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Analysis of work accident cost on occupational safety and health risk handling at construction project of Hasanuddin University the Faculty of Engineering[☆]



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KEYWORDS

Work accident;
Cost analysis;
Safety cost

Abstract

Objective: To analyze the work accident cost on occupational safety and health risk handling at the construction project of Hasanuddin University Faculty of Engineering.

Methods: An explorative study with a retrospective approach, analyzed the occupational accident records and Microsoft Excel for the safety cost data. The case samples were: 80 workers at ADHI Company Hasanuddin University Engineering Faculty construction Project who experience occupational health during the project. The instrument used in this study was a questionnaire and interviews.

Results: The results showed that the cost of OSH risk handling in this project is around IDR 956.4 million, the cost of work accidents handling is around IDR 64,534 million, the opportunity cost is around IDR 3475 million, cost of OSH risk controlling program is around IDR 724,275 million. **Conclusions:** The value of the benefit–cost ratio is 1.2 or ≥ 1 , which means the OSH program cost investment by ADHI Company is categorized as beneficial for the company. The safety cost data presented in this paper may be useful for practitioners to direct resource investment.

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Introduction

⁷ Ensuring health and safety in the workplace is a vital issue according to internationally agreed principles defined by the ILO's (International Labor Organization) tripartite constituents, i.e., governments, employers, and workers. A healthy and safe work environment results in reduced costs

for work accidents and occupational diseases and promotes enterprises' competitiveness and labor productivity. Also, another crucial issue is that decreased numbers of accidents can reduce costs for public and private insurance companies. The International Labor Organization (ILO) reports that in 2016 about 3,676,882.00 workdays lost due to occupational injury reasons.¹ Only in the United States of America, 4836 workers were killed on the job in 2015. Eurostat reports that in 2014, there were 3739 (estimate) workers died by fatal accidents at workplaces, in the European Union (28 countries).²

Health issues that emerge caused by the case of work do not only affect the workers themselves but also to the health cost issued by the company. In addition, unsafe actions that endanger workers themselves and others can cause work accidents, which can be caused by various things such as not using PPE, not following work safety rules, not following work procedures, and not working carefully.^{3,4} Workers with jobs where they work with tools or machines have a fivefold increased risk of injury in a work accident.⁵ On the other hand, the recent research findings suggest that lack of space, problems of coordination and management of site personnel, and overcrowding of the workplace are the main factors affecting health and safety management at confined construction sites.⁶ The results from another recent study conducted in three Australian organizations highlight the critical role played by first-level supervisors in acting as the conduit through which organizational safety priorities are communicated to the workforce.⁷

A study shows that more than \$600 billion had been spent as the compensation for non-fatal injuries in workplaces in America from 1998 to 2010 (current year dollars calculation). This amount was high but seems low compared to the entire cost of all work accidents and illnesses in the United States of America (USA). Over 13 years, worker's compensation direct cost spent on non-fatal injuries in America had increased from \$37 billion in 1998 to \$51 billion in 2010, increased nearly one billion dollars a week.⁸

The role of occupational safety and health management is very crucial for the company's competitiveness and productivity consolidation, as it means a better cost reduction caused by accidents, incidents, illnesses, and also motivation for the workers. One of the best efforts of the work accident prevention is implementing Occupational Safety and Health Management Systems (OSH MS). Occupational accidents and diseases become a huge burden on private and public social protection systems and require an integrated, coordinated, and strategic response.⁹ However, applying OSH standardization in a company must go through major consideration by the entrepreneur first, because it requires a high cost. A study result shows the increase in costs has been borne by the organization in implementing OSHAS 18001: 1999 in Malaysia.⁸

Construction work is an activity that massively uses a variety of equipment, both sophisticated and manual. Those are carried out in limited areas within various types of activities that cause a high risk of accidents. An example case from research on building construction projects in Turkey yielded safety costs percentage of 1.92% of the total construction cost.¹⁰ Besides, according to Kalma (2016), the amount of OSH costs for multi-story building projects in Makassar is about 0.4–0.5% of project contract values, with an average

of 0.44%.¹¹ Research by Rahaded (2014) shows three highest risks: unloading formwork column has a risk of people falling with a risk index of 7.92, service work and canals have a risk of landslide excavated with a risk index of 7.56, and slub excavation work also has a risk of landslide excavated with a risk index of 6.48. As the proposed cost for controlling purposes of IDR 170,160,400 (one hundred seventy million one hundred sixty thousand four hundred).¹² Shekh et al. (2013) also conclude that the *cost-benefit ratio* between workplace accident handling costs and OSH risk control costs is 1.06, which means that the OSH risk handling cost can minimize the company expenses in dealing with occupational accidents.¹³

As one of the leading state-owned companies in Indonesia, ADHI always gives the best in every building project that makes it a trusted company and becomes a part of infrastructure growth in Indonesia until nowadays. ADHI has got the Golden Flag and Audit Certificate of OSH MS in 2014. The building project of the Faculty of Engineering of Hasanuddin University had also been carried out by ADHI Company started in April 2016 with the total contract of IDR 129 billion. Based on the previous background, the researcher of this current study is interested in conducting further research on the cost analysis of occupational accidents at ADHI Company in the 2017 construction project of the faculty of engineering, Hasanuddin University.

Method

An explorative study with a retrospective approach was used in this research, along with primary and secondary data. The population of this research was 203 workers involved in the 2017 ADHI Company Faculty of Engineering Hasanuddin University construction project. The case samples were 80 samples that had been taken through a purposive sampling method. Those who were selected had to experience occupational accidents during the project. The instrument used in this study was a questionnaire and interviews. And also secondary data from the company's safety personnel dealing with the use of safety program costs in the project. The data was analyzed for the occupational accident records and Microsoft Excel for the safety cost data.

Result

Analysis of workers characteristics

The number of respondents was 80 workers, the highest percentage of respondents goes to the age group of 25–29 years old, or equal to 18 people (22.5%). The highest educational background is Junior High School, 41 people (51.3%). The total of the highest respondent is held hold by the workers whose work experiences from 0–4 years, 55 people (68.8%) can be seen in Table 1.

Cost analysis

The estimated amount of claims for work accident victim compensation for workers of ADHI Company in 2017 for the Hasanuddin University Construction Project can be seen in

Table 1 Distribution of respondents by age, latest education, and work experience.

Characteristics of respondents	Amount	
	n = 80	%
5 Age		
a. 16–19	4	5
b. 20–24	12	15
c. 25–29	18	22.5
d. 30–34	17	21.3
e. 35–39	13	16.3
f. 40–44	6	7.5
g. 45–49	5	6.3
h. >50	5	6.3
14 education		
a. Elementary school	15	18.8
b. Middle School	41	51.3
c. High school	21	26.3
d. D3	2	2.5
e. S1	1	1.3
12 work experience		
a. 0–4	55	68.8
b. >5–9	5	6.3
c. >10–14	13	16.3
d. >15–19	6	7.5
e. >20–24	1	1.3

Table 2 Estimated amount of claims for work accident victim compensation for workers.

Accident type	Formula	Amount (Rp)
Passed away	- 60% (100,000 * 30) * 80	144,000,000
	- Funeral	2,000,000
	- 200 × 24 mth	4,800,000
	Total 1 person	150,800,000
Defects in body function	Total 3 people	452,400,000
	70% (100,000 * 30) * 80	168,000,000
	Total 3 people	504,000,000
Total		956,400,000

Table 2. The results of the amount of claim given to the workers who had passed away, and those who had got organ malfunction diseases were IDR 956.4 million (Table 3). It is also found that there was a total cost of IDR 64,534,000 spent to handle the occupational accidents that the workers have undergone during the project (Table 4).

The Opportunity Cost can be calculated by multiplying a worker's hourly salary and a number of lost work hours. The total of the company lost due to the occupational accidents suffered by workers is IDR 3475,000. The total cost of the OSH Risk Preventing Program found as much as IDR 724,275,000. Benefit–Cost Ratio is calculated by dividing the total cost of the OSH Risk Preventing Program by the unit cost of the OSH Risk Preventing Program (Table 4). The unknown value of BCR can be found by dividing the cost of OSH Risk Handling with the OSH Risk Preventing Program. The result number Benefit–Cost Ratio is 1.2 or ≥ 1 ;

therefore, the investment alternatives or project feasibility is acceptable.

Discussion

Cost of OSH risk handling (OSH-RH)

The total amount of costs incurred by companies and workers to handle occupational accidents was 64,534,000 or about 0.05% of the total project costs. This value is much different from research conducted by Suryaningrum (2009) entitled *The Cost Analysis of Work Accidents in Building Construction Project: A Case Study of Waterplace Residence Phase II Project*. The tall building is one of the jobs with a high risk of accidents. In that case, study the Waterplace Residence Phase II in Surabaya, which is located in Jl. Raya Lontar Timur consists of Tower A (34 floors), Tower B (34 floors), Tower C (33 floors), Tower D (34 floors), and the Podium, which are calculated to be 1844 apartment units is categorized as a tall building.⁹

Cost of work accident handling (WAH)

This research calculated the direct and indirect costs and calculated the total costs by dint of occupational accidents. This research used a survey using a questionnaire. The data obtained were grouped based on the *Jaminan Sosial Tenaga Kerja (Jamsostek)*, then the next step has identified the effect of the occupational accidents, calculated the costs incurred, and found the risk level scale. As a result, the cost analysis of loss emerged because of the occupational accidents is IDR 33,021,000, – as the direct costs, and IDR 73,689,143, – as the indirect costs. Thus, the total costs of loss are IDR 106,710,143, – or as equal as 2.70% from the OSH allocation costs. The cost components included in the cost of handling work accidents in this study are first aid, equipment repairs, medical treatment at the clinic, and worker dependents. This cost component is not following, according to Tarwaka (2014), which details the direct and indirect costs of workplace accidents. This happens because no data is detailing these costs available in notes and reports from ADHI Karya Company.¹⁵

Opportunity cost (OC)

Opportunity cost refers to lost profits as a result of lost opportunities. This is a profit that is not realized due to work time lost by the workers who undergo accidents in the workplace and need break time for recovery, treating wounds, or resting until the pain decreases. In the case of a production company, OC can be calculated by evaluating the number of products that can be made during the lost time and then multiplying it by the value of those products. However, for a construction project, to get the value of OC, the lost work time should be multiplied by the salary received by the workers. The company's total amount of loss by the accidents encountered by the workers is IDR 3,475,000. This amount is not much since several accidents did not cause injury so that the workers would no longer have to take break time or treat their wounds. None the less, it still caused the loss for

Table 3 Total cost handling accident work.

Cost type	Amount (EA)	Unit Price (Rp)	Amount (Rp)
First aid kit	12	2,000,000	24,000,000
Equipment repair	1	3,000,000	3,000,000
Treatment at the clinic	12	3,000,000	36,000,000
Worker dependents	25	-	1,534,000
Amount			64,534,000

Table 4 Total cost of program prevention of accidents work.

Program	f	Unit cost (Rp)	Amount of cost (Rp)
<i>Safety work</i>			707,275,000
Manufacture and installation of K3L signs	82		25,175,000
Provision of PPE	8940		575,900,000
Safety award	4	300,000	1,200,000
The use of portable fire extinguisher training	2	3,000,000	6,000,000
Rigging safety training	1	3,000,000	3,000,000
Safety personnel (2 personnel)	12	8,000,000	96,000,000
<i>Occupational health</i>			17,000,000
Extra nutrition/vitamins & sports	12	1,000,000	12,000,000
Fogging	1	2,000,000	2,000,000
First aid training	1	3,000,000	3,000,000
Total			724,275,000

the company because several works that should be finished by the workers on time, if only they did not have an accident and the lost time did not happen.

The occurrence of health problems caused by work does not only have an effect on the worker concerned but also affects the expenditure on compensation for health costs incurred by the company. Based on the average reduction and estimated prevalence, overall economic burden, hypertension (\$392 per eligible employee per year), heart disease (\$368), depression and other mental illnesses (\$48), and arthritis (\$327). Other research also shows that more than \$600 billion in direct costs for workers' compensation was spent on non-fatal workplace compensation in the United States from 1998 to 2010 (sum of current year dollars); this figure is large, but it is considered small when compared to the overall burden of all work accidents and illnesses in the United States. Over 13 years, the direct costs of workers' compensation spent on non-fatal injuries in America increased from \$ 37 billion in 1998 to \$ 51 billion in 2010, rising to nearly one billion dollars a week.⁸

Cost of OSH risk control program (OSH-RPP)

This research has discovered the total costs of OSH Risk Prevention equal to IDR 724,275,000 or about 0.6% of the total project value. This value is quite higher than the result of the research by Kalma (2016) that identified the cost of OSH in the multi-story buildings in Makassar, which was about 0.4–0.5% of the project contract value. It reflects a big commitment of ADHI Company in the construction project of the Hasanuddin University's Engineering Faculty to uphold

the aspects of occupational safety and health.¹¹ It is proved by the absence of fatality and the routine implementation of the OSH program in this project. Even though high costs needed but it has prevented the company have to spend money, which may be up to IDR 956.4 million to become only IDR 64.534 million, giving remarkable cost efficiency that is carried out almost 15 times. The number of claims pledged to workers who have died and who have physical injuries or malfunctioning is IDR 956.4 million or 0.7% of the total value of this project. That number is only the calculation from the case of occupational accidents, not including material loss costs, late claims, case fees from the authorized parts, etc. Besides, this calculation is only for one type of job that has the highest risk, according to the workers when the research was conducted. A study from the USA indicates that the most cost-effective safety program elements are subcontractor selection and management and upper management support and commitment. Alternatively, the least cost-effective elements are the employment of a full-time safety manager and record-keeping.¹⁶

Benefit–Cost Ratio (BCR)

The value of BCR found in this research is 1.2 or ≥ 1 , so investment alternative or project feasibility is accepted. It means that the OSH program cost investment by ADHI Company is categorized as beneficial for the company. All threat potentials were controlled and met the safety standard limit, so they contributed to a safe, sound, and healthy production process, which finally maybe not only able to reduce risks but also able to improve the company's

productivity. Implementing standards regarding OSH in a company must pass a large consideration by the entrepreneur first because its application requires a very high cost. In line with the results of this study, there are results of research by Shekh et al. (2013) which concludes that the cost-benefit ratio between the cost of handling work accident incidents with OSH risk control costs is 1.06, which means that OSH risk handling costs can minimize the cost of corporate expenses in handle work accidents.¹³ Costs incurred by the company for the OSH risk control program must be considered as an investment, to produce benefits in the form of decreased work accident rates and handling costs, increased productivity, and the company's image tends to be good in the competitive market.

Conclusion

The study is concluded that the cost of OSH risk handling on the project is amounting to IDR 956,400,000. The cost of work accident handling on the project is that of IDR 64,534,000. The amount of opportunity cost for this project is IDR 3,475,000. The cost OSH risk controlling program in this project is IDR 724,275,000.

The value of the benefit-cost ratio found by dividing the cost of OSH Risk Handling with the cost of the OSH risk controlling program, and the result is 1.2, which means infestation or project worthy accepted. Research is suggesting that all company construction should be able to provide a budget for the cost of the K3 program so that the number of accidents of work and the cost of handling it can be minimized.

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Conflict of interest

The authors declare no conflict of interest.

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