CHAPTER 8

SUMMARY AND CONCLUSION

This Chapter gives a summary of the thesis. The research findings are summarized in Section 8.1. Section 8.2 explains the limitations of the present study. Scope for future work is suggested in Section 8.3 and Section 8.4 contains the conclusion drawn from the study.

Safety awareness that is spreading to all walks of life and all types of organizations has made ‘Safety Management’ a potential area of research. While considerable research has been done on the topics of safety management and safety culture/climate in developed countries, such work is not to be seen reported in India. Globalization and economic reforms warrants Indian industries to adopt better safety management to stay competitive in international markets. It is observed that industrial accidents, associated financial losses, and compensation claims eat away considerable portion of the profit earned by organizations. These also damage the reputation of organization and lower the morale of the employees. Captains of industries are still faced with the challenge of understanding the key issues in safety management so as to provide healthy and safe work environment to their employees. This underscores the need to study the various factors that influence industrial safety management, especially in high-risk industry such as chemical/process industry.

The survey of literature on safety management revealed that application of quality integrated safety management practices have enabled different types of industries to gain better control over accidents and injuries, and also to improve production and employee satisfaction and thus strengthen their level of competitiveness. Therefore, it is evident that a clear understanding of the critical factors in safety management would help the implementation of management practices to improve safety of employees and enable better control over accidents and injuries. However, empirical research works on this topic are quite few in Indian industries.
Moreover, it appears that the relationship between safety management practices and determinants of safety performance has not yet been examined rigorously. Similar is the case of relationship between determinants and components of safety performance. The impact of personal attributes of employees on safety performance variables is an area worth exploring from behavioral science angle also. Therefore, in this research, an attempt was made to unearth the critical safety management practices, determinants of safety performance and components of safety performance. This study also investigated their relationships with the help of an extensive empirical research.

The ultimate aim of safety management is to reduce accidents. As the level of safety management increases, accident rate has to reduce. This research also explored the predictive validity of safety management practices along with comparison of safety management practices in industrial units grouped based on accident rate.

More and more industries in India are embracing safety specific management system certifications such as OHSAS 18001 and ISRS in addition to ISO 9001 series quality certification. The effects of system certifications on safety management practices and determinants and components of safety performance, also appear to be unexplored. System certification becomes meaningful and useful if only it reflect in safety performance outcomes such as accidents and injuries. Nevertheless, empirical evidence appears to be lacking to support these beliefs. Therefore, attempts were made in the current study to investigate the impact of system certification on safety management practices as well as determinants and components of safety performance.

The relationships between the antecedents, determinants and components of safety performance are complex in nature with multiple interrelated dependence relationships. Survey of literature revealed that this area has not yet been thoroughly investigated. Hence, attempt was made in this study, to model safety performance using Structural Equation Modelling technique.

Safety climate is regarded as a manifestation of safety culture of an organization and is a more tangible expression of the workplace characteristics and attitude of employees towards safety at given point of time. This ‘snap-shot’ of safety culture of an organization
has distinct advantages over other safety measures. Safety climate studies are widely used in developed countries to determine the underlying factor structure, which can be a guide for the design of appropriate safety interventions to improve safety performance of employees. However, safety climate studies are at infant stage in India, with safety management itself gaining attention only very recently. Hence, an attempt was made in this research, to determine the underlying safety climate factors and to investigate their relationships with accident rate and system certification in chemical/process industry.

Researches in safety climate, covering wide variety of industries in various parts of the world reveal that, safety climate factors are not universally stable, but are mainly culture and industry dependent. But, some researchers argue that, still some generic safety climate factors do exist, which are independent of industries. Since this study was carried out in chemical/process industry, an attempt was also made to examine the extent to which the data collected from construction and engineering industry fit the already available safety climate factor structure. Subsequently, safety climate factors in construction and engineering industries were determined to locate and identify the generic safety climate factors.

8.1 RESEARCH CONTRIBUTIONS

The contributions of this research work are summarized as follows:

- Identified a list of six critical safety management practices, two determinants of safety performance and two components of safety performance, by addressing the various facets (human and non-human aspects) of safety management.

- Developed an instrument for measuring the levels of safety management practices, determinants and components of safety performance in organization, followed by extensive empirical tests for validity and reliability. Practitioners can use the instrument to measure the levels of safety management in their organizations. This use could provide vital information to the decision-makers for designing and developing safety intervention programs for enhancing their safety performance.
• This research demonstrated empirical validation of the measurement instrument to enrich the subject of theory building (especially in the context of scarcity of empirical research works in safety management literature).

• A holistic framework for safety management in high-risk industries is proposed in this research. This effort would help to provide a conceptual clarity in understanding the related issues and the critical factors of safety management.

• The six safety management practices identified in this research were found to be negatively correlated to self-reported accident rate. 'Worker Involvement' emerged as a key predictor of accident rate showing strongest correlation. This suggests that, 'Worker Involvement' need to be given high priority for success of any safety program implementation.

• Low accident rate organizations have significantly higher levels of safety management practices, determinants and components of safety performance, compared with medium and high accident rate organizations. This finding not only validated the measurement instrument, but also reiterated that management initiatives for better safety management are rewarded by safer work environment.

• Medium accident rate organizations were found to possess significantly higher levels of 'Management Commitment', 'Safety Rules and Procedures' and 'Safety Promotion Policies' compared with high accident rate organizations. Since these three management practices are mostly supervisor/first line officer centered, this finding testified the significance of their role in accident prevention in industry.

• Comparison of safety management practices, determinants and components of safety performance in industrial units grouped based on accident rate and system certification adds to the not-so-rich research literature in this field.

• Management system certified organizations were found to have significantly higher levels of safety management practices, determinants and components of safety performance, compared with non-certified organizations. This finding...
testifies that industries get remarkable benefit and advantage in safety performance by acquiring management system certification.

- ISO certified and non-certified organizations were found to have same level of ‘Safety Promotion Policies’. This reveals that, non-certified firms are adopting traditional safety management by encouraging workers to perform their work safely by offering incentives and rewards.

- OHSAS 18001 certified organization was found to have highest level of safety management practices. Hence, this research recommends OHSAS 18001 certification for adoption in Indian industries.

- It was found that ‘Safety Training’ predicts both determinants of safety performance, namely, ‘Safety knowledge (KNO)’ and ‘Safety motivation (MOT)’. It was also found that both KNO and MOT decrease with increase in age of employees. This indicated that, to maintain higher level of KNO and MOT among employees, management need to conduct regular training programs and participation must be made compulsory for all groups of workers. The high predictive capacity of KNO and MOT on both ‘Safety Compliance (COM)’ and ‘Safety Participation (PAR)’ reiterates the need of the above.

- The safety performance model that was finally accepted revealed the inter-relationships between various safety management practices, determinants and components of safety performance. This can guide safety professionals in designing safety programs for specific purposes targeting improvements in desired areas. This will add to the literature of structural equation modelling in industrial safety, which is very scarce, especially from developing Asian nations.

- Safety climate factors reveal the underlying dimensions that are significant in influencing safety in workplace. It not only gives safety management practices and work place characteristics, but also the attitudes and beliefs of workers that influence safety. Hence, practitioners can design safety programs for improving or strengthening these latent factors, which will finally contribute for better safety performance. This research revealed the following eight factors in safety climate:
Management attitude and actions for safety, Workers' knowledge and compliance to safety, Workers' attitude towards safety, Workers' participation and commitment to safety, Safeness of work environment, Emergency preparedness in the organization, Priority for safety over production and Risk justification.

- It was found that all the eight safety climate factors and the total score differ significantly among organizations indicating that organizations have different levels of safety climate in them. 'Workers' participation and commitment to safety' emerged as the significant predictor of self-reported accident rate with strongest correlation.

- Management system certified firms were found to have better safety climate, reaffirming the need to have system certification in industry.

- On determining safety climate factors in construction and engineering industry, it was found that they differ from those obtained from chemical/process industry. Still, it testified the theory that few generic safety climate factors, which are independent of type of industry, do exist.

- The present work adds value to the literature of safety management as the work is carried out in a developing country like India, where safety management is in a budding stage.

### 8.2 LIMITATIONS OF THE PRESENT WORK

As mentioned earlier, much work has not been done in this area in India. Hence, this research design had to be based mainly on work reported internationally. However, discussions with experts in the field were used to modify the research design to suit the Indian environment. India being a multi-cultural country, it was thought appropriate to study industries from a single cultural segment. This segment was chosen as the state of Kerala for reasons of familiarity of the researcher with the culture and the industry.

Kerala state being industrially not well developed, only eight large chemical/process industrial units were available for the survey in this study. The two fold reasons for this are the existence of a lower number of industrial units and the hesitation of some units in
participating in a study on safety, which is a sensitive issue. Limiting the number to eight resulted in the handicap of not being able to carry out correlations and some more predictive analysis with a high degree of reliability.

Availability of a small sample size reduced the number of organizations with OHSAS 18001 and ISRS certifications available in the samples to one each, which is definitely a limitation when one wants to generalize the results obtained in the study. The impact of this was contained to some extent by taking a large sample size from each of the organizations in order to understand and determine the characteristics of each organization.

Despite the above limitations of the study, with proper use of statistical tools and rigour of research methodology adopted, this research has been able to make contributions.

8.3 SCOPE FOR FUTURE RESEARCH

This work being one of the earliest ones in this area in the country has to stop at a place which leaves much more to be done by future researchers. This work effectively demonstrated the researchability and usefulness of this important area of research. Emphasis was given to large chemical/process units in this research for reasons stated earlier. It is possible and even desirable to extend this type of work to cover other industrial sectors where safety plays an important role. Another dimension in which this research could be extended is to cover culturally different segments by covering another state.

This work reveals clearly the importance of worker involvement in safety management, which in turn determines safety performance. It is a proven fact that behavioural studies can be used to study people related parameters. Worker involvement, being people based, could be studied from behavioural science angle also.

8.4 CONCLUSION

Attempting to do a work in the area of safety management in India posed a challenge. Identifying the objectives of the research, when not enough published material is available, was the first challenge. This was overcome by the use of international literature
survey and logical extension of the research findings and local expert opinion to understand the problem area and lay down objectives of the research. Formulation of research methodology was much easier. Design of the tool for data collection posed some challenge since the factors to be proved and questions to be asked to elicit response had to be appropriate for the respondents. When it came to sample selection and questionnaire administration, the delicacy of revealing safety related information and opinion posed a major hurdle. Some companies refused permission for this research. In those that permitted also, sample selection became an issue. This, however, became a boon in disguise helping the researcher to collect the response of a large number of participants rather than going for sampling. The large sample size from each unit helped to determine scores from that unit much more accurately. Differences between units became clearer and could be stated with more reliability. A wide variety of safety management level was to be seen even in the limited sample industrial units studied. This indicates clearly that safety management practices are different in different organizations with that in some being superior to that in others.

This study has established the importance of understanding the factors that influence safety management so as to enable industrial units at lower levels to improve their performance. This research could bring out the factors in chemicals/process industries and could also show that they were different from that in construction and engineering industries. Details of the analysis and findings presented earlier in this thesis will be of use to both researchers and practising managers. The objectives laid down in the beginning of the research could be finally achieved to a high degree of satisfaction. Like in all research, this work also has its limitations mentioned earlier. It also has laid ground for much more work in this area in future. This research was a very important learning experience for the researcher and has significantly contributed to his appreciation for the area of safety management and research methodology.