



A Mini Review on Efficacy of Safety Management Systems in Construction

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Abstract:

Safety is number one priority in all industries, specifically construction industry, which is one of the most hazardous industries among all other industries and the necessity of safety performance improvement is always an issue among practitioners and researchers. Developing and implementing safety management system in organizations is a necessity. Safety management system (SMS) is a complete Management system intended to oversee wellbeing components in the working environment. It incorporates approach, targets, plans, methods, association, duties and different measures. The purpose of this study is to discuss safety management system elements and sub elements, as well as evaluating and analyzing the relationship between implementing safety management system and safety performance based on previous studies. The results show that in mandatory and voluntarily interventions of safety management systems in organizations, the outcome, which are safety performance index and productivity is positive.

I. INTRODUCTION

According to Edwards and Nicholas (2002), Construction industry is one of the most hazardous industries among all other industries and the necessity of safety performance improvement is always an issue among practitioners and researchers. One of the main tools for improving safety performance is having a robust and in place safety management system (SMS). Safety management system (SMS) is a complete Management system intended to oversee wellbeing components in the working environment. It incorporates approach, targets, plans, methods, association, duties and different measures. The SMS is utilized as a part of businesses that oversee critical dangers, including avionics, oil, concoction, power era and others. The concept of safety management system has been emerged in the last two decades. Based on previous research, a good safety management system should characterize how the association is set up to oversee hazard, recognize working environment hazard and execute appropriate controls, actualize powerful correspondences over all levels of the association, actualize a procedure to distinguish and amend non-congruities, execute a consistent change process, and at last a safety management should be customized to be fit in that organization instead of being general and broad. Safety management system doesn't have a solid definition among researchers (Robson et al., 2007). As an example, the definition of safety management system by International Labor Organization (ILO) is "a set of interrelated r interacting elements to establish OSH policy and objectives, d to achieve those objectives. The definition by ILO is very broad and vogue since it can't be determined based on definition that whether management components are embedded in the safety management system or not. Nielsen (2000) has defined safety management system as "OHSM systems are not, of course, a well-defined set of management systems. Indeed, there are not clear boundaries between OHS activities, OHS management, and OHSM systems." Safety management systems are whether mandatory or voluntary, which the mandatory ones are the ones

that are obligated by government, and voluntary ones are the ones that are being developed and implemented by organizations.

Characteristics of Construction Industry

Hallowell (2008) has identified two main characteristics for construction industry. The first characteristic of construction industry is fragmentation. Construction industry is highly fragmented, and historically safety is the main responsibility of the contractor, and owner and designer have not been involved in safety performance improvement in the past. Construction projects are being done mostly under design bid build type of delivery which makes it more fragmented and parties are not cooperating with each other as it is in integrated project delivery (IPD). The other characteristic of construction industry is being dynamic. Unlike manufacturing, construction is highly dynamic, and the tasks are not repeatable. This feature is being considered as one of the main cause of poor safety performance in construction industry.

Three main safety management systems

There are three main safety management systems in the world which are known as mandatory safety management system.

HS (G) 65 – International Guidelines from the British Health and Safety Executive

The British Health and Safety Executive (HSE) is the UK government element that behaviors work environment Safety reviews. The reference for the HSE rules, entitled "Fruitful Health and Safety Management," is HS(G)65. They additionally apply the PDCA (design do-registration, see above) demonstrate. Like OHSAS 18001, HS(G)65 can be reviewed for consistence and has accomplished a specific level of universal reception.

ILO-OSH 2001, the Standard from the International Labor Organization: In 2000, the International Labor Organization (ILO) proposed ISO (the International Organization for

Standardization) may make a worldwide standard for a SMS, as ISO 9000 (quality). Be that as it may, ISO rejected the thought. Accordingly, the ILO (and not ISO) inspected a score of word related wellbeing and Safety Management systems from various nations, keeping in mind the end goal to deliver its own "Rules on word related Safety and wellbeing management systems – ILO-OSH 2001." The ILO rules are not certifiable, but rather like the other significant SMS gauges, they look to guarantee security, while protecting profitability and effectiveness. The rules are likewise custom-made to various industry segments, one of which is construction, referenced by Article 2.3. ILO-OSH 2001 is referenced by Japan specifically, which has created its own particular ILO-perfect construction SMS rules under the bearing of JCOSHA (The Japan Construction Occupational Safety and Health Association.) Toward the finish of 2013, the ISO endorsed a proposition to build up a SMS standard closely resembling the OHSAS 18000 gauges. The new ISO standard will be ISO 45001. One of the objectives of ISO is to build worldwide acknowledgment and usage of ISO 45001, contrasted with current levels accomplished by the OHSAS models. (Hinze, 1998)

Occupational Safety and Health Administration

In the US, the Occupational Safety and Health Management (OSHA) is the government organization attempting to enhance wellbeing and wellbeing at work. OSHA applies government laws for the US when all is said in done, albeit a few states additionally have their own obligatory wellbeing and wellbeing programs. Rather than endorsing a SMS, OSHA adopts an alternate. Different SMS models utilize diverse phrasing, the procedure and work process for wellbeing Management systems are generally comparative; (Ding, 2000)

- Arrangement – Establish inside strategy proclamations what the necessities are for the association as far as assets, characterizing Management duty and characterizing OSH targets
 - Sorting out – How is the association organized, where are duties and accountabilities characterized, who reports to who and who is in charge of what.
 - Arranging and Implementation – What enactment and models apply to our association, what OSH destinations are characterized and how are these audits, peril counteractive action and the appraisal and Management of hazard.
- Assessment – How is OSH execution measured and evaluated, what are the procedures for the announcing of mishances and episodes and for the examination of mishaps and what inner and outside review forms are set up to survey the system.

Common parameters in safety management systems

Each organization has its own customized version of safety management system, which is fit for that specific organization. According to Overseas Territories Aviation Circular, the broad safety management system consists of safety policy, intention, and policies for continues improvement (OTAR, 2006).

According to Peterson (2005), there are nine elements in safety management systems. The nine elements are listed below:

- Management credibility
- Supervisory performance
- Employee training
- Communications
- Employee involvement

- Accident investigation
- Stress
- Hazard control
- Employee attitude

Each of these elements has their own sub elements in order to be clear and easy to implement and enforce. The insurance Institute for Highway Safety has gathered elements that are necessary for implementing safety management systems. Their safety management system has 11 elements that are listed below (symposium, 2007).

- Safety promotion
- Management plan
- Hazard identification and risk management
- Data and information management
- Hazard and occurrence reporting
- Occurrence investigation and analysis
- Safety assurance oversight program
- Safety management trainings
- Management of changes
- Emergency preparedness and response
- Performance measurement

Each of these elements have its own sub elements, which in this case there are 89 sub elements related to these elements. According to ismail et al. (2011), each country has its own national safety management system that is mandatory for industries in that specific country. Safety elements in the safety management system in Austria are listed below:

- Project management committee
- Hazard management
- Training, information and promotion
- Implementation
- Recording, reporting and investigation
- Emergency procedures
- Safety review

Or in Malaysia, there are more in details, which are listed below:

- Organization in construction management
- Good communication
- Clear goals
- Availability
- Control of sub-contractors
- Contractors satisfaction
- Codes and standards
- Training
- Staff responsibility
- Construction cost optimization
- Safety controlling
- Management commitment

There is variety of similarities between each safety management system, which could be hidden sometimes since the wording and terms that are used in one system can be something else in the other safety management system. Safety management system in many cases are similar to each other, but the way of development for each of those are different, some are based on previous accident analysis, and some are based on previous safety program within that organization (Jazyeri&Dadi, 2017) Oregon OSHA is another organization that came up with safety

management system with 7 essential elements. The first element is management commitment, which is an important factor in any safety management system. Management can show to their employees that they are committed to safety by communicating safety tips with their employees and assigning duties and task to employees pertaining safety, and let employees feel that they can talk about their concerns regarding safety in the workplace. Owner's role is part of management commitment, which the importance of it has been proved by previous research. Owners have significant role in improving safety performance of project and the importance of owner's role in safety has been proven by previous research such as Liu et al. (2017) that they evaluated the role of owners in safety performance based on their model that consist of elements such as establishing attitudes toward safety, communicating attitudes toward safety, contractual safety arrangement, monitoring and involvement. The other element of the Oregon OSHA is accountability that should be implemented and it can be done by educating employees and giving them authorities in order to perform safely in work sites. The other element of Oregon OSHA is involvement, which is essential to any robust safety management system, that let employees feel comfortable to participate in any safety problems and become leaders in safety in every department. Liu et al. (2015) have developed 7 sub elements for this item, which are: development and review of safety and health policy, conducting risk assessments, organizing for safety and health activities, implementing the safety plan, measuring safety and health performance, investigating incidents, accidents, and near misses, and develop lessons learned from the investigations and review. The other element is hazard identification, which is significantly important because employees should have the ability to identify and mitigate hazards and there should be a robust system of controlling hazards. The other element is accident analysis, and the reason this element is significantly important for any safety management system is that by having this element in the system, each organization can analyze what happened or any near misses and control it or prevent it for better safety performance in the future (OSHACADEMY, 2017). The other element of Oregon OSHA is education and training, and it says that all employees should be trained and educated about safety in workplace in order to prevent and mitigate any hazards that could happen in job site. The last element in Oregon OSHA is reviewing and evaluating the current safety program in place in order to analyze it and fix it if it needs to be improved for continuous improvement. Redinger and Levine (1998) have gathered all the components of safety management system and made a universal safety management system that constitutes all the necessary factors that need to be in the safety management system. Below is the list of factors in their universal safety management system:

- management commitment and resources
- employee participation
- occupational health and safety policy
- goals and objectives
- performance measures
- system planning and development
- safety management system manual and procedures
- training system
- hazard control system
- preventive and corrective action system
- procurement and contracting

- communication system
- evaluation system
- continual improvement
- integration
- management review

One of the main issues with safety management systems that need to be considered beforehand is the way of measure each element. Each element should come with the way of measurement and specific threshold for enforcing it. Nowadays the industry is moving toward leading indicators as a method of measurement which all items of the safety management system should have the capacity of being measured in this way; otherwise it needs to be measured by lagging indicators. There are variety of problems with lagging indicators that are not being discussed in this paper.

Efficacy of safety management systems

The main goal of any safety management system is to have better outcome, which in this case it should be better safety performance. There are variety of studies that have investigated the relationship between safety management system and safety performance (Vinodkumar and Bhasi 2010; Bottani et al. 2009; Hamidi et al. 2012). Majority of these studies have proven that safety management system has a positive relationship with safety performance. There are some studies that says that the connection between safety management system and safety performance Is not clearly positive such as Gallagher et al. (2003). Bottani et al. (2009) has investigated 116 firms in area of manufacturing, building, commercial and etcin order to find the relationship between safety management system and safety performance. They categorized companies in two groups of adopters and non-adopter to see the differences between these two groups. The results show that adopters got higher scores with regard to employee training, assessing risks, defining safety and communicating those to employees, and updating risk data. Robson et al. (2006) has investigated research papaers regarding the effects of safety management system on safety performance, and they filtered out 13 papers that fit into their requirements. They evaluated the role of intervention (mandatory and voluntarily). Six of them are mandatory interventions (Dufour et al. 1998; Lewchuk et al. 1996; Saksvik and Nytro 1996; Nytro et al. 1998; Saksvik et al. 2003; Torp et al. 2000) and seven of them are voluntarily interventions (Alsop and LeCouteur 1999; Bunn et al. 2001; Edkins 1998; LaMontagne et al. 2004; Pearse 2002; Walker and Tait 2004; Yassi 1998). The size of the workplaces that have been investigated in those 13 papers range from 1 to 2092, and the quality of method ranges from normal to high quality, which is considered as good thing for systematic review in this size. The seven studies of voluntarily interventions all demonstrate positive effects which are:

- “increased OHSMS implementation over time;
 - intermediate effects (e.g., better safety climate, increased hazard reporting by employees, more organizational action taken on OHS issues);
 - decreases in injury rates;
 - decreases in disability-related costs (e.g., workers' compensation costs, short- and long term disability costs).”
- The mandatory inventions also show positive effects which the results are:
- “increased OHSMS implementation over time;

- intermediate effects (e.g., increased HES awareness; improved employee perceptions of the physical working environment and the psychosocial environment; and increased workers' participation in HES activities);
- decreases in lost-time injury rates; and
- Increases in workplace productivity.”

Which Safety Management System Should You Use?

The conditions and needs of your own construction organization are extraordinary, however a few pointers may help choose which systems are reasonable.

- Your decision may rely upon where your construction organization is found. In the US for instance, OSHA and any state-particular necessities must be met. In Japan, ILO-OSH 2001 might be the conspicuous decision – or the Japanese identical, which are the JCOSHA Construction Occupational Health and Safety Management System Guidelines.
 - Your clients might be more arranged to work with you in the event that you can show consistence with a SMS that they support. On the other hand, they might support the SMS you need to utilize. Do a little statistical surveying – ask them!
 - The procedure for confirmation to this famous standard can begin today.
 - In the event that you require a product based answer for set up your SMS and show consistence for worldwide affirmation, OHSAS 18001 may again be a decent trade off.
 - In the event that ISO confirmation is your objective, instead of OHSAS or ILO, and your timetable is adaptable, consider holding up until the ISO 45001 standard is distributed.
 - As a little construction organization, take a gander at adaptable cloud-based SMS arrangements that enable you to begin today, at that point overhaul your SMS capacities as your construction organization develops.
- By the brilliant administer is to have a wellbeing management system that works for your organization. While affirmation and consistence to a given SMS standard can influence your construction to organization look more appealing to your market, the quick need is for an appropriately performing Safety Management system that helps keep your representatives, clients, accomplices, and people in general safe.

II. CONCLUSION

The main purpose of the paper was to demonstrate common safety management systems, and main elements of each safety management system. There are similarities between safety management systems and in many cases the wording of elements could be different, but in majority of safety management systems, the whole concepts are very similar. The analysis on efficacy of safety management systems show that in both cases of mandatory and voluntarily, the results are almost the same and show the positive impact on safety performance. The safety performances in analysis above are decrease in lost time injury rate, increase in productivity, improvement in employee perception, and so on. Literature review in this study showed that customized safety management system for each organization is necessary since the method of measurement for each element is different in each organization. A SMS is a strategy, as opposed to an item. The execution of a SMS might be paper-based or programming based, for example. In any case, the

usage must be reported and auditable, implying that a Safety examiner (among others) can check it.

III. REFERENCES

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