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A Study on Improvement of the Fire Protection System Managers on Actual Status: Focusing on Moral Hazard Phenomenon

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Abstract: This study suggested ways to improving the fire protection system manager qualification system as movercome the moral hazard of fire inspection through the theoretical background and empirical analysis of the fire protection system manager qualification system. Firstly, it is necessary to allow cross appointment or dual appointment for technical fire protection inspection and testing engineers. Secondly, specific contents should be legalized in order to substantialize fire protection inspection and testing engineer's daily check items and area. Finally, it is proposed to implement a method to control the standards for the presence of technical fire protection inspection and testing engineers based on the responsibility of the fire protection system companies. In conclusion this study was conducted based on previous research and actual situation analysis.

Key words: Fire protection inspection and testing engineers, moral hazard, National Fire Safety Codes (NFSC), cultural competence education, insufficient inspection

INTRODUCTION

Recently, in terms of disaster circumstances, the frequency of disaster occurrence is increasing with the size enlarging thus the types of disasters are becoming diversified. As such disaster circumstances change rapidly, the importance of social safety net is growing. As recent human disasters are occurring in facilities used by multiple people, safety measures for multiuse facilities are urgently needed. In case of fire in multiuse facilities, enormous damages of human lives and property may arise. Therefore, maintenance control of fire protection system is crucial. Such multiuse facilities are designated as specified fire-prevention objects to undergo regular fire inspections. Due to increase of high-rise buildings, basement floors and complexity, the need for professional maintenance control has increased, leading to the implementation of the fire protection system manager qualification system in 1991.

The fire protection system manager qualification system is implemented for efficient and professional maintenance of specified fire-prevention object as threatening elements on fire safety are increasing due to the development of national economy and industries. Since the producing of fire protection system managers is smaller than the producing of specified fire-prevention object there are several problems such as exceeding daily inspection area limit or submitting false self-inspection reports. Nevertheless, researches on this issue have stayed only fragmentary since the implementation of the fire protection system manager qualification system (Oh, 2006; Kim, 2010a, b; Kim, 2012). It is necessary to study specifically on participation criteria like mandatory participation of fire protection system managers at self-inspections on fire protection system and limit on daily inspection area.

Therefore, the objective of this research is to propose improvements on self-inspection regulations of fire protection system managers based on the current state of moral hazards like violation of regulations and enhancement plans through analysis of the reality of fire protection system managers.

MATERIALS AND METHODS

The principal-agent problem

The significance of moral hazard: Moral hazard implies the occurrence of market failure due to asymmetric information on contractor's future and hidden behavior which cannot be observed after signing contract (Kang, 2005). In other words, it is the act of betraying other's trust or the act of moral insensitivity of misusing other's

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trust for own interest. It can be interpreted as the tendency for one party with information to act against the interest of the other party without information when a hidden action after achieving qualifications is an issue. In short it is the change of behavior in order to maximize own interest.

The term "moral" can be considered as acting against the principal's interest despite the explicit or implicit promise of doing one's best for the interest of the principal. Examples of moral hazard can be unnecessary and excessive visits to hospital due to insurance purchase, carelessness when driving due to car insurance purchase, carelessness about personal belongings due to theft insurance purchase, indifference to fire prevention measures due to fire insurance purchase, murdering life insurance policyholder for insurance money, arson for fire insurance money and so on (Kim, 2012; Jo, 2011; Kang, 2005). Meanwhile, solutions like ease of supplier screening (Kim, 2010; Whang, 1999; Kim, 2012; Kang, 2005; Jung and Lee, 2011) building manned system through regulation reinforcement (Son, 2007; Kim, 2012; Jo, 2011; Kang, 2005) have been suggested to overcome moral hazard. Among the ways to overcome moral hazard, this study intends to mainly discuss 'Manned system should be arranged by reinforcing regulation's among many problems from the current state.

Examination of precedent researches: Looking through precedent researches on fire protection system managers, Oh suggested improvement plans on the fire protection system manager qualification system through a study on fire professional qualification system. Ha point out in a study on fire protection system inspection system development plans that hands-on professional workers like fire protection system managers are insufficient and professionalism is also lacking (Shim, 2011). Shim (2011) pointed out in a study on fire protection system self-inspection system development plans that the government has guaranteed fire protection system manager's work to be monopolized because it is required to hire more than one fire protection system manager as technical professionals for fire protection system management business to register.

The followings can be found from putting the precedent researches together: first, the studies suggest various methods to enhance professionalism of fire protection system manager; second, due to the imbalance of the producing of fire protection system managers and of specified fire-prevention object, moral hazard may occur in inspection work; third, the studies emphasize social responsibility of fire protection which protects people's lives, body and properties.

The government strictly regulates laws on the certified fire protection system: The government strictly regulates laws on the certified fire protection system manager's participation as technical professional to arranged manned system through regulation reinforcements. However, the law should regulate duties that the certified fire protection system managers can actually perform but it is producing massive lawbreakers by applying legislations beyond practice. According to 'the Article 26 Section 2 of Enforcement Regulation on Fire Prevention, Fire-fighting Facilities Installation, Maintenance and Safety Supervision Act, fire protection system manager is required to participate as a technical professional when inspecting work function or going through detailed overall examination of special class, first and second class fire prevention and management objects as shown in Table 1.

Also, according to "Attachment 1" of Enforcement Regulation on Fire Prevention, Fire-fighting Facilities Installation, Maintenance and Safety Supervision Act, work function inspection and detailed overall examination should be carried out at least once a year and the detailed overall examination of specified fire-prevention objects exceptionally has to be carried out at least once in six months. However, Table 2 shows that the number of certified fire protection system managers is 1,282 and the number of fire protection system management companies is 626 as of 2016. An average fire protection system management company has to carry out autonomous checks for two or more fire protection objects per day. In fact, a prospering fire protection system management company has to carry out autonomous checks for about 10 places a day assuming that the company can carry out

Table 1: Test for measurement of heat transfer coefficient

Types of self-inspection	Criteria on participation technical professionals	Fire safety of objects (sites)
Work function inspection (special, 1st and 2nd class, fire safety management objects)	Fire protection system manager	110,752
Work function inspection (objects other than special, 1st and 2nd class fire safety management or assistant technical professional objects)	Fire protection system manager	171,186
Detailed overall examination	Fire protection system manager	60,385
Inspections requiring participationof a fire protection system manager		171,137

Table 2: Fire protection system managers vs fire protection system management companies

Fire protection system	Fire protection system management
1,282 managers	626 companies

autonomous checks for certain fire protection objects on Saturday and Sunday. In this case, the upper limit of its daily inspection area is maintained throughout the year including all Saturday, Sunday and public holiday. In reality, it is not possible to carry out autonomous checks for all these companies under the presence of a certified fire protection system manager.

Despite the situation as this, the current law requires that a fire protection system manager must be present at a fire protection system management company's autonomous check. In some cases, this current law leads to this actual situation where fire protection system managers give false reports when they have not been present during checks of certain fire protection objects. In 2002, 58 fire protection system managers were not present when fire protections systems of certain fire protection objects were checked but they prepared false reports of inspection results. They got caught and received administrative penalties. In addition, the auditors caught 118 fire protection system managers who reported that they had been present during fire protection system management companie's autonomous checks of certain fire protection objects because they stayed abroad or in the hospital from July 2012-September 2014. Therefore, it shows that some fire protection system managers neglect to perform their work. However, the fundamental reason they perform their work like this is that the laws related to the fire protection system management are too strict to keep.

Improvement plan for fire protection system manager system: According to critical analysis on moral laxity, the following points are proposed in order to prevent from mass production of law-breakers due to enforcement of the law related to participation standards for the certified fire protection system managers as technical professionals. First, it is necessary to be able to cross-appoint or duplicate-appoint technical professionals. There is a severe gap in number of specific fire protection objects to be self-inspected between fire protection system management companies. There is a company where upper limit of check-limit area for a day is maintained all-year-around including Saturday, Sunday and holiday while there is a company where check-limit area for a day is not accomplished a single day in a month. Also, due to a strict law that fire protection system manager appointed in a company where self-inspection orders prosper should participate as a technical professional every time self-inspection is done, it is difficult to have ordinary breaks such as hospitalization due to personal circumstances and overseas trip. However, fire protection system manager in a company where there are barely self-inspection orders faces an opposite situation. In the situation of severe imbalance between fire protection system management companies, a fire protection system manager degrading to law-breaker can be prevented if the related law is amended to be able to cross-appoint or duplicate-appoint technical professionals.

Table 3: Check-limit area for a day (current state)

Variable	Comprehensive precise check	Operating function check
Check-limit area	10,000 m²	12,000 m² (in case of small scale, 3,500 m²)

Table 4: Check-limit area for 1 week (improvement plan)

Variable	Comprehensive precise check	Operating function check
Check-limit area	50,000~60,000 m²	60,000~72,000 m² (in case of small scale, 17,500~21,000 m²)

Table 5: Inspection commission by area and home of the inspection limit (based on 3 managers)

Facility type	Comprehensive precise check	Operating function check
Welfare lodging etc.	8333.3 m²	10,000.0 m²
Culture, religion etc.	9,090.9 m²	10,909.1 m²
Amenity, health etc.	10,000 m²	12,000 m²
Factory, storage etc.	11,111.1 m²	13,333.3 m²
Lab, airplane, car etc.	12,500 m²	15,000 m²
Apartments	300 homes	350 homes
Commission per day	1,706,212 KRW	1,706,212 KRW

Second, check-limit area for a day needs to be internally stabilized. The law regulates, like in Table 3, the check-limit area, which is a total area of specific fire protection object that can be inspected for a day by 1 unit of inspection personnel composed of one fire protection system manager and two assistant technical professionals. This limits the area inspection personnel can practically carry out. However, there is no limitation on dates, causing companies which maintain the upper limit of check-limit area without any holidays all-year-around. This leads to breaking the law due to hard work fire protection system manager cannot afford. For the solution, we propose to set the check-limit area based on one week (5 or 6 day a week) like in Table 4 so that fire protection system manager can take a regular break. Check-limit area is considered appropriate based on one day.

Additionally, it is necessary to establish penal provisions as a means of supplement in case of disobeying inspection commission in Table 5 which is regulated in 'Article 25 Law on establishment, maintenance and safety management of fire prevention, firefighting facility.' This is in order to solve problems caused by decrease in rate of return of management companies when day self-inspection standards are restricted to a weekly unit.

As demand for obligatory fire protection system inspection increases, fire protection system inspection

has been settled as one industry. Therefore, fire protection system management companies are constantly increasing, leading to intensified competition between companies. Although, inspection commission is set, penal provisions against obeying inspection commission do not exist. Consequently, it has been generalized between fire protection system management companies to highlight cheaper price than other companie's as its competitiveness. As a result, it became difficult to find a company which competes with its inspection skills and services.

Fire protection system management market which work is ordered at low inspection price as mentioned is stated to be one of the serious factors which provoke weak inspection on fire protection systems. Therefore, penal provisions have to be established in case of disobeying inspection commission so that healthy competition between fire protection system management companies can be led through competing with inspection skills and services rather than with prices.

Lastly, we propose a means to regulate standards for fire protection system manager participating as a technical professional under fire protection system companie's responsibility. Meanwhile, the Board of Audit and Inspection insolvent in self-inspection has been constantly noted. This has led to reinforcement in control on fire station and amendment of the law from a relational person self-storing a report on self-inspection performance results to submitting to the fire protection director of the headquarters or the head of the fire department in case of operating function inspections. Also, multiplex available premises is additionally designated in overall detailed inspection and it has been reinforced to a total area of over 5,000 m^2 >16-11 floors in case of apartments. In the situation that fire protection system manager's work is increasing because of the law being reinforced in this way, the fire protection system management company is reporting work realistically impossible to perform on inspection performance results report in order to maintain its job in an intensified competition. This includes manager joining the inspection all-year-around without any holidays. For the alternative, it is necessary to have a means that enables not only fire protection system manager but also assistant technical professional to conduct operating function inspection on special, first and second class fire safety management objects. However, responsibilities are taken by fire protection system manager and fire protection system management companies in order to prevent from poor self-inspection.

Oh (2006) also states the necessity of organizing system and rules that conduct the system because insufficient rules and system can hinder settlement and improvement of fire protection system manager system. It is said that positive regulations such as providing necessary information, advising and guiding have to be actively supported so that fire protection system manager can fulfill its legal liability and social responsibility. Also, Oh (2006) approaches fire protection system manager system in a different point of view. He states that job training has to be regularly and constantly done in a direction that can deepen professional techniques.

In conclusion, it is necessary to be able to cross-appoint or duplicate-appoint technical professionals in order for fire protection system manager to fulfill legal liability and social responsibility. This prevents from mass production of law-breakers due to enforcement of the law related to participation standards for fire protection system manager as a technical professional. Also, we propose to actualize from check-limit area for a day to check-limit area for a week and to relieve participation standards for fire protection system manager as a technical professional under responsibility of fire protection system management companies. Additionally, job training for acquiring knowledge about change of the period and new technologies should be systematically realized.

CONCLUSION

This study approached qualification system of the engineers in fire protection systems based theoretically on principal-agent problem. The study has significance in that study on qualification system of the engineers in fire protection systems in South Korea did not exist before and that it has approached the main problem of qualification system of the engineers in fire protection systems in current state in the point of view of principal-agent problem, unlike the previous study direction of National Technical Qualifications. Therefore, it has derived an improvement plan from a satisfactory point of view on incentive structure in order to lower the uncertainty about choice decision of the principal on the agent.

SUGGESTIONS

There is an incentive structure that gives incentives or penalties through composition of a commission about errors of setting questions of qualification system of the engineers in fire protection systems, however, question errors are not decreasing because the structure is not operating well. Accordingly, based on critical analysis on principal-agent problem, we proposed following three

points in order to decrease the errors in setting questions on exams for the engineers in fire protection systems. First, it is necessary to reinforce the management system of setting questions by adopting process of question review and confirmation of final questions by the examiner following the procedures of setting questions for College Scholastic Ability Test.

Second, it is not easy to secure professionalism in that there is a limitation on comprehension and application of the subject the researcher is in charge of if the subject goes over the similar job field of the researcher. It is necessary to reinforce professionalism of researchers in Human Resources Development Service of Korea, who are qualification managers through various education programs such as selecting a firefighting major, readjusting the job range to the one similar to the job field of the researcher in charge of qualification management, having an obligatory regularization of regular supplementary education for the researcher to understand the work and having training programs and education programs at work.

Finally, it is necessary to implement a method in which written test on qualification system of the engineers in fire protection systems only tests about basic points and practical points are dealt during oral test. Additionally, we proposed the necessity of adaptation of real-name system on the members who set questions and review. We expect continuous progress of the study on the ways to decrease errors in setting exam questions for the engineers in fire protection systems in order for engineers in fire protection systems to take in charge of centric role in firefighting facilities career.

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