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Financial analysis of enterprises' costs for occupational safety at risk

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Abstract

This study examines the financial analysis of labor protection costs by companies at risk. It is noted that cost savings will be achieved in enterprises that pay close attention to labor protection, which will reduce the risks of industrial accidents and occupational diseases. The study conducted a thorough review of the literature in the field of occupational safety and decent and safe working conditions. To conduct a financial cost analysis and to identify specifics in the field of occupational safety, data from five enterprises in various sectors of the economy were used. To assess the effectiveness of the proposed methods, economic analysis tools such as cost–benefit analysis and return on investment (ROI) were employed. The adaptive approach ensured that the industry-specific characteristics of Kazakhstani enterprises were considered, enabling the application of a standardized yet flexible cost accounting methodology. The authors note that, for the first time in the country, expenses for occupational risk assessment and workplace certification were introduced in 2024. The authors conducted an in-depth financial analysis of the structure and directions of labor protection costs across various sectors of the economy, including a comparative analysis using data from three socially significant enterprises focused on sustainable development. The study covered three years of data indicators and included ten key categories of expenses. The financial analysis revealed both general patterns and unique features of accounting for labor protection costs at each enterprise. The identified spending trends indicate an active approach to workplace safety, resulting in significant investments in employee training, personal protective equipment, and improved working conditions. These measures aim not only to ensure compliance with regulatory requirements but also to minimize production risks specific to each industry.

Keywords: Cost management, Economic efficiency, Occupational risk, Occupational safety and health costs, Occupational safety and health.

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1. Introduction

Ensuring decent and safe working conditions requires costs from employers. At the same time, there are ways to plan and budget costs for safety and security: for providing personal and collective protective equipment; for training and retraining of personnel; for compulsory industrial accident insurance; and others. Insufficient financing of occupational safety and health costs can negatively affect the effectiveness of an organization, but above all, the health of employees.

For specialists responsible for organizing occupational safety and health, the implementation of cost management models that justify the importance of investment in workplace safety is becoming increasingly relevant. Such approaches not only ensure compliance with regulatory requirements but also demonstrate the financial benefits for the enterprise. Research confirms that adequate funding for occupational safety reduces the risks of workplace accidents and occupational diseases, which in turn leads to cost savings such as reduced compensation payments, medical expenses, fines, and staff replacement costs.

Moreover, the improvement of working conditions is directly linked to increased employee productivity and the quality of work performed, which ultimately contributes to the growth of the enterprise's financial performance.

2. Literature Review

Decent and safe working conditions are an important component of social and labor policy at all levels of government [1-19]. At all stages of mankind, scientists have paid special attention to the impact of working conditions on human health [19-25]. These issues are reflected in the writings of Hippocrates and Aristotle. Hippocrates, in particular, noted that labor in high-temperature environments (such as blacksmithing and metalworking) could lead to adverse health outcomes and facilitate the inhalation of metallic dust and other harmful substances into the lungs [8, 26-36].

During the Middle Ages, Paracelsus recognized as one of the founders of toxicology played a key role in the development of understanding occupational processes [35, 37-42]. He studied the effects of harmful substances on the human body and described diseases found among miners, stonemasons, and other workers exposed to sunlight and toxic agents [43]. He also emphasized the need for protective measures to prevent occupational diseases, which may be considered early occupational safety requirements [2].

In the same period, Italian physician Bernardino Ramazzini regarded as the «father of occupational medicine» published De Morbis Artificum Diatriba (Diseases of Workers) in 1700 [44]. This work provides a detailed description of the working conditions and occupational diseases of more than 50 professions, including physicians, blacksmiths, tanners, and bakers [45].

German scholar Georgius Agricola, known for his contributions to mining science, also advanced the understanding of occupational risks [46, 47]. In his work De Re Metallica (On Mining), published in 1556, he described various aspects of mining work, including hazards related to toxic substances, ventilation, and dust [48]. Agricola proposed the use of ventilation systems in mines to improve working conditions and mitigate the impact of harmful factors on miners' health [49].

The Industrial Revolution led to a significant increase in factory and plant jobs, where working conditions were often extremely dangerous and unhealthy. During this period, European liberal radicals and utopian socialists attempted to develop social programs and labor policies [45, 48]. For the first time, in 1875, German Social Democracy included in its Gotha Program demands such as occupational safety for working youth and adolescents, a ban on Sunday labor, sanitary supervision of workers' housing, and a standard workday in line with social needs [11, 50-63].

The development of occupational safety in Kazakhstan has gone through several key stages reflecting political, social, and economic changes. It began during the early Soviet period, following the October Revolution of 1917, when the first occupational safety laws were enacted across the Soviet Union, including Kazakhstan. In 1922, the Labor Code of the RSFSR was adopted, which set forth fundamental occupational safety norms also applied in Kazakhstan. In the 1930s, with the onset of industrialization and construction of major industrial sites, control over compliance with safety requirements intensified [64].

In the post–war period, beginning in the 1940s, Kazakhstan actively introduced new technologies in industry, necessitating higher safety standards during the economic recovery. In the 1950s and 1960s, the automation and mechanization of production processes continued, requiring new occupational safety standards and a focus on preventing occupational diseases. In 1972, the Labor Code of the Kazakh SSR was adopted. Notably, in the 1970s and 1980s, numerous decrees and regulations on occupational safety were issued, with an emphasis on production automation, which contributed to a reduction in manual labor and workplace injuries [53, 58, 65-69].

Following Kazakhstan's independence in 1991, the occupational safety system underwent reforms. In 1999, the Law on Labor in the Republic of Kazakhstan [10] was adopted, adapting Soviet experience to the new context and incorporating international standards. In the 2000s, Kazakhstan began active cooperation with international organizations such as the International Labour Organization (ILO), allowing global best practices to be integrated into national legislation. A new Labor Code was adopted in 2007, significantly updating the legal framework for occupational safety, strengthening state control, and helping reduce industrial injuries [11, 70-76].

3. Materials and Methods

In recent decades, state policy in the field of occupational safety has focused on further improving working conditions, implementing modern management systems, automating legal compliance monitoring, and developing a culture of safety in enterprises.

In the 2020s, emphasis has shifted toward digitalization and innovation in occupational safety, including automated systems for monitoring working conditions and improved worker education in this area. In 2023, the Concept of Safe Labor of the Republic of Kazakhstan for 2024–2030 was adopted, aimed at improving working conditions, enhancing workplace safety, and reducing occupational risks [77].

The research methodology is based on a systems approach, which enables the consideration of occupational safety cost accounting and financial analysis as a multifaceted and integrated system encompassing economic, social, and organizational aspects. The study involved a thorough theoretical analysis, empirical examination of current cost accounting practices, and the development of economic models aimed at enhancing cost management efficiency in the context of Kazakhstan's digital economy [78].

At the initial stage of the study, a detailed analysis of the theoretical foundations of occupational safety cost accounting and analysis was conducted. This included a review of scientific literature by domestic and international authors, as well as regulatory documents such as the Labor Code of the Republic of Kazakhstan and international standards like ISO 45001. The systematization of [55, 72, 73] theoretical data made it possible to identify key approaches to cost classification and to formulate conceptual foundations for accounting, tailored to the specific characteristics of Kazakhstan's economy.

To assess the effectiveness of the proposed methodologies, economic analysis tools such as cost–benefit analysis and return on investment (ROI) were used.

The adaptive approach ensured consideration of industry–specific features of Kazakhstani enterprises, allowing the application of a standardized yet flexible cost accounting methodology. The long–term orientation of the methodology emphasizes the strategic nature of occupational safety expenditures, viewing them as investments in improved working conditions, reduced occupational risks, and the promotion of sustainable development.

Thus, the research methodology represents a synthesis of theoretical and empirical approaches, enabling the development of innovative recommendations for improving occupational safety cost accounting and analysis in the context of Kazakhstan's digital transformation.

4. Results

In order to identify the specifics in the field of occupational safety and health, a financial analysis of the costs of occupational safety and health for five enterprises in various sectors of the economy was carried out. The presented results show different approaches to accounting for occupational safety and health costs, depending on the industry and working conditions Table 1.

Table 1.
Characteristics of the enterprises under study.

Name of Enterprise	Industry sector	Main areas of activity
LLP «Phosphate»	Manufacturing Industry	Production of phosphate fertilizers, raw material processing
LLP «Phosphor»	Manufacturing Industry	Production of phosphorus–based products, mineral raw material processing
JSC «Altai»	Mining Industry	Gold mining and processing, ore beneficiation
LLP «Project»	Mining Industry	Quarry development, extraction and processing of mineral resources
JSC «GRES–2»	Energy Sector	Electricity production, operation of energy facilities

Working conditions and the nature of the production environment at enterprises are largely determined by their industry sector, which significantly affects the specifics of occupational safety and health (OSH) cost accounting. Harmful factors associated with technological processes necessitate the development and implementation of measures aimed at minimizing their impact on employees. To assess the characteristics of working conditions and the factors influencing expenditures, enterprises from three priority sectors of the economy were analyzed: manufacturing, mining, and energy.

Each sector is characterized by specific harmful substances and production environment factors that define health risks for workers and shape the structure of OSH–related costs Table 2.

Table 2.
Characteristics of Harmful Factors and Working Conditions by Industry Sector.

Industry sector	Main harmful substances	Production environment factors	Risk classes
Manufacturing industry	Phosphorus–containing compounds, acids, dust, ammonia, hydrogen sulfide	– Chemical pollution. – High noise level from the equipment. Vibration. – Air pollution in the work area.	– High risk of occupational diseases due to constant contact with chemicals.
Mining industry	Quartz, gold–bearing ore dust, mercury, cyanides	– High dust content. – Noise from machinery and equipment. Danger of landslides and explosions. – Exposure to toxic chemicals.	– Increased risk of injury. – Occupational diseases of the respiratory system.
Energy industry	Gas emissions, coal dust, aerosols of oils and lubricants	– Noise from turbines, generators, and other equipment. – High temperature near the equipment. – Electromagnetic fields.	– The risk of heat stroke and burns. – Occupational respiratory diseases.

At enterprises in the manufacturing, mining, and construction sectors, a significant proportion of employees work under hazardous conditions, representing a substantial percentage of the total workforce Figure 1.
It is important to note that the most risk–exposed occupations in these sectors include:

- Manufacturing: process equipment operators, assembly line workers, and chemical laboratory personnel;
- Mining: miners, drifters, blasters, and excavator operators;
- Construction: welders, concrete workers, high–rise laborers, and crane operators.

These professions require special attention regarding occupational safety and health, as the nature of their work involves a high level of physical exertion, exposure to harmful chemical substances, and an increased risk of injury.

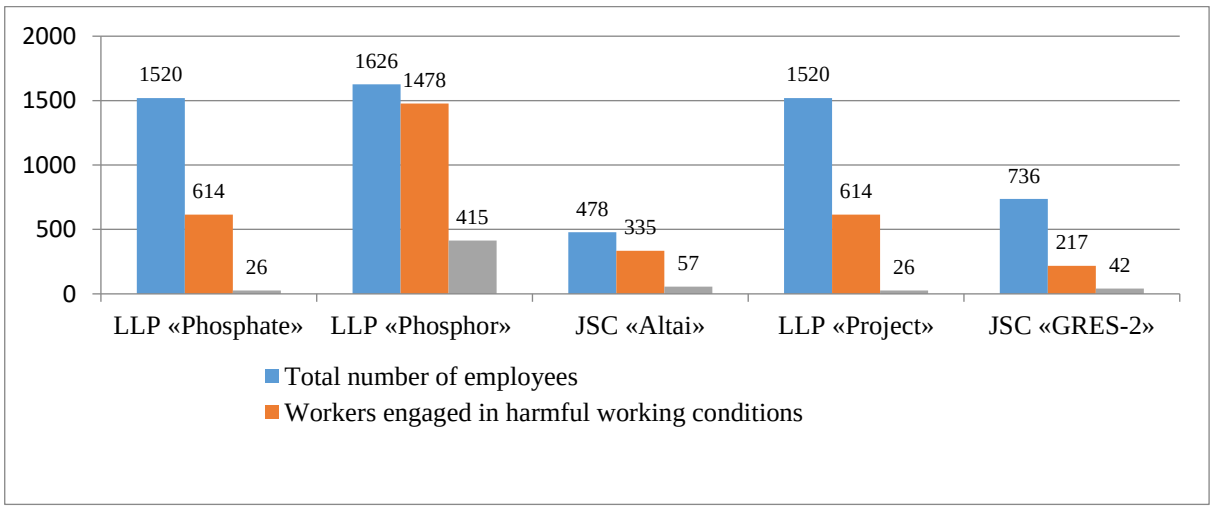

Figure 1.
Distribution of the number of employees and workers in harmful working conditions in enterprises of various industries.

These data highlight the importance of developing and implementing effective occupational safety and health measures, particularly concerning gender-specific considerations, as women are also employed in hazardous working conditions.

As part of the financial analysis of occupational safety expenditures at Kazakhstani enterprises, the main categories of expenses for the period from 2022 to 2024 were identified. The occupational safety and health costs of LLP «Phosphate» show a steady upward trend in some areas and a decrease in others over the 2022–2024 period Table 3.

Table 3.
Cost analysis for occupational safety and health at «Phosphate» LLP.

Type of costs (thousand tenge)	2022	2023	2024
The cost of conducting an occupational risk assessment	–	–	11 676,00
Costs of certification of production facilities	–	–	12 750,00
The cost of conducting training, briefing and knowledge testing	2 032,20	3 221,80	18 217,00
The cost of compulsory occupational accident insurance	164 627,70	210 583,20	106 136,60
Costs of personal protective equipment	192 001,60	92 921,40	141 569,80
The cost of providing collective protection	–	–	–
The cost of providing sanitary facilities	141 399,40	76 972,70	55 752,60
The cost of milk and specialized meals	186 652,00	305 813,10	37 466,20
The cost of reduced working hours and additional vacations	1594835,00	1993 543,40	2192898,70
The cost of conducting medical examinations and pre–shift medical examinations of employees	8 336,10	7 754,40	8 773,70
The cost of mandatory pension contributions	151 339,60	207 947,00	208 757,40

The expenditures at LLP «Phosphate» demonstrate dynamic changes in occupational safety and health investments over the three-year period.

Costs for sanitary facilities steadily declined, decreasing by 60% over the three-year period, while expenses for milk and food provisions also fell significantly, down to 37,466.2 thousand KZT in 2024 a steep drop from 186,652.0 thousand KZT in 2022.

Reduced working hours and additional leave remained the largest expense categories, growing by 37.5% over three years from 1,594,835.0 thousand KZT in 2022 to 2,192,898.7 thousand KZT in 2024.

These trends illustrate a strategic shift in resource allocation, aiming to strike a balance between regulatory compliance and the well-being of the workforce.

The financial analysis of occupational safety and health expenditures at JSC «Altai» for the period 2022–2024 reveals a trend of significant changes across various expense categories related to ensuring safe working conditions Table 4.

Table 4.
Cost analysis for occupational safety and health at JSC «Altai».

Type of costs (thousand tenge)	2022	2023	2024
The cost of conducting an occupational risk assessment	–	–	8,299,20
Costs of certification of production facilities	–	–	3,341,25
The cost of conducting training, briefing and knowledge testing	–	7,639,20	9,167,04
The cost of compulsory occupational accident insurance	93,396,41	244,193,70	293,032,45
Costs of personal protective equipment	19,029,43	57,445,83	63,275,54
The cost of providing collective protection	36,276,58	54,306,89	62,281,76
The cost of providing sanitary facilities	3,757,16	7,112,59	10,703,88
The cost of providing workers with milk or specialized products for therapeutic and preventive nutrition	29,150,85	1,335,893,47	540,975,36
The cost of reduced working hours	306,978,86	392,506,05	284,858,78
The cost of conducting medical examinations and pre–shift medical examinations of employees	32,033,09	31,540,37	47,675,09
The cost of mandatory pension contributions	–	–	–

The total cost of occupational safety and health at Altai JSC from 2022 to 2024 indicates a strengthening of the company's preventive policy.

The cost of training and retraining increased from 7,639.2 thousand tenge in 2023 to 9,167.0 thousand tenge in 2024.

The dynamics of expenditures on milk and specialized nutrition show significant fluctuations. In 2023, these expenses peaked at 1,335,893.5 thousand KZT, before dropping to 540,975.4 thousand KZT in 2024. This change is likely linked to adjustments in the company’s internal policies or a reduction in the number of employees working in hazardous conditions.

Expenditures on reduced working hours and additional leave showed mixed trends. In 2023, they increased to 392,506.1 thousand KZT (+28%), but declined to 284,858.8 thousand KZT in 2024. At the same time, spending on medical examinations rose by 48.8%, from 32,033.1 thousand KZT in 2022 to 47,675.1 thousand KZT in 2024.

It is important to note that the company reports no expenditures on mandatory pension contributions. In the long term, this may be viewed as an area requiring further attention regarding employee social protection. This is particularly relevant for a company where a substantial portion of the workforce is employed in hazardous and dangerous working conditions.

In conclusion, the observed expenditure trends at JSC «Altai» indicate positive progress in occupational safety and health, but they also underscore the need for continued monitoring and in–depth analysis of specific aspects to strengthen social protection and achieve optimal safety management efficiency.

The analysis of occupational safety and health expenditures at LLP "Project" during the study period reveals a trend of increasing costs across nearly all key areas. This reflects a growing emphasis on enhancing workplace safety and improving the production environment.

Expenditures for professional risk assessment and certification of production facilities appeared for the first time in 2024, which is attributed to the implementation of new regulatory requirements and the company's own initiatives aimed at improving working conditions Table 5.

Table 5.
Cost analysis for occupational safety and health at LLP «Project».

Type of costs (thousand tenge)	2022	2023	2024
The cost of conducting an occupational risk assessment	–	–	5,845,00
Costs of certification of production facilities	–	–	3,600,00
The cost of conducting training, briefing and knowledge testing	1,831,20	1,688,80	3,984,60
The cost of compulsory occupational accident insurance	38,727,40	72,640,10	105,546,00
Costs of personal protective equipment	28,484,90	50,561,20	62,811,60
The cost of providing collective protection	–	–	–
The cost of providing sanitary facilities	16,929,80	27,552,90	17,223,70
The cost of providing workers with milk or specialized products for therapeutic and preventive nutrition	100,109,60	205,985,90	305,212,50
The cost of shorter working hours, additional vacations, and higher wages	551,208,40	877,549,70	915,959,50
The cost of conducting medical examinations and pre–shift medical examinations of employees	3,304,80	4,104,00	–
The cost of mandatory pension contributions	65,450,30	98,234,10	143,099,70

The analysis of occupational safety and health expenditures at LLP "Project" for the period 2022–2024 demonstrates the company's strong focus on ensuring workplace safety and improving working conditions. The expenditure categories show both steady growth and temporary fluctuations, reflecting the nature of implemented measures and regulatory requirements.

Professional risk assessment and workplace certification costs were introduced for the first time in 2024, amounting to 5,845.0 thousand KZT and 3,600.0 thousand KZT, respectively. This is likely due to updates in regulatory frameworks and scheduled activities aimed at minimizing occupational risks.

In 2024, training and knowledge verification expenses amounted to 3,984.6 thousand KZT, representing a 136% increase compared to the previous year. This surge may be associated with strengthened requirements for employee qualifications and an overall emphasis on staff preparedness.

Mandatory insurance for workplace accidents more than doubled over the three-year period, rising from 38,727.4 thousand KZT in 2022 to 105,546.0 thousand KZT in 2024. This increase is likely a result of changes in insurance premium rates and expanded coverage.

Provision of personal protective equipment (PPE) for employees showed a 120.5% increase over the financial analysis period, reaching 62,811.6 thousand KZT in 2024. This reflects the company's commitment to enhancing worker protection against harmful factors in the production environment.

Sanitary and hygiene facility expenditures peaked in 2023 at 27,552.9 thousand KZT, followed by a 37.5% decrease in 2024. This decline is likely due to the completion of previously planned infrastructure projects or cost optimization measures.

The largest expenditure category compensation for reduced working hours and additional leave increased by 66.2% over three years, reaching 915,959.5 thousand KZT in 2024. This growth is associated with a rise in the number of employees working under hazardous conditions and a revision of compensation policies.

Provision of milk and specialized nutrition for employees also showed a significant increase. In 2024, expenditures reached 305,212.5 thousand KZT, more than tripling compared to 2022. This reflects enhanced efforts to protect the health of workers operating in hazardous conditions.

Medical examination costs remained stable in 2022 and 2023, amounting to 3,304.8 thousand KZT and 4,104.0 thousand KZT, respectively. The absence of data for 2024 may be due to administrative changes or a shift in the approach to organizing medical examinations.

Pension contributions received significant attention, increasing by 118.5% over the three-year period to 143,099.7 thousand KZT in 2024. This rise is likely attributable to an increase in the wage fund or adjustments in pension contribution rates.

Overall, the dynamics of occupational safety and health expenditures at LLP «Project» demonstrate the company's commitment to regulatory compliance and improving working conditions. The most significant changes were observed in

categories related to compensation for work in hazardous conditions, specialized nutrition, and mandatory insurance. However, the decline in certain expenditures such as those for sanitary and hygiene facilities requires further analysis to assess potential long-term implications.

At the same time, occupational safety expenditures at LLP «Phosphor» exhibited considerable variation during the study period, reflecting both internal changes within the company and external factors, such as legislative amendments or increased attention to workplace safety Table 6.

Table 6.
Cost analysis for occupational safety and health at LLP «Phosphor».

Type of costs (thousand tenge)	2022	2023	2024
The cost of conducting an occupational risk assessment	–	–	2,412,00
Costs of certification of production facilities by working conditions	–	–	1,095,00
The cost of conducting training, briefing and knowledge testing	176,4	1,372,00	3,984,60
The cost of compulsory occupational accident insurance	21,989,70	27,487,20	105,545,90
Costs of personal protective equipment	12,771,70	15,964,60	60,209,00
The cost of providing collective protection	–	–	–
The cost of providing sanitary facilities	–	15,300,00	17,223,70
The cost of providing workers with milk or specialized products for therapeutic and preventive nutrition	19,969,20	24,961,40	93,397,10
The cost of providing reduced working hours and additional vacations	45,315,10	56,643,90	14,132,60
The cost of conducting medical examinations and pre–shift medical examinations of employees	1,860,30	2,075,50	2,449,30
The cost of mandatory pension contributions	78,587,30	98,234,10	143,099,70

Employee training and instruction at LLP «Phosphor» showed a remarkable increase. From 252.0 thousand KZT in 2022, expenditures rose to 3,984.6 thousand KZT in 2024 an increase of 1,481%. This reflects a more proactive approach to preparing workers for the safe performance of their duties.

Mandatory insurance costs for workplace accidents increased by 380% over three years, from 27,487.2 thousand KZT in 2022 to 105,545.9 thousand KZT in 2024. This growth may be attributed to changes in premium rates or insurance coverage, indicating the company's commitment to minimizing accident-related risks.

Medical examination expenses remained stable, rising from 2,075.5 thousand KZT in 2022 to 2,449.3 thousand KZT in 2024 an 18% increase, highlighting the continued importance of preventive health measures among employees.

Finally, mandatory professional pension contributions increased by 46% over the three-year period, from 98,234.1 thousand KZT in 2022 to 143,099.7 thousand KZT in 2024. This increase may be linked to rising wage levels or a growing workforce.

Overall, the dynamics of occupational safety and health expenditures at LLP «Phosphor» indicate the company's increasing focus on improving safety and working conditions. However, the decline in some key expense categories warrants further analysis to assess their potential impact on employee protection.

The main categories of occupational safety and health expenditures at JSC "GRES–2" over the three-year period were analyzed. The total amount of expenditures shows a positive trend, increasing from 52,628.86 thousand KZT in 2022 to 71,228.23 thousand KZT in 2024 an overall 35.4% growth during the specified period Table 7.

In particular, spending on materials for occupational safety rose by 24.4%, from 36,869.25 thousand KZT in 2022 to 45,889.56 thousand KZT in 2024.

Table 7.
Cost analysis for occupational safety and health at JSC «GRES–2».

Type of costs (thousand tenge)	2022	2023	2024
Occupational safety and health materials costs	36,869,25	42,778,73	45,889,56
Costs of workwear and personal protective equipment	5,060,47	8,249,98	9,179,85
The cost of special meals	2,850,54	3,970,24	4,299,67
The cost of conducting medical examinations and pre–shift medical examinations of employees	2,805,33	3,211,65	3,869,98
Costs of certification of workplaces	1,536,42	1,799,89	1,949,64
The cost of providing drinking water	1,474,67	1,779,56	1,929,72
Other costs of occupational safety and health	2,032,18	3,641,76	4,109,81

Note: Compiled by the authors [1-40].

Workplace certification remains an important cost category. In 2022, expenditures totaled 1,536.42 thousand KZT, increasing by 26.9% to 1,949.64 thousand KZT in 2024. This reflects the company's commitment to the regular assessment of working conditions.

Spending on the provision of drinking water increased by 30.8%, reaching 1,929.72 thousand KZT in 2024, compared to 1,474.67 thousand KZT in 2022. This increase may be attributed to higher sanitation standards or a growing workforce.

Other occupational safety expenditures showed the most substantial growth more than doubling over the period. From 2,032.18 thousand KZT in 2022, they increased to 4,109.81 thousand KZT in 2024 (+102%), likely reflecting the implementation of new safety programs and initiatives aimed at improving workplace conditions.

In conclusion, the financial analysis of occupational safety expenditures at JSC "GRES–2" demonstrates a consistent increase in investment in worker safety. The growth in most expenditure categories indicates the company's clear commitment to enhancing working conditions and complying with regulatory requirements.

5. Discussions

The financial analysis of the dynamics of occupational safety and health (OSH) cost accounting across the studied enterprises from various economic sectors has revealed both common trends and sector-specific features, which are closely linked to the nature of their production activities. Changes in the structure of expenditures may be influenced by a combination of external and internal factors, including increased government regulation, implementation of new technologies, production expansion, and growing employer awareness of the importance of occupational safety.

To gain deeper insight, an analysis of key cost categories was conducted from a cause–and–effect perspective, identifying potential factors driving their dynamics Table 8.

Table 8.
Causal relationships and industry–specific accounting for occupational safety and health costs.

Cost category	The trend	Causal factors	Effects
Conducting an occupational risk assessment	It appeared only in recent years	Stricter legal requirements, the need to comply with occupational safety and health standards	Improving the quality of risk management, reducing the likelihood of incidents
Certification of workplaces	Growth in recent years	Introduction of new regulations, the need to update information about workplaces	Raising awareness of harmful factors, planning improvements
Training and instruction	Gradual growth	The introduction of compulsory training programs increases the level of knowledge of employees	Reducing the risk of human error, increasing productivity
Compulsory insurance against industrial accidents	Steady growth	Increase in insurance rates, expansion of insurance coverage	Protecting employees from the consequences of accidents, and reducing financial risks for the employer
Personal protective equipment	Fluctuations (increase/decrease)	The purchase of PPE depends on current working conditions and changes in the number of employees.	Ensuring the safety of workers at work
Collective protection equipment	Irregular costs	Investments in protective systems are planned as necessary, and equipment upgrades are planned.	Reducing the impact of harmful factors
Sanitary facilities	Irregular but significant costs	Modernization of sanitary facilities, maintenance of hygiene standards	Improving working conditions, increasing employee satisfaction
Milk and specialty food	Cost reduction	Reducing the number of workers in harmful conditions or switching to alternative forms of compensation	Possible deterioration of workers' health due to reduced nutrition
Reduced working hours and additional vacations	Increased costs	Increase in the number of workers in harmful conditions, increase in compensation requirements	Increase employee satisfaction and reduce employee fatigue
Medical examinations	Steady growth	Stricter health standards, an increased number of employees	Early diagnosis of occupational diseases

Source: Compiled by the authors Huang and Watson [1] and Ajekbarov et al. [23]

The conducted analysis revealed both general patterns and unique characteristics in the accounting of occupational safety and health expenditures at each enterprise. The identified spending trends indicate a proactive approach to ensuring workplace safety, reflected in substantial investments in employee training, personal protective equipment, and improvements to working conditions. These measures are aimed not only at ensuring compliance with regulatory requirements but also at minimizing production-related risks specific to each industry.

To gain a deeper understanding of the structure and directions of occupational safety expenditures across different economic sectors, a comparative analysis was conducted using data from three enterprises: LLP «Fosfat», JSC «Altai», and LLP «Project».

The study covers the period from 2022 to 2024 and includes ten key cost categories, such as training, personal protective equipment (PPE), sanitary measures, compensation for hazardous conditions, and specialized nutrition.

The financial analysis revealed a significant increase in training investments at LLP 'Fosfat', steady growth in PPE expenses across all organizations, and the highest expenditures for compensation due to hazardous working conditions. Nutrition and milk costs were the most volatile, especially at JSC 'Altai'.

There was also a gradual increase in expenses for medical examinations and the emergence of certification and risk assessment costs, reflecting heightened attention to occupational risk management.

The comparison revealed both common trends and industry-specific features. Enterprises in the chemical and mining industries demonstrate a systematic approach to occupational safety, focusing on preventive measures and worker protection.

The table 9 presents the evolution of training expenditures across three enterprises **Fosfat**, **Altai**, and **Project** over the period from 2022 to 2024.

Table 9.
Dynamics of Training Expenditures by Enterprise (2022–2024).

	2022	2023	2024
Fosfat	2032.2	3221.8	18217.0
Altai	0.0	7639.2	9167.04
Project	1831.2	1688.8	3984.6

Fosfat significantly increased its training expenditures, reaching 18,217.0 thousand tenge in 2024, indicating a strong strategic focus on workforce development. Altai and Project showed moderate but growing investments, reflecting a shift toward more structured training efforts across enterprises.

The analysis of training expenditures across the three enterprises reveals distinct strategic approaches to workforce development Figure 2.

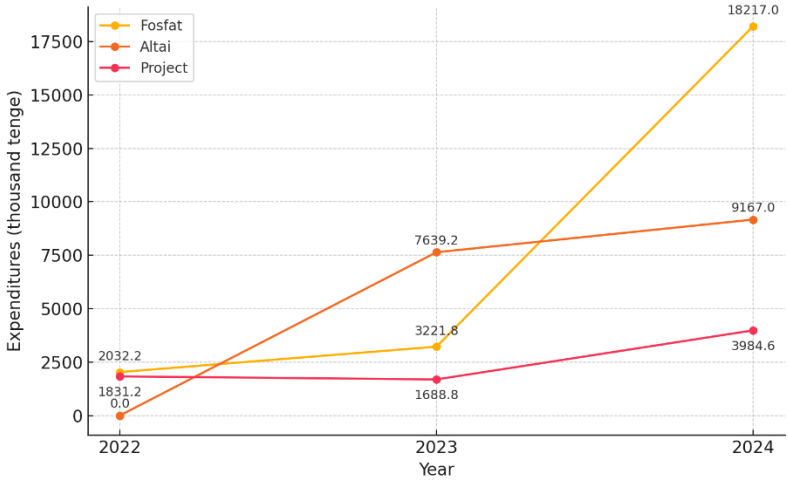

Figure 2.
Dynamics of Training Expenditures by Enterprise (2022–2024).

Fosfat demonstrated a significant surge in investment in 2024, with expenditures reaching 18,217.0 thousand tenge. This sharp increase indicates a robust commitment to enhancing employee skills and strengthening occupational safety culture.

Altai, in contrast, began allocating funds for training only in 2023, followed by a moderate increase in 2024. This pattern suggests a recent but growing emphasis on formalized training programs, likely in response to evolving safety regulations or internal restructuring.

Project maintained a modest yet consistent training budget throughout the observed period. A gradual rise to 3,984.6 thousand tenge in 2024 reflects incremental development, possibly aligned with long-term workforce planning and stepwise program implementation.

Altai demonstrated a steady and significant increase in insurance costs, reaching 293,032.45 thousand tenge in 2024, becoming the highest among the three enterprises Table 10. In contrast, Fosfat showed a peak in 2023 followed by a sharp decline, while Project displayed a consistent upward trend across all years.

Table 10.
Dynamics of Insurance Expenditures by Enterprise (2022–2024).

	2022	2023	2024
Fosfat	164627.7	210583.2	106136.6
Altai	93396.41	244193.7	293032.45

Project	38727.4	72640.1	105546.0

The dynamics of insurance expenditures across the three enterprises reflect varying strategies and financial commitments to workforce protection Figure 3.

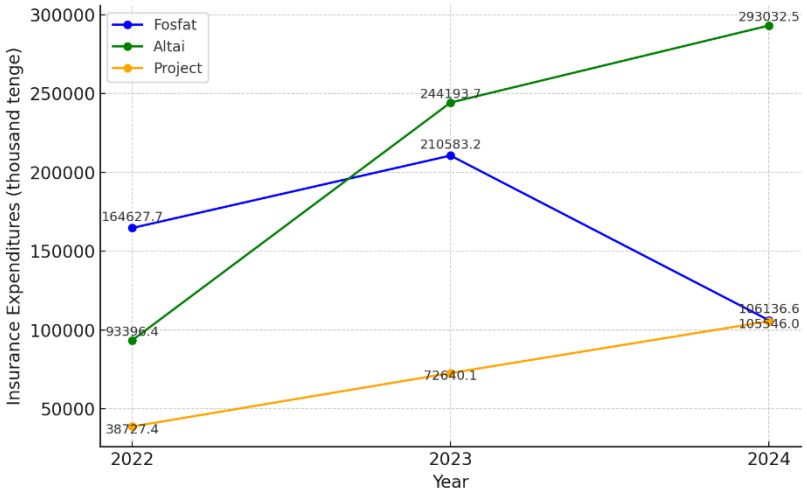

Figure 3.
Dynamics of Insurance Expenditures by Enterprise (2022–2024).

Altai showed a steady and substantial increase, culminating in 293,032.45 thousand tenge in 2024, becoming the top spender in this category. Fosfat, in contrast, peaked in 2023 but reduced its insurance spending significantly in 2024, possibly reallocating resources to other safety priorities. The project displayed consistent year-over-year growth, nearly tripling its expenditures from 2022 to 2024, indicating a strengthening focus on employee insurance coverage.

All three enterprises increased their investments in PPE by 2024, with Fosfat maintaining the highest expenditures despite a dip in 2023 Table 11.

Table 11.
Dynamics of Personal Protective Equipment (PPE) Expenditures by Enterprise (2022–2024).

	2022	**2023**	**2024**
Fosfat	192001.6	92921.4	141569.8
Altai	19029.43	57445.83	63275.54
Project	28484.9	50561.2	62811.6

Altai and Project showed consistent year–over–year growth, reflecting a strengthening of safety compliance and protective measures.

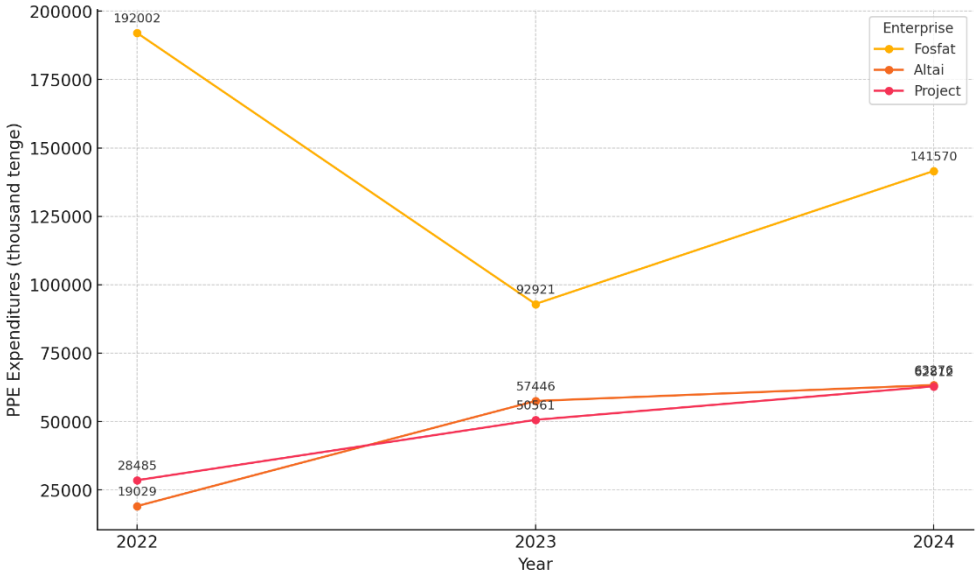

Figure 4.
Dynamics of Personal Protective Equipment (PPE) Expenditures by Enterprise (2022–2024).

Figure 4 illustrates the dynamics of expenditures on Personal Protective Equipment (PPE) by three enterprises, Fosfat, Altai, and Project from 2022 to 2024.

- Fosfat initially had the highest PPE spending in 2022 (192,001.6 thousand tenge), followed by a sharp decline in 2023, and then a substantial recovery in 2024, indicating a possible cyclical procurement pattern or adjustments in safety strategy.
- Altai demonstrated a consistent increase in PPE expenditures each year, growing from 19,029.43 thousand tenge in 2022 to 63,275.54 in 2024, which may reflect progressive investment in workplace safety Table 12.

Table 12.
Dynamics of Sanitary Expenditures by Enterprise.

	2022	2023	2024
Fosfat	141399.4	76972.7	55752.6
Altai	3757.16	7112.59	10703.88
Project	16929.8	27552.9	17223.7

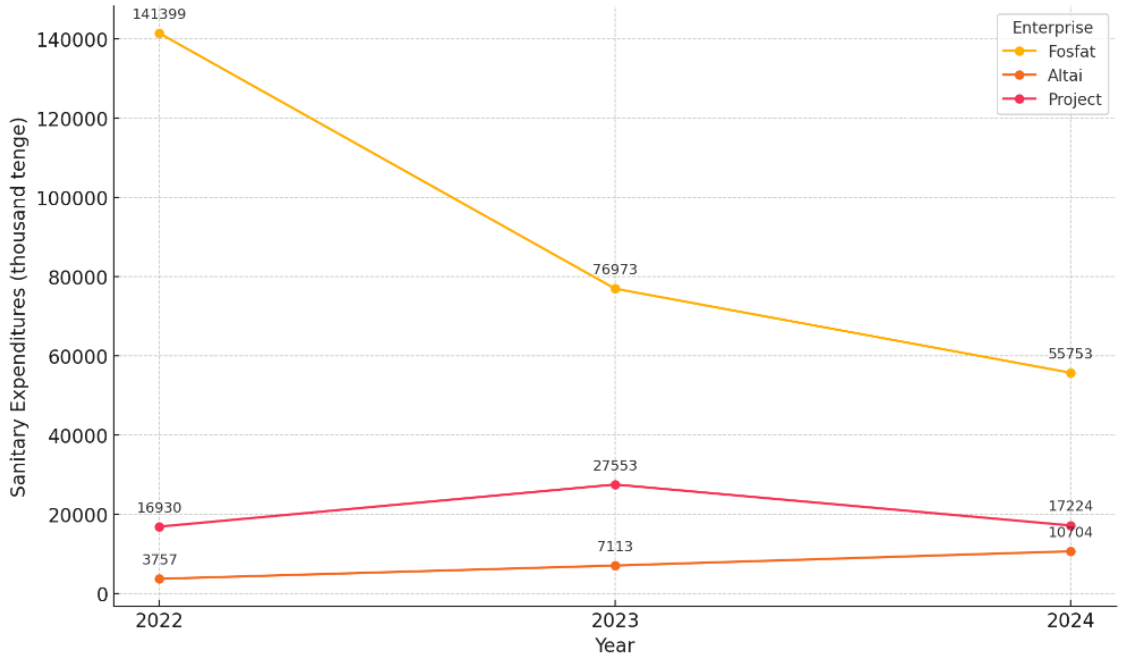

Figure 5.
Dynamics of Sanitary Expenditures by Enterprise (2022–2024).

Figure 5 presents the trends in sanitary expenditures by the enterprises Fosfat, Altai, and Project from 2022 to 2024. Fosfat showed a substantial and continuous decrease in spending, dropping from 141,399.4 thousand tenge in 2022 to 55,752.6 in 2024, possibly indicating optimization or a shift in priorities. In contrast, Altai demonstrated a steady rise in allocations, suggesting a growing emphasis on sanitary conditions. Project peaked in 2023 before reducing its expenditures in 2024, potentially reflecting the completion of major initiatives or changes in operational scale.

Altai recorded an extraordinary spike in nutrition-related expenditures in 2023, exceeding 1.3 billion tenge, which sharply dropped the following year Table 13.

Table 13.
Dynamics of Nutrition Expenditures by Enterprise.

	2022	2023	2024
Fosfat	186652.0	305813.1	37466.2
Altai	29150.85	1335893.47	540975.36
Project	100109.6	205985.9	305212.5

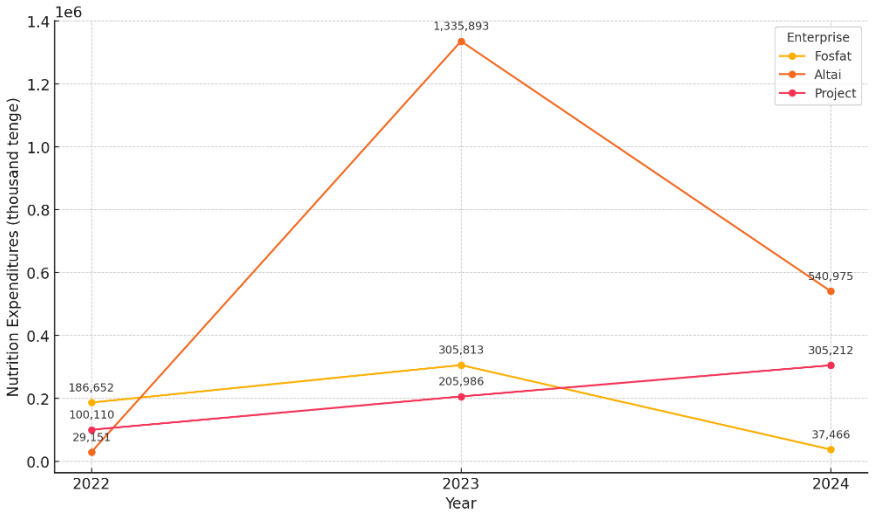

Figure 6.
Dynamics of Nutrition Expenditures by Enterprise (2022–2024).

Figure 6 the text illustrates the dynamics of nutrition expenditures by Fosfat, Altai, and Project enterprises for 2022–2024. Altai shows an explosive increase in 2023 to over 1.3 million thousand tenge, followed by a sharp drop in 2024, although it still remains far above 2022 levels. The project demonstrates steady growth across all three years, reaching 305,212.5 thousand tenge in 2024. In contrast, Fosfat's expenditures peaked in 2023 before plunging significantly in 2024, possibly due to policy changes or budget reallocations.

Fosfat consistently maintained the highest level of expenditures on compensation for reduced working hours, with a steady increase reaching 2,192,898.7 thousand tenge in 2024 Table 14.

Table 14.
Dynamics of Expenditures for Compensation Due to Reduced Working Hours.

	2022	2023	2024
Fosfat	1594835.0	1993543.4	2192898.7
Altai	306978.86	392506.05	284858.78
Project	551208.4	877549.7	915959.5

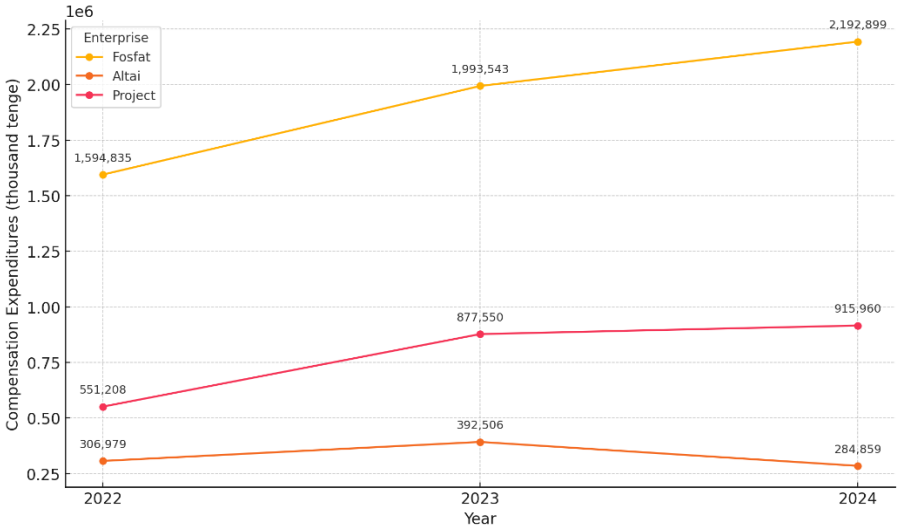

Figure 7.
Dynamics of Expenditures for Compensation Due to Reduced Working Hours (2022–2024).

Figure 7 demonstrates the dynamics of compensation expenditures due to reduced working hours across Fosfat, Altai, and Project enterprises from 2022 to 2024. Fosfat consistently leads in expenditures, showing steady growth from 1.59 million to over 2.19 million tenge. The project also reveals upward momentum, nearly doubling its spending over the period. Altai, while starting with moderate growth, exhibits a decline in 2024, potentially reflecting stabilization in work schedules or restructuring.

Altai maintained the highest level of medical examination expenditures across all three years, with a notable increase to 47,675.09 thousand tenge in 2024 Table 15.

Table 15.
Dynamics of Medical Examination Expenditures by Enterprise.

	2022	2023	2024
Fosfat	8336.1	7754.4	8773.7
Altai	32033.09	31540.37	47675.09
Project	3304.8	4104.0	0.0

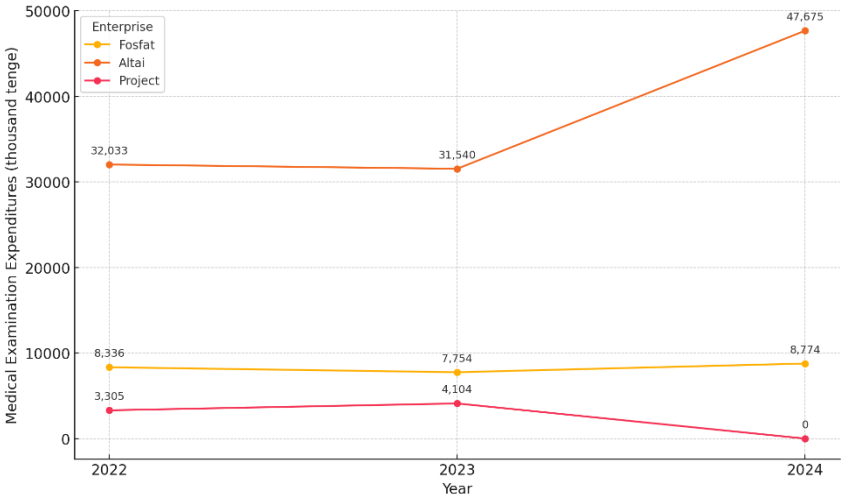

Figure 8.
Dynamics of Medical Examination Expenditures by Enterprise (2022–2024).

In contrast, the project shows minimal expenditures that completely cease in 2024, potentially indicating a suspension or outsourcing of medical examinations.

Fosfat made a substantial pension contribution in 2022 (151,339.6 thousand tenge) but sharply reduced these expenditures in the following years Table 16.

Table 16.
Dynamics of Pension Contribution Expenditures by Enterprise.

	2022	2023	2024
Fosfat	151339.6	7754.4	8773.7
Altai	0.0	31540.37	47675.09
Project	65450.3	98234.1	143099.7

Meanwhile, Project consistently increased its pension funding, and Altai began allocating resources only in 2023, demonstrating a growing focus on long-term employee benefits.

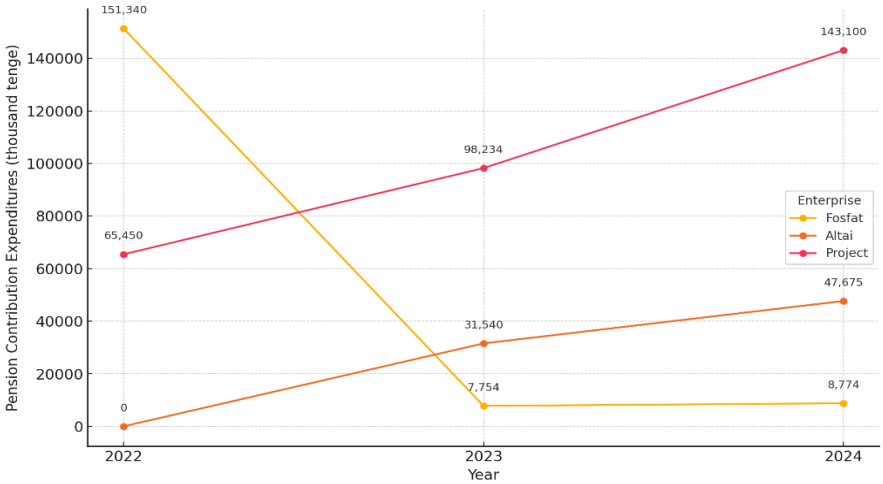

Figure 9.
Dynamics of Pension Contribution Expenditures by Enterprise (2022–2024).

Figure 9 illustrates pension contribution expenditures by enterprises for the years 2022–2024. Fosfat experienced a sharp decline after a high in 2022, stabilizing at significantly lower levels in subsequent years. In contrast, Altai shows a strong upward trend, having initiated contributions only from 2023. The project demonstrates steady growth, with

contributions more than doubling from 2022 to 2024, signaling consistent and expanding investment in employee social protection.

All three enterprises began allocating funds for risk assessment only in 2024, marking a new stage in compliance with safety standards Table 17.

Table 17.
Dynamics of Occupational Risk Assessment Expenditures by Enterprise.

	2022	2023	2024
Fosfat	0.0	0.0	11676.0
Altai	0.0	0.0	8299.2
Project	0.0	0.0	5845.0

Fosfat led with the highest investment (11,676.0 thousand tenge), followed by Altai and Project, indicating increasing awareness of proactive risk management.

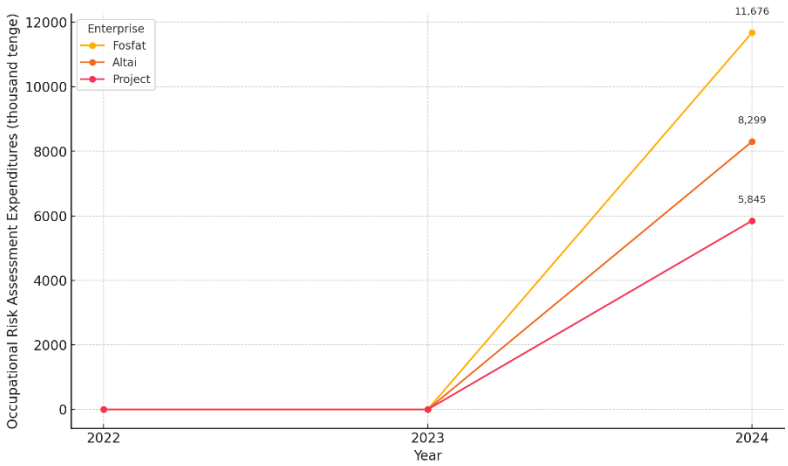

Figure 10.
Dynamics of Occupational Risk Assessment Expenditures by Enterprise (2022–2024).

Figure 10 shows the dynamics of expenditures for occupational risk assessment by Fosfat, Altai, and Project. All three enterprises reported zero spending in 2022 and 2023, followed by a noticeable increase in investments in 2024. Fosfat leads with 11,676.0 thousand tenge, followed by Altai and Project. This simultaneous increase suggests a coordinated or regulatory push toward implementing formal risk assessment practices across enterprises.

Certification expenditures were introduced only in 2024, indicating the implementation of new regulatory or internal standards Table 18.

Table 18.
Dynamics of Workplace Certification Expenditures by Enterprise.

	2022	2023	2024
Fosfat	0.0	0.0	12750.0
Altai	0.0	0.0	3341.25
Project	0.0	0.0	3600.0

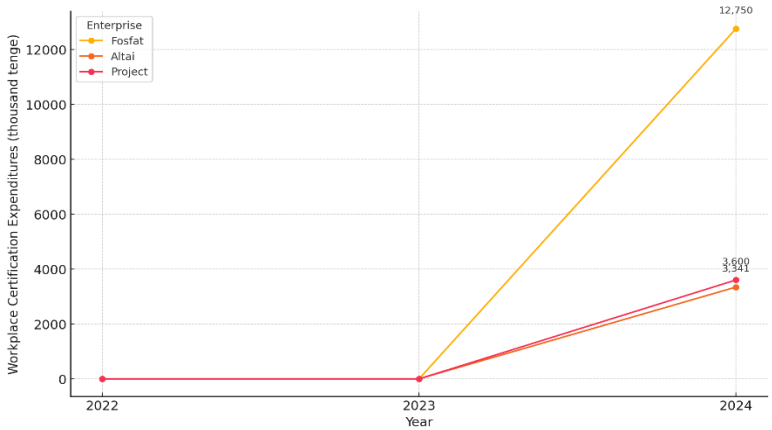

Figure 11.
Dynamics of Workplace Certification Expenditures by Enterprise (2022–2024).

Total Occupational Safety Expenditures by Enterprise Table 19.

Table 19.
Total Occupational Safety Expenditures by Enterprise.

	2022	2023	2024
Fosfat	2441223.6	2898757.0	2793998.0
Altai	484345.8	2076331.21	1261328.59
Project	806046.4	1338316.7	1563282.6

Both Altai and Project showed significant growth from 2022 to 2023, although Altai experienced a sharp decline in 2024, unlike Project, whose costs continued to rise.

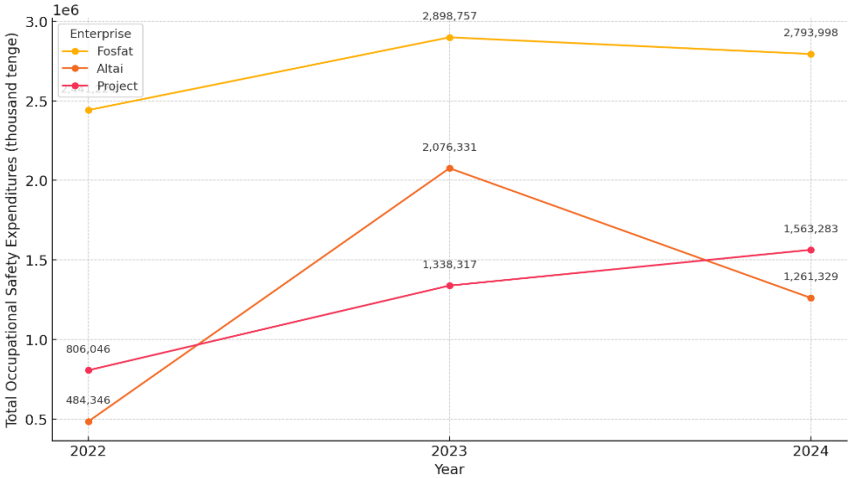

Figure 12.
Total Occupational Safety Expenditures by Enterprise (2022–2024)

Altai shows a dramatic rise in 2023, followed by a notable decrease in 2024, while Project exhibits steady annual growth, culminating in 1.56 million thousand tenge in 2024. These dynamics suggest differing safety strategies and investment cycles across enterprises.

6. Conclusions

In sum, the financial analysis underscores a growing prioritization of occupational health and safety across diverse industries. The differences in timing, volume, and category-specific focus point to varying levels of maturity and strategic orientation in safety management, offering valuable insights for policy development, benchmarking, and future enterprise-level planning.

Notably, 2024 marked the first year in which all enterprises began allocating funds to occupational risk assessments and workplace certification, highlighting a sector-wide transition toward more proactive and standardized safety practices, likely influenced by evolving regulatory frameworks.

Altai, while initially exhibiting moderate expenditures, made substantial one-time investments in specific areas, particularly in nutrition and compensation during 2023, followed by more moderate levels in 2024. This may indicate reactive or restructuring-driven safety financing rather than a sustained programmatic strategy.

Across all three enterprises, there has been a noticeable intensification of investment in key safety domains, particularly in personal protective equipment, compensation for hazardous working conditions, and training. Fosfat maintained a leading position in overall spending, reflecting a robust and systematic approach to occupational safety, with consistently high investments across nearly all categories. The project demonstrated a steady and strategic increase in funding, signaling a long–term commitment to safety infrastructure and workforce support.

Companies that actively invest in OSH achieve lower injury rates, higher labor productivity, and enhanced competitiveness. The identified sectoral specifics emphasize the importance of a differentiated approach to planning and allocating OSH expenditures, which ultimately contributes to the sustainable development of enterprises and the improvement of working conditions.

The analysis of data from five enterprises across various sectors of the economy has made it possible to identify the key characteristics of the modern system of occupational safety and health (OSH) cost accounting within the context of Kazakhstani practice. The findings reveal both common patterns in expenditure allocation and variations driven by industry–specific factors and the internal policies of the organizations.

The expenditure structure demonstrates a high degree of standardization. Across all the analyzed enterprises, the main cost categories include: personal protective equipment, mandatory insurance, employee training and instruction, specialized nutrition, medical examinations, and compensation for hazardous working conditions. This confirms that the regulatory

framework for occupational safety and health has a systemic influence on budget formation, and that enterprises, regardless of industry rely on established expenditure categories.

There is evidence of uneven and unstable financing across certain areas of occupational safety and health. For example, in several cases, a sharp increase or decrease in expenditures was observed for specialized nutrition, sanitary and hygiene facilities, risk assessments, and collective protection measures. This may indicate the project–based nature of many initiatives, a lack of systematic planning, and limited enterprise resources, which affect the consistency and continuity of OSH investments.

Occupational safety and health financing is directly linked to sector-specific risks. In the mining and manufacturing industries, a higher share of expenditures is allocated to protective measures, training, and compensation, reflecting the increased hazards of the production environment. In contrast, in the energy and chemical sectors, the focus shifts toward material support and preventive measures, highlighting differing priorities in managing occupational risks.

Occupational risk assessment and workplace certification remained underrepresented in previous years and only began to appear in reports from 2024 onward. This indicates a delayed implementation of legislative requirements and a lack of integration of risk assessment procedures into the overall cost accounting system.

Conclusion. Investments in employee training demonstrate a positive trend, which may indicate increasing managerial awareness of the importance of preventive measures.

In conclusion, the analysis indicates that while Kazakhstani enterprises generally strive to comply with occupational safety and health regulations, in practice, cost accounting is often fragmented and lacks completeness. The findings derived from the analysis of actual data will be further applied in Chapter 3 to develop recommendations for enhancing the occupational safety and health cost accounting system.

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