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ANALYSIS OF OCCUPATIONAL ACCIDENTS IN THE MALAYSIAN CONSTRUCTION SECTOR

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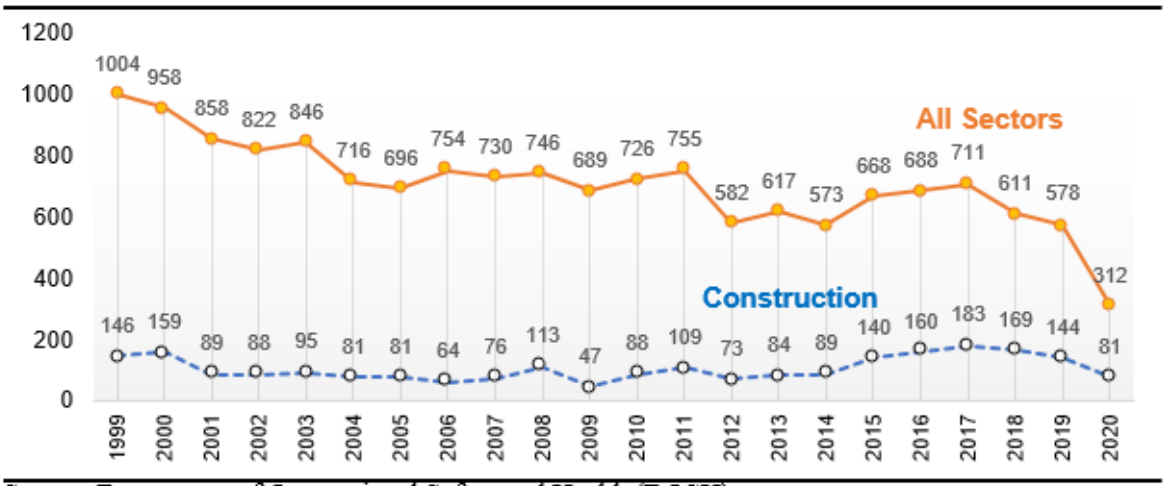
INTRODUCTION

An occupational accident is defined as "an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work, resulting in one or more workers incurring a personal injury, disease or death" (OECD, 2007). According to the International Labour Organization (ILO), there are around 313 million occupational accidents annually, with over 350,000 deaths, corresponding to over 800 thousand accidents, and 959 succumb every day (ILO, 2015).

Occupational accidents should not be underrated and are considered one of the utmost critical issues for the economy. The ILO (2012) estimated that the devastating consequences of occupational accidents to the economy are approximately a loss of 4 per cent of global gross domestic products (GDP). This fact is supported by the research of the European Agency for Safety and Health at Work (EU-OSHA), as it found that the burden of work injuries and diseases is 3.9 per cent of global GDP and 3.3 per cent of European GDP (EU-OSHA, 2017).

In Malaysia, the number of occupational accidents were 32,674 cases in 2020, with the number of occupational fatalities being 312 cases (DOSM, 2021). The main sectors that contribute to occupational accidents are Services, followed by Manufacturing and Construction sectors. Although the Construction sector ranks third in terms of numbers of injuries, the industry ranks first in terms of occupational fatalities rate. This sector remains the most dangerous instead of showing a long-term stable trend (see figure 1) as it posted the highest rate of occupational fatalities, which is 3.3 times higher than the overall national occupational fatalities in 2020 (see figure 2).

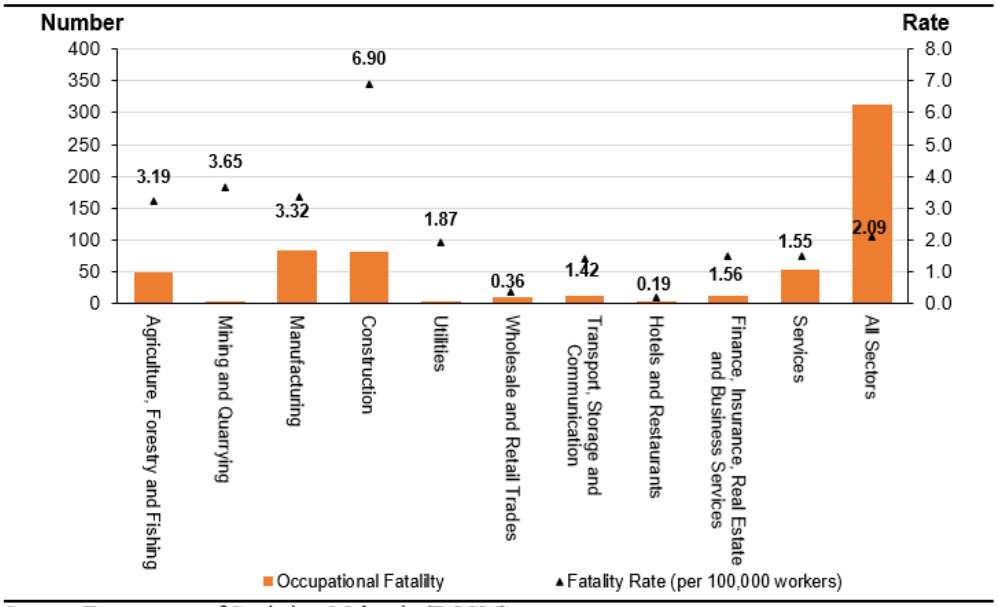
Figure 1: Number of Occupational Fatalities for Construction and All Sectors for the Year 1999 to 2020



Source: Department of Occupational Safety and Health (DOSH).

Higher occupational fatality rates for the Construction sector compared to overall sectors were also recorded in other countries. The US Bureau of Labor Statistics reported 1,008 mortality due to occupational accidents in the US Construction sector, with a rate of 10.2 death per 100,000 workers, compared to a 3.4 fatalities rate across overall industries (BLS, 2021). In the UK, the Health and Safety Executive (HSE) reported that the fatal injury rate in the Construction sector was 1.74 compared to 0.34 for overall industries (HSE, 2021). For the Asia region, Japan recorded a rate of 5.24 fatal accidents per 100,000 workers in the Construction sector (all industries: 1.49 per 100,000 workers) while Singapore was 2.2 (all industries: 0.9 per 100,000 workers).

Figure 2: Number of Occupational Fatalities and Fatality Rate by OSHA Sectors, 2020



Source: Department of Statistics, Malaysia (DOSM).

Given its association with a high rate of mortalities, the Construction sector is recognised as one of the most unsafe and highly hazardous sectors globally. Thus, this issue has garnered much research interest to investigate the factors contributing to injuries and fatalities. Therefore, this paper aims to analyse occupational accidents in the Construction sector further and identify the factors that influence individual death in the Malaysian Construction sector due to occupational accidents. By identifying factors that influence occupational accidents and death in the said sector, workplace safety and workers' protection can be improved as well as reduce the economic and social cost of occupational accidents.

LITERATURE REVIEW

A considerable amount of empirical studies have examined the factors contributing to occupational accidents and fatalities in the Construction sector. These factors include time-related, victim's background, i.e. worker's gender, nationality, age, occupation and education, as well as accident characteristics, i.e. type of accidents, cause of accidents and location of accidents.

TIME CHARACTERISTICS

Many studies found that occupational accidents in the Construction sector are associated with the day of the week. Lopez et al. (2008) claimed that the accidents fell as the week progressed. Akboga Kale & Baradan (2020) found that most of the occupational injuries in Turkey's Construction sector occurred on Monday, which confirmed the theory of Monday Effects. The same conclusion was stated by Arquillos, Romero & Gibb (2012), Campolieti & Hyatt (2006) and Kazan (2003). Meanwhile, Liao & Perng (2008) revealed that the majority of fatalities occurred during the morning of a rainy Monday or Tuesday in Taiwan.

Xu & Xu (2021) discovered that most of the Construction and deaths in China's Construction industry occurred in August, while February was the lowest. The temperature in August is claimed to surpass what workers can endure resulting in more injuries. Heat stress increases the risk of injuries due to sweaty palms and dizziness (Uher, Cimboláková, & Kaško, 2017). On the contrary, the weather in February is cold and coupled with low construction activities due to the Chinese Spring Festival.

SOCIO-DEMOGRAPHIC CHARACTERISTICS

Personal and work characteristics combined with the working environment are believed to influence the creation of a hazardous environment that could be triggered by different mechanisms that cause accidents. In terms of gender, a study by Dumrak et al. (2013) found that only a few females have met with occupational accidents in the Construction sector. The study also found that none of the female workers died due to occupational accidents in South Australia from 2002 to 2011. Worked by Alkan & Gultekin (2020) discovered that males are two times higher probability of having work accidents than women. The difference in occupational accident statistics and consequences between males and females are reflected in the differences in occupation between gender (Hinze, Huang, & Terry, 2005).

Salminen's (2011) review of several works of literature found that average immigrants were involved in occupational injuries 2.13 times more often than native workers. At the highest, based on the hospitalisation records in Al Ain's hospital in the United Arab Emirates, Barss et al. (2009) discovered that foreign workers had ten times more occupational injuries than native workers. In Europe, many studies reported that immigrants are more vulnerable to safety

accidents and have a higher risk for fatal and non-fatal occupational injuries (Lopez-Jacob et al., 2008, Rubiales-Gutiérrez et al., 2010, Salvatore, 2013, Elders, Burdorf & Ory, 2004, Lee & Wrench, 1980). Generally, the higher risk of occupational accidents by the immigrant worker was due to the worse work conditions of the immigrant worker as compared to the native workers. According to Arici et al. (2019), immigrants usually work for longer hours and are in worse condition than the native workers. They have always been employed for 3D jobs (dangerous, dirty, and demanding/degrading). Therefore, they have higher rates of adverse occupational exposures than natives, leading to poorer health outcomes.

Several studies and reviews have been undertaken to explore the role of age in influencing occupational accidents. Cheng et al. (2012) identified that most occupational accidents happen to workers aged 35-44 years old. However, the study found that the youngest and the oldest workers are most likely to be involved in fatal occupational accidents than those aged 35-44. Meanwhile, Akboga Kale & Baradan (2020) revealed that the workers aged 19-24 years old had more injuries than the older group. The study also found that the number of accidents was inversely proportional to the increasing age of workers. Similarly, Sawacha, Naoum, & Fong (1999) showed that workers aged 16-20 in the Construction sector were more likely to have accidents than others. Further analysis of the data in the same paper suggests that the level of accidents tends to decline steadily after the age of 28 to reach a low point in the mid-40s. Conversely, in Spain, Arquillos, Romero & Gibb (2012) discovered that the severity of injuries due to occupational accidents in the Construction sector increases with workers' age. Furthermore, the study also found that the fatal accident rate for workers aged 60-65 was more than double compared to the total fatalities rate.

The educational background of workers seems to be associated with the risk of occupational accidents. Based on the review, workers with higher educational levels tend to be less likely to be injured and fatal due to occupational accidents. Akboga Kale & Baradan (2020) found that more than half of accidents involved workers with education below high school qualification. Meanwhile, by using logistic regression, Alkan & Gultekin (2020) discovered that workers who have lower than a university qualification had higher odds of having a work accident.

Past research has shown that the worker's work activity was considered to be instrumental in the occupational injuries. Dumrak et al. (2013) discovered that occupations that needed the worker to be always on the construction site, such as supervisors, plant operators and unskilled

workers, were the most accident-prone. Of the all seventeen major occupation categories listed, plant operators were the highest number of fatalities. Meanwhile, Akboga Kale & Baradan's (2020) findings indicate that workers in formwork and material handling have the most accidents in Turkey's Construction sector. Others, Huang & Hinze (2003) analysed the occupational accidents in the US Construction sector and revealed that roofers were the major fall in the US.

It was believed that geographical location has associated with the frequency of occupational accidents. Congested high-density areas are expected to be more prone to occupational accidents. Ling, Liu & Woo's (2009) studies on construction fatalities in Singapore discovered that most fatal occupational accidents happen in Singapore's south and central business district. On the contrary, Dumrak et al. (2013) found higher occupational fatalities in the construction sites of suburbs of Adelaide compared to the central business district area. However, the study revealed that the proportion of occupational fatality accidents in the central business district of Adelaide almost doubled than overall accidents.

ACCIDENT CHARACTERISTICS

Information on accident characteristics such as type of injury, injury location (body part), and cause of accidents are essential to describe and understand the occurring incidents. Most of the studies discovered that the falling of person (Akboga Kale & Baradan, 2020, Dumrak et al., 2013, Arquillos et al., 2012, Lopez et al., 2011, Ling, Liu, & Woo, 2009, Huang & Hinze, 2003) and struck by objects (Akboga Kale & Baradan, 2020, Dumrak et al., 2013, Ling, Liu, & Woo, 2009) were among the top type of accidents happened in the Construction sector. Previous studies also notified that the fall of persons was the deadliest type of accident (Akboga Kale & Baradan, 2020, Dumrak et al., 2013, Arquillos et al., 2012, Lopez et al., 2011, Ling, Liu, & Woo, 2009, Huang & Hinze, 2003).

Regarding the nature of injuries, the most common injuries in the Construction sector typically begin with a sprain or strain. In Spain, superficial wounds, body sprains and strains are 80 per cent of total occupational accidents (Arquillos, Romero, & Gibb, 2012). Akboga Kale & Baradan's (2020) studies on Turkey's Construction sector also found that superficial wounds and bruises constituted 46.2 per cent of total injuries experienced by the victims. In terms of the body location of the injury, Zhang et al. (2009) found that most US Workers from 1997 to

2005 experienced extremities, torso, head and neck injuries. Meanwhile, Dumrak et al. (2013) notified that the trunk and hand are the most common part of body injuries in the Construction sector where almost half of the occupational accidents occurred from 2002 to 2011 involving such injuries. However, the study showed that no fatalities resulted from such injuries. The study discovered that internal organs, multiple injuries, and the head were dominant among fatalities. Similarly, Ling, Liu, & Woo (2009) found that multiple injuries, the head and trunk were the most vulnerable areas and at risk of causing death.

According to Chia, Han, & Kim (2013), site conditions or work environments play an important role in construction accidents. Construction sites are often labelled as dangerous places to work (Sherratt, Farrell, & Noble, 2013).

POLICIES DIRECTION & AWARENESS

As mentioned by Yan & Lee (2020) in an article regarding the legislative framework of occupational safety and health in Malaysia, the main legislation for safety and health is Occupational Safety and Health Act (OSHA) 1994. It is also supported by a study done by AuYong (2014) , which noted that non-compliance of OSHA 1994 requirements would lead to lacking of safety culture. It was also highlighted that among others, technology support dimension including safety inspection and government support dimension such as statutory inspection were found significant in improving safety awareness (AuYong, Zailani, & Surienty, 2014).

In order to promote ‘preventive culture’ (Yan & Lee, 2020), DOSH has display its aims and expectation in Occupational Safety and Health (OSH) Master Plan 2020 which contained three key objectives namely; i) to reduce the rate of work-related deaths by 10%; ii) to reduce the rate of occupational accidents by 10%; and iii) increase reporting of occupational diseases by 30%. These objectives however, can only be achieved by the support and serious participation from various industrial community particularly employers, OSH practitioners, workers, employers’ and employees’ associations as well as government agencies.

Apart from the abovementioned legislation and directive set forth by the government, there are few issues that need to be addressed to ensure the safety of community in Construction sector.

a. Education

As seen in previously mentioned logistic regression analysis which show that the level of worker education is significantly associated with occupational accidents, the enhancement in education and knowledge acquisition of constructions' personnel and workers are very important to promote safety culture in Construction sector. The role of Construction Industry Development Board (CIDB) as sectorial-based front-line agencies for accredited green card training in Construction sector is very significant to enhance the competencies of personnel and workers in this sector especially regarding safety in construction site. Construction companies is highly encouraged to enrol their OSH personnel and workers in trainings organised by CIDB.

b. Cause of accidents

According to Guidelines of Occupational Safety and Health in Construction Industry (Management) (OSHCIM) 2017 outlined by DOSH, proper risk assessment need to be carried out by the construction company and implementing risk control measure (empowered the guideline on equipment handling) in order to control the cause of accidents. The design team need to ensure to eliminate risk which associated with design element i.e. building design, reduce any remaining risk and control the risk to an acceptable level. For example, unsafe and improper design could be contributing factor in cost increases due to occupational accident. The company will loss assets and has to temporarily seized construction operation during investigation which will consequently delay the project completion.

In addition, developers and contractors need to leverage on technology to monitor and protect workers in the field more effectively. Wireless technology combined with the latest software and tools such as drones and remote sensing devices are able to ensure security managers perform monitoring via laptops and smartphones.

c. Nationality

To address the findings of non-Malaysian workers have higher likelihood of death due to occupational accidents, the aspects of communication (readable and understandable of instruction in Construction site) dan education of these workers need to be levelled up. According to OSHCIM 2017, the developer and employer shall have a written statement of his general policies with respect to safety and health at work for his employees who may be exposed to occupational safety and health (OSH) hazards. Low awareness in adhering to the guideline and work instruction due to communication and language barrier may also be one of the factors. Apart from that, most non-Malaysian workers are involved in 3D jobs which has high risks of encountering OSH hazards.

Other than OSHCIM 2017, Occupational Safety and Health-Specification and Bill of Quantities (BQ) for Construction Work developed by CIDB also stated that developer should have safety and health plan and to ensure compliance to the policies and law. Developer is also encourage to use latest technology for safety supervision in promoting safety culture. Developer should give adequate training to personnel to identify the risk of Hazard Identification, Risk Assessment and Risk Control (HIRARC) and regularly conduct evacuation training as part of the management plan to ensure the worker ready for any emergency situation or incident. The authority in related to Construction industry must ensure that construction work in construction site comply with the specification stated by OSHA expert. The construction site need regular inspection visit by the authority especially at the state with highest cases.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The high rate of occupational accidents and mortalities in the Construction sector has garnered much research interest to investigate the factors contributing to injuries and fatalities. This study uses three statistical analysis techniques on 8,821 construction occupational accident records for the years 2019 to 2020, provided by SOCSO and DOSH, to describe and analyse the factors associated with occupational accidents and fatalities in the Construction sector. Using univariate analysis, the findings showed that male, Malaysian, aged between 25 to 44 years old, who work in the low-skilled occupation and work in Selangor, Pulau Pinang, and Sarawak are most prone to occupational accidents. Most occupational accidents occur in the second half of the year and on the Thursday of the week. Two primary types of accidents that generally happen in the Construction sector are Stepping on, striking against or being struck by objects, including falling objects and Falls of person. The study also found that most of the accidents were caused by the working environment. Most of the accidents involved upper limb, multiple and lower limb injuries, of which head and multiple injuries were dominant in fatalities.

Meanwhile, analyses on the relationship between fatality due to occupational accidents and explanatory factors found that socio-demographic factors and accident characteristics were statistically significant. Worker nationality and cause of the accident have a very strong relationship with fatalities in this sector. On the contrary, the study also indicates that time characteristics such as day of the week and month are insignificant to the fatalities.

Additionally, by using logistic regression, the study indicates that non-Malaysian workers and workers who fall and suffer head and multiple injuries are 10 times more likely to die due to occupational accidents. It also revealed that the low education worker is five times more likely to be ~~a~~ part of fatality statistics due to occupational accidents than workers with a higher education level. The study showed that workers above 64 are the riskier group in this sector in terms of age.

The main findings of this study provide signal to policymakers to look at issues related to occupational accidents in the Construction sector. Although the overall number of deaths due to occupational accidents in the country showed an improvement, the number of deaths due to occupational accidents in this sector is seen to be stagnant. Thus, adequate training, effective

guidelines, continuous enforcement, and elimination of risk associated with a design element, i.e. building design, reducing any remaining risk and controlling the risk to an acceptable level, is recommended to ensure this risk can be reduced. Other than that, utilising technology Industry Revolution 4.0 to assist in safety compliance monitoring work is seen as an effort that needs to be explored to increase OSH aspect in the Construction sector.

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