

ORIGINAL ARTICLE

Prioritizing the Elements of OHSAS-18001 in Construction Segments in India – AHP Approach

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ABSTRACT

Construction industry is the second most contributor of gross domestic product and the high rates of accidents /fatalities have tarnished the image of construction industry in India. The importance of safety at site cannot be underscored and it needs the combined attention of all stakeholders to address the issue of safety in construction industry in India. Although the construction industry plays an important role in contributing to the economic performance of the country, its contribution to the workplace accident is equally substantial. The unsatisfactory safety record of construction industry has always been highlighted since the safety management system is neglected area and has not been pursued and implemented systematically in the construction industry. Although the safety regulations imposed in the construction industry by Department of Labour through Building and other construction workers act, 1996 are quite comprehensive and most of the State Governments have not implemented the provisions mentioned under the act. Due to lack of enforcement from Government, majority of the construction organizations in India are certified under Occupational health safety assessment series (OHSAS 18001) to provide a safe and conducive working environment for their workers and subcontractors. The purpose of the study is to present a hierarchy decision model for assessing the priority of elements of goals of OHSAS 18001 in construction segments that is infrastructure and real estate in India by using the analytic hierarchy process(AHP) methodology.

Keywords: Occupational health safety, Analytic hierarchy process, Construction segments

INTRODUCTION

Safety in the construction segments has always been a critical issue and one of the most unprotected segments of the unorganized labour in India. A large number of workers in this sector are susceptible to the various workplace accidents and occupational health problems. Safety and health protection has become a

major positive factor in favour of economic growth and productivity.

The Occupational Health and Safety Assessment Series (OHSAS) 18001:1999 is a comprehensive Occupational Health and Safety management system specification, designed to enable organization to control OH&S risks and improve their performance. The first step in establishing an occupational health and safety management system is the development of formal policy, to ensure that a clear direction is set and aids in

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formulating a series of steps for enhancing the business performance which forms an integral part of an assurance towards invariable advancement [1].

In a study conducted in Mauritius printing industry, it is recommended to implement OHSAS 18001 due to lack of control procedures, on prioritization of hazards, irregular conduct of risk assessments and lack of training to employees on health & safety issues, with a focus on continual improvement [2]. A model developed basing on OHSAS 18001 performances in Malaysian automotive industry and it can be used as a tool to benchmark to serve as a guide and reference to implement OHSAS. OHSAS 18001 guidelines has gained worldwide acceptance as it mainly focus on continual improvement and accident prevention, performance indicators become one of the most critical tools to evaluate the effectiveness of such systems [3]. Traditional safety management methods targeting short term benefits are not successful in safety management. Organizations with OHSAS 18001 certification have highest levels of the safety management practices; management commitment, safety training, worker involvement in safety, safety communication, feedback, safety rules and procedures, safety promotion policies and safety behavior. OHSAS 18001 elements are effectively implemented by safety inspections and audits. Typical difference found in OHSAS 18001 certified organizations compared to other organizations is safety training, which forms part of a continuous programme, providing repeated training and exposure for employees in various aspects of safety [4]. The reasons to seek OHSAS are to eliminate or minimize risks to workers, reducing the number of labor accidents and reduce the rate of absenteeism due to occupational diseases. The major impacts of OHSAS certification were improved workplace conditions, legal compliance with health and safety legislation and effective communication about risks and dangers to employees [5]. Construction organizations should establish OHSAS for minimizing risks to its employees and other affected parties; implement, maintain, and continuously improve occupational health and safety management systems; assure itself of its conformance with its stated occupational health and safety policy; demonstrate conformances and make self-determination and declaration of conformance within specifications [6].

Building and other construction workers act, 1996 was enacted and applicable to whole of India with an objective to provide safety, health and welfare measures to building workers in India [7]. Due to lack of enforcement of the provisions under the act by most of the state governments, the construction organizations are opted for OHSAS to meet the goals of construction organizations towards occupational health and safety issues. Many companies have implemented OHSAS 18000 systems as an effort to meet government

guidelines and business (export) compulsions resulted in barely any visible impact because organizational requirement, employees' needs and their participation are completely missing during implementation level [8].

Large construction projects have little variation in safety levels, while small projects have a wide variation in their safety performance and safety level in construction sites varies with the project size [9]. Bureau of Indian Standards has formulated an Indian Standard on Occupational Health and Safety Management Systems known as IS18001:2007 in accordance with international guidelines, OHSAS 18001 formulated by International Labor Organization and promoted in Indian industries considering the fact that, Indian industry badly needs a comprehensive framework [10]. Safety in construction industry is a major concern, especially in developing countries, because of lack of safety acts [11].

The purpose of the study is to identify the priorities towards safety for both the segments.

MATERIALS AND METHODS

Indian Construction Industry

Indian construction industry can be broadly classified into 2 sub-segments [12] as in Fig 1.

- 1) Real estate (Residential, Commercial/Corporate, Industrial and Special Economic Zones)
- 2) Infrastructure (Transportation, Urban development, Utilities)

The study was conducted in Indian construction segments that are real estate and infrastructure to prioritize the goals and elements of OHSAS -18001 employing analytic hierarchy process. The construction industry needs a new paradigm for measuring safety performance in construction sites that is proactive approach rather than depending on the reactive data, and the proactive approach is able to provide essential feedback on performance before incidents occur [13].

OHSAS

OHSAS specification OHSAS 18001, have been developed as recognizable occupational health and safety management system standard against which management systems can be assessed and certified. OHSAS 18001 is compatible with the ISO 9001 (Quality) and ISO 14001 (Environmental) management systems standards, which facilitates the integration of quality, environmental and occupational health and safety management systems by organizations [14].

Organizations of all kinds are increasingly concerned with achieving and demonstrating sound occupational health and safety (OH&S) performance by controlling their OH&S risks, consistent with their policy and objectives. By utilizing a systematic approach to safety, OH&S management system optimize the overall co-ordination of prevention and control measures embodied in these three philosophies,

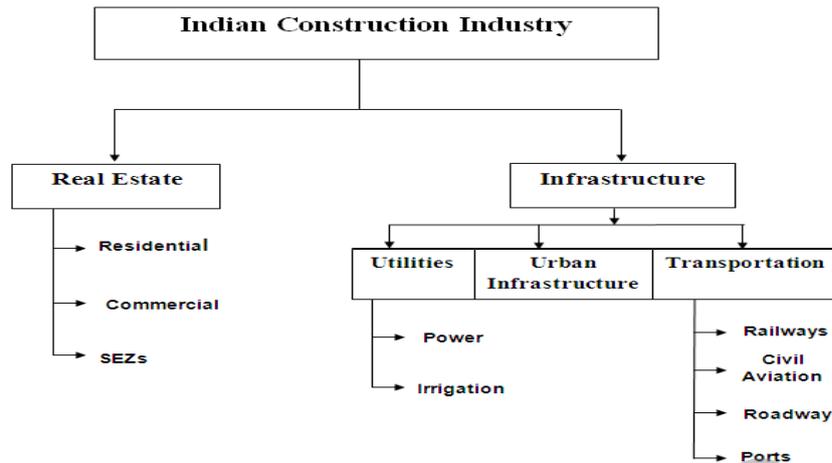


Fig 1. Categorization of Indian construction industry

and so offer much more than the traditional five treatment options advocated by the hierarchy of controls -elimination, substitution; isolation; administrative controls and lastly personal protective equipment [15-16]. The safety management guidelines and specifications, as per OHSAS18001 stress the safety policy, planning, implementation and performance evaluation while the major difference falls on the order of element presentation [17].

OHSAS 18001 uses a management approach tool called the PDCA cycle. PDCA is an ongoing process that enables an organization to establish, implement and maintain its health and safety policy based on top management leadership and commitment to the safety management system. The elements of OHSAS are shown in Table 1. Plan – establish the objectives and processes necessary to deliver results in accordance with the organization’s OH&S policy. Do –implement the process. Check –monitor and measure performance against OH&S policy, objectives, legal and other requirements, and report results. Act – take actions to continually improve OH&S performance. The standard can be implemented to whole organization or to just a part of it. The best results though come when the whole organization is working on the same system and OH&S policy is integrated into other management systems and into the culture of the organization.

Analytic Hierarchy Process (AHP)

In order to evaluate the priorities of goals of OHSAS in construction segments in India the AHP methodology was employed. The Analytic Hierarchy Process (AHP) is a theory of measurement through pair wise comparisons and relies on the judgments’ of experts to derive priority scales. It is these scales that measure intangibles in relative terms. The comparisons are made using a scale of absolute judgments that represents how much more; one element dominates another with respect

to a given attribute. The judgments may be inconsistent, and how to measure inconsistency and improve the judgments’, when possible to obtain better consistency is a concern of the AHP [18]. AHP involves the decomposition of a complex problem into a multi-level hierarchical structure of characteristics and criteria with the last hierarchical level constituting the decision alternatives [19]. A model was developed called construction safety index to measure the effectiveness of safety management systems of using analytic hierarchy process [20].

The goal of implementation of OHSAS -18001 was categorized into seven criteria from extensive literature survey and from company documents as follows:

- i) Customer satisfaction – through delivery of products that consistently meet customer requirements whilst safeguarding their health and property [21].
- ii) Reduced operating costs – by decreasing downtime through incidents and ill health and reducing costs associated with legal fees and compensation [22].
- iii) Improved stakeholder relationships – by safeguarding the health and property of staff, customers and suppliers (Company’s document).
- iv) Legal compliance – by understanding how statutory and regulatory requirements impact the Employee safety and health – through clear identification of potential incidents and implementation of controls and measures [23].
- vi) Proven business credentials – through independent verification against recognized standards [24].
- vii) Client’s requirement– to meet safety and health standards as per client’s requirement (Company’s document).

A group of six evaluators were interviewed for evaluating goals of OHSAS. The evaluators were lead auditor of OHSAS from a leading certifying body, consultant of OHSAS and two each from real

Table 1. Elements of OHSAS

Cycle	Goals	Importance
Plan	Devise an OH&S policy Hazard identification, risk assessment and controls measures Plan for emergencies and responses Provide and ensure the appropriate use of safety equipment Train in order to introduce an OH&S culture	Management has to be consulted in order for them to feel confident in supporting the new system and constantly driving it forward. The workforce has to be consulted. It is very likely that the lower level employees have valuable insight, ideas and feedback about the new system
Do	Appropriate structure Employee competencies	In order to ensure smooth implementation a lead senior manager should be in charge of the new OH&S system.
Check	Conducting internal audits Evaluation of legal compliance Measuring performance and monitoring	The failure to conduct internal audits periodically will most likely result in the breakdown of the system as a whole. Any arising non-conformities should be tackled instantly using the devised corrective actions.
Act	Management review Provide the necessary resources for their implementation	Management review is done by the senior management and involves reviewing the suitability, adequacy and effectiveness of the system and also for improvement/necessary changes in the OH&S policy.

Table 2. Intensities of relative importance for pair wise comparison

Intensity	Definition
1	Equal importance
3	Moderate importance of one over another
5	Essential or strong importance
7	Demonstrated importance
9	Extreme importance
2,4,6,8	Intensities values between the two adjacent judgments

estate/infrastructure segments working as a corporate safety heads and all the evaluators are having more than 20 years of experience in their respective field of work. The goals of OHSAS was explained to the evaluators and requested to do the rating. The evaluators were requested to compare the seven goals of OHSAS pair wisely using a nine –point scale of intensity, shown in Table 2 [25].

For example if an evaluator decided that “Customer satisfaction” was strong important than “Proven business credentials” then the former would be rated as “5” and the later would be rated as “1/5” [18]. A matrix was obtained as result of pair wise comparisons. The matrix was used for calculating importance of each goal as shown in level 2 of Fig 2. Inconsistency ratios were calculated to verify the consistency of the comparison process. The computations and analysis of interview findings were made using Analytic Hierarchy Process (Multiple inputs). K. Goepel, version 11.12.2012 and Expert Choice.

RESULTS

The evaluators were requested to make pair wise comparisons of goals of OHSAS-18001. Local normalized weights of goals of OHSAS-18001 and the inconsistency ratio of pair wise comparisons for each construction segment are given in Table 3. It was found that factors vary among construction segments when motivating enterprises to attend safety and health performance. The critical criteria for real estate and infrastructure segments are “client requirement”. Last important goal for both the segments are “legal compliance”. The goals “client requirement” and “legal compliance” is equal importance for both the segments. “Employee safety and health” was ranked second and third for real estate and infrastructure segments respectively. Results showed that responses in the pair wise comparisons were consistent, as their inconsistency ratios were less than 0.10 [18].

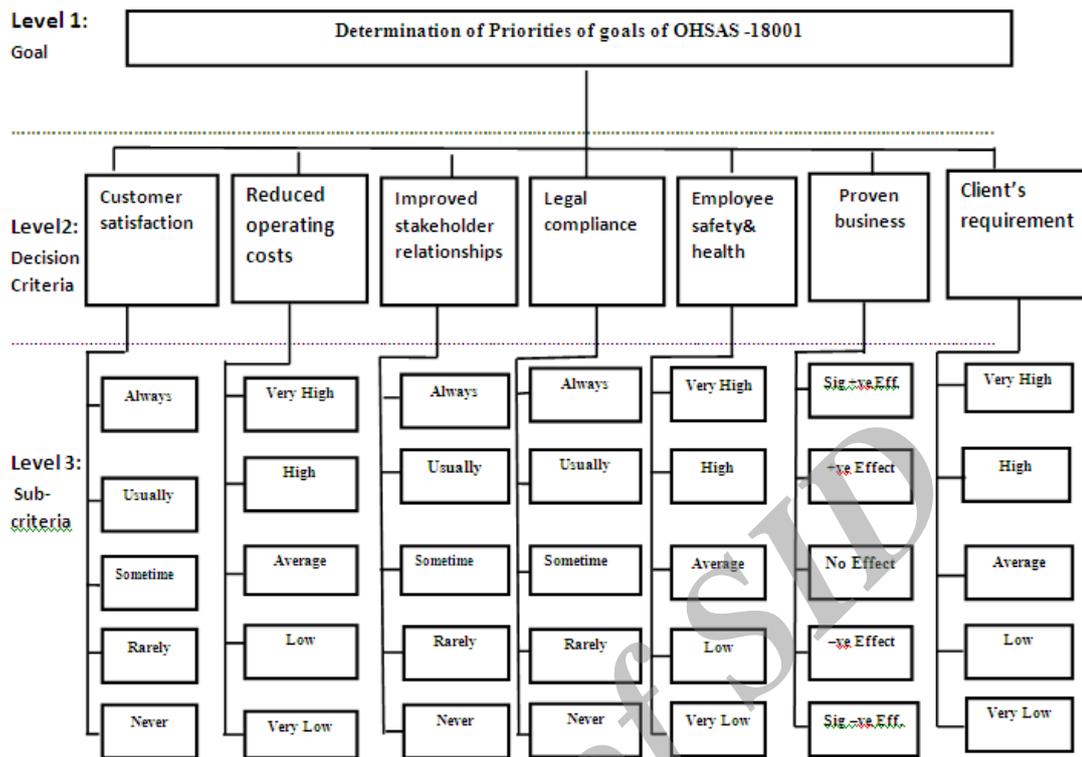


Fig 2. A Hierarchy Model for AHP

The elements of OHSAS that is safety policy, appropriate structure, hazard identification risk assessment, safety training, and safety equipment had high ranks (1st to 5th) in both the segments and the results are shown in Table 4. These results indicated that evaluators stressed on personal safety including safety training and safety equipment. The top ranking elements in both the segments are falling under “plan” and “do” category except the elements legal requirements and manage change effectively. The results showed that the evaluators have given less emphasis on “legal requirements”.

DISCUSSION

The goal of implementation of OHSAS is to meet client's requirement and to improve safety and health in both the segments. This is mainly due to lack of enforcement from government and the clients are very much interested towards OH&S of the employees and sufficient budget was allocated to meet their requirements and Legal compliance was ranked last in goals as well as in OHSAS elements. It is practically not possible to implement all the elements of OHSAS concurrently and the results will helpful to prioritize the implementation of elements and that is reason why OHSAS focus on continual improvement. It is proven that implementation OHSAS 18001 can help to reduce

the accident rate and other benefits that are 52.9% result to organization with improving their company image, 50% improve productivity and working environment, 66.2% result for risk reduction on occupational safety and health accidents and last benefits is can be treated as a self with 45.6% [26].

Motivating factor to implement OHSAS 18001 as part of integrated management systems is to satisfy customers' requirements, fulfill legal requirements and to cope up with stress from competitors. In a study conducted in the construction industry of china, implementation of OHS management systems and the OHSAS 18001 was studied through Questionnaire surveys and structured interviews with focus on exploration of attitude towards the OHSAS 18001 implementation, demand for the OHSAS 18001 and evaluation of benefits and diffiulties in integrating the OHSAS 18001 and ISO 9001 management systems. The results of the study are OHSAS 18001 offers a good framework for construction firms to follow and 20% of the respondents considered that the implementation of the OHSAS 18001 should be a mandatory requirement for the construction industry [27]. Theoretical model for OHSAS coupled with risk analysis and plan, do, check & act approach was developed and was tested in practice without conflicts [28]. A model developed by adopting AHP methodology in implementation of OHSAS in a business operations system and results of the model has

Table 3. Weights of goals of OHSAS

Goals of OHSAS	Real estate segment	Infrastructure segment
	weights rank	weights rank
Customer satisfaction	0.156 3	0.206 2
Reduced operating costs	0.108 4	0.090 6
Improved stakeholder relationships	0.094 6	0.137 5
Legal compliance	0.088 7	0.047 7
Employee safety and health	0.214 2	0.154 3
Proven business credentials	0.098 5	0.148 4
Client's requirement	0.242 1	0.218 1
Inconsistency ratio	0.07	0.04

Table 4. Priorities of OHSAS Elements for Construction Segments

Category	Elements of OHSAS	Real Estate	Infrastructure
		weight rank	weight rank
Plan	Devise an OH&S policy	0.446 1	0.468 1
	Hazard identification, risk assessment and controls measures	0.424 3	0.426 3
	Plan for emergencies and responses	0.400 6	0.388 7
	Provide and ensure the appropriate use of safety equipment	0.408 5	0.418 4
	Train in order to introduce an OH&S culture	0.410 4	0.400 5
Do	Appropriate structure	0.432 2	0.446 2
	Employee competencies	0.388 7	0.398 6
Check	Conducting internal audits	0.320 9	0.364 8
	Evaluation of legal compliance	0.260 12	0.286 12
	Measuring performance and monitoring	0.316 10	0.318 11
Act	Management review	0.288 11	0.332 10
	Provide the necessary resources for their implementation	0.348 8	0.344 9

contributed 33% weight towards continual improvement as result of implementation of OHSAS [29]. Multi-criteria approach based on the AHP methodology is to be implemented to reduce levels of risks identified and to improve the efficiency of the management systems and plan to consider criteria relating to management systems [30].

In the present study, top rankings of elements of OHSAS have fallen under "plan" and "do" categories. It clearly indicates that the construction organizations are mainly focusing on stabilizing the system rather than safety audits, incident analysis and management review. The hierarchy decision model was established to determine goals and elements in the design, establishment and implementation of OHSAS system. The evaluators also stressed on personal safety rather

than other elements of OHSAS. Implementation and prioritization of elements OHSAS can be validated in construction sector by streamlining human resources, organizational structure, organization culture understanding and perception, which are under the control of management. The factors outside the purview of the management are technical guidance, certifying bodies, stakeholder and customers.

CONCLUSION

The discrimination in the priorities for both the segments are mainly due to scope of work, hazardous conditions at work place, lack of awareness among employees towards OH&S, safety culture and the variation can be eliminated or minimized through external safety audits, incorporating safety in the

corporate culture of an organization and management review.

The factors such as organizational safety policy, safety training, safety equipment, safety inspection, safety incentives and penalties, and workers attitude towards safety must be considered for improving safety performance in a specific context. Standard operating procedures are missing in Indian construction segments because standard practices can improve skill level, prevent accidents and improve safety performance. Medical facilities are still worse in Indian construction segments although government regulation needs employee insurance, health schemes and medical facilities to be extended to the employees.

Construction industry has a poor safety record, and safety culture is an important role in improving safety and the enablers for safety culture improvement are commit more on safety, open more on safety suggestions, safety accountability to all workers, and behave as a role model in safety implementation.

The research can be further extended to ascertain the prioritization of OHSAS elements within segments, as there is possibility of discrimination in their preferences.

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