Safety and Health at Work 6 (2015) 200–205

Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.org

Original Article

Factors Influencing Implementation of OHSAS 18001 in Indian Construction Organizations: Interpretive Structural Modeling Approach

Sunku Venkata Siva Rajaprasad [1,2,*], Pasupulati Venkata Chalapathi [3]

[1] Koneru Lakshmaiah University, Vaddeswaram, India
[2] National Institute of Construction Management and Research, Hyderabad, India
[3] Department of Mechanical Engineering, Koneru Lakshmaiah University, Vaddeswaram, India

ARTICLE INFO

Article history:
Received 2 December 2014
Received in revised form
23 March 2015
Accepted 9 April 2015
Available online 30 April 2015

Keywords:
interpretive structural modeling
occupational health and safety
occupational health and safety management system

ABSTRACT

Background: Construction activity has made considerable breakthroughs in the past two decades on the back of increases in development activities, government policies, and public demand. At the same time, occupational health and safety issues have become a major concern to construction organizations. The unsatisfactory safety performance of the construction industry has always been highlighted since the safety management system is neglected area and not implemented systematically in Indian construction organizations. Due to a lack of enforcement of the applicable legislation, most of the construction organizations are forced to opt for the implementation of Occupational Health Safety Assessment Series (OHSAS) 18001 to improve safety performance.

Methods: In order to better understand factors influencing the implementation of OHSAS 18001, an interpretive structural modeling approach has been applied and the factors have been classified using matrice d'impacts croises-multiplication appliqué a un classement (MICMAC) analysis. The study proposes the underlying theoretical framework to identify factors and to help management of Indian construction organizations to understand the interaction among factors influencing in implementation of OHSAS 18001.

Results: Safety culture, continual improvement, morale of employees, and safety training have been identified as dependent variables. Safety performance, sustainable construction, and conducive working environment have been identified as linkage variables. Management commitment and safety policy have been identified as the driver variables.

Conclusion: Management commitment has the maximum driving power and the most influential factor is safety policy, which states clearly the commitment of top management towards occupational safety and health.

1. Introduction

The purpose of health and safety procedures in the construction industry is to ensure the health, safety, and wellbeing of workers. Due to the high accident rates on construction sites internationally, strong health and safety legislation has been devised to minimize accidents and promote construction workers' safety. Construction work is one of the most well-known high-risk occupational areas in modern society and among the most hazardous, as measured by work-related mortality, injury rates, and workers' compensation payments [1]. It is accepted that construction workers have a higher risk of work-related illnesses and accidents than workers in any other branches of industry and the public sector.

Occupational health and safety (OHS) issues in the construction industry have always been a major concern to the management in India. The construction industry is labor intensive and the work

* Corresponding author. National Institute of Construction Management and Research (NICMAR), NAC Campus, Kondapur P.O., Hyderabad 500084, India.
E-mail address: sunku.vsrp@gmail.com (S.V.S. Rajaprasad).

2093-7911/$ – see front matter
http://dx.doi.org/10.1016/j.shaw.2015.04.001

force is vulnerable to workplace injuries. Protecting employees from injuries is the priority of the management. The Occupational Health and Safety Assessment Series (OHSAS) 18001:1999 is a comprehensive OHS management system specification, designed to enable organizations to control OHS risks and improve their performance. The first step in establishing an OHS management system is the development of a formal policy, to ensure that a clear direction is set and aids in formulating a series of steps for enhancing the business performance, which forms an integral part of an assurance towards invariable advancement [2]. OHSAS 18001 specifications have been framed in concordance with quality and environmental management systems, keeping a view to integrate the systems. However, OHSAS 18001 does not focus on OHS performance metrics or design of management systems. It is a challenge to the top management to implement the three systems separately and it would be effective by integrating the systems. The immediate threat to most organizations is poor safety performance, which has a direct impact on organizational productivity and indirectly affects the morale of the employees. To overcome this situation, OHSAS is a robust tool in the hands of top management.

Globally, the construction industry has the third highest number of quality management system certifications among all other sectors. Most of the construction organizations are to implement safety and environment management systems for continual improvement [3–5]. Management system certifications on quality, safety, and the environment have been widely adopted by most organizations globally. OHSAS 18001 acts as a proactive control, to minimize risks and improve safety performance [6]. Compliance with legal requirements, implementation of safe operating procedures, review of the safety policy, conducting a risk assessment, and safety training of employees were lacking in the printing industry in Mauritius, and to have better control of OHS issues, it is suggested to implement OHSAS 18001 [7]. It is presumed that the implementation of OHSAS 18001 can stimulate a safety culture towards sustainable construction in the Malaysian construction industry [8]. OHSAS 18001 can be integrated with other management systems, such as quality and the environment, which improves OHS performance besides reducing the cost of accidents.

Sustainable construction during various stages of construction is practical through six principles: monitoring quality, safe work environment, protection of the natural environment, utilizing recyclable resources, reducing resources, and enhancing reuse; all of which are possible through implementation of OHSAS18001 [9]. The OHSAS certification is relevant to any management interested in enacting an OHS management system to eliminate or curtail risk to all stakeholders who may be exposed to OHS risks, compliance with OHS policy, manifest compliance to others, uphold and continually upgrade OHS management systems, and diligence towards compliance with OHSAS certification.

The reputation of the organization, work place safety, and employee morale are improved by implementing OHSAS18001 [10]. It has been shown that, after OHSAS 18001 implementation, the Malaysian automotive industry continued to perform more efficiently and effectively to become the best among its competitors in other countries [11]. The OHSAS 18001 standard specifies the requirements for implementing an OHS management system that allows the organization to develop and implement a safety policy, establish objectives and processes for achieving the commitments of the policy, and take the actions necessary to improve system performance [12].

Accomplishment of the OHSAS 18001 relies upon the commitment of all levels in the organization [13]. A study conducted in chemical plants in the state of Kerala, India to investigate the perception of employees on six safety variables revealed that perception levels varied in plants certified with OHSAS 18001 and ISO 9001 and those without certification. Perception of employees towards safety in the plants certified with OHSAS 18001 were higher and the study also emphasizes the importance of certification to improve safety performance [14]. In the current scenario, the framework of safety, quality, and environmental management systems has become a crucial prerequisite in industries to stay competitive. This is on the grounds that the future achievements of a company is reliant on its capacity to enhance its operations by restructuring safety management systems for continual improvement [15]. The essence of OHSAS 18001 encompasses hierarchy, expectations, strategies, and the organizational structure to maintain OHS policy [16].

Safety policy is the prime mover in an organization as it sets a clear direction for better safety performance, and also creates awareness among employees towards safety [17]. Policy framing is based on the scope of organizational activities and commitment of the top management to integrate safety and health with other business activities. Safety culture refers to “individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and style and proficiency of, an organization’s health and safety management”. Safety culture at an organization level reduces injury rates, which ultimately minimize cost of accidents. Safety performance will improve through safety culture, resulting into better productivity [18]. Knowledge, skills, and positive attitude towards safety are possible through training. Knowledge refers to safety information, attitude refers to feelings associated with safety, and behavior represents organizational, management, or employee performance. All employees need to be imparted safety training in order to improve their safety awareness. Safety training is a continuous process involving all cadres of employees as it directly influences the behavior of employees [19]. It is evident that management plays an important role in an efficient and effective safety program. Management must fully and actively translate ideas into safety actions, including issuing a written comprehensive safety policy, allocating sufficient resources, promptly reacting to safety suggestions and complaints, attending regular safety meetings and training, and regularly visiting the workplace [20]. Based on an extensive literature survey combined with discussion with safety consultants, safety professionals and academics in the field of safety, nine factors have been identified, influencing OHSAS 18001, in Indian construction organizations.

The Building and Other Construction Workers (Regulation of Employment Conditions service) Act 1996 was enacted by the Indian Government to safeguard safety, health and welfare of employees in the construction industry [21]. Except for a few state governments, others have failed to implement the act fully and enforcement from government is lacking. This practice is continuing to date and clients/contractors have explored an alternate system to improve safety performance, reduce cost of accidents, and maintain company reputations. Many construction organizations in India feel that OHSAS 18001 is a management system that guides the organizations in the right direction to improve safety performance. However, there is a dearth of studies on implementation of OHSAS 18001 by construction organizations in India, and it was felt that, in the current situation, there was a strong case for carrying out the present study. The purpose of the study was to identify factors influencing implementation of OHSAS 18001; to establish the relationships between factors; to propose a structural model of OHSAS 18001 implementation; and to classify the identified factors into various categories. The factors were also classified based on their driving power and dependence. The results of the study is useful to build relationship among variables and to lead the management to interpret the interdependence among variables influencing implementation of OHSAS 18001 in Indian

Table 1
Factors influencing implementation of OHSAS 18001

Factors	Description	Refs
Safety culture	OHSAS 18001 can stimulate safety culture Safety culture has impact on performance	[8,18]
Safety performance	OHSAS 18001 acts as a proactive tool Safety performance will depend on culture	[6,18]
Sustainable construction	Stimulates to sustainable construction	[8]
Continual improvement	Implementation leads continually	[2,3,5]
Management commitment	Depends on management commitment at all levels Hierarchy, strategies, & the organizational structure Management involvement	[13] [16] [20]
Conducive working environment	Achieved through sustainable construction	[9]
Morale of employees	Reduces accident rate	[10]
Safety policy	Set clear direction Establish objectives & processes creates awareness among employees	[2,12,17]
Safety training	Continuous process as it will influence on behavior of employees	[7,20]

OHSAS, Occupational Health Safety Assessment Series.

scenario. Implementation of safety norms in the construction industry is dynamic; mainly due to progress of the work, lack of skilled personnel, and working conditions. The results of this study can be implemented by managers who work in a dynamic and changing environment in construction organizations. Earlier studies mainly concentrated on post-implementation benefits and improvement of safety performance in organizations certified under OHSAS 18001. The objective of the present study was to identify the prerequisites of OHSAS 18001 certification prior to implementation.

2. Materials and methods

Interpretive structural modeling (ISM) was first proposed by Warfield [22] in 1974. It enables individuals or groups to develop a map of the complex relationships among many elements involved in a complex decision situation. ISM is an interpretive modeling technique based on judgment of experts. A driver-dependency grid evolves an overall mapping of influencers and helps in classification/categorization/prioritization of variables for optimum allocation of resources. The concept of plotting drivers and barriers on a common driver-dependency map, to gain strategic insights for implementation can be extended to projects/programs in any field/area [23]. ISM methodology is utilized for supplier selection by understanding the dynamics between the supplier selection process enablers. ISM has been developed for a leading telecom service provider in India and the hierarchy of various inhibitors was established based on the outcomes of the final reachability metrics [24].

2.1. Step by step procedure of ISM

The various steps involved in the ISM technique [25] are: (1) identification of variables that are relevant to the problem or issues – this could be done by literature review, past research studies, and brainstorming with experts; (2) establishing a contextual relationship between variables with respect to which pairs of variables are examined; (3) developing a structural self-interaction matrix (SSIM) of variables that indicates pairwise relationships among variables of the system; (4) developing a reachability matrix from the SSIM, and checking the matrix for transitivity of the contextual relationship is a basic assumption in ISM, which states that if variable A is related to B, and B is related to C, then A is related to C; (5) partitioning of the reachability matrix into different levels; (6) based on the relationships given above in the reachability matrix, drawing a directed graph (digraph), and removing the transitive links; (7) converting the resultant digraph into an ISM-based model by replacing variable nodes with the statements; and (8) reviewing the model to check for conceptual inconsistency, and making the necessary modifications.

2.2. MICMAC analysis

Matrice d'impacts croises-multipication appliqué a un classement (MICMAC) [26] analysis contains the following three steps: (1) identification of relevant variables: usually through brainstorming or based on expert opinions, variables related to the research topic are identified. A complete variable list is crucial for future studies and analysis; (2) build the causal relationship between variables; and (3) identify key variables: this step is mainly about identifying key variables and factors that are important to overall system changes.

3. Results

3.1. Evaluation of ISM

3.1.1. Identification of factors

A set of factors were identified after an extensive literature survey of past research studies and through discussions with experts in the field of construction safety (Table 1). The opinions of the experts are strongly aligned with the factors identified from the literature survey.

3.1.2. Relationship among variables

The ISM model suggests the use of experts' opinions in identifying the contextual relationship among variables. Thus, in this research for identifying the contextual relationship among the factors influencing in implementing OHSAS 18001, 25 experts from different construction and consultant firms in India were invited to participate. Sixteen experts responded with a response rate of 64%. For this group of experts, six (38%) had worked for $\leq$ 15 years, and 10 (62%) for $>$ 10 years. The majority of respondents held senior positions in their organizations, with 40% being corporate safety managers, 28% safety managers, and 32% consultants/auditors.

Four symbols (V, A, X and O) were used to denote the direction of the relationship between the variables (i and j): V – variable i led to variable j; A – variable j led to variable i; X – variables i and j led to each other; and O – variables i and j were unrelated. Variable 8 led to variable 9, so V was assigned in the cell (8, 9); variable 5 led to variable 1, so A was assigned in the cell (1, 5); variables 1 and 6 led to each other, so X was assigned in the cell (1, 6); and variables 7 and 9 did not lead to each other, so O was assigned in the cell (7, 9). The number of pairwise comparisons for developing SSIM were $\{(N) \times (N-1)/2\}$, where N was the number of variables, and the number of pairwise comparisons was 36. The symbols in SSIM were assigned after obtaining the concurrent opinions of the experts. Based on the contextual relationships, SSIM was developed as shown in Table 2.

3.2. Reachability matrix

Finally, to convert the SSIM into the binary reachability matrix with the dependence and enabling power, V, A, and X were replaced by a digit 1 and O by digit 0. The substitution of l s and 0s

Table 2
Structural self-interaction matrix

Factors	9	8	7	6	5	4	3	2	1
1. Safety culture	A	O	O	X	A	O	V	O	–
2. Safety performance	V	O	X	X	A	X	O	–	–
3. Sustainable construction	A	O	O	V	O	A	–	–	–
4. Continual improvement	A	O	A	A	A	–	–	–	–
5. Management commitment	V	V	A	A	–	–	–	–	–
6. Conducive working environment	A	O	O	–	–	–	–	–	–
7. Morale of employees	O	A	–	–	–	–	–	–	–
8. Safety policy	V	–	–	–	–	–	–	–	–
9. Safety training	–	–	–	–	–	–	–	–	–

was according to the following rules. (1) If the (i,j) entry in the SSIM was V, the (i,j) entry in the reachability matrix became 1 and the (j,i) entry became 0. (2) If the (i,j) entry in the SSIM was A, the (i,j) entry in the reachability matrix became 0 and the (j,i) entry became 1. (3) If the (i,j) entry in the SSIM was X, the (i,j) entry in the reachability matrix became 1 and the (j,i) entry also became 1. (4) If the (i,j) entry in the SSIM was O, the (i,j) entry in the reachability matrix became 0 and the (j,i) entry also became 0.

The final reachability matrix is shown in Table 3 and was constructed from the initial reachability matrix, taking into account the transitivity rule, which states that if variable A is related to B, and B is related to C, then A is necessarily related to C. The driving power and the dependence of each factor are also shown. The driving power for each variable was the total number of variables (including itself), which it may impact. Dependence was the total number of variables (including itself), which may be impacting it. These driving power and dependencies were used in the MICMAC analysis, where the variables were classified into four groups of autonomous, dependent, linkage, and independent (driver) variables.

3.3. Level partitioning

The reachability set and antecedent set [17] for each variable were determined from the final reachability matrix. Subsequently, the intersection set of these sets was derived for all variables. The variable, for which the reachability and the intersection sets were the same, was designated the top-level variable in the ISM hierarchy. From Table 4, it is seen that the safety culture, morale of employees, and continual improvement were found at Level I. The iteration was continued until the level of each variable was determined. The identified levels helped to build the diagraph and the final model of the ISM. The reachability matrix was partitioned on the basis of the reachability and antecedent sets for each of variables, and through a series of iterations, these were grouped into various levels and shown in Tables 5–8.

Table 3
Final reachability matrix

Factors	1	2	3	4	5	6	7	8	9	Driving power
1. Safety culture	1	0	1	0	0	1	0	0	0	3
2. Safety performance	1	1	1	1	0	1	1	0	1	7
3. Sustainable construction	1	0	1	0	0	1	0	0	0	3
4. Continual improvement	1	1	1	1	0	1	1	0	1	7
5. Management commitment	1	1	1	1	1	1	1	1	1	9
6. Conducive working environment	1	0	1	0	0	1	0	0	0	3
7. Morale of employees	1	1	1	1	0	1	1	0	1	7
8. Safety policy	1	1	1	1	0	1	1	1	1	8
9. Safety training	1	0	1	0	0	1	0	0	1	4
Dependence	9	5	9	5	1	9	5	2	6	–

Table 4
Iteration 1

Factor	Reachability set	Antecedent set	Intersection set	Level
1	1,3,6	1,2,3,4,5,6,7,8,9	1,3,6	I
2	1,2,3,4,6,7,9	2,4,5,7,8	2,4,7	–
3	1,3,6	1,2,3,4,5,6,7,8,9	1,3,6	I
4	1,2,3,4,6,7,9	2,4,5,7,8	2,4,7	–
5	1,2,3,4,5,6,7,8,9	5	5	–
6	1,3,6	1,2,3,4,5,6,7,8,9	1,3,6	I
7	1,2,3,4,6,7,9	2,4,5,7,8	2,4,7	–
8	1,2,3,4,6,7,8,9	5,8	8	–
9	1,3,6,9	2,4,5,7,8,9	9	–

Table 5
Iteration 2

Factor	Reachability set	Antecedent set	Intersection set	Level
2	2,4,7,9	2,4,5,7,8	2,4,7	–
4	2,4,7,9	2,4,5,7,8	2,4,7	–
5	2,4,5,7,8,9	5	5	–
7	2,4,7,9	2,4,5,7,8	2,4,7	–
8	2,4,7,8,9	5,8	8	–
9	9	2,4,5,7,8,9	9	II

3.4. MICMAC analysis

MICMAC analysis was done with the help of the driving power and dependence power of the variables. Variables were classified into four clusters: autonomous, dependent, linkage, and driver/independent. In the final reachability matrix, the driving power and dependence power of each of the variables were plotted. Autonomous variables (1st cluster) had weak driving power and dependence power. These variables could be disconnected from the system. The dependent variables (2nd cluster) had weak driving power and strong dependence power. The linkage variables (3rd cluster) had strong driving power and dependence power. The independent variables (4th cluster) had strong driving power and weak dependence power [27].

4. Discussion

The diagraph was the model generated from the final reachability matrix. After removing the transitivity links and replacing the node numbers by statements, the ISM model was generated (Fig. 1). Management commitment was a significant critical success factor in implementation of OHSAS 18001, because it was at the base of the ISM hierarchy. There is no evidence from earlier studies regarding the structural model of factors influencing implementation of OHSAS 18001 certification in an Indian context. Further, the

Table 6
Iteration 3

Factor	Reachability set	Antecedent set	Intersection set	Level
2	2,4,7	2,4,5,7,8	2,4,7	III
4	2,4,7	2,4,5,7,8	2,4,7	III
5	2,4,5,7,8	5	5	–
7	2,4,7	2,4,5,7,8	2,4,7	III
8	2,4,7,8	5,8	8	–

Table 7
Iteration 4

Factor	Reachability set	Antecedent set	Intersection set	Level
5	5,8	5	5	–
8	8	5,8	8	IV

Table 8
Iteration 5

Factor	Reachability set	Antecedent set	Intersection set	Level
5	5	5	5	V

study provided a hierarchy of variables for implementation of OHSAS 18001 in Indian construction organizations; thus, the hierarchy could help all stakeholders with successful implementation of certification by resolving complex issues.

The driver power–dependence diagram is shown in (Fig. 2). The first cluster consisted of the autonomous variables that had weak driver power and weak dependence. No variable was identified as an autonomous variable. The second cluster consisted of the dependent variables that had weak driver power but strong dependence. Safety culture, continual improvement, morale of employees, and safety training were identified as dependent variables. The third cluster had the linkage variables that had strong driver power and dependence. Safety performance, sustainable construction and conducive working environment were identified as linkage variables. The fourth cluster included the independent variables that had strong driving power but weak dependence. Management commitment and safety policy were identified as the driver variables.

To better understand the factors influencing implementation of OHSAS 18001 in Indian construction organizations, we used an ISM approach. We identified nine factors crucial for implementation of OHSAS 18001 and the relationships among them. The results of the study serve as a guideline for top management to concentrate on influential factors and it can assure the successful implementation of OHSAS 18001 in construction organizations. In this case, management commitment and safety policy fall in the category of independent (driver) factors. It is obvious that management

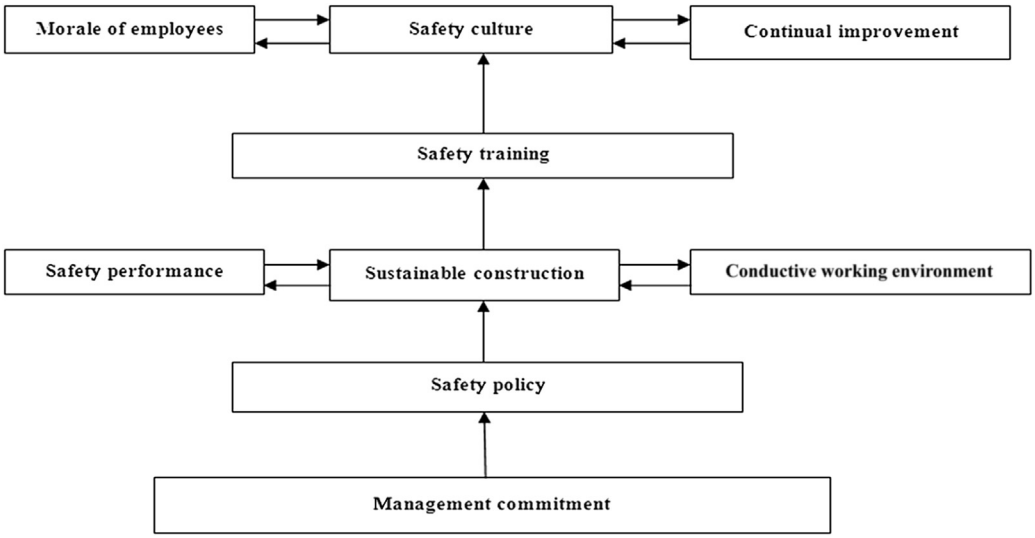

Fig. 1. ISM-based model of implementationof OHSAS 18001. ISM, interpretive-structural-modeling; OHSAS, Occupational Health Safety Assessment Series.

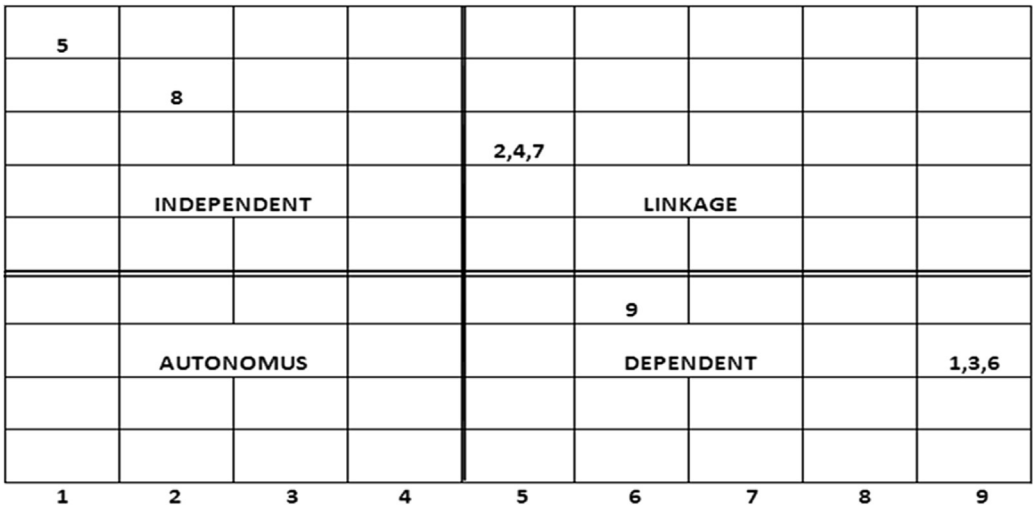

Fig. 2. Clusters of factors influencing implementation of OHSAS 18001. OHSAS, Occupational Health Safety Assessment Series.

commitment has the maximum driving power, and therefore, this is the most important factor and has a major influence on the other factors. The second most influential factor is safety policy, which states clearly the commitment of top management towards OSH, and well-being of employees. The model developed in this research was based upon expert opinions. The results of the analysis may vary in real world setting as the study considered nine variables, which directly influence adoption of OHSAS 18001. In case a model needs to be developed for a specific organization, some variables may be deleted and/or added based on experts opinion.

Future research could validate the applicability of the hierarchy model in other sectors/organizations, in order to reveal sector-specific characteristics and comparative analysis of factors influencing OHSAS 18001 implementation should be conducted.

Conflicts of interest

All authors declare no conflicts of interest.

References

[1] Larsson S, Pousette A, Torner M. Psychological climate and safety in the construction industry-mediated influence on safety behaviour. Saf Sci 2008;46:405–12.

[2] Ramrooop S, McCarthy JJ, Naidoo K. Successful occupational health and safety: a management perspective. In: 8th world Congress on environmental health Document Transformation Technologies. South Africa 2004.

[3] Chini AR, Valdez HE. ISO 9000 and the U.S. construction industry. J Manage Eng 2003;19:78–82.

[4] Low SP, Chin PY. Integrating ISO 9001 and OHSAS 18001 for construction. J Constr Eng M Asce 2003;129:338–47.

[5] Zeng SX, Tam CM, Deng ZM, Vivian WY. ISO 14000 and the construction industry. J Manage Eng 2003;19:107–15.

[6] Matias JCDO, Coelho DA. The investigation of the standards systems of quality management, environmental management and occupational health and safety management. Int J Prod Res 2002;40:3857–66.

[7] Khodabocus BF, Constant KC. Implementing OHSAS 18001:2007: a case study of hazard analysis from the printing industry. Int J Eng Res Africa 2010;1:17–27.

[8] Marhani MA, Adnan H, Ismail F. OHSAS 18001: a pilot study of towards sustainable construction in Malaysia. Procedia Soc Behav Sci 2013;85:51–60.

[9] Langston CA, Ding GKC. Sustainable practices in the built environment. Oxford (UK): Butterworth-Heinemann; 2001.

[10] Ledesma AST, Fernandaz Muniz B, Montes Peon JM, Vazquez Ordas CJ. Spanish survey reveals motivations, obstacles and benefits of OHSAS 18001 certification. ISO Manage Syst 2009;9:36–40.

[11] Fuzi NM, Zamri FIM. The impact of occupational safety and health administration practices (OSHAP) and OHSAS 18001 efforts in Malaysian automotive industry. J App Sci Res 2013;1:47–59.

[12] Hosny G, Elsayed EA, El gamal AA, Shalaby EA. Intervention Program for occupational health, safety and environmental standards among workers in Petroleum Industry: a case study. Int Res J Sci Find 2014;1:73–81.

[13] Sadhra S, Beach JR, Aw TC, Sheikh AK. Occupational health research priorities in Malaysia: a Delphi study. Occup Environ Med 2001;58:426–31.

[14] Vinodkumar MN, Bhasi M. A study on the impact of management system certification on safety management. Saf Sci 2011;49:498–507.

[15] Hitt MA, Hoskisson R, Harrison J. Strategic competitiveness in the 1990s: challenges and opportunities for US executives. Acad Manage Exec 1991;5:7–22.

[16] Chao C-J, Wang H-M, Feng W-Y, Tseng FY. A study for safety and health management problem of semiconductor industry in Taiwan. Ind Health 2008;46:575–81.

[17] Hinze J, Wilson G. Moving toward a zero injury objective. J Constr Eng Manage 1999;126:399–403.

[18] Agwu MO. Impact of employee's safety culture on organizational performance in Shell Bonny Terminal integrated project. Eur J Bus Soc Sci 2012;1:70–82.

[19] Johnston JJ, Catteledge GTT, Collins JW. The efficacy of training for occupational injury control. Occup Med 1994;9:147–58.

[20] Shirouyehzad H, Khodadadi-Karimv M, Dabestani R. Prioritizing critical success factors influencing safety, using TOPSIS. Int J Bus Soc Sci 2011;2:295–300.

[21] Government of India. The Building and Other Construction Workers (Regulation of Employment Conditions service Act 1996 [Internet]. [cited 2014 Sep 27]. Available from: http://www.mahashramm.gov.in/maha/acts_download/Building&Consrtuction_Act 1996.

[22] Warfield JW. Developing interconnected matrices in structural modeling. IEEE T Syst Man Cyb 1974;4:51–81.

[23] Ketkar SP, Shankar R, Banwet DK. Structural modeling and mapping of M-banking influencers in India. Electron Commer Res 2012;13:70–87.

[24] Pramod VR, Banwet K. Interpretive structural modeling for understanding the inhibitors of a telecom service supply chain. In: Proceedings of the 2010 International Conference on Industrial Engineering and Operations Management, Dhaka, Bangladesh January 9–10, 2010.

[25] Kumar S, Kant R. Supplier selection process enablers: an interpretive structural modeling approach. IJMIE 2013;3:28–42.

[26] Mudgal RK, Shankar R, Talib P, Raj T. Greening the supply chain practices: an Indian perspective of enablers' relationship. Int J Adv Oper Manage 2009;1:151–76.

[27] Kumar S, Luthra S, Haleem A. Customer involvement in greening the supply chain: an interpretive structural modeling methodology. J Ind Eng Int 2013;9:1–13.