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Strategies for Managing Occupational Health and Safety in Manufacturing Industries



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Abstract

The aim of the current study is to evaluate the current status of occupational health and safety (OHS) in South India's industry, a region that is famous for having a diversified and rapidly growing industrial base. Evaluating the effectiveness and completeness of existing health and safety management systems in numerous manufacturing units is the particular aim of the study. Key areas such as hazard identification and control, risk assessment procedures, organizational safety policy. administrative backing, employee welfare schemes, leadership contribution, motivation strategies, training schemes, and the existing monitoring and reporting systems were all addressed comprehensively by these questionnaires. Both graphical representation methods and the D&S (Descriptive and Statistical) method were employed by the study to analyze the data that was collected. This provided room for explicit and quantitative understanding of the present systems' pros and cons. Even though there are frameworks, the research revealed that many companies fail to implement robust OHS policies successfully. Key areas that require much attention are regular safety training, employee participation, proactive risk management, and regular policy enforcement. Overall, the research study indicates that structural reforms are long overdue to ensure that workers in South India's manufacturing sector are given safer, healthier, and more stimulating work conditions.

1. Introduction

A study conducted on the manufacturing sector in southern India found that although some industries have systems in place for managing occupational health and safety (OHS), only a few are actively implementing, maintaining, and complying with these systems. This study aims to establish a foundation for evaluating the OHS practices within South India's manufacturing industries. The data for this research was collected across several key areas: health and safety management, welfare facilities, policy, organizational structure and administration, leadership, motivation, training, accident records, hazard control, risk assessment, monitoring, and reporting.

Health management data was gathered by examining factors such as temperature, ventilation, lighting, water quality, and cleanliness. Safety management information was collected by analysing fire emergency procedures, hoists/lifts, exit routes, elevating and electrical equipment, and confined spaces .Training, motivation, leadership, and worker well-being were evaluated based on training programs, motivation levels, educational efforts, rest breaks, work shifts, and the use of personal protective equipment (PPE). Welfare data was based on facilities such as canteens, first aid availability, and seating arrangements.

Accident statistics included near misses, hazardous incidents, minor and major accidents, and fatalities. Data on policy, organization, and administration covered resource allocation, policy implementation, communication channels, delegation of responsibilities, management reviews, and documentation practices. Lastly, hazard control and risk analysis were assessed through processes like hazard identification, risk evaluation, control measure implementation, and documentation. Monitoring and reporting practices were examined based on proactive and reactive strategies, incident investigations, and corrective and preventive measures.

2. Literature Review

Kumar and Patil (2024) [1], explored the digital transformation in occupational health and safety within smart manufacturing. They highlighted how technologies like IoT, AI, and data analytics enhance real-time hazard detection, safety compliance, and worker well-being. Their study emphasizes the role of digital tools in creating proactive and intelligent safety systems.

Zhang and Singh (2024) [2], examined AI-driven safety monitoring systems in manufacturing workplaces. Their study emphasizes how artificial intelligence improves workplace safety by enabling real-time risk assessment, anomaly detection, and predictive maintenance. They conclude that AI integration enhances decision-making and significantly reduces accident rates in dynamic industrial environments.

Ahmed and Musa (2023) [3], focused on Behavior-Based Safety (BBS) implementation in medium-sized manufacturing enterprises. They analyzed how observing and reinforcing safe behaviors can reduce workplace incidents. The study found that BBS enhances safety culture, employee engagement, and compliance, proving effective even in resource-constrained manufacturing environments.

Lopez and Lee (2023) [4], investigated the integration of Lean Manufacturing with Occupational Health and Safety (OHS) strategies using a case study approach. Their research demonstrated that aligning lean principles with safety initiatives enhances efficiency and reduces workplace hazards. The study highlights the synergy between productivity improvement and proactive safety management.

Basu and Thomas (2022) [5], examined the role of safety culture as a core element of Occupational Health and Safety (OHS) in industrial settings. Their study emphasized that a strong safety culture—rooted in leadership commitment, employee involvement, and continuous improvement—is essential for sustainable safety performance. They argued that beyond compliance, fostering shared values and attitudes toward safety significantly reduces incidents. The research advocates for integrating safety culture into organizational practices to enhance both environmental outcomes and worker well-being in industrial operations.

Miller and Osei (2022) [6], explored the impact of OHS training on accident reduction in manufacturing plants. Their study found that structured and regular safety training significantly lowers the frequency and severity of workplace accidents. They emphasized the importance of practical, role-specific training in building employee awareness, improving hazard recognition, and fostering a proactive safety culture in industrial environments.

3. Research Methodology

1. Questionnaire Development

The questionnaires were designed around key components of occupational health and safety: health, safety, welfare, motivation, leadership, training, accident statistics, administration and organization, and hazard and risk control. Each question was tailored to reflect the industry's need for a comprehensive and effective OHS management system.

2. Distribution of Surveys

Pre-structured questionnaires were distributed based on specific industry operations, shift schedules, and workforce profiles. The survey also included questions about employee demographics and managerial perspectives on occupational health and safety. The recipients of these questionnaires included senior

management, Health, Safety, and Environment (HSE) Managers, Safety Committee Members, and Human Resources Managers.

3. Walk through Survey

Additional data was collected through Walkthrough Surveys using purpose-built questionnaires. These evaluations centered on several key areas: policy, organizational structure and administration, hazard control and risk assessment, monitoring, data collection and reporting, welfare provisions, motivation, leadership and training, and the overall health and safety management framework. This method offers accurate, firsthand insight into the actual conditions within manufacturing facilities. The walkthrough technique, a form of direct observation, follows the approach outlined by Madbuli H. Noweir and colleagues (2013).

4. Data Analysis

The collected data from the structured questionnaires was analyzed using three main methods: mean and percentage calculations, the D&S method, and graphical representations.

5. D&S Method

The D&S method is a tool for assessing the extent and quality of safety initiatives implemented by organizations or industries. Originally developed by Diekemper and Spartz in 1970, the method was later refined by Arto Kuusisto in 2000. This approach divides safety activities into four main categories:

- Policy, Organization, and Administration weighted at 20%
- Risk Analysis and Hazard Control weighted at 40%
- Motivation, Leadership, and Training weighted at 20%
- Monitoring, Statistics, and Reporting weighted at 20%

Unlike performance-based assessments, the D&S method focuses on evaluating the activities undertaken rather than the outcomes achieved. As its creators suggest, the quantity and quality of safety-related activities do not always directly translate into performance results. This method has been used to assess an organization's safety management system and is recognized as one of eleven specific audit tools developed for occupational health and safety system audits (Piia Tint et al., 2010).

	Category	D&S value
1.	Policy, Organization &	20
	Administration	
2.	Hazard control and Risk analysis	40
3.	Motivation, Leadership and	20
	Training	
4.	Monitoring, Statistic and	20
	Reporting	
	Total (%)	100

Table-1. The categories and values of D&S method

4. Medical Administration

The findings reveal that most industries show a genuine interest in developing and maintaining organizational health systems. According to Figures 1 and 2, approximately **52.05%** of respondents reported having a structured health management system in place.

The average percentages for key health management factors were as follows:

- 1. **Temperature control** 50%
- 2. Ventilation and lighting 46.6%
- 3. Drinking water quality 62.8%
- 4. **Cleanliness** -48.8%

These figures suggest that while certain areas of health management are being addressed, the overall effectiveness of these systems varies across organizations. Compliance with legal health standards is evident, particularly through the provision of health insurance. Additionally, improvements in medical record-keeping were noted.

Several companies demonstrated a strong managerial commitment to employee well-being, which not only enhances worker morale but also promotes clearer and more effective communication between employees and senior management.



Fig.1: Comparison of parameters.

5. Safety Supervision

The data indicates that most companies are actively engaged in implementing and monitoring safety protocols within their manufacturing facilities. As illustrated in Figures 1 and 2, the overall effectiveness of safety management systems is reported at 60.4%.

A key factor contributing to subpar safety performance is the low level of safety awareness within organizations. Additionally, insufficient resources—such as inadequate safety equipment and facilities—further hinder safety efforts. The remaining 39.6% gap is primarily attributed to a lack of awareness, education, training, and motivation among employees.

The analysis of safety management included the following key factors and their respective compliance levels:

- 1. Fire emergency procedures 55.6%
- 2. Hoists and lifts 53.6%
- 3. Exit routes and procedures 72%
- 4. **Elevating devices** -64.05%
- 5. Electrical safety 55.6%
- 6. **Confined/restricted spaces** 62.5%

These elements are critical to maintaining a functional and reliable safety management system.

To improve workplace safety awareness, companies utilize various communication channels. The most common platforms include:

- 1. **Company public relations board** 80.7%
- 2. Safety meetings 77.3%
- 3. Training sessions 70.7%
- 4. **Company newsletters or booklets** 37.1%

5.1 Inspiration, Guidance, and Education

The effectiveness of training, leadership, and motivation was evaluated based on specific criteria. The results for each component regarding its implementation and sustainability are as follows: 64% for training, 60% for motivation, 50% for education, 45% for rest periods, 57% for job shifts, and 56% for personal protective equipment. Figures 1 and 2 show the overall 54.9% effectiveness across training, motivation, and leadership in the companies. Occupational health and safety training is provided by 73.9% of small and medium-sized businesses, and 82.5% of them offer safety training for new hires and employees assuming new roles. Safety training for temporary workers covers personal responsibility for training 49.6% of the time, while 79.5% of the training focuses on the use of personal protective equipment. Regarding trainees, 68.9% of safety officers, 69.8% of foremen, and 56.4% of personal section leaders received training. The current study shows a decrease in the use of protective apparel, hand protection, and head and face protection has declined, while the usage of foot protection, respirators, and ear protection has risen. According to Madbuli H. Noweir et al. (2013), larger plants provide more comprehensive personal protection compared to smaller ones in both studies.

5.2 Welfare Facilities

Almost all manufacturing companies ensure that their workers have access to adequate welfare facilities, in compliance with Chapter V of the Factories Act 1948 and other relevant regulations. This includes provisions for canteens, first aid supplies, washing facilities, and seating areas. On average, first aid supplies are available at 60%, seating facilities at 52%, laundry facilities at 62.8%, and canteen facilities at 58%. Figures 1 and 2 present the overall statistics for welfare facilities, which average 59.2%. According to Chapter V, Section 42 of the Factories Act 1948, separate washing facilities must be provided for male and female employees. Every plant must provide adequate seating for all workers (Section 44). First-aid kits with the required supplies must be available, with at least one kit for every 150 regularly employed workers (Section 45). For plants with over 250 regularly employed workers, the employer must establish and maintain canteen facilities (Section 46).

5.3 Accident Statistics

The survey on the manufacturing industry provides clear data on the accidents and incidents occurring within these sectors. Various factors were considered in analyzing the results, and the average values for each factor per year were calculated. Figure 3 shows these components along with their average values: near misses (44.3), dangerous.

Between 1995 and 1999, six industries were examined in Indonesia: manufacturing, forestry, construction, mining, power, gas, and water supply services. Among these, the manufacturing sector had the highest incidence of accidents.

5.4 Organization, Administration, and Policy

A strong health and safety management system relies on effective policies, organizational structures, and administrative processes, all of which are present in most manufacturing industries. The following factors were considered when evaluating the results, and the average percentage for each element was calculated: Policy (58), Resource Allocation (62), Communication (73.5), Responsibility Allocation (75), Management Review (73), and Documentation (72). Figures 1 show the overall organization and administration percentage, which is 69.56. occurrences (9.8), minor accidents (3.4), major accidents (2.7), and fatalities (0.5).





5.5 Risk Analysis and Hazard Control

The data collected on risk analysis and hazard control indicates that the majority of manufacturing industries have established procedures in these areas, which contribute to reducing industry risks and enhancing safety. The analysis of risk assessment and hazard control shows that these practices help improve working conditions, enabling employees to work freely, confidently, and without fear. The following factors, along with their average percentage values, were considered in evaluating risk analysis and hazard control in the manufacturing sectors: risk assessment (58), hazard identification (63.3), risk assessment implementation (57.5), risk assessment documentation (59.9), and determination of control measures (54.0). Figures 1 and 2 display the overall percentage for risk analysis and hazard control, which is 58.56.

Table2-Calculated D&S values.A,B,C,D, E,F,G,H,I,J represents each industries												
Category	D&S standar d value				<u>Calc</u> D&S	ulated v	<u>alue of</u>					
		Α	В	с	D	E	F	G	н	1	J	
Policy, Organization and Administration	20	11.32	14.82	9.83	17. 8	15.5	14.6	15.1 6	14. 16	13. 66	12.16	
Hazard control and risk analysis	40	16.6	26.06	12.7 6	33. 92	27.7 2	26.3 2	30.6 4	15. 56	29. 36	15.12	
Motivation leader ship and training	20	6.52	13.22	7.9	15. 06	12.6	14.4	8.32	8.7	10. 12	13.1	
Monitoring statistic sand reporting	20	6.4	13.4	7.6	16. 8	13.2	8	11_6	11.6	14	11.2	
Total(%)	100	40.82	67.50	38.0 9	83. 58	69.0 2	63.3 2	65.7 2	50. 02	67. 14	51.58	

Table: 2 D&S Value

6. D&S Approach

Table 2 shows the results from the D&S technique analysis of the collected data, including the overall percentage for each industry. According to the D&S method, Industry D has the most effective health and safety management system, with an overall percentage of 83.58. In contrast, Industry C has a lower percentage of 38.09, indicating a decline in performance.

6.1 Result

The study aimed to evaluate the effectiveness of various strategies employed to manage occupational health and safety (OHS) in manufacturing industries. Data was collected through surveys, interviews, and on-site observations across 20 medium- to large-scale manufacturing facilities

1. Awareness and Training Program

Results showed that 85% of the facilities had ongoing OHS training programs. Among these, 73% reported a noticeable reduction in workplace accidents over a two-year period. Employees in these organizations demonstrated significantly higher safety awareness scores (average score: 8.2/10) compared to those without regular training (5.9/10).

2. Use of Personal Protective Equipment

It was observed that 90% of the industries mandated PPE usage. However, only 68% of the workers were consistently compliant. Facilities with strict enforcement mechanisms and regular PPE audits had 40% fewer injury reports than those with lax enforcement.

3. Risk Assessment and Hazard Identification

75% of the industries conducted regular risk assessments. Of these, 60% updated their control measures following assessment findings. This was associated with a 28% reduction in near-miss incidents and a 21% drop in injury-related downtime.

4. Management Commitment and worker involvement

Facilities where top management was actively involved in safety committees and policy implementation reported higher employee participation in safety programs (78%) compared to others (42%). A strong correlation (r = 0.72) was found between management commitment and improved safety performance.

5. Incident Reporting and Emergency Preparedness

Only 52% of facilities had a formal incident reporting system. Among them, prompt corrective actions were taken in 80% of reported cases. Moreover, industries that regularly conducted emergency drills experienced faster response times and improved evacuation efficiency.

7. Conclusions

A comprehensive review and analysis of the occupational health and safety management system were conducted, focusing on areas such as policy, organization and administration, monitoring, statistics, reporting, hazard control, risk analysis, welfare facilities, health and safety management, motivation, leadership, and

training. The findings show that the lowest score of 52.5% was in health and safety management, while the highest score of 69.56% was in policy, organization, and administration. The results indicate that most manufacturing industries lack a robust occupational health and safety management system.

The study highlights the crucial need for a strong health, safety, and management system to protect worker health, improve safety standards, and enhance industry performance. To address the current shortcomings, a commitment from top-level management is essential. Furthermore, improving communication between workers and management is key to effectively integrating safety and health within the organization.

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Conflict of Interest

The authors declare that there is no conflict of interest related to this research work.

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