

ORIGINAL RESEARCH PAPER

The relationship between delegated responsibilities to the HSE employees and the performance indicators in the building construction projects in urban areas

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ABSTRACT

Construction projects are one of the most important economic sectors in the world. At the same time, these projects are one of the hazardous industries that cause many accidents resulting from injuries and deaths, occupational diseases, delay in time, environmental problems and other direct and indirect damages. While in many industries, the issue of health, safety and environment is meticulously planned as an important and structured topic, in construction projects this is not taken seriously. Therefore, the vital role of the Health, Safety and Environment staff would be meaningless without sufficient power. The current study examined the status of Health, Safety and Environment authorities in construction projects and their impact on the performance indicators of this sector. Eight indicators were identified in relation to the main research question and the relationship between Health, Safety and Environment authority delegation and the eight performance indicators. Out of these significant relationships, authority delegation had the maximum correlation (0.690) with environmental health status and the least correlation was observed with per capita disease (-0.513). The results of the data analysis showed that the terms of discretion of the Health, Safety and Environment authorities in construction projects are inadequate. Managers of this field trust authorities with higher academic degrees and give them more authority.

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INTRODUCTION

The construction industry is one of the oldest industries that have received much attention in recent years due to the increasing population and urbanization. In addition to the three factors of time, cost, and quality, Health, Safety and Environment (HSE) has also been emphasized as an important factor for success in construction projects (Ngacho and Das 2013). Construction

is one of the most dangerous industries around the world, in which a number of accidents occur resulting in injuries and deaths, work-related illnesses, environmental problems and other direct and indirect damages (Biggs *et al.*, 2013; Ardeshir and Amiri 2015). Lack of attention to HSE issues imposes irreparable costs on both employers and contractors (Befort and Budd, 2009). These costs can include those associated with work accidents, re-work, delays, and loss of national and international credibility of the organization and contractors (Alzahrani and Emsley 2013).

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Prevention of injuries, occupational diseases, and environmental problems affecting employees are vital in construction projects (Arndt *et al.*, 2005). Due to increasingly dynamic and complex lifecycle of a construction project, it is positioned as a dangerous or highly hazardous industry (Cheng *et al.*, 2004). The nature of construction industry is derived from several fragmentations of the involved parties throughout the various phases of construction projects (Sousa *et al.*, 2015). It requires harmonization of different interdependent contractors, sub-contractors and operations that may result in increased risk of injury (Pinto *et al.*, 2011). Statistics on occupational accidents revealed that high rise building construction is as one of the riskiest workplaces (Gyekye, 2006; Hsu *et al.*, 2008). Accidents ensued in a great burden to employee and employer in terms of absenteeism, loss of productivity, ergonomic disabilities, high cost incurred, bad company reputation, higher incidence rates of illnesses and fatal (Fung *et al.*, 2010). Accident investigation findings concluded that accident causations are rooted from poor working condition, management failure, unsafe acts and non-human related events. Human error such as improper lifting, contributed by unstable working surfaces and misuse of fall-protection equipment worsen the situation. Study by Amir *et al.*, (2013) stated that accident arises from failure in the interaction between construction personnel and workplace; whilst equipment and materials giving rise to the incident circumstances. In essence, construction activities are allied with the variety of dormant hazards. High-rise buildings are the recent trend in construction industry because of its convenience, advantages, architectural design, grade and luxury. It is characterized by continual changes, use of many different resources, poor working conditions, no steady employment, tough environments such as noise, vibration, dust, handling of cargo and expose to stochastic elements such as weather conditions, soil characteristics and road accidents (Hsu *et al.*, 2008). Many scholars categorized hazards into natural disaster such as bad weather or climate conditions and technological disaster like chemical

spill and explosion (Amir *et al.*, 2013). Construction project normally bound to a tight schedule, thus burden the workers with excessive workload (Sousa *et al.*, 2015; Sofwan, 2016). This situation will induce psychological hazards ensuing in stress, loss of motivation and lack of intrinsic satisfaction. The management team in a construction project acts as a role model to influence safe attitude among construction workers, thus nurturing safe environment. Several studies indicated that highly qualified industry professionals are proficient in accurately quantifying relative safety risks for specific tasks and work environments (Takala, 2010; Hallowell Gambatese, 2010). Given that, it is vital to have insight on the perceptions or previous experience of the construction management personnel on assessing the likelihood and severity of the hazards and safety risks. Risk is present in all project components of any projects irrespective of their size or sector. It is a measurable uncertainty because the same hazard does not always present the same risk. Safety professionals are the anchor person at the construction site who needs to conduct a comprehensive risk assessment to improve safe type performance at the site (Aksorn and Hadikusumo, 2008). In recent years, the role of this culture and its impact on the performance of HSE has attracted the attention of construction and university professionals in particular (Abd Rahman *et al.*, 2016). With the implementation of HSE-related programs, relatively good measures have been taken to prevent and improve the HSE performance of the industry. However, unfortunately the problems arising from inappropriate deployment of this system are still more pronounced than in other industries. This can be attributed to the high percentage of occupational accidents (Sousa *et al.*, 2015). Many experts believe that the main cause of doubts about the effectiveness of HSE system is the role of its staff in improving the HSE trends; that role would naturally be ineffective in this area without sufficient power and authority. Thompson *et al.*, 1998 believed that the management support for HSE and the practitioners in this field is the most effective factor. Most researchers and experts

believe that improving the performance of HSE systems depends on a variety of variables. There have been many studies in the construction industry, but most of them have focused on a specific dimension or area of HSE while the factors contributing to the improvement of its deployment have remained understudied. In this regard, [Tom et al., \(2004\)](#) have addressed twenty five factors affecting the performance in construction civil workshops in China. Also, [Ng et al., \(2005\)](#) identified the relative importance of these factors by identifying the factors affecting HSE system using network analysis. [Teo and Ling, \(2006\)](#) presented a model using a hierarchical analysis approach to measure the effectiveness of safety management performance of construction sites. [Al Haadir et al., \(2011\)](#) highlighted factors such as education, supervision, support, discretion, having clear goals, and attitudes. They examined the effect of these factors on the success of HSE performance in building workshops in Saudi Arabia. On the other hand, [Ismail et al., \(2012\)](#) described management, resources, personal, motivational and communicational factors as effective factors in implementing HSE management system for construction civil workshops. [Pakjoo et al., \(2016\)](#) investigated the effectiveness of HSE programs and their impact on job satisfaction. ([Mohammadfam et al., \(2015\)](#)) also addressed the parameters affecting HSE systems through network analysis method through variables such as management commitment and employee participation. The revision of the previous studies revealed the variables affecting the effectiveness of HSE systems in the previous literature have been considered. However, the study of the impact of delegation of authorities on improving the HSE criteria in the construction has not been investigated. Therefore, the two issues are examined and answered in this study:

1. The status of the extent of the power of action arising from the authorities conferred on HSE employees in the construction industry;
2. The relationship between the rate of authority conferred and the status of HSE indicators in the construction projects in Tehran.

The current study has been carried out in (Tehran) in (2019).

MATERIALS AND METHODS

Given the nature and subject of this research (authority delegation and performances of HSE system) in the field of HSE management and behavioral sciences, the survey research method was employed to collect data which is a library and field study method. The method of data analysis was descriptive-correlation. The statistical population of this study consisted of HSE officials of construction companies operating in Tehran (about 200 people). Specifically, 51 individuals were selected by simple random sampling using Cochran's rule at 90% confidence level and 10% error level. The employed questionnaire consisted of two main parts:

- Statements to determine the degree of authority delegated to HSE officials in terms of planning of responsibility delegation, Delegation of decision-making authority, and Delegation of control authority, senior management support, and authority delegations traps.
- Items to measure the evaluation indices of HSE unit performance in the form of three safety concepts (including weighted mean, large, small and quasi-incident per capita, Accident Frequency Rate (AFR) and Accident Severity Rate (ASR)), health concept (including environmental health indicators for the workshop, dining room, restrooms and accommodation, per capita reported occupational diseases and edible health (water and food), and environmental concept (including energy consumption per capita (water, electricity, gas and fossil fuels) plus the waste management status (rubbish and sewage).

In the first step, the content validity of the questionnaire was assessed using the opinions of professors and experts with experience in research and study in the field of research. Cronbach's alpha coefficient was used to measure the reliability of the instrument, which was 0.924 for the questionnaire. After confirming the validity and reliability, the questionnaire was prepared online and the samples were provided. They were

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Table 1. The status of the research variables

	Minimum	Maximum	Mean	Std. Deviation
Rate of assigned authorities				
Delegation of Planning Authority	1.75	4.25	2.858	0.6466
Delegation of decision-making authority	1.33	4.67	2.706	0.8734
Delegation of control authority	1.67	4.67	2.739	0.8700
Senior management support	1.57	4.29	2.726	0.7657
Authority delegation traps				
Authority delegation	1.33	4.33	2.673	0.7556
Estimation indices on HSE unit function	1.80	4.03	2.760	0.6889
Per capita Accidents				
Per capita Accidents	0.11	0.70	0.359	0.1651
Accident Frequency Rate	2.30	252.06	72.667	59.0763
Accident Severity Rate	8.43	882.8	58.084	119.8893
Environmental Health Status	1.50	5	2.799	0.8201
Per capita disease	0.03	0.42	0.172	0.0999
Food health status	1.50	4.50	3.078	0.6955
energy consumption	1	3.67	2.771	0.6682
Waste status	1	4	2.693	0.7329

Table 2 Correlation between authority delegation and HSE performance indicators.

		Per capita events	Accident Frequency Rate	accident severity rate	Environmental health
Authority delegation	Correlation coefficient	-0.391	-0.462	-0.411	0.690
	P-value	0.005	0.001	0.003	0.000
		Per capita disease	Food Health	Energy consumption	Waste status
Authority delegation	Correlation coefficient	-0.513	0.501	0.499	0.531
	P-value	0.000	0.000	0.000	0.000

processed using SPSS 23 software. In addition, data were analyzed using frequency, percentage, mean, Pearson correlation coefficient and t-test.

RESULTS AND DISCUSSION

Data were collected through 51 web-based questionnaires with 44 questions. Survey of the questionnaire suggested that according to the type of job, most of the participants were male (about 76.5%). The mean age and standard deviation of participants, who were mostly within the age range of 30 to 40 years, were 33.84 and 5.08 years, respectively (ranging from 26 to 48 years). About 64.7% were married and 80% had less than 10 years of related work experience. Regarding the level of education, the master's degree was the most frequent (62.7%). Research variables containing

items relevant to determining the rate of assigned authorities and items relevant to evaluation of estimation indices on HSE unit function are mentioned in [Table 1](#).

The mean number of delegated authorities was 2.760 and 52.9% of HSE officials considered the status of their delegated authority as inappropriate which was confirmed by a mean test (P-value <0.05). On the other hand, highly educated had a have relatively better status. According to the results, most HSE indices were not in a good condition. The per capita rate of accidents indicated a relatively high rate as large as 0.359, suggesting that each person is exposed to various hazards per year, and this probability of danger wastes the person's working time. Accident Frequency Rate exceeded 72 events and accident severity rate indicated

Table 3 Partial correlation between authority delegation dimensions and HSE indices.

		Planning authority delegation	Decision-making authority delegation	Control authority delegation	Senior management support	Authority delegation traps
Per capita events	Correlation coefficient	-0.272	-0.243	-0.440	-0.436	0.213
	P-value	0.054	0.086	0.001	0.001	0.121
Accident Frequency Rate	Correlation coefficient	-0.323	-0.512	-0.672	-0.419	0.186
	P-value	0.021	0.003	0.000	0.002	0.155
Accident severity rate	Correlation coefficient	-0.175	-0.514	-0.380	-0.416	0.062
	P-value	0.22	0.004	0.040	0.022	0.666
Environmental health status	Correlation coefficient	0.600	0.599	0.623	0.633	0.11
	P-value	0.000	0.000	0.000	0.000	0.101
Per capita disease	Correlation coefficient	-0.456	-0.556	-0.424	-0.410	0.417
	P-value	0.001	0.000	0.002	0.003	0.002
Food health status	Correlation coefficient	0.448	0.589	0.409	0.522	-0.135
	P-value	0.001	0.000	0.003	0.000	0.116
Energy consumption status	Correlation coefficient	0.490	0.404	0.377	0.528	-0.421
	P-value	0.000	0.003	0.006	0.000	0.002
Residual status	Correlation coefficient	0.419	0.543	0.440	0.439	-0.481
	P-value	0.002	0.000	0.001	0.001	0.000

the number of 58 working days lost per 200,000 works per year. The health status of the companies was relatively modest based on the three criteria of environmental health, food, and per capita health. Also, the status of environmental variables including energy consumption status and residual management status were moderately downward (2.771 and 2.693) (Table 1). The results of the correlation test between authorities delegated to HSE officials and performance indices of HSE are reported in Table 2.

Based on the Table 2, the highest significant correlation coefficient was related to environmental health index (0.690) with a direct relationship while the lowest one was associated to per capita disease index (-0.513) with an indirect relationship. On the other hand, according to the analysis of correlation between the variable dimensions of authority delegation and HSE performance indices based on

Table 3, most of the relationships with P-value less than 5% have been significant.

The HSE system is one of the organizational systems and reliable supports for organization movement in pursuit of its goals. This system is a critical factor in building construction companies and construction contractors, as construction poses a set of HSE problems during the project. HSE practitioners can play an effective role in alleviating these problems. Nevertheless, the role of such individuals, and consequently the improvement of HSE elements, seems to depend on various factors, including the extent to which individuals have control, supervision, and different decisions. The purpose of this study was to identify the factors affecting the performance of HSE system in order to determine the status of authorities delegated to HSE officials and its impact on HSE performance indices in construction companies in Tehran.

CONCLUSION

For the first question of the study, surveys indicated that the scores of authority delegation variable and its dimensions (especially decision-making dimension) were low (below average), which was confirmed by T-test at 5% confidence level. On the other hand, only 20% of individuals considered the authority delegation to be above average. HSE officials acknowledge that industry executives not only do not believe in the HSE, but consider it a hindrance and are dissatisfied with the costs they incur in preventing it. Among the HSE performance indicators, environmental indicators showed a moderate level, disease and health status indicated a medium downward, and safety indicators showed a low status. On the other hand, the results of the correlation test indicated a significant relationship between the authority delegated by managers to HSE officials and the status of HSE performance indicators. As the magnitude of authority delegated increased, the safety dimensions examined in this study and per capita diseases diminished, and food plus environmental health status improved. Also, decision-making authority delegation and control authority delegation had more correlated dimensions with HSE performance indicators in the construction companies in Tehran. This suggests that these two dimensions are relatively more important than other dimensions and that investing in these two dimensions can improve the performance indicators. On the other hand, the dimension of authority delegation traps had a less favorable correlated validity than the other dimensions did; this lack of correlation indicates a weakness of this dimension in improving the HSE indicators. The overall conclusion demonstrates the importance of HSE unit of companies in the construction industry, which experiences a large number of accidents. Further, a space for improving the performance of this unit creates a huge benefit for the organization and its environment. This space can only be improved in the light of the actual authority delegated to the officials of this unit to create a suitable environment, training and dealing with HSE anomalies in construction companies. Eight indicators were identified in relation to the main

research question and the relationship between HSE authority delegation and HSE performance indicators. Out of these significant relationships, authority delegation had the maximum correlation (0.690) with environmental health status and the least correlation was observed with per capita disease (-0.513).

SUGGESTIONS

- Providing a detailed map of the authority delegation process and activities performed as well as the compliance of assigned activities and tasks;
- Developing and implementing a control system and evaluating authority delegation so that the manager is always aware of the delegated operation process and provides the necessary feedback to the delegated authority;
- In order to make such tasks effective, the manager should give full delegation authority from micro targeting and planning for it to HSE unit, even in financial matters;
- The manager should provide the necessary support to make the authority delegated to HSE unit effective;
- Obstacles to authority delegation, including those related to delegator (boss), subordinate, environment, and organizational culture must be overcome;
- Companies and officials should focus on HSE discussions;
- Providing financial resources and facilities required to carry out HSE programs in order to delegate authorities;
- The present study should be conducted in other parts of the country to compare the results.

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CONFLICT OF INTREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. In addition, the ethical issues; including plagiarism, informed consent,

misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy have been completely observed by the authors.

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