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The effect of integrated management system on safety and productivity indices: Case study; Iranian cement industries

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ABSTRACT

Nowadays, with implementation of management systems and environment management and due to the influence of safety and health issues on working processes, organizations have also sought to acquire health and safety management systems. This study which aims to examine the influence of integrated management system on safety and productivity indices has retrospective experimental nature. It was conducted in Cement Factories in which three systems are used: quality, environment and safety systems. The collected data were: accident reports and the investigation of events in 6 years during 2005–2010 (3 years before and 3 years after the implementation of the system). The safety indices that used in this study are: IFR, ISR, FSI, and Safe *T*. Score. Then, the data analyzed with the *T*-test, mean and standard deviation. The results showed a significant difference between various safety indices before and after the implementation. The examination of production indices such as increasing rate of productivity and production indicates the influence of these systems on production and productivity indices. The results have showed that the safety system existence cannot ensure productivity increase. Indices definition can be helpful for the safety system effectiveness and system continual improvement. It is important to say that there might be various indices definition in different industries.

1. Introduction

1.1. IMS system

Health and safety standards have improved in various production and service organizations in 20th century. Seeking to achieve a better performance, organizations have implemented quality management as well as HSE-Q (health, safety, environment and quality) systems (Whitelaw, 2004; Bernardo et al., 2009; Zeng et al., 2007). These organizations have developed integrated management system (IMS) (ISO-9001, ISO-14001 and OHSAS-18001) to acquire and save their resources. In many companies, quality, health and safety and environmental management exist as three parallel systems (Fig. 1). Therefore, an IMS should integrate all currently formalized systems focusing on quality, health and safety, environment, personnel, finance, security, etc. What this means is that all the processes and the documents that describe them would be integrated. In IMS, daily work means not only correct running of plants, but also safety management of hazardous materials and the proper management of wastes including dead products at the end of their useful lifetimes.

Quality, environmental and health and safety managements are aspects of the same organization (Fresner and Engelhardt, 2004; Whitelaw, 2004). Ofori et al. believed that on acquiring ISO-9001, an organization can be qualified for receiving ISO-14001 through making minor revisions in the former, namely ISO-9001; hence, both can be implemented simultaneously by the process of integration (Ofori et al., 2002). In 2004, Tam et al. published a paper in which they considered the similarities and consistency among management systems as the main reason behind the combination and integration of systems (Tam et al., 2004). The integrated system has been defined differently in relevant literature. In 2009, Bernardo et al. considered many organizations which require implementing an IMS jointly, in parallel or sequentially, with other management systems (Bernardo et al., 2009). When this happens, there is an option of integrating all the systems in a single IMS. In 2007, Zeng et al. considered this system as a degree of adaptation in organizations (Zeng et al., 2007). Fresner and Engelhardt defined this system as a clear and rapid improvement in the performance of quality, environment, safety and health (Fresner and Engelhardt, 2004). Bragatto looked at this system as an integrated management system which is deemed as the most effective method to manage the affairs (Bragatto et al., 2007). Generally, the integrated management can be considered as an attempt to create a single management system which is built base on interrelationships among the various management systems with a focus on

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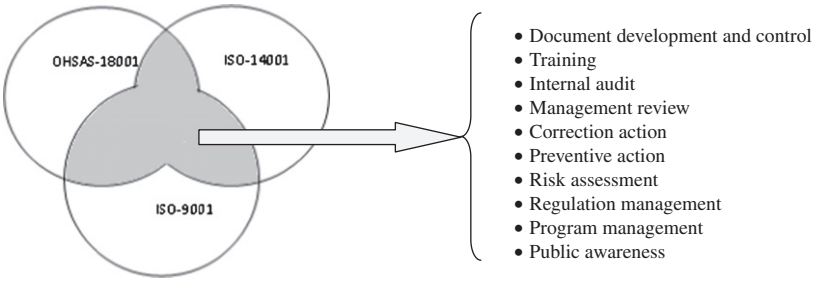

Fig. 1. Integrated management system.

effectively satisfying the needs of interest groups. In 2005, many concepts of IMS were discussed by Bobreck and Sokovic. They were essential for achieving quality. Singapore productivity and standard board have announced that there is high potentiality to implement this system in Singapore's cement production sector. The board believes that IMS is useful in cement sector for producing a product of quality with the least cost (Bobrek and Sokovic, 2005). Bernado have pointed to the increasing number of organizations adopting these systems. This is an indication of efficient managers who believe that integrated system can bring to all sections of organizations (Bernardo et al., 2009). In 2007, Zeng applied the same system to Chinese industry in order to promote the safety. They asserted that one needs to use these systems in combination with quality management systems for the purpose of achieving higher effectiveness (Zeng et al., 2007). In addition, there are several good reasons for integration, to:

- Reduce duplication and therefore costs.
- Reduce risks and increase profitability.
- Balance conflicting objectives.
- Eliminate conflicting responsibilities and relationships.
- Diffuse the power system.
- Turn the focus onto business goals.
- Formalize informal systems.
- Harmonies and optimize practices.
- Create consistency.
- Improve communication.
- Facilitate training and development.

1.2. The effects of IMS

Seeking to ameliorate the environmental effects of companies, Fresner and Engelhardt proposed the clean strategy whose implementation was possible by IMS (Fresner and Engelhardt, 2004). In 2008, Casadesus considered this system necessary due to the existence of many internal and external stimuli (Casadesus et al., 2008). They explained variety of the factors influencing safety and environmental conditions of companies in which we used integrate management systems to achieve a quality and environment-friendly product. In 2004, having studied the safety conditions in Chinese cement industry, Tam et al. concluded that there was a high rate of accidents in this section. They maintained that government regulations and the implementation of programs such as IMS could considerably reduce the number of accidents (Tam et al., 2004). In 2005, Teo et al. conducted some researches on cement industry in Singapore, and found inappropriate policy, unsafe actions and the employees' low attitudes toward safe behavior and insufficient commitment that mangers have toward their organizations. They offered IMS as a solution to overcome these shortcomings (Teo et al., 2005). According to the article which was published by Celik, "Integrated management system can decrease the bureaucratic formalities; hence indication of the system efficacy can contribute to the organizations" (Celik, 2009a,b). Celik believed that integrated management system could reinforce the senior managers' credibility. These managers appeal to IMS in order to improve their social and professional profile. In 2005, Yeung and Mok pointed out that the implementation of integrated management system may be inspired by a drive to improve standards (Yeung and Mok, 2005). In 2007, Muniz et al. claimed that safety management system and its integration with other management systems were the most effective method through which resources could be allocated to safety measures (Muniz et al., 2007). Muniz's study on Spanish industries (2007–2009) concluded that Spain suffers from low safety standards in industry hence proposing safety management system and its integration with other management systems (Muniz et al., 2009). Labodova said that IMS is useful and plausible in all organizations (Labodova, 2009). Salomone's study on 104 Italian companies showed the effect of factors such as structure, size and economy on the integration of management systems (Salomone, 2008). Karapetrovic and Casadesus (2009) studies on 176 Spanish companies showed some influential factors including; range of systems application, the sequence of systems application, the time needed for systems to be implemented and the range of systems integration (Karapetrovic and Casadesus, 2009). In 2008, Zeng et al. studied the sequence in which systems are used as well as the factors that influencing the implementation of IMS in 104 Chinese companies. They came to the conclusion that all companies (100%) have initially adopted a quality management system followed by management systems of other disciplines (Zeng et al., 2008). Battini et al. Claimed that environmental and technological variables affect on ergonomics and productivity (Battini et al., 2011). The factors which are influencing the implementation in the companies were given as the following: internal factors including human resources, organizational structure, organizational culture, perceptive factors, external factors including technical guidelines, licensing organizations, shareholders, customers and organization contexts (Zeng et al., 2008; Fernandez-Muniz et al., 2007). In 2010, Abbaspour et al. claimed that HSE system and its integration with other management systems are the most effective methods to achieve a quality and environment-friendly product (Abbaspour et al., 2010). This study is descriptive-analytic one which reviews past literature. The hypotheses which have examined in this study are as follow:

H_1: IMS system implementation has positive impact on the human productivity.
H_2: IMS system implementation has positive impact on the production quality.
H_3: IMS system implementation has positive impact on the losses decline.
H_4: IMS system implementation has positive impact on personnel's complaints decrease.
H_5: IMS system implementation has positive impact on the personnel's absence decrease.

H_6: IMS system implementation has positive impacts on the accident decrease.

1.3. Cement industries in Iran

One of the biggest industries in Iran is cement production. Having daily cement with the output of 9000 tons (taking account of mixed cement) and the average of staff population of each factory was 600. The cement production factories are considered as one of the biggest and the most dangerous companies in Iran. Thus, it is very essential to take advantages of the latest managerial methods and strategies for the sake of offering better products and services as well as protecting environment and promoting safety standards. This study seeks to analyze the safety indices before the implementation of integrated management system (which integrates three systems of quality management (ISO-9001), environment management (ISO-14001) and safety system (OHSAS-18001; 2007) and those safety indices achieved after the implementation phase. The study was done in all of active cement industries in Iran within the time span of 2005–2010. This study which aims to examine the influence of integrated management system on safety and productivity indices has a retrospective experimental nature.

2. Methodology

2.1. Materials and methods

This study which is retrospective descriptive-analytic in nature was conducted in four cement production companies, drawing on the data collected in 6 years during 2005–2010. There were four active cement industries in Iran during 2005–2010 which Implemented IMS management system. The workers number in each company and demographics of the companies under study are shown Table 1.

The aim of this study is to determine IMS role in safety indices and productivity. To this end, the statistical indices were investigated 3 years before and 3 years after the IMS implementation. Number of accidents which investigated in all of companies was 1093 in 6 years during 2005–2010.

The companies under study received the IMS license and implemented the system between 2007 and 2008. The effect of quality (ISO-9001), health & safety (OHSAS-18001) and environment (ISO-14001) management systems on production were studied, using the data and statistical information given by the companies. The most important data were: injury frequency rate (IFR), injury severity rate (ISR), combined indices such as frequency severity indicator (FSI) and Safe *T*. Score and production indices which are the production level and productivity index (Revelle and Stephenson, 2005). Managerial and cultural indices are counseling hours per person, the number of joint meetings with other supervisors, training hours per person, the use of personal protection equipment (PPE) and how the personnel use PPE which all of them were done randomly. *T*-test as well as statistical indicators of mean and standard deviation was used to analyze the results.

Table 1
Demographic of the companies under study.

Company No.	Number of workers	Average of age	Average of years of service	Percentage of unlettered (%)	Production rate (kg/day 1000)
1	650	39.5	18	6.5	8.5
2	610	38	16.3	9	6.5
3	625	37.7	15.1	8	7.2
4	583	36.1	14.5	7	6.4

2.2. Indices definitions

2.2.1. Safety and health indices

2.2.1.1. IFR_{osha}. Injury frequency rate is defined in relation to the rate of accident in 200,000 work hours. The index is calculated in Eq. (1) (see OSHA 1996 standard http://www.bls.gov/news.release/osh.toc.htm) (Revelle and Stephenson, 2005; Asfahi and Rieske, 2010).

$$\mathrm{IFR_{osha}} = \frac{a_{cn} \times 200,000}{n \times \text{total time}} \tag{1}$$

where $\mathrm{IFR_{osha}}$: Injury frequency rate; a_{cn}: Total number of injuries and accident (number); $n \times$ total time: Number of hours worked by all employees; n: Number of employees; total time: Total time of work in a year (h); 200,000(Ref value): 100 (number of worker) $*$ 40 (number of working hours per week) $*$ 50 (number of working weeks a year).

2.2.1.2. $ISR_{(osha)}$. Injury severity rate is defined in relation to the number of loss a day caused accident in 200,000 work hours. The index is calculated in Eq. (2) (see OHSA 1996 standard: http://www.bls.gov/news.release/osh.toc.htm) (Asfahi and Rieske, 2010).

$$\mathrm{ISR_{osha}} = \frac{D_l \times 200,000}{n \times \text{total time}} \tag{2}$$

where $\mathrm{ISR_{OSHA}}$: Injury severity rate; D_l: Total loss times that are caused accident (day); $n \times$ total time: Number of hours worked by all employees; n: Number of employees; total time: total time of work in a year (h); 200,000(Ref value): 100 (number of worker) $*$ 40 (number of working hours per week) $*$ 50 (number of working weeks a year).

2.2.1.3. FSI. The index is an integrated indicator between IFR and ISR. This index is calculated in Eq. (3) (see ANSI z16.1 standard).

$$\mathrm{FSI} = \sqrt{\frac{\mathrm{IFR} \times \mathrm{ISR}}{1000}} \tag{3}$$

where FSI: Frequency severity indicator; IFR: Injury frequency rate; ISR: Injury severity rate.

2.2.1.4. Safe T. Score. The Safe *T*. Score technique, which employs the results of accident frequency rate calculation, goes beyond basic math. It makes use of the statistical analysis technique referred to as the student's *t*. The index is defined in Eq. (4). The value of Safe *T*. Score was showed in Table 2 (Zeng et al., 2008).

$$\text{Safe T. Score} = \frac{\mathrm{IFR_{new}} \times \mathrm{IFR_{last}}}{\sqrt{\frac{\mathrm{IFR_{last}}}{\text{total time}/200,000}}} \tag{4}$$

where $\mathrm{IFR_{new}}$: Injury frequency rate in this year; $\mathrm{IFR_{last}}$: Injury frequency rate in last year; total time: Total time of work of "n" worker in a year (h); n: Number of employees; 200,000(Ref value): 100 (number of worker) $*$ 40 (number of working hours per week) $*$ 50 (number of working weeks a year).

Table 2
The procedure for assessing Safe *T*. Score.

Safe *T*. Score rate	Assessing
−3 to +3	No significant different between this year and last year
Less than −3	Significant decrease in the number of accidents in this year compared with that in the last year
More than +3	Significant increase in the number of accidents of this year compared with that in the last year

Age: Years of services:	Type of job: manager ☐ Supervisor ☐	Company name: Section name:	
Safety Training subject:			
No.	Question	Yes	No
1	Do you Know the integrated management system?		
2	Has training program affected in your Worker task?		
3	Did worker safety behavior change after safety training		
4	Does the safety program caused to change your safety behavior?		
5	Did your worker use PPE in work place?		
6	Is PPE obligated in your work place? Do you agree with it?		
7	Is number of accident decreased in your work place		
8	Was The safety training course effectiveness?		
9	Is your worker know, safety program is required in your work place?		
10	Is Worker believed to work permits system?		

Fig. 2. Effectiveness training questionnaire.

2.2.1.5. How to use PPE. The index was defined as the number of accident reports due to abused PPE. There are numerous models for accident investigation; e.g. Domino model, Bow-tie model, and Human factor model (Hale et al., 2007). In Bow-tie model emphasis falls on effectiveness of safety and control layers. In Human factor model, as Lund and Aaro (2004) maintain, human errors, particularly in design and implementation phases, are highlighted. One of the best models to utilize in order to identify the major sources of accidents in individual's behavior as well as his attitudes towards a safety issue is Domino model. This model determines the hierarchy of causes through which the source of accidents is identified (Lund and Aaro, 2004). The index was measured using Domino accident investigation method. In Domino model, the cause of accidents is distinguished. One of the most important causes of accident was PPE abused. The percentage of accident was reported because abused PPE is the rate of the index.

2.2.1.6. Particulate matter exposure. The level of exposure with cement particulate matter.

2.2.2. Quality management indices

2.2.2.1. Production rate. This index is defined in:

$$P_r = \frac{P - P_d}{t} \tag{5}$$

where P_r: Production rate (ton/day); P: Rate of production in one day (ton); P_d: Rate of production damage in one day (ton); t: Total time of work in a day.

2.2.2.2. Human productivity. This index is defined in:

$$\mathrm{HP}r_r = \frac{P - P_d}{n \times t} \tag{6}$$

where $\mathrm{HP}r_r$: Human productivity; P: Rate of production in one day (ton); P_d: Rate of production damage in one day (ton); t: Total time of work in a day; n: Number of employees.

2.2.2.3. Consultation man hour. This index is defined in:

$$C = \frac{\sum_{i=1}^{n} n_{ci} \times T_{ci}}{n \times t} \tag{7}$$

where C: Total time of consultation hour per man; n_{ci}: The number of employees present in i consultation meeting; T_{ci}: The total time of i meeting; t: Total time of work in a day; n: Number of employees.

2.2.2.4. Short term education man hour. Short-term programs greatly expand study participation by attracting students from groups that are less likely to study abroad for a semester or full year, whether for financial, academic or personal reasons. This includes students from underrepresented groups, such as ethnic minorities, first generation students, and non-traditional students, students in fields with extensive course requirements, community college students, student athletes and males. Well designed short-term programs can have a profound impact on participants and may provide students with an initial experience that encourages them to consider future study or work overseas.

At last, "Short-term education" is defined as any education program that is eight weeks or shorter. Short term education man hour is defined as the time of short term education for a man in a year. This index is defined in:

$$\mathrm{Ed}_{\text{short term}} = \frac{\sum_{i=1}^{n} n_{ei} \times T_{ei}}{n \times t} \tag{8}$$

where $\mathrm{Ed}_{\text{short term}}$: Education man hour; n_{ei}: The number of employees was trained in safety short training course ith in education (e); T_{ei}: The total time of safety short training course ith in education (e); t: Total time of work in a day; n: Number of employees.

2.2.2.5. Effectiveness training index. This index measured by a questionnaire. Questionnaire was asked about the measure of human performance increased after training. The change of worker safety behavior, increase of safety culture and workers cooperation in safety programs are effectiveness training indices. Supervisors grant a concession to each question (between 1 and 100). Average of scores was effectiveness training index. The questionnaire has been showed in Fig. 2.

As Fig. 2 shows, individual's safety behaviors and beliefs have been questioned to measure the safety training course effectiveness which is held in the organization. In this regard, after 3 months of holding training course, this questionnaire was sent to related supervisor and asked him to fill out the questionnaire and send it to HSE unit for the trained person. If supervisor's responses are positive for a person, it means trainings are effective. And if one the responses are not positive, it means training is not effectiveness.

2.2.3. Environmental indices

2.2.3.1. Stack emission. The average of concentration of PM in stack outlet in a year.

2.2.3.2. Percentage of complaint of neighbor of company. The percentage of complaint of occupant of town of near of company. For this purposed, the question was inquired into inconvenience company air pollution.

3. Results

As Fig. 3, personnel agreement percentage in the 4th company compared to the other companies is lower. As Fig. 3 shows, in all

under-studied companies, 85.6% of the personnel have had positive responses regarding the effectiveness of the integrated management system implementation. The survey showed that the 4th company personnel have participated in the safety program for horror. They have not believed them. So that, management or safety department press to them was caused that they did safety programs at their work. However, personnel of other companies consider the program as a part of their work.

One of the part of IMS system is training. Also one of the sub-clause of IMS systems is "competence, training and awareness" This sub-clause is designed to enable an organization not only to identify training needs, as appropriate, but also to measure the success of that training. For assessing this part of IMS system, Training hours per person and training effectiveness rate indices was defined. Fig. 4 shows the same index in the years preceding and those following IMS implementation. As the figure shows, there is a significant difference between the average number of training hours per person before IMS implementation and those achieved after IMS implementation ($p < 0.05$).

The number of training hours per person in itself cannot represent the improved knowledge and performance of an industrial company. The training effectiveness as an influential index has been confirmed in safety management systems. Fig. 5 shows the results. There is a significant difference between the training efficacy index before IMS implementation and that achieved after IMS implementation ($p < 0.05$).

A consulting man hour's index received by each person was developed to investigate the cooperation between employees and

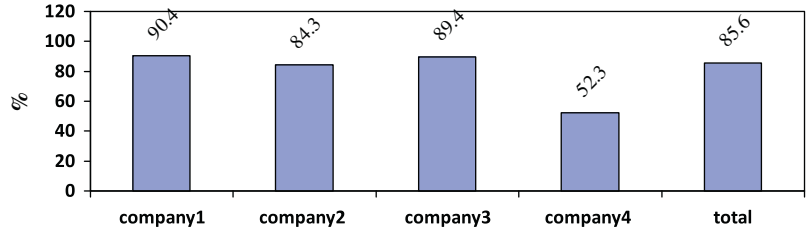

Fig. 3. Personnel satisfaction percentage of the IMS system in under-studied companies.

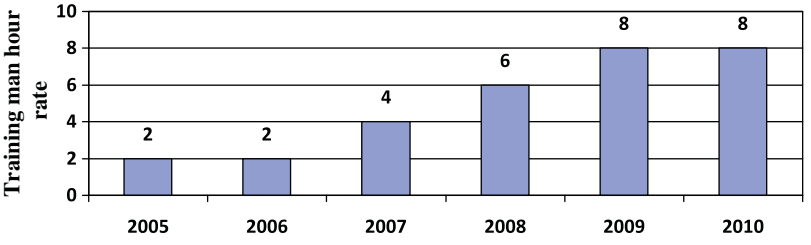

Fig. 4. Average of training hours per person in Cement Factories during 2005–2010.

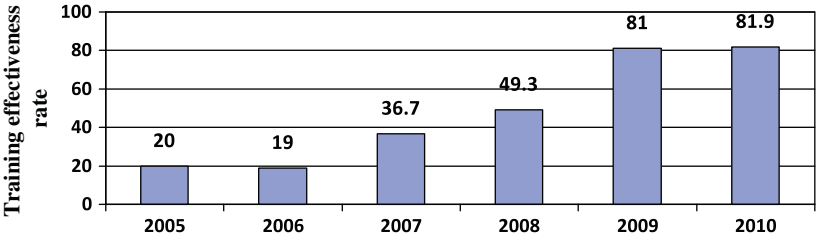

Fig. 5. Average of training effectiveness index rate in the Cement Factories during 2005–2010.

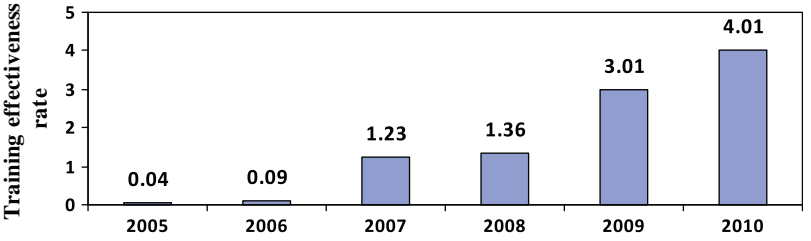

Fig. 6. Consulting man hours average in the Cement Factories during 2005–2010.

management. The result was showed in Fig. 6. This index was developed based on the ratio of the number of sessions and the people who attended the sessions to the time each session took. The high rate indicates that managers are more attentive to the employees' ideas and opinions.

The number of accidents was happened during 2005–2010 was showed in Table 3. The same progressive trend can be observed in the following years. The Injury frequencies associated with different years were also examined (Fig. 7). As the figure illustrates, injury frequency rate (IFR) was decreased by the IMS system. There is a statistically significant difference between the frequencies of injury before IMS implementation and those observed after safety system implementation ($p < 0.05$).

As the Fig. 8 was showed that there was significant deferent between IFR in Company 1, 2 and 3 during 2005–2010 ($p < 0.05$). In Company 4 there was not significant deferent between IFR during 2005–2010 ($p > 0.05$). The most important cause was that the 4th company personnel have participated in the safety programs for horror. They did not believe to safety programs. So that, management or safety department press to them was caused that they did safety programs at their work.

The injury severity rate index associated with different years was investigated (Fig. 8). As Fig. 9 shows, the index decreases in the years following the safety system implementation. The same trend continues in the following years. As the diagram shows, following the safety system implementation, severity magnitude is constantly decreased. There is a significant difference between severity magnitude before IMS implementation and after IMS implementation ($p < 0.05$).

The FSI associated with different years was investigated too (Fig. 10). Using paired *T*-test, it was showed a significant difference between the years before safety system implementation and after

Table 3
Number of accidents in various units of cement industries.

No.	Unit	Number of accidents during consecutive years in different units					
		2005	2006	2007	2008	2009	2010
1	Pre-heater	10	7	5	4	3	2
2	Furnace	8	12	10	9	5	2
3	Cement mill	8	9	8	7	4	2
4	Diesel oil heater	12	11	10	9	5	3
5	Cleaner strip	9	7	7	5	3	1
6	Cleaner warehouse	8	5	5	4	2	2
7	Packaging	6	3	3	3	3	0
8	Laboratory	7	8	7	5	4	0
9	High voltage unit	14	12	11	9	6	3
10	Industrial electricity	17	15	14	12	7	4
11	Crane	18	22	21	18	10	5
12	Hydraulic	16	20	19	17	12	3
13	Turnery	19	20	18	16	11	7
14	Molding	15	11	11	9	7	3
15	Raw material mill	20	19	18	17	11	8
16	Mine	22	21	20	19	14	7
17	Health and safety	15	8	7	6	2	0
18	Pack making	10	11	10	9	6	4
19	Warehouse	10	7	6	5	4	3
20	Cooler	6	5	5	3	2	1
21	Installations	10	6	5	4	3	0
Sum		260	239	220	190	124	60

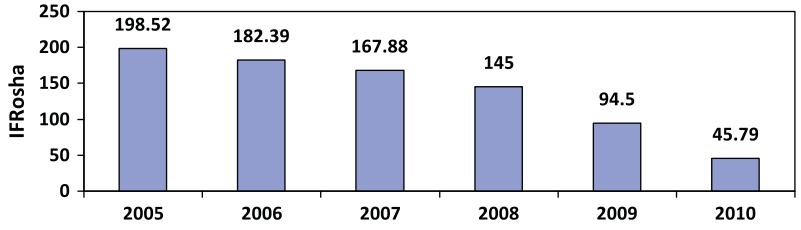

Fig. 7. Injury frequency rate in the Cement Factories during 2005–2010.

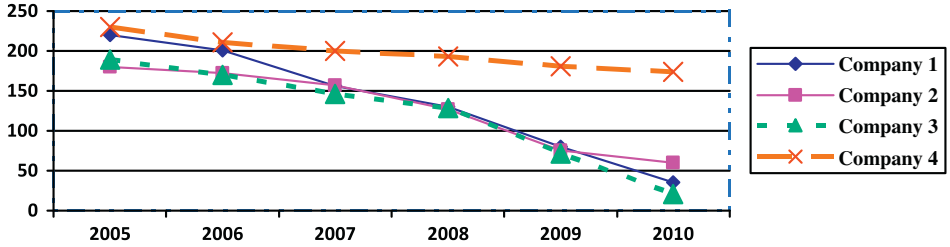

Fig. 8. Injury frequency rate in the each company during 2005–2010.

safety system implementation ($p < 0.05$). There was also a significant difference between average FSI before IMS system application and after safety system application ($p < 0.05$). Also there was negative significant correlation between FSI score and production rate ($p < 0.05$). This issue was showed in Table 4.

Also the Safe *T.* Score was examined (Fig. 11). As the figure shows, this index was gradually decreased during the years, becoming significant in 2009 and 2010. This index does not show any significant efficacy in the first year (Safe *T.* Score > −3) (see Table 2).

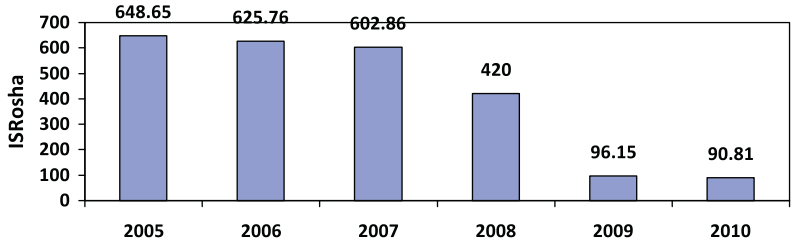

Fig. 9. Injury severity rate index in Cement Factories during 2005–2010.

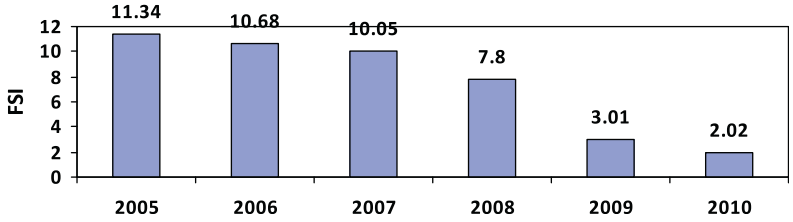

Fig. 10. FSI index in Cement Factories during 2004–2009.

Table 4
Correlations between different outcomes.

Safety	Productivity					
	Consultation	P_r	HPr_r	$C_{meeting}$	$Ed_{short\ term}$	Effectiveness training
IFR	−.981**	.990**	.992**	−.980**	−.985**	−.980**
ISR	−.983**	.998**	.985**	−.980**	−.996**	−.996**
FSI	−.991**	−.992**	−.986**	−.964**	−.992**	−.989**
Safety *T.* Score	−.986**	.988**	.989**	−.990**	−.996**	−.995**
PPE	.991**	−.855	−.843	.981**	.940*	.948*

* Correlation is significant at the 0.05 level ($p < 0.05$).
** Correlation is significant at the 0.01 level ($p < 0.01$).

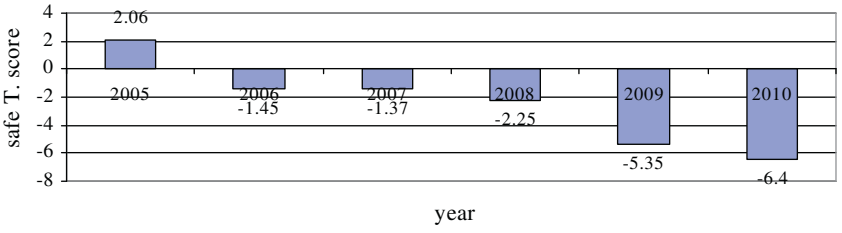

Fig. 11. Safe *T.* Score index in Cement Factories during 2005–2010.

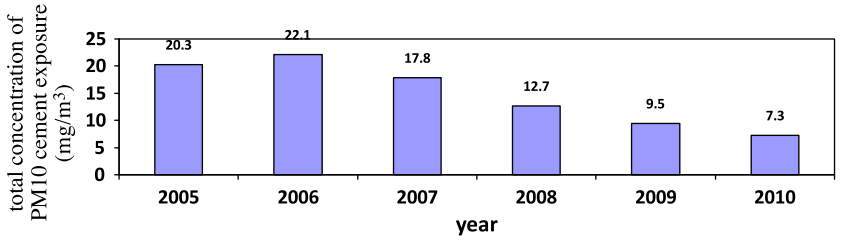

Fig. 12. The average of total concentration of cement PM exposure during 2005–2010.

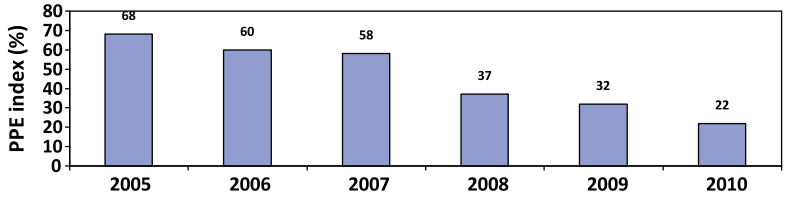

Fig. 13. Percent of accident was reported because of abused PPE in Cement Factories during 2005–2010.

Table 5
Quality management and production index for cement industries during 2005–2010.

Year	Average of consultation man hour	Average of human productivity	Average of Production rate (kg/day 1000)	Average of the number of meetings with manager	Average of education effectiveness	Average of short term education man hour
2005	2	20	4	37	40	0.04
2006	2	19	4	44	38	0.09
2007	4	36.7	9	56	52	1.23
2008	6	49.3	10	60	60	1.36
2009	8	81	13	72	83	3.01
2010	8	81.9	13	73.1	81.5	4.01

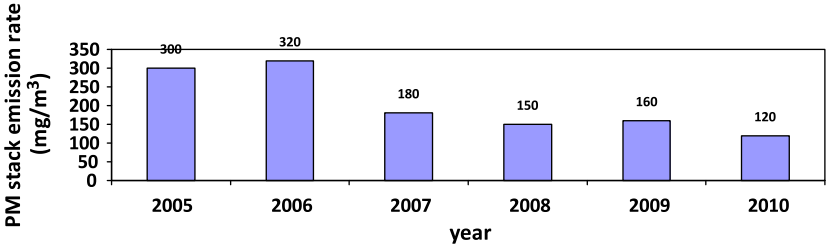

Fig. 14. The average of PM stack emission during 2005–2010.

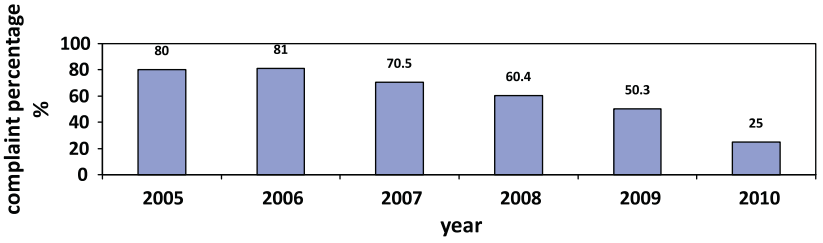

Fig. 15. The complaint percentage during 2005–2010.

The average of total concentration of cement particulate exposure during 2005–2010 was showed in Fig. 12.

The index representing the extent, to which the percent of accident was reported because of abused PPE in different years, was also investigated (Fig. 13). There is a significant difference between the magnitude of this index in the years preceding IMS system application and that in the years following the IMS system application ($p < 0.05$).

The obtained results of statistics analysis between the safety and productivity and production indices present that correlation coefficient between the safety and the productivity indices with regard to collected data; have been represented in Table 4.

The production rate analysis was showed that the IMS impact on production rate. Table 5 shows the results associated with different years. Also environmental control system was effect on production. The control system caused that large quantity of cement was collected in AHF (Advanced Hybrid Filter) or electrostatic filter.

The PM concentration was happened during 2005–2010 was showed in Fig. 14. The same progressive trend can be observed in the following years. There is a significant difference between the average concentration before IMS system implementation and that in the years following the IMS system implementation ($p < 0.01$).

The average of neighbor complaint was showed in Fig. 15. There is a significant difference between average of neighbor complaint between 2005 and 2010 ($p < 0.05$). There is no significant difference between average of neighbor complaint between 2005 and 2008 or 2009 ($p > 0.05$). This result showed that IMS system was effect in long term.

There is also a significant difference in the years before IMS system implementation and those following the IMS system imple-

mentation in terms of production rate. Moreover, there is a significant difference between personnel's productivity rate magnitude before IMS system application and that after IMS system application ($p < 0.05$). The result was showed that there was not a significant deference between effective factor on production (for example: machinery, technology, number of employer, production capacity and type of raw material) during 2005–2010 ($p > 0.05$).

4. Conclusion and discussion

One of the most important conclusions that can be highlighted from the findings is that integrated management system focus on team work. Continuous improvement of quality, environmental aspects and health and safety can help to ensure that a company's leadership is committed to get on the continuous improvement journey toward sustainable development. They are more likely to continue on that journey with their employees, suppliers, shareholders, Customers and other stakeholders. Such stakeholder involvement could be lead to the expansion of the scope of improvement outside the boundaries of the company (Fresner and Engelhardt, 2004). Tam et al. concluded that there was a high rate of accidents in this section. They maintain that government regulations and the implementation of programs such as safety system can considerably reduce the number of accidents (Tam et al., 2004). Findings of the current study are consistent with those of Celik (2009a,b) who found that integrated management system" can decrease the bureaucratic formalities; hence an indication of efficacy can contribute to the organizations (Celik, 2009a,b). Accident Occurring was affected by many parameters, in current study many parameters were stable during 2005–2010 (alterations are very slowly In Iranian industrials) there is no significant different between cement industries of the current study ($p < 0.05$) unless IMS requirements. As a result, the causes of accident rate decreasing were IMS system. Also, given the results associated with Safe *T*. Score, the effect of safety system on production is not significant. However, as they come to know the system better through receiving training, they would develop a positive attitude toward the system. These findings of the current study are consistent with those of Goldenhar et al. (2001) who found the IMS system was affected on long term (usually after 2–3 year). Also the effects of IMS on production index amounts to significant level in the second and third years after safety system implementation (Goldenhar et al., 2001). This It is also specified that not only safety programs cause to decline job accidents but also can affect on the personnel's attitude and their job satisfaction. These accidents create by accident decline and safety culture. Shikdar and Sawaqed studied ergonomic factors impacts on job satisfaction and diseases. The findings presented those weak ergonomic factors at work environment cause to increase personnel's' complaints and absence and to decrease the productivity. As it has been showed, there are many accidents in the organizations which impress organizations with direct and indirect costs. So there is a direct relationship between safety rules respect and work condition optimization which arouse productivity development in the organizations (Shikdar and Sawaqed, 2003). This trend is true for all the indices discussed above. The systems can be easily integrated; inflicting no dysfunction in organization routine operation provided that the needs of each management system are planned and met and the personnel also are aware of and committed to system needs. The IMS application resulted in the improved safety and quality management indices in cement section studies, indicating the efficacy which this system brings to cement industry. The results have showed that the IMS system existence cannot ensure productivity increase. The results were showed That IMS system was effect on rate of production. Rate of production was increased by two reasons, at the first, safety system decrease loss time due to accident and occupational disease and the other reason, environmental system decrease the rate of Cement Stack emission (the most production waste in cement industries is stack emission that in IMS system was controlled). Indices definition can be helpful for the IMS system effectiveness and system continuous performance optimization. It is important to say that there might be different indices definition in different industries. It is essential to investigate these cases in different industries. Thus:

1. The IMS system was improved performance as well as safety indices in The Cement Factory.
2. The implementation of safety system requires the involvement and full participation of all personnel and interest parties. This can be accomplished by holding training sessions and meetings with interest parties.

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