Investigation on the Effect of Industrial Hygiene towards Innovation Performance: A Case of the Construction Industry in Malaysia

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Abstract. The construction industry is growing extraordinarily, progressive and profitable. It is one of the topmost sectors that contribute to the economy of a country. Even so, it is the riskiest industry as construction workplace has the highest number of fatality and injuries. Safety and health issues remain critical to the construction industry due to its working environment and the complexity of working practices. When related to health, hygiene is one factor to be observed, in which safety is a primary concern in the construction sector. Hygiene, being part of safety and health management in site plays a significant role in the performance of an organization. At some extent, ignorance of hygiene resulted catastrophically. The present study found the influence of industry hygiene towards innovation performance in the construction industry. The industrial hygiene which measured through few dimensions, i.e. hygiene knowledge, personal hygiene behaviour and hygiene personnel protection equipment are tested against innovation performance as the dependent variable. Following the comprehensive reviews, it is pertinent for the research to choose a quantitative undertaking, where questionnaires survey is the primary tool to collect the data among the construction companies, i.e., developers and contractors that registered with CIDB. The instrument will be developed to investigate the influence of industrial hygiene practices toward innovation performance. The research objectives will be achieved by statistically analyzing the collected data with Structural Equation Modeling (SEM) to verify the relationship between the variables.

1. Introduction
The construction sector is notorious for accounting for numerous occupational deaths, injuries, and illnesses in many countries. In several countries, it is common to hear of tragic accidents or incidents in construction that results in injury, death, or illness to workers and members of the general public. In Malaysia, out of the 214 occupational fatalities recorded in 2015, the construction sector accounted for 88 deaths which are the highest amongst all the sectors [1]. Work in a construction site is a complex activity because people will work under constant challenge demands of the job. Moreover, the construction industry overwhelmed by delay and often has suffered cost and time overrun. This result
refers to the sector of construction management suffers many problems, and the majority is practical to be solved or better understood.

A study toward safety, hygiene, and environment in African small and medium companies resulted that an improvement can be achieved with a minimum of goodwill and management support [2]. The key was management that being applied or implemented in an organization. Management tends to create a safety management system by combining the management process and activities into one system [3]. In this manner, organizations would be profited through performance as though safety performance can be improved. Workers safety practices are one of the components to observed with the end goal to have a decent management framework executed [4].

Despite that, many industries do not pay attention to aspects of industrial hygiene as it is more focus on safety. Safety and hygiene are both close yet different in the way of implementing it on the construction site. The construction industry has been taken the issue of hygiene lightly and not focusing on it. Workers might be presented to the chemical and physical stressor, which may cause them to be ill or likely die, and this may cause in delay of project delivery prompting to profit loss to the organization.

However, it is fundamental for the construction industry to sustain its growth and attain more excellent performance to avoid a downturn. Figure 1 show that the construction industry innovation performance currently is reported to be amongst the lowest as compared to the others [5]. Main contractors on average performed poorly on level of innovation profitability and the number of advanced practices adopted, but otherwise, their average ratings were positive in Australian construction sectors.

![Figure 1. Level of innovation performance graph by sector](image)

Regarding all of the above situations, it shows how important safety and health in the construction industry to be well manageable by all parties that involved in a construction site, otherwise, they may face some severe problems. The problems might be a hazardous condition which can cause death or serious injuries, difficulty in bad safety records of performing work in an unsafe manner and legal actions and costs. The issue exists when concentrating on any factor of the management; it will result in ineffectiveness also confusing and lead to misleading.

### 1.1 Research Question

i. Can industrial hygiene influence the innovation performance of an organization in construction management?
2. Literature Review

2.1. Construction Management

Construction Management commenced to evolved in the centre of the 20th century when the construction industry went through massive adjustments. Construction management suffers many troubles, and the majority is practical, which need to be solved or higher understood. As a result, the construction industry is overwhelmed through delay and frequently has suffered cost and time overrun [6]. One of the researchers has noted that contractor poor site management is one of the most remarkable causes in inflicting construction delays [7]. In spite of extra attention being paid to safety management in current years, the accident rate of the construction industry continues to be excessive [8].

In particular, the safety management system ought to be adequately deliberate so that it permits site managers and alternate workforces to no longer solely without difficulty become aware of and apprehend safety risks but also communicate with every other during the construction process [9]. This practice resulting in poor performance happened on the construction site. Although in general, the returns are pretty low, a massive enhancement could be executed with at least cooperative attitude along with management assist [10].

2.2. Safety Management System

Safety management system (SMS) is a framework which is utilized to control and oversee safety either it is a management framework specifically focus toward safety. Since the year of 1973, the safety management system has frequently formed into a most important subject for safety science. A very much structured safety management system (SMS) could commit to the fruitful usage of a safety management system in the work environment. A study has specified that the mishap rate is one of the key performance markers in the SMS [11]. Results demonstrated that there was an eminent decrease in construction miscalculation rate without a moment delay after the presentation of SMS in Hong Kong.

Emphasis is put on whereby mishaps in a project could be diminished by the practical method of safety management. If safety performance can be enhanced, organizations would advantage through the multiplied return. Although a safety management system has been observed to improve safety performance, most construction projects do not establish such a system on-site [12]. Fundamentally, construction safety management is strategies for safety knowledge flow, including facts accumulation, transmission, stockpiling, examination, estimation, representation, and reaction [13]. Different innovative technologies could be embraced to help in overseeing safety knowledge flow.

2.3. Industrial Hygiene

Industrial hygiene has been described as the art and science committed to the anticipation, recognition, evaluation, and control of occupational hazards that occur or may additionally occur in the work surroundings. Industrial hygiene is a matter that is once in a while viewed to cause the company's efforts in growing the sales will appear in vain for an accident is no longer only going to spend the dollars for the remedy itself but also the cost of recovery, which will minimize the productivity of workers, workers who lost time when subjected to occupational diseases, and so on [14].

Based on the research of hygiene and sanitation practices among primary school learners in Botswana indicates that hygiene behaviours and knowledge in the study area are unsatisfactory, prompting the need to think beyond the infusion approach and to establish health clubs in primary schools [15]. The research resulted that with an initiative of having a good hygiene education, knowledge, and personal practices give a contribution to communities as it can reduce hygiene disease-related in the district and country. Moreover, a most high-income country with health promotion interventions implemented has given proof of affecting the effectiveness [16]. Also, finding indicated that increase hygiene awareness is related to an increased level of education. Studies have been performed in Finland food industry mentioned that maintenance personnel is a credible source of contamination of food products due to the nature of their work [17]. The cause was once due to the
fact that they do not have sufficient training regarding hygiene matters to be capable of acting and working commensurate with these hygiene issues. The research concluded that the role of education, experience, and training was the component that determined the overall hygiene practice in the workplace. However, based on previous research by several researchers shows that there is not enough focus on hygiene in the construction industry. There was slightly low or not so poor response gained in the construction industry about hygiene [16].

2.4. Innovation Performance
Innovation in construction referred to as a subject being talked about amid an impressive timeframe. The construction industry is as a rule progressively tested to effectively innovate with the end goal to fulfil the desires and demands of society and customers, along with to enhance the aggressiveness. It is by, and large acknowledged that innovation is the execution of virtually new procedures, items, or the management approaches with the end goal to expand the effectiveness of an association [18]. It is uncovered that with regards to the construction industry, the sorts of innovation wandered by the association have a distinctive effect on the project performance along with business performance [19]. The significance of encouraging innovative practice in the construction industry is broadly recognized. Construction industry innovation performance, as of now, is accounted for to be among the most minimal when contrasted with the others [5].

Various factors influence innovation performances which are product innovation, association innovation, process innovation, or advertising innovation [20]. With the end goal to accomplish product innovation enhancement, an organization should consolidate their innovation systems inner and outside knowledge sources whereas, for the innovation process, the company should substitute inside participation information sources. Innovation is related to the abnormal state of vulnerability and hazard; in this manner, adequate resources are required with the end goal to guarantee innovation success [21]. In numerous researches, powerful management of occupational safety and health found to assume an urgent job in maintaining an active business [22]. This lead to safety management systems which include hygiene and safety to plays an essential role in influencing innovation. The researcher has portrayed that working environment being hazardous and undesirable means innovation performance cannot be accomplished as the business rate diminishes and from the reverse migration increments in creating economies.

3. Conclusion and Recommendation
Overexposure to industrial hygiene hazards, namely environmental factors or stressors, i.e., chemical hazard, physical hazard, biological hazard and ergonomics hazard, are significant causes of occupational illness among workers [23]. Researches did in these hazard categories cover the main areas of industrial hygiene, i.e., occupational safety, occupational health, and environmental. Occupational accidents can be reduced by designing and installing a systematic management approach that focuses on hazard mitigation [24]. There is a unique opportunity for integrating occupational hygiene and health as essential elements of the safety and health management systems following his research on risk management in the small-scale workplaces [25]. Not only industrial hygiene focuses on how hazards of the facility affect the workers, but also on mitigating the potential impacts upon the surrounding community and the families of each worker [26]. It will be reasonably good to have insight knowledge on the influence of industrial hygiene towards innovation performance of an organisation. Past researches suggested that industrial hygiene should be incorporated within a management system. However, little has been done to explore the possibility of industrial hygiene to be a factor influencing the management system or examine its effect on the relationship organisational variables, mainly on the firm's performance. Thus, this paper suggests exploring the possibility of industrial hygiene as factors in determining the innovation performance of an organisation. The method used will be quantitative by disseminating questionnaires to construction companies, i.e., developers and contractors that registered with the Construction Industries Development Board (CIDB)
of Malaysia. The research objectives will be achieved by statistically analysing the collected data with Structural Equation Modelling (SEM) to verify the relationship between the variables.

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**References**

[1] Y Fernando and W Lin 2017 *Conservation & Recycling Impacts of energy management practices on energy efficiency and carbon emissions reduction: A survey of Malaysian manufacturing firms* 126–73

[2] U Unver and O Kara 2019 *Journal of Cleaner Production* 215 1362–1370

[3] D N M Abang Abdullah and G C M Wern 2010 *Int. Conf. E-business Manag. Econ* 3 1–4

[4] J Meité V Baeyens and R Dewil 2009 *Journal of Environmental Management* 90(3) 1463–1468

[5] L Harms-Ringdahl 2004 *Journal Hazard Mater* 111(1–3) 13–19

[6] H Li M Lu S C Hsu M Gray and T Huang 2015 *Safety Science* 75 107–117

[7] M Hardie G Miller K Manley and S McFallan 2012 *Australas J Constr Econ Build* 6(1)

[8] R F Aziz and S M Hafez 2013 *Alexandria Eng J* 52(4) 679–695

[9] M Samsivan and Y M Soon 2007 *Int Journal Proj Manag* 25(5) 517–526

[10] H Guo Y Yu M and Skitmore 2012 *Automation in Construction* 73 135–144

[11] C S Park and H J Kim 2013 *Automation in Construction* 33 95–103

[12] H Y Chong and T S Low 2014 *Int Journal Occupational Safety Ergonomics* 20(3) 503–513

[13] N S N Yiu N N Sze and W M Chan 2018 *Journal of Safety Research* 64 1–9

[14] E W L Cheng N Ryan and S Kelly 2012 *Safety Science* 50(2) 363–369

[15] Z Zhou Y M Goh and Q Li 2015 *Safety Science* 72 337–350

[16] H S Zahara S Mushalia I H Iridiastadi and D Ph 2012 *Industrial Hygiene Programs Design in The Oil & Gas Company* 65 (ICIBSoS) pp 468–472

[17] O T Thakadu B N Ngwenya N A Phaladze and B Bolaane 2018 *Phys Chem Earth* 0–1

[18] T Spee J G Timmerman R Rühl K Kersting D J J Heederik and L A M Smit 2016 *Contact Dermatitis* 74(5) 259–266

[19] K Aarnisalo Tallavaara K G Wirtanen R Maijala and L Raaska 2006 *Food Control* 17(12) 1001–1011

[20] U Kulatunga R D G Amaratunga and R P Haigh 2006 *Conference in the Built and Human Environmen Delft Univ Technol TNO*

[21] M Z Tajuddin M H Ibrahim and N Ismail 2015 *Univers J Ind Bus Manag* 3(4) 87–99

[22] A M Serrano-Bedia M C López-Fernández and G García-Piqueres 2018 *BRQ Business Research Quarterly* 21(1) 53–67

[23] T O Kowang C S Long and A Rasli 2015 *Int Educ Stud* 8(6) 32–45

[24] K Jilcha and D Kitaw 2017 *Engineering Science and Technology an International Journal* 20(1) 372–380

[25] B A Plog and P J Quinlan 2002 *Fundamental of Industrial Hygiene National Safety Council* (Fifth Ed) http://doi.org/10.1016/B978-1-4557-5134-1.00001-9

[26] H R Seifi Azad Mard P Estiri A Hadadi P and Seifi Azad M Mard M 2017 *International Journal of Occupational Safety and Ergonomics* 0(0) 1–8

[27] http://doi.org/10.1080/10803548.2016.1264715

[28] Kogi 2010 *Italian Journal of Occupational and Environmental Hygiene* 1(2) 69–75

[29] D L Dahlstrom S Nikfar A A Malekirad and A F Behboudi 2014 *Industrial Hygiene*. In Encyclopedia of Toxicology 3rd ed Elsevier pp 1032–1035