

Measuring the Effectiveness of Safety Incentives in Construction Sites in Korea

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Abstract

The purpose of this study is to investigate the effect of motivation factors that actively induce construction workers participate in safety prevention activities and to investigate the effect of incentive program as motivation factor by conducting questionnaire survey. The survey was conducted for construction workers from September, 2017 to October, 2018, and the number of respondents was 256. The results of this study are that the factor of the greatest role in encouraging workers to voluntarily participate in accident prevention activities is management factors and that the introduction of new management methods such as safety incentives to reduce safety accidents is necessary. These results indicate that the accident prevention facilities and safety education and training have their limitations. Therefore, it is necessary to thoroughly reconsider what has already been done, and to find more innovative methods to reduce construction accidents.

Keywords

Accident Prevention Activities, Motivation Factors, Safety Incentives

1. Introduction

Among industrial accident fatalities in Korea in 2017, the number of deaths due to construction accidents was shown to be the highest compared to other types of industries and accounted for more than half of the total number of accident fatalities due to accidents [1]. Therefore, reducing the occurrence of accident fatalities in the construction industry is very important in many respects, and construction companies are making great efforts in providing accident prevention, safety education and training, and safety management. In reality, however, effects to reduce industrial accidents occurring in the construction industry do not appear to be significant. This phenomenon may be attributable to the fact that

most of the efforts currently being made are passive ones based on laws and regulations rather than active ones made by workers.

Construction companies in Korea have focused on safety checks and safety education and training in order to reduce unsafe working conditions of site and unsafe acts of worker, which are the causes of accidents, with a view to reduce construction accidents [2]. According to this tendency, various studies [3] [4] [5] [6] have been consistently conducted to reduce accidents through effective safety education and training for worker. In addition, the Ministry of Employment and Labor and the Korea Occupational Safety and Health Agency regularly audit the status of accident prevention in construction sites for preventing accidents. Despite the various efforts to reduce construction accidents, however, construction accidents have not decreased and have been showing the highest rates of work occupational fatalities among various industries.

Therefore, it can be said that new and innovative approaches that can prevent accidents and reduce safety hazards in construction sites are necessary [7]. In addition, as argued in a study conducted by Hong *et al.* [1], activities considering workers and inducing them to actively participate in safety activities as safety training and education are important for accident prevention in construction sites. However, measures to concretely practice the foregoing are insufficient. A study conducted by Barg *et al.* [8] presented improved management techniques related to incentives for related workers and communication with workers as methods to motivate construction workers.

To reduce accidents in construction sites, concrete motivational methods that can encourage workers to voluntarily participate in safety activities are necessary. A study conducted by Ghasemi *et al.* [7] presented that the accident prevention of construction sites was improved when an incentive system was introduced, and a study conducted by Goodrum and Gangwar [9] indicated that incentive program led to improvement of accident prevention in construction sites. Several big construction companies in Korea are applying incentive program to construction site so that these encourage construction workers to participate actively in accident prevention activities to prevent accidents.

Therefore, this study examines the effects of individual motivation factors that encourage workers to voluntarily participate in accident prevention to reduce accidents in construction sites and the effectiveness of incentive programs used as motivation factors. The findings of this study will be one of other methods that can be applied hereafter to safety education and training and encourage workers to voluntarily participate in accident prevention activities to reduce construction accidents.

2. Literature Review

2.1. Previous Studies

Various studies on whether incentive programs are effective in improving the performance of accident reduction have been conducted over the last several decades. In their study, McAfee and Winn [10] investigated the findings of 24

studies to reveal that incentives or feedback contributed to improving safety conditions or reducing accidents. In another study, Haines III *et al.* [11] argued that safety incentive programs could be an effective factor of health and safety strategies when applied to interdependent teams sharing construction manager and worker relationships and safety rules. Goodrum *et al.* [9] stated that there is great uncertainty about the effects of safety incentive programs in the construction industry and that according to the results of a survey on the effects of incentive programs on US construction companies' safety performance, incentive programs were effective for the improvement of safety performance. Hasan and Jha [12] derived study findings indicating that the implementation of safety incentives and penalty provisions between the client and the contractor is useful for improving safety performance. A study conducted by Ghasemi *et al.* [7] proved that incentives can improve the employer's safety performance in a short period of time, but the amazing value may gradually decrease over time. Although there are various studies indicating that incentive programs are effective in improving safety performance as such, studies on which incentive programs are effective are not sufficient. Therefore, studies to measure the effects of implementable incentive programs are necessary so that they can be applied to actual construction sites.

2.2. Motivation and Incentive Systems for Construction Workers

Motivation is the driving force that physiologically or psychologically induces individuals' acts to pursue one or more goals in order to satisfy the individuals' needs or expectations [13]. At construction sites too, the morale of construction workers should be improved by motivation to achieve management goals. For the management of construction workers, approaches such as appropriate resource management and work design, lifelong learning programs, open communication, effective compensation systems, the manager's ongoing leadership, employee value recognition and encouragement, and continuous evaluation for the development of motivational programs are required [14]. In a study on the selection of productivity-related motivators conducted by Kim *et al.* [14], motivation factors were divided into economic factors, social factors, and psychological factors, and the high-ranked factors among economic factors are wage amounts, and the following rankings are payment of wages timely, job stability, incentives, and welfare benefits.

Incentive programs are a major method of realizing control, and can be defined as the relationship between the organization and the individual by specifying exchange conditions [15]. Incentive programs indicate things that are expected from individual employees and things individual employees can expect in return for the foregoing [16]. Incentive programs can affect the implementation of the company's strategies in many ways, such as staff recruitment and retention, performance motivation, technology and knowledge development promotion, and corporate culture formation [17]. Therefore, the use of incentives to

motivate workers has become an essential factor in the development of most construction companies around the world [18]. However, in Korean construction companies, the use of incentives for motivation is not common, as incentives are used limitedly by several major construction companies.

2.3. Safety in Construction Sites

Improving safety is essential in the context of improving the productivity and efficiency of the construction industry [19] because construction has traditionally been regarded as a dangerous occupation since industrial accidents and fatal accidents have occurred frequently in the industry [20]. Therefore, improving accident prevention in construction sites is a top priority task in almost all countries, because the construction industry is blamed as a major cause of serious and fatal accidents among all industrial fields [21]. Not only is this reality identical in Korea, but also many efforts are made to solve such problems in Korea, too.

Many activities at construction sites such as safety education and training implemented by construction managers and safety managers, communication for safety, safety rules and procedures, and safety incentives are intended to improve workers' safety performance [7]. A study conducted by Molenaar *et al.* [22] presents five potential features that can explain the safety culture of construction companies, which are 1) company's obligation regarding safety; 2) safety incentives provided to the site to improve safety performance; 3) corporate culture to work together with cooperative companies; 4) accountability and contribution to site safety; and 5) disadvantages of unsafe acts. These features are indicators of the company's safety performance [22].

3. Measuring the Effectiveness of Safety Incentives

3.1. Data Collection

A questionnaire survey was conducted to investigate the effects of motivation on workers and their preference for incentives at construction sites. The questionnaire survey subjects were workers who were currently working at construction sites and the number of respondents who answered the questionnaire was 256. The survey respondents are as shown in **Table 1**.

The questionnaire consists of two main contents; 1) motivation factors for workers related to accident prevention; 2) incentive programs that might greatly affect safety if implemented or implement in construction site. The survey items of motivation factors were selected from the variables used in previous other researchers' motivation studies. In addition, the types of incentives that used this questionnaire are chosen from preliminary surveys of construction workers who experienced incentives at construction site.

3.2. Results

When asked about the roles of economic factors, working environment and safety culture factors, and management factors as motivation factors that en-

courage workers to participate in accident prevention activities, the workers answered that management factors have the greatest effects as shown in **Figure 1**.

Among the motivational economic factors that motivate workers to voluntarily participate in accident prevention activities, salary levels were shown to have the greatest effects, the following rankings are payment of salary timely, job stability, and safety incentive program (Refer to **Figure 2**). Among the working environment and safety culture factors that motivate workers to voluntarily participate in accident prevention activities, accident prevention facilities were shown to have the greatest effects, the following rankings are safe working conditions, safety education and training, and relationships with colleagues (Refer to **Figure 3**). Among the management factors that motivate workers to voluntarily participate in accident prevention activities, a few work proceeding in same place simultaneously and interference between proceeding works were shown to have the greatest effects, the following rankings are the managing ability of construction manager, rework, and change order while work is in progress (Refer to **Figure 4**).

Table 1. The respondents of questionnaire.

Variables	Category	Number of respondents	Percentage (%)
Work type	Framework	87	33.1
	Finishing work	83	31.6
	Electricity, machine	64	24.3
	Other	22	8.4
Career	Less than 5 years	86	32.7
	5 - 10 years	64	24.3
	More than 10 years	106	40.3
Nationality	Korea	233	88.6
	China	23	8.7

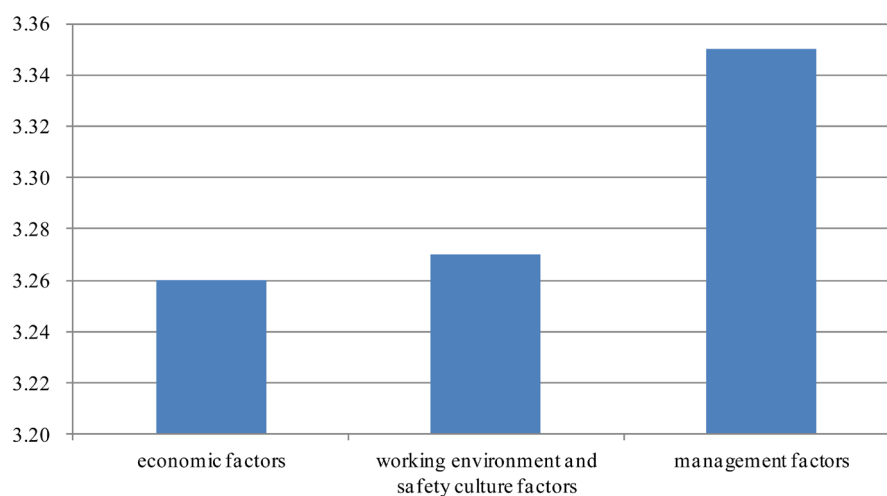


Figure 1. Effectiveness of voluntary participation in accident prevention activities by motivational factors.



Figure 2. Effectiveness of voluntary participation in accident prevention activities by economic factor.

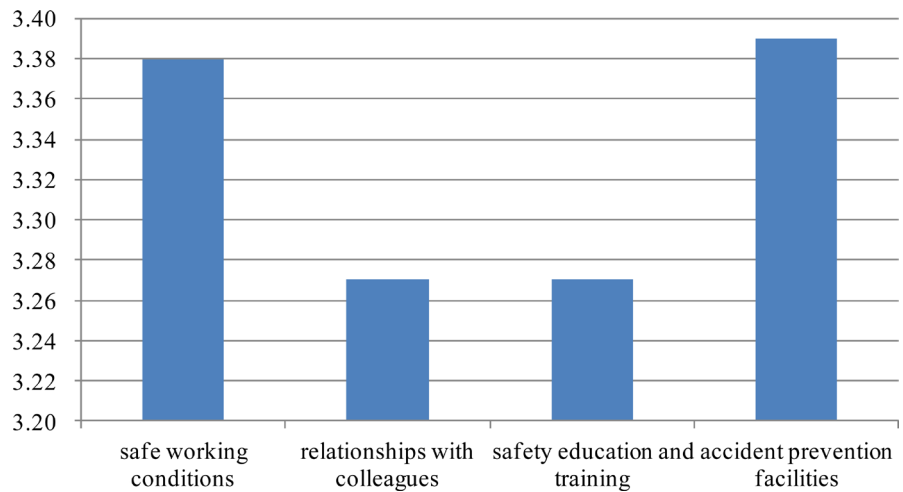


Figure 3. Effectiveness of voluntary participation in accident prevention activities by working conditions and safety culture factor.

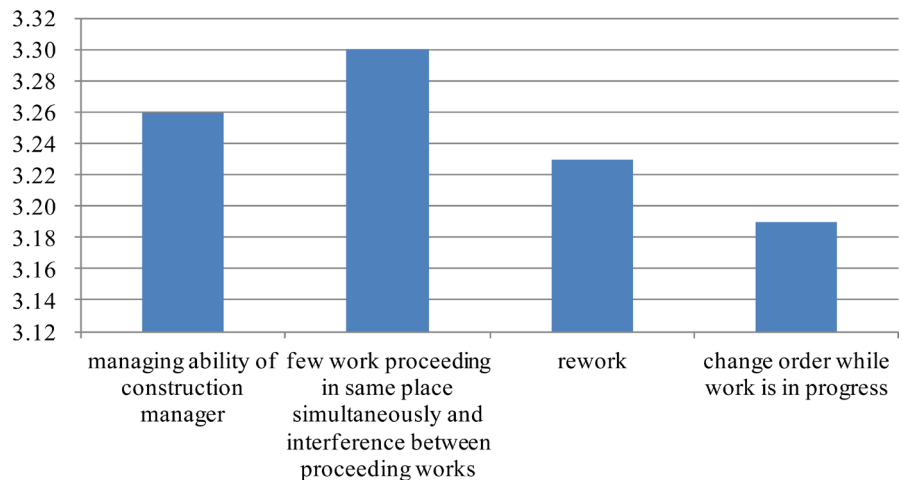


Figure 4. Effectiveness of voluntary participation in accident prevention activities by management factor.

99 workers of the 256 respondents experienced safety incentives while 157 workers did not experience any safety incentives. Therefore, 61.3 percent worker, which is a considerably high ratio of workers, was shown to do not have experience of safety incentives. Also, 87 workers of the 99 workers who experienced safety incentives were working for the top 100 Korean construction companies. This indicates that the safety incentive is being implemented by the big construction companies in Korea. In addition, as shown in **Table 2**, the respondents are most chosen that the high priority actions for the accident prevention of construction site is the introduction of new management methods such as safety incentives. And following rankings are wearing safety gear thoroughly and worksite tidy, well-lit and well laid out. Therefore, it can be identified that measures to encourage workers to voluntarily participate in accident prevention activities through the introduction of safety incentives is necessary.

As shown in **Table 3**, it can be revealed that the workers who received goods such as safety gears or gift voucher as incentives are 82.5 percent of the workers who have experienced safety incentives. However, the incentives that 90.6 percent workers want to receive is economic benefits such as salary increases, prize money (or gift voucher), and paid vacation (see **Table 4**).

4. Discussion

This study is revealed that the factor of the greatest role in encouraging workers to voluntarily participate in accident prevention activities is management factors. This means that the role of construction manager is important. Therefore,

Table 2. High priority actions for the accident prevention.

Attribute	Frequency	Percentage (%)
Strengthen safety education and training	38	14.8
Wearing safety gear thoroughly	41	16
Fast and accurate installation of accident prevention facilities	34	13.3
Strengthen safety monitoring activities	28	10.9
Worksite tidy, well lit and well laid out	39	15.2
Introduction of new management methods	61	23.8
Inspection of work equipment	11	4.3
Other	4	1.6

Table 3. Safety incentives received.

Attribute	Frequency	Percentage (%)
Cash (prize money)	15	14.6
Gift voucher	35	34
Goods such as safety gears	50	48.5
Other	3	2.9

Table 4. Effective incentives for accident prevention activities

Attribute	Frequency	Percentage (%)
Salary increase	111	43.4
Prize money (or gift voucher)	69	27
Paid vocation	52	20.3
Empowerment of accident prevention activities, etc.	21	8.2
Other	3	1.2

it is necessary for not only the construction manager but also the supervisor to understand the worker's requirements and to manage it so that the worker voluntarily participates in accident prevention activities and reduces safety accidents in construction site. In addition, since the greatest effect factors among motivation factors are salary levels of the economic factors, accident prevention facilities of working environment and safety culture factors, and a few works proceeding in same place simultaneously and interference between proceeding works of management factors, those factors should be given priority considering. The accident prevention facilities are already considered essential to prevent safety accidents and this is regulated in Korea by law. And it is recognized that a few works proceeding in same place simultaneously and interference between proceeding works must be considered in terms of management in order to prevent safety accidents. The safety incentive system of the economic factors and the relationship between colleagues of work environment and safety culture factors are important in this study and should be newly prepared for preventing safety accident.

This study revealed that 61 percent of the questionnaire respondents experienced safety incentives and that 90 percent of those respondents who experienced the safety incentives worked for the top 100 Korean construction company. Construction workers think that the introduction of new management methods such as safety incentives to reduce safety accidents is necessary, and may be considered to be questioning the effectiveness of current accident prevention activities applied. In addition, since new management methods such as safety incentive system is believed to reduce safety accidents, it is necessary to actively introduce safety incentives even in small and medium-sized construction companies.

In addition, the null hypothesis, that the effects of motivation factors between those who had experienced incentives and those who had not experienced are equal, could be rejected because the significance probability is less than 5% in T-tests. Workers who have experienced safety motivation factors think to be that the safety motivation factors are less affected to accident prevention than workers who have not experienced. This result could be implied that workers thought the effects of safety motivation factors would be significant, but when they experience them, they think the effects are less than expected. Therefore, in the future, it is necessary to carefully consider the application of safety motivation

factors such as safety incentives to construction sites.

5. Conclusions

This study was conducted on the effects of safety motivation factors that cause workers to voluntarily participate in safety accident prevention activities conducted at construction sites and measuring the effectiveness of safety incentives by a questionnaire survey with workers. The motivation factors were classified into three categories: economic factors, working environment and safety culture factors, and management factors. Since this study resulted in that the management factors have the greatest effect to workers' participation of the accident prevention activities, the role of construction manager is important for accident prevention activities. Since not only management factors, but also economic factors, and work environment and safety culture factors also have more than the usual effect on voluntary safety activities of worker, it should be necessary to carefully consider to each part of the construction site management.

In addition, the construction workers think that the introduction of new methods such as safety incentives for reducing safety accidents is needed. These results indicate although the accident prevention facilities and safety education and training are important, the construction workers are aware of their limitations and expect new system and methods. Therefore, it is necessary to thoroughly reconsider what has already been done, and it can be said that safety accidents can be reduced by finding more innovative methods. Since this study has been conducted on some construction workers, it is necessary to investigate construction worker more in the future and to study detailed and innovative method for reducing safety accident in construction sites.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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