A Comparative Study on Safety and Security Management Systems in Industries

[1]Palanisamy Sivaprakash and [2]Murugesan Sakthivel
Department of Mechanical Engineering,
[1]Varuvan Vadivelan Institute of Technology, Tamilnadu, India
[2]Anna University of Technology, Coimbatore, India

Abstract: Problem statement: To understand and appreciate the safety and security management systems in industries with a view to find out critical areas requiring attention so as to enhance the effectiveness of safety management systems and security management systems in large, medium and small scale industries. **Approach:** The study was restricted to Large, Medium and Small scale industries located in Tamilnadu, Kerala, Pondycherry, Karnataka and Andhra Pradesh states of India. The data have been randomly collected from 45 samples each from Large, Medium and Small scale industries. This study has taken into the account of 6 major elements namely management commitment, documentation, facilities, promotion, procedure and training and each major elements having 6 sub elements thus consisting of 36 sub elements of safety management systems and 36 sub elements of security management systems. The sub-elements are prepared such as to reflect the availability of the safety and security management system in industries. **Results:** Major accident hazard industries require more attention towards safety and security management systems. The safety management system has gained more prevalence than security management system in large scale industries than the medium and small scale industries. The safety management system has considerable prevalence than security management system in medium scale industries than the small scale industries. The safety and security management system have more or less the same prevalence in the small scale industries. **Conclusion:** All the industries should devise systems for the adoption and implementation of safety and security management system. Security failures can lead to safety failures and hence they must be given equal importance. The major accident hazard industries should adopt all the safety and security management elements. All the elements of safety and security management systems should be given equal importance for effective and safe functioning of the industries. The security management system is an upcoming field which needs to be sincerely implemented in the industries in the present scenario of global terrorism. The safety and security management system should go together in a coherent manner to reduce the societal risk.

Key words: Major accident hazard industries, management commitment, small scale industries, safety and security management, procedure element

INTRODUCTION

During the second half of the eighteenth century, the need for improving the techniques and organization of production was more acutely felt. The changes in the methods and organization of production have led to the development of the industrial economy. The industrial revolution made its beginning in England and later spread to other countries. The industrial revolution brought in new inventions of machines and techniques of production which changed the ways of man's living and thinking throughout the world. The industrial revolution and the consequent industrialization have brought in lot of hazards (Carroll, 1995; Feyer and Williamson, 1991) and risks to the industrial workers. The advancement in science and technology (Kurzman, 1987) have paved way for more and more complex and hazardous industries which further increase the risk to the industrial workers. Every year millions of industrial accidents (Saxena, 1978) occur causing immense suffering to the accident victim, their family and enormous loss to the organization (Ashford, 1976; Heinrich, 1959) and ultimately to the nation. Safety is the freedom from incidents that results in injury, damage, or harm.

Corresponding Author: Palanisamy Sivaprakash, Department of Mechanical Engineering, Varuvan Vadivelan Institute of Technology, Tamilnadu, India

Table 1: Safety and security management systems (Large scale industries)

| Safety management system | | | | | | Security management system | | | | | |
| Available elements | | | | | | Available elements | | | | | |
MC	DC	FT	PN	PD	TN	MC	DC	FT	PN	PD	TN
6	6	5	5	5	6	2	0	3	0	1	0
4	4	5	5	6	0	5	2	6	3	6	1
6	6	6	5	6	6	6	6	5	3	6	4
4	2	3	4	6	0	2	0	5	0	0	0
6	3	6	4	6	1	5	3	5	1	1	2
5	6	5	4	6	1	5	3	4	1	4	4
4	2	6	4	5	2	5	2	5	4	4	1
5	6	6	4	6	1	6	6	5	3	4	0
6	6	6	5	5	5	6	6	6	4	5	4
6	6	6	5	5	6	3	0	2	1	4	0
6	6	6	6	6	6	0	0	0	0	0	0
6	4	6	6	5	6	2	0	1	0	1	0
3	4	6	3	4	3	2	0	4	0	1	0
6	6	6	6	5	6	6	6	5	6	6	6
6	4	5	4	4	4	3	0	5	1	1	0
6	6	6	6	6	6	5	3	6	1	6	6
4	6	3	5	6	0	2	0	1	0	0	0
6	6	4	6	6	3	3	0	3	0	5	3
6	4	6	6	5	3	5	3	5	4	6	2
6	6	6	6	6	6	0	0	0	0	0	0
6	4	5	4	4	6	3	1	5	1	5	0
6	6	6	5	6	3	5	6	6	2	5	3
4	5	3	3	5	0	4	6	5	4	4	6
4	3	5	4	3	4	2	4	2	4	5	6
5	6	6	4	5	4	6	6	4	6	5	5
6	6	6	6	5	6	6	6	6	3	5	6
6	5	6	4	6	6	3	3	6	4	4	3
6	6	6	6	6	6	5	6	5	3	2	1
6	6	6	6	6	5	5	6	5	3	2	1
6	6	6	6	6	6	6	4	4	0	5	3
6	6	6	4	6	6	4	0	4	0	2	2
6	5	6	6	6	6	6	6	6	6	6	6
6	6	0	0	6	6	0	0	5	6	6	6
5	4	5	3	5	6	4	4	3	3	3	2
5	5	5	6	4	5	4	5	4	4	5	4
6	6	5	5	6	6	5	5	4	3	5	2
6	6	4	3	5	6	5	5	3	2	3	4
5	6	6	5	5	5	5	4	3	4	4	4
5	5	5	5	5	5	3	3	2	4	4	3
6	5	6	5	5	6	4	5	3	5	4	5
4	4	5	3	3	3	4	3	3	5	2	3
5	6	4	4	5	4	4	4	3	2	3	3
6	4	5	5	4	6	5	3	3	3	4	3
6	5	6	5	5	6	6	5	6	4	4	4

Table 2: Safety and security management system (Medium scale industries)

| Safety management system | | | | | | Security management system | | | | | |
| Available elements | | | | | | Available elements | | | | | |
MC	DC	FT	PN	PD	TN	MC	DC	FT	PN	PD	TN
1	4	6	6	6	6	5	6	6	6	6	6
5	2	5	0	4	4	5	1	0	0	2	1
5	4	4	4	2	5	6	3	4	1	0	4
1	3	5	3	4	4	1	0	0	0	0	0
2	2	6	0	4	6	0	0	4	3	0	6
5	3	5	3	5	6	6	4	3	5	0	0
5	4	6	1	6	6	6	0	0	5	0	0
2	2	5	6	6	6	2	0	6	0	0	0
6	5	6	4	6	6	3	1	6	3	3	1
6	3	4	4	5	3	5	1	6	1	4	4
1	0	4	0	1	0	0	1	0	0	0	0
6	5	5	3	2	4	5	1	0	2	1	0
2	0	4	3	1	0	2	0	0	0	0	0
6	5	4	3	6	2	4	0	5	1	2	1
6	3	6	6	6	4	5	4	3	6	5	5
6	5	0	0	5	6	4	4	4	4	4	4
5	4	3	4	5	6	5	3	3	3	4	2
4	5	4	3	6	5	4	4	3	2	3	3
5	4	4	4	2	6	4	3	4	3	3	2
3	6	4	5	4	4	4	3	3	3	4	3
4	5	5	4	5	6	5	4	4	4	3	3
5	4	3	2	3	4	2	2	3	1	4	3
6	5	6	2	2	1	1	1	2	1	1	1
4	5	3	3	5	4	2	2	3	2	4	2
3	6	4	1	5	4	2	1	4	0	3	2
2	5	4	2	0	5	1	3	2	4	1	1
5	3	2	4	3	0	2	4	5	3	2	0
1	6	4	3	4	5	3	0	5	4	3	4
4	2	3	5	3	2	1	4	3	2	2	2
5	4	4	3	5	5	4	3	4	2	4	5
4	5	4	5	3	4	4	5	3	4	2	1
6	4	3	4	4	4	3	2	3	0	3	3
3	2	3	2	4	5	3	5	1	4	2	2
1	2	5	5	6	4	3	0	3	3	4	1
5	4	4	3	3	3	2	2	2	3	4	2
3	5	4	3	2	0	4	2	3	2	3	2
4	4	2	4	1	4	3	2	1	2	0	1
2	3	4	3	5	4	4	2	2	1	1	1

Safety management system and Security Management (Santos-Reyes, 2002; Brauer, 2005; Florio *et al*., 1979) Systems require the occupier to implement a safety and security management system for the purpose of ensuring the safety (Hurst, 1997; Sahar *et al*., 2010; Williamson *et al*., 1997), security, protecting the health and welfare of persons employed in the factory. Safety and security lapses are rise to accidents and disasters in industries and hence they need to be prevented.

Objectives: In order to solve the problem defined during the beginning of this research work, the following objectives were set:

- To determine the level of the safety and security management systems
- To identify the weak links in the safety and security management systems
- To find out the correlation between the safety and security management systems
- To arrive at various strategies to enhance safety and security management systems

MATERIALS AND METHODS

The study is restricted to industries located in Tamilnadu, Kerala, Pondycherry, Karnataka and Andhra Pradesh states of India. The data has been randomly collected from three categories of industries, Large Scale Industries, Medium Scale Industries and Small Scale Industries. The data have been collected from 45 samples each from Large, Medium and Small scale industries. This study taken into the account of six major elements such as Management Commitment (MC), Documentation (DC), Facilities (FT), Promotion (PN),

Procedure (PD) and Training (TN). Each major element has six sub elements thus consisting of 36 sub elements of safety management systems and 36 sub elements of security management systems. The sub-elements are prepared such as to reflect the availability of the safety management and security management systems in industries. The study has enabled to comparison of safety and security management systems in industries. The Table 1 shows the available elements in safety and security management systems for large scale industries.

Table 3: Safety and security management system (Small scale industries)

Safety management system Available ELEMENTS						Security management system Available elements					
MC	DC	FT	PN	PD	TN	MC	DC	FT	PN	PD	TN
4	1	4	1	1	2	2	1	2	2	0	3
3	3	6	4	2	3	1	1	1	4	2	3
4	3	5	1	3	6	1	0	4	0	3	6
6	3	6	6	2	3	0	3	6	6	4	3
2	2	3	2	2	2	2	2	1	1	1	0
3	2	5	4	2	6	2	2	3	1	1	1
3	5	6	5	5	6	5	3	5	5	3	6
1	3	2	4	4	5	2	1	1	2	1	2
1	4	5	3	4	4		4	2	3	4	1
3	3	4	3	1	5	3	1	2	4	2	2
4	3	4	5	4	4	4	1	1	1	1	0
4	5	3	5	3	2	3	2	4	1	1	2
3	4	2	2	4	4	3	1	2	1	2	0
3	3	3	1	4	5	1	2	1	4	2	1
2	4	3	5	1	2	1	1	3	1	1	0
3	3	4	2	1	2	1	1	1	1	1	3
1	5	4	4	3	5	1	3	2	3	1	2
3	4	1	5	2	6	3	4	2	0	3	2
3	3	4	3	4	4	1	2	1	3	2	1
1	4	1	4	2	3	2	4	2	3	2	3
4	3	2	5	3	4	1	1	1	1	2	1
3	5	4	4	3	3	4	1	2	3	1	3
1	5	1	2	2	5	3	2	3	2	2	3
4	4	3	5	3	4	1	1	1	2	1	1
3	5	1	5	3	1	2	3	1	1	1	0
3	4	3	5	3	4	2	3	3	2	2	2
5	4	5	1	2	1	3	2	1	2	2	1
3	4	3	5	3	5	4	3	2	3	2	1
5	3	4	4	3	3	4	2	2	1	3	1
4	4	1	3	4	1	2	3	1	1	2	3
5	1	1	4	3	5	1	2	1	3	2	1
2	4	3	1	2	3	1	2	2	4	4	2
4	5	2	3	4	3	2	1	3	2	1	2
2	1	4	2	1	5	3	3	2	1	3	1
5	1	4	4	3	3	2	2	1	3	1	1
4	4	5	5	4	5	3	2	2	3	2	3
2	3	1	3	3	4	3	4	3	1	2	1
1	4	3	4	2	4	1	1	4	2	2	3
3	1	3	1	4	3	2	2	1	3	1	1
2	4	4	2	3	5	2	0	3	4	1	3
3	3	4	3	3	2	2	1	2	0	0	0
3	3	0	0	1	1	2	2	2	1	1	0
2	2	2	2	1	0	0	1	1	0	2	1
2	3	3	2	2	2	2	2	1	1	2	1
3	2	3	2	2	0	2	2	2	1	2	2

The Table 2 shows the available elements in safety and security management systems for Medium scale industries.

The Table 3 shows the available elements in safety and security management system for Small scale industries.

RESULTS

The Table 4 shows the mean and standard deviation of the safety and security management systems for Large scale industries.

The Table 5 shows the correlation coefficient and t- test for large scale industries.

The Table 6 shows the mean and standard deviation of the safety and security management systems for Medium scale industries.

The Table 7 shows the correlation coefficient and t- test for Medium scale industries.

Table 4: Mean and standard deviation (Large scale industries)

Element	Safety management system		Security management system	
	Mean	SD	Mean	SD
Management commitment	5.44	0.84	4.04	1.73
Documentation	5.11	1.15	3.24	2.36
Facilities	5.27	1.20	4.11	1.64
Promotion	4.71	1.24	2.56	1.95
Procedure	5.27	0.84	3.67	1.92
Training	4.38	2.03	2.76	2.15

Table 5: Correlation Coefficient and t- test (Large scale industries)

Correlation (r)	0.189	0.258	0.100	-0.092	-0.014	0.240
t- test	5.288	5.348	4.016	6.019	5.101	4.220

Table 6: Mean and standard deviation (Medium scale industries)

Element	Safety management system		Security management system	
	Mean	SD	Mean	SD
Management commitment	4.04	1.66	3.27	1.74
Documentation	3.91	1.47	2.31	1.62
Facilities	4.13	1.20	2.91	1.77
Promotion	3.18	1.55	2.51	1.65
Procedure	3.96	1.61	2.27	1.67
Training	4.00	1.78	2.04	1.73

Table 7: Correlation Coefficient and t- test (Medium scale industries)

Correlation(r)	0.389	0.221	-0.059	0.248	0.377	0.346
t- Test	2.773	5.546	3.737	2.275	6.185	6.524

Table 8: Mean and standard deviation (Small scale industries)

Element	Safety management system		Security management system	
	Mean	SD	Mean	SD
Management Commitment	3.00	1.22	2.04	1.15
Documentation	3.31	1.18	1.93	1.03
Facilities	3.20	1.50	2.07	1.18
Promotion	3.24	1.52	2.07	1.40
Procedure	2.69	1.06	1.80	0.94
Training	3.44	1.63	1.76	1.38

Table 9: Correlation coefficient and t-test (Small scale industries)

Correlation(r)	0.113	0.129	0.288	0.162	0.050	0.321
t- Test	4.056	6.304	4.699	4.162	4.304	6.406

The Table 8 shows the mean and standard deviation of the safety and security management system for Small scale industries.

The Table 9 shows the correlation coefficient and t- test for Small scale industries.

DISCUSSION

- 't' values between safety and security management system in respect of elements pertaining to large scale industries such as Management Commitment, Documentation , Facilities, Promotion , Procedures and Training, the obtained 't' values are statistically significant since they are greater than theoretical 't' value 1.96 at 0.05 level of significance except procedure element in which the 't' value is less than 1.96 at 0.05 level of significance and hence the procedure element does not show any significant difference
- 't' values between safety and security management system in respect of elements pertaining to medium scale industries, the obtained 't' values are statistically significant only to procedure and training and all other values are less than 1.96 at 0.05 level of significance
- 't' values between safety and security management system in respect of elements pertaining to small scale industries, the obtained 't' values is statistically significant only to facilities and all other values are less than 1.96 at 0.05 level of significance
- 53% of the large scale industries are major accident hazard industries and 16% of the medium scale industries are major accident hazard industries. There are no major accident hazard industries in the small scale industries
- Major accident hazard industries require more attention towards safety and security management systems since their accident potential and consequence of such accidents will be devastating
- The safety management system has gained more prevalence than security management system in large scale industries than the medium and small scale industries
- The safety management system has considerable prevalence than security management system in medium scale industries than the small scale industries
- The safety and security management systems have more or less the same prevalence in small scale industries

- All the safety and security management elements should be given equal priority for effective management
- The management commitment, documentation and promotion element of safety management system is significantly different than the security management system in large scale industries
- The facility element of safety management system is significantly different than the security management system in large and small scale industries
- The procedure element of safety management system is significantly different with security management system in medium scale industries
- The training element of safety management system is significantly different with security management system in large and medium scale industries
- All the elements of safety and security management systems are significantly different except procedure element in large scale industries
- All the elements of safety and security management system are not significantly different in medium scale industries except procedure and training element
- All the elements of safety and security management systems are not significantly different in the small scale industries except facility element

CONCLUSION

Safety and security management systems are essential because of the increased risk in industries compelled with public awareness and cost towards compensation against damages. There are large scale of improvements in the understanding of safety and security management system globally. It becomes imperative on Indian industries irrespective of the size to adopt safety and security management elements as a measure towards social commitment, legal compliance, meeting supplier and end user requirements. It is also equally important that both safety and security management system should go together, hand-in-hand, in a harmonious manner to achieve the objective of safer industries with minimal risk to the society at large. At present the adoption of the safety and security management system has become a self-compliance measure to show the capability of organizations in ensuring their functioning in a safe manner. Sensitization and awareness building among all the stake holders such as employees, employer and government are essential for the successful implementation of the safety and security management system. The management commitment is a pre-requisite for the success of the implementation of the safety and

security management system in industries which is further propelled by the social accountability and corporate ethics. The standards, codes and practices which are available will further assist industries to adopt effective and efficient adoption of safety and security management system. The Indian industries should avail all these inputs for enhancing their safety and security standard to the global level thus paving the way for the safe living of human beings and inhabitants and less damage to the environment.

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