KEY PROCESS AREAS (KPAs), KEY PROCESSES, AND KEY PRACTICES OF ENABLERS IN OSH MANAGEMENT SYSTEMS

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ABSTRACT: This paper reports on finding of the study of the key process areas, key processes, and key practices of enablers in OSH. Key processes of the OSH management system were categorized under 4 major topic areas: OSH requirements management, OSH planning, hazard management, and OSH measurement and analysis. The enablers of the OSH evaluation can be divided into 4 parts: commitment to perform, ability to perform, activities performed, and verifying implementation. Each of them contains at least two key practices to indicate whether the implementation and institutionalization of the key processes is effective, repeatable and lasting.

Keywords *:* Construction industry, Occupational Safety and Health management, Enablers in OSH

1. INTRODUCTION

Construction industry has earned the reputation of being a highly hazardous industry because of the high incidence of accidents and fatality rates. It is needed to look into a new way in improving its image. One key to success in business is minimizing cost. Providing a safe and health workplace is one of the most effective strategies for holding down the cost of doing construction business. Accidents frequencies and property losses create great impact to construction company. Not only do they cause delays in operations but also directly and indirectly incur cost. Therefore, it is mandatory for all construction companies to provide a safe working environment for their workers and subcontractors.

Occupational Safety and Health (OSH) at work is an issue affecting all businesses. OSH is a major issue for companies mainly due to the fear of prosecution. With better enforcement of the legislation and commitment from employers and employees, construction safety has received greater attention (R.Kunju, *et al*, 1999). Consequently, the improvement of safety and health in construction is a necessary goal for all participants in the construction process. Besides that, safer workplaces will help to improve productivity accompanied by reduced costs, better time performance and increased profitability.

In the increasingly global competitiveness of the construction business, quality control and quality assurance for a consistent level of performance in OSH is no longer optional. OSH management system is a decisive factor in the effectiveness of the operations of construction companies. The implementation of OSH management system provides a structured process to minimize potentials of work-related injuries while simultaneously achieving significant cost reductions. It provides a foundation for construction companies to implement a documented approach to continual improvement of its OSH performance.

2. OBJECTIVES

The objectives of this paper are:

a) To identify the key process areas and key processes of OSH management system.
b) To identify the key practices of enablers to indicate whether the implementation and institutionalization of the key processes is effective, repeatable and lasting.

3. RESEARCH METHODOLOGY

The methodology of this study consists of the following:

a) Literature review is to determine: OSH performance of the construction industry.
b) Identify the key process areas (KPAs), key processes and key practices of enablers.
c) To verify the key process areas, key processes, and key practices of enablers through the formal interviews.

A comprehensive literature review was conducted to study the scenario of OSH performance in the construction industry and the concept of Capability Maturity Model (CMM). The essential information obtained from the comparison study of the four international standards of OSH management system is to identify the KPAs and key processes that will affect the OSH management system performance. And the key practices of enablers for each of the KPA were then being identified.

Following an extensive literature review, formal interviews with 5 certified safety experts of construction industry were conducted. It is a survey to determine the importance of the selected KPAs, key process and key practices to evaluate the performance of OSH management system in the construction industry. The response was very positive and recommendations helped to focus on essential OSH management elements. This modification was also achieved by grouping some similar key processes into the same KPA.

4. RESULTS AND DISCUSSIONS

Having identified key processes and key practices of enablers from the literature review, this research respectively presents the results and discussions on the perceptions of the construction company to the OSH management system activities. This was achieved using data obtained from a postal questionnaire survey and interviews. These construction companies were selected from the list of Kuala Lumpur Stock Exchange (KLSE) and local contractors Grade 7. It was because their construction projects were usually big and most of them were using the OSH management system in their company.

4.1 Identify the Enablers

Four enablers were identified according to the concept of Capability Maturity Model (CMM) they are **Commitment to Perform, Ability to Perform, Activity Performed, and Verifying Implementation**. But within each of the enablers there are some different key practices according to the characteristics of key processes. Four enablers organize the generic practices of each process area. Key practices of enablers are identified through the literature review of the OSH management and the concept of CMM.

4.2 Analysis of Key Processes

The level of agreement of the key processes was ranked according to their priorities. 14 key processes of the OSH management system were categorized under 4 major topic areas: OSH requirements management, OSH planning, hazard management, and OSH measurement and analysis. The 14 key processes were developed through an intensive literature review and discussion with 10 of the experienced safety managers and safety officers. From this survey, the researcher hoped to assess the industry responses towards the importance of these 14 key processes regarding each of the topic areas.

Table 1 displays the responses according to the type of company. The overall response was 1.57. The breakdowns of these averages were 1.56 and 1.58 representing the responses of KLSE listed construction companies and Grade 7 construction companies. Responses from these two groups were almost the same. Frequency analysis was also performed for the 14 key processes by 2 groupings of the construction companies. Percentage scoring of the 'agree' region of the scale was calculated for each of the key processes. The analysis indicated that more than 80% of the respondents from KLSE listed construction companies and Grade 7 construction companies perceived all of the key processes presented to them were as important as the OSH management activities.

Table 1: Mean score of the key processes

Key Process Areas	Listed company	Grade 7 company	Total response	Probability value for Kruskal - Wallis test
1. OSH REQUIREMENTS MANAGEMENT				
1.1 Develop OSH goals and objectives	1.33	1.55	**1.45**	**0.78**
1.2 Regulatory compliance and conformity	1.33	1.55	**1.45**	**0.25**
1.3 OSH management programs	1.39	1.45	**1.43**	**0.63**
2. OSH PLANNING				
2.1 Hazard identification	1.44	1.36	**1.40**	**0.79**
2.2 OSH risk assessment	1.50	1.55	**1.53**	**0.60**
2.3 Risk control	1.61	1.41	**1.50**	**0.49**
2.4 Emergency response plan	1.61	1.50	**1.55**	**0.68**
3. HAZARD MANAGEMENT				
3.1 Operational & engineering control	1.67	1.55	**1.60**	**0.42**
3.2 OSH inspection & evaluation	1.56	1.77	**1.68**	**0.40**
3.3 Accidents, incidents and non-conformance investigation	1.61	1.73	**1.68**	**0.92**
3.4 OSH training	1.56	1.55	**1.55**	**0.18**
4. OSH MEASUREMENT & ANALYSIS				
4.1 OSH performance measures	1.78	1.55	**1.65**	**0.38**
4.2 OSH audit	1.72	1.82	**1.78**	**0.48**
4.3 Management review	1.72	1.77	**1.75**	**0.86**
Overall Response	**1.56**	**1.58**	**1.57**	

*Krukal-Wallis 1-way ANOVA test for k-independent sample with significance level of 5% (1 = strongly agree, 2 = agree, 3 = moderate agree, 4 = disagree, 5 = strongly disagree).

To determine whether there is a statistically significant difference perception amongst the 2 categories of construction companies, a non-parametric Kruskal-Wallis 1-way ANOVA test for k-independent sample with significance level of 5% was performed using the SPSS statistical package. The Krukal-Wallis test requires the data to be measured at least on an ordinal scale. This result signified that the probability of occurrence under null hypothesis of values is large as the H values (Kruskal-Wallis Coefficient) were greater than the set level of significance, with α = 0.05. Table 6 shows that the significance of all the key processes was greater than the set level of significance (0.05). It means that the research samples that came from different populations can be accepted.

The agreement indices calculated for all of the key processes showed similar levels of agreement from KLSE listed construction companies and Grade 7 construction companies. Table 2 shows that the mean indices for all of the key processes are above 0.84, conforming concordance in views between the two categories of construction company. The total indices calculated for key processes resulted in mean indices ranging between 0.85 – 0.92.

Through the ANOVA (Kruskal-Wallis) test and relative index analysis, we can confirm that all of the key processes had been rated in a similar manner (strongly agreement and agreement) by the respondents. Since both of the mean score analysis and relative agreement indices analysis have shown a good agreement for all of the key processes, they are all important activities for the OSH management system.

4.3 Ranking of Key Processes

Agreement indices calculated for each of the 14 key processes were used to rank them in order of importance. The largest index of the key process means the highest rank in their topic area. Subsequently, the mean index of all key processes for each respective area (OSH Requirements Management, OSH Planning, Hazard Management, and OSH Measurement and Analysis) was calculated to rank them. These rankings prioritize the level of attention to be given to each key process and respective activities within them.

From Table 2, it can be seen that the OSH management programs and hazard identification are considered the two of the most important areas in the OSH management system. Their agreement indices were the highest, 0.92. This is probably because both of them play the main roles in the OSH management system. But the difference between the other key processes was not very clear. It means that all of the key processes were also play an important role in the OSH management system. Beside that, agreement indices of key processes between the KLSE listed construction companies and Grade 7 construction companies were very close.

For example, the evaluation of OSH management system is started from the OSH Requirements Management. To identify the satisfactory of the OSH Requirements Management, the person who conducts the OSH evaluation matrix will start to evaluate the OSH management programs. The evaluation process will be continued by evaluate the following key processes. But to achieve a mature OSH management system, all of the key processes must be satisfied.

Table 2: Relative agreement indices of key processes

Key Process Areas	Listed company	Grade 7 company	Total sample	Rank
1. OSH REQUIREMENTS MANAGEMENT				
1.1 Develop OSH goals and objectives	0.93	0.89	**0.91**	**2***
1.2 Regulatory compliance and conformity	0.93	0.89	**0.91**	**3**
1.3 OSH management programs	0.92	0.91	**0.92**	**1**
2. OSH PLANNING				
2.1 Hazard identification	0.91	0.93	**0.92**	**1**
2.2 OSH risk assessment	0.90	0.89	**0.90**	**3**
2.3 Risk control	0.88	0.92	**0.90**	**2***
2.4 Emergency response plan	0.88	0.90	**0.89**	**4**

Key Process Areas	Listed company	Grade 7 company	Total sample	Rank
3. HAZARD MANAGEMENT				
3.1 Operational & engineering control	0.87	0.89	**0.88**	**2**
3.2 OSH inspection & evaluation	0.89	0.85	**0.87**	**3***
3.3 Accidents, incidents and non-conformance investigation	0.88	0.85	**0.87**	**4**
3.4 OSH training	0.89	0.89	**0.89**	**1**
4. OSH MEASUREMENT & ANALYSIS				
4.1 OSH performance measures	0.84	0.89	**0.87**	**1**
4.2 OSH audit	0.86	0.84	**0.85**	**3**
4.3 Management review	0.86	0.85	**0.86**	**2**
Overall Response	**0.89**	**0.89**		

*Based on percentage response scored above median value on the agreement scale

4.4 Analysis of Key Practices by 2 Categories of Construction Company

The enablers of the OSH evaluation can be divided into 4 parts. They are: Commitment to Perform, Ability to Perform, Activities Performed, and Verifying Implementation. Each of them contains at least two key practices to indicate whether the implementation and institutionalization of the key processes is effective, repeatable and lasting.

Key practices of enablers for the Commitment to Perform, Ability to Perform, and Verifying Implementation are the same. It is because they are being called as the institutionalizing common features. So their requirements for the OSH management's mature process are more common and similar. On the other hand, key practices for the Activities Performed for each of the key process areas are varied. They are being described as implementing common features. Management activities are different according to the characteristic of the job. It is impossible to group all the key practices of the Activities Performed into one. Some of the key practices of Activities Performed are essential for certain key process areas, but not for the others.

Tables 3, 4 and 9 show the results of the key practices of Commitment to Perform, Ability to Perform, and Verifying Implementation. Mean score of 'important' region of the scale was calculated for their enablers separately for KLSE listed construction companies and Grade 7 construction companies to test their significance at 5% level. The mean values of the enablers of Commitment to Perform were lowest, they were 1.63 and 1.84. So, OSH policy and continual improvement should be noted that the said to be best practices are recognized by the construction industry to indicate the implementation of OSH management system.

To support the findings of mean score analysis, the median score calculated for each of the key practices concentrates on either 1 or 2 of the scale as shown in appendix B. This means that the key practices were either 'very important' or 'important' to indicate the implementation of the key process areas. The median values were also calculated for each of the key practices. The median scores represent the central tendency of responses.

Tables 5-8 are the analysis results of the key practices of the Key Performed from the key process areas (OSH requirements management, OSH planning, hazard management, and OSH measurement and analysis). The mean values of the key practices were between 1.70-1.92. Mean values of the Activities Performed were higher than the other groups. Their median scores were concentrated on 2 of the scale. This means that the key practices are 'important' to indicate the implementation of the Activities Performed.

The ANOVA (Kruskall-Wallis) test was applied to each one of the key practices for the 2 categories of respondents (KLSE listed construction companies and Grade 7 construction companies). Although the mean scores of the KLSE listed construction companies and Grade 7 construction companies were fairly close. They still needed to identify any differences between the perception of the respondents. As the result, the significance of the key practices of Activities Performed for the OSH Planning and OSH Measurement and Analysis was nearly to the 0.05.

The significance values for OSH Planning and OSH Measurement and Analysis are 0.06. However, they were proven to be acceptable. Except two of them, there was no statistical significant difference between the two groups of respondents at 5% of significance level. This means that the research samples which came from the different populations should be accepted.

Table 3 : Commitment to Perform analysis

Commitment to perform	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. The organization follows a written OSH policy for planning and managing the key process.	1.73	1.59	**1.00**	**1.65**	**0.44**
2. Commitment to continual improvement.	1.67	1.61	**1.00**	**1.63**	**0.96**

Table 4 : Ability to Perform analysis

Ability to perform	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Establish and maintain a plan for performing the key process.	1.80	1.78	**2.00**	**1.79**	**0.27**
2. Assign responsibility and authority.	1.71	1.71	**2.00**	**1.71**	**0.99**
3. Provide adequate and appropriate resources and funding.	1.78	1.89	**2.00**	**1.84**	**0.38**
4. Availability of reliable OSH records/ information.	1.71	1.77	**2.00**	**1.74**	**0.46**
5. Personnel have experience or receive training to applicable to their areas of responsibility.	1.78	1.81	**2.00**	**1.79**	**0.36**

Table 5 : Analysis of Activity Performed – OSH Requirements Management

Activity Performed	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Review the key process before they are incorporated into the construction project.	1.74	1.67	**2.00**	**1.70**	**0.38**
2. Key process as the basis for OSH plan, hazard management, OSH measurement and analysis.	1.83	1.77	**2.00**	**1.80**	**0.28**
3. Monitor and control the performing of key process against the plan and take appropriate corrective action.	1.78	1.74	**2.00**	**1.76**	**0.35**

Table 6 : Analysis of Activity Performed – OSH Planning

Activity Performed	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Identify and involve the relevant stakeholders of the key process as planned.	1.97	1.88	**2.00**	**1.92**	**0.10**
2. Key process is planned according to a documented procedure.	1.78	1.84	**2.00**	**1.81**	**0.37**
3. Collect all relevant OSH improvement data and information.	1.78	1.80	**2.00**	**1.79**	**0.06**
4. Monitor and control the performing of key process against the plan and take appropriate corrective action.	1.74	1.86	**2.00**	**1.81**	**0.24**

Table 7 : Analysis of Activity Performed – Hazard Management

Activity Performed	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Document the approach to perform the key process.	1.79	1.83	**2.00**	**1.81**	**0.59**
2. Execute the key process according to a documented procedure.	1.83	1.81	**2.00**	**1.82**	**0.59**
3. Data collection and analysis, and record keeping.	1.85	1.78	**2.00**	**1.82**	**0.29**
4. Monitor and control the performing of key process against the plan and take appropriate corrective action.	1.79	1.80	**2.00**	**1.79**	**0.18**

Table 8 : Analysis of Activity Performed – OSH Measurement and Analysis

Activity Performed	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Document the approach to perform the key process.	1.94	1.74	**2.00**	**1.83**	**0.49**
2. Perform the key process according to a documented procedure.	1.87	1.77	**2.00**	**1.82**	**0.33**
3. Analyzed and reported the measurement data.	1.76	1.73	**2.00**	**1.74**	**0.66**
4. Manage and store measurement data, measurement specifications, and analysis result.	1.81	1.76	**2.00**	**1.78**	**0.25**
5. Monitor and control the performing of key process against the plan and take appropriate corrective action.	1.81	1.76	**2.00**	**1.78**	**0.06**

Table 9 : Verifying Implementation analysis

Verifying Implementation	Listed	Grade 7	Median	Mean score	Significance level of 5%
1. Objectively evaluate adherence of the key process against its process description, standards, procedures, and address noncompliance.	1.77	1.83	**2.00**	**1.81**	**0.58**
2. Periodic review status and results with higher level management and resolve issues.	1.77	1.90	**2.00**	**1.84**	**0.89**

5. CONCLUSION

This study has analyzed the data obtained from the questionnaire survey with the aim of evaluating the key processes and key. The key processes and key practices were identified through the literature review. Several statistical tests including analysis of mean, frequency analysis, relative indices, and analysis of variance were used to analyze the data. Results of the analysis revealed a demonstrable relationship between the findings of the literature review and their practical applications to the construction companies. It was also shown that the key processes and key practices were all accepted.

Four enablers were identified according to the concept of CMM; they are **Commitment to Perform, Ability to Perform, Activity Performed, and Verifying Implementation**. But within each of the enablers there are some different key practices according to the characteristics of key processes. Four enablers organize the generic practices of each process area. Key practices of enablers are identified through the literature review of the OSH management and the concept of CMM.

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