

# Work accident reporting in coal mining, Indonesia: A systematic literature review

Muhammad Sultan <sup>1\*</sup>, Djoko Setyadi <sup>2</sup>, Iwan Muhamad Ramdan <sup>3</sup>, Haviluddin <sup>4</sup>,  
Tetra Hidayati <sup>5</sup>

<sup>1</sup> Universitas Mulawarman Jalan Kuaro Kelurahan Gunung Kelua, Kota Samarinda, Indonesia

<sup>1\*</sup> [muhammadsultan812@gmail.com](mailto:muhammadsultan812@gmail.com); <sup>2</sup> [djoko.setyadi@gmail.com](mailto:djoko.setyadi@gmail.com);

<sup>3</sup> [iwanmuhamadramdan@gmail.com](mailto:iwanmuhamadramdan@gmail.com); <sup>4</sup> [haviluddin@unmul.ac.id](mailto:haviluddin@unmul.ac.id); <sup>5</sup> [tetra.hidayati@feb.unmul.ac.id](mailto:tetra.hidayati@feb.unmul.ac.id)

\* corresponding author



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## ABSTRACT

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**Background:** Work accidents and work-related diseases are still considered as nightmares in Indonesia, especially in the coal mining sector. Badan Penyelenggara Jaminan Sosial (BPJS) Ketenagakerjaan (Social Security Agency for Employment) reported that there were as many as 234,370 cases of work accidents and work-related diseases in 2021, where the mining sector contributed as many as 6,565 cases. This study aims to present the analysis and synthesis of various research to provide solution recommendations in the management of accident reporting which are suitable to the characteristics of coal mining in Indonesia.

**Method:** This study is a Systematic literature review of a number of studies sourced from Elsevier, Science Direct, Google Scholar, Pubmed, Proquest, DOAJ, Perpunas RI, Garuda, and other sources.

**Results:** Based on the literature analysis, it is found out that reporting management based on digitalization either in the form of website portal or application is a solution to optimize the effort to control work accidents and work-related disease in coal mining.

**Conclusion:** This reporting system can be applied in coal mining in Indonesia.



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## 1. Introduction

Coal mining is one of business sectors with high risk of work accidents and work-related diseases (WRD). A number of factors contributing to the occurrence of work accidents and WRD in mining, among others, are unsafe behaviors, workloads, and moving equipment. Whereas, activities with highest risks are equipment maintenance, moving equipment operation, and work equipment cleaning (Stemn, 2019).

Work accidents and work-related diseases continue to be present in Indonesia. Badan Penyelenggara Jaminan Sosial (BPJS) Ketenagakerjaan (Social Security Agency for Employment) reported that there were as many as 234,370 cases of work accidents and work-related diseases in 2021, where the mining sector contributed as many as 6,565 cases. This figure is a two-times increase from the previous year of 3,131. Work accidents and WRD have caused both direct and indirect loss to the companies as well as life casualties among the employees.

Such occurrence would have significant impacts on the companies, whereas most of work accidents and WRD can be avoided by implementation of occupational safety and health (OSH) in systematic and integrated manners (Morgado et al., 2019) like what is explained in ISO 45001:2018 (*International Standardization Organization*) (ISO, 2018) on the requirement for occupational health and safety management system (OSHMS).

Work accidents and WRD would continue to occur if no immediate effort to control is made. One approach which is considered important in controlling work accidents is implementation of statistical evaluation on every work accident, either it is non-fatal or fatal (Ivaschu & Cioca, 2019). Reporting of mining accident is made as an effort to identify and evaluate every activity which invites unsafe behaviors among employees (Kumar et al., 2020). In Indonesia, this is known as the reporting of work accidents and hazards which is aimed at identifying the basic cause of an accident so that it is easy for a company to proceed with improvement measures to prevent similar occurrence from happening in the future.

The Indonesian Government through the related ministry has issued a number of regulations regarding the obligation by companies to report work accidents and hazards, especially in the coal mining sector. Some of the regulations are *UU Nomor 1 Tahun 1970* (Law No. 1 of 1970), *Peraturan Menteri Tenaga Kerja RI Nomor 03 Tahun 1998* (RI Manpower Minister Regulation No. 03 of 1998) and *Permenakertrans RI Nomor 01 Tahun 1981* (RI Manpower and Transmigration Minister Regulation No. 01 of 1981) (Permenaker, 1998; Indonesian Government, 1997; Permenakertrans, 1981). Similarly, employees are compulsorily required to report accidents according to directions for the implementation of Mining Safety Management System or MSMS (or SMKP, *Sistem Manajemen Keselamatan Pertambangan*) as regulated by *Keputusan Direktur Jenderal Mineral dan Batubara Kementerian ESDM RI Nomor 185.K/37.04/DJB/2019* (or Decree of the Director General of Mineral and Coal of the Ministry of Energy and Mineral Resources of RI No 185.K/37.04/DJB/2019) (Dirjen, 2019).

Reporting management for work accidents and hazards in coal mining is a system which is meant to provide information on accident and WRD issues to the company as one effort to create a feasible work environment. To achieve a sustainable (continuous) reporting management, it is necessary to have standardization of regulations which are adaptable to information and communication, monitoring and control of hazards, and the presence of an expert in charge of OSH (Min et al., 2019).

Accident and hazard reporting is one of the efforts to control accidents as mentioned in the Regulation of the Minister of Energy and Mineral Resources No. 26 of 2018 on Good Mining Practice and Supervision of Mineral and Coal Mining (*Peraturan Menteri ESDM Nomor 26 Tahun 2018 tentang Pelaksanaan Kaidah Pertambangan yang Baik (Good Mining Practice) dan Pengawasan Pertambangan Mineral dan Batubara*) (Menteri ESDM RI, 2018). Reporting of hazards including near miss which is followed by proper handling will contribute to the reduction of potential accidents in the future (Winkler et al., 2019). The highly important state of accident and hazard reporting has made it necessary to conduct a study on the management of accident and hazard reporting to create work environment with zero accident.

## 2. Method

The method applied in this study was the Systematic Literature Review on journal articles published during 2019-2023 which was done through four steps, namely planning, data collection, data analysis, and synthesis. This study established two Research Questions, namely 1) How is the state of the accident and hazard reporting management system implemented by coal mining at the moment? and 2) What accident and hazard reporting management system can be implemented in

Indonesian coal mining? The next, data collection was carried out by searching publications regarding the studies of accident and hazard reporting management through Elsevier, Science Direct, Google Scholar, Pubmed, Proquest, Perpustakaan RI, Directory of Open Access Journals/DOAJ, Indonesian OneSearch, Garuda, and other sources to obtain answers of the research questions. Once the data were collected, they were then analyzed and proceeded to the synthesis.

### 3. Results and Discussion

Issues with regards to work accidents and WRD in the mining sector have kept on demanding more serious attention from the past until now. Mining activities are not free from hazards which may result in work accidents. Work accident prediction using *Poisson* method of probability distribution is one of approaches to prevent similar work accidents in a certain period of time (Pahdian et al., 2021). Another accident prediction method which is common is the traditional method such as regression model and *fault tree analysis*. However, this model cannot be used to predict accidents in the future. Therefore, *grey interval predicting method GM (1,1)* has been introduced to predict the characteristics of fatal accidents in the future by integrating the root cause, possible consequence, and appropriate risk control measure for an accident which are arranged in a diagram (Xu & Xu, 2020).

Such prediction methods are highly dependent on the availability of data on work accidents and hazards. This means that activities of predicting work accidents and preventing them cannot be separated from the availability of data. The reporting of work accidents and hazards done by employees becomes the only source of data which is required to support the control of work accidents and WRD. Mining data is highly helpful in the prevention and control of accidents, including coal explosions (Xie et al., 2019).

Coal mining is one of the sectors with the highest rate of fatality (Roberts et al., 2021). Unsafe acts are the most dominant cause of work accidents in coal mining. Increasing number of work accidents caused by unsafe acts among coal mining employees is caused by a number of factors such as work environment, organization influence, supervision of employees, employees' error and violation (Fa et al., 2021).

The dominant factors which cause unsafe act practices during work among others are management of company's resources, process in organization, and company's failure in solving issues in the workplace. In addition, some of the common practices of unsafe acts are inappropriate placement of employees or inappropriate workload given to employees, failure in reinforcing prevailing regulations, and work tools or equipment which do not meet required technical specifications (Yang et al., 2022).

Unsafe behaviors among employees including work accident reporting in coal mining has definitely been the concern of the Indonesian Government since, if it is ignored, the risk of injuries among employees would increase due to such factors as age, experience, service years and working hours (Tian et al., 2022). The Indonesian Government has established a number of regulations to administer the reporting of work accidents and WRD. Among others are Law No 1 of 1970 on Occupational Safety (*UU Nomor 1 Tahun 1970 tentang Keselamatan Kerja*), Manpower Minister Regulation No. 03 on the Procedures of Accident Reporting and Inspection, (*Permenaker Nomor 03 tentang Tatacara Pelaporan dan Pemeriksaan Kecelakaan*), Manpower and Transmigration Minister Regulation No. 01 of 1981 on Obligation to Report WRD (*Permenakertrans Nomor 01 tahun 1981 tentang Kewajiban Melaporkan PAK*), Decree of Director General of Mineral and Coal of the Ministry of Energy and Mineral Resources of RI No. 185.K/37.04/DJB/2019 (*Keputusan Direktur Jenderal Mineral dan Batubara Kementerian ESDM RI Nomor 185.K/37.04/DJB/2019*), and other regulations.

The Indonesian Government has established policies on the management of Indonesian coal mining which contain work safety and environmental aspects. However, there is no inter-relation and synchronization among the regulations so that inequality, contradictions, and conflicts in each of the policies take place (Yulianingrum et al., 2022). For example, the existing regulations do not clearly elaborate on administrative sanctions and closure of mining business for companies committing violations. Such a condition may become one of the factors which result in practices of non-compliance among companies in implementing regulations.

The complexity of issues regarding work accident and hazard reports is not only related with regulatory aspects, but also with the reporting formats available in mine sites. The reporting formats are paper copies such as those found in the inspection of accident risks using safety checklists in coal mines (Fu et al., 2019). The frequently different reporting formats in each site and low participation of employees, especially underground employees, present quite a difficulty and require much time for the company management in their effort to control accidents.

Employees' difficulty in reporting work accidents and hazards has called for the need for the development of incident reporting management (Hulme, 2019) which becomes a part of a continuous mining safety system to make employees participate more actively in reporting accidents (Jiskani et al., 2020). Application of safety software systems is highly important to minimize the rate of accidents in the mining sector (Ismail et al., 2021).

Coal mining companies in Sweden have since long applied accident reporting systems and practices both technically and organizationally. It proves that the presence of an incident reporting system has made it easy for a company management to succeed in managing work accidents and, on the contrary, a company will not be able to make preventive action initiatives without being preceded by an incident report (Lööv & Nygren, 2019). This means that the presence of work accident and hazard reports is the basis of a company to proceed with proper and sustainable measures of accident and WRD control.

Mining companies in Australia have also carried out transformation to face the prospects and challenges of mining industries in the future. In dealing with the challenges, mining companies have made improvements and optimization in all the supporting factors of mining activity sustainability through implementation of information and communication technology (Jang & Topal, 2020). Current era of information technology requires new paradigms by companies to adapt immediately so that their business will survive and develop.

Furthermore, underground coal mining, with its high risk of accidents and WRD such as chemical, physical, and biological hazards, requires environmental monitoring systems including accident reporting with the help of *Internet of Things (IoT)* platform (Martinez et al., 2020). Management information systems based on application technology implemented in Luxi coal mine, China, have significantly improved the capability of safety management and supported healthy coal mining practices (Miao et al., 2023).

There have been some coal mining companies in Indonesia which have implemented digital reporting systems. One of the practices is by developing a web portal to make the process of reporting, monitoring, and controlling of OSH easier and faster (Novianti et al., 2021). In addition, work accident and hazard reporting management in coal mining can also be done through a mobile application system which is used as the source for data analysis and evaluation for work accident control. This system can improve the number of reports on unsafe conditions and unsafe actions by 15% compared to the paper-based reporting (Sinaga et al., 2019).

Based on the research of various sources, the optimization of work accident and hazard reporting in coal mining can be done through the provision of digital management information systems either in the form of web portal or mobile application. The reporting results can be used to prevent *extraordinarily severe coal mine accidents/ESCMA* and reduce potential similar accidents in the future (Zhang et al., 2020).

### **Is Digitalization of Accident and Hazard Reporting Possible in Indonesia?**

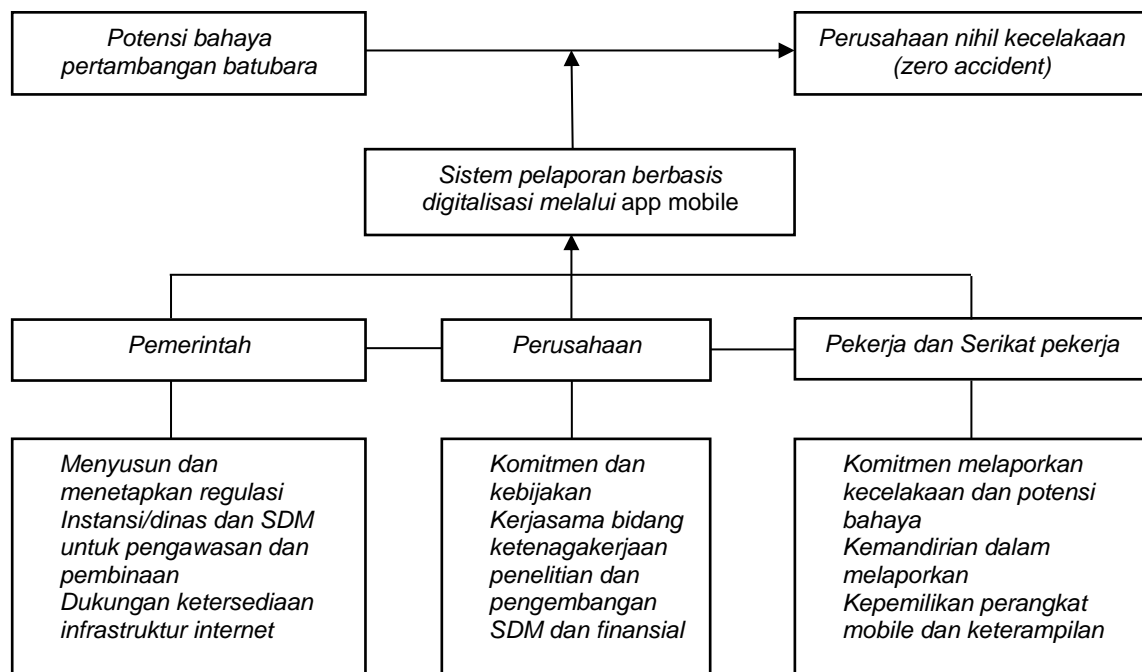
The Indonesian coal mining sector is one of the contributors to the number of work accidents and WRD. If this is not given more serious attention by various parties and not immediately encountered with efforts to develop control programs which are appropriate with the current needs, then such occurrence will continue and employees will always become the victims. Therefore, all the concerned parties should consider to participate optimally in accordance with their responsibility in the implementation of digital reporting systems in coal mining.

The current reporting system in Indonesian coal mining is still based on paper forms and is considered as less effective in supporting the updated and accurate data management. There is the possibility of missing reports which will affect the quantity and quality of the reports to the inspecting agencies such as the Office of Manpower and Ministry of Manpower. Even some irresponsible and

non-transparent company management may commit data manipulation practices on the conventionally prepared reports.

Hazard potentials which always arise in every stage of coal mining need serious attention from the Government, company management, and employees and need to be controlled to prevent work accidents and WRD. The control of work accidents and WRD is not solely the responsibility of the company management, but it also needs the involvement of the local government and employees. The roles and responsibilities of each of the parties in the implementation of digital reporting can be seen in the following [Figure 1](#).

- Potensi bahaya pertambangan batubara* = Coal mining hazard  
*Perusahaan nihil kecelakaan* = Company with zero accident  
*Sistem pelaporan berbasis digital melalui app mobile* = Digital reporting via mobile app  
*Pemerintah* = Government  
*Perusahaan* = Company  
*Pekerja dan Serikat pekerja* = Employees and Union  
*Menyusun dan menetapkan regulasi* = Prepare and establish regulation  
*Instansi/Dinas dan SDM untuk pengawasan dan pembinaan* = Agency and Human Resources for inspection and guidance  
*Dukungan ketersediaan infrastruktur internet* = Support for the availability of internet facilities  
*Komitmen dan kebijakan* = Commitment and policies  
*Kerjasama bidang ketenagakerjaan, penelitian, dan pengembangan* = Cooperation in Human Resources, research, and development  
*SDM dan finansial* = Human Resources and financial  
*Komitmen melaporkan kecelakaan dan potensi bahaya* = Commitment to report accidents and hazards  
*Kemandirian dalam melaporkan* = Independence in reporting  
*Kepemilikan perangkat mobile dan keterampilan* = Ownership of mobile device and skill



**Fig. 1.** Roles and responsibilities of the Government, company, and employees in accident and hazard reporting (Source: Adaptation from the book of OSH ([Sultan, 2020](#)) and literature research)

The Indonesian Government has shown their serious concern in performing the control of work accidents and WRD in workplaces with high risk of accidents, especially in coal mining, by preparation and establishment of regulations. However, there are still companies that have not

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implemented OSH according to the regulations. Therefore, the Government is not only expected as a regulator, but more importantly also as the agent to perform and improve inspection roles for the implementation of the regulation at work.

Local governments via the Offices of Manpower which are located throughout all the provinces in Indonesia also become one of the parties with significant roles in performing inspection and guidance in their areas of work. One of the causes of the less optimal inspection on companies is the insufficiency in the number of inspectors which is not enough for the number of coal mining companies to be inspected. This issue can be solved by increasing the number of inspectors even though such an effort is not easy to make.

The Government support to control work accidents and hazards through the provision of digital reporting information systems in coal mining may also be done with the provision of internet line facilities (infrastructure). Even though the Government has the limitation in providing the internet infrastructure, it has the capability to prepare regulations to support investors to invest in the communication sector. The inequality of internet transmission among coal mining areas due to their remoteness from urban areas can be overcome with the provision of digital reporting information systems without internet access.

Coal mining companies have tried to maximally implement the Mining Safety Management System or MSMS (*Sistem Manajemen Keselamatan Pertambangan or SMKPP*) as per the Decree of Director General of Mineral and Coal of the Ministry of Energy and Mineral Resources of RI No. 185.K/37.04/DJB/2019 (*Keputusan Direktur Jenderal Mineral dan Batubara Kementerian ESDM RI Nomor 185.K/37.04/DJB/2019*). As a matter of fact, the prevailing regulation does not automatically make companies comply with it. One of the causes is the commitment from companies in their policies of MSMS implementation. MSMS implementation among coal mining companies still needs a number of improvements such as establishment and formation of OSH units, appointment of dedicated technical staff for the mining sector, and mining safety committee (Ganjari & Fadhilah, 2022), the need for revisions of regulations and operational standards of occupational safety (Ahad & Saldy, 2021), and the need for evaluation and follow-up to ensure that the MSMS is implemented according to the regulations (Wardani et al., 2022).

Indonesian coal mining opens the opportunities for other parties to collaborate in various fields such as employment, research, and development. Mining activity reporting is not solely provided for internal purposes by performing routine formal reporting for the Government, but also for the sustainability of the business especially for the community around the mining area and preventing the disruption during operation (Amoako et al., 2022).

Companies in general, including mining companies, usually conduct recruitment of new employees through collaboration with universities. Such is what happens with business development purposes through the research conducted by the partners. The presence of many universities throughout almost all cities in Indonesia becomes one of the opportunities for the companies to collaborate in various areas which can be adapted to the needs of the companies. In addition, the availability of human resources and financial capability of the mining companies are one of the supporting factors in the implementation of digital reporting information systems for work accidents and hazards.

Efforts to control work accidents and WRD in coal mining are highly affected by the commitment among employees to participate actively and independently in reporting every occurrence of work accident and hazard in the mining area. As a matter of fact, the level of employee participation in reporting accidents and hazards in coal mining is still very low (Sultan et al., 2021). This obstacle factor can be overcome by optimizing socialization programs and training for employees. Other factors that can support the optimum implementation of digital reporting information systems is the ownership of mobile devices and skill to make the use of information technology.

#### 4. Conclusion

Digital reporting information system is considered more effective than conventional methods in optimizing the employees' participation to report work accidents and hazards in coal mining. Digital reporting information systems, either in the form of a website portal or a mobile application, can

become one alternative solution for the control of work accidents in coal mining in Indonesia. Research development is required on the implementation and evaluation of digital reporting information systems for work accidents and hazards in relation to the optimization of OSH performance in order to control work accidents and WRD in coal mining.

### Declaration

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