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Influencing factors on safety culture in mining industry: A systematic literature review approach

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ABSTRACT

Safety culture is a promising solution to reduce mining accidents. However, the systematic review on influencing factors of safety culture in the mining industry is still lacking. The objective of the study is to investigate the influencing factors of safety culture in the mining industry. A systematic literature review (SLR) study by applying the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) review method has identified 33 articles on safety culture in mining from twelve countries: China, USA, India, Sweden, Brazil, Turkey, Kenya, South Africa, Mongolia, Russia, Taiwan, and Ghana. Qualitative studies used four main databases, such as Science Direct, Scopus, Web of Science and SpringerLink databases. Three main themes have been developed; psychological, situational, and behavioural dimensions and produced 17 sub-themes. The study found that the behavioural dimension has the greatest influencing factor in constructing a positive safety culture (47%), followed by the situational dimension (29%) and psychological dimension (24%). Moreover, the management's commitment was the biggest contributor in constructing safety culture in the mining industry. In conclusion, a systematic review study could hopefully increase awareness among mine owners, miners, government, and policymakers in providing better understanding on safety culture to reduce mining accidents in the future.

1. Introduction

The mining industry is well known as one of the riskiest industries in the world (Zhang et al., 2020; Jiang et al., 2020) and has a high potential for the occurrence of accidents or disasters. China is a leading country in the mining sector in the world for their underground coal mining activities and has actively published articles related to coal mine accidents (Chen et al., 2019; Nie et al., 2019; Qin et al., 2019; Xiao et al., 2019; Lin et al., 2019; Lyra, 2019; Cordeiro et al., 2019). Other countries that also reported on mining accidents were Brazil (Lyra, 2019; Cordeiro et al., 2019), United States of America (Düzgün and Leveson, 2018), India (Prasad et al., 2015; Aliabadi et al., 2018, 2019), and Spain (Gil-jiménez et al., 2017; Sanmiquel-pera & Bascompta, 2019). There were sixteen main causes of mining accidents reported by previous researchers; (1) human error (Geng and Saleh et al., 2015; Xiang et al., 2019; Li et al., 2019; Tong et al., 2019), (2) unsafe behaviour (Bonsu et al., 2017; Jiang et al., 2017), (3) unsafe acts (Sanmiquel et al., 2015; Bonsu et al., 2017), (4) lack of safety training (Xiang et al., 2019; Bonsu et al., 2017), (5) lack of safety education (Li et al., 2019; Sanmiquel-pera & Bascompta, 2019; Qiao et al., 2018), (6) inexperienced worker (Qiao et al., 2018; Sanmiquel et al., 2015; Bonsu et al., 2017), (7) poor leadership of supervisor (Liu et al., 2015; Wang et al., 2016; Pons, 2016), (8) organizational deficiency (Pons, 2016; Dash et al., 2016; Aliabadi et al., 2018; Lyra, 2019), (9) mechanical failure (Xiang et al., 2019; Wang & Zhang., 2019; Shao, 2019), (10) geological factor (Wang and Zhang, 2019; Düzgün and Leveson, 2018), (11) poor workplace environment (Düzgün and Leveson, 2018; Bonsu et al., 2017), (12) lack of safety culture (Geng and Saleh, 2015; Düzgün and Leveson, 2018), (13) safety awareness (Wang et al., 2018; Aliabadi et al., 2019; Li et al., 2019), (14) poor safety records (Geng and Saleh, 2015; Düzgün and Leveson, 2018; Spada and Burgherr, 2016), (15) lack of rules and regulations (Liu et al., 2015; Geng and Saleh, 2015; Bonsu et al., 2016; Wang et al., 2018; Düzgün and Leveson, 2018; Qiao et al., 2019; Sanmiquel-pera & Bascompta, 2019), and (16) poor safety management (Li et al., 2019; Xiang et al., 2019).

There are four main phases of safety research in the mining industry (Bloch, 2012). The first phase of safety is safety engineering and the second phase focused on policies, procedures, and safety regulations in the mining industry. Both these phases agreed that 95% of mining accidents and incidents were due to human factors (Bloch, 2012). The conventional accident prevention which focuses on safety engineering

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and human error have shifted to culture based behavioural safety which is the embedment of behavioural safety culture and transformation of safety issues in reducing mining accidents for the next phases. Therefore, the third phase is known as Behaviour-Based Safety (BBS), which strongly focused on human behaviour as something that can be altered to improve safety. At this stage, the concept of safety culture also received attention from various industries around the world as a solution to minimize the potential for large-scale disasters and accidents (Cooper, 2000). The fourth phase is known as Culture Based Behavioural Safety, which is the combination of behaviour safety culture and transformation of safety issues. The key to this phase is not only transforming the corporate culture of a mine, improving safety and production, and building a safe environment, but it also uses worker's cultures as a means of winning hearts and minds in the battle for safe production. Strong relationships are built through engagement at all levels, leading to everything being focused on the best needs of the company and its constituents as a whole (Bloch, 2012).

Recently, most major accidents in mining industries were reported due to poor safety culture (Jiang et al., 2020; Zhang et al., 2020). Many researchers have shifted the conventional accident prevention towards promoting a healthy safety culture in organizations (Stemn et al., 2020; Jiang et al., 2019; Lööw et al., 2019). Safety culture has been recognized as a mechanism or new strategy to reduce large-scale industrial accidents. It focuses on the identification of root causes of the accidents and preventative measures that will be taken to avoid the accidents (Abdelhamid and Everett, 2000; Porkka et al., 2016; Jiang et al., 2020). Moreover, managing the behavioural dimension of safety culture among mining employees is important as part of the preventative mechanism of mining accidents. A positive behaviour of safety culture could lead to safe production and operations in mining, produce a responsible miner, create a safe workplace environment, and minimize mining accidents.

Various safety culture models or theories have been developed, such as Social Learning Theory (Bandura, 1977), Schein's Theory (Schein, 1992), Total Safety Culture or Geller's Theory (Geller, 1994), Reason Safety Culture Model (Reason, 1997), Guldenmund's Three Layered Organisational Culture (Guldenmund, 2000), Reciprocal Safety Culture Model (Cooper, 2000), Reiners Model/P2T Model (Reiners, 2011) and The Egg Aggregated Model (Vierendeels et al., 2018). All these models focused on the psychological (*how people feel)*, situational (*what the organization has)* and behavioural *(what people do)* dimensions as a preventative measure to reduce accidents and to establish a healthy safety culture in organizations, which is applicable to various industries. For example, poor physiological status and bad safety habits are examples of safety attitudes among 27 coal mining enterprises as reported by Jiang et al. (2019). One of the difficulties to implement safety culture is the ignorance on safety among miners (Lööw et al., 2019). To promote good safety culture, safety knowledge must be strengthened first, such as knowledge on production and production equipment, machine handling, safety awareness, knowledge on skills and competencies, and training on self-protection (Miao et al., 2020; Zhang et al., 2020; Jiang et al., 2020; Wang and Wu, 2019). Moreover, to foster safety culture, it is important for the mine owner to provide a safer working environment to mine workers (Jiang et al., 2020; Rubin et al., 2020).

Despite having various safety culture models or theories mentioning the importance of psychological (people/person), situational (environment) and behavioural dimensions to build a healthy safety culture in the organization, there is scarce systematic literature review (SLR) conducted to understand the influencing factors of safety culture in the mining industry. The main research question guiding this systematic review is what are the influencing factors of safety culture studies that have been conducted in the mining industry? Therefore, the objective of the study is to investigate the influencing factors on psychological, situational, and behavioural dimensions of safety culture in the mining industry.

2. Methodology

The systematic literature review (SLR) aims to locate, search, and synthesize literature systematically related to previous studies or research in a well-organized and transparent process, using replicable procedures throughout each step. Systematic reviews can also be called Meta-narrative reviews or mixed studies reviews. (Wong et al., 2013). According to systematic literature review refers to identify, evaluate and interpret all available research relevant to a specific research question, topic area or phenomenon of interest by using a replicable and detailed methodology (Kitchenham, 2004; Cook et al., 1995). Moreover, identifying the known and unknown is a time-consuming process. That is the critical reason why the systematic literature reviews should be conducted with predefined and transparent methodological steps. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) was used in this study to establish the systematic literature review (SLR) on safety culture in mining industries. PRISMA is a very well-known method to conduct SLR in various fields of research, such as in safety research (Adaku et al., 2021; Nyoni et al., 2019), social sciences (Shaffril et al., 2019), healthcare (Danielli et al., 2021; Vásquez-Cárdenas et al., 2019) and business (Cubric et al., 2020). Four main steps for PRISMA include identification, screening, eligibility and data abstraction and analysis.

2.1. Identification

The first step in the systematic review process is identification, which is the identification process that was performed in December 2020. In this stage, research questions and research objectives were clearly identified. Four leading indexed databases were used for this review; ScienceDirect, Scopus, Web of Science and SpringerLink. These four indexed databases were chosen because of their established indexing systems for citations and to ensure the quality of the articles reviewed in this paper. The research published in peer-reviewed journals also have good reputation and representation of the scholarly research in the particular field of study. By using keywords and search strings of "safety culture" and "mining", this process yielded a result of 850 articles from Science Direct, 1210 articles from Scopus databases, 210 articles from Web of Science (WoS) and 1730 from Springer Link databases.

2.2. Screening

The second step is the screening process that includes or excludes articles according to criteria determined by the authors with the assistance of the specific databases. In the screening process, eligibility, inclusion, and exclusion criteria were determined to find suitable articles to be included in the systematic review process as shown in Table 1. After the identification process, there were 4000 articles to be screened. The results presented 99 articles after the screening stage that selected articles published from January 2016 to December 2020 and focused on safety culture in the mining industry only. The journals that included systematic reviews or review papers, conference papers, proceedings, chapters in books, book series, and books were excluded. The purpose is to focus on the real research on safety culture at real mining sites or

Table 1
The criteria for inclusion and exclusion.

Criteria	Inclusion	Exclusion
Publication timeline	January 2016–December 2020	2015 and before
Document type	Journal (research articles)	Journals (systematic review), review paper, conference proceeding, chapters in book, book series, books
Type of industry	Safety culture in mining industry only	Exclude safety culture other than mining
Language	English	Non-English

companies.

2.3. Eligibility

The third step is the eligibility process where the articles were included or excluded based on authors' specific criteria. There were 29 similar articles that were excluded in both databases for the next phase, which left 70 documents for the eligibility process. This is screened manually for literature focusing on mining accidents and criteria from the earlier screening processes (inclusion and exclusion criteria). The review managed to obtain 33 selected articles related to safety culture in the mining industry.

2.4. Data abstraction and analysis

The final step is data abstraction and analysis. The remaining articles were evaluated, reviewed, and analysed and 33 selected articles (studies) were discussed in detail in this paper as tabulated in Table 2. The reviews were based on specific studies that matched the research questions and objectives of the study. The studies were then extracted to identify relevant themes and sub-themes for the current study by reading the title, then the abstracts, and then throughout the full text of the articles. The summary of the SLR process is shown in Fig. 1.

In order to identify themes related to influencing factors of safety cultures, a thematic analysis was carried out. The main issues, similarities and differences highlighted and portrayed in the 33 articles were identified and categorized. To construct themes in this SLR study, six steps were followed in the thematic analysis and were suitable for the qualitative analysis, as proposed by Nowell et al. (2017). The steps include:

1) Familiarization with the data (understand and analyze the 33 articles),
2) Generating initial code (identify the similarities and differences of the issues discussed in the 33 articles),
3) Creation of themes (create or identify suitable themes to construct, based on the identified similarities and differences in the 33 articles)
4) Reviewing themes (ensure the proposed themes and subthemes are within the main context of each article)
5) Defining and naming themes (three main themes and 17 subthemes were created in this study based on the 33 articles)
6) Producing a report (in this case, this refers to the SLR study)

Table 2
SLR results based on year, country, number of published articles, title of journal and rankings.

Year	Country	No of published articles	Title of Journal	Journal Impact Quartile
2020	China	6	Process Safety and Environmental Protection	Q1
			Safety Science	Q1
			Resources Policy	Q1
			Safety and Health at Work	Q2
	USA	1	Journal of Safety Research	Q1
	Ghana	1	Safety Science	Q1
	India	1	Engineering Failure Analysis	Q1
	Kenya	1	Safety and Health at Work	Q2
2019	China	7	Resources Policy	Q1
			Safety Science	Q1
			Progress in Nuclear Energy	Q2
			Processes	Q2
			International Journal of Environmental Research and Public Health	Q1
	Kenya	1	Safety Science	Q1
	Sweden	1	Resources Policy	Q1
2018	China	1	Safety Science	Q1
	South Africa	1	Journal of the Southern African Institute of Mining and Metallurgy	Q4
	Turkey	1	Safety Science	Q1
2017	China	3	Safety Science	Q1
			Petroleum Science	Q1
			Sustainability	Q2
	Russia	1	Ecology, Environment and Conservation	Q2
	USA	1	International Journal of Mining Science and Technology	Q1
	Brazil	1	Gestao& Producao (Management and Operations Review)	Q3
	Taiwan	1	Sustainability	Q2
2016	China	2	Accident Analysis and Prevention	Q1
			International Journal of Environmental Research and Public Health	Q1
	Mongolia	1	Journal of Cleaner Production	Q1
	India	1	International Journal of Disaster Risk Reduction	Q2

3. Results

The review managed to obtain 33 selected articles from 12 countries, which are China, India, USA, Ghana, Mongolia, Russia, Taiwan, Turkey, Brazil, Kenya and South Africa and Sweden that reported on safety culture in the mining industry. Regarding the type of mine, 28 studies reported on safety culture in coal mines from China, India, USA, Ghana, Mongolia, Russia, Taiwan, Turkey, and Brazil. Three studies reported on gold mines in Kenya and South Africa and others were reported in USA and Sweden. Table 2 shows the number of published articles in safety culture in the mining industry from twelve countries for year 2016 until 2020. Overall, China was the leading country in publishing articles 5 years back with 19 articles, USA (2 articles), Kenya (2 articles), India (2 articles) and followed by 1 article each from Ghana, Mongolia, Russia, Taiwan, Turkey, Brazil, South Africa, and Sweden. Furthermore, 15 articles were fully quantitative, 9 articles were qualitative articles and 9 articles were a mix of both qualitative and quantitative articles. Table 2 shows the SLR results based on year, country, number of published articles, title of journal and rankings. The details for each article on the SLR study are shown in Table 3. Most of the articles obtained in the SLR study using the PRISMA approach have an excellent reputation in the Journal Impact Quartile, as shown in Table 2.

By applying thematic analysis, three main themes and 17 sub-themes were created. The theme of psychological, situational, and behavioural dimensions is also by referring to the established safety culture models, such as Social Learning Theory (Bandura, 1977), Schein's Theory (Schein, 1992), Total Safety Culture or Geller's Theory (Geller, 1994), Reason Safety Culture Model (Reason, 1997), Guldenmund's Three Layered Organisational Culture (Guldenmund, 2000), and Reciprocal Safety Culture Model (Cooper, 2000). All these models stressed on the importance of psychological, situational, and behavioural dimensions to establish good safety culture. The number of articles related to each dimension and the details for each dimension are summarized in Fig. 2 and Table 3, respectively. Based on the SLR, 47% reported on the behavioural dimension, followed by 29% on the situational dimension and 24% on the psychological dimension of safety culture in the mining industry. Management's commitment is the most influencing factor of safety culture in the mining industry (n = 30), followed by safety training (n = 24), and safety knowledge (n = 23). The least influencing factor on the formation of safety culture in the mining industry is peer influence (n = 2). Poor safety culture led to the mining accidents as summarized in Fig. 2.

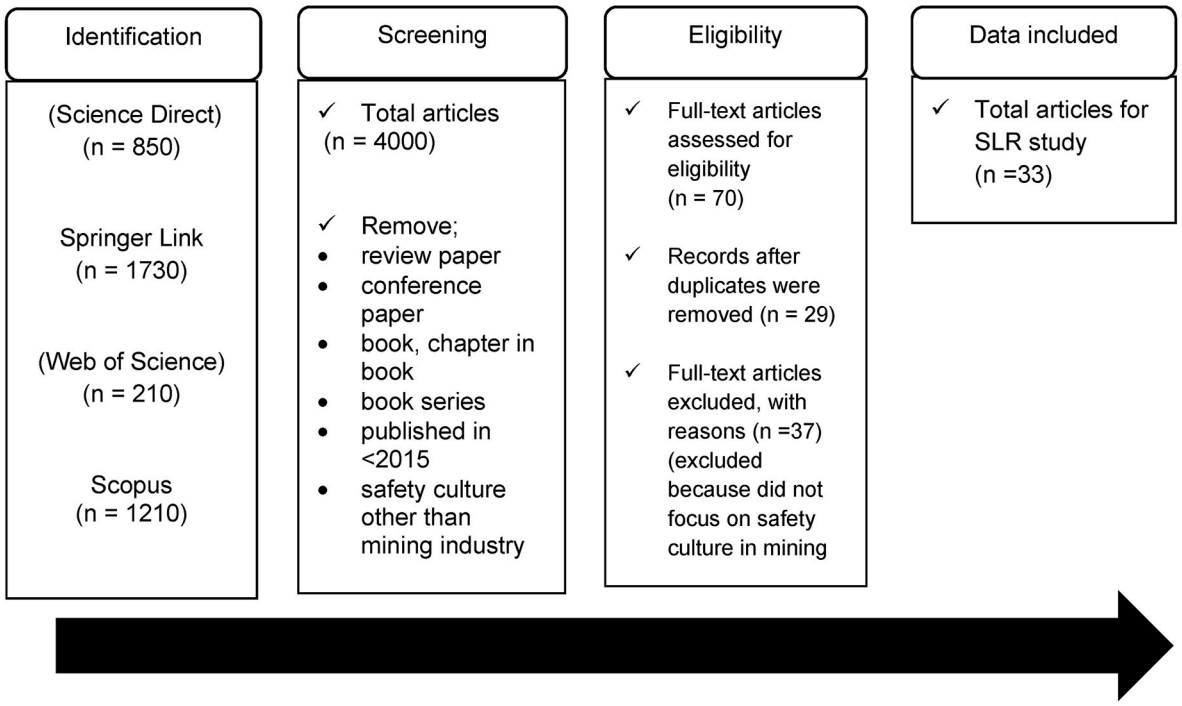

Fig. 1. The steps of PRISMA for SLR studies (Adapted from Moher et al., 2009; Shaffril et al., 2019).

4. Discussion

The main objective of the current study is to conduct a systematic review and investigate the influencing factors of psychological, situational, and behavioural dimensions of safety culture in the mining industry. The main reason for understanding the safety culture is to prevent the occurrence of mining accidents. The current review identified 33 studies that served the significant influencing factors for psychological, situational, and behavioural dimensions of safety culture in the mining industry.

4.1. Psychological dimension for safety culture

Safety attitude, peer influence, safety knowledge and perception of risk were identified as the influencing factors of the psychological dimension for safety culture in the mining industry. Safety attitude refers to psychological perception towards safe culture, procedures and accident prevention (Hu et al., 2011; Wang et al., 2018). The problem of poor safety culture in the mining industry was due to low education background. It contributes to poor safety attitudes, poor safety knowledge, giving bad influence on peers and having low perception on the risk or potential hazards. Safety knowledge on the production process, production equipment, machine handling, safety awareness, knowledge on skills and competencies, self-protection training is among the knowledge required in the mining industry because it is important to ensure mine workers have enough confidence and proper knowledge in dealing with any potential accidents, risks or hazards at mine sites. This is supported by Wu et al. (2017). He investigated 725 coal miners and concluded that 84% of miners have low education background that led to fatalist attitude and low self-motivation among miners. Zhang et al. (2020) also mentioned that ignored safety laws and regulations are the examples of bad safety attitudes among miners.

4.2. Situational dimension of safety culture

Situational dimension refers to the working environment of the mine itself as a response to safety culture in the mining industry. Safety environment, safety rules, accident and incident reporting, and job satisfaction are the influencing factors of situational dimension that is required to build a safety culture in the mining industry. A safe environment or working place is important to ensure the mine workers have high motivation in performing their job and fostering good safety culture environment. For example, miners tend to ignore the safety rules in mine sites due to a bad safety environment. Poor safety regulations and systems for mine production, poor management and supervision, ignorance on safety rules are the potential contributors to mining disasters (Ajith et al., 2019). Rubin et al. (2020) revealed that some miners did not report some accidents and near misses because of the flaws in the confidentiality. He also mentioned the poor safety norms at mine sites, which is a high tendency to break the safety rules. They felt that they will be penalised if they report on their accidents.

Moreover, Zhang et al. (2020) mentioned on safety rule breaches among miners, such as imperfect emergency management system, failure to follow safety production system, unauthorized risk-taking operation and use of equipment. The contributing factor on the ignorance on safety rules was due to a lack of knowledge on safety itself and it will lead to mining disasters. Moreover, the unsupportive environment in the mining industry should be overcome because it also can contribute to job dissatisfaction and give bad impact on the mine worker's productivity. There are a lot of safety environment issues related to the mining industries and are summarized in Table 4.

Based on Table 4, mining organizations and mine workers must work together to create a safe working environment. The safety rules need to be regularly updated and safety information must be disseminated to all various levels of mine workers in an efficient way through communication channels, such as safety meetings, safety week, and safety signage. The leadership of a supervisor is also important in order to monitor and supervise all the mine workers and ensure they follow the safety regulations properly so that the safety culture becomes their working lifestyle and practice.

4.3. Behavioural dimension of safety culture

Management's commitment, safety commitment, ownership of

Table 3
SLR results on safety culture in the mining industry in 2016 until 2020.

Authors	Type of study	Type of mine	Country	Psychological Dimension				Situational Dimension					Behavioural Dimension							
				SA	PI	SK	PR	SR	AI	RE	WE	JS	MC	SC	OS	ST	CO	RR	SI	WA
Yorio et al. (2020)	QN	24,910 mines	USA						/	/			/			/	/			
Miao et al. (2020)	MM	coal mine	China			/			/		/					/				/
Stemn et al. (2020)	QN	coal mine	Ghana	/				/	/	/			/	/	/	/	/			
Zhang et al. (2020)	MM	coal mine	China	/		/		/			/		/	/	/	/	/		/	/
Fu et al. (2020)	QN	coal mine	China	/		/		/	/	/	/		/	/		/				/
Rubin et al. (2020)	QN	coal mine	China	/	/	/	/	/	/	/	/	/	/			/	/	/		
Jiang et al. (2020)	QN	coal mine	China		/	/		/	/		/		/	/	/	/		/	/	
Bhattacharjee et al. (2020)	QL	coal mine	India			/	/	/	/		/		/	/		/	/			/
Liu et al. (2020)	QL	coal mine	China			/	/						/	/						
Ajith et al. (2020)	QN	gold mine	Kenya			/							/		/	/				
(Ajith et al., 2019)	QN	gold mine	Kenya					/			/	/	/							
Tong et al. (2019)	MM	coal mine	China	/		/					/	/	/	/		/	/			/
Cao et al. (2019)	MM	coal mine	China			/	/	/	/		/		/	/		/	/			
(Wang and Wu, 2019)	MM	coal mine	China	/		/					/		/	/		/	/			
Fu et al. (2019)	MM	coal mine	China	/		/		/			/	/	/	/	/	/		/		
Yu et al. (2019)	MM	coal mine	China	/		/					/		/			/	/			/
Jiang et al. (2019)	QN	coal mine	China	/		/							/	/	/					
(Lööw et al., 2019)	QL	Not mentioned	Sweden	/		/					/		/	/		/			/	/
Qiao et al. (2019)	QL	coal mine	China						/	/			/			/	/			/
Hussain et al. (2018)	QN	gold mine	South Africa.			/				/						/	/			/
Wang et al. (2018)	MM	coal mine	China	/		/		/			/	/	/	/	/	/	/	/		/
(Düzgün et al., 2018)	QL	coal mine	Turkey			/	/			/	/		/			/	/			
(Nikulin et al., 2017)	QL	coal mine	Rusia				/				/	/	/	/			/		/	
Wu et al. (2017)	MM	coal mine	China	/			/		/		/	/	/	/	/					
Zhang et al. (2017)	QN	coal mine	China			/	/	/					/	/		/				/
Komljenovic et al. (2017)	QL	coal mine	USA								/		/	/		/				
Vassem et al. (2017)	QN	coal mine	Brazil			/							/	/			/			
Yeh (2017)	QN	Not mentioned	Taiwan						/		/					/				
Fu et al. (2017)	QL	coal mine	China			/		/					/							/
Smith et al. (2016)	QN	coal mine	Mongolia					/			/		/							
Dash et al. (2016)	QN	coal mine	India	/		/				/			/	/			/	/		
Zhang et al. (2016a)	QN	coal mine	China	/		/		/			/		/			/	/			/
Zhang et al. (2016b)	QN	coal mine	China					/			/		/	/	/	/	/		/	

Psychological Dimension	Situational Dimension	Behavioural Dimension	Type of Study
SA= Safety Attitude	SR=Safety rules	MC = Management commitment	QL = qualitative study
PI= Peer influence	AI = Accident and incident	SC= Safety commitment	QN = quantitative study
SK= Safety Knowledge	RE = Reporting	OS = Ownership of Safety	MM = mixed mode study
PR = Perception of Risk	WE = Working Environment	ST= Safety Training	
	JS = Job Satisfaction	CO= Safety communication	
		RR = Reward and recognition	
		SI= Safety investment	
		WC= Worker's competencies	

safety, safety training, safety communication, reward and recognition, safety investment, worker's competencies were the influencing factors of behavioural dimensions that contribute to the formation of safety culture in the mining industry based on SLR findings. The mining management must put safety concerns as the priority to ensure all the safety issues can be managed and solved properly. For example, Yorio et al. (2020) analysed 24,910 mines in USA and revealed 469 accidents and fatality occurred due to weaknesses of organizational safety and management's commitments towards handling safety issues among mine workers. Zhang et al. (2020) revealed that the poor safety culture reflects the weaknesses of the management's commitment to safety issues. Moreover, good leadership and coordination ability is the key element for the management to construct good safety culture (Düzgün et al., 2018).

According to Grote (2018) and Porkka (2016), safety culture should play an important role in high level decisions, such as work planning, individual job scopes as well as in resource and budget planning. The importance of an organizational structure and safety culture was discussed by Schulman et al. (2020). Managing occupational health and safety in the mining industry is crucial to reduce mining accidents as reported by Jiang et al. (2020). Another study by Stemn et al. (2019) showed the importance of the relationship between safety culture maturity and safety performance of the mining industry to reduce accidents at the mine sites. Therefore, it is beneficial to mining companies if safety culture becomes their main priority in preventing mining accidents.

Safety investment which refers to the investments on employees, facilities technologies and tools, communication channels and platforms related to production safety are also one of the responsibilities of the management to ensure a safe working environment is provided to their employees. A good working environment can stimulate and motivate the mine workers to work in a safe manner and abide the rules. Moreover,

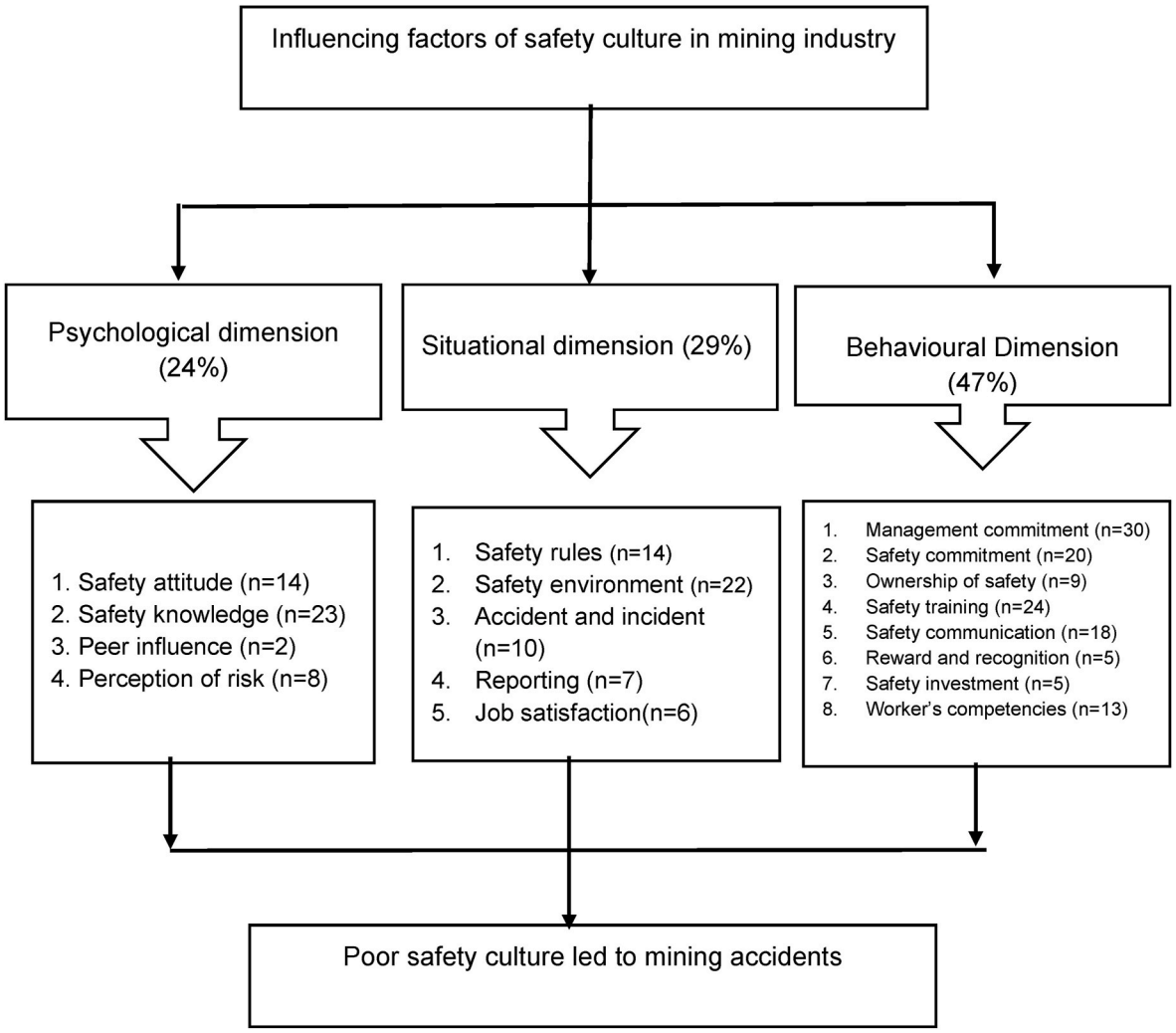

Fig. 2. Summary of safety culture dimensions based on SLR results (n refers to number of articles).

the reward and safety incentives can be awarded to the mine workers that show high commitment in implementing and practicing a safe working attitude. Therefore, a good atmosphere of safety culture can be built more easily and will be followed by other mine co-workers. Furthermore, the mining management should provide safety training and competency courses to the mine workers to educate them about safety issues and enhance worker's skills. Good safety training and safety education will increase safety awareness among miners and the safety culture can be formed easily. A study conducted by Zhang et al. (2020) on coal mines in China revealed that 80.6% of mine workers has poor educational background, lack of systematic job training and inappropriate training contents that led to the deficiencies in safety culture. In contrast, skilful and high competence of mine workers are important to ensure a sustainable mine operation as well as for human capital development. Therefore, competent miners should be created so that production will run in a safe and good working condition. Moreover, low level of education and poor vocational skills also contribute to low competency in workers and led to major mine accidents in China (Zhang et al., 2020; Lööw et al., 2019).

Good communication channels or platforms must be strengthened to form a good safety culture in the mining industry because it will lead to a mutual understanding between mine workers and the organization, and the information can be disseminated in an effective way. Safety communication was agreed by previous researchers to be the main criteria to build a safety culture in the mining industry. Most of the common safety communication issues raised in the mining industry are summarized in Table 5.

To overcome all these issues, the management should play an important role to ensure all the information can be received and understood by various levels of mine workers. For example, most of the mining sites are in the remote areas and have disruption in internet connectivity; therefore, the dissemination of safety information through email is not promising. One way to overcome it is by having safety signage, safety corner or short briefings every day or regular meetings and safety briefings to ensure all the information can be directly received by the mine workers. Conducting a safety survey is also one of the efforts that can be done to improve the safety rules and regulations, identify and record any potential hazards, near misses, and unsafe behaviour of mine workers. All these efforts directly contributed to the formation of a good safety culture in mining and minimizing the occurrence of mining accidents.

5. *Limitations, implications and recommendations for future research*

While this SLR was conducted in a disciplined manner, some limitations exist. The search process was limited to indexed journals that the author could access through a university library system and were peer-reviewed in the English language. For that reason, this SLR cannot claim to cover non-indexed journals since they were ineligible against the predefined inclusion criteria. With the broad interest in safety culture, there are possibly more empirical studies carried out in other languages that can confirm, clarify or dispute the findings of the current SLR.

Table 4
Safety environment issues on situational safety culture.

Country/Type of mine	Key findings related to safety environment	Reference
China/Coal mine	• optimize safety funds investment structure • increase the proportion of safety equipment allocation funds • introduce advanced technology and safety facilities	Miao et al. (2020)
	• imperfect work conditions.	Zhang et al. (2020)
	• the adequacy of the number of workers at the mine site	Rubin et al. (2020)
	• work team pressure	
	• satisfaction on facilities	Jiang et al. (2020)
	• Poor working conditions	(Wang and Wu, 2019)
	• Satisfaction of facilities	Fu et al. (2019)
	• Poor physical environment at workplace	Yu et al. (2019)
	• Poor physical environment at workplace	Wang et al. (2018)
	• Poor physical environment at workplace	Wu et al. (2017)
	• Lack of responsibility system of safety production	Zhang et al. (2016a)
Turkey/Coal mine	• Ventilation problems • Insufficient personal safety equipment	(Düzgün et al., 2018)
	• Ventilation problems • Stress due to increased production • Insufficient personal safety equipment • Subcontracting the mining operations • Insufficient precautions for methane explosion • Unsatisfactory support systems • Inadequate escape routes • Inadequate mine monitoring systems Problems related to search and rescue	
Russia/Coal mine	• maintaining workplace safety	(Nikulin et al., 2017)
USA/Coal mine	• Poor working area	Komljenovic et al. (2017)
Mongolia/ Coal mine	• the negative impacts of temporary living arrangements including crowded living spaces, • unsanitary conditions • lack of facilities services • social conflicts among miners and between miners and surrounding communities, mining companies, and authorities	Smith et al. (2016)
Kenya/Gold mine	• Poor working conditions	(Ajith et al., 2019)
Sweden/ Others	• Lack of safety at workplace • Poor physical work environment • Psychosocial work environment	(Lööw et al., 2019)

Table 5
Safety communication issues.

Country/type of mine	Safety communication issues	References
China/coal mine	i. Missing report, poor system of hazard reports, poor accident early warning report, flaws in emergency process, and production site issue report and feedback, failure to perform safety duties and safety work, failure to abide by safety management system and operation rules ii. Required safety communication through HSE meetings iii. Poor participation in safety-related meeting or activity, poor safety report and poor safety advice iv. Poor safety information communication and communication procedures. v. Lack of coordination among workers vi. Required clarity and accessibility of safety systems vii. Promote the transformation and restructuring of coal enterprises for ease communication viii. The problem on channeling the information ix. Lack of communication through e-mail, forum, work report and communication corner.	Zhang et al. (2020) (Stemn et al., 2020) (Wang and Wu, 2019) (Yu et al., 2019) (Zhang et al., 2016a) Rubin et al. (2020) (Zhang et al., 2016b) (Hussain et al., 2018) (Wang et al., 2018)
Turkey/coal mine	i. Proper adequate communication system and coordination between the various decision makers in the mine, ii. Develop codes and standards for safe mining practice. iii. Provide a channel for coordination and communication for emergencies.	(Düzgün et al., 2018)
Russia/coal mine	i. Required a feedback channel between employees and company management	(Nikulin et al., 2017)
Brazil/coal mine	ii. Poor information channels	Vassem et al. (2017)
India/coal mine	i. Poor in engineering, design and maintenance, ii. Failure to heed warning signs iii. Poor in risk assessment iv. Poor in management systems v. Poor in system auditing, economic/reward pressures compromising safety vi. Failures in regulatory oversight vii. Ignored worker/supervisor's instructions viii. Lack of management communication and trust ix. Poor in emergency and rescue procedures	Dash et al. (2016)

Moreover, the methods and findings of the studies were supported by an assessment procedure to increase the accuracy level of the evaluation phase. Nevertheless, the attempt to aggregate results of both qualitative and quantitative data analyses (featured in only two studies) may have limited the ability to adequately examine all methodological concerns when integrating the results. This study has a good implication for the development of guidelines, policies or practices by referring to the influencing factors of safety cultures that were highlighted in this study. Practically speaking, mine managers, mine owners and safety practitioners may find this study useful to understand the factors that contribute to the formation of safety culture in the mining industry and help them build it in a guided way. The findings from the study are also helpful in identifying the weaknesses that may hinder the formation of safety culture in their mine site towards creating a safe working environment as well as preventing mining accidents in the future. This review offers several recommendations for future studies. Various databases or search engines can be used to expand the knowledge of the existing study on safety culture in the mining industry, such as using Google Scholar. Moreover, it is recommended to use various searching techniques, such as contacting experts, citation tracking, reference searching, and snowballing, to support the existing techniques applied on the SLR safety culture study.

6. Conclusion

The SLR on the influencing factors for psychological, situational, and behavioural dimensions of safety culture issues in the mining industries for year 2016 to 2020 have been successfully developed. Thirty-three selected articles have systematic reviews from ScienceDirect, Scopus, Web of Science and SpringerLink databases using the PRISMA approach. The study found that the behavioural dimension has the greatest influencing factor in constructing a positive safety culture (47%), followed by situational dimension (29%) and psychological dimension (24%). Management's commitment was the biggest contributing factor to the formation of safety culture and must be strengthened to ensure it can be executed smoothly. This systematic review study could hopefully encourage mine owners in providing better understandings and emphasis on the issues related to safety culture and make sense to relevant miners, government, and policymakers in reducing mining

accidents in the future.

Credit author statement

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References

Abdelhamid, T.S., Everett, J.G., 2000. Identifying root causes of construction accidents. J. Construct. Eng. Manag. 126 (1), 52–60.

Adaku, E., Ankrah, N.A., Ndekugri, I.E., 2021. Design for occupational safety and health: a theoretical framework for organisational capability. Saf. Sci. 133 (September 2020), 105005. https://doi.org/10.1016/j.ssci.2020.105005.

Ajith, M.M., Ghosh, A.K., 2019. Comparison of parameters for likelihood and severities of injuries in artisanal and small-scale mining (ASM). Saf. Sci. 118 (April), 212–220. https://doi.org/10.1016/j.ssci.2019.04.010.

Ajith, M.M., Ghosh, A.K., Jansz, J., 2020. Risk factors for the number of sustained injuries in artisanal and small-scale mining operation. Safety and Health at Work 11 (1), 50–60. https://doi.org/10.1016/j.shaw.2020.01.001.

Aliabadi, M.M., Aghaei, H., Kalatpour, O., Soltanian, A.R., Seyedtabib, M., 2018. Effects of human and organizational deficiencies on workers' safety behavior at a mining site in Iran. 1–9. Epidemiology and Health 40, 9. https://doi.org/10.4178/epih.e2018019. Article ID: e2018019.

Aliabadi, M.M., Aghaei, H., Kalatpuor, O., Soltanian, A.R., Nikravesh, A., 2019. Analysis of the severity of occupational injuries in the mining industry using a Bayesian network. 1–7. Epidemiology and Health 41, 7. https://doi.org/10.4178/epih.e2019017. Article ID: e2019017.

Bandura, A., 1977. Social Learning Theory. Prentice-Hall.

Bhattacharjee, R.M., Dash, A.K., Paul, P.S., 2020. A root cause failure analysis of coal dust explosion disaster – gaps and lessons learnt. Eng. Fail. Anal. 111 (October 2019), 104229. https://doi.org/10.1016/j.engfailanal.2019.104229.

Bloch, L., 2012. The 4th Wave: culture-based behavioural safety. The Southern African Institute of Mining and Metallurgy Platinum 2012 163–176.

Bonsu, J., Dyk, W. Van, Franzidis, J., Petersen, F., Isafiade, A., 2016. A systems approach to mining safety: an application of the Swiss Cheese Model. 777–784. J. S. Afr. Inst. Min. Metall 16. https://doi.org/10.17159/2411-9717/2016/v116n8a10.

Bonsu, J., Dyk, W. Van, Franzidis, J., Petersen, F., Isafiade, A., 2017. A Systemic Study of Mining Accident Causality: an Analysis of 91 Mining Accidents from a Platinum Mine in South Africa, pp. 59–66.

Cao, Q., Yu, K., Zhou, L., Wang, L., Li, C., 2019. In-depth research on qualitative simulation of coal miners' group safety behaviors. Saf. Sci. 113 (November 2018), 210–232. https://doi.org/10.1016/j.ssci.2018.11.012.

Chen, Z., Qiao, G., Zeng, J., 2019. Study on the relationship between worker states and unsafe behaviours in coal mine accidents based on a Bayesian networks model. Sustainability 11 (18). https://doi.org/10.3390/su11185021.

Cook, D.J., Sackett, D.I., Spitzer, W.O., 1995. Methodological guidelines for systematic reviews of randomized control trials in health care from the postdam consultation on meta-analyisis. J. Clin. Epidemology 48, 167–171.

Cooper, M.D., 2000. Towards a model of safety culture. Saf. Sci. 36, 111–136.

Cordeiro, M.C., Garcia, G.D., Rocha, A.M., Tschoeke, D.A., Campeão, M.E., Appolinario, L.R., Soares, A.C., Leomil, L., Froes, A., Bahiense, L., Rezende, C.E., de Almeida, M.G., Rangel, T.P., De Oliveira, B.C.V., de Almeida, D.Q.R., Thompson, M. C., Thompson, C.C., Thompson, F.L., 2019. Insights on the freshwater microbiomes metabolic changes associated with the world's largest mining disaster. Sci. Total Environ. 654, 1209–1217. https://doi.org/10.1016/j.scitotenv.2018.11.112.

Cubric, M., 2020. Drivers, barriers and social considerations for AI adoption in business and management: a tertiary study. Technol. Soc. 62 (April), 101257. https://doi.org/10.1016/j.techsoc.2020.101257.

Danielli, S., Coffey, T., Ashrafian, H., Darzi, A., 2021. Systematic review into city interventions to address obesity. EClinicalMedicine 32. https://doi.org/10.1016/j.eclinm.2020.100710.

Dash, A.K., Bhattacharjee, R.M., Paul, P.S., 2016. Lessons learnt from Indian inundation disasters: an analysis of case studies. International Journal of Disaster Risk Reduction 20 (May), 93–102. https://doi.org/10.1016/j.ijdrr.2016.10.013.

Düzgün, H.S., Leveson, N., 2018. Analysis of soma mine disaster using causal analysis based on systems theory (CAST). Saf. Sci. 110 (December), 37–57. https://doi.org/10.1016/j.ssci.2018.07.028.

Fu, G., Cao, J.L., Zhou, L., Xiang, Y.C., 2017. Comparative study of HFACS and the 24Model accident causation models. Petrol. Sci. 14 (3), 570–578. https://doi.org/10.1007/s12182-017-0171-4.

Fu, G., Zhao, Z., Hao, C., Wu, Q., 2019a. The accident path of coal mine gas explosion based on 24Model: a case study of the Ruizhiyuan Gas explosion accident. Processes 7 (2). https://doi.org/10.3390/pr7020073.

Fu, Gui, Zhao, Ziqi, Hao, Chuanbo, Wu, Qiang, 2019b. The accident path of coal mine gas explosion based on 24Model: a case study of the ruizhiyuan gas explosion accident. Processes 2019, 7, 73. https://doi:10.3390/pr7020073.

Fu, G., Xie, X., Jia, Q., Tong, W., Ge, Y., 2020. Accidents analysis and prevention of coal and gas outburst: understanding human errors in accidents. Process Saf. Environ. Protect. 134, 1–23. https://doi.org/10.1016/j.psep.2019.11.026.

Geller, E.S., 1994. Ten principles for achieving a total safety culture. Prof. Saf. 39 (9), 18–24.

Geng, F., Saleh, J.H., 2015. Challenging the emerging narrative: critical examination of coalmining safety in China, and recommendations for tackling mining hazards. Saf. Sci. 75, 36–48. https://doi.org/10.1016/j.ssci.2015.01.007.

Gil-jiménez, E., Manzano, J., Casado, E., Ferrer, M., 2017. Science of the Total Environment the role of density-dependence regulation in the misleading effect of the Aznalcollar mining spill on the booted eagle fecundity. Sci. Total Environ. 583, 440–446. https://doi.org/10.1016/j.scitotenv.2017.01.098.

Grote, G., 2018. On the importance of culture for safety. In: Gilbert, C. (Ed.), Safety Cultures, Safety Models. Springer Briefs in Safety Management. https://doi.org/10.1007/978-3-319-95129-4_9.

Guldenmund, F., 2000. The nature of safety culture: a review of theory and research. Saf. Sci. 34 (1–3), 215–257. https://doi.org/10.1016/S0925-7535(00)00014-X.

Hu, K., Rahmandad, H., Smith-Jackson, T., Winchester, W., 2011. Factors influencing the risk of falls in the constructionindustry: a review of the evidence. Construct. Manag. Econ. 29 (4), 397–416. https://doi.org/10.1080/01446193.2011.558104.

Hussain, I., Cawood, F.T., Ali, S., 2018. Towards safer mining: scientific measurement approaches that could be applied for imaging and locating the buried container lamp-room at lily mine. J. S. Afr. Inst. Min. Metall 118 (2), 185–192. https://doi.org/10.17159/2411-9717/2018/v118n2a12.

Jiang, W., Zhu, Z.M., Xiang, Y.C., 2017. Study on the unsafe acts and education function in coal mine accidents caused by rescue. 8223(11), 6203–6209. EURASIA Journal of Mathematics Science and Technology Education ISSN 1305–8223 (9), 6203–6209. https://doi.org/10.12973/eurasia.2017.01059a (online) 1305-8215 (print) 2017 13.

Jiang, W., Liang, C., Han, W., 2019. Relevance proof of safety culture in coal mine industry. Int. J. Environ. Res. Publ. Health 16 (5), 4–8. https://doi.org/10.3390/ijerph16050835.

Jiang, W., Fu, G., Liang, C. yang, Han, W., 2020. Study on quantitative measurement result of safety culture. Saf. Sci. 128 (11), 104751. https://doi.org/10.1016/j.ssci.2020.104751.

Kitchenham, B., 2004. Procedures for Performing Systematic Reviews. Jt. Tech. Report. Keele Univ.

Komljenovic, D., Loiselle, G., Kumral, M., 2017. Organization: a new focus on mine safety improvement in a complex operational and business environment. International Journal of Mining Science and Technology 27 (4), 617–625. https://doi.org/10.1016/j.ijmst.2017.05.006.

Li, Y., Wu, X., Luo, X., Gao, J., Yin, W., 2019. Impact of safety attitude on the safety behavior of coal miners in China. Sustainability 11 (22), 1–21. https://doi.org/10.3390/su11226382.

Lin, B., Wei, X., Junjie, Z., 2019. Computers and Geosciences Automatic recognition and classification of multi-channel microseismic waveform based on DCNN and SVM. Comput. Geosci. 123 (August 2018), 111–120. https://doi.org/10.1016/j.cageo.2018.10.008.

Liu, D., Xiao, X., Li, H., Wang, W., 2015. Historical evolution and benefit – cost explanation of periodical fluctuation in coal mine safety supervision. An evolutionary game analysis framework. Eur. J. Oper. Res. 243 (3), 974–984. https://doi.org/10.1016/j.ejor.2014.12.046.

Liu, Q., Dou, F., Meng, X., 2020. Building Risk Precontrol Management Systems for Safety in China's Underground Coal Mines. Resources Policy, February, p. 101631. https://doi.org/10.1016/j.resourpol.2020.101631.

Lööw, J., Nygren, M., 2019. Initiatives for increased safety in the Swedish mining industry: studying 30 years of improved accident rates. Saf. Sci. 117 (April), 437–446. https://doi.org/10.1016/j.ssci.2019.04.043.

Lyra, M.G., 2019. The extractive industries and society challenging extractivism : activism over the aftermath of the fundão disaster. The Extractive Industries and Society 6 (3), 897–905. https://doi.org/10.1016/j.exis.2019.05.010.

Miao, C., lin Duan, M., meng, Sun, xiu, X., Wu, X. yu, 2020. Safety management efficiency of China's coal enterprises and its influencing factors—based on the DEA-Tobit two-stage model. Process Saf. Environ. Protect. 140, 79–85. https://doi.org/10.1016/j.psep.2020.04.020.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The Prisma Group, 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 6 (7), e1000097 https://doi.org/10.1371/journal.pmed1000097.

Nie, X.X., Bai, C., Zhang, J., 2019. Simulation research on the effectiveness of a multiagent mine safety supervision system and its verification. 2019. Math. Probl Eng. ume 2019, 18. https://doi.org/10.1155/2019/8457124. Article ID 8457124.

Nikulin, A., Nikulina, A.Y., 2017. Assessment of occupational health and safety effectiveness at a mining company. Ecol. Environ. Conserv. 23 (1), 351–355.

Nowell, L.S., Norris, J.M., White, D.E., Moules, N.J., 2017. Thematic analysis: striving to meet the trustworthiness criteria. Int. J. Qual. Methods 16 (1), 1–13. https://doi.org/10.1177/1609406917733847.

Nyoni, W., Pillay, M., Rubin, M., Jefferies, M., 2019. Organizational factors, residual risk management and accident causation in the mining industry: a systematic literature review. In: Advances in Intelligent Systems and Computing, vol. 791. Springer International Publishing. https://doi.org/10.1007/978-3-319-94589-7_2. July 2018.

Pons, D.J., 2016. Pike river mine disaster:systems-engineering and organisational contributions. Safety 2016 2, 21. https://doi.org/10.3390/safety2040021.

Porkka, P.L., 2016. Functional model for organisational and safety culture. Chemical Engineering Transactions 48, 907–912. https://doi.org/10.3303/CET1648152.
Prasad, S., Reddy, T.B., Vadde, R., 2015. Environmental aspects and impacts its mitigation measures of. Corporate Coal Mining 11, 2–7. https://doi.org/10.1016/j.proeps.2015.06.002.
Qiao, W., Liu, Q., Li, X., Luo, X., Wan, Y., 2018. Using data mining techniques to analyze the influencing factor of unsafe behaviors in Chinese underground coal mines. Resour. Pol. 59 (April), 210–216. https://doi.org/10.1016/j.resourpol.2018.07.003.
Qiao, W., Li, X., Liu, Q., 2019. Systemic approaches to incident analysis in coal mines: comparison of the STAMP, FRAM and "2–4" models. Resour. Pol. 63 (May), 101453 https://doi.org/10.1016/j.resourpol.2019.101453.
Qin, Z., Li, T., Li, Q., Chen, G., Cao, B., 2019. Combined Early Warning Method for Rock Burst and its Engineering Application. 2019.
Reason, J., 1997. Managing the Risks of Organizational Accidents. Ashgate, Aldershot.
Reniers, R.L.E.P., Corcoran, R., Drake, R., Shryane, N.M., Völlm, B.A., 2011. The QCAE: a questionnaire of cognitive and affective empathy. J. Pers. Assess. 93 (1), 84–95. https://doi.org/10.1080/00223891.2010.528484.
Rubin, M., Giacomini, A., Allen, R., Turner, R., Kelly, B., 2020. Identifying safety culture and safety climate variables that predict reported risk-taking among Australian coal miners: an exploratory longitudinal study. Saf. Sci. 123 (November 2019), 104564 https://doi.org/10.1016/j.ssci.2019.104564.
Sanmiquel, L., Rossell, J.M., Vintró, C., 2015. Study of Spanish mining accidents using data mining techniques. https://doi.org/10.1016/j.ssci.2015.01.016, 75, 49-55.
Sanmiquel-pera, L., Bascompta, M., 2019. Analysis of a historical accident in a Spanish coal mine. Int. J. Environ. Res. Publ. Health 16, 3615. https://doi:10.3390/ijerph16193615.
Schein, E., 1992. Organizational Culture and Leadership, second ed. Jossey-Bass, San Francisco.
Schulman, P.R., 2020. Organizational structure and safety culture: conceptual and practical challenges. Saf. Sci. 126 (October 2019), 104669 https://doi.org/10.1016/j.ssci.2020.104669.
Shaffril, H.A.M., Abu Samah, A., Samsuddin, S.F., Ali, Z., 2019. Mirror-mirror on the wall, what climate change adaptation strategies are practiced by the Asian's fishermen of all? J. Clean. Prod. 232, 104–117.
Shao, L., 2019. Geological disaster prevention and control and resource protection in mineral resource exploitation region. February, 142–146. International Journal of Low-Carbon Technologies 2019 14, 142–146. https://doi.org/10.1155/2019/1269537 doi:10.1093/ijlct/ctz003. Hindawi Advances in Civil Engineering Volume 2019, Article ID 1269537, 10 pages.
Smith, N.M., Ali, S., Bofinger, C., Collins, N., 2016. Human health and safety in artisanal and small-scale mining: an integrated approach to risk mitigation. J. Clean. Prod. 129, 43–52. https://doi.org/10.1016/j.jclepro.2016.04.124.
Spada, M., Burgherr, P., 2016. An aftermath analysis of the 2014 coal mine accident in Soma, Turkey : use of risk performance indicators based on historical experience. Accid. Anal. Prev. 87, 134–140. https://doi.org/10.1016/j.aap.2015.11.020.
Stemn, E., Bofinger, C., Cliff, D., Hassall, M.E., 2019. Examining the relationship between safety culture maturity and safety performance of the mining industry. Saf. Sci. 113 (April 2018), 345–355. https://doi.org/10.1016/j.ssci.2018.12.008.
Stemn, E., Ntsiful, F., Azadah, M.A., Joe-Asare, T., 2020. Incident causal factors and the reasons for conducting investigations: a study of five Ghanaian large-scale mines. Saf. Now. 6 (1) https://doi.org/10.3390/safety6010009.
Tong, R., Yang, X., Li, H., Li, J., 2019. Dual process management of coal miners' unsafe behaviour in the Chinese context: evidence from a meta-analysis and inspired by the JD-R model. Resour. Pol. 62 (April), 205–217. https://doi.org/10.1016/j.resourpol.2019.03.019.
Vásquez-Cárdenas, J., Zapata-Noreña, Ó., Carvajal-Flórez, Á., Barbosa-Liz, D.M., Giannakopoulos, N.N., Faggion, C.M., 2019. Systematic reviews in orthodontics: impact of the PRISMA for Abstracts checklist on completeness of reporting. Am. J. Orthod. Dentofacial Orthop. 156 (4), 442–452. https://doi.org/10.1016/j.ajodo.2019.05.009 e12.
Vassem, A.S., Fortunato, G., Bastos, S.A.P., Balassiano, M., 2017. Factors that make up safety culture: a look at mining industry. Gestão Produção 24 (4), 719–730. https://doi.org/10.1590/0104-530X1960-16.
Vierendeels, G., Reniers, G., van Nunen, K., Ponnet, K., 2018. An integrative conceptual framework for safety culture: the Egg Aggregated Model (TEAM) of safety culture. Saf. Sci. 103 (September 2017), 323–339. https://doi.org/10.1016/j.ssci.2017.12.021.
Wang, B., Wu, C., 2019. Safety culture development, research, and implementation in China: an overview. Prog. Nucl. Energy 110 (September 2018), 289–300. https://doi.org/10.1016/j.pnucene.2018.10.002.
Wang, J., Zhang, J., 2019. Research on high-power and high-speed hydraulic impact testing machine for mine anti-impact support equipment. 2019. Shock Vib. 2019 https://doi.org/10.1155/2019/6545980. Article ID 6545980, 12 pages.
Wang, Q., Wang, H., Qi, Z., 2016. An application of nonlinear fuzzy analytic hierarchy process in safety evaluation of coal mine. Saf. Sci. 86, 78–87. https://doi.org/10.1016/j.ssci.2016.02.012.
Wang, L., Cao, Q., Zhou, L., 2018. Research on the influencing factors in coal mine production safety based on the combination of DEMATEL and ISM. Saf. Sci. 103 (November 2017), 51–61. https://doi.org/10.1016/j.ssci.2017.11.007.
Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J., Pawson, R., 2013. RAMESES publication standards: meta-narrative reviews. BMC Med. 11 (20), 1–15. http://www.biomedcentral.com/1741-7015/11/20.
Wu, X., Yin, W., Wu, C., Li, Y., 2017. Development and validation of a safety attitude scale for coal miners in China. Sustainability 9 (12). https://doi.org/10.3390/su9122165.
Xiang, C., Zhou, E., Hong, R., Liu, H., Xu, X., 2019. Brittleness Risk Evaluation of Mine Safety Based on Brittle Relational Entropy. 2019.
Xiao, W., Xu, J., Lv, X., 2019. Establishing a georeferenced spatio-temporal database for Chinese coal mining accidents between 2000 and 2015. Geomatics, Nat. Hazards Risk 10 (1), 242–270. https://doi.org/10.1080/19475705.2018.1521476.
Yeh, L.T., 2017. Incorporating workplace injury to measure the safety performance of industrial sectors in Taiwan. Sustainability 9 (12). https://doi.org/10.3390/su9122241.
Yorio, P.L., Haas, E.J., Bell, J.L., Moore, S.M., Greenawald, L.A., 2020. Lagging or leading? Exploring the temporal relationship among lagging indicators in mining establishments 2006–2017. J. Saf. Res. 74, 179–185. https://doi.org/10.1016/j.jsr.2020.06.018.
Yu, K., Cao, Q., Xie, C., Qu, N., Zhou, L., 2019. Analysis of intervention strategies for coal miners' unsafe behaviors based on analytic network process and system dynamics. Saf. Sci. 118 (November 2018), 145–157. https://doi.org/10.1016/j.ssci.2019.05.002.
Zhang, Y., Shao, W., Zhang, M., Li, H., Yin, S., Xu, Y., 2016a. Analysis 320 coal mine accidents using structural equation modeling with unsafe conditions of the rules and regulations as exogenous variables. Accid. Anal. Prev. 92, 189–201. https://doi.org/10.1016/j.aap.2016.02.021.
Zhang, J., Chen, N., Fu, G., Yan, M., Kim, Y.C., 2016b. The safety attitudes of senior managers in the Chinese coal industry. Int. J. Environ. Res. Publ. Health 13 (11). https://doi.org/10.3390/ijerph13111147.
Zhang, S., Shi, X., Wu, C., 2017. Measuring the effects of external factor on leadership safety behavior: case study of mine enterprises in China. Saf. Sci. 93, 241–255. https://doi.org/10.1016/j.ssci.2016.12.017.
Zhang, J., Fu, J., Hao, H., Fu, G., Nie, F., Zhang, W., 2020. Root causes of coal mine accidents: characteristics of safety culture deficiencies based on accident statistics. Process Saf. Environ. Protect. 136, 78–91. https://doi.org/10.1016/j.psep.2020.01.024.