UNRAVELLING HAZARDS: INVESTIGATING ROOT CAUSES OF OCCUPATIONAL ACCIDENTS IN THE MANUFACTURING SECTOR

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Abstract: The study carefully examines the human factors that lead to workplace accidents, sorting through complex issues pertaining to employee behaviour, distractions, inadequate instruction, and the influence of stress or exhaustion on judgement. By doing a comprehensive analysis, the research seeks to pinpoint the locations where safety procedures and human factors collide, offering guidance for tailored solutions that enhance workers' well-being. Examining equipment and machinery failures as important causes of occupational accidents is a major component of the research. The purpose of the research is to identify weak points in the production infrastructure by evaluating maintenance procedures, the age of equipment, and the efficacy of safety measures. It is essential to have this knowledge in order to suggest specific improvements for machinery upkeep and safety protocols, which will lower the likelihood of mishaps caused by technical issues. Furthermore, explored in the study are the safety-related organizational cultures and practise in manufacturing firms. Analyzing the commitment of the leadership to safety, the dissemination of safety procedures, and the incorporation of safety measures into regular operations are all part of this. Ultimately, the study hopes to reduce the incidence of occupational hazards in the manufacturing sector by offering suggestions for developing a robust safety culture through the dissection of organizational dynamics that influence safety practise.

Keywords: Occupational Accidents, Manufacturing Sector, Root Causes, Hazard Investigation, Workplace Safety, Industrial Accidents

1.Introduction

The manufacturing sector emerges as a vibrant and indispensable industry in the realm of occupational safety, grappling persistently with the challenge of occupational accidents. The study delves into the various aspects of human factors, equipment failures, and organizational practise that intertwine to generate potential hazards, with a primary focus on recognizing and comprehending the fundamental foundations of these accidents. The importance of scrutinizing human behaviour, attention lapses, training deficiencies, and the influence of stress on decision-making processes becomes clear, as mirrored in existing literature. Concurrently, the study investigates the critical role of equipment and machinery failures, scrutinizing maintenance practise, machinery age, and the effectiveness of safety mechanisms. Furthermore, the study investigates the impact of organizational culture and practise, with a focus on safety commitment, protocol communication, and the incorporation of safety measures into daily operations. This study aims to provide practical implications for industry stakeholders, regulatory bodies, and safety professionals as well as to contribute scholarly perspectives to occupational safety.

The research seeks to facilitate targeted interventions and policies that cultivate a safer working environment, thereby mitigating risks and improving overall workplace well-being by unraveling the fundamental causes of occupational accidents in the manufacturing sector.

2. Materials and Methods

2.1 Design

This qualitative study set out to find out how team members and supervisors see the reasons for work-related mishaps, as well as how the responses of participants are shaped by their own experiences with incidents. Using coding principles, content analysis is a reproducible technique for classifying words in a document. (Mohammadi, A., 2018). Open coding, a method for creating and abstracting inductive content analysis, takes the concepts straight out of the transcripts. A deductive method of text evaluation becomes crucial when a researcher wants to evaluate an established theory or repeat data in a new category or context that is based on theories from relevant literature. (Cho and Lee, 2014, Elo et al., 2014)

2.2 Participants and data collection

This study included superiors n=13 safety engineers n=4, employees n=25 from gear and clutch manufacturing industry in Chennai, India. The interviews were conducted to represent a range of ages, nature of work and educational qualification, they were experienced already at least one year of experience in the manufacturing industries and an experience with the occupational accidents. HSE professionals of the industries were contacted, and the necessary approvals in consultation with those professionals. Then, after the conversations with them and meet directly and explaining the study objectives, the interviews agreed to participate with their own interest with free of cost. At the work place of the participants of employment conducted direct interviews lasting an average of 35 minutes were used. The interviews were conducted in their break times for every individuals.by the first author, and the interviewees were asked the following questions: Have you or your team member ever been injured on the job? What are your thoughts on the factors that contribute to occupational injuries exclude the identified root causes? How feasible is it to prevent occupational injuries at your workplace? Experienced and trained for the particular job where the incident happened? How feasible is it to prevent occupational injuries at your workplace?

2.3 Data analysis

All interviews were digitally recorded and fully transcribed. The data were tested using content analysis to identify the relevant constructs. The transcripts were thoroughly analyzed and marked questions are coded. All codes are separately described with a specified time. Classified as based on concepts and control measures. At last, the categories were integrated to provide a detailed explanation of the accidents and root causes. After the both authors confirmed on the contents were developed.

3. Results
3.1 Causes of occupational accidents towards organization

3.1.1 Inadequate training and education

Smith and colleagues (2017) explore the ramifications of inadequate training and the influence of stress and exhaustion on compromised decision-making, offering a basis for comprehending the complex interactions between human factors and safety procedures. Human and organizational factors are the most significant and dominant elements in accidents (M.Syed, 2022). Young workers

are most likely to be assigned a task without the proper qualifications, use inappropriate work methods, and misunderstanding instructions (J. A. Carrillo Castrillo,2016). Safety training is necessary to control the employees' unsafe acts and conditions for creating awareness (Abolfazl Ghahramani, 2021). The most frequently encountered type of accident is pressing of the body or members between two objects (Bülent Altunkaynak, 2018). Accidents may result from inadequate training programme or from a lack of knowledge about safety precautions. Employees must comprehend the pertinent safety procedures and be well-versed in the safe operation of machinery. The correlations between worker characteristics—such as young workers being given jobs without the necessary training or low-experience workers experiencing a lack of experience—and accident causation were emphasized.

3.1.2 Practices and performances

A common issue in safety literature is the impact of organizational culture on safety practise. The relevance of a leadership commitment to safety is emphasized by Hofmann and (Behera R.K., 2019), which is consistent with the current study's focus on understanding organizational dynamics. Furthermore (Clarke, 2017) investigates how safety precautions are incorporated into regular operations, offering insightful advice for developing a strong safety culture.

According to Avanzi's research from 2018, supervisor support, safety climate, and organizational identification are important factors that improve workers' adherence to safety protocols. (Saat, 2016) emphasizes the importance of scrutinizing safety performance within Malaysian small and medium enterprises (SMEs), emphasizing the impact of organizational safety practise on overall safety performance.

3.1.3 Lagging Communication

Miscommunication about safety protocols and changes in procedures can lead to misunderstandings and contribute to accidents. A safe working environment requires clear and effective communication. According to the research, communication breakdowns significantly contribute to accidents in the manufacturing industry. (Bourassa, 2016) identified equipment failures as a major factor in numerous manufacturing accidents, which were linked to breakdowns in communication within maintenance and reliability processes. Similarly, in 2021, Oghyanoosi's study on industrial accidents in the chemical process industry identified communication breakdowns as one of the primary causes. These findings highlight the importance of effective communication in both preventing and mitigating accidents in industrial settings.

3.1.4 External Factor

External factors such as changes in regulatory mandates, economic stressors, or unexpected occurrences have the potential to impact manufacturing safety. Which is unidentified in the previous researches, there were hidden root causes may not list. Lacking other potential factors by the decision taken by the management changes leads to policy updates, challenges in business and targets.

3.2 Factors of investigating root causes

3.2.1 Ergonomic Design Deficit

Inadequately designed work spaces and equipment can contribute to musculoskeletal disorders and other health problems, which can lead to accidents. (Colim, 2019) discusses a case study in the furniture manufacturing sector, emphasizing the importance of ergonomic interventions in

reducing risk factors for Work-Related Musculoskeletal Disorders (WMSD) and improving worker well-being. (Cruz, I., 2015) investigates the processes and design in structural and fabrication shops, identifying the presence of Musculoskeletal Disorder (MSD) risks due to poor ergonomic design. The study suggests specific actions to address these issues. In summary, these papers all support the idea that a lack of proper ergonomic design can contribute to accidents and health issues in the manufacturing industry.

3.2.2 Poor Equipment Maintenance

The most common apparent causes of accidents, according to Botti 2020, were the willful adoption of inappropriate protocols, inappropriate equipment use, and a lack of cooperation. (Fatemi, 2020) noted that employee behaviour was a significant factor in industry accidents and injuries, highlighting the necessity of job-specific health and safety training. When machinery and equipment are not properly maintained, malfunctions and failures can occur, raising the possibility of accidents. To guarantee the dependability of equipment, routine inspections and preventive maintenance are essential. The relevance of equipment failures as contributors to occupational accidents is shown by research on the subject. Turner and analysis clarify the significance of assessing safety measures, machinery age, and maintenance practise in order to detect vulnerabilities. Their research advances our knowledge of the technical factors affecting manufacturing accident rates.

3.2.3 Inadequate Safety Measures

The risk of accidents in manufacturing settings can be increased by inadequate safety measures, such as inadequate protective gear and poorly implemented safety protocols. The papers highlight the manufacturing industry's inadequate safety measures. (Kumar, 2020) emphasizes the importance of proper safety measures in order to eliminate accidents and improve production. (Mamtani, 2020) discusses the lack of occupational safety and health practise in Indian manufacturing industries, with only a few export houses implementing occupational safety and health practise. The importance of safety management awareness and training in creating a safety culture in the manufacturing industry is highlighted in (Warule 2020).

3.2.4 High-paced Production Demands

In order to meet production targets and deadlines, workers may take shortcuts or bypass safety measures in order to save time, increasing the probability of accidents. The concentration missing for doing safe work due to workload increase, overtime, unplanned production. According to the papers, high-paced production demands have an impact on accidents in the manufacturing industry. (Probst, 2013) discovered that high levels of perceived production pressure were associated with more accidents overall and more negative attitudes towards reporting accidents.

3.2.5 Failure to address near misses

Neglecting or inadequately dealing with near misses and minor incidents may indicate underlying safety concerns that, if not addressed, could lead to more serious accidents. These studies suggest that failing to address near misses may result in industrial accidents in the manufacturing sector. (Gnoni, 2023) emphasizes the importance of Near Miss Management Systems (NMSs) in improving safety while identifying barriers to their implementation in the industrial domain. According to (Caffaro, 2017), near misses act as a moderator in predicting

agricultural machinery accidents. These findings emphasize the importance of thorough near miss reporting and analysis in the manufacturing industry for accident prevention.

3.2.6 Human Factor

Employee behaviour, inattention, and decision-making errors are all significant factors in accidents. To improve safety, it is critical to understand and correct human factors such as fatigue and stress. Based on the research papers, human error is a major cause of accidents in the manufacturing industry. Yeow emphasizes the impact of human error on workplace accidents and injuries (Reyes, 2015) investigates the relationship between human error and hand injuries in the automotive manufacturing industry. (Mohamadfam, 2012) study evaluates the management of human errors in manufacturing during emergency situations. Furthermore, (Bourassa, 2016) research investigates how equipment failures contribute to industrial incidents in manufacturing. These findings emphasize the importance of increased awareness and effective management of human error in the manufacturing sector in order to prevent accidents. However, the absence of knowledge on intermediate and human factors made the investigation of fundamental causes difficult.

4. Discussion

The significance of investigating occupational accidents in the manufacturing sector (Hämäläinen, P., 2006). Provide statistics and trends related to occupational accidents in the manufacturing sector. Explore various factors contributing to accidents, such as human error, machine malfunctions, and organizational issues and the role of human factors in accidents and the importance of ergonomics and human-machine interaction (Salvendy, G.,

2012). regulations and standards in ensuring occupational safety in the manufacturing sector

5. Study strength and Limitations

The manufacturing industry presents considerable obstacles to worker safety in the form of occupational accidents, which calls for a thorough investigation of the underlying reasons. This review provides insights into the complex elements of occupational accidents in manufacturing by synthesizing important data from pertinent studies.

These researches were individually discussed about the manufacturing industry accidents and the root causes were investigated with superiors and team members were used. In the previous literature helps to identified the hidden root causes were not concentrated clearly like ergonomics, organization practices and some. Where it should be concentrated to develop the function safety management. However, it will be the greater one to support identifying root causes of every incident takes place.

6. Conclusion

The results of this study have helped to identify some of the elements that lead to workplace accidents in the industrial sector. Rather of identifying and outlining the precise duties involved, participants tended to blame external causes beyond their control for the responsibility for accident prevention. Managing the underlying causes of accidents is essential, and supervisors should put the necessary preventive measures in place based on the causes that have been found and the requirements of the participants. Safety regulations must be inspected and enforced by occupational health and safety (OHS) authorities, and the government should provide funding for the creation and application of preventative safety measures.

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