



Contents lists available at ScienceDirect

# Safety and Health at Work

journal homepage: [www.e-shaw.net](http://www.e-shaw.net)

## Original Article

# Implementation of ISO45001 Considering Strengthened Demands for OHSMS in South Korea: Based on Comparing Surveys Conducted in 2004 and 2018



Junghyun Lee<sup>1</sup>, Jinyeub Jung<sup>2</sup>, Seok J. Yoon<sup>1</sup>, Sang-Hoon Byeon<sup>1,\*</sup>

<sup>1</sup> Department of Health Science, Korea University, Anam-ro 145, Seongbuk-gu, Seoul, 02841, Republic of Korea

<sup>2</sup> Department of Civil, Safety & Environmental Engineering, Hankyong University, Jungang-ro 327, Anseong-si, Gyeonggi-do, 17579, Republic of Korea

## ARTICLE INFO

### Article history:

Received 17 May 2020

Received in revised form

6 August 2020

Accepted 26 August 2020

Available online 11 September 2020

### Keywords:

ISO45001

occupational health and safety management system

social responsibility

worker participation

## ABSTRACT

**Background:** According to the previous studies, the work-related accident rate decreased in Korea after the introduction of occupational health and safety management system (OHSMS), but there were several disasters in Korea such as subway worker's death at Guui station in 2016 and the Taean thermal power plant accident in 2018, which escalated the social demand for safety. In 2018, OHSMS became an international standard, as ISO45001 was announced.

**Methods:** A survey was conducted to research the implementation status of OHSMS and changes in people's perception, and the results were compared with those of a past survey.

**Results:** Enhanced social demand and various stakeholders' (not only buyer) needs, and social responsibility are perceived as the motivation for the introduction of OHSMS rather than legal compliance or customer demand. In the questionnaire about problems with the implementation of OHSMS, the factors with higher response rate in 2018 than 2004 were "excessive cost" and "complicated documentation management." In the questionnaire about how to promote OHSMS in organizations, most people answered "reduction of workers' compensation insurance rate" in 2004, but most people answered "exemption from health and safety supervision" in 2018.

**Conclusion:** For the effective implementation of ISO45001, emphasis is placed on social demand, training to recognize health and safety as a part of management, and the reduction of certification and consulting costs to promote the introduction of OHSMS. Incentives such as insurance premium cuts and exemptions from health and safety supervision are needed.

© 2020 Occupational Safety and Health Research Institute, Published by Elsevier Korea LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The increasing scale of business in the late 20th century alongside growing social interests in health and safety accidents increased the economic and social cost of accidents [1]. As health and safety issues began to receive the attention of top management, health and safety departments grew larger. Systematic and strategic methods for managing health and safety issues were developed with the basic principle of efficiency, effectiveness, and responsibility through a system management approach [2]. Health and safety management systems are designed to predict and prevent health and safety risks that can occur in an organization through plan-do-check-act activities and ultimately contribute to an organization's enterprise risk management. Companies use

occupational health and safety management systems (OHSMS) to establish goals for the maintenance and promotion of the health and safety of workers, subcontractors, and visitors with the participation of all members and stakeholders to prevent industrial accidents and create pleasant working environments. This system enables material and human resources in an organization to be managed by defining and documenting the organization, responsibilities, and procedures used to accomplish the management of such resources [3].

OHSMS has appeared in many forms. In 1996, the British Standards Institute developed the BS 8800:1996-Guide to occupational health and safety management [4]. The ISO 18001 standard was then proposed to the ISO General Assembly in 1997 to disseminate this system. However, the proposal was rejected at the General

\* Corresponding author. Department of Health Science, Korea University, Anam-ro 145, Seongbuk-gu, Seoul, 02841, Republic of Korea.

E-mail addresses: [ltl8368@naver.com](mailto:ltl8368@naver.com) (J. Lee), [shbyeon@korea.ac.kr](mailto:shbyeon@korea.ac.kr) (S.-H. Byeon).

Assembly. Since then, 13 certification and consulting organizations in Europe have agreed to create temporary OHSMS standards [5]. OHSAS18001 was developed in 1999. Over the two decades since its development, OHSAS18001 continued to gain its popularity, being used in approximately 90,000 certifications in 127 countries [6]. In 2013, ISO agreed that it was necessary to develop an OHSMS International Standard. In 2018, ISO45001 was published as an international standard, replacing several OHSMS [5].

In Korea, the Korea Occupational Safety & Health Agency (KOSHA) developed and disseminated the KISCO2000 (revised to KOSHA18001 in 2003) in 1999 [3]. In general accordance with the new ISO45001 international standard, the KOSHA established KOSHA-MS in 2018 [7].

The scope of business management has expanded in the 21st century while management paradigms have shifted to global management. A company's health and safety management is no longer recognized as a moral problem but as a new management tool to secure transparency, productivity, and competitiveness. Accordingly, OHSMS certification is increasingly viewed as a key to responsible corporate competitiveness through its stimulation of management processes [8]. According to previous studies, the effectiveness of the OHSMS has been proved. The work-related accident rate decreased in Korea after the introduction of the occupational health and safety management system [3,9].

Although industrial accidents continue to decrease, more than 900 deaths occur each year [10]. There were several disasters in Korea such as the subway worker's fatality at Guui station in 2016 and the Taeon thermal power plant accident in 2018, which escalated the social demand for safety [11,12]. The government has strengthened safety regulations by issuing plans to prevent serious industrial accidents [10]. Companies that must accommodate the strengthened stakeholders' needs for safety should use OHSMS more proactively. In addition, the government should consider how the new OHSMS can be settled by reflecting the social demand.

Choi et al [13] (2004) examined the items that caused difficulties in establishing and operating OHSMS and the effects of the implementation of OHSMS. Risk assessment was derived as a difficult item in the establishment and operation of OHSMS; accordingly, the researchers found that governments should support education and training on risk assessment. In addition, the results indicated that the implementation of OHSMS contributes to the prevention of disasters and the enhancement of a company's productivity and image [13]. Rajaprasad and Chalapathi [14] (2015) analyzed factors influencing the implementation of OHSAS18001 in the construction industry. Safety culture, continuous improvement, employee morale, and safety training were identified as factors influencing implementation. Safety and conducive working environments were identified as linking variables, and management commitment and safety policy were identified as the strongest driving variables [14]. M. Bevilacqua [15] (2016) analyzed decisional factors (factors influencing the success and failure of OHSAS18001 implementation). Decision-making factors allowed companies to be certified, while increased bureaucracy, shortages of skilled workers and high certification costs led to failures in OHSAS18001 implementation [15].

Many studies have been conducted to promote OHSMS as described before. However, previous studies have not compared public perception changes in accordance with the escalated social demand for safety and change of the business environment after the introduction of OHSMS. To successfully implement ISO45001 and KOSHA-MS, which have been practiced more than 20 years after the introduction of OHSAS18001 in Korea, the survey was conducted to research changes in people's perception of OHSMS, and plans for the successful implementation of ISO45001 were derived.

## 2. Materials and methods

A survey was conducted on respondents' recognition of OHSMS based on the questionnaire developed by Choi et al [13] (2004) to derive ways to promote a company's safety and health management performance. The questionnaire consists of asking people's perceptions about the motivation for developing OHSMS, effectiveness of implementing OHSMS, etc. The survey was conducted in 2004 and 2018 for KOSHA18001-certified sites' managers. Respondents were asked about the problems of OHSMS implementation and the effects of OHSMS operation and execution on a 5-point Likert scale regarding their agreement with each variable, and the *t* test and Pearson's Chi-square test were conducted for comparison.

In 2004, questionnaires were distributed to all of the KOSHA18001-certified sites (297), 97 of which were not collected. A total of 195 questionnaires were included in the study, while five unsuitable questionnaires were excluded for analysis. During the 2018 survey, we distributed questionnaires to randomly sampled 200 KOSHA18001-certified sites and collected 138 questionnaires. The KOSHA18001-certified sites are categorized into manufacturing and construction by sectors and are classified into two groups; one with 50 workers or more and another less than 50 workers by company size. The target companies of this survey was classified and grouped by these criteria.

The survey analysis results are expressed as the number and percentage of responses to categorical variables. The Pearson's Chi-square test was used when the number of items with less than five respondents did not exceed 25% of the total. There were not enough respondents in some categories to assume normality; hence, we conducted Fisher's exact tests. Statistical analysis was performed using SPSS (version 22.0; SPSS, Inc., Chicago, Illinois, USA). A two-sided *p* < 0.05 was considered to be statistically significant.

## 3. Results

### 3.1. Differences in OHSMS awareness in 2004 and 2018 surveys

The two surveys used in this study were conducted in October 2004 and August 2018. Table 1 and Fig. 1 show the characteristics of the basic information of survey respondents in 2004 and 2018. In 2004, 65.6% of the respondents were in the manufacturing field, while 34.4% worked in construction. In 2018, 64.5% worked in manufacturing and 35.5% were in construction. The proportion of survey respondents with an employment period of less than 5 years was the highest in 2004, at 33.9%. In 2018, respondents with less than 5 years and at 5–10 years accounted for the highest rate, at

**Table 1**  
Basic information of survey respondents in 2004 and 2018.

Category	Sub category	2004 N (%)	2018 N (%)	<i>p</i>
Sectors	Manufacturing	128 (65.6%)	89 (64.5%)	0.828
	Construction	67 (34.4%)	49 (35.5%)	
	Total	195 (100.0%)	138 (100.0%)	
Employment period	Less than 5 years	63 (33.9%)	41 (29.7%)	0.051
	5–10 years	59 (31.7%)	41 (29.7%)	
	10–20 years	47 (25.3%)	36 (26.1%)	
	More than 20 years	12 (6.5%)	20 (14.5%)	
	Others	5 (2.7%)	0 (0.0%)	
	Total	186 (100.0%)	138 (100.0%)	
Number of company workers	Less than 50	62 (31.8%)	47 (34.1%)	0.668
	50 or more	133 (68.2%)	91 (65.9%)	
	Total	195 (100.0%)	138 (100.0%)	

## Running head: ISO 45001 AND HEALTH AND SAFETY IN SOUTH KOREA

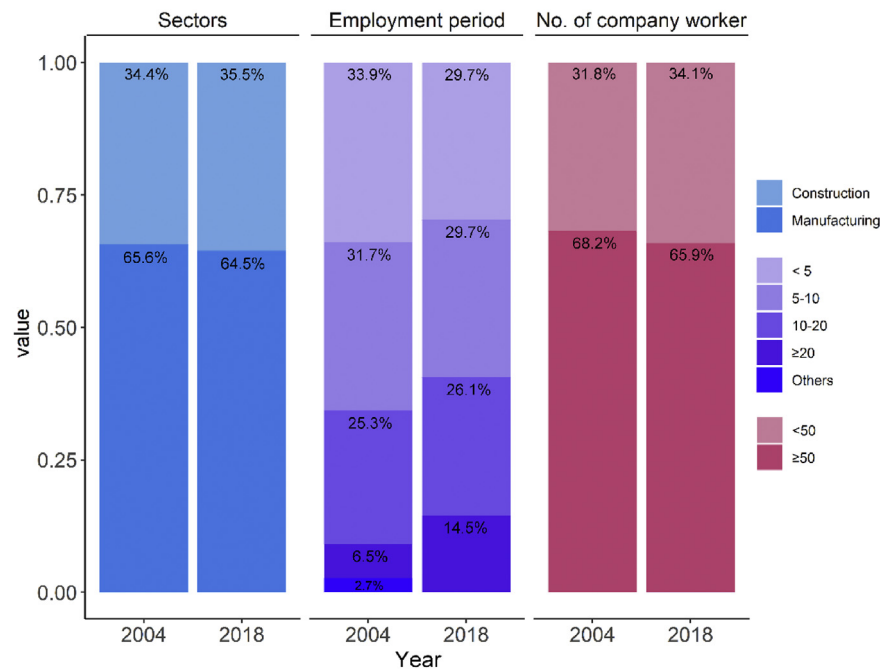


Fig. 1. Basic information of survey respondents in 2004 and 2018.

29.7% each. In 2004, 68.2% of respondents belonged to the sites with 50 workers or more. In 2018, 65.9% of respondents belonged to the sites with 50 workers or more. The  $p$  values for the basic information of the surveys were more than 0.05, indicating that the differences between two survey groups were not significant.

Participants' responses to the main purpose of the introduction of OHSMS are shown in Table 2. In 2004 and 2018, 57.4% and 52.2%, respectively, answered that the main purpose of implementing

OHSMS was to manage the root cause of health and safety risks. In the question of whether the main purpose of OHSMS was the "requirement of a systematic approach for accident prevention and continuous improvement," 82.1% answered "no" in 2004 and 73.9% answered "yes" in 2018. The  $p$  value was less than 0.05, indicating a statistically significant change in perception. When asked whether the main purpose of the introduction of OHSMS was "minimal active response to the health and safety requirements of

Table 2  
Motivation for developing OHSMS.

Category		2004 N (%)	2018 N (%)	$p$
Root cause management of health and safety risks	Yes	112 (57.4%)	72 (52.2%)	0.341
	No	83 (42.6%)	66 (47.8%)	
	Total	195 (100.0%)	138 (100.0%)	
A systematic approach is required for accident prevention and continuous improvement	Yes	35 (17.9%)	102 (73.9%)	0.000*
	No	160 (82.1%)	36 (26.1%)	
	Total	195 (100.0%)	138 (100.0%)	
Minimal active response to stakeholder's health and safety requirements	Yes	65 (33.3%)	91 (65.9%)	0.000*
	No	130 (66.7%)	47 (34.1%)	
	Total	195 (100.0%)	138 (100.0%)	
To meet the needs of the parent company or customer (buyer)	Yes	116 (59.5%)	56 (40.6%)	0.001*
	No	79 (40.5%)	82 (59.4%)	
	Total	195 (100.0%)	138 (100.0%)	
Company's autonomous response to various laws and regulations	Yes	85 (43.6%)	52 (37.7%)	0.280
	No	110 (56.4%)	86 (62.3%)	
	Total	195 (100.0%)	138 (100.0%)	
Responding to increased corporate social responsibility	Yes	91 (46.7%)	128 (92.8%)	0.000*
	No	104 (53.3%)	10 (7.2%)	
	Total	195 (100.0%)	138 (100.0%)	
To eliminate management risks due to health and safety issues	Yes	40 (20.5%)	22 (15.9%)	0.291
	No	155 (79.5%)	116 (84.1%)	
	Total	195 (100.0%)	138 (100.0%)	
To reduce management burden due to increased safety costs	Yes	61 (31.3%)	52 (37.7%)	0.224
	No	134 (68.7%)	86 (62.3%)	
	Total	195 (100.0%)	138 (100.0%)	

\*  $p < 0.05$ . OHSMS, occupational health and safety management system.

**Table 3**  
Problems in implementation of OHSMS.

Category	N		Average		Standard deviation		T value	p
	2004	2018	2004	2018	2004	2018		
Nominal certifications	94	70	3.53	3.17	1.267	.992	2.042	0.043*
Excessive cost of obtaining and maintaining certifications	84	71	2.65	2.77	1.103	1.098	-.676	0.500
Complicated documentation management	94	71	3.44	3.52	1.141	1.067	-.487	0.627
Noncompliance with existing OHSMS	93	71	3.23	2.94	1.095	1.054	1.662	0.099
No measurement of visible achievements	87	71	3.54	2.85	1.087	1.078	4.014	0.000*
Noncompliance with regulations	86	71	3.08	2.82	1.239	1.099	1.400	0.163
Not needed by external buyers	85	71	3.16	2.75	1.271	1.079	2.191	0.030*
No incentives	96	71	4.05	3.42	1.127	1.130	3.565	0.000*

\* $p < 0.05$

OHSMS, occupational health and safety management system.

stakeholders,” 66.7% answered “no” in 2004 and 65.9% answered “yes” in 2018, and the  $p$  value was less than 0.005. There was a statistically significant difference. In the question of whether the main purpose of OHSMS was “responding to increased corporate social responsibility,” 53.3% answered “no” in 2004 and 92.8% answered “yes” in 2018, and the  $p$  value was less than 0.05.

The results regarding problems in the implementation of OHSMS are shown in Table 3. Regarding the answer that the problem in the implementation of OHSMS was due to the “nominal certification,” the average response rate was 3.53 in 2004, and the 2018 average was 3.17, which was statistically significantly lower ( $p = 0.043$ ). The response to “excessive cost of obtaining and maintaining certification” was 2.65 in 2004 and 2.77 in 2018, but the difference was not significant. The response to “complicated documentation management” was 3.44 in 2004 and 3.52 in 2018, which was higher, but the difference was not significant ( $p = 0.627$ ). The response to “no measurement of visible achievements” was 3.54 in 2004, and the average in 2018 was 2.85, which was statistically significantly lower ( $p < 0.005$ ). The response to “no needs of external buyers” demand was 3.16 in 2004, and the average in 2018 was 2.75, which was statistically significantly lower ( $p = 0.030$ ). The response to “no incentives” was 4.05 in 2004, and the average in 2018 was 3.42, which was statistically significantly lower ( $p < 0.005$ ).

Answers for evaluating the effectiveness of implementing OHSMS are shown in Table 4. For the question on the effectiveness of each effect, the answers were interpreted on a scale of “very much,” 5 points, to “not very much,” 1 point; in consequence, the higher the score, the greater the effect.

For the effect of “effective on-site health and safety management,” there was a statistically significant difference between the average points of 2004 and 2018, which were 3.25 and 3.59, respectively ( $p = 0.008$ ). In terms of the “improving

quality and productivity” effect, the average response in 2004 was 4.13, and in 2018, 3.80, a statistically significant difference ( $p = 0.001$ ). In light of “improving safety consciousness of management,” the average response in 2004 was 3.91, and that in 2018 was 4.21 ( $p = 0.001$ ). There was a statistically significant difference in the “improving safety consciousness of workers” effect from 2004 to 2018, from 3.70 points to 4.01 points, respectively ( $p = 0.014$ ).

The reasons that respondents selected for the poor understanding and participation of employees are shown in Table 5. In 2004 and 2018, 54.9% and 93.5% of the respondents answered “yes” to the question of whether the employees had poor understanding and participation because of the “lack of worker health and safety education” ( $p < 0.05$ ). When asked whether the employees had poor understanding and participation because of the “lack of understanding of management system,” 82.1% of respondents answered “yes” in 2004 and 62.3% answered “yes” in 2018 ( $p < 0.05$ ). In 2004 and 2018, 51.3% and 97.1% of respondents answered that the reason for the low understanding and participation of employees was “lack of health and safety awareness of top management” ( $p < 0.05$ ).

Participants’ responses about the factors considered most necessary for effective OHSMS are shown in Table 6. In 2004, the supporting response rates were 48.7% for the “reduction of workers’ compensation insurance rate” accounted for the highest rate; 28.3% for “exemption from health and safety supervision;” 12.0% for “development of performance Indicator;” and 11.0% for “media promotion.” In the 2018 response, the “exemption from health and safety supervision” accounted for the highest rate at 39.1%; 38.4% for “reduction of workers’ compensation insurance rate;” 17.4% for “development of performance Indicator;” and 5.1% for “media promotion.”

**Table 4**  
Effectiveness of implementing OHSMS.

Category	N		Average		Standard deviation		T value	p
	2004	2018	2004	2018	2004	2018		
Prevention of accidents	191	138	4.07	3.92	.785	.913	1.629	0.104
Legal compliance	187	138	3.95	4.02	.795	.797	-0.843	0.400
Effective on-site health and safety management	184	138	3.25	3.59	1.146	1.065	-2.690	0.008*
Improving quality and productivity	188	138	4.13	3.80	.811	.889	3.441	0.001*
Improving safety consciousness of management	191	138	3.91	4.21	.838	.699	-3.420	0.001*
Improving safety consciousness of workers	189	138	3.70	4.01	1.266	1.014	-2.458	0.014*
Improving the company’s image	188	138	4.12	3.95	.838	.923	1.710	0.088

\* $p < 0.05$

OHSMS, occupational health and safety management system.

**Table 5**  
Reasons for the poor understanding and participation of employees.

Category		2004 N (%)	2018 N (%)	<i>p</i>
Operation of business centered on quality and production	Yes	142 (72.8%)	97 (70.3%)	0.613
	No	53 (27.2%)	41 (29.7%)	
	Total	195 (100.0%)	138 (100.0%)	
Lack of worker health and safety education	Yes	107 (54.9%)	129 (93.5%)	0.000*
	No	88 (45.1%)	9 (6.5%)	
	Total	195 (100.0%)	138 (100.0%)	
Lack of understanding of the management system	Yes	160 (82.1%)	86 (62.3%)	0.000*
	No	35 (17.9%)	52 (37.7%)	
	Total	195 (100.0%)	138 (100.0%)	
Lack of health and safety awareness of top management**	Yes	100 (51.3%)	134 (97.1%)	0.000*
	No	95 (48.7%)	4 (2.9%)	
	Total	195 (100.0%)	138 (100.0%)	
Lack of consciousness of participation by middle managers	Yes	153 (78.5%)	112 (81.2%)	0.547
	No	42 (21.5%)	26 (18.8%)	
	Total	195 (100.0%)	138 (100.0%)	

\**p* < 0.05

\*\*Fisher's exact test was performed with an expected frequency of less than 5 (50.0%).

**Table 6**  
How to activate OHSMS.

Category	How to activate OHSMS				Total	<i>p</i>
	Reduction of workers' compensation insurance rates	Media promotion	Exemption from health and safety supervision	Development of performance indicators		
2004	93 (48.7%)	21 (11.0%)	54 (28.3%)	23 (12.0%)	191 (100.0%)	0.021*
2018	53 (38.4%)	7 (5.1%)	54 (39.1%)	24 (17.4%)	138 (100.0%)	
Total	146 (44.4%)	28 (8.5%)	108 (32.8%)	47 (14.3%)	329 (100.0%)	

\**p* < 0.05

OHSMS, occupational health and safety management system.

#### 4. Discussion

The scope of business management has expanded in the 21st century while management paradigms have shifted to global management. A company's health and safety management is no longer recognized as a moral problem but as a new management tool to secure transparency, productivity, and competitiveness [4,8]. Accordingly, OHSMS certification is increasingly seen as a key to responsible corporate competitiveness through its stimulation of management processes [8]. The purpose of standards is to accommodate the changing environmental and social demand surrounding a company. As corporate social responsibility gains importance, emphasis is placed on the purpose of ISO45001: to provide application guidance for organizations that enables them to improve their Occupational Health & Safety (OH&S) performance to prevent work-related injuries and/or ill health to workers and to provide safe and healthy workplaces [16,17]. The purpose of OHSAS18001 was to enable organizations to control their OH&S risks and improve their OH&S performance [18]. ISO45001 is more focused on prevention and sustainability, reflecting increasingly complex organizational environments [19]. In this study, we attempt to determine whether this changed environment changed awareness and increased demands for OHSMS. Changes in the perception of OHSMS were reviewed, and plans for the successful introduction of ISO45001 were derived.

The response to the motivation of OHSMS implementation shows interesting results. There were four items with statistically significant differences: "a systematic approach is required for accident prevention and continuous improvement," "active response to stakeholder's health and safety requirements," "to meet the

needs of the parent company or customer (buyer)," and "responding to increased corporate social responsibility." The need for a systematic approach for accident prevention and continuous improvement and the response to the increase in corporate social responsibility have increased in 2018 compared with 2004, while the number of respondents who answered that OHSMS was introduced for satisfaction of the parent company or buyer decreased significantly.

In addition, the 2018 survey responded to the motivation for introducing OHSMS as a "root cause management of health and safety risks" and "active response to stakeholder's health and safety requirements." The percentage of respondents who answered "yes" in 2018 was low when the motivation for introducing OHSMS was "company's autonomous response to various laws and regulations," "eliminate management risks due to health and safety issues," and "reduced management burden due to increased safety costs."

This suggests that enhanced social demand and various stakeholders (not only buyers), or social responsibility, are perceived as the motivation for the introduction of OHSMS rather than legal satisfaction or customer demands. In other words, it suggests that the number of cases have been increased in which OHSMS have been introduced by understanding the fundamental purpose of the safety and health management system by exceeding the legal compliance. Just as ISO45001 more clearly identified social demand than OHSAS18001, people's perception is changing to meet the social demand. However, "eliminate management risks due to health and safety issues" or "reduced management burden due to increased safety costs" has not been revealed as a motivation factor. This seems to be due to the fact that the OHSMS's merit of being able to integrate the requirements of occupational health and

safety with the business system and keep the objectives of the occupational health and safety aligned with the business objectives is not yet recognized [5,20]. As an advantage of introducing the OHSMS, it is important to focus on the fact that occupational health and safety can be integrated into an organization's business.

In response to the question of whether there was a problem with the introduction of OHSMS, both 2004 and 2018 survey respondents reported a problem. In 2018, respondents reported that nominal certification, no measurement of visible achievements, no need of external buyers, and no incentives were a significant problem in implementing OHSMS. The proportion of respondents who reported a problem higher in 2018 than in 2004 was "excessive cost of obtaining and maintaining certification" and "complicated documentation management." To successfully introduce ISO45001, it is necessary to lower the cost of certification and not complicate the document management system. The high-level structure will ensure better compatibility and systems governance, making the implementation within the organization a lot smoother [21].

The recognition of the effectiveness of implementing OHSMS was as follows. In 2018, the proportion of respondents who reported the terms of "effective on-site health and safety management," "improving safety consciousness of management," and "improving safety consciousness of workers' increased significantly. In 2018, the item with a statistically significant lower response rate was "improving quality and productivity." It can be estimated that the level of recognition has been increased in line with the purpose of OHSMS [22].

In 2018, a high proportion of respondents stated that all workers understand and participate in OHSMS-related tasks related to their work. There were three items with statistically significant differences: "lack of worker health and safety education," "lack of understanding of the management system," and "lack of health and safety awareness of top management." Among them, the number of respondents who answered that poor employees' understanding and participation were induced by lack of worker education and health and safety awareness of top management increased significantly. According to a study by Choi et al [13], the lack of understanding of workers was the main reason for the lack of awareness of the top management. In 2018, the perception on the importance of the top management role is still high and more emphasized. To encourage the participation of workers, the safety and health awareness of the top management is important. This is because the ultimate responsibility for safety and health rests with top management, and leadership and commitment of top management are the most important to achieve health and safety performance [14].

In 2004, the "reduction of workers' compensation insurance rate" was the highest, and the "exemption from health and safety supervision" increased in 2018. When introducing the ISO 9000 quality management system, the domestic quality management system was revitalized by actively encouraging the introduction of quality management certification by the government as well as the parent company and providing incentives [23]. In addition, the example of the Voluntary Protection Programs in the United States is recommended to be introduced because it provides convenience such as supervision and relaxation [24]. However, it is necessary to recognize that worker satisfaction through accident prevention and imperative performance brings more benefits than quality and productivity.

The results of the other survey items showed that the level of awareness of the relevant officials increased, but this may seem contradictory as the OHSMS activation plan still require incentives. However, this survey may be limited because it was conducted with site managers only. In addition, when using the questionnaire designed in 2004, it seems that the questionnaire was not provided

to reflect the strengthened social demand for safety. In further studies, more advanced opinions can be heard by using techniques such as interviews on how to promote OHSMS and improve the certification system.

As mentioned before, the participants in the survey were limited to site managers only. In further studies, it would be better to hear a variety of opinions, such as site managers, top managements, workers, auditors, academics, and experts. As shown in Table 1, the *p* value of the employment period of two groups was 0.051. Although it is not statistically significant, the difference is only 0.001, which can be seen as a limitation of the study.

**5. Conclusions**

The purpose of this study was to examine differences in perceptions and in the demand for OHSMS due to changes in corporate environments and social demand since the implementation of OHSAS18001. The findings were also used to derive a plan for the successful introduction of ISO45001. For this purpose, surveys were conducted in 2004 and 2018 on respondents' recognition of the introduction and implementation of OHSMS, and the results of each year were compared.

We found that respondents believed the objective of implementing OHSMS has been changed to accommodate social demand, which is consistent with the objective of introducing ISO45001. However, there was still a limitation that OHSMS was not considered in connection with safety management. The factors that lowered workers' participation in and understanding of OHSMS are factors such as "lack of worker health and safety education" and "lack of health and safety awareness of top management." To revitalize OHSMS, incentives such as lowering workers' compensation rates and exemption from health and safety supervision should be implemented. Therefore, for the effective introduction and implementation of ISO45001, emphasis is placed on social demand, training to recognize health and safety as a part of management, and the reduction of certification and consulting costs to promote the introduction of OHSMS. In addition, incentives such as insurance premium cuts and exemptions from health and safety supervision are strongly recommended.

**Conflicts of interest**

All authors have no conflicts of interest to declare.

**Acknowledgments**

This study did not receive any grants from funding agencies in the public, commercial, or not-for-profit sectors.

**Appendix. Questionnaire**

*General information.*

Sectors	Manufacturing Construction
Employment period	Less than 5 years 5–10 years 10–20 years More than 20 years Others (_____)
Number of company workers	Less than 50 50 or more

1 What is the motivation for developing OHSMS?

- (a) Root cause management of health and safety risks
  - (b) A systematic approach is required for accident prevention and continuous improvement
  - (c) Minimal active response to stakeholder's health and safety requirements
  - (d) To meet the needs of the parent company or customer (buyer)
  - (e) Company's autonomous response to various laws and regulations
  - (f) Responding to increased corporate social responsibility
  - (g) Eliminate management risks due to health and safety issues
  - (h) To reduce management burden due to increased safety costs
- 2 If you stated that there are problems, what kind of problems do you mean?
- (a) Nominal certifications
  - (b) Excessive cost of obtaining and maintaining certifications
  - (c) Complicated documentation management
  - (d) Noncompliance with existing OHSMS
  - (e) No measurement of visible achievements
  - (f) Noncompliance with regulations
  - (g) Not needed by external buyers
  - (h) No incentives
- 3 What is the effectiveness of implementing OHSMS?
- (a) Prevention of accidents
  - (b) Legal compliance
  - (c) Effective on-site health and safety management
  - (d) Improving quality and productivity
  - (e) Improving safety consciousness of management
  - (f) Improving safety consciousness of workers
  - (g) Improving the company's image
- 4 What are the reasons for the poor understanding and participation of employees?
- (a) Operation of business centered on quality and production
  - (b) Lack of worker health and safety education
  - (c) Lack of understanding of the management system
  - (d) Lack of health and safety awareness of top management
  - (e) Lack of consciousness of participation by middle managers
- 5 How to activate OHSMS
- (a) Reduction of Workers' Compensation insurance rates
  - (b) Media promotion
  - (c) Exemption from health and safety supervision
  - (d) Development of performance indicators

## References

- [1] Grimaldi J, Simonds R. *Safety management*. IRWIN; 1989.
- [2] Redinger C, Levine S. *Occupational health and safety management system performance measurement*. AIHA Press; 1999.
- [3] Yoon SJ, Lin HK, Chen G, Yi S, Choi JW, Rui Z. Effect of occupational health and safety management system on work-related accident rate and differences of occupational health and safety management system awareness between managers in South Korea's construction industry. *Saf Health Work* 2013;4: 201–9.
- [4] BS 8800. *Guide to occupational health and safety management systems*. BSI; 2004.
- [5] Lacey J, Jones R. *ISO45001 and the evolution of occupational health and safety management systems*. IOSH; 2016.
- [6] Health and safety Practitioner [Internet], Green R. *ISO45001: the definitive international standard* [cited 2019 Sep 18]. Available from: 2014. [www.shponline.co.uk/ask-professionals-iso-45001/](http://www.shponline.co.uk/ask-professionals-iso-45001/).
- [7] Kang SM, Lee IB, Yoon SJ, Jung JW, Cho KS. *A study on the improvement plan through the survey of the Korean health and safety management system (KOSHA 18001)*. KOSHA; 2018.
- [8] Lee GH, Yoon SJ, Choi JW, Yoon MR. *Study on the revitalization of occupational health and safety management system for companies*. In: *Proceedings of 2005 KOSOS Spring Conference 2005*. p. 191–6.
- [9] Lee JS, Lee MG, Lee DY, Oh TK. *A study on the improvement of effectiveness of KOSHA 18001 in Construction Industry*. *J Korean Soc Saf* 2015;30: 80–4.
- [10] *Joint ministries. Plans to prevent serious industrial accidents*; 2017.
- [11] Hyun-ju Ock. *Death of subway worker triggers wave of protests* [cited 2020 July 15]. Available from: The Korea Herald. 2016. [http://www.koreaherald.com/view.php?ud=20160605000257&ACE\\_SEARCH=1](http://www.koreaherald.com/view.php?ud=20160605000257&ACE_SEARCH=1).
- [12] Park Ju-young. *Government apologizes for Taean power plant tragedy, promises to prevent reoccurrence* [cited 2020 July 15]. Available from: The Korea Herald. 2018. [http://www.koreaherald.com/view.php?ud=20181217000807&ACE\\_SEARCH=1](http://www.koreaherald.com/view.php?ud=20181217000807&ACE_SEARCH=1).
- [13] Choi JW, Seok JY, Lee SJ, Kim HS, Yang HS. *A Study on the revitalization of occupational health and safety management system for companies*. OSHRI; 2004.
- [14] Rajaprasad S, Chalapathi P. *Factors influencing implementation of OHSAS18001 in Indian construction organizations: interpretive structural modeling approach*. *Saf Health Work* 2015;6:200–5.
- [15] Bevilacqua M, Ciarapica FE, Sanctis I. *How to successfully implement OHSAS18001: the Italian case*. *J Loss Prevent Proc Ind* 2016;44:31–43.
- [16] BSI. *BS ISO45001:2018 Occupational health and safety management systems. Requirements with guidance for use*; 2018.
- [17] Darabont DC, Moraru RI, Antonov AE, Bejinariu C. *Managing new and emerging risks in the context of ISO45001 standard*. *Sustainable Dev Qual Innovat Eng Res* 2017;18:11–4.
- [18] OHSAS Project group. *OHSAS18001:2007, Occupational health and safety management systems – Requirements*; 2007.
- [19] Field K. *The world's first global health and safety management system*. BSI; 2018.
- [20] Jung JW. *ISO45001 enactment trend and countermeasures*. *Korean Industrial Health Association*; 2017.
- [21] Kleinová Renáta, Szaryszová Petra. *The new health and safety standard ISO45001:2016 and its planned changes*. *Int J Interdisciplinarity Theory Prac* 2014;3.
- [22] Energy Institute. *HSE Understanding your culture*; 2008.
- [23] Han JG, Kim KT, Park HG. *A study on the application of ISO 9001: 2000 in Domestic Construction Industry*, vol. 20. *Architectural Institute of Korea*; 2002. p. 515–8.
- [24] *Occupational Safety and Health Agency. OSHA Instruction CSP 03-01-005*; 2020.