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Dealing with Uncertainties: Unearthing Measures for Recovery

ANALYSIS OF OCCUPATIONAL ACCIDENTS IN THE MALAYSIAN CONSTRUCTION SECTOR: 2019-2020

Mohd Firdaus bin Zaini[1]; Munira Balkis binti Mohd Bakri[2]; Naulli binti Abdul Razak[3]; Mohd Nazri bin Ahmad Sabar[4]; Betty binti Hasan[5]

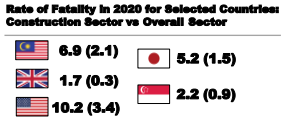
[1] Malaysian Bureau of Labour Statistics (MBLS)
[2,3,4,5] Institute of Labour Market Information and Analysis (ILMIA)

1. Introduction

Why?

- According to 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).
- The devastating consequences of occupational accidents to the economy are approximately **a loss of 4 per cent of GDP** (ILO, 2012).
- In Malaysia, the number of occupational accidents were 32,674 cases in 2020, with occupational fatalities being 312 cases (DOSM, 2021). The **Construction sector ranks first in terms of occupational fatalities rate**. Higher occupational fatality rates for the Construction sector compared to overall sectors were also recorded in other countries.
- By identifying factors, workplace safety and workers' protection can be improved as well as reduce the economic and social cost of occupational accidents.

Rate of Fatality in 2020 for Selected Countries: Construction Sector vs Overall Sector



Note:
Numbers in bracket are rates of fatality across all industries

2. Data Sources

- Data used in the study have been extracted from the occupational accidents database provided by **Malaysia's Social Security Organisation (SOCSO)** and the **Department of Occupational Safety and Health (DOSH).**
- The dataset contains **8,821 Construction sector occupational accident records for the years 2019 and 2020**
- Data contains information on Time, Geography, Worker demographics, and Accident characteristics

3. Methodology

How?

- This study uses three (3) statistical analysis techniques to analyse the data.

Univariate

First analysis is to establish a deeper understanding of the construction's occupational accident pattern

Bivariate

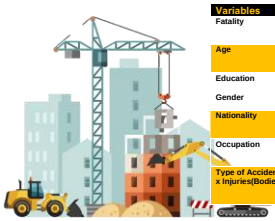
The relationship between fatality due to occupational accidents and explanatory factors (independent variables) was tested using Pearson's chi-square statistics and Cramer's V.

Pearson's Chi-square $\chi^2 = \sum_{i=1}^{N} \left(\frac{O_i - E_i}{E_i}\right)^2$ **Cramer's V** $v = \sqrt{\frac{\chi^2}{n(k-1)}}$

Logistic Regression

Third analysis, is to check the combined effect of statistically significant independent variables as well as determine the relationship between a dependent variable and the set of explanatory variables

$$\text{Probability of } (Fatality_t) = \alpha_0 + \beta_1 Age_t + \beta_2 Education_t + \beta_3 Gender_t + \beta_4 Nationality + \beta_5 Occupation + \beta_6 (Type\_of\_Accidents \times Injuries(Body)) + \varepsilon_t$$



Variables	Descriptions	Abbreviation
Fatality	Event of fatality due to an occupational accident. One (1) is for death, and zero (0) if otherwise.	Dummy_Fatality
Age	The age of workers is the group in the ordinal scales of ten-year age intervals.	Age_Group
Education	Education has been divided into two categories according to the worker's occupation. High education =1 while Low education =0	Dummy_Edu
Gender	Dummy Gender is being used as Male =1 and Female=0	Dummy_Male
Nationality	Nationality of worker has been divided into two categories, namely Malaysian worker=1 while non-Malaysian worker=0	Dummy_Malaysian
Occupation	Occupations of workers are categorised based on the broad skill level. Low-Skilled = 1, Semi-Skilled = 2, High-Skilled = 3	Occupation
Type of Accidents x Injuries(Bodies)	Event of accidents by type of accidents and location (bodies) of injuries. One (1) is for a person's fall, which causes head or multiple injuries, and zero (0) if otherwise.	Dummy_Fall_Injuries

4. Result

- Male, Malaysian, aged between 25-44 years old, who work in the low-skilled occupation and work in Selangor, Pulau Pinang, and Sarawak are most prone to occupational accidents. 2 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.
- Analysis of determining the strength of the relationship between variables showed that a strong relationship occurred for the location of injury (Crv: 0.23) and type of accident (Crv: 0.16), while nationality (Crv: 0.25) and cause of the accident (Crv: 0.30) have a very strong relationship with the dependent variable with fatalities

Independent Variables	Pearson's χ^2	p-value	Phi Cramer's V	Relationship
Month of accident	$\chi^2(11)$=14.39	p=0.212	-	-
Day of accident	$\chi^2(6)$= 6.07	p=0.415	-	-
Gender	$\chi^2(1)$= 23.47	p=0.000**	crv(1)=0.05	Weak
Age group	$\chi^2(4)$= 139.64	p=0.000**	crv(4)=0.13	Moderate
Education	$\chi^2(1)$= 79.00	p=0.000**	crv(1)=0.10	Moderate
Occupation	$\chi^2(2)$= 79.27	p=0.000**	crv(2)=0.10	Moderate
Nationality	$\chi^2(1)$= 541.01	p=0.000**	crv(1)=0.25	Very strong
Geographical	$\chi^2(10)$= 139.64	p=0.000**	crv(10)=0.13	Moderate
Location of Injury	$\chi^2(7)$= 472.27	p=0.000**	crv(7)=0.23	Strong
Type of accident	$\chi^2(8)$= 225.07	p=0.000**	crv(8)=0.16	Strong
Cause of accident	$\chi^2(9)$= 788.15	p=0.000**	crv(9)=0.30	Very Strong

Note: * and ** refre to the rejection level of the null hypothesis at a significance level of 5% and 1%, respectively.

- 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 5 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.

$$\text{Probability of } (Fatality_t) = -2.30346 + 0.11952 * Age\_Group_t + (-1.73805) * Dummy\_Edu_t + 1.532283 * Dummy\_Male_t + (-2.35821) * Dummy\_Malaysian_t + (-0.57675) * Occupation_t + 2.303402 * Dummy\_Fall\_Injuries_t$$

Variable	Coefficient "β"	SE	p-value	Odds Ratio for "β"	95% Confidence Interval	
Constant	-2.303456	1.032	p=0.0256*	0.010	0.013	0.762
Age_Group	0.119520	0.034	p=0.0004**	1.127	1.054	1.205
Dummy_Edu	-1.738053	0.463	p=0.0002**	0.175	0.070	0.439
Dummy_Male	1.532283	0.490	p=0.0018**	4.629	1.686	12.706
Dummy_Malaysian	-2.358213	0.163	p=0.0000**	0.095	0.069	0.129
Occupation	-0.576745	0.290	p=0.0467*	0.561	0.315	1.002
Dummy_Fall_Injuries	2.303402	0.180	p=0.0000**	10.008	7.080	14.147

Number of observations	= 8,821
LR statistic	= 530.09
Prob (LR statistic)	= 0.0000**
Hosmer and Lemeshow test	=14.8508 (p=0.0621)
Andrew statistic	=13.1501 (p=0.2154)
McFadden R^2	= 0.2530

5. Discussion & Conclusions

Policies Recommendation

- Eliminate risk which associated with design element
- Training to identify the risk of HIRARC
- Leverage on technology
- Regular inspection visit by the authority especially at the state with highest cases

The main findings of this study provide signal to policymakers to look at issues related to occupational accidents in the Construction sector. 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.

Main References

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