Original Article

Effectiveness of Direct Safety Regulations on Manufacturers and Users of Industrial Machines: Its Implications on Industrial Safety Policies in Republic of Korea

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ABSTRACT

Background: Despite considerable efforts made in recent years, the industrial accident rate and the fatality rate in the Republic of Korea are much higher than those in most developed countries in Europe and North America. Industrial safety policies and safety regulations are also known to be ineffective and inefficient in some cases.

Methods: This study focuses on the quantitative evaluation of the effectiveness of direct safety regulations such as safety certification, self-declaration of conformity, and safety inspection of industrial machines in the Republic of Korea. Implications on safety policies to restructure the industrial safety system associated with industrial machines are also explored.

Results: Analysis of causes in industrial accidents associated with industrial machines confirms that technical causes need to be resolved to reduce both the frequency and the severity of such industrial accidents. Statistical analysis also confirms that the indirect effects of safety device regulation on users are limited for a variety of reasons. Safety device regulation needs to be shifted to complement safety certification and self-declaration of conformity for more balanced direct regulations on manufacturers and users. An example of cost-benefit analysis on conveyor justifies such a transition.

Conclusion: Industrial safety policies and regulations associated with industrial machines must be directed towards eliminating the sources of danger at the stage of danger creation, thereby securing the safe industrial machines. Safety inspection further secures the safety of workers at the stage of danger use. The overall balance between such safety regulations is achieved by proper distribution of industrial machines subject to such regulations and the intensity of each regulation. Rearrangement of industrial machines subject to safety certification and self-declaration of conformity to include more movable industrial machines and other industrial machines with a high level of danger is also suggested.

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1. Introduction

Despite considerable efforts made in recent years, the industrial accident rate (defined as the number of injuries and deaths per 100 workers or employees) and the fatality rate (defined as the number of deaths per 100,000 workers or employees) in the Republic of Korea are much higher than those in most developed countries in Europe and North America [1]. Statistical analysis further revealed that 76.92% of all industrial accidents associated with industrial machines (hereafter referred to as “items”) were caused by technical reasons in the Republic of Korea. For ease of interpretation, the term “industrial accidents” was used to indicate all industrial accidents that involved injuries or deaths or both in this study.

Fig. 1 depicts a flow chart for cause analysis of industrial accidents associated with items. Causes of industrial accidents are first classified into technical ones, managerial ones, and educational ones at the highest level. These causes are further classified at subsequent levels. In 2009, 28,441 cases of industrial accidents associated with items were analyzed to classify their causes according to the flow chart in Fig. 1. Most of the industrial accidents caused by technical reasons were mainly due to defects of items, items without safety devices, or malfunctioning of safety devices attached to them, as shown in Table 1. Malfunction or defects of personal protection equipment account for only a small portion of those cases. Statistical analysis also showed that 59.66% (16,968 cases) among them were preventable. Managerial causes and

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educational causes were responsible for only 21.03% and 0.44% of all cases, respectively. Most of the technical causes can be resolved at the stage of manufacture, and subsequent elimination of sources of danger appear to be more effective than any other means for prevention of industrial accidents associated with items. Safety certification is, therefore, thought to play a key role in preventing industrial accidents associated with items.

The importance of safety function of industrial machines was also important in other countries. A 2014 survey commissioned by the European Union Occupational Safety and Health Agency in collaboration with the Health and Safety Executive in the UK, e.g., explores how health and safety risks are managed at the workplace. The most common reported workplace risk was “machines or tools.” Compared with what we know about causes of injury, one in five of all fatal injuries in the sector over the past 5 years were due to contact with machinery and it accounts for over 10% of employer-reported nonfatal injuries within the manufacturing sector [3]. About 5% of employer-reported fatal and nonfatal injuries were due to contact with machinery within the construction sector [4].

However, as explained in a subsequent section, current direct regulations on industrial machines used in the workplace in the Republic of Korea are mainly focused on users. Safety device regulation on users, which is unique, in the Republic of Korea is a good example. Limited responsibility of manufacturers may lead to a situation where effective elimination of sources of danger at the stage of manufacture are not realizable. There also arises a question as to whether such a direct regulation is efficient enough to lower the industrial accident rate associated with industrial machines to the level in most developed counties in the near future with limited resources put on.

The effectiveness of safety certification and inspection in the Republic of Korea which is based on European Conformité Européene (CE) marking have been evaluated elsewhere [2,5,6]. In other countries such as Taiwan where industrial safety systems are similar to the Republic of Korea, effectiveness of CE marking-compatible safety certification and its impact on competitiveness of items have been reported [7]. Another report also confirmed the effectiveness of CE marking on industrial machines [8]. No quantitative evaluation of direct regulation on users such as safety device regulation has ever been made in the Republic of Korea and its effectiveness is still in question.

Table 1
Causes of industrial accidents associated with industrial machines in 2009, Journal of Korean Society of Safety, 2014 [1]

| Classification level        | High                  | Middle             | Low                     |
|----------------------------|-----------------------|--------------------|-------------------------|
|                           | No. of cases (%)      |                    |                         |
| High                       |                       |                    |                         |
| Technical causes           | 9,845 (34.62)         | 334 (1.20)         | 6,299 (22.14)           |
|                           | 351 (1.23)            | 139 (0.48)         | 4,909 (17.26)           |
|                           | 21,877 (76.92)        |                    |                         |
| Managerial causes          | 544 (1.91)            | 57 (0.20)          | 545 (1.92)              |
|                           | 541 (21.03)           |                    |                         |
| Educational causes         | 126 (0.44)            |                    | 458 (1.61)              |
| Not classified             | 458 (1.61)            |                    |                         |
| Total                     | 28,441 (100.00)       |                    |                         |

PPE, personal protection equipment.

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