry of Manpower RI, 2018).

Previous studies emphasize the importance of safety culture and digital innovation in reducing mining accidents. Sutopo et al. (2020) found that high accident rates in coal mining are closely linked to poor hazard identification and limited worker involvement in safety programs, often resulting in delayed follow-up. However, their study relied heavily on conventional approaches such as manual reporting, which are prone to errors and incomplete documentation. Meanwhile, Wicaksono et al. (2021) highlighted the role of digital systems in OSH management, showing that mobile-based safety reporting tools improve the accuracy of hazard documentation and response time. However, their research did not fully integrate behavioral aspects such as motivation and awareness in hazard mapping, which remain key drivers of safety compliance in high risk industries.

The novelty of this study lies in evaluating the effectiveness of a comprehensive digital Safety Accountability Program (SAP) that not only documents hazards but also provides structured inspections, safe behavior observations, and personal contact features to strengthen awareness and participation. Based on this context, this research aims to evaluate the increase in SAP reporting and reduction in accident numbers after transitioning to the digital application system, as well as the effectiveness of SAP implementation at the PT Energi Batubara Lestari coal mine.

## **MATERIALS AND METHODS**

This research was conducted at PT Energi Batubara Lestari, a coal mining company located in Tapin Regency, South Kalimantan, using a qualitative descriptive research method. The research variables consist of an independent variable, namely the Implementation of the SAP Digital Application, and a dependent variable, namely the Number of Workplace Accidents. A qualitative descriptive method with an analytical approach was chosen to enable an in-depth analysis of the changes in accident frequency before and after the implementation of the SAP Digital application.

The study was conducted in the operational area of the company with a population consisting of PT Energi Batubara Lestari employees and contractor workers. The research sample comprised workers who served as key informants with adequate knowledge of the implementation of the SAP Digital application. The research subjects or informants totaled seven individuals, consisting of two operators, two mechanics, one group leader, one supervisor, and one manager, while the research object was the implementation of the SAP Digital program in the company.

Data collection techniques included document and record review, observation, and interviews. The document and record review focused on the SAP reporting database and accident statistics of PT Energi Batubara Lestari and its contractors across all accident classifications, including Fatality, Lost Time Injury (LTI), Medical Treatment Injury (MTI), First Aid Case (FAC), Property Damage, Fire Case, Environmental Case, and Near Misses during the first half of 2024 (before SAP implementation) and the first half of 2025 (after SAP implementation). Observations were conducted to monitor the hazard reporting process using the SAP application across various work areas. Interviews with key informants were carried out to obtain qualitative insights from stakeholders.

The researcher employed data triangulation techniques, which involve combining multiple data sources and collection methods to obtain a comprehensive understanding of the

effectiveness of the SAP (Safety Accountability Program) digital application and to enhance the validity and reliability of the study. Triangulation was implemented through three main approaches: document and record review, field observations, and in-depth interviews with key informants. This triangulation enabled the researcher to verify whether the reduction in accidents was indeed related to the increase in reporting and the use of SAP Digital, to identify consistency between physical data evidence (database), actual behavior (observation), and worker narratives (interviews), and to assess the effectiveness of the SAP application more objectively and comprehensively. When findings from all three data sources aligned, the research results were considered valid and accountable.

## RESULTS AND DISCUSSION

### Research Findings

**Table 1. Comparison of SAP Reporting Volume**

| No | Month    | 2024<br>Semester I | 2025<br>Semester I |
|----|----------|--------------------|--------------------|
| 1  | January  | 2031               | 5092               |
| 2  | February | 1573               | 5194               |
| 3  | Maret    | 2958               | 5010               |
| 4  | April    | 1309               | 4065               |
| 5  | May      | 1872               | 4355               |
| 6  | June     | 958                | 4387               |
|    | Total    | 10703              | 27103              |

Based on the SAP (Safety Accountability Program) reporting data presented above, there is a significant increase in the number of reports submitted after the implementation of the Digital SAP application in Semester I of 2025. In 2024, the total number of reports recorded in the first semester was 10703, while in the same period in 2025 this figure increased to 27103 reports.

**Table 2. Comparison of Occupational Accident Cases**

| No | Accident Case                   | 2024<br>Semeter I | 2025<br>Semeter I |
|----|---------------------------------|-------------------|-------------------|
| 1  | <i>Fatality</i>                 | 0                 | 0                 |
| 2  | <i>Loss Time Injury</i>         | 0                 | 0                 |
| 3  | <i>Medical Treatment Injury</i> | 0                 | 0                 |
| 4  | <i>First Aid Case</i>           | 0                 | 0                 |
| 5  | <i>Property Damage</i>          | 7                 | 2                 |
| 6  | <i>Fire Case</i>                | 2                 | 0                 |
| 7  | <i>Environment Case</i>         | 2                 | 0                 |
| 8  | <i>Nearmiss</i>                 | 5                 | 2                 |
|    | Total                           | 16                | 4                 |

Based on accident statistics, there is a significant decrease in the number of workplace accidents between Semester I of 2024 and Semester I of 2025. In Semester I of 2024, a total of 16 occupational accident cases were recorded, while in Semester I of 2025 this number

decreased to 4 cases.

## **Discussion**

### **SAP (Safety Accountability Program) Reporting**

Table 1 shows that the trend of increasing SAP reports indicates improved awareness and participation of workers in reporting through the Safety Accountability Program. According to Yuliani (2021), digital-based reporting systems can enhance transparency, worker engagement, and the speed of response to potential hazards. This is in line with Siregar (2022), who stated that the digitalization of OHS reporting systems can accelerate information flow between departments and strengthen workplace safety culture.

### **Workplace Accident Trends**

Table 2 shows that the number of workplace accidents decreased by 75% after the implementation and optimization of the digital SAP (Safety Accountability Program) application. The downward trend in accident numbers can be calculated using the following formula:

$$\begin{aligned}\% \text{ Reduction in Accidents} &= \frac{(\text{Total Accidents in 2024} - \text{Total Accidents in 2025})}{\text{Total Accidents in 2024}} \times 100\% \\ &= \frac{(16 - 4)}{16} \times 100\% \\ &= 75\%\end{aligned}$$

The detailed breakdown of incident types shows that Property Damage cases decreased from 7 cases to 2 cases, while Fire Cases and Environmental Cases were successfully reduced to zero incidents in 2025. This reduction indicates an improvement in the effectiveness of the early reporting system, enabling faster risk control before hazards develop into serious incidents.

These results align with the study by Wibowo & Haryanto (2021), which found that the implementation of a digital reporting system can reduce workplace incident rates through increased near-miss reporting and data-based supervision. According to Darmawan (2020), the success of digital safety systems depends not only on technology but also on behavioral changes among workers, who become more proactive in reporting hazardous conditions.

### **Effectiveness of Digital SAP (Safety Accountability Program) Implementation**

Based on interviews with key informants, consisting of management personnel, supervisors, SHE (Safety, Health, and Environment) officers, heavy-equipment operators, and mechanics, it was found that the implementation of the Digital Safety Accountability Program (SAP) at PT Energi Batubara Lestari has brought positive changes to the safety reporting system.

The effectiveness of the Digital SAP in reducing workplace accidents is calculated at 75%, based on the percentage decrease in the number of accidents. This finding is also supported by interview data showing that most informants stated that the SAP application facilitates the reporting process for hazard identification (Hazard Reports), near misses, and unsafe conditions.

**Table 3. Interview Results from Informants**

| Informant                | Company                                       | Interview                                                                                                                                                                                                                                                                                                  | Main Topic                                                                 |
|--------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| SHE Manager              | PT Energi<br>Batubara Lestari                 | “Since the digital SAP system was implemented, we can monitor hazard reports directly from the dashboard. All divisions respond to findings more quickly, and the number of reports has increased significantly compared to before. SAP data can also be used as material for management review meetings.” | Effectiveness of the digital reporting system; faster follow-up of reports |
| Production Supervisor    | PT Energi<br>Batubara Lestari                 | “This SAP really helps us in the field, especially when there is an unsafe condition. We just take a photo, fill in the description, and send it through the application. No need to wait for paper forms anymore. The response from the PIC is also fast.”                                                | Ease of use of the application in the field                                |
| SHE Group Leader         | PT Energi<br>Batubara Lestari                 | “In the past, many manual reports were lost or never followed up. Now, through SAP, the status of every report can be tracked. This helps us ensure that all hazards are addressed.”                                                                                                                       | Transparency and accountability in reporting                               |
| Off High Truck Operator  | PT Cipta<br>Kridatama<br>(Kontraktor)         | “When I see a slippery road or an equipment oil leak, I immediately report it through SAP. Previously, I was sometimes reluctant to fill out paper forms, but now I just send it from my phone. It's fast and easy.”                                                                                       | Increased participation in hazard reporting                                |
| Dump Truck Operator      | PT Farhan Afifa<br>Bersaudara<br>(Kontraktor) | “SAP makes us more aware of hazards. Now almost every shift someone reports a potential hazard. Supervisors also often provide feedback through the application.”                                                                                                                                          | Improved hazard awareness and safety culture                               |
| Heavy Equipment Mechanic | PT Cipta<br>Kridatama<br>(Kontraktor)         | “Before SAP, reports of damage or hazardous conditions in the workshop were often processed late. Now everything can be seen directly by the supervisor. Coordination has become much faster.”                                                                                                             | Improved communication efficiency between divisions                        |
| Electrician              | PT Ombilin Fusi<br>Nusantara<br>(Kontraktor)  | “We use SAP to report damaged equipment or potential fire hazards. Our reports are immediately responded to by the PIC, allowing preventive action to be taken more quickly.”                                                                                                                              | Faster response to potential hazards                                       |

Interview results indicate that the ease of use of the SAP Digital application or its user friendly interface. It is a key factor driving the increased participation of workers in safety reporting. In the context of coal mining operations, an application that enables rapid and simple reporting via mobile phones reduces the administrative barriers previously associated with manual systems. When workers can submit reports by simply uploading a photo and a brief description, psychological barriers such as reluctance, laziness, or the burden of filling out paper forms or waiting for supervisor approval are significantly reduced.

This finding is consistent with López, P., et al. (2024), who provide empirical evidence that mobile applications designed specifically for hazard identification in mining improve hazard detection and accelerate reporting workflows (photo upload and description). This supports the relevance of simple mobile-based system design in improving field-level reporting.

Field observations also reinforce these results, showing a faster processing time for hazard reports. Previously, report follow-up could take 2–3 days due to layered bureaucratic processes in the manual system. Currently, the average processing time has been reduced to less than 24 hours. This aligns with the findings of Karlsen et al. (2022) and Naji & Hassan (2024), who highlight that digital reporting systems accelerate risk communication through automated analysis and real-time notifications. Thus, this acceleration not only enhances operational efficiency but also strengthens accident prevention through faster decision-making.

Supervisors and SHE personnel emphasized that the tracking feature in the SAP application plays a crucial role in increasing accountability and transparency. Every report in SAP has a digital trail from submission, verification, to closure. This finding aligns with Cooper (2015), who stresses the importance of behavior-based safety and measurable feedback mechanisms in strengthening safety culture. Through status tracking, SHE personnel can ensure that each report moves beyond the reporting stage and is fully resolved. Such transparency eliminates the common issues found in manual systems, such as lost reports, backlogs, or unprocessed submissions.

Interviews with management confirm that the SAP (Safety Accountability Program) application functions as a data-driven monitoring and evaluation tool. All reports can be categorized by hazard type, location area, risk level, and incident frequency. This structured dataset supports the concept of data-driven safety management, where safety decisions are based on actual trends rather than assumptions. Management can identify high-risk areas, units with the most findings, and recurring hazard patterns. This is consistent with Wibowo & Haryanto (2021), who state that digital safety data enhances the accuracy of accident trend analysis and the relevance of corrective interventions. The accumulated database is also used in Management Review Meetings as a basis for strategic decision-making related to safety system improvements. As noted by Badri, Boudreau-Trudel & Souissi (2018), modern safety management systems use data for strategic planning, including management review processes.

The use of SAP Digital has strengthened the reporting culture among coal mining workers. Before digitalization, workers tended to avoid reporting hazards due to complicated processes, paper forms, and lengthy procedures. This negative perception caused workers to report only after incidents occurred rather than at the near-miss or hazard stage. With the digital application, such barriers are removed, making workers more active in reporting hazards because the process is faster, simpler, and free from layered administrative requirements. This phenomenon supports Geller's (2001) safety behavior theory, which states that a supportive work environment and accessible systems increase worker participation in safety behaviors.

In the context of safety culture, increasing reporting participation demonstrates that workers are becoming more aware of potential risks. This contributes positively to accident prevention, as a higher volume of hazard reports allows companies to identify and control risks before they escalate into serious incidents. This aligns with the findings of Cruz-Ausejo et al. (2024) and Ramacciati et al. (2021), who emphasize that early hazard identification is one of

the most effective components of accident prevention in high risk industries such as mining.

## CONCLUSION

Based on the research findings, it can be concluded that the implementation of the SAP Digital (Safety Accountability Program) application at PT Energi Batubara Lestari has proven effective in enhancing safety reporting and reducing the number of workplace accidents in coal mining operations. The increase in SAP reports more than double in 2025 compared to 2024 demonstrates improved worker participation in reporting potential hazards. The number of workplace accidents in 2025 also decreased significantly compared with 2024. This confirms that the digitalization of the SAP reporting system is highly effective (75%) in strengthening safety culture, accelerating response to potential hazards, and supporting the creation of a safer and more sustainable work environment in the mining industry.

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