

# Analysis of Critical Management Factors for Managing Safety and Health of High Rise Building Construction Projects

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DOI: <https://doi.org/10.30880/rtcebe.2021.02.01.003>  
Received 30 January 2021; Accepted 28 April 2021; Available online 30 June 2021

**Abstract:** The construction sector has been recognized as one of the major economic forces in developing Malaysia to become a developed nation. Nevertheless, there are safety and health issues that have always been seen as a major challenge and should be given attention in the construction industry so that it does not contradict Malaysia's direction to become a developed nation. This study aims to identify the critical management factors on safety and health management practices in high-rise building projects, considering that the current research is a lack understanding of these factors within this particular context. The questionnaire survey was carried out, targeting respondents from high-rise building projects at Johor and Melaka. The descriptive data was analyzed using frequency and percentage distributions to measure respondent demographics. Meanwhile, the agreement on the critical management factors was analyzed using the mean score and the Relative Importance Index (RII). Moreover, the RII was also used to determine the significance of critical management factors and rank the factors. Based on the findings, the occupational safety and health committee (RII = 0.821; mean 4.10) are the most influential critical factor among 13 factors for managing the safety and health of high-rise building construction projects. The finding of this study helps the practitioner to more careful attention to critical management factors that will be impacting the success of safety and health management for construction high-rise building projects.

**Keywords:** Critical Management Factor, Safety and Health, High Rise Building Projects, RII

## 1. Introduction

The construction industry is an important element of Malaysia's economy because it is widely linked with many other parts of the economy such as building material products which include the iron and steel industries. According to the Master Plan of Malaysia Construction Industry 2006 – 2015, the construction industry and private sector have assumed an important role in generating wealth and improving the quality of life through the government's socio-economic policies into social and

economic infrastructures and buildings [1]. The construction sector has historically been recognized as one of the main economic powers that have contributed immensely in developing Malaysia on becoming a developed nation by the year 2020 . Unfortunately, its credibility has been tarnished by high rates of injuries and death incidences that have happened on sites. Based on the statistics from the Department of Occupational Safety and Health (DOSH, 2019), until October 2019 there were 275 accidents occurred in the construction industry compared to the other industries, for instance, manufacturing which has 4070 accidents, which is considered as low. However, the recent number of incidents, injuries, and fatalities recorded are still high and unacceptable as compared to other developed countries.

High rise building can be described as a multistory building generally provided with high-speed elevators, constructed using a structural frame, and combining extraordinary height with ordinary room spaces such as could be found in low-buildings [2]. However, the absolute height of high-rise structures poses a wide variety of building safety management problems, including extreme temperatures on high-altitude floors and diverse physiological and psychological effects on construction workers from operating at those altitudes [3].

Safety and health issues in the construction industry need to pay more attention due to the frequent development of high-rise buildings in the country [4]. There are four types of high-rise accidents which are caused by scaffolding, people fall from a height, hit by an object, and plant and machinery falling [5]. The workers are constantly exposed to the threat of scaffolding collapse. Most of the scaffolding incidents are related to the use of defective scaffolding materials and the unskilled and reckless manufacture of scaffolding. Based on Kai et al. [4], the most frequently happened accidents at high rise building construction site were people falling from height accidents and accidents due to struck by falling object or working tools.

The unsatisfactory occupational safety and health (OSH) record of the construction industry has also been increasing because the OSH management system is being neglected and unfollowed regulation and applied consistently in the construction industry [6]. The increase in statistics on lawsuits in the construction industry is evidence of a lack of knowledge of security law in the construction industry in Malaysia [7]. Many construction companies, do not focus on the significance of providing safety metrics that can contribute to promoting good safety records [8].

Construction sites are high-risk workplaces that can cause accidents because there are many dangerous activities. Thus, having a safe and healthy workplace is one of the most successful methods for keeping down the cost of doing construction business. Considering the current lack of understanding of critical management factors that affects safety and health management within this particular context, this study is an essential step to improve safety and health management in the construction industry, particularly in high-rise building projects. This study aims to investigate the significance of critical management factors that influence safety and health management in high-rise building construction projects. The finding of this study helps the practitioner to more careful attention to critical management factors that will be impacting the success of safety and health management for construction high-rise building projects.

## **2. Critical Management Factors**

The concept of critical success factor (CSF) has been significantly used to present or identify a few key factors that organizations should focus on to be successful. As a definition, critical success factors refer to the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department, or organization [9]. CSFs are the few key variables or factors that the manager should prioritize in other to achieve his/her goals for current or future areas of activity [10]. To maximize the probability of an effective project, an organization needs to identify what

the key performance factors are, routinely and quantitatively analyze these critical factors, predict potential consequences, and then use suitable approaches to resolve them.

However, this study only focuses on the management element in CSF which includes policy, resource management, management culture, and safety management aspects, plays a significant role in contributing to accidents in the construction industry [11]. For instance, accidents or incidents which occur are symptoms transpiring from lack of management commitment in terms of safety issues and 98% of these accidents could be prevented by management personnel [12]. The management element is an indirect cause that enhances the risks of accidents and illnesses [13]. Therefore, for critical safety management factors, these are usually a set of variables or indicators that are closely associated with safety management performance and may contribute to effective management. Critical safety management factors demand management to focus on organizational issues needing attention and right management. By focusing on these factors it can lead to the reduction of accidents [14]. The summary of critical management factors that synthesis from the past researches is as shown in Table 2.1 below.

**Table 2.1: Summary of Critical Management Factors that synthesis from literature reviews**

Item	Critical Management Factors	Researcher (s)
1	Safety education and training of workers	[15, 16, 17, 18, 19, 20, 21]
2	Health and safety communication and feedback	[8, 15, 22,23,24,25,26,27,28,29,30]
3	Safety incentive or reward system	[17, 19, 20, 21, 22, 31]
4	Management support	[15, 16, 17, 20 32, 33]
5	Occupational health and safety policies and programs	[15, 34, 35,36, 37]
6	Occupational health and safety committee	[25, 26, 27, 31, 33, 38, 39]
7	Control of subcontractor	[12, 17, 23, 29]
8	Resources and insurance policies	[27, 32, 37, 38]
9	Emergency response plan	[29, 33, 35]
10	Suitable supervision	[29, 33, 35, 36]
11	Clear and reasonable objective	[15, 16, 19, 25]
12	Safety environment	[9, 21]
13	Health and safety meetings	[15, 24, 33]

Details of the element of critical management factors that can enhance safety and health management practices on a high-rise building project are discussed as follows;

#### 2.1 Safety education and training for workers

Education and training are used to improve worker safety awareness and knowledge and skills to prevent accidents [40]. Adequate safety training can contribute to increased proficiency and decreasing the occurrence of accidents [41]. If employers do not provide sufficient education and training to workers at the construction site, it might lead to some minor and major accidents at the high-

rise building construction site. Previous studies commonly contend that adequate safety training can contribute to increased proficiency and decreasing the occurrence of accidents [41].

## 2.2 Health and safety communication and feedback

Health and safety communication and feedback are known to be another effective way of enhancing health and safety performance in organizations [24]. The processes involving daily health and safety sessions, regular personal interaction by periodic checkups, health and safety committees, and publications in the form of newsletters, correspondence, and memoranda, should be used to provide useful coordination and guidance on health and safety.

## 2.3 Safety incentive or reward system

Safety incentives are widely used to incentives help to motivate the workers to work with safe behavior and to increase safety awareness among the workers on construction sites [43]. Incentives are meant to be a means of constructive strengthening. Monetary (economic type) or career promotion may be a rewarding method. This will make workers give more concerned about safety and health issues during their period at high-rise construction.

## 2.4 Management support

Management support is defined as the top management's involvement and engagement in actions towards achieving a goal [38]. Management support ensures that sufficient resources are allocated for safety management, and proper actions are conducted to improve safety performance. Support from management is an important dimension of safety climate and safety culture to encourage workers to attach more importance to safety. The management must be committed to investing money into those activities to effectively implement OSH [12]. Top management is responsible and appreciates the health and welfare of their workers and does their hardest to reduce the risk, detecting, monitoring, and regulating risks at building sites.

## 2.5 Occupational health and safety policies and programs

Occupational health and safety policy is a published statement showing the organization's thinking and goal in affiliation with the management of health and safety practices [34]. The policy element is generally important in understanding the limit, setting up objectives, and providing proper guidelines in managing OSH in specific activities or situations. This policy can increase safety awareness and at the same time provide information and instruction regarding regulations and good practices [45]. Thus, the implementation of effective policies and good occupational health and safety programs are inter-dependent to enhance occupational health and safety education, also increase awareness of the workers [20]

## 2.6 Occupational health and safety committee

OSH committee is an organizational group within a workplace with members from management, the workers as well as all departments and staff. They provide a way for management and worker to meet regularly to discuss workplace safety and health issues. In relation to the construction site, the safety committee often consists of representatives of the employer, worker, and subcontractor. Safety committees have proved to be effective in discovering unsafe practices and problems [46]. In practice, safety committees take charge of compiling and auditing the technical and management scheme, as well as the implementation of management measures [3].

## 2.7 Control of sub-contractor

Sub-contractors are an essential component in the success of a project as they play a major role in completing the works awarded to the main contractors. [47]. The controlling subcontractor will help avoid injury to employees, protect company integrity, encourage compliance with regulatory laws, and prevent heavy fines associated with violations. Sub-contracting in the construction industry has been proven to be a key challenge for safety management because a greater number of sub-contractors are

involved [47,48]. Controlling the subcontractor will help avoid injury to employees, protect company integrity, encourage compliance with regulatory laws, and prevent heavy fines associated with violations. The level of control is a critical element because it helps to achieve the necessary compliance.

## 2.8 Resources and insurance policies

Resources included budget, safety representative, equipment and tools, and technology. Resource allocation is important to help in safety promotion implemented effectively and to inculcate safety, health, and culture at the construction site. An insurance policy is a contract between the two parties and spells out obligations, responsibilities, benefits available, and policy exclusion [19]. Project owners can manage their risk by requiring contractors to take out certain kinds of insurance (49). Insurance can protect contractors against certain events. Having an accident insurance policy for a construction project was thought to be very vital and hence, also to make sure employees are properly compensated when there is an accident on site [50,51].

## 2.9 Emergency Response Plan (ERP)

An ERP outlines the protocols and processes required to address emergencies. ERP plans include actions to deal with complex emergencies, and workplace management roles and tasks will arise in the event of an emergency. High-rise building projects can be risky areas and should have an ERP, such that in case of a crisis, swift and successful steps can be taken to alleviate the seriousness of the situation and to minimize the effects. Lack of ERP at the project sites makes the construction workers find it difficult to get proper guidance to follow during emergency time. In the event of an accident, emergency rescue is the most efficient way to minimize loss[3].

## 2.10 Suitable supervision

On construction sites, supervision has a key role to play in preventing accidents. One of the important practices at the construction site is guidance and supervision during work progress [36]. Supervision is therefore involved in the running of a typical construction project and in particular in ensuring that health and safety are effectively managed. Appropriate supervision from government agencies such as DOSH should guarantee the provision of adequate safety resources and standardized management. Supervising departments from DOSH as an example will regularly inspect construction sites to ensure safety management conforms to relevant regulations and standards [40]. Inadequate supervision continues to be a feature of the many accidents that occur on construction sites.

## 2.11 A clear and reasonable objective

Clear and reasonable safety goals are the main directions for the safety management of a project. Safety management strategies, such as plans, schemes, and detailed measures, all should aim to achieve the project's safety goals [40]. Making zero accident hours at a construction site should be set as the main objective to reduce safety and health issues in the site.

## 2.12 Safety Environment

Safety environment is essential for every employee in the construction industry because all workers want to work in a safe and protected environment. Safety environment covers a wide scope including physical environment (e.g., light and temperature), site layout, and safety protection [40]. Health and safety are the major factors for all sectors to encourage the well-being of employees and employers alike. It is the company's obligation and social responsibility to see to the safety of the employee. Organizations are legally responsible for creating and maintaining a conducive working environment in which employees can work safely, with no risk to their physical and psychological health and well-being. Poor site management in terms of site layout, space, tidiness, and cleanliness also need to be given attention as causes of occupational accidents [36].

### 2.13 Health and safety meetings

A safety meeting is a gathering which involves all the construction workers to discuss health and safety [20]. This meeting is compulsory for all the key players in the project and the safety committee to attend. The meeting will be led by the representative of the safety committee. During the safety meeting, they will discuss the current issues regarding safety matters such as current accident statistics, recent accident cases, the implementation of safety practices at construction sites. Researchers point-out that with regular safety meeting it would improve safety performance by reinforcing the importance of safety concept and cultivating a culture of safety among the workers [48].

### 3. Research Methodology

A questionnaire survey was designed to collect the main data. The questionnaire was constructed using a five-point Likert scale from strongly disagree to strongly agree. The numbers of items developed in the questionnaire survey for the element of critical management factors are as indicated in Table 3.1.

**Table 3.1: Summary of Variables and Indicators**

Items	Variables (Factors)	Number of Indicators(Items)
<b>Critical Management Factors</b>		
1	Safety education and training of workers	4
2	Health and safety communication and feedback	4
3	Safety incentive or reward system	4
4	Management support	4
5	Occupational health and safety policies and programs	4
6	Occupational health and safety committee	4
7	Control of subcontractor	4
8	Resources and insurance policies	4
9	Emergency response plan	4
10	Suitable supervision	4
11	Clear and reasonable objective	4
12	Safety environment	4
13	Health and safety meetings	4
<b>Total number of Indicators/ Items</b>		<b>52</b>

A process of validating the questionnaire was done through expert validation to determine the degree to which elements of an assessment instrument are relevant to and representative of the targeted constructs. The assessment by experts is essential to ensure that the questionnaire is capable to collect the information needed and meet the objectives of the survey. Feedback gathered from the expert interviews was used to revise the initial questionnaire.

The questionnaire survey was administrated to workers in high-rise building construction projects at Johor and Melaka based on the population and sample size formula. Moreover, the samples of this study were distributed using the purposive sampling technique. A total of 100 questionnaires were distributed through postage mailed to project managers, assistant managers, site engineers, and safety officers who involve in the high-rise building construction projects. One hundred valid questionnaires were collected, giving a response rate of 100%. The response rate of 100% exceeds the normal range of 20%-30% for construction industry research [52 – 54].

#### 4. Result and Discussion

##### 4.1 Respondent demographics

The demography of the respondents covers respondent profile and organization information, as indicated in Table 4.1. 100 respondents who participated in the study are from Melaka and Johor. These locations were chosen because only these locations were available due to the pandemic virus Covid 19 throughout the study.

**Table 4.1: Profile of Respondent (General Information)**

Profile Description	Category	Number	Percentage (%)
Respondents location	Melaka	30	30.0
	Johor	75	75.0
	Total	100	100.0
Level of education	Bachelor degree	58	58.0
	Master degree	39	39.0
	PhD	3	3.0
	Total	100	100.0
Position	Project Manager	5	5.0
	Assistant Manager	6	6.0
	Safety Officer	2	2.0
	Site Engineer	87	87.0
	Total	100	100.0
Years' experience in construction	Less than 5	8	8.0
	6 - 10	31	31.0
	11 - 15	48	48.0
	16 - 20	7	7.0
	More than 20 years	6	6.0
Total	100	100.0	
Progress project status	41 – 60 %	51	51.0
	61 – 80%	20	20.0
	81 – 100%	29	29.0
	Total	100	100.0

Based on these findings, it shows that the respondents are fairly well educated and hence are capable, skilled, and knowledgeable on the subject referred.

#### 4.2 Critical Management Factors That Influence Safety and Health Management in the High-Rise Building Construction Projects.

The critical management factors on safety and health management at high rise project were determined using the mean score and the relative important index (RII) based on the formula [55].

$$RII = \frac{\sum \omega}{A \times N}$$

Where  $\omega$  weighting of each factor obtained from respondents, ranging from 1 to 5 and A is the highest weight (i.e. 5 is highest in this study) and N is the total number of samples. This equation enables normalizing each factor's significance ranging from 0 to 1 and it is the RII. The factor with the highest RII or rank 1 has a maximum impact on safety performance and vice versa. According to Akadiri (2011), five levels of RII values: high (H) ( $0.8 \leq RI \leq 1$ ), high-medium (H-M) ( $0.6 \leq RI \leq 0.8$ ), medium (M) ( $0.4 \leq RI \leq 0.6$ ), medium-low (M-L) ( $0.2 \leq RI \leq 0.4$ ) and low (L) ( $0 \leq RI \leq 0.2$ ). Table 4.2 shows the complete analysis of the element critical management factors that influence safety and health management of high-rise building construction projects. For this study, data ranking was applied to find the significance factors that impacting the success of safety and health management for construction high-rise building projects.

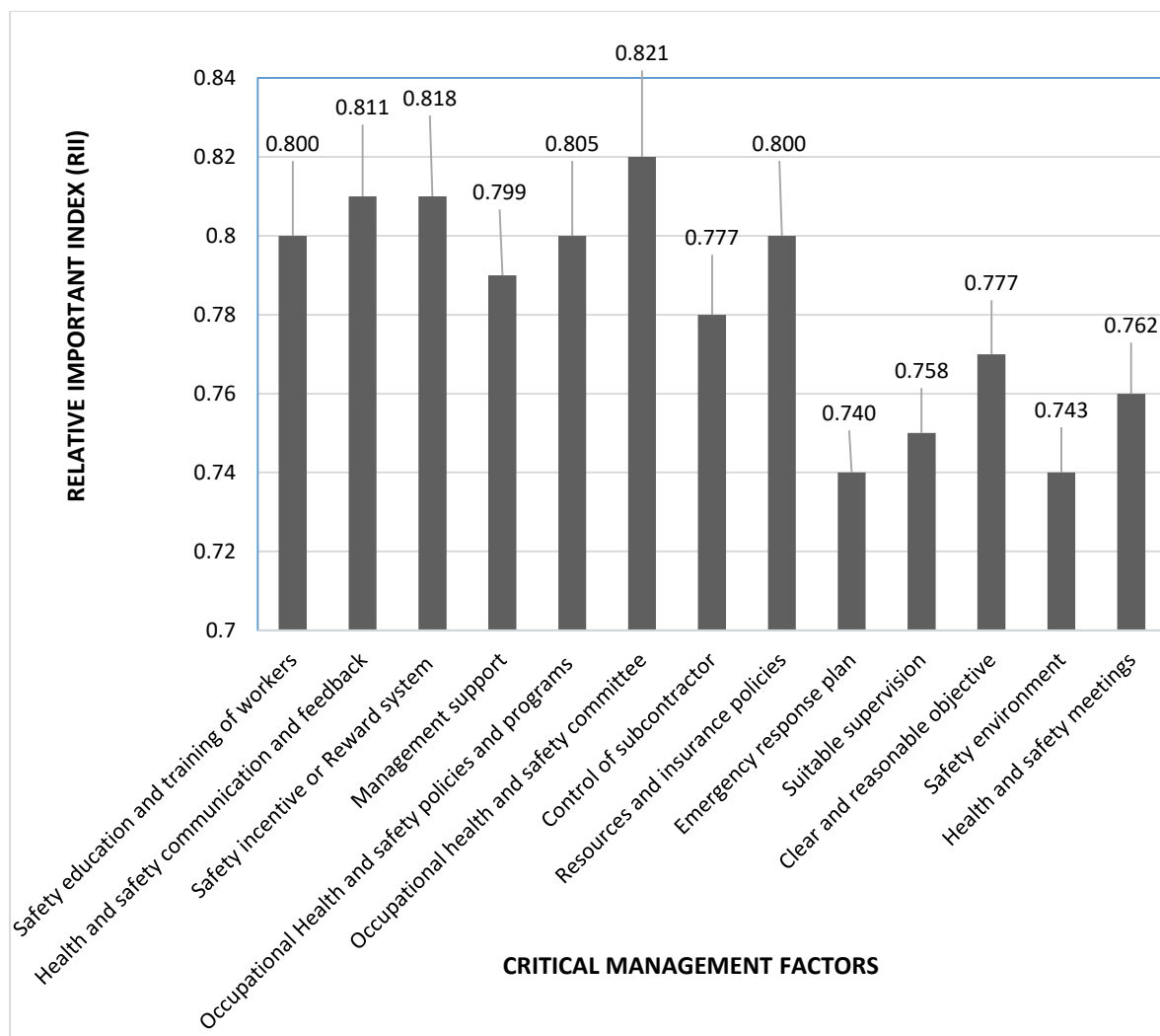
**Table 4.2: Analysis of Critical Management Factors**

Item	Element of Critical Management Factors	Weighted mean rating	RII	Level of RII	Ranking
1	Safety education and training of workers	4.00	0.800	High	5 <sup>th</sup>
2	Health and safety communication and feedback	4.16	0.811	High	3 <sup>rd</sup>
3	Safety incentive or reward system	4.09	0.818	High	2 <sup>nd</sup>
4	Management support	4.02	0.799	High - Medium	7 <sup>th</sup>
5	Occupational health and safety policies and programs	4.02	0.805	High	4 <sup>th</sup>
6	Occupational health and safety committee	4.10	0.821	High	1 <sup>st</sup>
7	Control of subcontractor	3.89	0.777	High - Medium	8 <sup>th</sup>
8	Resources and insurance policies	4.00	0.800	High	5 <sup>th</sup>
9	Emergency response plan	3.70	0.740	High - Medium	13 <sup>th</sup>
10	Suitable supervision	3.79	0.758	High - Medium	11 <sup>th</sup>
11	Clear and reasonable objective	3.89	0.777	High - Medium	8 <sup>th</sup>
12	Safety environment	3.72	0.743	High - Medium	12 <sup>th</sup>
13	Health and safety meetings	3.81	0.762	High - Medium	10 <sup>th</sup>

Based on Table 4.2, the critical management factors have been rearranged according to their rank. The summary of the critical management factors ranking is indicated in Figure 4.1. The occupational health and safety committee shows the most significant factors that influence the safety and health of high-rise building construction projects with an RII value of 0.821 (high significance). A safety



committee helps to promote accident prevention and safe working habits of the on-site construction workforce [42]. This factor is the main concern in high-rise building construction projects to overcome major safety and health issues. On the other hand, safety incentives and rewards (RII = 0.818) and health and safety communication and feedback (RII = 0.811) have been evaluated as the second and third most critical factors in this study. Safety incentives and rewards can motivate the workers and others to enhance their safety awareness in performing their tasks. With an effective communication and feedback system, management and workers can identify risks, thus preventing accidents and injuries [23]. It is revealed that the safety environment (RII = 0.743) and ERP (RII = 0.740) perceived a low agreement value among respondents, but this factor still obtained high-medium significance factors. Overall thirteen critical management factors in this study were rating as high impact (more than 0.6) which should prioritize by management in other to achieve high safety performance in the high-rise building construction projects.



**Figure 4.1: Significant Critical Management Factors of Safety and Health Management for a High-Rise Building Projects**

## 5. Conclusion

It was shown that the thirteen critical management factors that affect safety and health management in high-rise building construction projects were at between high significance (RII, 0.800-0.821) to high-medium significance (RII, 0.740-0.799). Thus, these factors may underlie the main reasons for accidents, injuries, and fatalities in high-rise building construction projects. This study suggests further research on these critical factors through evaluating the relationship between the most significant factors such as safety and health committee and safety incentive or reward systems to the safety performance of high-rise building construction projects.

## Acknowledgment

The authors would like to thank the Faculty of Civil and Built Environment, Universiti Tun Hussein Onn Malaysia for its support.

## References

- [1] P. H., Shaikh, N. B. M., Nor, A. A., Sahito, P., Nallagownden, I., Elamvazuthi and M. S., Shaikh, "Building energy for sustainable development in Malaysia: A review", *Renewable and Sustainable Energy Reviews*, May, Vol. 75, pp 1392–1403. 2017. <https://doi.org/10.1016/j.rser.2016.11.128>
- [2] A. Rajmani, N. Road, P. P. Guha, & N. Road, "Analysis of wind and earthquake load for different shapes of high-rise building", *International Journal of Civil Engineering and Technology (IJCIET)*, February, Vol. 6, Issue 2, pp 38–45, 2015
- [3] Y. Li, Y. Ning & W. T. Chen, "Critical success factors for safety management of high-rise building construction projects in China, Hindawi", *Advances in Civil Engineering*, pp 1-15, 2018. <https://doi.org/10.1155/2018/1516354>
- [4] K. C. Goh, H. H. Goh, M. F. Omar, T. C. Toh, & A. A. Mohd Zin, "Accidents preventive practice for high-rise construction". *MATEC Web of Conferences*, Vol. 47, pp 3–8. 2016. <https://doi.org/10.1051/mateconf/20164704004>
- [5] S. Ahn, T. Kim, Y. Park, & J. Kim, "Improving effectiveness of safety training at construction worksite using 3d bim simulation", *Hindawi, Advances in Civil Engineering*, pp 1-12. 2020. <https://doi.org/10.1155/2020/2473138>
- [6] Purohit, P. Devdatt., N. A. Siddiqui, A. Nandan, & B. P. Yadav, "Hazard Identification and Risk Assessment in Construction Industry", *International Journal of Applied Engineering Research*, Vol. 13, siri 10 , pp 7639–7667. 2018.
- [7] A.A. Frefer, M. Mahmoud, H. Haleema, & R. Almamlook, "Overview Success Criteria and Critical Success Factors in Project Management", *Industrial Engineering & Management*, Vol. 7, Issue 1, pp 1-6. 2018. <https://doi.org/10.4172/2169-0316.1000244>
- [8] Demirkesen, Sevilay, & B. Ozorhon, "Impact of integration management on construction project management performance", *International Journal of Project Management*, Vol. 35. Issue 8, pp 1639–1654. 2017. <https://doi.org/10.1016/j.ijproman.2017.09.008>
- [9] J. F Rockart, "The changing role of information system executive: A critical success factors perspective", *Sloan Management Review*, Vol. 24. Issue 1, pp 3-13, 1982.
- [10] B, Blaskovics. "The impact of project manager on project success - The case of ICT sector. *Society and Economy*", Vol. 38. Issue 2, pp 261–281. 2016. <https://doi.org/10.1556/204.2016.38.2.7>

- [11] N. Azmi, A. Bari, R. M. Yusuff, N. Ismail, & A. Jaapar, "Industrialised Building Systems (IBS): It's attribute towards enhancing sustainability in construction", *Asian Journal of Environment-Behaviour Studies*, Vol. 3, Issue 8, pp 109-119. 2018. <https://doi.org/10.21834/aje-bs.v3i8.284>
- [12] O. Abudayyeh, T. K. Fredericks, S. E. Butt, & A. Shaar. "An investigation of management's commitment to construction safety", *International Journal of Project Management*, Vol. 24, Issue 2, pp 167-174. 2006.
- [13] A. Suraji, A. R. Duff, & S. J. Peckitt, "Development of causal model of construction accident causation", *Journal of Construction Engineering and Management.*, Vol. 14, Issue 337, pp 337–344, 2001.
- [14] A. Tamara, Y. Latief & R. A. Machfudiyanto, "The development of safety plan to improve OHS (occupational health and safety) performance for construction of irrigation channel based on WBS (work breakdown structure)". *IOP Conference Series: Earth and Environmental Science*, Vol. 426, Issue 1. 2020. <https://doi.org/10.1088/1755-1315/426/1/012016>
- [15] T. Aksorn, & B. H. W. Hadikusumo, "Critical success factors influencing safety program performance in Thai construction projects", *Safety Science*, April, Vol. 46, Issue 4, pp 709-727. 2008. <https://doi.org/10.1016/j.ssci.2007.06.006>
- [16] S. Alhaadir & K. Panuwatwanich, "Critical success factors for safety program implementation among construction companies in Saudi Arabia", *Procedia Engineering*, Vol. 14, pp 148-155. 2011. <https://doi.org/10.1016/j.proeng.2011.07.017>
- [17] W.L. Cheng, H. Li., D.P. Fang, & F. Xie. "Construction safety management: an exploratory study from China", *Construction Innovation*, Vol. 4, Issue 4, pp 229-241, 2014.
- [18] R. M. Choudhry & D. Fang, (2008). "Why operatives engage in unsafe work behaviour: Investigating factors on construction sites". *Safety Science*, Vol. 46, Issue 4, pp 566-584, 2008.
- [19] R. M. Choudhry, W. Ahmad, S. Azhar, & J. Hinze, "Safety management practices in the construction industry of Pakistan. Paper presented at the Third International Conference on Construction in Developing Countries (ICCIDC-III)", "Advancing Civil, Architectural and Construction Engineering & Management", Bangkok, Thailand. 2012.
- [20] F. A. Gul, M. M. S. Danuri, O. Mohamed, & M. M. N. Nawi, "Health and safety management practices in high-rise building projects in Pakistan – A systematic literature review". *Journal of Advanced Research in Dynamical and Control Systems*, Vol. 11, Issue 5, pp 1605–1627, 2019.
- [21] Teo, E. A. L., Ling, F. Y. Y., & Chong, A. F. W. "Framework for project managers to manage construction, *International Journal of Project Management*", Vol. 23, Issue 4, 329-341, 2005.
- [22] Vinodkumar, M., & Bhasi, M. "Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation". *Accident Analysis & Prevention*, Vol. 42, Issue 6, 2082-2093., 2010.
- [23] A. G. Vredenburg, "Organizational safety: which management practices are most effective in reducing employee injury rates?", *Journal of safety Research*, Vol. 33, Issue 2, pp 259-276, 2012.
- [24] J. H. Williams, "People-based safety", *Professional Safety*, Vol. 48, Issue 2, pp 1-32, 2003
- [25] C. Subramaniam, Mohd. Shamsudin, Mohd Zin, S. Sri Ramalu, & Z. Hassan, "Safety management practices and safety compliance in small medium enterprises: Mediating role of safety participation", *Asia-Pacific Journal of Business Administration*, Vol. 8, Issue 3, pp 226-244, 2016.

- [26] N. F. Pidgeon. "Safety culture and risk management in organizations, *Journal of Cross-Cultural Psychology*", Vol. 22, Issue 1, pp 129-140, 1991.
- [27] S. Cox, & A. Cheyne "Assessing safety culture in offshore environments, *Safety Science*", Vol. 34, Issue 1-3, pp 111-129, 2000.
- [28] D. Díaz-Cabrera, E. Hernandez-Fernaund, & R. Isla-Díaz, "An evaluation of a new instrument to measure organisational safety culture values and practices", *Accident Analysis & Prevention*, Vol. 39, Issue 6, pp 1202- 1211, 2007.
- [29] W. A. Khdair, F. Mohd Shamsudin, & C. Subramaniam, "A proposed relationship between management practices and safety performance in the oil and gas industry in Iraq", *World Review of Business Research*, July, Vol. 1, Issue 3, pp 27-45, 2011.
- [30] P. Arocena, I. Núñez, & M. Villanueva, "The impact of prevention measures and organisational factors on occupational injuries", *Safety science*, Vol. 46, Issue 9, pp 1369-1384, 2008.
- [31] A. Cohen, M. J. Smith, & W. K. Anger, "Self-protective measures against workplace hazards", *Journal of safety Research*, Vol. 11, Issue 3, pp 121-131, 1979.
- [32] A. H. Memon, I. A. Rahman, M. R. Abdullah, & A. A. A. Aziz, "Factors affecting construction cost in Mara large construction project: perspective of project management consultant", *International Journal of Sustainable Construction Engineering and Technology*, Vol. 1, Issue 2, pp 41-54, 2011.
- [33] E. Sawacha, S. Naoum, & D. Fong, "Factors affecting safety performance on construction sites", *International Journal of Project Management*, Vol. 17, Issue 5, pp 309-315, 1999.
- [34] A. Griffith, & T. Howarth, "Construction health and safety management", Routledge, London, 2014.
- [35] H. Abbasianjahromi, H. Rajaie, E. Shakeri, & O. Kazemi. "A new approach for subcontractor selection in the construction industry based on portfolio theory", *Journal of Civil Engineering and Management*, Vol. 22, pp 346–356, 2016.
- [36] T. C. Keng, & N. A. Razak, "Case studies on the safety management at construction site", *Journal of Sustainability Science and Management*, Vol. 9, Issue 2, pp 90-108, 2014.
- [37] O. Adenuga, A. Soyngbe, & M. Ajayi "A Study of selected safety measures on construction companies in Lagos", *Proceedings of the Construction and Building Research Conference of the Royal Institution of Chartered Surveyors*, Georgia Institute of Technology, Atlanta, 6-7 September 2007, pp 678-689, 2007.
- [38] D. Cooper, "The impact of management's commitment on employee behaviour: A field study". American Society of Safety Engineers, Paper presented at the 7<sup>th</sup> Proceedings of the 7th Professional Development Conference & Exhibition, Kingdom of Bahrain, , 18-22 March, 2006.
- [39] N. De Silva, & P. Wimalaratne, "OSH management framework for workers at construction sites in Sri Lanka". *Engineering, construction and architectural management*, Vol. 19, Issue 4, pp 369-392, 2012.
- [40] Y. Tang, G. Wang, H. Li, & D. Cao, "Dynamics of collaborative networks between contractors and subcontractors in the construction industry: Evidence from national quality award projects in China", *Journal of Construction Engineering and Management*, Vol. 144, Issue 9. 2018. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001555](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001555)

- [41] S.Ahn, T. Kim, Y. Park, & J. Kim, “Improving Effectiveness of Safety Training at Construction Worksite Using 3D BIM Simulation”, Hindawi, *Advances in Civil Engineering*, 2020, pp 1-12. 2020. <https://doi.org/10.1155/2020/2473138>
- [42] O. Akadiri, “Development of a multi-criteria approach for the selection of sustainable materials for building projects”. Unpublished Ph.D. thesis, School of Engineering and the Built Environment (SEBE), University of Wolver Hampton, United Kingdom, 2011.
- [43] M. N. M. Nawawi, F. Baharum, M. F. Rajemi, J. A. Ibrahim, & M. Z. Tahir, “Energy management: A case study on the government office building in Putrajaya”, *Reegetech*, pp 63–68. 2014.
- [44] D. Cooper, “The impact of management’s commitment on employee behaviour: A field study”. Paper presented at the Proceedings of the 7th Professional Development Conference & Exhibition, Kingdom of Bahrain. 2006.
- [45] R. Masood, D. Choudhry, S. Azhar, & H. Jimmie, “Mapping construction safety non-practice behaviour with culture constructs”. Paper presented at the 3<sup>rd</sup> International Conference on Construction in Developing Countries (ICCIDC-III): Advancing Civil, Architectural and Construction Engineering & Management, Bangkok, Thailand, July 4 -6. 2012.
- [46] J. Lin, & A. Mills, “Measuring the occupational health and safety performance of construction companies in Australia”. *Facilities*, Vol. 19, Issue 3/4, pp 131-139, 2001.
- [47] A. Labodova, “Implementing integrated management systems using a risk analysis-based approach”, *Journal of Cleaner Production*, Vol. 12, Issue 6, pp 571-580, 2004.
- [48] W.A. Thanoon, M.S. Jaafar, M.R. Abdul Kadir, A.A. Abang Ali, D.N. Trikha, A.M.S. Najm, “Development of an innovative interlocking load bearing hollow block system in Malaysia”, Vol. 18, Issue 6, pp 445-454, 2004.
- [49] E. Kasapoğlu, “Risk management in construction, Sustainable buildings - Interaction between a holistic conceptual act and materials properties”, *IntechOpen*. 2018. doi:10.5772/intechopen.76341.
- [50] O. Adenuga, A. Soyngbe, & M. Ajayi, “A study of selected safety measures on construction companies in Lagos, Nigeria”. *Proceedings of the Construction and Building Research Conference of the Royal Institution of Chartered Surveyors, Georgia Institute of Technology, Atlanta, 6-7 September 2007*, pp 678-689. 2007.
- [51] N. De Silva, & P. Wimalaratne, “OSH management framework for workers at construction sites in Sri Lanka”. *Engineering, construction and architectural management*, Vol. 19, Issue 4, pp 369-392. 2012.
- [52] S. A. Akintola., & J. M. Malcolm, “Risk analysis and management in construction”, *International Journal of Project Management*, Vol 15, Issue 1, pp 31-38, 1997.
- [53] T. W. Loushine, P.L.T. Hoonakker, P. Carayon, & M. J. Smith, “Quality and safety management in construction”. *Total Quality Management*, Vol. 17, Issue 9, pp 1171– 1212. 2006.
- [54] A. Enshassi, J. Al-Najjar & M. Kumaraswamy, “Delays and cost overruns in the construction projects in the Gaza Strip”, *Journal of Financial Management of Property and Construction*, Vol. 14, pp 126-51. 2009.

- [55] R. Usukhbayar, & J. Choi, “Critical safety factors influencing on the safety performance of construction projects in Mongolia”. *Journal of Asian Architecture and Building Engineering*, Vol. 19, Issue 6, pp 600–612. 2020. <https://doi.org/10.1080/13467581.2020.177009>