

Occupational Health & Safety Assessment of Large Scale Manufacturing Industry in India: A Case Study

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Abstract

Background: To elucidate the current status of safety in Large scale manufacturing industry and find out the impact of various factors on worker safety in India. **Methods:** To identify the current status and factors that contribute to a safety culture, a survey questionnaire was developed based on the prior studies. Modified Kappa Coefficient applied to check validity and inter rater agreement in questionnaire. The questionnaire was randomly distributed to 320 employees of Large Scale Manufacturing Industry and valid questionnaire were 300. SPSS software was used and diverse tests, including the Mean, Mode, Standard Deviation, Cronbach's Alpha, Correlation, Variance, Frequencies, were used for the analysis of data. **Results:** The result showed that there are inadequacies in many factors like Management response to safety, Safety training, Safety communication, Work distribution, Workplace layout and Workplace environment problems like more noise and ergonomics problems. **Conclusion:** As this study revealing the current status of safety in India is not appropriate. There is a large scope of improvement. Workers and management both are not aware about safety related problems. There is also difference in the opinion of workers and management about work related problems.

Keywords- Work environment, worker's health and safety, safety training, small and large scale industries, management, safety behavior

I. INTRODUCTION

The blood-curdling Bhopal gas tragedy happened in 1984 in India was an eye opener for the industries not only in India but also throughout the world. After the investigation of this incident, investigators unearthed harsh reality of inadequate safety procedures. They found that company management ignorance, the complacency of workers and irresponsible attitude from regulatory agencies (Gupta, 2002) were the major reasons for this accident. He also mentioned that these accidents can be occurring in advanced countries also in the presence of any of above conditions. These accidents worth such loss that can never be recover again. It affects each and every corner of work place, like large compensatory expenses, production losses and loss of morale and life of workers.

More than three decades have passed after Bhopal Gas tragedy, yet the rate of fatal accidents in Indian manufacturing industries is 20 fatalities per hundred thousand employees (DGFASLI). The Factories Act, 1948 (Central Act 63 of 1948) and Rules formed there under by the state governments are major regulators to organize the level of safety and health of workers. To measure the safety level of an organization we must find out the factors related to safety climate, safety culture, safety performance, management and safety training.

A. Safety Climate

Safety climate acknowledged as the perception of worker about safety related problems, procedure, and practices in an organization. According to the Zohar (1980) safety climate is defined as the sum up of the perceptions that employees discuss about the safety at their work atmosphere. Zohar considered that there is a direct relation between safety climate and workplace. To find out the weak areas in work place related to safety, we have to analyze the safety climate.

B. Safety Culture

The term Safety culture came in existence after the investigation of Chernobyl disaster (1986). Initially International Atomic Energy Agency (IAEA) mentioned it in reports of investigation. Although there is no single definition of safety culture, however it is widely used in safety concerns. After blood curdling accident, Chernobyl disaster (1986), the term Safety culture used as a key term in the investigation of King's Cross fire (Fennell, 1988), Piper Alpha (Cullen, 1990) accidents.

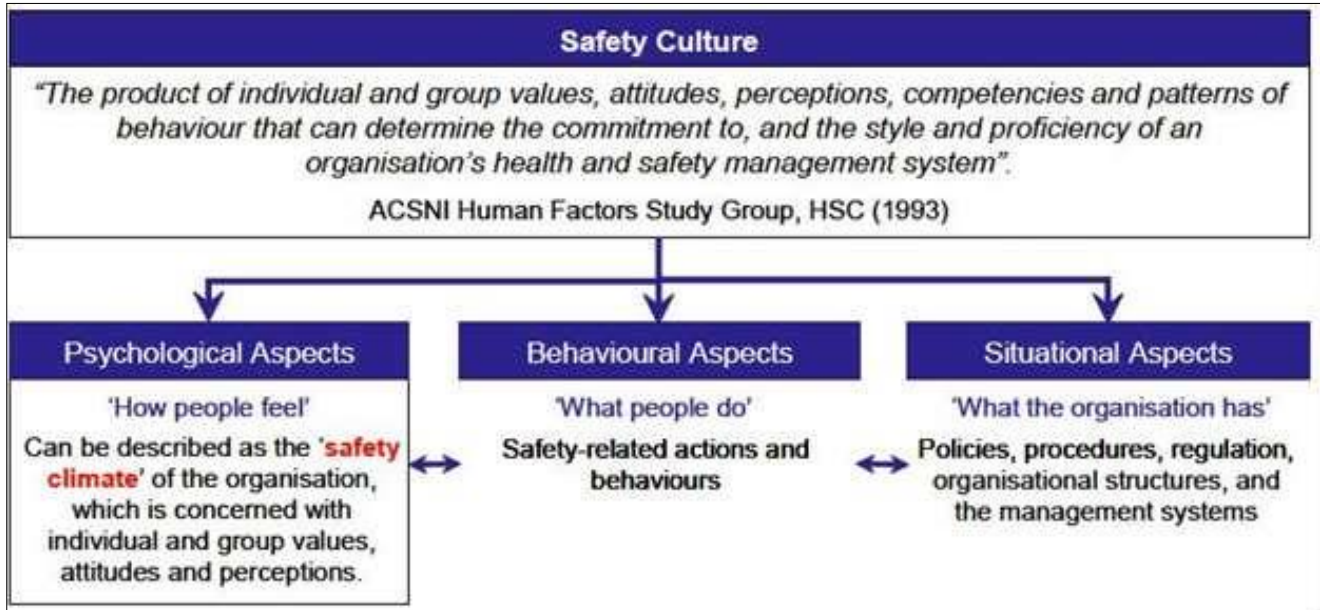


Fig. 1: Safety culture and its aspects

C. Safety Performance

There are basically two components of safety climate are safety compliance and safety participation. Both components define the safety behavior of worker. Safety compliance is all about the activities necessitate to safety. These are indispensable activities needs to be performed by workers to maintain workplace safety like using PPE and wearing gloves.

D. Management

Management is very important in developing safe environment in the organization. Management policies and procedures shows the commitment of the management towards safety and how much Importance given by the management to the worker's safety and well-being. Management at various levels has different impact on safety. Top management make safety related policies and procedures which are implemented by the lower level like supervisor level in a workplace.

Policies made by top management show their commitment toward worker's well-being and safety. It is the responsibility of the middle and lower management to implement the policies and procedures made by top management. Leadership style of the management and communication b/w management and workers also plays important role in the perception and attitude of workers towards safety.

E. Safety Training

Safety training is crucial in improving worker's safety because it enhances the skill and knowledge of workers about basic safety procedures or methods. Safety knowledge helps workers to know about the right way of performing a job without risk. Workers are able to identify the hazards associated with their work and how they can protect themselves from these hazards. It helps workers to know more about the new procedures or methods. With the help of safety training workers are able to know about the consequences of not performing a job in the proper manner.

F. Objectives of Research Paper

It is manifested that there are a lot of issues related to worker health and safety in India. Even after the Bhopal Disaster, in last three decades very less work has been done on this topic. So the purpose of this research is:-

- 1) Study the influence of various factors on worker's safety in large scale manufacturing Industry.
- 2) Develop and validate a questionnaire for large scale industry to find out the perception of workers about safety.
- 3) To find out the problems face by worker's related to safety in large scale industry
- 4) To give recommendations to the large scale industries about how to improve the worker's safety.

II. METHODOLOGY

A. Development of a Questionnaire

A literature review performed and a sum of 145 safety climate items produced from the on hand questionnaires in the published articles and the documents. The number of items condensed to 45 after discussing with experts associated to manufacturing industry.

B. Data Collection

Data was collected from Rail Coach Factory, which is a large scale manufacturing and assemble industry of railway parts, located in Kaputhlala. Questionnaires were distributed to around fifty workers in each shop to collect responses. Participation of workers was voluntary. Information related to age and experience of workers was also collected. A total of 320 questionnaires were distributed and collected from workers out of which 300 was valid and considered for analysis.

C. Content Validity

Content validity is the amount to which a questionnaire has a correct number of statements to represent the area of interest that is whether the area of interest is properly represented by statements or not?

Lyan (1986) proposed that there are two stages of content validity development stage and judgment stage. In development stage we identified the statements from literature review and discussions according to our area of interest. In second stage we apply quantitative techniques like CVI and kappa to finalize the questionnaire.

D. Content Validity Index (CVI)

Content validity index or fraction part is one of the quantifiable approaches to catch out the content validity of a tool/questionnaire. It permits experts to individually review and assess the relevancy of each item of a tool. The responses of the experts are taken on a Linkert scale with four options i.e. 1= not relevant, 2= somewhat relevant, 3= quite relevant, 4= highly relevant. The CVI is the amount of items that get a rating of 3 or 4 by the experts. We use seven experts to find out the content validity of the questionnaire. Scale content validity index (S-CVI) is used to evaluate the validity of whole questionnaire

E. Face Validity

The face validity was checked by 6 experts who have the knowledge and experience about worker's safety in manufacturing industry in India. They evaluate the questionnaire and were asked the questions like "Are these questions are understandable, logical and clear according to occupational safety issues in LSI's in India. If they are not satisfied with the language of statements or order they are free and feel open to recommend a better statement." Comments were discussed by the researchers.

F. Modified Kappa Coefficient (k^*)

Modified kappa coefficient is mainly used to test the validity of a tool beyond chance agreement which come into place when we convert responses in dichotomous categories. To compute the modified kappa, first we have to calculate probability of chance agreement: $P_c = [N! / A! (N-A)!] * 0.5^N$ where N is the number of experts and A is the number of experts give rating 3 or 4. k^* was calculated with formula $k^* = [I-CVI - P_c] / [1 - P_c]$. Kappa values range from +1.00 to -1.00, with a positive kappa shows that validity beyond chance agreement.

G. Cronbach's Alpha

It was developed by Lee Cronbach's in 1951 to measure the reliability or internal consistency of a tool or questionnaire. It is the extent to which all items in a questionnaire measure the same concept. Its value ranged from 0 to 1 with low value shows that there is less internal consistency between statements in a questionnaire and high value shows better inter consistency between statements. Standard value of alpha is .70.

H. Logical Analysis

In this analysis we use simple calculation for questionnaire part 2. All the responses given by the workers would examine individually to find out the status and problem of workplace and worker.

III. INTERNAL CONSISTENCIES/RELIABILITY AND RESULTS

The internal consistency or reliability of the final questionnaire after content validity was analyzed using SPSS. It is very important to analyze the internal consistency of the questionnaire to make sure that all the items or statements measure the same parameter or factor. The value of Cronbach's alpha which is the measure of internal consistency for the whole questionnaire was .741, which is above the standard value of .70

Table 4.2: Case Processing Summary

*		N	%
Cases	Valid	300	100.0
	Excluded ^a	0	.0
	Total	300	100.0

Table 4.3: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items				N of Items		
.741	.737				29		
Summary Item Statistics							
	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.579	1.613	4.103	2.490	2.543	.641	29
Item Variances	.730	.322	1.824	1.502	5.671	.078	29

Item Statistics					
	Mean	Std. Deviation	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Variance
My company responds quickly to safety concerns	2.7733	1.14586	.747	.100	1.313
My company provides safety information	3.9500	.86603	.702	.749	.750
My company provide enough & good safety equipments	4.0433	.85473	.746	.048	.731
My company emphasizes safe working conditions	4.0200	.88064	.746	.054	.776
Management maintains all safety records	3.9500	.86603	.702	.749	.750
Management is concerned about our well-being	3.9500	.86603	.702	.749	.750
Management have clear & useful safety policy	3.9500	.86603	.702	.749	.750
Safety training given to me is adequate to enable me to assess hazards in work areas	4.0133	.89208	.748	.023	.796
Newly recruits are trained adequately to learn safety rules and procedures	4.1033	.78829	.742	.102	.621
Safety training programs help prevent accidents	3.9500	.86603	.702	.749	.750
Training about new procedures and equipments	3.8933	.94778	.736	.227	.898
Safety issues are given high priority in training programs	2.3033	.72092	.738	.180	.520
There is open communications about safety issues in this work place	3.9500	.86603	.702	.749	.750
Management consults with employees regularly about work place health and safety issues	2.8900	1.35055	.741	.215	1.824
Communication with supervisors regarding safety matters is easy	3.9500	.86603	.702	.749	.750
There is sufficient opportunity to discuss and deal with safety issues in meetings	1.6900	.56713	.743	.061	.322
I know how to perform my job in a safe manner	4.0667	.81922	.743	.089	.671
I use all necessary safety equipment's to do my job	4.0500	.82650	.748	.019	.683
I know how to reduce the risk of accidents and incidents in the workplace	3.8300	.94024	.746	.077	.884
I know what are the hazards associated with my job and the necessary precautions to be taken while doing my job	4.0667	.82735	.749	.000	.685
I believe there is sometimes pressure to put production before safety	4.0500	.83054	.745	.071	.690
Rules relating to personal safety sometimes make it difficult to work faster	4.0467	.82468	.743	.098	.680
I have to neglect some tasks because I have too much to do	4.0500	.83456	.739	.173	.696
I am unable to take sufficient breaks	1.6133	.59301	.745	.016	.352
I have to work very intensively	2.2700	.65717	.737	.197	.432
Proper space b/w machines	4.0333	.80064	.741	.126	.641
Sufficient fire extinguisher	4.0667	.79855	.737	.196	.638
Proper lighting	4.1000	.81170	.742	.121	.659
Maintain proper temperature and humidity	2.1700	.63438	.738	.168	.402

A. Ascertained Statements

The collected data describe that there are some statements show negative relation with safety. There is scope of improvement in the following scales:

- 1) Management commitment- My company responds quickly to safety concerns
Mean- 2.7733, Standard deviation-1.14586)
- 2) Safety training- Safety issues are given high priority in training programs

Mean-2.3033, Standard deviation-0.72092)

- 3) Safety communication- Management consults with employees regularly about work place health and safety issues
(Mean- 2.8900, Standard deviation- 1.35055)
- 4) Safety communication- There is sufficient opportunity to discuss and deal with safety issues in meetings
(Mean- 1.6900, Standard deviation- .56713)
- 5) Work pressure- I believe there is sometimes pressure to put production before safety
(Mean- 4.0500, Standard deviation-.83054)
- 6) Work pressure - Rules relating to personal safety sometimes make it difficult to work faster
(Mean-4.0467, Standard deviation-.82468)
- 7) Work pressure - I have to neglect some tasks because I have too much to do
(Mean-4.0500, Standard deviation- .83456)
- 8) Workplace layout- Maintain proper temperature and humidity
(Mean-2.1700, Standard deviation-.63438)

B. Workplace Environmental Problems

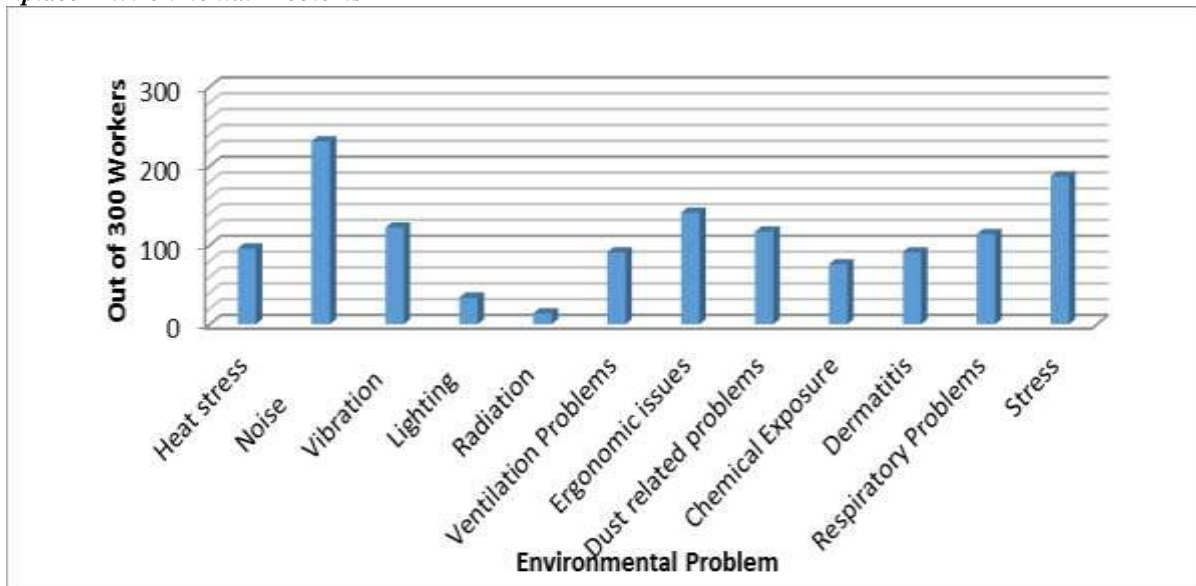


Fig. 4.1: Bar graph of Workplace Environmental Problems

Heat stress	96
Noise	231
Vibration	122
Lighting	34
Radiation	14
Ventilation Problems	91
Ergonomic issues	141
Dust related problems	117
Chemical Exposure	76
Dermatitis	91
Respiratory Problems	114
Stress	187

After the evaluation of all data, collected from various shops in Rail Coach Factory, we calculate that noise and stress are the major environmental problem at work place. Out of 300 workers, 231 complaining that noise is the prime factor of energy drain. When we were correlating the data, we found that people suffering from noise in industry, they are stressed also. Stress is the second major problem after noise and 187 suffering from it. We observe those workers working in less noisy workplaces are much better to concentrate at work and behave more polite. Hence it is clear that noise is the root cause of stress, which further leads to various behavioral and health problems. Ergonomic issues are also making the workplace unfavorable. Workers feel that their work places are not well arranged and access to tools is not easy, that become cause of low back ace, fatigue, or other muscle pain. Dust related problems and respiratory problems are two interrelated problems. Many workers are complaining about this problem also. Other problems like Ventilation Problems, Chemical Exposure, and Dermatitis also mentioned by some workers but these are rare.

C. Age Factor

As we observed, that some workplace issue are related to age. Worker with age 40 and above are more complaining about stress and ergonomics problems. Noise and Respiratory problem is common in all age groups. Young workers are more sensitive towards dust related problems and more health conscious.

D. Other Observations

As regards with Health Promotion Programs, company has no definite plan. As per provided information, there are few health programs followed by company, and time is also not mentioned anywhere. Workers have no information about the time intervals of such programs. Company policy for follow up on the preventive health checkup report of employees is also skeptical. There is also no manifested time to follow up the health checkup of employees. Blue collared workers feel that they are at more risk than the workers at higher level. But at the same time they also feel that routine of seniors is leading them towards acute and life style diseases.

IV. CONCLUSIONS

The objective of the thesis is to check the current status of safety in LSI in India and ways to improve the occupational safety or worker safety. We develop a questionnaire and found some factors like management commitment, work pressure related to workers safety. We also take the opinion of management about different safety related issues and compare that with the opinion of workers on the same issues. We found that on some factors like safety knowledge and compliance, and work pressure there is difference in the opinion of workers and management. Management thought that workers have all knowledge related to safety and compliance but in the opinion of workers they lack in safety related knowledge and compliance. There is also difference in the opinion of workers and management about work pressure. Management thought that there is no work pressure on workers but in the opinion of workers they feel work pressure and have to work very intensively. We recommend the management of the organizations to work upon the knowledge of workers about safety issues and try to manage the work load of workers more effectively so that workers don't feel work pressure at workplace. We told them that there is should be better opportunities for workers to communicate with management. Work pressure is also related to accidents so it is advisable to organizations to manage their workload so that workers can work in safely and correct manner..

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