

Review Article

A Review on Occupational Health & Safety Implementation Protocols of the Mining & Petroleum Industries in Ghana

Justice Badam Parmaak ^{1*}

1. Kwame Nkrumah University of Science and Technology, Kwame, Ghana.

* Correspondence: parmaaklambon4@gmail.com

Abstract: The mining and petroleum industries are some of the most highly risky places to work in, where workers are often exposed to a variety of physical, chemical, mechanical, biological, and psychosocial hazards. In today's competitive corporate environment, business entities constantly have to deal with the increasingly evolving demands of accelerating product development and technological changes, staying ahead of competition with rival businesses, deregulation and demographic changes in target markets, and the obvious need to survive by implementing policies and programs to cope with the ever changing work environment. This study reviewed the implementation of occupational health and safety protocols in selected mining and petroleum companies in Ghana. The issue of a safe and conducive workplace environment has recently gained prominence because labor experts believe that occupational health and safety measures are necessary for the continuation of industrial production. Ghana started producing oil in commercial quantities in 2009 under the President Mills regime. Since then, the country has grown to become one of a significant oil producer in the continent, with the influx of heavy investments from several multinational oil and gas companies in the exploration and downstream petroleum sectors. Secondary data has been collect as current status of OHS implementation protocols in the mining and petroleum industries in Ghana. A comparative evaluation of OHS implementation in the oil and mining industries, develop an OHS blueprint and policy document in line with Global Best Practice for the Mining and Petroleum Industry in Ghana. As a result, research into accidents and injuries within Ghana's mining and petroleum sectors has been limited, despite the industries' longstanding recognition as a safety-critical domain.

Keywords: Assessment, Models, Occupational health and safety, OHS

1. INTRODUCTION

In today's competitive corporate environment, business entities constantly have to deal with the increasingly evolving demands of accelerating product development and technological changes, staying ahead of competition with rival businesses, deregulation and demographic changes in target markets, and the obvious need to survive by implementing policies and programs to cope with the ever changing work environment [1]. The issue of a safe and conducive workplace environment has recently gained prominence because labor experts believe that occupational health and safety measures are necessary for the continuation of industrial production. The mining and petroleum industries are some of the most highly risky places to work in, where workers are often exposed to a variety of physical, chemical, mechanical, biological, and psychosocial hazards [2]. Ghana started producing oil in commercial quantities in 2009 under the President Mills regime. Since then, the country has grown to become one

of a significant oil producer in the continent, with the influx of heavy investments from several multinational oil and gas companies in the exploration and downstream petroleum sectors [3]. In the mining sector, the country since pre-colonial era has been known to be a haven of mineral resources. Ghana has become a popular destination for mineral investment; with the legitimate mining industry accounting for more than 49% of the country's gross foreign exchange earnings. Mining and oil exploration activities present the country with not only economic opportunities but also significant challenges, particularly in the area of occupational health and safety (OHS) for employees working in these industries. The significance of healthy workplaces recognized worldwide as a broad concept influencing quality of life of workers, and to a large extent, can have implications for public health [4]. Occupational health and safety (OSH) is a multidisciplinary concept focused on ensuring the promotion of health and safety among employees through implementation of policies and protocols that minimizes risks of injuries or accidents at the workplace [5]. It encompasses the worker's mental, emotional, and physical well-being in relation to the conduct of his work and, as a result, is a critical topic of interest that has a positive impact on the achievement of organizational goals. Data available show startlingly high rates of work-related deaths and injuries in both developed and developing countries. The International Labour Organization (2021) estimates that 2.3 million people die each year owing to work-related accidents or illness, and 350,000 of these deaths are attributable to occupational accidents. Furthermore, there 264 million non-fatal accidents occur each year resulting in work-related illnesses and approximately 3 days of absence from work. The mining and petroleum industries contribute significantly to the Ghanaian economy. The mining industry contributes about 16% of the country's GDP and employs a large number of people, whereas the petroleum industry is relatively new but has significant growth potential [6]. However, these industries are inherently dangerous, and workers face a variety of hazards that can result in injuries, illnesses, or death. Several studies have highlighted the importance of OHS protocols in Ghana's mining and petroleum industries. It found that mining accidents and injuries were a major cause of work-related fatalities in Ghana. The study revealed that between 2010 and 2016, about 34% of all fatal occupational accidents occurred in the mining sector [7]. Similarly, the workers in the mining and petroleum industry were subjected to a variety of hazards, including toxic chemicals, fires, and explosions, with injury rates among mine workers reported to be higher than other major mining countries, such as Australia and the USA. The research bemoaned the poor state of occupational safety management practices in sites surveyed due to a lack of awareness and inadequate implementation of safety. These studies would emphasize the critical need for companies in the mineral and petroleum resources exploration space to continuously develop and implement OHS protocols to ensure the safety and health of workers in the mining and petroleum industries in Ghana. The implementation of these protocols requires a concerted effort by industry stakeholders, including the government, employers, workers, and regulatory agencies. In recent years, there have been notable efforts by various organizations to promote OHS in the mining and petroleum industries in Ghana. The International Labour Organization (ILO) has been involved in several initiatives aimed at improving OHS in these industries. The organization has collaborated with the government of Ghana and other stakeholders to develop OHS policies and guidelines for the mining and petroleum industries. The ILO has also provided technical support to the Ghanaian government in the development of a National Occupational Safety and Health Policy. The Ghana Chamber of Mines, an industry association for mining companies in Ghana, has also been involved in promoting OHS in the mining industry. The chamber has developed a code of conduct for its members, which includes provisions for OHS management (Ghana Chamber of Mines, 2014). The chamber also organizes annual safety awards to recognize mining companies that have demonstrated exceptional commitment to OHS. The petroleum industry in Ghana is regulated by the Petroleum Commission, which is responsible for ensuring that OHS protocols are implemented by industry players. The commission has developed regulations that require petroleum companies to have OHS policies and procedures in place (Petroleum

Commission, 2015). The commission also conducts regular inspections of petroleum facilities to ensure compliance with OHS regulations. Despite the many efforts to promote OHS, accidents and work-related injuries are a daily occurrence in these highly hazardous industries. Numerous studies have been carried out on this subject but much of the research has concentrated on assessing the relationship between mine workers' perception of adequate organizational commitment to occupational health and safety management and work output [8], impact of physical well-being on affective commitment of employee, and the mediating role of safety knowledge in the relationship between Occupational Health and Safety Management Frameworks (OHSMF) and workplace accidents and injuries among workers in oil and gas industrie [9]. Evaluate the effectiveness of OHS protocols in reducing the incidence of work-related injuries, illnesses, and fatalities in the mining and petroleum industries in Ghana. Develop risk assessment matrix for selected high risk OHS operations. Do a comparative evaluation of OHS implementation in the oil and mining industries Develop an OHS blueprint and policy document in line with Global Best Practice for the Mining and Petroleum Industry in Ghana. Three main theories were considered applicable to this study. These include the risk theory/defence-in-depth theory, the accident model grounded in systems theory, and the actively caring model. These theories were chosen due to their applicability and relevance within the field of occupational health and safety.

2. THE RISK/DEFENSE IN-DEPTH THEORY

The first theoretical model is the risk/defense theory, risk defense in the organizational work setting passes through various layers of defense, barriers, and safeguards. Reason argues that adopting a defense-in-depth approach acknowledges the fallibility of all systems and suggests that by aligning multiple layers of defense, organizations can intercept, slow down, or eliminate risks before they result in failure [10]. Similarly, human risk factors exhibit a comparable trajectory, encompassing both active failures and latent conditions that accumulate over time, often culminating in adverse health outcomes and decreased productivity within the workplace. Implementing the Defense in Depth theory within an occupational health context involves exploring four critical layers of health defense, namely pre-employment health screening, health management (including surveillance, assessments, well-being initiatives, and absenteeism monitoring), injury management/rehabilitation (Workers' Compensation), and exit medical evaluations [11]. Each of these layers serves to intercept, slow down, or eliminate risk, thereby reducing the likelihood of failure significantly. However, in many organizations, these four critical health layers are managed by separate departments, leading to compartmentalized information that is not utilized holistically to enhance health outcomes. Aligning all health components and establishing communication channels between them becomes essential to unlock valuable, risk-based information that can greatly improve an organization's ability to identify health risk trends and proactively address them to mitigate adverse health outcomes and achieve tangible business and employee benefits. Utilizing the Defense in Depth model within an occupational health framework enables organizations to establish multiple layers of defense against failure. In the context of occupational health and safety, failure includes identifiable injuries, loss of productivity due to ill-health, or post-employment claims [12].

3. THE ACCIDENT MODEL

The underlying philosophy of this model known as Systems-Theoretic Accident Model and Processes (STAMP), posits that system theory offers a valuable framework for analyzing accidents, particularly those involving systemic failures [13]. According to this safety paradigm, accidents occur when the control system fails to adequately address external disturbances, component failures, or dysfunctional interactions among system components, thereby leading to insufficient control or enforcement of safety-related constraints during system development, design, and operation. In this context, the

organization under examination is conceptualized as the system. Safety is thus conceptualized as a control challenge, managed by a control structure integrated within an adaptive socio-technical system. The objective of the control structure, represented by the management of the mining company, is to enforce constraints on both system development (comprising the development process and resulting system design) and system operation to promote safe behavior [14]. Consequently, understanding the root causes of accidents necessitates identifying the shortcomings of the control structure, while preventing future accidents entails designing a control structure capable of effectively enforcing the required constraints. Within the framework of STAMP, systems are perceived as interconnected components maintained in a state of dynamic equilibrium through feedback loops of information and control. Contrary to a static design perspective, a system in this context is viewed as a dynamic process continually adapting to achieve its objectives and respond to internal and external changes [15]. Hence, the initial design must not only impose appropriate constraints to ensure safe operation but also sustain safety amid evolving circumstances. The progression toward an accident, or loss event, can be elucidated through an adaptive feedback function that fails to uphold safety as performance undergoes changes over time to fulfill a diverse array of goals and values [16]. Rather than defining safety management solely in terms of averting component failures, it is perceived as an ongoing control endeavor aimed at imposing the necessary constraints to confine system behavior within safe bounds amidst changes and adaptations. Through this model, accidents are comprehended by scrutinizing why the existing controls failed to prevent or detect maladaptive changes, specifically by identifying the safety constraints breached and elucidating the inadequacies in control enforcement. Key concepts in STAMP include constraints, control loops, process models, and levels of control [17].

4. THE ACTIVELY CARING MODEL

The Actively Caring Model originated from a collaborative session among safety leaders at Exxon Chemical Company, where Geller (2010) introduced the concept to denote a pinnacle objective in occupational safety: the sincere concern of employees for the safety of their colleagues, prompting proactive action [18]. Put simply, individuals embodying actively caring behavior continuously monitor their surroundings for potential hazards and unsafe practices, taking corrective measures upon identifying any unsafe conditions or behaviors. Geller [19] theorized that three key factors contribute to an individual's inclination to "actively care" (AC) for the safety or health of their peers. Those deemed most likely to engage in AC behavior are individuals with high self-esteem (i.e., feeling valued), optimism (i.e., believing they can effect positive change), and a sense of group belongingness or cohesion (e.g., feeling connected to their work team) [20].

5. CONCEPTUAL FRAMEWORK

The researcher adapted concepts from these selected theories to develop a conceptual model that suitably underpin this study, given each of the above discussed model have aspects that have relevance to the current study and can be applied to design constructs of the framework [21]. The risk theory/defense-in-depth theory is useful for explaining how the mining and petroleum companies under study may establish layers of defense to mitigate identifiable injuries to employees, productivity losses due to health/occupational hazards, or post-employment claims among its workforce who may suffer injuries in their line of duty [22]. Secondly, the accident causation model with its underlying philosophy of Systems-Theoretic Accident Model and Processes (STAMP), posits that accidents occur when the control system fails to adequately address external disturbances, component failures, or dysfunctional interactions among system components, thereby leading to insufficient control or enforcement of safety-related constraints during system development, design, and operation. In this context, the organization under examination is conceptualized as the system. This construct helps to explain the how organizational management can enforce behavioral changes in staff through OHS

protocols to avert accidents among its workforce [23]. Thirdly, the accident model grounded in the systems theory delineates how the organizational structures within mining and petroleum companies in Ghana can proactively implement OHS measures in their operational sites to prevent accidents among employees. Finally, the Actively Caring Model facilitates an examination of whether employees within the mining and petroleum Companies demonstrate concern for each other's well-being during fieldwork [24]. This model also help in exploring whether staff members possess intrinsic values such as self-esteem, optimism, and a sense of group cohesion. Figure 01 is a conceptual framework illustrating how OHS protocols are implemented and maintained in the work environment.

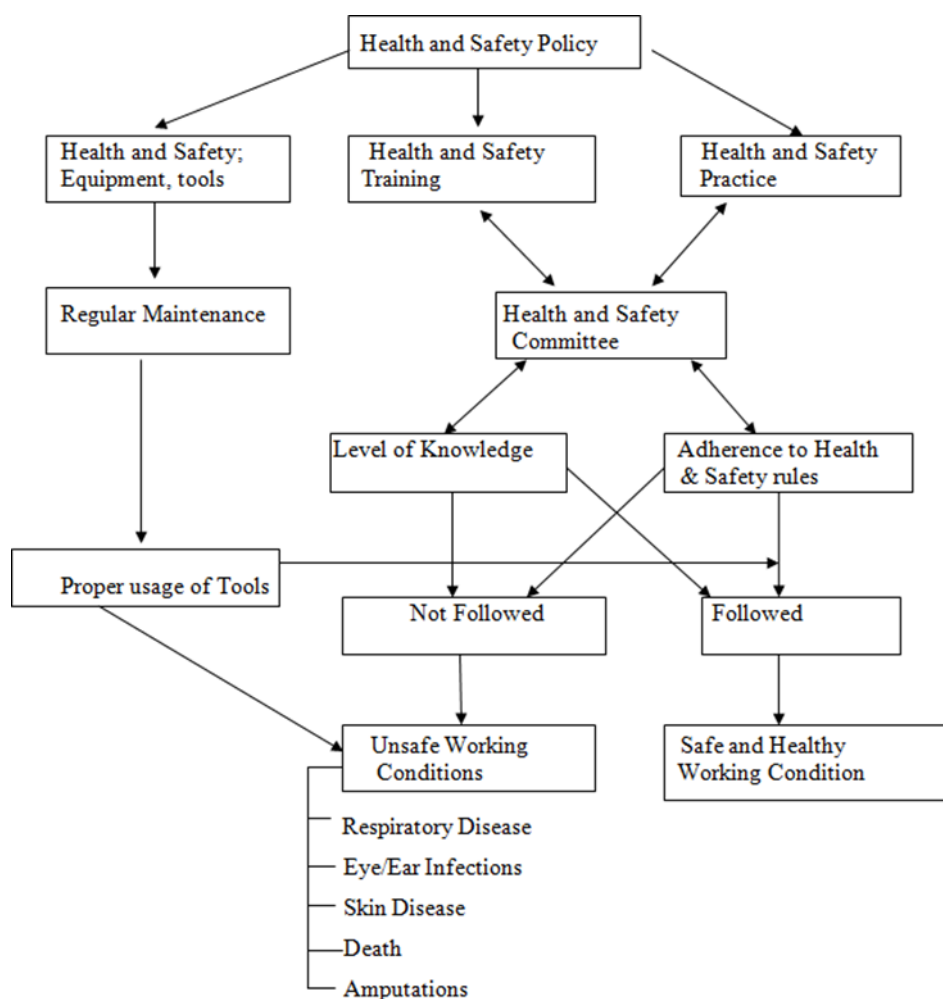


Figure 01: Conceptual framework on occupational health safety policy implementation and practice, adapted from Geller (2006).

6. OVERVIEW OF THE CONCEPTS OF OCCUPATIONAL HEALTH AND SAFETY

Concepts of occupational health and safety encompass a comprehensive understanding of the factors affecting workers' well-being and workplace safety. Occupational Health involves the systematic examination and management of environmental factors within the workplace that may lead to sickness, compromised health, or discomfort among workers or community members [25]. Conversely, Occupational Safety entails the thorough inspection and assessment of workplace conditions, equipment, and procedures to identify potential weaknesses and risks for accidents, followed by the implementation of corrective measures such as employee training, job redesign, and ongoing

monitoring [26]. International bodies such as the World Health Organization (WHO) and the International Labour Organization (ILO), as well as labour laws of countries have provided various definitions of occupational health and safety. Summarily, occupational health encompasses multidisciplinary efforts aimed at safeguarding workers' health, preventing occupational diseases and accidents, creating a healthy and safe work environment, enhancing workers' overall well-being and productivity, and contributing to sustainable development [27]. The fundamental issues in health and safety at the workplace revolve around hazard recognition, risk identification, and accident monitoring to minimize occurrences. Safety hazards pose immediate and sometimes severe harm or fatality risks, while health hazards gradually deteriorate workers' health. These hazards necessitate a comprehensive approach involving the participation of all stakeholders, including governments, trade unions, insurance companies, and the public [28]. In the developed world, superior occupational health and safety systems are evident due to enhanced programs, better medical facilities, and active worker involvement in decision-making processes. Conversely, industries with high accident risks globally include mining, agriculture, forestry, logging, and construction. However, in many developing countries, such as those in the third world, healthcare access for workers remains limited, and primary health care infrastructure requires substantial development to address prevalent health risks such as pesticide exposure, physical strain, and hazardous working conditions [29]. The issue of underreporting accidents in African organizations underscores the low priority often given to health and safety concerns, driven by political or commercial considerations, which points to an urgent need for greater attention to health and safety practices to ensure the well-being and productivity of workers across various industries. However, many studies suggest that workers in high risk industries in developing sub-Saharan Africa are always reluctant to report minor accidents, which partially stems from the prevailing attitude among many organizations in Africa where health and safety considerations are often downplayed or overlooked for political or commercial expediency. This disregard for safety protocols not only compromises the well-being of workers but also undermines organizational sustainability and long-term productivity. Worker participation is crucial in fostering a culture of safety within organizations. According to the International Labour Organization, empowering employees to identify hazards, report incidents, and contribute to decision-making processes regarding health and safety initiatives enhances overall workplace safety and reduces the likelihood of accidents [30]. Furthermore, fostering partnerships with local communities and stakeholders can facilitate the exchange of knowledge and resources to address occupational health and safety challenges effectively. Addressing the challenges of occupational health and safety requires a multifaceted approach that covers regulatory enforcement, employer commitment, worker empowerment, and community involvement. Governments play a pivotal role in establishing and enforcing regulations to ensure workplace safety standards are upheld. Additionally, employers must prioritize health and safety measures by investing in training programs, providing adequate protective equipment, and implementing preventive measures to mitigate hazards [31].

7. AWARENESS OF OHS PROTOCOLS AMONG WORKERS IN THE MINING AND PETROLEUM INDUSTRY

The success of occupational health and safety programmes within high risk work environments (such as the mines) depends heavily on how well employees and supervisors cooperate in the implementation of the OHS policies and/or regulations. This implies that awareness of the frequency of periodical machines and guards' inspection at workplace in order to ascertain the health and safety policies of the company is in good taste. This implies that it is important that workers have adequate understanding of the workplace safety regulations to ensure compliance with the company's health and safety policies. Workers in the mining and petroleum industries work in a hazardous environment, and thus, their knowledge of safety policies of the company is key to the prevention of avoidable accidents [32]. Hence, occupational health and safety policies in these industries require field workers to wear protective

apparel whenever on duty at site. Assessing the awareness of health and safety policies among AngloGold Ashanti Iduapriem Ghana Limited employees reported that a majority of respondents (57%) acknowledged the requirement to use appropriate personal protective equipment (PPE) consistently. Additionally, one-fifth (20%) mentioned accident reporting as a company policy, while 15% of participants cited maintaining cleanliness and tidiness in the workplace. The study found that mandatory use of appropriate personal protective equipment (PPE) at all times was one of the occupational health and safety policies strictly enforced by the company. The International Labour Organization recommends that to guarantee the safety of workers, employers must take proactive steps to give employees continuous training on workplace safety [33]. This requirement is even more relevant in the mining and petroleum industries which are regarded as having exposure to hazardous environment. Safety training enables employees to grasp the hazards present in the workplace and fosters an understanding of safety protocols, facilitating compliance. Accidents often stem from insufficient experience and inadequate safety training, emphasizing the importance of incorporating proper task execution methods and risk management strategies into safety training. Effective safety training should aim to raise awareness and promote behavioral change among employees, with the success of such programs hinging on the ability to recognize health and safety hazards inherent to the mining industry. One other mechanism through which occupational health and safety managers ensure compliance to organizational safety standards in the work setting is creating a conducive OHS environment fosters stronger emotional attachment, sense of obligation, and overall commitment among workers [34]. A cross-sectional survey involving 370 workers of mining companies in Ghana examined the relationship between occupational health and safety (OHS) and employees' organizational commitment in Ghana's mining industry. The findings revealed a positive and significant correlation between OHS management and affective, normative, and continuance commitment, which highlights the significant impact of OHS on these dimensions of organizational commitment. Thus, the study emphasized the need for management in the Ghanaian mining sector to invest in robust OHS policies and practices to enhance organizational commitment among employees. Similarly, [35] investigated the relationship between organizational safety culture and employee accidents in the mining industry in Ghana, and reported that safety culture significantly predicted work safety, management safety practices, safety programs, co-worker safety, and supervisor safety. This implies that enhancing safety culture among workers can effectively improve workplace safety in the Ghanaian mining industry, hence HR managers need to prioritize initiatives aimed at cultivating a strong safety culture among all employees to mitigate accidents and injuries in the sector [36].

8. OCCUPATIONAL HEALTH AND SAFETY PROTOCOLS IN THE MINING AND PETROLEUM INDUSTRIES

The mining and petroleum industries have long been known as highly volatile in terms of safety of the people who work at site, as evidenced by the history of frequent disasters and accidents often resulting in a high rate of disabling injuries during its formative years. The health hazards associated with working in these industries stem from gases, dust, chemicals, noise, extreme temperatures, and various other physical factors that pose risk to workers, leading to numerous chronic ailments and occasionally fatal illnesses [37]. Attribute this phenomenon to the exceedingly stressful working conditions endured by miners. Such fatalities, injuries and accidents although less frequent in this modern times due to improved technology, continue to occur in the mining industry. The Labour Act of 2003 (Act 651) of the Republic of Ghana clearly outlines the roles and responsibilities of employers and employees concerning the management of Occupational Health, Safety, and Environment within the work environment. The Act lacks specificity regarding accident and occupational illness reporting procedures, criteria for defining occupational illnesses, and the entity responsible for ensuring that industries in Ghana implement corrective actions. The lack of specificity may lead to ambiguity and inconsistency in addressing workplace accidents and illnesses, potentially compromising the well-being of workers and

the overall safety culture within Ghanaian mining and petroleum industries [38]. This raises concerns regarding effective occupational health and safety management in the nation's industries. There is the need for comprehensive legislative frameworks that provide explicit guidance on these critical aspects of occupational health and safety management, thereby promoting a safer and healthier work environment for all stakeholders. Despite the existence of regulatory frameworks and safety initiatives, challenges persist in ensuring adequate OHS management in the mining and petroleum industries. Poor enforcement of regulations, inadequate training and supervision, and pressure to maximize production often undermine safety efforts. Additionally, the transient nature of work in these industries, characterized by contract employment and frequent turnover poses challenges in maintaining a strong safety culture [39].

9. CONCLUSIONS

It is concluded that in Ghana, by law, reports on mining incidents and accidents are mandated to be submitted to the Inspectorate Division of the Minerals Commission. Hence, there should have been the existence of a comprehensive database documenting all reported incidents within the industry which readily accessible to the public. However, access to such data remains a significant challenge, which is identified as the primary obstacle hindering research in this field. As a result, research into accidents and injuries within Ghana's mining and petroleum sectors has been limited, despite the industries' longstanding recognition as a safety-critical domain.

REFERENCES

- [1] Ablo, A. D. (2015). Local content and participation in Ghana's oil and gas industry: Can enterprise development make a difference? *The Extractive Industries and Society*, 2(2), 320–327. <https://doi.org/10.1016/j.exis.2015.02.003>
- [2] Peter John, Irina Yang & Aparna Goel (2022). A Systematic Literature Review of Importance of Emotional Competence in Healthcare Management. *Dinkum Journal of Medical Innovations*, 1(01):19-26.
- [3] Amponsah-Tawiah, K., & Mensah, J. (2016). Occupational Health and Safety and Organizational Commitment: Evidence from the Ghanaian Mining Industry. *Safety and Health at Work*, 7(3), 225–230. <https://doi.org/10.1016/j.shaw.2016.01.002>
- [4] Annan, J.-S., Addai, E. K., & Tulashie, S. K. (2015). A Call for Action to Improve Occupational Health and Safety in Ghana and a Critical Look at the Existing Legal Requirement and Legislation. *Safety and Health at Work*, 6(2), 146–150. <https://doi.org/10.1016/j.shaw.2014.12.002>
- [5] Aram, S. A., Saalidong, B. M., Appiah, A., & Utip, I. B. (2021). Occupational health and safety in mining: Predictive probabilities of Personal Protective Equipment (PPE) use among artisanal goldminers in Ghana. *PLOS ONE*, 16(9), e0257772. <https://doi.org/10.1371/journal.pone.0257772>
- [6] Tuba Ahmed, Yumna Rehman & Adeela Kausar (2023). Associations between the Sustainable Development Goals and Oral Health. *Dinkum Journal of Medical Innovations*, 2(11):491-499.
- [7] Betts, P. W. (2009). *Supervisory studies: A managerial perspective* (5th ed.). Pitman.
- [8] Bhagawati B. (2015). Basics of occupational safety and health. *IOSR J Environ Sci Toxicol Food Technol* 2015;9:91e4.
- [9] Dr. Kul Raj Shahi, Dr. Ujjwol Arayal & Dr. Sandesh Pandit (2024). Study on Risk Factors of Non Alcoholic Fatty Liver Disease in Patients Attending NGMCTH. *Dinkum Journal of Medical Innovations*, 3(05):367-378.
- [10] Cole, G. A. (2014). *Personnel and human resource management*, Biddles Limited, London.
- [11] Creswell, J. (2007). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches*. 3rd Edition. Sage Publications, California, U.S.A.
- [12] Dr. Navindra Dhakal, Dr. Bina Prajapati Manandhar, Dr. Najala khatun & Dr. Sanju Poudel (2024). Comparison of Acute Illness Observation Scale (AIOS) & Chest X-Ray in Children with Acute Respiratory Infection. *Dinkum Journal of Medical Innovations*, 3(05):391-400.

- [13] Creswell, J. W. (2009). "Research Design: Qualitative, Quantitative and Mixed Methods Approaches" (3rd ed.). Los Angeles: Sage.
- [14] Maryam Majeed, Rubab Ali, Ume e Aimen & Aqsa Jabeen (2023). Medical Staff, Workplace Bullying and Its Effects on the Performance. *Dinkum Journal of Medical Innovations*, 2(04):120-125.
- [15] Geller, T. (2006). Five Steps to Risk Assessment. HSE Books.
- [16] Gentles, S., Charles, C., Ploeg, J., & McKibbin, K. A. (2015). Sampling in Qualitative Research: Insights from an Overview of the Methods Literature. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2015.2373>
- [17] Gyekye, S. A. (2016). Workers' Perceptions of Workplace Safety: An African Perspective. *International Journal of Occupational Safety and Ergonomics*, 12(1), 31–42. <https://doi.org/10.1080/10803548.2006.11076667>
- [18] Anand Gopal & Nandita Shetty (2023). Literature Review on Comparison of Efficacy and Safety of Mometasone Furoate 0.1% Gel Versus Mometasone Furoate 0.1% Cream and Adapalene Gel 0.1%. *Dinkum Journal of Medical Innovations*, 2(02):57-71.
- [19] ILO. (2017). Saferwork. Global estimates of fatal work related disease and occupational accidents, World Bank Regions.
- [20] Ribha Verma, Ramakant Lamichhane & Joshna Shrestha (2024). Formulation & In Vitro Evaluation of Effect of Polymer in Gastro-Retentive Drug Delivery System Using Ciprofloxacin Hydrochloride as A Model Drug. *Dinkum Journal of Medical Innovations*, 3(03):271-289.
- [21] Ivancevich, J. M. (2017). Human resource management. Boston : McGraw-Hill Irwin. http://archive.org/details/humanresourceman0000ivan_y2f7
- [22] Jafry, T., & O'Neill, D. H. (2020). The application of ergonomics in rural development: A review. *Applied Ergonomics*, 31(3), 263–268. [https://doi.org/10.1016/S0003-6870\(99\)00051-4](https://doi.org/10.1016/S0003-6870(99)00051-4)
- [23] Jooste, K. (2010). The principles and practice of nursing and health care: Ethos and professional practice, management, staff development, and research. Pretoria: Van Schaik.
- [24] Tanka Bhattarai (2024). Optimization of Vegetables Proportion in Emulsion Type Chicken Sausage & Study on Its Storage Stability. *Dinkum Journal of Medical Innovations*, 3(07):533-549.
- [25] Dr. Nabin Kumar Sinjali Magar, Dr. Dhruva Gaire & Dr. Prasanna Bahadur Amatya (2024). Evaluation of Pulmonary Hypertension in Chronic Obstructive Pulmonary Disease (COPD) by assessment of Chest X-Ray, ECG and Echocardiography. *Dinkum Journal of Medical Innovations*, 3(02):132-144.
- [26] Che Huei, L., Ya-Wen, L., Chiu Ming, Y., Li Chen, H., Jong Yi, W., & Ming Hung, L. (2020). Occupational health and safety hazards faced by healthcare professionals in Taiwan: A systematic review of risk factors and control strategies. *SAGE Open Medicine*, 8, 2050312120918999.
- [27] Abdelrahim, R. A., Otitolaiye, V. O., Omer, F., & Abdelbasit, Z. (2023). Scoping review of the occupational health and safety governance in Sudan: the story so far. *Safety and health at work*, 14(2), 174-184.
- [28] Rikhotso, O., Morodi, T. J., & Masekameni, D. M. (2022). Occupational health and safety statistics as an indicator of worker physical health in South African industry. *International journal of environmental research and public health*, 19(3), 1690.
- [29] Ateeq, A., Al-Refaei, A. A. A., Alzoraiki, M., Milhem, M., Al-Tahitah, A. N., & Ibrahim, A. (2024). Sustaining organizational outcomes in manufacturing firms: The role of HRM and occupational health and safety. *Sustainability*, 16(3), 1035.
- [30] Zhang, X., & Mohandes, S. R. (2020). Occupational Health and Safety in green building construction projects: A holistic Z-numbers-based risk management framework. *Journal of cleaner production*, 275, 122788.
- [31] Hoeft, M., & Trask, C. (2022). Safety built right in: exploring the occupational health and safety potential of BIM-based platforms throughout the building lifecycle. *Sustainability*, 14(10), 6104.
- [32] Olcay, Z. F., Temur, S., & Sakalli, A. E. (2021). A Research on the Knowledge Level and Safety Culture of Students Taking Occupational Health and Safety Course. *Cypriot Journal of Educational Sciences*, 16(1), 187-200.
- [33] Tian, H., Zhang, S., Garg, H., & Liu, X. (2024). An extended SECA-GDM method considering flexible linguistic scale optimization and its application in occupational health and safety risk assessment. *Alexandria Engineering Journal*, 88, 317-330.

- [34] Duryan, M., Smyth, H., Roberts, A., Rowlinson, S., & Sherratt, F. (2020). Knowledge transfer for occupational health and safety: Cultivating health and safety learning culture in construction firms. *Accident Analysis & Prevention*, 139, 105496.
- [35] Shankar, J., Lai, D., Chen, S. P., Turin, T. C., Joseph, S., & Mi, E. (2022). Highly educated immigrant workers' perspectives of occupational health and safety and work conditions that challenge work safety. *International journal of environmental research and public health*, 19(14), 8757.
- [36] Liu, R., Hou, L. X., Liu, H. C., & Lin, W. (2020). Occupational health and safety risk assessment using an integrated SWARA-MABAC model under bipolar fuzzy environment. *Computational and Applied Mathematics*, 39(4), 276.
- [37] Shoaib, D. M., Ahmed, T., Tabassum, K. F., Hasan, M., Shariar, F., Rahman, M., ... & Alam, M. U. (2024). Evaluation of occupational health and safety intervention for the waste and sanitation workers in Bangladesh during COVID-19. *International Journal of Hygiene and Environmental Health*, 255, 114288.
- [38] Zhang, M., Shi, R., & Yang, Z. (2020). A critical review of vision-based occupational health and safety monitoring of construction site workers. *Safety science*, 126, 104658.
- [39] Salguero-Caparrós, F., Pardo-Ferreira, M. D. C., Martínez-Rojas, M., & Rubio-Romero, J. C. (2020). Management of legal compliance in occupational health and safety. A literature review. *Safety science*, 121, 111-118.