

# IDENTIFYING FACTORS AND IMPACTS OF OCCUPATIONAL SAFETY AND HEALTH (OSH) TOWARDS WORK ACCIDENT IN ACHIEVING SUSTAINABLE CONSTRUCTION

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**Abstract**—Construction Sector is the third biggest contributor to accident cases in Malaysia. The numbers of accident cases are becoming worrisome as other than human factor, it could also result in losing of workforce, hence affecting the development. Due to green and sustainable practices become more common nowadays, there is an opportunity to promote worker safety and health as a fundamental dimension of true sustainability. The purpose of this study is to identify the causes and effects of accidents on construction projects and the impacts of work accident as Occupational Safety and Health (OSH) concept to project performance. This research utilised quantitative method of data collection by means of questionnaire survey to 72 respondents from G7 contractors that involved in the construction of high rise buildings in Daerah Petaling, Selangor. From the survey, results show that the major factors of accidents consist of eleven (11) factors which can be divided into four (4) main factors (i.e., Human; Worksite; Organisation and Management; and External). Furthermore, the results show that the effects of accidents on construction projects include loss of ability to work which may lead to the decrease and loss of individual/family income and standard of living, work disruption, delay of work progress, loss of time in project execution, need extra health and safety compliance work, effect on company reputation and image, damages of plant and equipment due to accident, increases of fine and legal expenses, and decrease and loss of productivity. Moreover, based on the results most of respondents strongly agree with all the nine (9) statements of the impacts of OSH concept towards project performance including increase productivity of the workers, reduce rate of accidents and injuries, increase safety at construction project, improve the efficiency, human relations, increase profit, company reputation, business performance, reducing of penalties, insurance premiums and employment costs, quality of product, job satisfactions, company reputation, morale of the workers, costs saving, and facilitated to the enhancement of project performance. These results are hoped to assist in designing more effective solutions which effectively address both green and occupational safety objectives.

**Keywords**— *Occupational Safety and Health (OSH) Concept; Work Accident; Sustainable Construction*

## I. INTRODUCTION

Construction industry is vital for national development as the industry is an economic investment and its relationship with

economic development is well posited [1]. Social Security Organization (SOCISO), in 2016 put forward that construction sector saw 2,880 accident cases; which involved 55 deaths. This statistics is becoming worrisome because other than human factor, it could also result in losing of workforce, hence affecting country's development. According to [2], 402 workers in construction sector were involved in construction accidents between 2011 and October 2016; whereby from January to October 2016, 55 workers were killed and 95 others were injured.

As green and sustainable practices become more common nowadays, there is an opportunity to promote worker safety and health as a fundamental dimension of true sustainability [3]. The reason is some green building design features could increase jobsite hazards (i.e., despite the greater use of skylights and atria in buildings increase light and give a sense of greater space, they also increase fall hazards during construction).

There are many factors contributed to the accidents on construction projects which include human factor, worksite factor, organization and management factor, and also external factor [4]. Nonetheless, [5] state that the factors that contribute to construction accident were inappropriate ergonomic design environment and supporting policy. In addition, unsafe acts and unsafe condition are also the factors that can contribute to the construction accidents.

As a result of accidents that occur at construction site, it is undoubtedly will affect to the construction project. The effects of construction accidents can be divided into two which are economic impact and social impact [6]. Moreover, [7] proved that accidents will also affect the psychological and behavioural of the workers. Accidents that happened at a construction project possibly will cause delay in completion of the construction project which related to time factor in project performance [8]. Moreover, the accident happened gave an impact to the project performance in terms of indirect costs of workplace to the employer and employees [9]. This is due to an increase of expenses which affect the project performance in terms of financial. It is also supported by [10] where the safe and healthy workplaces are extremely important as they not only protect employees but increase productivity. Therefore, when the occupational safety and health (OSH) culture increases, the workplace injuries can be reduced as well as

improve the efficiency, productivity and business performance [11]. Thus, it is noteworthy to identify the causes and effect of accidents on construction project and the impact of work accidents as Occupational Safety and Health (OSH) concept to project performance.

## II. LITERATURE REVIEW

Figure 1 shows that the factors that contribute to accidents in construction industry can be divided into four main factors (i.e., human factor, worksite factor, organization and management factor and external factor) [4]. In addition, human factor includes physical, experience, attitude and behaviour of the workers in doing their work. Besides that, human factor also includes improper use of protection equipment [12]; [13], lack of safety awareness [14] and careless among the workers in doing their work [15]; [16]; [13].

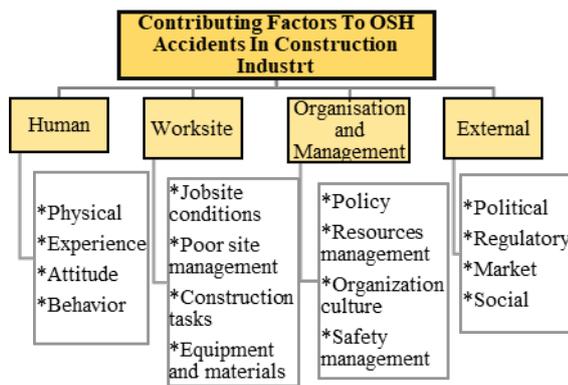


Fig. 1. Contributing factors to OSH accidents in construction industry [4]

Worksite factor is the factor that includes jobsite conditions [17], poor site management [18]; [19]; [20]; [14]; [21], construction task and equipment, and material. Furthermore, lack of safety awareness as well as lack of skill and knowledge in the specific work will encourage to unsafe actions which defined as improper working procedure such as fail to follow the procedure of work [17], improper installation and operation work [22]; [19]; [12]; [21] and adopting unsafe position. In addition, ergonomic design such as light, noise and vibration and environment factor such as weather and sunlight also become factors that contribute to construction accidents [5]; [17].

Other than that, organisation and management factor consists of policy, resources management, and organisation culture and safety management [4]. Also, Management factor includes lack of maintenance of access equipment and structures [20], insufficient training of works [18]; [23]; [16]; [14]; [12] and adequate supervision [18]; [13]. Moreover, managerial faults such as ignorance, disregarding and lack of equipment are the main reasons for dangerous behaviours also are the contributing factors to the construction accidents [24]. Reference [21] also found that the high rates of accidents happened were due to the management careless, lack of legislation and safety policy [17], careless of inspection, lack of employs of safety officers, lack of safety motivation, and neglect safety training by the top management [2] [23].

Likewise, external factor is the factor that connected not under full jurisdiction of the construction organisation which not directly influenced, but it can due to the increase of risk to the construction accident [20]. This includes political regulatory, market and social [4].

Table I presents several effects identified from previous researchers that can be divided into three categories (i.e., effects to individual, effects to company/business, and effect to construction project). Individual effect includes decrease of family income and standard of living, increase debt, increase medical expenses, increase family depression, loss of social welfare, loss quality of life, and loss of income.

TABLE I. INDIVIDUAL EFFECT OF CONSTRUCTION ACCIDENTS

Individual Effect	
Decrease Family Income	[25]; [6]; [9]
Decrease standard of living	[6]
Increase in Debt	[6]
Medical Payment/ Expenses	[25]; [26]; [9]
Family Depression	[6]
Loss of Social Welfare	[6]
Loss quality of life	[25]; [6]; [9]
Loss of income	[25]; [9]

Whereas, referring to Table II, company/business effect includes the effect on company reputation, need of extra OSH compliance work, loss of business, increase expenses, increase in fine and legal expenses, increase insurance cost, depression of employees, damages of plant and equipment, property and asset, legal penalties, increase investigation cost, decrease productivity, loss of production, and decrease of workers morale and work quality.

TABLE II. COMPANY/BUSINESS EFFECT OF CONSTRUCTION ACCIDENTS

Company/ Business Effect	
Company Reputation	[25]
Extra OSH compliance work	[27]
Loss of business	[27]; [6]
Increase expenses	[25]; [27]; [9]
Fines & Legal Expenses	[6]; [9]
Increased Insurance Cost	[25]; [6]
Depression of employees	[6]
Damages of plant & equipment, property and asset	[25]; [27]; [6]; [21]; [17]
Legal Penalties	[27]; [6]
Investigation Cost increase	[25]; [9]
Decrease of Productivity	[21]; [26]; [9]
Loss of Production	[27]; [6]; [21]; [17]
Decrease worker morale	[27]; [6]; [21]; [26]; [17]
Decrease work quality	[26]

Moreover, since accidents happened at the construction site, undeniably it will affect the project in term of loss of time in project execution, delay of work progress, work disruption, loss of customer satisfaction and absenteeism of the workers as found by previous researcher as show in Table III.

TABLE III. PROJECT EFFECT OF CONSTRUCTION ACCIDENTS

Project Effect	
Loss of time in Project Execution	[28]
Delay of Work Progress	[6]; [28]
Work Disruption	[6]; [21]
Loss of Customer Satisfaction	[6]
Absenteeism	[25]; [28]

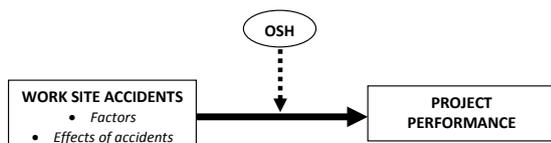
According to [29], project performance can be measured by producing effective result in term of productivity, avoidance of waste in fraud which helped in reducing cost, and by professional outlook of manager and their employees in the intrinsic satisfaction (i.e., job satisfaction) as the occupational accidents and ill health are clearly bad for productivity. Moreover, safe and health workplaces are extremely important as not only to protect employees but also to increase productivity [10].

Furthermore, by implementing occupational safety and health programme and development of OSH teams in workplace, it will lead to reducing absenteeism, lower turnover and higher productivity hence increase company profit [30]. On top of that, the workplace health and safety should consist of leveraging ergonomic interventions in order to improved productivity and efficiency which result to increase of company reputation [31]. Additionally, penalties arising from the accidents will increases insurance premiums and increase employment cost [32].

OSH are also critical for sustainable development which stand to bring in superior intangible benefits ranging from improved environmental and social performance, higher employee job satisfaction and commitment, increased innovation and creativity [33]. Above and beyond, innovation of workplace safety and health brings sustainable development through healthy people, safer workplace, reduced cost of accidents, controlled environment, managed workplace accidents and improve workplace safety knowledge [34]. Therefore, management of green jobs should value in the same way either environmental or economic goal as well as occupational health and safety issues in order to achieve more realistic evaluation of sustainability and enhancement of active and healthy worker [35].

Based on the Literature Review, Figure 2 shows the conceptual framework consisting two main elements including *accidents* (i.e., factor and effect of accidents) and *project performance*. This is due to the fact that accidents may affects project performance, however contribution of OSH also can affect project performance positively. Therefore, it is inevitable to note that these three elements are required for ensuring sustainable construction.

Fig. 2. Conceptual Framework



### III. METHODOLOGY

This study utilised quantitative method of data collection by means of questionnaire survey to 72 respondents from G7 contractors that involved in the construction of high rise building in Daerah Petaling, Selangor.

### IV. FINDINGS

Table IV and Table V illustrates the respondents' job designation and years of experience for the questionnaire survey. In overall of the survey which involving 72 respondent that representing 75 percent of response rate, the 59.7 percent of the respondents are from executive level such as Project Manager, Site Engineer, Health and Safety Officer and others (i.e., Architect Coordinator, Safety Coordinator and Quantity Surveyor). The findings also show that 43 percent of the respondents have experiences of more than 6 years in the construction of high rise building. Therefore, the range of respondents' experiences and their designation proved that they have vast experiences with the issue at hand.

TABLE IV. RESPONDENTS' JOB DESIGNATION

Job Designation	Frequency	Percentage (%)
<b>Project Manager</b>	<b>9</b>	<b>12.5</b>
<b>Site Engineer</b>	<b>17</b>	<b>23.6</b>
<b>Health and Safety Officer</b>	<b>12</b>	<b>16.7</b>
Site Supervisor	15	20.8
Safety Site Supervisor	14	19.4
<b>Others</b>	<b>5</b>	<b>6.9</b>
Total	72	100.0

TABLE V. RESPONDENT'S YEARS OF EXPERIENCE

Years of Experience in Construction of High Rise	Frequency	Percentage (%)
Less Than 1 Years	15	20.8
2-5 Years	26	36.1
<b>6-10 Years</b>	<b>16</b>	<b>22.2</b>
<b>11-15 Years</b>	<b>7</b>	<b>9.7</b>
<b>More Than 15 Years</b>	<b>8</b>	<b>11.1</b>
Total	72	100.0

#### A. Factor Contribute to Accident

Table VII shows that there are 48 respondent (66.7%) indicated that human factor is the most contributing factor that may lead to the accident on construction project. This in in line with the previous research conducted by [12]; [13]; [15]; [7]; [36]; [37]; [14]. Thus from the survey results, it can be determined that there are four (4) factors that contribute to accidents on construction project including human factor, worksite factor, organization and management factor and external factor. As shows in Table VI, there are 47 respondents (65.3%) believed that careless among the workers is the most important human factor that may lead to accidents and followed by improper use of personal protective equipment (59.7%), unsafe acts (55.6%) and lack of safety awareness (51.4%).

TABLE VI. FACTOR CONTRIBUTE TO ACCIDENT ON CONSTRUCTION PROJECT

Human Factor	Frequency	Percentage (%)
Careless among the workers	47	65.3
Improper use of PPE	43	59.7
Unsafe acts	40	55.6
Lack of safety awareness	37	51.4
<b>Work-site Factor</b>		
Unsafe condition	46	63.9
Unsafe actions	46	63.9
Poor safety practice	40	55.6
Unsuitable tools and equipment	36	50.0
<b>Organization and Management Factor</b>		
Lack of knowledge/incompetency	47	65.3
Lack of supervision /monitoring	40	55.6
<b>External Factor</b>		
Regulatory	44	61.1

Other than that, worksite factor contributes to accident as agreed by the respondent including unsafe condition (63.9%), unsafe actions (63.9%), poor safety practice (55.6%) and unsuitable tools and equipment (50%). This result is similar with previous research findings by [38]; [39]; [40]; [41].

TABLE VII. MAIN FACTOR CONTRIBUTE TO ACCIDENT

Main Factor Contribute to Accident	Frequency	Percentage (%)
Human Factor	48	66.7
Worksite Factor	17	23.6
Organization and Management Factor	5	6.9
External Factor	2	2.8
Total	72	100.0

Moreover, based from the organisation and management factor, lack of knowledge and incompetency (65.3%) and lack of supervision and monitoring (55.6%) may contribute to accidents. This result is in line with the research done by [39]; [40]; [41]; [18] who found that lack of skill and experiences among the workers is the most factor that may lead to the construction accidents.

Lastly, there are 44 respondent (61.1%) stated that regulatory is the most external factor that may contribute to construction accidents. This is similar with previous research which found that major reason for non-adherence are include non-enforcement of existence regulatory [42].

### B. Effect of Accident on Construction Project

Table VIII presents the three (3) effects of accidents on construction project that clarified by all of the 72 respondents. This includes individual effect, project effect, and organization/business effect. The results show that the respondents are strongly agree with the individual effect of construction accidents that caused the loss of ability to work which may lead to the decrease and loss of individual/family income and standard of living (M=4.19). Furthermore, results show that the project effects of accidents on construction project include work disruption (M=4.22), delay of work progress (M=4.21) and loss of time in project execution (M=4.21).

TABLE VIII. EFFECT OF ACCIDENT ON CONSTRUCTION PROJECT

Item	Mean
<b>Individual Effect</b>	
Loss ability to work lead to the decrease and loss of individual/family income and standard of living	4.19
<b>Project Effect</b>	
Work Disruption	4.22
Delay of Work Progress	4.21
Loss of time in Project Execution	4.21
<b>Organization/Business Effect</b>	
Need extra health and safety compliance work	4.26
Effect Company Reputation	4.24
Damages of plant & equipment, property and asset	4.19
Increase of Fine & Legal Expenses	4.01
Decrease and Loss of Productivity	4.00

Construction accident will also effect the organisation and business of the company such as the need for extra health and safety compliance work (M=4.26), company reputation (M=4.24), damages of plan and equipment, property and asset (M=4.19), increase of fine and legal expenses and decrease (M=4.01) and loss of workers' productivity (M=4.00).

### C. Impact of Occupational Safety and Health (OSH) Concept to Project Performance

Table IX shows the impact of OSH concept to project performance. The findings show that most of the respondents are strongly agree with the impact of occupational safety and health (OSH) concept to project performance. This includes 'safety and healthy workplace important to increase productivity' (M=4.47) and 'low accident will also indicate to high productivity of the workers' (M=4.39). This is similar with the findings by previous researchers [40]; [10]; [43]. Above and beyond, the results also indicate that poor site condition affects labor productivity (M=4.38), hence the respondents agreed that health and safety factor may affect project performance (M=4.28) which is in line with the findings by [40]. The result also shows that respondents are strongly agreed with 'construction accidents has a relationship with project performance' (M=4.26) which supported the previous researches conducted by [44]; [45]. In addition, the result also found similar findings with [30] in term of 'when the occupational safety and health (OSH) culture and programmed increase, workplace injuries reduce as well as increase the efficiency, productivity, profit and business performance' (M=4.25).

Apart from that, respondents also strongly agreed that if the workplace health and safety practice improve, it will help in reducing penalties, insurance premiums and employment costs (M=4.25) which also similar with [46]. Furthermore, Ergonomic program also helped in reducing accidents besides increase productivity, efficiency, quality of product and moral of the workers (M=4.22). This is also proved by [26] and [31] in their research on ergonomic programs to improve productivity, efficiency, quality and morale of the workers.

TABLE IX. IMPACT OF OCCUPATIONAL SAFETY AND HEALTH (OSH) CONCEPT TO PROJECT PERFORMANCE

Item	Mean
Safety and healthy workplace important in order to increase productivity.	4.47
Low accident happened will indicate to the high productivity of the workers.	4.39
Poor site condition affects labour productivity at construction site.	4.38
Health and safety factor affect performance of construction project.	4.28
Construction accident has a relationship with project performance.	4.26
When the Occupational Safety and Health (OSH) culture and programmed increases, the workplace injuries can be reduce as well as improve the efficiency, productivity, profit and business performance.	4.25
If the workplace health and safety practice improve, it will held in reducing of penalties, insurance premiums and employment costs.	4.25
Ergonomic program helped in reducing the accident and injuries besides increase of productivity, efficiency of work, quality of product and morale of the workers.	4.22
Poor practice of workplace health and safety drive to the reducing of business potential profit and reputation losses.	4.07

Finally, respondent also strongly agreed that poor practice of workplace safety and health will drive to reducing business potential profit and losses company reputation (M=4.07) which support the findings of [31] that highlighted healthy and safe workplace drive to increase profit and reputation of company.

## V. CONCLUSIONS

In conclusion, this study shows the major factors of accidents consist of careless among the workers, improper use of Personal Protective Equipment (PPE), unsafe acts, lack of safety awareness among the workers, unsafe condition, unsafe action, poor safety practice and unsuitable and improper use of tools and equipment, lack of knowledge and incompetency, lack of supervision and monitoring and lack enforcement of safety policy and regulations. Furthermore, effect of accidents on construction project include loss of ability to work which may lead to the decrease and loss of individual/family income and standard of living, work disruption, delay of work progress, loss of time in project execution, need extra health and safety compliance work, effect on company reputation and image, damages of plant and equipment due to accident, increase of fine and legal expenses, and decrease and loss of productivity. Moreover, most of respondents strongly agree with the statement of the impacts of occupational Safety and Health (OSH) concept to project performance include increase productivity of the workers, reduce rate of accidents and injuries, increase safety at construction project, improve the efficiency, human relations, increase profit, company reputation, business performance, reducing of penalties, insurance premiums and employment costs, quality of product, job satisfaction, morale of the workers, costs saving, and facilitated to the enhancement of project performance. Therefore, this result may contribute in reducing the number of accidents at workplaces and could assist in designing more effective solutions that effectively address both green and occupational safety objectives.

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