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Research Article

MINING, HEALTH, AND SOCIETY: A COMPARATIVE ANALYSIS OF OCCUPATIONAL ACCIDENTS IN KAZAKHSTAN AND JAPAN

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ABSTRACT

This study compares occupational incidents in the mining industries of Kazakhstan and Japan from 2018 to 2023. Kazakhstan's rising workplace accidents, particularly in coal mining, highlight deficiencies in safety management despite adopting global standards. In contrast, Japan benefits from advanced safety technologies and stringent protocols, resulting in significantly lower incident rates. The study analyses trends in incident types, such as falls and machinery-related injuries, using harmonized injury classifications. Findings reveal regulatory weaknesses and underreporting in Kazakhstan, while Japan faces challenges with aging infrastructure and disaster preparedness. The research emphasizes Kazakhstan's need to enhance legal frameworks, training, and safety culture, while Japan must address infrastructure-related risks. Recommendations for both countries focus on improving occupational safety systems to meet international standards, providing key insights for policy reform in high-risk industries such as mining.

Keywords: Mining industry, Occupational injuries, Socioeconomic factors, Culture of safety, Kazakhstan, Japan.

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INTRODUCTION

The mining industry is globally acknowledged as one of the most hazardous sectors, characterized by a significant incidence of occupational accidents and fatalities. Workers in this industry face numerous risks attributable to the complex and dynamic nature of mining operations, which frequently entail hazardous environments, heavy machinery, and challenging working conditions. This literature review synthesizes research findings from various studies to elucidate the causes, trends, and preventive measures associated with occupational accidents within the mining industry. Numerous studies have consistently underscored the increased risk of injuries and fatalities within the mining workforce. For instance, Sanmiquel et al. (2018: 462; 2021: 13122) conducted an analysis of occupational accidents within the Spanish mining sector and concluded that, despite advancements in safety protocols, the incidence rate of such accidents remains disproportionately higher than in other industries. Similarly, Stemn (2019: 151) documented a significant prevalence of injuries within the Ghanaian mining industry, underscoring the urgent need for improved safety measures. Cruz-Ausejo et al. (2024) reported that mining accounts for 8% of global fatal occupational injuries. Their study aimed to identify the sociodemographic and occupational characteristics that influence injury risks. Moreover, the review sought to ascertain the causative factors and health consequences of such injuries in order to develop enhanced preventive strategies for the sector. A systematic search of databases, including Scopus, Embase, and PubMed, was performed, resulting in a total of 123 studies, of which nine met the established eligibility criteria. The review was restricted to observational studies published between 2010 and 2022, encompassing a variety of mining environments worldwide. Given the limitations identified in the review, including language bias favoring publications in English, Spanish, and Portuguese, as well as a lack of data differentiating between fatal and non-fatal injuries, an examination of the Asian perspective – specifically from Kazakhstan and Japan – could yield a more nuanced understanding of occupational risks in mining. The distinctive conditions of Kazakhstan's mining industry, characterized by challenging environmental and geological factors, present both obstacles and opportunities for the integration of advanced occupational safety practices that are consistent with international standards. Japan's initiatives, spearheaded by organizations such as the Japan International Cooperation Agency (JICA) and the Japan Industrial Safety and Health Association (JISHA), seek to assist Kazakhstan's scientific and technical community in adopting enhanced safety protocols. Japan's extensive experience in implementing stringent safety standards through regulatory frameworks and technological innovation can serve as a pertinent model for Kazakhstan. Japanese practices frequently incorporate comprehensive risk management strategies, regular safety training, and a systematic approach to monitoring worker health, all tailored to minimize accidents in high-risk sectors. For Kazakhstan, the integration of insights from Japan's approach to managing human and organizational factors – particularly in relation to night shifts and irregular schedules – holds substantial relevance. These factors are particularly pronounced in Kazakhstan's mining regions, where extreme weather conditions exacerbate occupational hazards. The inclusion of sociodemographic and biochemical data in occupational health research could further elucidate factors contributing to injuries, such as cumulative fatigue, reduced concentration, and physiological responses to high-altitude conditions. By leveraging Japanese ex-

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pertise, Kazakhstan could establish a more comprehensive occupational health system. This system would not only prioritize physical protection measures but also emphasize injury prevention through regular health assessments and psychological support. As Kazakhstan's scientific community adapts these advanced practices, it could significantly contribute to the reduction of incidents within the mining sector, thereby aligning with global safety standards while addressing local needs.

LITERATURE REVIEW

Mining accidents emerge from a complex interplay of human, equipment, environmental, and organizational factors, thereby creating a multifaceted risk landscape. Human error remains a predominant causal factor, with inadequate training and inexperience significantly contributing to occupational injuries (Mirzaei Aliabadi et al., 2019; Yaslı and Bolat, 2019: 781). Notably, injuries frequently occur early in a shift, indicating that fatigue and diminished alertness heighten accident risks (De et al., 2020: 1124). Furthermore, equipment misuse and mechanical failures exacerbate these hazards. Heavy machinery, including conveyor belts, haul trucks, and dumpers, is commonly implicated in accidents during maintenance activities (Duarte et al., 2018: 84; 2019: 63; 2021: 21). Environmental hazards – such as poor ventilation, hazardous gases, and dust – further elevate the risk of injury. For instance, gas explosions in Chinese coal mines (Yin et al., 2017: 173) underscore the critical need for controlling environmental factors to enhance safety outcomes. Organizational deficiencies, including inadequate safety protocols, insufficient supervision, and poor risk assessment, significantly magnify the dangers inherent in mining operations. A deficient safety culture and organizational shortcomings significantly contribute to coal mining accidents in China (H. Zhang et al., 2021: 247; J. Zhang, Fu, et al., 2020: 78; J. Zhang, Xu, et al., 2020: 332; Y. Zhang et al., 2016: 189). Globally, the mining industry consistently reports high fatality rates, rendering it one of the most hazardous occupations (Hämäläinen et al., 2006: 137). Accident rates in developing countries remain disproportionately elevated, primarily due to inadequate regulatory frameworks (Takala, 1999: 640). Regional analyses indicate varying trends: while Spain has observed a decline in mining accidents, associated risks still exceed those of other industries (Sanmiquel et al., 2018: 462; 2021: 13122); India encounters specific job-related hazards within the coal mining sector (Senapati et al., 2020: 306); Ghana reports elevated injury rates, highlighting the necessity for targeted research (Stemn, 2019: 151). In Kazakhstan, alarmingly high levels of workplace accidents and occupational diseases necessitate the implementation of improved safety practices (Abikenova, Marcelloni, et al., 2023: 23; Yerdessov et al., 2022; Abikenova et al., 2023: 41; Taubayev et al., 2023: 4). Advancements in data analysis are indispensable for comprehending contemporary trends within the mining sector. The application of statistical methods and data mining facilitates the identification of patterns and risk factors (Noraishah Ismail et al., 2021: 105438). For instance, the observed correlation between elevated noise levels and increased injury incidence underscores the necessity of environmental monitoring (Shkembi et al., 2022: 35). Fostering a robust safety culture within mining organizations is of paramount importance. Addressing minor accidents, which can lead to significant consequences, necessitates a comprehensive commitment to safety at the organizational level (Jørgensen, 2016: 46). Furthermore, the implementation of tailored training pro-

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grams for specific activities, such as the operation of heavy machinery, is essential (Duarte et al., 2019: 63). The integration of modern equipment and monitoring systems has demonstrated considerable potential in mitigating accident risks. Predictive technologies, such as hybrid classifiers, effectively anticipate coal mining accidents, thereby enhancing safety protocols (Javaid et al., 2023: 13211). Compliance with national and international safety regulations further strengthens risk management efforts. In Kazakhstan, stricter enforcement of safety laws and the implementation of mandatory health supervision could contribute to a reduction in accident rates (Abikenova, Aitimova, et al., 2023: 317). Health monitoring, particularly with regard to fatigue and workload management, represents another critical preventive measure, given the established correlation between extended working hours and increased injury risks (Friedman et al., 2019: 389). Mining accidents have repercussions that extend beyond physical injuries to encompass psychological effects, including trauma and stress. Injuries, particularly to the hands and wrists, can result in long-term disabilities, adversely affecting both health and financial well-being (Alessa et al., 2020: 104792). Vulnerable populations may experience heightened psychological distress; for instance, the excess mortality due to external causes among female miners in South Africa underscores the urgent need for mental health support (Wilson et al., 2020: 1875). Furthermore, mining accidents impose substantial economic burdens on both workers and companies. Compensation claims highlight significant costs associated with injuries, emphasizing the necessity of preventive strategies (Heberger and Wurzelbacher, 2024: 3067). Adherence to international safety standards, particularly those established by the International Labour Organization (ILO), remains critical in fostering safer practices across mining industries globally (Quiroz et al., 2023: 47). National initiatives, such as strategic insurance programs in Kazakhstan, are aimed at enhancing safety and reducing occupational risks (Smatlayev et al., 2023: 42). Ensuring mining safety requires a multifaceted approach that integrates human, environmental, organizational, and technological considerations, underscoring the importance of fostering a comprehensive safety culture to address the complex risk factors inherent in the industry. The mining industry is critical to the economies of both Kazakhstan and Japan. In Kazakhstan, mining is essential for the extraction of coal, uranium, copper, and various other minerals, positioning the country among the most resource-rich nations globally. However, the industry is characterized by elevated rates of occupational incidents. Despite ongoing efforts to enhance safety-including the adoption of best practices derived from compulsory occupational accident insurance frameworks of developed nations and alignment with international standards (Abikenova, Aitimova, et al., 2023: 317; Smatlayev et al., 2023: 42) – Kazakhstan has witnessed a significant increase in mining accidents, with a 45% rise in the number of victims from 2018 to 2022 (Bakishev, 2024: 109). Additionally, the high rate of underreported injuries, averaging 15,2:1, exacerbates the situation (Bakishev, 2024: 109). These incidents have considerable material and social repercussions, highlighting the urgent need for enhanced safety protocols and preventive measures (Yerdessov et al., 2022: Taubayev et al., 2023: 4). Kazakhstan's resource mining industry, while being a global leader in mineral extraction, faces significant challenges related to environmental pollution and occupational health risks. Toxic elements present near mining sites pose serious health hazards to workers, and current occupational health policies and insurance frameworks do not adequately ad-

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dress these risks. This deficiency raises concerns regarding the effectiveness of Kazakhstan's regulations in safeguarding the mining workforce from hazardous substances. Conversely, Japan's mining industry, while smaller in scale, benefits from stringent regulations and advanced safety protocols, which contribute to a lower incidence of accidents (Molé, 2024: 955). The 14th Labour Accident Prevention Plan, implemented by Japan's Ministry of Health, Labour and Welfare (Higuchi, 2023: 12), addresses safety concerns across diverse sectors, including mining, with a focus on both the implementation of preventive measures and the reduction of incidents. Nevertheless, the existing Japanese scholarly literature tends to concentrate more on occupational accidents in sectors such as construction, public health, forestry, and transportation, reflecting the country's sectoral priorities, where these industries engage a larger workforce and exhibit higher rates of incident reporting (Kawasaki and Koroki, 2018). Research indicates that inattentiveness remains a significant contributor to occupational accidents across various industries in Japan, including mining (Wasaki and Takahashi, 2024). Accidents associated with inattentiveness tend to increase with age, reflecting the demographic shift towards an aging workforce. Addressing human error and inattentiveness through industry-specific safety measures is imperative. Japan's approach to reducing workplace accidents incorporates comprehensive safety measures, including proactive risk assessments, strict safety protocols, and legislative adjustments. For example, mandatory fall prevention systems have been implemented in the construction sector to address high-risk areas (Kawasaki and Koroki, 2018: 28). Furthermore, the Ministry of Health, Labour and Welfare (MLHW, 2023: 15) outlines «Prevention Measures for Occupational Accidents from the Perspective of the 14th Labour Accident Prevention Plan», highlighting Japan's focus on preventing accidents, particularly among elderly workers and women in the service sector. This plan aims to ensure that over 50% of enterprises implement robust fall prevention measures by 2027, reflecting Japan's commitment to minimizing behaviour-related accidents like falls and back injuries.

In Kazakhstan, predictive models are being explored to enhance workplace safety. Holt's mathematical model, implemented at Kazzinc LLP, has exhibited a notable predictive accuracy of 91.3% in forecasting workplace injuries (Abdugaliyeva et al., 2024:8). By leveraging historical injury data and adapting to changing production conditions, this model plays a critical role in refining safety protocols and reducing occupational risks within metallurgical environments.

A statistical analysis of occupational injuries in Kazakhstan's coal mining sector reveals that accidents are more prevalent among workers aged 50–59 and those with either less than one year or more than 31 years of experience (Abikenova, Aitimova, et al., 2023: 317). Additionally, a higher incidence of injuries occurs during nighttime shifts and winter months, underscoring the need for targeted safety strategies tailored to these high-risk conditions.

Comparative overview of mining operations in Kazakhstan and Japan

When analysing the mining sectors of Kazakhstan and Japan, it is essential to comprehend their geographic and industrial disparities. Kazakhstan, endowed with an abundance of natural resources, boasts extensive coal, mineral, and rare earth mining operations that make significant contributions to its economy. In contrast, Japan, characterized by a scarcity of natural resources, emphasizes un-

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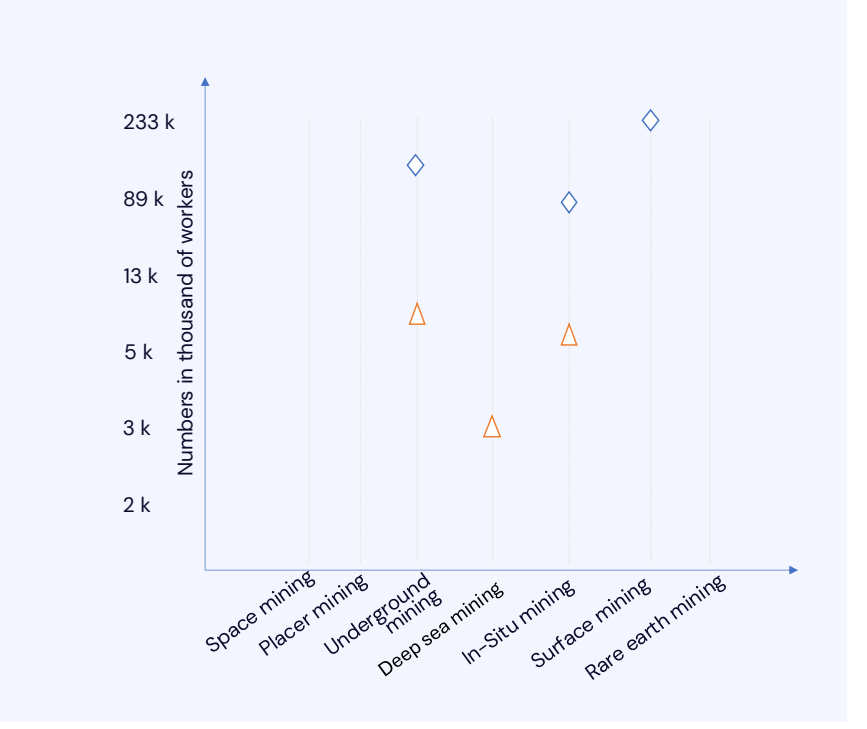
derground and in-situ mining methods due to land and spatial limitations. These distinctions markedly influence the types and scales of mining operations, as well as the distribution of the workforce. This geographic divergence underscores the necessity of recognizing the varying mining methodologies and their corresponding workforce requirements across both nations.

Figure 1 illustrates two sets of data representing the number of workers employed across various types of mining in Japan (indicated by orange triangles) and Kazakhstan (indicated by blue diamonds). The mining types included are surface mining, underground mining, deep-sea mining, in-situ mining, placer mining, and rare earth mining. The y-axis quantifies workforce numbers in thousands. The data indicate that Kazakhstan has a larger workforce in sectors such as surface and rare earth mining, whereas Japan is represented in sectors such as underground and in-situ mining, albeit with generally smaller workforce sizes.

In the methodology of this study, the mining sectors in Japan and Kazakhstan were classified into large and medium scales based on the distribution of the workforce across various mining activities.

Figure 1. *Mining Map of Kazakhstan and Japan*



Source: The author's elaboration

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The large-scale sectors in Kazakhstan, including surface and rare earth mining, employ significant workforces, with numbers reaching up to 233,000 workers. In contrast, Japan exhibits a concentration on medium-and small-scale operations, particularly in underground and in-situ mining, characterized by a comparatively smaller workforce size, approximately 20 thousand workers.

The mining industry has historically played a pivotal role in the development of various economic sectors in Japan. In earlier periods, revenues generated from mining activities facilitated the establishment of new manufacturing capacities in industries such as engineering, machinery production, and metalworking. These sectors, in turn, became integral components of Japan's industrial base, thereby supporting the development of the country's economy. Despite a decline in the number of active mines in recent decades, Japan remains a significant player in the global metallurgical industry. Currently, the metallurgy sector in Japan is heavily reliant on imported raw materials, such as copper and zinc concentrates. The country contributes approximately 10% to global copper production and around 8% to zinc production. These industries, which have evolved alongside mining, can be regarded as foundational to Japan's overall industrial landscape, particularly in metallurgy, machinery manufacturing, and the electronics sector, demonstrates a pronounced emphasis on safety and efficiency (JICA, 2024: 12).

METHODOLOGY

Building on the previously established classification of mining scales between Kazakhstan and Japan, we adopted a comparable methodology to harmonize occupational injury categories, thereby ensuring consistency across the distinct reporting systems of both countries. This harmonization facilitates effective comparisons of injury trends and addresses industrial safety priorities through a sustainable, data-driven approach. Such a framework has the potential to inform future policy improvements and enhance cross-border collaboration in occupational health and safety standards. Given the discrepancies in categorization between the two nations, the initial step involved identifying common injury types. Incidents were categorized according to shared characteristics (e.g., falls, collisions, exposure to harmful substances) with the objective of establishing uniform categories. This approach not only aids in trend identification but also supports the formulation of more robust, data-driven safety regulations. Furthermore, this methodology can serve as a sustainable framework for future research in occupational health and safety, promoting cross-country collaboration and the establishment of international safety standards.

In the provided Figure 2, the key steps are delineated into three distinct phases: identifying commonalities in the causes of injuries, grouping incidents into harmonized categories, and applying these categories for data standardization and trend analysis.

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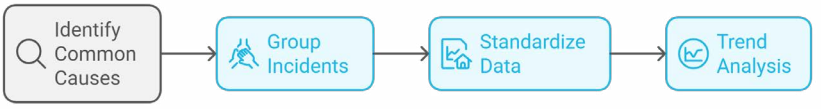
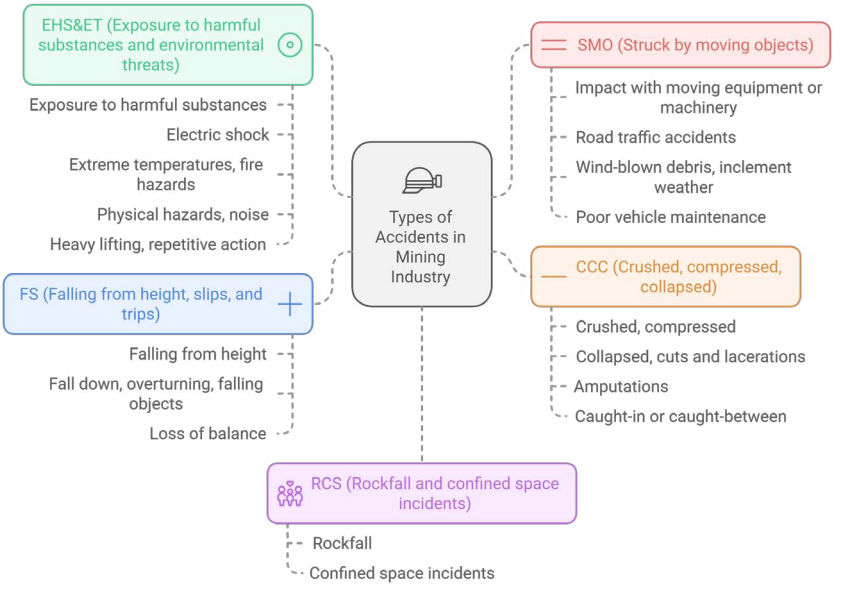
Figure 2. *Phases of Harmonization and Standardization of Occupational Injury Data*



Source: The author's elaboration

The methodology for classifying types of fatal and non-fatal accidents in the mining industry focuses on harmonizing data by comparing existing classification systems from Japan and Kazakhstan. Incidents are grouped based on their causes (e.g., falls, moving objects) and their effects (e.g., injury location), creating a unified matrix for better standardization (see figure 3). This harmonization facilitates consistent monitoring and management of workplace safety, allowing for targeted interventions to mitigate risks and improve worker protection across the mining sectors of both countries.

Figure 3. *Classified Harmonization of Types of Fatal and Non-fatal Accidents in Mining Industry*



Source: The author's elaboration

By standardizing the classifications of accidents across both countries, this study ensures a robust comparison of incident data, allowing for meaningful trend analysis. The harmonization of occupational injury categories paves the way for identifying key patterns in mining safety, providing a comprehensive foundation for the following results, which highlight critical differences and shared

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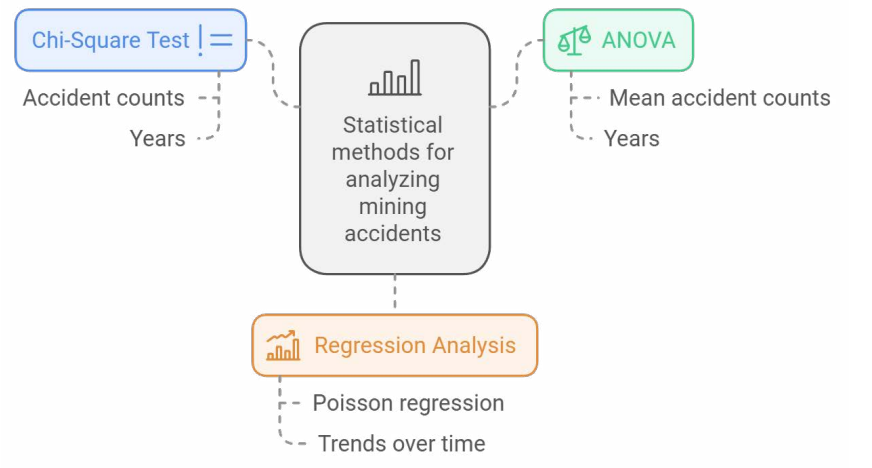
challenges between Japan and Kazakhstan from 2018 to 2023. These findings will inform recommendations for improving safety protocols in both countries.

Despite the fact that mining is a critical sector that significantly contributes to the economy, it is associated with high-risk working conditions. Monitoring workplace accidents is essential for the implementation of effective safety measures. This report aims to identify significant changes in accident counts over time across various mining industries in Japan from 2018 to 2023. We utilize Chi-Square tests, ANOVA, and regression analysis to assess trends and patterns, ensuring that all statistical assumptions are validated (see figure 4).

Figure 4. *Three Methods for Analysing Statistical Mining Injuries*



Source: The author's elaboration

In this study, a series of statistical analyses were applied to evaluate the trends and patterns in workplace accidents over time. The Chi-Square Test was employed to determine whether the distribution of accident counts was independent of the years in which the accidents occurred. This test assesses whether the observed frequencies deviate significantly from the expected frequencies. To ensure the validity of the test, we confirmed that the expected frequencies were equal to or greater than five and that the observations were independent.

ANOVA (Analysis of Variance) was used to compare the mean accident counts across different years. This method allowed us to ascertain whether there were statistically significant differences in the average number of accidents over time. Prior to performing the ANOVA, we validated the assumptions of normality of the accident count data, homogeneity of variances to ensure similar variance across years, and independence of observations.

Statistical data on occupational injuries in Japan's mining sector

The data from the Ministry of Health, Labour and Welfare (MHLW) for Japan spanning the years 2018 to 2023 provides a comprehensive perspective on occupational accidents across various industries, including mining. In this context, occupational accidents are defined as incidents resulting in either fatal or

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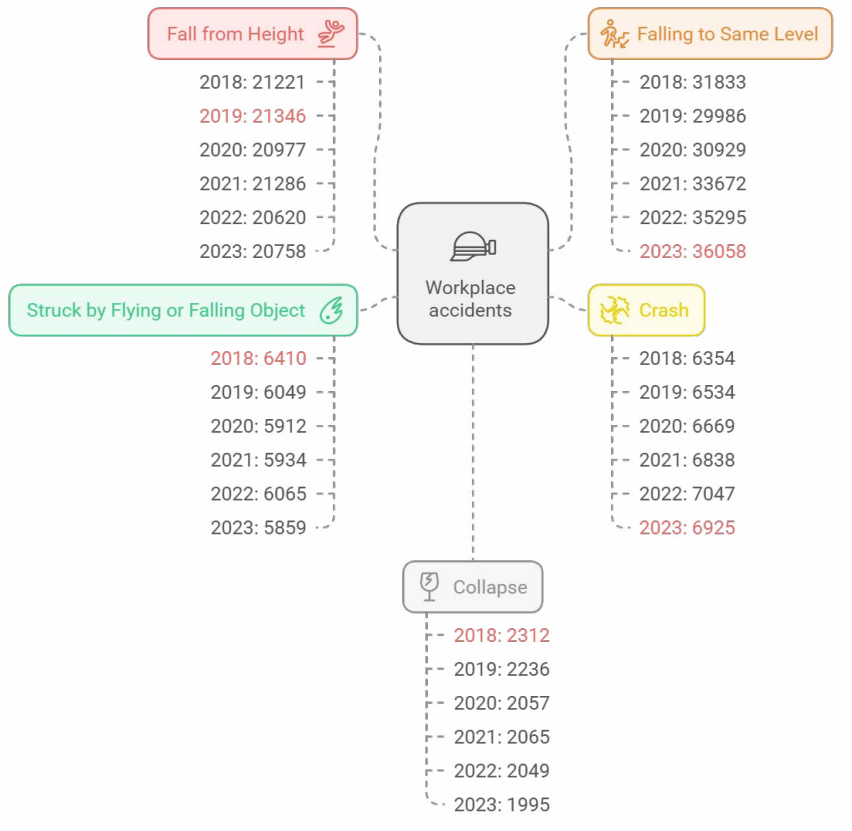
non-fatal injuries, as well as work-related illnesses that necessitate an absence of four or more days. It is noteworthy that the inclusion of COVID-19 cases significantly impacted the increase in reported incidents during 2020 and 2021, with 131,156 and 149,918 cases recorded, respectively. In contrast, data following 2022 indicates a return to pre-pandemic levels (see figure 5).

Figure 5. *Total Occupational Accidents in Japan from 2018 to 2023*



Source: JISHA statistical data (2023)

The total number of occupational accidents fluctuated from 2018 to 2023, with an overall increase evident in recent years. The most prevalent types of accidents-falls from height, falls to the same level, and incidents involving workers caught in or between objects—are particularly relevant to the mining and industrial sectors. Falls from height consistently ranged between 20,620 and 21,346 incidents per year, while incidents involving falls to the same level escalated over the years, culminating in 36,058 incidents in 2023 (see figure 5), thereby reflecting a steady upward trajectory. Similarly, accidents involving workers caught in or between objects consistently demonstrated an annual average exceeding 14,000 cases, underscoring the persistent risks associated with industrial machinery (JISHA, 2024: 7). The increase in total incidents, specifically during 2020 and 2021, can be attributed to factors related to the pandemic. However, upon excluding COVID-19 cases from 2022 onwards, the data illustrates Japan's industrial emphasis on miti-

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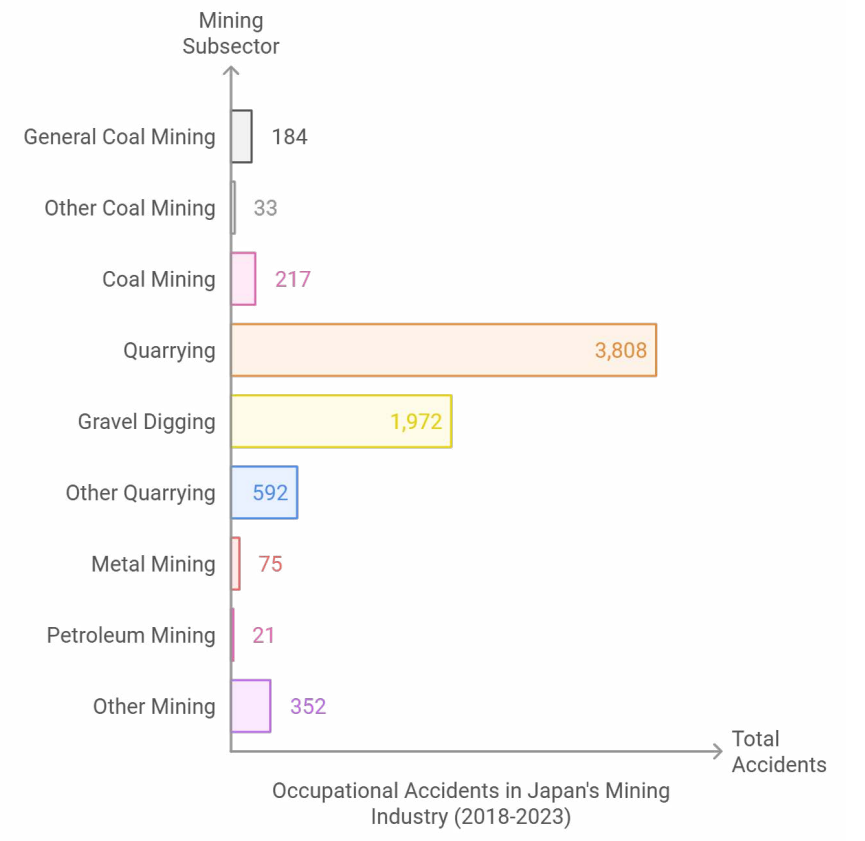
gating prevalent types of occupational hazards, particularly within sectors such as mining. The necessity for continuous enhancement of safety measures, especially with regard to falls and machinery-related accidents, is underscored by the stability of these figures despite increased regulatory efforts.

The dataset (see figure 6) concerning occupational accidents within Japan's mining sector from 2018 to 2023 indicates a relatively stable trend in reported incidents, with an annual average of approximately 206 cases. Occupational incidents were predominantly concentrated in quarrying, which accounted for 92% of total accidents. In contrast, coal mining recorded minimal accidents, reflecting the industry's decline in Japan, while the «other mining» category maintained low but fluctuating rates over the years. A detailed yearly breakdown reveals that in 2018, coal mining experienced its highest number of incidents (6); however, from 2019 to 2020, no accidents were reported in this sector. Minor incidents reemerged between 2021 and 2023, suggesting either reduced activity or the implementation of effective safety protocols. The quarrying sector remained the most consistent contributor to mining-related accidents, peaking at 201 incidents in 2021 before subsequently declining to 182 in both 2022 and 2023, likely attributable to improved safety practices. Other mining activities exhibited minor fluctuations, with incidents varying from 10 to 17 per year.

Figure 6. *Total Mining Incidents in Japan from 2018 to 2023*



Source: JISHA statistical data (2023)

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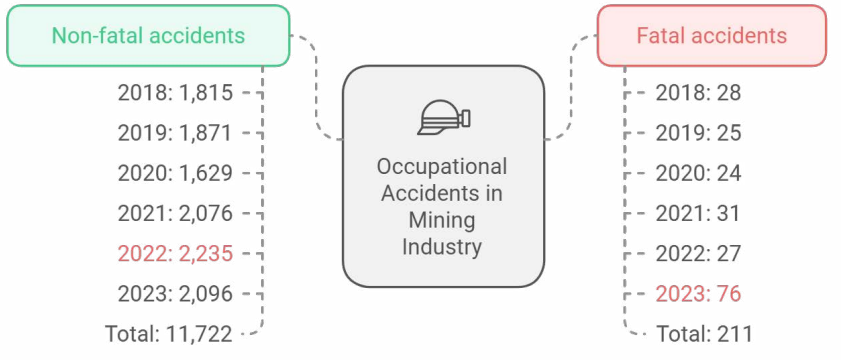
The predominant causes of these accidents include falls and collapse due to unstable geological conditions, machinery-related injuries involving heavy equipment, explosions and fires resulting from gas leaks or improper handling of explosives, and exposure to hazardous substances, which can lead to occupational diseases. Compared to all other industries, the mining sector accounted for only 0.16% of occupational incidents across Japan, a relatively low figure in contrast to high-risk industries such as manufacturing and construction, which exhibited significantly higher incident rates. This disparity underscores the comparatively reduced risk associated with the mining sector; however, the persistent occurrence of accidents in quarrying highlights the necessity for more focused safety measures.

Statistical data regarding occupational injuries within the mining sector in Kazakhstan.

Over the six-year period, a total of 11,722 non-fatal accidents and 211 fatal accidents were reported. This substantial disparity between non-fatal and fatal incidents underscores the generally hazardous conditions prevalent in the mining sector in Kazakhstan; however, the year 2023 stands out as an anomaly in terms of fatal incidents (see figure 7).

Over the six-year period from 2018 to 2023, a total of 9,948 workplace injuries were reported in Kazakhstan, classified as light, moderate, or severe injuries, each of which qualifies for compensation under Kazakhstan's compulsory accident insurance legislation (see figure 8).

Figure 7. *Analysis of Occupational Accident Data for Kazakhstan (2018–2023)*



Source: Committee on Statistics of the Republic of Kazakhstan (2024)

In accordance with Kazakhstan's compulsory accident insurance legislation, eligibility for compensation is predicated upon the severity of injuries sustained by workers in work-related incidents. Compensation is disbursed as a percentage of the worker's pre-injury wage, with variations depending on the classification of the injury as light, moderate, or severe (see figure 9).

Data standardization and harmonization

Under Article 97 of the Ordinance on Industrial Safety and Health, Japanese employers are legally obligated to report workplace accidents to the Labour Stand-

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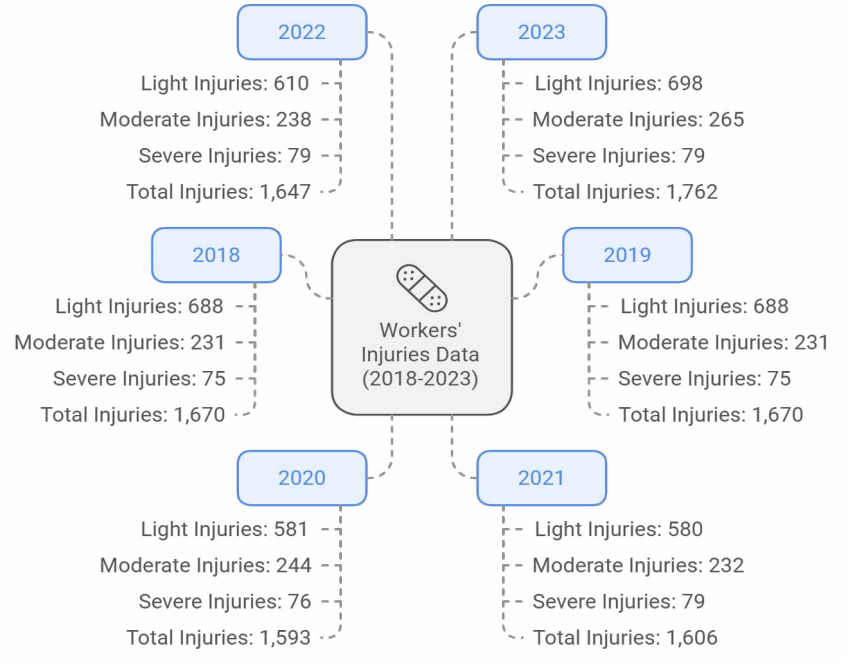
ards Inspection Office. This report must encompass accidents that occur during work hours and within the workplace, even when a worker is off-duty; however, incidents occurring outside the workplace, such as commuting accidents, are excluded. Compliance with this regulation is enforced through penalties for non-reporting, and a subset of accident data (approximately 25%) is made available as open data, thereby promoting transparency. In certain instances, Labour Standards Inspectors, who possess powers akin to those of police officers, may carry out inspections, impose penalties, or suspend operations to ensure adherence to safety regulations. The harmonized matrix of occupational accidents, depicted in figure 10, presents a five-year comparative analysis of Japan and Kazakhstan, with particular emphasis on incidents within the mining sector.

The data is categorized by affected body parts and classified into fatal and non-fatal cases, thereby providing insights into the accident profiles of both countries. The matrix categorizes injuries across six body parts: (1) head, mouth, and neck, (2) hands, shoulders, arms, and fingers, (3) lumbar and thoracic regions, back, and trunk, (4) toe, ankle, foot, knee, and leg, (5) eyes, and (6) multiple parts. This structured classification facilitates a more precise comparison of accident severity and injury types, highlighting significant trends. In Japan, non-fatal incidents are most frequently associated with injuries to the lumbar and thoracic regions (50 cases) and the hands and arms (36 cases), indicating that activities involving heavy machinery handling and manual labour pose considerable risks. Fatalities are rare, with the highest number recorded in the lumbar and thoracic regions (2 cases). Collisions, contacts, and crashes (CCC) emerge as the predominant type of accidents, particularly affecting hands and limbs, which reflects areas where safety interventions could be most impactful.

Figure 8. *Data on Workers' Injuries in Kazakhstan from 2018 to 2023*



Source: Committee on Statistics of the Republic of Kazakhstan (2024)

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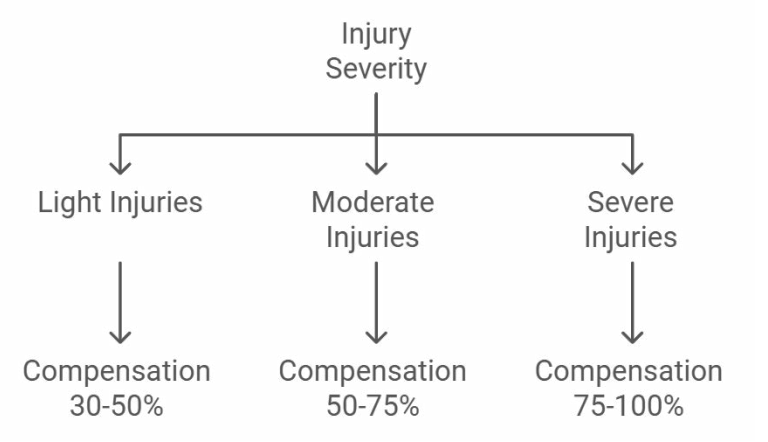
Figure 9. *Severity of the Injuries in Kazakhstan*



Source: The author's elaboration

The data from Japan underscores the importance of implementing enhanced protective measures and ergonomic interventions to mitigate injuries that adversely affect workers' productivity and mobility. Conversely, Kazakhstan demonstrates a markedly higher rate of fatal incidents across various body categories. Fatal injuries are particularly prevalent in the lumbar and thoracic regions, as well as in the lower limbs (toe, ankle, knee, and leg), each with 74 cases. Non-fatal injuries are also widespread, especially in the hands, shoulders, arms, and fingers (612 cases) and the lumbar and thoracic areas (835 cases). Similar to Japan, CCC accidents account for a significant number of both fatal and non-fatal cases, underscoring the high-risk nature associated with the operation of heavy machinery and material handling.

Additionally, Kazakhstan reports a considerable number of fatal falls and slips (17 cases), indicating that inadequate fall protection and unstable work surfaces are major safety concerns. This comparison reveals critical differences and shared challenges in the mining sectors of Japan and Kazakhstan. Japan's higher non-fatal injury rates, particularly those affecting hands and arms, emphasize the need for protective equipment and ergonomic adjustments. In contrast, Kazakhstan's elevated fatality rates highlight the urgent necessity for comprehensive safety enhancements, including stricter enforcement of safety protocols, modernized equipment, and robust worker training programs. By harmonizing occupational injury data, this matrix facilitates a more effective comparison of safety standards, aiding in the identification of shared risk factors and the formulation of targeted safety policies. Ultimately, this analysis supports international collaboration and data. sharing as essential strategies to enhance worker safety in the mining industry, encouraging the adoption of best practices and the development of proactive safety measures across borders.

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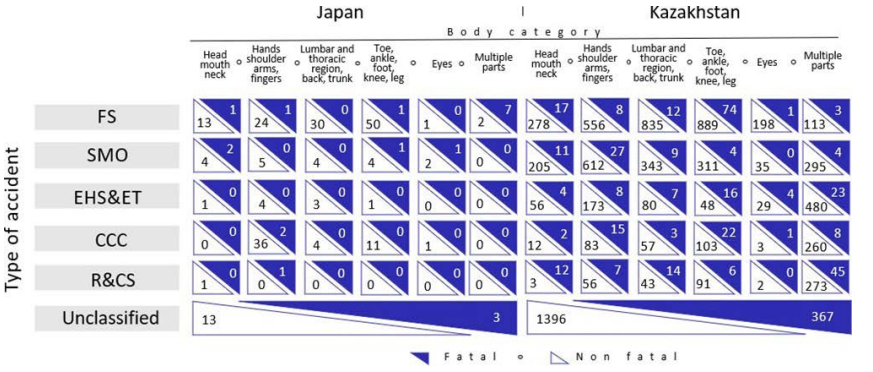
Figure 10. *Matrix of Harmonization of Occupational Fatal and Non-fatal Injury Statistics data*

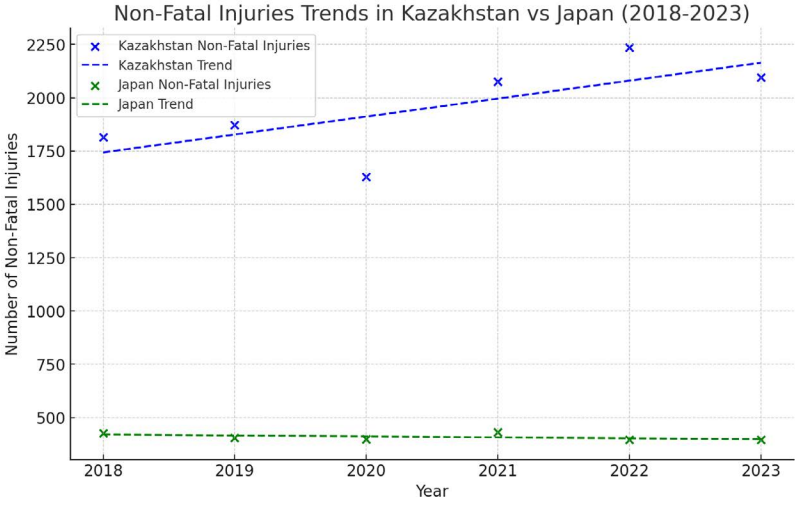


Source: The author's elaboration

RESULTS

This study utilized a quantitative methodology to analyse occupational incidents in the mining sectors of Kazakhstan and Japan from 2018 to 2023, highlighting distinct trends in mining safety across the two nations. A comparative analysis reveals a notable increase in both fatal and non-fatal mining incidents in Kazakhstan, particularly within the coal and quarrying sectors, whereas Japan's mining industry demonstrates a stable or slightly declining trend in incidents over the same period (see figure 11). In Japan, non-fatal incidents remained consistently low, suggesting the effectiveness of regulatory and safety measures. Conversely, Kazakhstan experienced a marked upward trajectory in non-fatal injuries, indicating potential safety protocol and enforcement deficiencies.

Figure 11. *Comparison of Incident Trends*



Source: The author's elaboration

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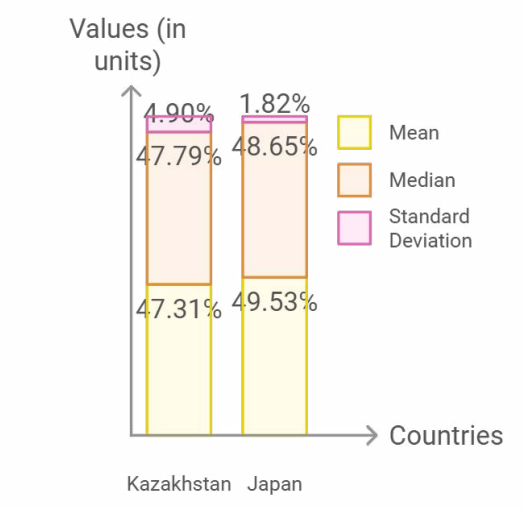
Statistical tests, including Chi-Square and ANOVA, confirm significant year-on-year changes in accident rates in Kazakhstan, with sharp increases observed in 2020 and 2023 ($p < 0.05$). Conversely, Japan's data display no significant fluctuations, underscoring the stability of its safety measures. Regression analysis further supports these observations, indicating that Kazakhstan's non-fatal injury rates increased by an average of 84 cases per year, while Japan exhibited a slight annual decrease of approximately 4.5 cases. The analysis also reveals that Kazakhstan's higher incident rates correlate strongly with workforce size, particularly in large-scale operations where non-fatal injuries are prevalent. Fatal incidents in Kazakhstan were more frequent in specific types of accidents, such as falls and machinery-related incidents, reflecting hazardous conditions that necessitate improved safety measures and equipment upgrades (see figure 12).

Figure 12. *Descriptive Statistics*



Source: The author's elaboration

These findings suggest that while Japan's regulatory frameworks and proactive safety culture contribute to its stable accident rates, Kazakhstan's mining industry faces significant challenges due to its rapid expansion, larger workforce, and regulatory gaps. Enhanced safety protocols, targeted worker training, and stricter enforcement are essential to address the rising incident rates in Kazakhstan.

DISCUSSION

The comparative analysis of occupational incidents in the mining sectors of Kazakhstan and Japan from 2018 to 2023 reveals significant disparities attributable to variations in technological adoption, regulatory frameworks, socioeconomic factors, and safety cultures. These disparities have profound implications for both countries' occupational safety and health (OSH) outcomes.

Similarities and differences in the underlying causes of injuries

Both Kazakhstan and Japan's mining industries face inherent risks linked to mining activities, such as hazardous working conditions, the operation of heavy

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machinery, and environmental hazards. However, the root causes of incidents exhibit significant disparities between the two countries, attributable to variations in safety practices, regulatory enforcement, and workforce characteristics. In Kazakhstan, the elevated rates of occupational diseases and injuries can be traced to inadequate safety protocols, insufficient training, and weak regulatory enforcement (Bakishev, 2024: 109; Chebotarev and Sementsova, 2021: 114). The rapid expansion of the mining sector has outstripped the development of essential safety measures, resulting in increased exposure to dust, toxic substances, and noise (Yerdessov et al., 2022). Furthermore, the underreporting of incidents and a lack of transparency impede effective safety interventions (Bakishev, 2024: 109).

Conversely, Japan has achieved lower incident rates through the implementation of stringent safety regulations, advanced technologies, and a proactive safety culture (Hara et al., 2023: 243; Kadyrzhanova, 2024: 320). The primary causes of incidents in Japan are frequently associated with human factors, such as inattentiveness and challenges arising from an aging workforce, which can lead to non-fatal injuries ((Wasaki and Takahashi, 2024). The emphasis on continuous improvement and worker involvement contributes to more favorable safety outcomes (Shimizu et al., 2022: 260).

Socioeconomic and demographic factors exert a significant influence on accident rates in both Japan and Kazakhstan. In Japan, the aging workforce contributes positively to safety vigilance, as older workers exhibit a heightened adherence to safety practices, which correlates with reduced accident rates (Isa et al., 2021: 18). Nonetheless, the age-related physical limitations experienced by older workers in Japan may heighten their susceptibility to specific categories of injuries, thereby necessitating the implementation of targeted safety measures (Hayashi et al., 2023: 196). Conversely, in Kazakhstan, the prevalence of a younger and less experienced workforce is correlated with increased accident rates (Isa et al., 2021: 18). The rapid pace of industrial growth, in conjunction with inadequate training, exacerbates the risks encountered by these workers, as many lack the essential skills and knowledge required to navigate hazardous environments safely (Liu et al., 2024: 107375).

Advancements in technology and automation possess the potential to significantly mitigate injuries, particularly in high-risk sectors such as mining. However, the successful integration of these innovations necessitates comprehensive worker training and proactive organizational support to ensure their effective utilization and sustainability. The adoption of technology and automation has significantly affected occupational safety within Japan's mining sector. Advanced safety technologies, including real-time monitoring systems, automated machinery, and hazard detection devices, have substantially improved risk management practices and diminished human exposure to hazardous environments (Kadyrzhanova, 2024: 320). These innovations enable the early identification of potential hazards and enhance emergency response capabilities (Hara et al., 2023: 243). Conversely, the mining industry in Kazakhstan has witnessed a slower pace of advanced technology adoption, primarily attributable to economic constraints and the prioritization of production over safety investments (R. Liu et al., 2021: 103672). The dependence on outdated equipment and insufficient technological infrastructure contributes to elevated accident rates and greater severity of incidents (Yerdessov et al., 2022). Moreover, the absence

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of automation and contemporary safety systems hinders the capacity to monitor and mitigate risks effectively, thereby exacerbating occupational hazards (Taubayev et al., 2023: 4).

Theoretical contribution of government policies and private sector initiatives

This comparative investigation significantly contributes to the sociological discourse on labour inequalities, state regulatory frameworks, and the intricate relationship between industrial safety measures and overarching social welfare policies. The mining industry serves as a crucial case study, illustrating the complex interplay between worker protection, economic pressures influencing labour conditions, and governance mechanisms in high-risk sectors. The findings resonate with established sociological theories regarding state responsibility and protection, emphasizing state intervention's vital role in safeguarding workers' well-being and safety in hazardous environments. Drawing upon institutional theory, which posits that organizations conform to the norms and rules established by institutions to achieve legitimacy (Meyer and Rowan, 1977: 341), the stark contrast between Japan and Kazakhstan's regulatory approaches underscores the significant impact of variations in regulatory frameworks on labour conditions and industrial safety standards. In Japan, the government enforces stringent occupational safety and health (OSH) regulations, supported by comprehensive oversight and mandatory compliance for mining operations (Hara et al., 2023: 243). The private sector actively invests in safety training, adopts international safety standards, and fosters a culture of safety consciousness (Okumura et al., 2018: 14). This alignment between government policies and private sector initiatives reflects a cohesive institutional environment that prioritizes worker safety.

Conversely, Kazakhstan's regulatory framework, while comprising legal requirements similar to those of developed nations, is undermined by weak enforcement mechanisms and the underreporting of incidents (Abikenova et al., 2023: 41; Bakishev, 2024: 109). From the perspective of conflict theory, which asserts that societal structures reflect the interests of powerful groups often, at the expense of others (Marx and Engels, 1848: 25), the prioritization of economic gains over worker safety becomes evident. The compulsory accident insurance system emphasizes compensation rather than prevention or rehabilitation, thereby diminishing incentives for proactive safety measures (Kazbekova, 2023: 87). Limited private sector initiatives and inadequate collaboration between government and industry in prioritizing worker safety further exacerbate these challenges (Smatlayev et al., 2023: 42). This situation highlights how disparities in regulatory enforcement and safety culture contribute to increased labour inequalities and occupational risks.

Furthermore, the incorporation of risk society theory by Ulrich Beck (1992: 19), which argues that modern societies are increasingly preoccupied with the future and safety through systematic management of hazards and insecurities, illustrates that Japan's approach demonstrates proactive risk management and preventive measures. Meanwhile, Kazakhstan's reactive stance underscores a lack of effective strategies to mitigate the industrial risks inherent in mining operations.

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Sectoral priorities and reporting practices

Japan's sectoral priorities play a pivotal role in shaping the reporting and management of occupational accidents. Secondary industries, such as mining and manufacturing, exhibit higher levels of occupational safety and health (OSH) reporting compared to tertiary sectors, reflecting a stronger emphasis on safety measures (Shimizu et al., 2022: 260). This prioritization enhances data collection and analysis, enabling more precise and targeted interventions.

Meanwhile, the aging workforce in Japan introduces additional complexities, necessitating adjustments to safety protocols to meet the specific needs of older employees (Hayashi et al., 2023: 196). Workplace adaptations and revised practices are crucial for minimizing risks tied to demographic shifts. In contrast, Kazakhstan faces significant challenges with underreporting incidents, particularly in large-scale mining operations (Bakishev, 2024: 109). Sociocultural barriers, such as limited transparency and accountability, hinder accurate documentation of accidents, thereby complicating the development of effective safety strategies (Chebotarev and Sementsova, 2021: 114).

Impact of safety culture

Safety culture plays a pivotal role in both the causation and prevention of workplace accidents. In Japan, a well-established safety culture—characterized by continuous improvement, active employee participation, and strict adherence to established protocols—has significantly contributed to the reduction of incident rates (Tetzlaff et al., 2021: 412). The integration of educational initiatives, engineering controls, and enforcement mechanisms further enhances hazard management practices (Sherin et al., 2023: 85).

Conversely, Kazakhstan's mining industry exhibits an emergent safety culture. Insufficient emphasis on hazard recognition, inadequate risk assessment, and limited worker empowerment in safety-related matters contribute to elevated risk levels (Yerdessov et al., 2022). Furthermore, the absence of effective safety attitudes and practices exacerbates the consequences of existing hazards (Taubaev et al., 2023: 3).

Limitations and future research

Despite the valuable insights gained, this study has several limitations that must be considered when interpreting its findings. First, the harmonization of occupational injury data from two countries—each operating under distinct reporting and accounting systems—complicated the direct comparison of indicators. Underreporting or incomplete documentation of occupational injuries, particularly in the context of Kazakhstan, may have affected the statistical analysis. Constraints in accessing detailed information on the nature and circumstances of injuries also impede a more nuanced evaluation of trends.

Second, the qualitative data collected in this study did not include direct interviews with workers. As a result, the everyday safety practices and individual perceptions of risk—especially within high-hazard industries—remain less thoroughly explored. The absence of first-hand worker testimony limits the identification of sociopsychological factors that influence behaviour in high-risk environments.

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Third, the theoretical framework, rooted in concepts of regulatory state capacity and comparative political economy, requires further elaboration. Expanding these conceptual boundaries and integrating theories of labour protection and corporate accountability would help link the study's findings to a broader array of institutional factors.

Based on these observed limitations, several avenues for future research emerge:

– further operationalization of such concepts as "regulatory state capacity" and "comparative political economy" is needed to illuminate the institutional underpinnings of occupational safety systems;

– future inquiries should prioritize uncovering the sources of underreporting and adopt robust verification measures. For instance, researchers might supplement official statistics with alternative data sources (worker surveys, labour union reports, etc.) to minimize the risk of systematic errors;

– follow-up studies should incorporate direct interviews with workers and examine documented case studies to offer deeper insights into "safety culture" at the operational level. Qualitative observations can enrich quantitative analyses by revealing underlying social and organizational factors;

– future publications would benefit from integrating descriptive and analytical findings into a coherent structure that more clearly connects statistical data to interpretive discussions, thus enhancing transparency and coherence;

– it is crucial to more explicitly address the role of international guidelines (e.g., ILO-OSH 2001) and national legislation in shaping corporate accountability practices, while aligning the findings with broader global debates on labour rights.

CONCLUSION

This comparative analysis elucidates the significant disparities in occupational safety trends between Kazakhstan and Japan. Kazakhstan is currently confronted with increasing challenges in managing workplace safety within its rapidly expanding mining sector. Elevated accident rates and under-reporting of incidents indicate deficiencies in safety management systems and highlight the urgent need for comprehensive reforms. In contrast, Japan's comparatively stable incident rates reflect the effectiveness of its advanced safety protocols and stringent regulatory oversight; however, the country must address issues associated with an aging work-force to ensure that safety measures evolve in accordance with changing demographics and industry requirements. The findings from this study underscore the pressing necessity for enhanced cross-country collaboration aimed at improving occupational health and safety standards, particularly within high-risk industries such as mining. Establishing more robust regulatory frameworks, enhancing worker training programs, and fostering a strong safety culture is imperative for minimizing risks and safeguarding workers in hazardous occupations. By adopting best practices from countries like Japan, Kazakhstan could achieve substantial reductions in workplace accidents, thereby aligning with international standards for occupational health and safety. Overall, this study emphasizes the critical importance of effective government policies and active private sector engagement in enhancing occupational safety. Strong regulatory frameworks and a robust safety culture are essential in miti-

gating risks and protecting workers. The comparative analysis not only illuminates existing gaps but also contributes to a broader sociological understanding of how institutional practices and societal values influence labour conditions and worker safety.

In conclusion, while both Kazakhstan and Japan recognize the importance of worker safety in the mining industry, they face distinct challenges. Kazakhstan grapples with elevated accident rates and underreporting, which underscore deficiencies in safety management systems and the urgent need for reforms. Conversely, Japan, despite lower incident rates, must contend with issues related to an aging workforce and ensure that safety measures are adaptable to evolving industry requirements.

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Ethical Commission Approval

This study did not require approval from an ethics committee as it did not involve human participants, animals, or sensitive personal data. All data used in this research were obtained from publicly available sources.

Conflict of Interest Statement

There is no conflict of interest with any institution or person within the scope of this study.

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REFERENCES

Abdugaliyeva, Gulzhan, Gulzhan Daumova, Baurzhan Makhiyev and Aigerim Akylkankyzy (2024). "Prognosis of Injuries at Metallurgical Plants of KazZinc LLP by Mathematical Modelling". *Analysis of Statistical Indicators of Occupational Injuries That Occurred at Coal Mines of Kazakhstan*, 1(463): 8–16.

Abikenova, Sholpan K., Bauyrzhan M. Iskakov, Ainur N. Turekulova, Bibigul T. Chereyeva, (2023). "Features of Reducing Occupational Injuries in Kazakhstan and Abroad". *Bulletin of the Kazakh University of Economics, Finance and International Trade*, 2(51). doi: 10.52260/kuef.2023.51.2.041

Abikenova, Sholpan, Roberto Marcelloni and Sholpan Aitimova (2023). "Mathematical Aspects of Occupational Risk and its Classification Considering Statistical Indicators". *Bulletin of the L.N. Gumilyov Eurasian National University. Mathematics. Computer Science. Mechanics Series*, 145(4): 23–34. doi: 10.32523/2616-7182/bulmathenu.2023/4.3.

Abikenova, Sholpan, Sholpan Aitimova, Gulnara Sattarova, Aidos Bekmagambetov and Aidos Tolepov (2023). "Analysis of Statistical Indicators of Occupational Injuries that Occurred at Coal Mines of Kazakhstan". *Analysis of Statistical Indicators of Occupational Injuries That Occurred at Coal Mines of Kazakhstan*, 4(404): 317–329.

Alessa, Faisal M., Ashish D. Nimbarte and E. Mark Sosa (2020). "Incidences and Severity of Wrist, Hand, and Finger Injuries in the U.S. Mining Industry". *Safety Science*, 129: 104792. doi: 10.1016/j.ssci.2020.104792.

Bakishev, K. A. (2024). Injuries during mining or construction work: Condition, dynamics, prognosis. *Journal of Actual Problems of Jurisprudence*, 109(1). doi: 10.26577/JAPJ2024109110.

Beck, Ulrich (1992). *Risk Society: Towards a New Modernity*. Sage Publications.

Chebotarev, Aleksandr G. and Darya D. Sementsova (2021). "Comprehensive Assessment of Working Conditions and Occupational Disease Rates at Mining and Metallurgical Enterprises". *Mining Industry Journal (Gornay Promishlennost)*, 1(2021): 114–119. doi: 10.30686/1609-9192-2021-1-114-119.

Committee on Statistics of the Republic of Kazakhstan (2024). Occupational Injuries and Occupational Diseases in the Republic of Kazakhstan, Analytical Report. Retrieved from https://stat.gov.kz/ru/news/o-travmatizme-svyazannom-s-trudovoy-deyatelnostyu-i-professionalnykh-zabolevaniyakh-v-respublike-kaz1/. Accessed: 05.05.2024.

Cruz-Ausejo, Liliana, Nieves Alejandra Cama-Ttito, Patricia Flores Solano, Anthony Copez-Lonzoy and Víctor Juan Vera-Ponce (2024). "Occupational Accidents in Mining Workers: Scoping Review of Studies Published in the Last 13 Years". *BMJ Open*, 14(10): e080572. doi: 10.1136/bmjopen-2023-080572.

De, Sudeshna, Kirsten S. Almberg, Robert A. Cohen and Lee S. Friedman (2020). "Injuries during the First Hour at Work in the U.S. Mining Industry". *American Journal of Industrial Medicine*, 63(12): 1124–1133. doi:10.1002/ajim.23186.

Duarte, Joana, António Torres Marques and João Santos Baptista (2021). "Occupational Accidents Related to Heavy Machinery: A Systematic Review". *Safety*, 7(1): 21. doi: 10.3390/safety7010021.

Duarte, Joana, João Santos Baptista and António Torres Marques (2019). "Occupational Accidents in the Mining Industry—A Short Review. In Pedro M. Arezes et al. (Ed.), *Occupational and Environmental Safety and Health,* 202: 61–69). Springer International Publishing. doi: 10.1007/978-3-030-14730-3_7.

Duarte, Joana, João Santos Baptista and António Torres Marques (2018). "Evidence of Occupational Accidents with Equipment in Mining – A Systematic Review Protocol". *International Journal of Occupational and Environmental Safety*, 2(2): 84–88. doi: 10.24840/2184-0954_002.002_0009.

Friedman, Lee S., Kirsten S. Almberg and Robert A. Cohen (2019). "Injuries Associated with Long Working Hours Among Employees in the US Mining Industry: Risk Factors and Adverse Outcomes". *Occupational and Environmental Medicine*, 76(6): 389–395. doi: 10.1136/oemed-2018-105558.

Hämäläinen, Päivi, Jukka Takala and Kaija Leena Saarela (2006). "Global Estimates of Occupational Accidents". *Safety Science*, 44(2): 137–156. doi: 10.1016/j.ssci.2005.08.017.

Hara, Kunio, Mitsuo Hinoue and Sumiyo Ishimatsu (2023). "Causes of Countermeasures Against Serious Accidents Caused by Health Hazards of Chemical Substances, Based on Cases of Occupational Accidents in Japan". *Journal of UOEH*, 45(4): 243–257. doi: 10.7888/juoeh.45.243.

Hayashi, Chisato, Soshiro Ogata, Hiroshi Toyoda, Naoko Tanemura, Toshiyuki Okano, Masahiro Umeda and Shinobu Mashino (2023). "Risk Factors for Fracture by Same-Level Falls among Workers across Sectors: A Cross-Sectional Study of National Open Database of the Occupational Injuries in Japan". *Public Health*, 217: 196–204. doi: 10.1016/j.puhe.2023.02.003.

Heberger, John R. and Steven J. Wurzelbacher (2024). "Mining Injuries 2012-2019: Using Workers' Compensation Claims Data From 35 States to Identify Rates and Costs Associated by Nature of Injury, Event/Exposure, and Body Part Affected". *Journal of Occupational and Environmental Medicine*. doi: 10.1097/JOM.0000000000003067.

Higuchi, Masazumi (2023). 第14次労働災害防止計画の概要 [Overview of the 14th Plan for the Prevention of Occupational Accidents]. 産業医学ジャーナル, 45(1): 49–54.

Javaid, Ali, Muhammad Abubakar Siddique, Aijaz Ahmad Reshi, Mui-zzud-din, Furqan Rustam, Eunhee Lee and Vishal Rupapara (2023). "Coal Mining Accident Causes Classification Using Voting-Based Hybrid Classifier (VHC)". *Journal of Ambient Intelligence and Humanized Computing*, 14(10), 13211–13221. doi: 10.1007/s12652-022-03779-z.

JICA (2024). Data collection survey on the monitoring for environmentally friendly mining development: Final report. Japan International Cooperation Agency : Sumiko Resources Exploration and Development Co., Ltd.: Mitsubishi Materials Techno Co.

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JISHA (2024). Data and graph of transition of occupational accidents in industries in each type of accidents in 1999-2023 [Dataset]. *Ministry of Health, Labour and Welfare, Japan*.

Jørgensen, Kirsten (2016). "Prevention of "Simple Accidents at Work" with Major Consequences". *Safety Science*, 81: 46–58. doi: 10.1016/j.ssci.2015.01.017.

Kadyrzhanova, Tatyana S. (2024). "Analysis of Foreign Trends in The Field of Occupational Safety and Health". *Bulletin of the Institute of Legislation and Legal Information of the Republic of Kazakhstan*, 2(77): 320–326. doi: 10.52026/2788-5291_2024_77_2_320.

Kawasaki, Akie and Katsuya Kōroki. (2018). 労災保険関連統計にみる林業労働災害の発生傾向と災害防止対策の課題. 一般社団法人日本森林学会 [Trends in Forestry Labor Accidents Observed in Labor Accident Insurance-Related Statistics and Challenges in Disaster Prevention Measures]. doi: 10.11519/jfsc.129.0_28.

Liu, Jinli, Subasish Das and Md Nasim Khan (2024). "Decoding the Impacts of Contributory Factors and Addressing Social Disparities in Crash Frequency Analysis". *Accident Analysis and Prevention*, 194: 107375. doi: 10.1016/j.aap.2023.107375.

Liu, Rong, Zhi Liu, Hong-Chao Liu and Hui Shi (2021). "An Improved Alternative Queuing Method for Occupational Health and Safety Risk Assessment and Its Application to Construction Excavation". *Automation in Construction*, 126: 103672. doi: 10.1016/j.autcon.2021.103672.

Marx, Karl and Engels, Friedrich (1848). The Communist Manifesto.

Meyer, John W. and Brian Rowan (1977). "Institutionalized Organizations: Formal Structure as Myth and Ceremony". *American Journal of Sociology*, 83(2): 340–363. doi: 10.1086/226550.

Mirzaei Mostafa Mirzaei, Hamed Aghaei, Omid Kalatpuor, Ali Reza Soltanian and Asghar Nikravesh (2019). "Analysis of the Severity of Occupational Injuries in the Mining Industry using a Bayesian Network". *Epidemiology and Health*, 41: e2019017. doi: 10.4178/epih.e2019017.

MLHW (2023). The 14th occupational safety and health program. *Ministry of Health, Labour and Welfare*.

Molé, Dale M. (2024). "Mining Accident". In *Ciottone's Disaster Medicine*, 955–957. Elsevier.

Quiroz, Diana, María Paula, Quiceno Mesa and Estela Ospina Salinas (2023). "Occupational Safety and Health Risks: The Situation of Direct and Outsourced Mining Workers in Bolivia, Colombia, and Peru. *Profundo*.

Sanmiquel, Lluís, Marc Bascompta, Josep M. Rossell and Hernán Anticoi (2021). "Analysis of Occupational Accidents in the Spanish Mining Sector in the Period 2009–2018". *International Journal of Environmental Research and Public Health*, 18(24): 13122. doi: 10.3390/ijerph182413122.

Sanmiquel, Lluís, Marc Bascompta, Josep M. Rossell, Hernán Francisco Anticoi and Eduard Guash (2018). "Analysis of Occupational Accidents in Underground and Surface Mining in Spain Using Data-Mining Techniques". *Interna-*

tional Journal of Environmental Research and Public Health, 15(3): 462. doi: 10.3390/ijerph15030462.

Senapati, Amrites, Ashis Bhattacherjee and Nearkasen Chau (2020). "Associations of Job-Related Hazards and Personal Factors with Occupational Injuries at Continuous Miner Worksites in Underground Coal Mines: A Matched Case-Control Study in Indian Coal Mine Workers". *Industrial Health*, 58(4): 306–317. doi: 10.2486/indhealth.2019-0102.

Shimizu, Takashi, Takahiro Nagata, Akira Fujimoto, Shinya Inoue, Masashi Nagata and Koji Mori (2022). "Occupational Safety and Health Aspects of Corporate Social Responsibility Reporting in Japan: Comparison between 2012 and 2020". *BMC Research Notes*, 15(1): 260. doi: 10.1186/s13104-022-06145-6.

Shkembi, Abas, Lauren M. Smith and Richard L. Neitzel (2022). "Retrospective Assessment of the Association between Noise Exposure and Nonfatal and Fatal Injury Rates Among Miners in the United States from 1983 to 2014". *American Journal of Industrial Medicine*, 65(1): 30–40. doi: 10.1002/ajim.23305.

Siti Noraishah Ismail, Ahmad, Ramli and Hanafi Abdul Aziz (2021). "Research Trends in Mining Accidents Study: A Systematic Literature Review". *Safety Science*, 143: 105438. doi: 10.1016/j.ssci.2021.105438.

Smatlayev, Baurzhan M., Abikenova, Sholpan K. and Saktaganova, Indira S. (2023). Legal Analysis of the Implementation of Insurance Programs in the Republic of Kazakhstan to Prevent Accidents at Work and Assess the Need for Investments in Safe Work at the Expense of the Insurance Fund Formed in the Compulsory Accident Insurance System". *Bulletin of L.N. Gumilyov Eurasian National University. Law Series*, 144(3): 42–50. doi: 10.32523/2616-6844-2023-144-3-42-50.

Stemn, Eric (2019). "Analysis of Injuries in the Ghanaian Mining Industry and Priority Areas for Research". *Safety and Health at Work*, 10(2): 151–165. doi: 10.1016/j.shaw.2018.09.001.

Takala, Jukka (1999). "Global Estimates of Fatal Occupational Accidents". *Epidemiology*, 10(5): 640–646. doi: 10.1097/00001648-199909000-00034.

Taubayev, Aidos A., Dana M. Turekulova, Sholpan K. Abikenova and Bauyrzhan M. Iskakov (2023). Analysis of occupational injuries and their economic consequences in Kazakhstan's enterprises. *Bulletin of the Kazakh University of Economics, Finance and International Trade*, 2(51): doi: 10.52260/kuef.2023.51.2.004.

Wasaki, Natsuko and Akiko Takahashi (2024). "Characteristics of Occupational Accidents Caused by Inattentiveness". *Journal of Occupational Safety and Health*, JOSH-2023-0016-GE. doi: 10.2486/josh.JOSH-2023-0016-GE.

Wilson, Kerry S., Tahira Kootbodien and Nisha Naicker (2020). "Excess Mortality Due to External Causes in Women in the South African Mining Industry: 2013–2015". *International Journal of Environmental Research and Public Health*, 17(6): 1875. doi: 10.3390/ijerph17061875.

Yaslı, Fatma, and Bersam Bolat (2019). "A Bayesian Network Analysis for Occupational Accidents of Mining Sector". In Numan M. Durakbasa and Mehmet G. Gencyilmaz (Eds.), *Proceedings of the International Symposium for*

Production Research 2018, 781–799. Springer International Publishing. doi: 10.1007/978-3-319-92267-6_63.

Yerdessov, Nurbek, Asset Izdenov, Timur Beisenov, Roza Suleimenova, Bakhtiyar Serik and Ermek Sraubaev (2022). "Industrial Traumatism and Occupational Morbidity in Mining Industry of Kazakhstan". *Journal of Public Health Research*, 11(1): jphr.2021.2169. doi: 10.4081/jphr.2021.2169.

Yin, Wenting, Guang Fu, Cheng Yang, Zhong'an Jiang, Kai Zhu and Yong Gao (2017). "Fatal Gas Explosion Accidents on Chinese Coal Mines and the Characteristics of Unsafe Behaviors: 2000–2014". *Safety Science*, 92: 173–179. doi: 10.1016/j.ssci.2016.09.018.

Zhang, Han Yuan, Xue Yang and María Dolores Martínez-Aires (2021). "A Reference Framework for Health and Safety in the Workplace in China and the European Union: A Comparative Study". *Work*, 70(1): 247–261. doi: 10.3233/WOR-213569.

Zhang, Jiangshi, Jing Fu, Hongyu Hao, Gui Fu, Feng Nie and Wei Zhang (2020). "Root Causes of Coal Mine Accidents: Characteristics of Safety Culture Deficiencies Based on Accident Statistics". *Process Safety and Environmental Protection*, 136: 78–91. doi: 10.1016/j.psep.2020.01.024.

Zhang, Jinjia, Kaili Xu, Genserik Reniers and Greg You (2020). "Statistical Analysis of the Characteristics of Extraordinarily Severe Coal Mine Accidents (ESCMAs) in China from 1950 to 2018". *Process Safety and Environmental Protection*, 133: 332–340. doi: 10.1016/j.psep.2019.10.014.

Zhang, Yong, Wei Shao, Ming Zhang, Hui Li, Shenghua Yin and Yonggang Xu (2016). "Analysis of 320 Coal Mine Accidents Using Structural Equation Modeling with Unsafe Conditions of the Rules and Regulations as Exogenous Variables". *Accident Analysis and Prevention*, 92: 189–201. doi: 10.1016/j.aap.2016.02.021.