

The Role of Training in Reducing Workplace Accidents An Analytical Study at the High Plateaus Mills Complex – Setif –

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Abstract:

This study aims to explore the role of training in reducing workplace accidents at the Upper Plateaus Flour Mills Complex in Sétif, by examining the current status of training and occupational incidents within the complex, and by identifying their interrelationship through the evaluation of select occupational accident indicators predicated on training efficacy.

The results demonstrate that the Upper Plateaus Flour Mills Complex possesses a training strategy and implements procedures designed to mitigate workplace accidents; nevertheless, these measures do not fully satisfy the complex's requirements for their sufficient reduction. Furthermore, the findings reveal a robust correlation between the quality of specialized training and the diminution of occupational accident rates, with the study culminating in a set of recommendations, including the imperative to cultivate continuous and effective training strategies that guarantee the attenuation of workplace accident risks and the bolstering of occupational safety standards within the complex.

Keywords: training, work accidents, occupational safety, High Plateaus Mills Complex

Jel Classification Codes : M14 ; M50 ; M59.

Résumé:

Cette étude vise à explorer le rôle de la formation dans la réduction des accidents du travail au Complexe des Moulins des Hauts Plateaux à Sétif, en examinant l'état actuel de la formation et des incidents professionnels au sein du complexe, et en identifiant leur interdépendance par l'évaluation de certains indicateurs d'accidents du travail fondés sur l'efficacité de la formation.

Les résultats démontrent que le Complexe des Moulins des Hauts Plateaux dispose d'une stratégie de formation et met en œuvre des mesures destinées à atténuer les accidents du travail ; néanmoins, ces mesures ne répondent pas pleinement aux exigences du complexe pour leur réduction adéquate. Par ailleurs, les conclusions révèlent une corrélation forte entre la qualité de la formation spécialisée et la diminution des taux d'accidents du travail, l'étude se concluant par une série de recommandations, parmi lesquelles la nécessité de développer des stratégies de formation continues et efficaces garantissant l'atténuation des risques d'accidents du travail et le renforcement des normes de sécurité professionnelle au sein du complexe.

Mots clés: formation, accidents du travail, sécurité professionnelle, usine des moulins des Hauts Plateaux.

Jel Classification Codes : M14 ; M50 ; M59.

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I. Introduction

Training is an important and organized process in economic institutions in general and industrial ones in particular. It aims to develop the skills and knowledge of employees and enable them to perform their tasks efficiently and effectively. It is also considered one of the essential elements for developing human competencies within the institution, as it provides the necessary knowledge, technical skills, and behavioral skills that help improve performance quality and achieve the organization's goals. Training is regarded as a central pillar for improving productivity and competitiveness. Through it, institutions acquire the necessary competencies to keep up with market and technological changes. It also enhances the continuous development of employees and improves their work environment, which contributes to reducing work accidents. This is achieved by informing employees about workplace hazards, promoting safety behaviors among them, increasing their awareness of preventive procedures, and how to deal with emergency situations. Despite the aforementioned importance of training, the question remains about its actual effectiveness in reducing work accidents in economic institutions in general and industrial ones in particular. This study highlights the role of training as a key element in reducing work accidents and urges the development of continuous and effective training strategies to ensure the reduction of work accident risks and enhance safety in the economic environment.

1.1 Research Problem:

Through this simple presentation, we can formulate the problem of our research, represented by the following question:

- What is the role of training in reducing work accidents at the High Plateaus Mills Institution – Setif ?

Under this problem, a set of subsidiary questions fall, which are as follows:

- Does the High Plateaus Mills Complex - Setif - possess the scientific knowledge of procedures and policies related to specialized training, and the extent of its importance in reducing work accidents ?

- To what extent do occupational safety and health performance indicators improve under training at the High Plateaus Mills Complex – Setif ?

1.2 Hypothesis:

Training plays a role in reducing work accidents at the High Plateaus Mills Complex – Setif.

1.3 Importance of the research:

The importance of the research is manifested through the following:

- Clarifying the concept and importance of training as one of the topics concerned with how to protect workers from daily risks, injuries, and work accidents in industrial economic institutions in general and the High Plateaus

Mills Complex - Setif in particular;

- Studying the reality of work accidents and training in the manufacturing system at the High Plateaus Mills Complex - Setif;
- Evaluating some occupational safety and health indicators based on the effectiveness of training at the High Plateaus Mills Complex – Setif.

1.4 Study methodology:

To answer the problem and test the main hypothesis, this study relied on the descriptive method, in order to enrich the conceptual aspect related to training and work accidents, and to describe and analyze the role of this training in reducing work accidents at the High Plateaus Mills Complex - Setif.

E - Study structure: We will attempt to address the topic through three sections:

- Basic concepts about work accidents.
- Basic concepts about training.
- An analytical study at the High Plateaus Mills Complex - Setif.

II. Basic concepts about work accidents

II.1 Concept of work accident:

Definitions of the concept of work accident have varied because it is a complex concept. It was defined by (Laila Al-Alfi) as: "That incident which occurs directly in the work situation and position, or from devices, machines, or the individual himself due to poor performance or poor preparedness." (Al-Alfi, 2023) This definition focuses heavily on the direct causes that occur only in the workplace and neglects accidents that happen during commuting to and from the work site. It also overlooks environmental and organizational factors that contribute to accidents, such as lack of training, weak safety procedures, or unsafe working conditions. Additionally, it does not clearly specify whether accidents include psychological incidents or occupational diseases.

Meanwhile, Portuguese law defines it as: "Any unexpected event that occurs in the workplace during working hours, which directly or indirectly results in physical injury, functional disorder, or illness leading to reduced work capacity or death. These classifications include commuting accidents, injuries and occupational diseases, and inability to work." (Arezes, 2019)

From this definition, we observe that it is broader than the first and aligns with definitions adopted in international laws and systems related to occupational safety and health, where the concept of accidents has been expanded to include both physical accidents and disorders and diseases affecting the worker during or because of working conditions.

Based on the above, we can say that a work accident is: an unexpected event that occurs during or because of the worker performing their tasks at the workplace, leading to physical injury, functional disorder, occupational disease, or death.

II .2 Causes of Work Accidents:

The factors and causes of accidents are numerous, as modern trends in the development of occupational health and safety try to emphasize. For example, the Domino theory attributes the occurrence of accidents to multiple factors. The scientist (Heinrich) primarily attributes them to the human factor, which has propelled research related to human causes. It is not surprising that these causes hold an important position because humans are involved in every accident that occurs; they are the common factor in all accidents except those related to place and time. The presence of a person under something expected to fall on them is attributed to them because if they were not present, the injury would not have occurred. Meanwhile, (Frankie Bird) attributes accidents to problems in management and organization, while another study by (Hanachi Ababsia) titled (Preventive Management) suggests that the lack of supervision is one of the most important causes leading to this social phenomenon (work accidents). Studies related to working conditions conducted on various occupational groups showed that workers' complaints often focus on vibrations, noise, and heat. Some reports indicate that exposure to chemicals and vibrations are the most stressful and harmful factors perceived by workers. (Jahmi, 2016) As for (Hughes and Ferrett), they divided the causes into human and non-human causes, as illustrated in the following table (01).

Table (01): Direct and implicit human factors leading to workplace accidents

Direct or immediate include	Indirect, root or underlying include
- Unsafe acts by individuals due to poor behavior or a lack of training, supervision, information or competence or a failure to wear PPE. - Unsafe conditions, such as inadequate guarding, inadequate procedures, hazardous substances, ergonomic and/or environmental factors. - Fire or explosive hazards.	- Poor machine maintenance and/or start-up procedures. - Management and social pressures. - Financial restrictions. - Lack of management commitment to health and safety. - Poor or lack of health and safety policy and standards. - Poor workplace health and safety culture. - Workplace and trade customs and attitudes.

Source: Hughes and Ferrett, International Health and Safety at Work Revision Guide, Third Edition, Routledge, Taylor & Francis Group, New York, U S A, 2022, p 71.

Based on the above and in general, theory and related studies confirm that workplace accidents are not merely random incidents but result from interactions between human, organizational, and environmental factors. However, the human factor is the primary cause of accidents. This was affirmed by Heinrich, who believed that 88% of all accidents were caused by unsafe acts or behaviors of workers, 10% due to unsafe physical conditions, and the remaining 2% due to "fate and destiny," which cannot be prevented. (Sharman, 2014)

II.3 The most important ways to reduce workplace accidents:

In order to minimize accident probability, the first step became the need of encouraging the habit of accident prevention.

Therefore, this required constant and correct use of engineering and process control measures such as providing personal protective equipment (PPE), if possible, less and/or minimizing hazardous substances, supplies, machineries, or methodology. In order to achieve such objectives, it was realized that we need to have management responsibility and support in areas such as product safety and quality, production quantity, customer service satisfaction, and target date.

Therefore, accident prevention needs an effective OHS program supported by higher management level who is ultimately responsible for health and safety in an organization.

Of course, the presence of a trained and qualified safety professional with the authority to act is a must. A good accident prevention program should consider constant training and reminders of common and possible hazards involved to which people may be exposed with particular attention to the materials, equipment, machine, process, and facilities with which they work.

III. Basic concepts about training

III.1 Concept of training:

The term "training," including "workforce training," broadly refers to educational initiatives aimed at acquiring specific knowledge or skills across various sectors. In industry, it encompasses programs offered by companies to enhance employee capabilities and productivity. It is essential in human resource development, ensuring employees can meet the evolving demands and challenges of their roles and sectors. (Mohammed, 2022)

Training is the process of acquiring specific skills, concepts, or attitudes to establish efficient performance in current or anticipated activities. Training ensures individuals are adequately prepared for continuing requirements or new situations, enabling them to become, remain, or progress as acceptable performers in organizations. (Almeida, 2010)

A second definition provided by Hanson (1976) describes training as the process of acquiring knowledge, skills, and attitudes necessary for a particular job, or the instruction in such knowledge and skills. Training in its broadest sense

involves any development activity undertaken to improve the current skills and knowledge, or the future performance of employees. Effective training develops employee competencies and enhances organizational effectiveness, therefore playing a strategic role in all facets of an organization. (Ahmad, 2014)

Based on the above, it can be said that training is an educational and developmental process aimed at acquiring specific knowledge, skills, and attitudes that enable individuals to achieve effective performance in their current or future activities. Training includes various programs and initiatives across different sectors, especially in the industrial sector, where companies offer these programs to enhance their employees' capabilities and increase their productivity. Training is essential for human resource development, as it ensures that employees are able to meet the changing requirements and challenges of their roles. It is also defined as a continuous developmental activity to improve current skills and knowledge and support future performance, thereby enhancing individual efficiency and organizational effectiveness. Training plays a strategic role in reducing workplace accidents, which will be discussed in the next section

III.2 The role of training in reducing work accidents

A review of the research literature on occupational health and safety training shows that training in occupational health and safety has a positive impact on workers' practices and behavior. (Reese, 2012) For example, in the United States, training is prominently placed as one of five essential elements of OH&S programs, along with employer commitment, hazard surveillance, hazard control and prevention, and program evaluation. Given the importance of effectively communicating health and safety information in today's workplaces, the question of how to develop and implement effective health and safety training programs is vital. (Kellaway, 2021) Where the latter provides employees and managers with the knowledge and skills necessary to identify risks and perform their duties safely and effectively. In addition to emergency response: by organizing, training, and coordinating skilled personnel regarding emergencies such as fires, accidents, or other disasters. (Professionals, 2000)

Focusing on young and inexperienced workers who often have more accidents than other employees. Therefore, new workers and students must be introduced to safe work practices from the very beginning of their careers. (Barroso, 2020) Employers are required to train each employee who must use personal protective equipment (PPE). Employees must be trained to know at least the following: when PPE is necessary; what type of PPE is necessary? How to properly put on, take off, adjust, and wear the PPE, and the limitations of the PPE. And the proper care, maintenance, useful life and disposal of PPE. (Taherian, 2023)

IV. Case Study of the High Plateaus Mills Complex – Setif –

The High Plateaus Mills Complex in Setif is one of the prominent public complexes in the field of flour and wheat products production in Algeria. It plays a vital role in supporting the country's food security and enhancing the stability of the food market. This complex was chosen because the food production process involves many risks, such as handling heavy machinery, chemicals, and unsafe working conditions. Accidents in this sector vary, providing an opportunity to study how training impacts the reduction of these accidents.

IV.1 Introduction to the High Plateaus Mills Complex – Setif –

After Algeria's independence, the Algerian government had to establish a management body known as management committees to continue and maintain the units that were previously under the control of the French government. In 1964, the state established the National Semolina Institution called (SEMBAC), responsible for managing everything related to grain processing and the development of these units.

In 1982, after the restructuring of the (SEMBAC) institution, the National Corporation for Grain and Food Industries was established in Riyadh. This corporation was divided into five entities: Riyadh – Setif (headquarters of the general directorate in Bizar neighborhood), Riyadh – Bel Abbès, Riyadh – Algiers, Riyadh – Constantine, and Riyadh – Tiaret.

There are also subsidiaries affiliated with the parent corporation (Riyadh Setif), which are: High Plateaus Mills – Setif (MHP); Biban Mills – Bordj Bou Arreridj (BBA); Ziban Mills – El Kantara (ZIBANS); Soummam Mills – Sidi Aissa (SOUMMAM); Hodna Mills – M'sila (HODNA); Agricultural Grain Corporation – Ouargla (AGROSUD); Oasis Mills – Touggourt (AOSIS-TGT). These subsidiaries include companies specialized in processing both hard and soft wheat, and producing food products such as semolina and various pastas. The role of the parent corporation is to supervise these subsidiaries and follow up to achieve continuous development, provide products for the national market, and also develop relations with its customers to build trust between the corporation and its stakeholders.

On 02/04/1990, after entering the stage of autonomy, it became an independent corporation managing its economic affairs and the management of its units spread across several provinces, including the province of Setif. The latter includes the High Plateaus Mills unit, which was established by a notarized contract dated 07/10/1997 as a capital company valued at 265,000,000.00 DZD. The Upper Highlands Complex is located north of Setif Province, 5 km away near Wadi Bouslam, where its waters were used to wash wheat before the pollution level rose. Its activity focuses on processing grains of both hard and soft types, and producing food products such as semolina, flour, and various

kinds of pastries. Its capital was estimated at 265.000.000.00 DZD, then increased on 01/01/2009 to 845.830.000.00 DZD after the incorporation of the Fouara establishment, which led the complex to reassess its lands and survey some debts with the parent company. Its current capital is 891.310.000.00 DZD. The number of employees in the company is estimated at 275 workers across its various units as of 2023.

IV.2 The training situation at the High Plains Mills Complex - Setif –

The following table (02) presents indicators related to training at the High Plains Mills Complex in Setif during the period 2021-2023, focusing on: the number of workers, the number of trained workers, training costs, the number of trainees in the field of occupational health and safety, in addition to the type of training.

Table (02): indicators and figures about training at the High Plateaus Mills Complex - Setif - during the period (2021-2023)

Year	2021	2022	2023
Number of Workers	274	276	275
Number of Trainees	42	55	70
Trainee Percentage of Total Workers (%)	15.3	19.9	25.5
Training Costs (DZD)	196560000	246330000	315782000
Training Cost per Trainee (DZD)	46,800	44,788	45,112
Trainees in Occupational Health and Safety	20	13	11
Percentage of Health and Safety Trainees of Total Trainees (%)	47.6	23.6	15.7
Type of Training	External	External	External

Source: Prepared by the researcher based on the documents of the complex.

Based on Table No. (02), the aforementioned indicators can be analyzed as follows:

- **Number of workers:** The number of workers shows relative stability during the three years of the study period, with 274 workers in 2021, slightly increasing to 276 in 2022, then decreasing to 275 in 2023, indicating the stability of the workforce structure in the complex, meaning the complex's ability to maintain its workforce during this period.
- **Number of trained workers:** The number of trained workers witnessed a

continuous and significant increase from 42 workers in 2021 to 55 workers, an increase of 31%, rising by 27% in 2023 to 70 workers. This increase reflects the complex's commitment to developing workers' skills and enhancing their capabilities, contributing to the overall improvement of the complex's performance under study in the medium and long term.

- **Training costs:** Training costs in the complex saw a significant increase, rising by 25% from 2021 to 2022, and by 28% from 2022 to 2023, in line with the increase in the number of trainees. This increase reflects the complex's investment in developing workers of various categories.

- **Trainees in the field of occupational health and safety:** Despite the importance of this type of training in a food industrial complex, the number of trainees in occupational health and safety shows a noticeable decrease from 2021 to 2023, with a 35% decrease from 2021 to 2022, and 15% from 2022 to 2023. This decrease is concerning, as focusing on occupational health and safety is necessary to reduce accidents and improve the work environment. Therefore, the complex should reevaluate its training strategies in this field.

- **Type of training:** All training over the past three years has been "external," indicating the facility's reliance on external training centers or entities rather than internal training. Relying on external training can provide new experiences and knowledge, but it may lack adaptation to the specific needs of the facility, which could affect the quality of training. It also increases costs compared to internal training. Therefore, it is important for the facility to balance between external and internal training to better meet the workers' needs.

Based on the above, all indicators show that the facility under study is moving towards increasing training and development, with an expansion in the number of trainees and a relative decrease in training costs per individual in some years. This reflects a clear strategy by the facility to invest in human capital. However, the facility recorded a decline in specialized training in the field of occupational health and safety, which requires the facility's leadership to pay attention and reconsider this vital aspect to ensure a healthy and safe work environment.

IV.3 The Reality of Work Accidents at the Highlands Mills Complex - Setif -

The following Table (03) presents some indicators related to occupational safety and health at the Highlands Mills Complex in Setif during the period 2021-2023, focusing on the number of injuries, accident frequency rate, accident severity rate, and the number of trained workers.

Table (03): Development of the number of cases at the High Plateaus Mills Complex during the period (2021-2023)

Year	2021	2022	2023
Number of Workers	274	276	275
Number of Injuries	8	14	31
Accident Frequency Rate	13.98	24.29	53.98
Accident Severity Rate	252	283	650

Source: Prepared by the researcher based on the documents of the complex.

Based on Table No. (03), the aforementioned indicators can be analyzed as follows:

- **Number of injuries:** It is calculated by recording the number of accidents regardless of working hours. A sharp increase indicates a significant rise in workers' exposure to danger. The number of injuries in the facility under study showed a noticeable increase during the period (2021-2023), rising from 8 injuries in 2021 to 31 injuries in 2023, which is more than a threefold increase in the number of injuries. This is a serious indicator reflecting deterioration in safety conditions and an increase in workplace hazards.
- **Accident frequency rate:** Usually calculated per million working hours, an increase suggests that accidents have become more frequent relative to actual activity. Referring to the data in the above table, this indicator rose from 13.98 in 2021 to 53.98 in 2023, an increase of more than threefold, indicating a significant rise in the frequency of accidents experienced by workers at the facility, necessitating a comprehensive review of safety methods.
- **Accident severity rate:** Reflects the seriousness of injuries (lost days, downtime). An increase means that the consequences of accidents are more costly to health and production. Returning to the data in the above table, this rate also saw a significant rise from 252 in 2021 to 650 in 2023, confirming that injuries have not only increased numerically but also intensified in their impact on workers. That is, the accidents that occurred have become more severe, indicating urgency in improving safety procedures and training at the facility.

Based on the above, the data show that the increase in the number of injuries and their frequency rate, simultaneously with a sharp rise in the severity rate, indicates an uncomfortable situation concerning occupational safety in the plant. The stable number of workers means this increase in accidents is not related to an increase in workforce but reflects other factors such as weak safety procedures, lack of specialized training, and deterioration of the work

environment. There is an urgent need to improve safety procedures at the High Plateaus Mills Complex, and immediate steps must be taken to address these issues to ensure the safety of the workers.

To delve deeper into the negative changes affecting work accidents in the plant, we will study the distribution of these accidents across the different work departments of the plant and according to the means of injury.

IV.4 Distribution of incidents in the different departments of the complex

The injuries that workers are exposed to vary from one department to another in the High Plateaus Mills Complex - Setif - depending on the nature of the activity carried out. This will be addressed in the following Table (04):

Table No. (04): the distribution of injuries by department in the High Plateaus Mills Complex - Setif - during the period (2021-2023)

Year	Exploitation and Inventory Directorate			Marketing Directorate	Preventive Security	Total
	Production Department	Maintenanc Department	Unit Officers Department			
2021	6	2	0	0	0	8
2022	9	1	2	1	1	14
2023	23	6	0	1	1	31
Total	38	9	2	2	2	53

Source: Prepared by the researcher based on the documents of the complex.

Based on Table No. (04), we observe that all five departments of the complex recorded a number of injuries during the study period. The following is an analysis of the injuries by each department:

- **Production Department:** This department bears the largest burden of injuries (38 injuries out of a total of 53), accounting for about 72% of the injuries. This is due to the nature of direct operational hazards: dealing with machines, raw materials, conveyors, industrial dust, noise, slipping/tripping, and working full-time shifts.
- **Maintenance Department:** Comes second with 9 injuries (about 17%), as this department is associated with many risks including: hazards related to stop/start interventions, isolated/non-isolated energy, working at heights, uncomfortable postures, and welding and cutting operations.

Regarding injuries in the departments of unit supervisors, operations management, marketing management, and preventive security combined, they represent a small percentage compared to the production and maintenance departments (11%).

From the above, it is found that the injuries recorded in the complex are largely concentrated in the production department, indicating that this department is the most exposed to risks and has the most challenging work environment in terms of occupational safety. Also, the spread of injuries to include other departments and directorates in 2022 and 2023 indicates that hazards are spreading throughout the entire complex and not limited to a specific area. Therefore, it is necessary for the complex under study to train workers, especially in the production department, and to design specific awareness programs for each department of the complex according to the specific risks therein.

IV.5 Distribution of Injuries by Cause of Injury at the High Plateaus Mills Complex During the Period (2021-2023)

The optimal use of production tools by workers leads to a reduction in work accidents, but any negligence on their part results in adverse outcomes. To analyze the relationship between the distribution of injuries and the tools used in the complex, we prepared the following Table (05).

Table No. (05): Distribution of Injuries by Cause of Injury at the High Plateaus Mills Complex During the Period (2021-2023)

Year	Hand tools	Fall	Lifting heavy objects	Total
2021	5	3	0	8
2021	4	5	5	14
2021	12	10	9	31
Total	21	18	14	53

Source: Prepared by the researcher based on the documents of the complex.

From the table (05) above, we observe that there are three causes that led to worker injuries, with hand tools significantly contributing to workplace accidents. The number of injuries resulting from hand tools reached 21 cases. The facility recorded 5 and 4 injuries in 2021 and 2022, respectively, and then increased by 21 injuries in 2023. This is due to workers not using the machines properly and not following safety and prevention procedures, in addition to increased working hours in the last year of the study. Falling is also considered a cause of many injuries, with the facility recording 18 injuries during the study period. In 2021,

there were 3 injuries, which rose to 5 and 10 injuries in the following two years, respectively. This indicates the presence of risks related to fieldwork conditions, such as uneven floors or elevated work areas. Therefore, it is necessary to focus on improving the work environment and providing appropriate safety measures. Regarding lifting heavy objects, the facility recorded 14 injuries during the study years. No injuries related to lifting heavy objects were recorded in 2021, but the following two years recorded 5 and 9 injuries, respectively. This indicates the absence of proper lifting techniques or the lack of use of assistive devices, which increases physical risks for workers.

Based on the previous analysis, we find that hand tools were the leading cause of workplace accidents, followed by falls and lifting heavy objects, which caused significant and tangible injuries during the study years. These combined causes indicate a lack of occupational safety procedures and deficiencies in training on the proper use of equipment and safe work techniques (proper lifting techniques or assistive devices).

IV.-6 Costs of Workplace Accidents at the Upper Plateaus Flour Mills Complex - Sétif - and Their Relationship to Training Costs

The escalation in both the frequency and severity of workplace accidents within any economic institution signifies substantial direct and indirect costs. Apparent costs encompass contributions to social security for work place accidents, medical treatment and first aid for injured workers, and administrative management expenses related to these incidents. Conversely, Hidden costs include compensation for injured employees, wages for lost work hours due to accidents, and production losses resulting from such occurrences, as illustrated in Table (6) below.

Table No. (06): Evolution of Workplace Accident Costs at the Upper Plateaus Flour Mills Complex during the Period (2021-2023)

Year	2021	2022	2023
Direct Costs of Workplace Accidents (Social Security, First Aid, Administration) (DZD)	587858,00	1162490,00	1079407,00
Indirect Costs of Workplace Accidents (Compensations, Wages, Production) (DZD)	891045,00	1676431,00	2962345,00
Total Costs of Workplace Accidents (DZD)	1478903,00	2838921,00	4041752,00

Source: Prepared by the researcher based on the documents of the complex.

Table (6) above illustrates the evolution of total workplace accident costs over three years (2021-2023), categorized into direct costs (social security, first aid, administration), indirect costs (compensations, wages, production), and total costs, each exhibiting the following patterns:

-Direct Costs: An increase followed by a decline, rising from 587,858 DZD in 2021 to 1,162,490 DZD in 2022 at a growth rate of (+98%), then decreasing to 1,079,407 DZD in 2023 at (-7%), attributable to variations in the number and severity of worker injuries.

-Indirect Costs: Continuous increase throughout the study period, moving from 891,045 DZD in 2021 to 1,676,431 DZD in 2022 (+88%) then to 2,962,345 DZD in 2023 (+77%), indicating that the economic impact of workplace accidents exceeds direct compensations to include production losses and wages paid to absent workers.

-Total Costs: Experienced growth throughout the study period, jumping from 1,478,903 DZD in 2021 to 2,838,921 DZD in 2022 (+92%) then to 4,041,752 DZD in 2023 (+42%), primarily driven by indirect costs which constituted 60-73% of total costs across the study years.

Upon revisiting and scrutinizing the training cost data previously addressed in Table (2) alongside workplace accident costs, it becomes evident that the latter experienced a substantial increase (from 1,478,903 DZD to 4,041,752 DZD, +173%) despite rising training expenditures, revealing an ineffective inverse relationship wherein augmented training investments failed to curtail accidents. This phenomenon is attributable to a decline in the proportion of trainees in health and safety programs (from 47.6% to 15.7%), signifying inadequate emphasis by complex management on occupational safety training initiatives despite overall escalation in general training outlays.

Moreover, indirect workplace accident costs (compensations, wages) surged by 233%, surpassing the return on training investments, which underscores that the training program lacks proper orientation or sufficiency.

Consequently, the nexus between training costs and workplace accidents hinges not merely on expenditure magnitude but rather on its strategic management, training quality, and alignment with practical operational needs aimed at mitigating incidents and associated costs. Incrementally escalating training budgets without refining their focus on safety may yield counterproductive outcomes, manifesting as heightened accident costs—a pattern corroborated by the preceding data.

V. Conclusion:

The study attempted to highlight the importance of training as one of the fundamental factors in reducing workplace accidents and improving the occupational safety environment within the industrial complex. Increasing the percentage of trainees and enhancing the quality of training reflect the complex's commitment to developing workers' skills and their ability to follow safe methods in performing their tasks. The study also shows that a lack of focus on occupational health and safety negatively impacts the rising rates and severity of accident recurrence.

V.1 Study Results:

- The increase in the percentage of trainees relative to the total number of workers suggests that the plant places greater importance on improving workers' skills and may enhance productivity. Additionally, the rise in training costs indicates an expansion in the scope of training programs, possibly improving their quality or diversifying training areas;
- The reliance on external training throughout the three years reflects the plant's approach to benefiting from specialized external expertise and facilities, but it reduces direct control over the training content;
- The High Plains Mills Plant - Setif - implemented specialized training programs in the field of occupational health and safety, with the highest number of trainees in this field being 20 in 2021. In the following two years, there was a decrease in the number of trainees in this field, accompanied by an increase in the number of work accidents, indicating an inverse relationship between the two;
- The plant recorded an increase in all indicators related to work accidents, including the number of injuries, accident frequency rate, and accident severity rate throughout the study period, reaching about three times higher. This indicates deterioration in safety conditions and increased risks in the workplace, with a significant rise in the frequency and severity of accidents affecting workers at the plant;
- The High Plains Mills Plant - Setif - recorded the highest number of accidents in the production department compared to other departments, with the number of injuries estimated at 38. This is due to the large number of workers in this section. The lowest number of work accidents was recorded in the inventory management department;
- The number of work accidents at the High Plains Mills Plant - Setif - fluctuates from year to year throughout the study period. It was also found that hand tools are the means causing the highest number of injuries, which is attributed to the nature of the work;
- Ineffective inverse relationship between increased training costs and rising workplace accident costs (+173%) despite growing expenditures ;

- Decline in health and safety trainees ratio (47.6% to 15.7%) alongside indirect costs surge (+233%) indicates misdirected training programs.

V.2 Study Recommendations:

In light of the results of the presented study on training programs and workplace accidents at the High Plateaus Mills Complex - Setif, the following recommendations can be made:

- Continuously increase the percentage of trainees with a focus on improving the quality of training programs, especially by diversifying training fields to include occupational health and safety in accordance with practical needs;
- Balance reliance on external training with the development of internal training capabilities, so that the complex can directly control the content and ensure its suitability to the complex's specific characteristics and requirements;
- Introduce continuous and standardized training programs in the field of occupational health and safety to cover all categories and workers, updating them based on accurate evaluations of their impact on reducing workplace accidents;
- Reassess the occupational health and safety strategy in the complex comprehensively, especially after observing an inverse relationship between the number of trainees in the field and the rising accident rate;
- Implement awareness campaigns and targeted field training in the production department, considering it the most accident-prone sector, while providing safe work tools and personal protective equipment for workers;
- Improve preventive and maintenance procedures for machinery and hand tools identified as the main causes of injuries by implementing periodic technical monitoring and specialized training on their safe use.

V.3 Study Prospects:

The study has research prospects that can be expanded, the most important of which are as follows:

- Strategies for preventing work accidents and injuries, including designing a suitable work environment and regular maintenance of equipment;
- The role of occupational risk management in analyzing the causes of accidents and developing effective preventive procedures in the workplace;
- Applications of modern technology in monitoring and managing occupational risks to enhance safety and reduce injuries;
- The role of interactive training and educational games in improving employees' understanding of safety concepts and reducing accidents;
- Evaluating the impact of various prevention programs on workforce turnover and reducing occupational accidents in industrial institutions.

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