Occupational Health And Safety (K3) Risk Management Analysis On Building Construction Projects In Indonesia: Literature Review

Andi Maddeppungeng[1*], Siti Asyiah[2], Dwi Esi Intari[3], Miftha Adityo Putra[4], Dwi Novi Setiawati[5]
[1,2,3,4]Department of Civil Engineering, Sultan Ageng Tirtayasa University, Indonesia
[5]Department of Civil Engineering, Bina Bangsa University, Indonesia

Article Info

Article history:

Received September 11, 2023
Accepted October 17, 2023
Published October 30, 2023

Keywords:

OHS, Indonesia Building Construction, Risk Management

ABSTRACT

The construction of building construction projects in Indonesia is inseparable from various risks related to work accidents, therefore risk management is very important for construction to prevent or minimize negative influences caused by an unexpected event. Since the announcement of covid-19 for the first time in 2020 until now, Indonesia is still experiencing the COVID-19 pandemic so large-scale social restrictions are imposed. This leads to restrictions on activities in the construction project environment. This study aims to analyze risk identification, risk assessment, and risk control contained in building construction projects in Indonesia. This research uses the systematic literature review method where data sources are obtained from "google scholar" in the form of published journals regarding occupational safety and health risk management in building construction projects in Indonesia from 2016-2021 with the keywords risk management, risk identification, risk assessment, risk control, and building construction. After the selection process, 23 journals were obtained. From this literature review, the most identified risks are technical project risks, the most emerging risk levels are moderate, and the most widely used risk control is administrative control.

Available online at http://dx.doi.org/10.36055/fondasi

Corresponding Author:

Andi Maddeppungeng,
Department of Civil Engineering,
Sultan Ageng Tirtayasa University,
Jl. Jendral Soedirman Km 3, Banten, 42435, Indonesia.
Email: andimaddeppungeng@untirta.ac.id

1. INTRODUCTION

The construction of high-rise building construction projects in Indonesia is inseparable from various risks related to work accidents including errors in the use of work methods and negligence in work can cause work accidents.[1]

Mentioned in his writings in Suara.com, the number of losses caused by work accidents is still high. Based on data from the Social Security Organizing Agency (BPJS) employment, there was an increase in work accident cases from 2019 to 2020 recorded more than one hundred thousand, including

occupational diseases and COVID-19 cases. This figure is obtained from claims submitted by the employment BPJS for accidents that occur. [2]

Risks often occur in construction projects, risks greatly affect the completion of construction projects. Therefore, the risk cannot be ignored but can be minimized or transferred to other parties and controlled. Risk management has an important role for the construction world to manage a risk in a structured manner so as to obtain time and cost efficiency. The purpose of holding risk management in a project is to prevent or minimize negative influences caused by an unexpected event.[3]

Tower Crane can work operated by operators, tower cranes work by moving goods or materials in the course of the project. In the use of tower cranes, the term tower crane productivity is known. The Big Dictionary Indonesian records productivity has meaning as the ability to produce something.

The process of knowing risks and making systematic risk management and risk responses, as well as reducing negative impacts on every construction project activity is the definition of risk management. [4]

Since the announcement of the first COVID-19 case in March 2020 announced by president Jokowi and health minister Terawan until now it has been more than 1 year, Indonesia is still experiencing the COVID-19 pandemic so that large-scale social restrictions are enforced. This leads to restrictions on activity in the construction project environment.

The literature review method is one of the choices of research methods that can be used in this Covid-19 pandemic, which still applies restrictions on activities outside the home and working from home or commonly called work from home. Therefore, this study aims to analyze risk identification, risk assessment and risk control contained in building construction projects in Indonesia.

Based on the background above, a study was conducted on "Risk Management Analysis of Occupational Health and Safety (K3) in Building Construction Projects in Indonesia: Literature Review".

2. METHODS

2.1 Journal Collection

Journal collection is a researcher's process in finding research data (search process). The process of collecting journals using the help of the google scholar search engine. The keywords used in this study are "risk management" analysis "risk identification" "risk assessment" "risk control" k3 building construction in Indonesia. The results of the search process (journal collection) will be tabulated and grouped based on junal to find out the type of journal and the number.The secondary data obtained in this study are as follows; location data, field observation, working drawings, documentation or photographs of the work.

2.2 Journal Selection

The data that has been collected in the form of journals will be selected using inclusion and exclusion criteria made based on *research questions.* It was found that the journals that [16] had been obtained were then reviewed so that 23 research journals were obtained that were relevant to the research objectives.

2.3 Journal Analysis

The journal data that has been collected will be synthesized. The purpose of data synthesis is to collect evidence from selected studies to answer research questions, narrative synthesis methods are generally used for research with systematic literature review methods.[19] The journal analysis process also includes determining the risks, risk assessment, and risk control contained in the journal to answer research objectives, in analyzing risks, risk assessment and how to control risk journal data is tabulated to find out the results of the research objectives.

3. RESULTS AND DISCUSSION

3.1 Search Process Results

The search process with keywords grouped by journal type is intended to make it easier to see it at the source of data publication or the type of journal obtained, so that search *process* results are found with a total of 153 journal data.

3.2 Study Selection Results

The results of the *search process* will be selected based on inclusion and exclusion criteria. Journal data that includes inclusion criteria will be used as research data while those that include exclusion criteria are not used as research data. The selection process based on the inclusion and exclusion criteria left 39 journals and further screening of journal data. Journal data can be grouped by year of publication of the journal as shown in figure 1

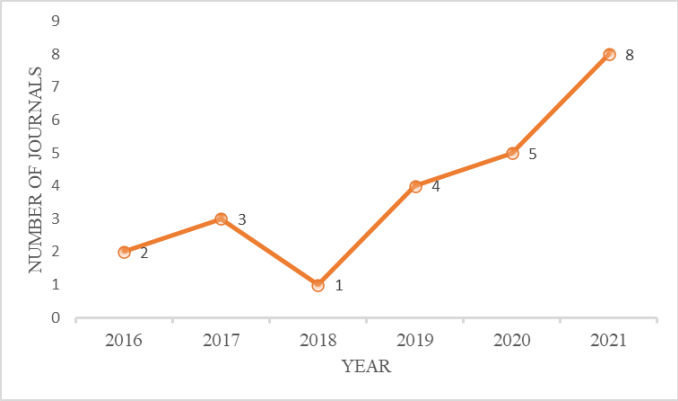

Figure 1. Grouping of journals by year
Source : Author's Analysis, 2022

3.3 Data Analysis

Journal data that met inclusion and exclusion criteria underwent quality assessment to address research objectives. The criteria included journals indexed in Google Scholar with categories of risk identification and risk level, as well as journals that discussed risk control in construction projects in Indonesia. The resulting data set consisted of a total of 23 journals as shown in Table 1.

Table 1. Research journal data

No.	Author	Title	Year
1	Theresia Avila Bria, Onisius Loden	Manajemen Risiko K3 pada Proyek Konstruksi di Kota Kupang	2016

No.	Author	Title	Year
2	Ryan Cakra Pamungkas, M.Hamzah Hasyim, Kartika Puspa Negara	Manajemen Risiko Keselamatan dan Kesehatan Kerja (K3) Studi Kasus Pada Proyek Pembangunan Gedung Apartemen Puncak CBD Surabaya)	2016
3	Irbah Mahdiah Zulfa, M. Hamzah Hasyim, Saifoe El Unas	Analisis Risiko K3 Menggunakan Pendekatan HIRADC dan JSA (Studi Kasus Proyek Pembangunan Menara BNI di Jakarta)	2017
4	A.A Bayu Dharma Widnyana	Manajemen Risiko Keselamatan dan Kesehatan (K3) pada Proyek Pembangunan Jambuluwuk Hotel & Resort	2017
5	Uppit Yuliani	Manajemen Risiko K3 pada Infrastruktur Gedung Bertingkat	2017
6	Marsya Rethyna	Analisa Risiko Keselamatan dan Kesehatan Kerja pada Bangunan Gedung Bertingkat	2018
7	Widi Hartono, Sugiyarto, Arumsya Hening Putri Rheinanda, Pangestuti Siwi Rahayu	Studi Manajemen Risiko Kesehatan dan Keselamatan Kerja dengan Metode HIRAC (Studi Kasus: Pada Proyek Pembangunan Apartemen Tamansari Amarta Yogyakarta)	2019
8	Moch Ichwan N.E, Mirdan	Analisis Resiko Bahaya Keselamatan dan Kesejatan Kerja (K3) Pada Proyek Pembangunan Grand Kamala Lagoon-Barclay Tower	2019
9	Mohammad Indra Arisandi Sabirin	Analisa Tingkat Risiko (K3) Pada Kegiatan Konstruksi Pembangunan Gedung Laboratorium BBPOM Samarinda	2019
10	Hendra Alexander, Silvia Nengsih, Oni Guspari	Kajian Keselamatan dan Kesehatan Kerja (K3) Konstruksi Balok Pada Konstruksi Bangunan Gedung	2019
11	Agus B Siswanto, M. Afif Salim, M.Sofi Ardani	Analisis Manajemen Risiko K3 dengan Metode Hazard Identification Risk Assesment & Determining Control pada Proyek Pembangunan Hotel Quest by Aston	2020
12	Taufiq Ihsan, Sarah Azzahra Hamidi, Febyta Amanda Putri	Penilaian Risiko dengan Metode HIRADC pada Pekerjaan Konstruksi Gedung Kebudayaan Sumatera Barat	2020
13	Sri Kiswati, Ummi Chasanah, Sri Subekti	Analisis Manajemen Risiko Bekisting Konvensional Pada Pelaksanaan Pembangunan Proyek The Trans Icon Surabaya Jl. Ahmad Yani No. 260 Surabaya , Jatim 60235	2020
14	Gede Eka Sastrawan, Putu Hermawati, Wayan Sri Kritinayanti	Analisis Manajemen Risiko Pelaksanaan Konstruksi Gedung Pada Pembangunan Gedung Satlantas Polres Badung	2020
15	Ulin Nuha, Rokheb Efendi	Artikel Analisis Tingkat Risiko Keselamatan Dan Kesehatan Kerja (K3) Pada Proyek Pembangunan Gedung Kampus Institut Teknologi Telkom Purwokerto Pt. Sandhy Putra Makmur	2020

No.	Author	Title	Year
16	Fathur Rozy	Analisa Faktor Keselamatan dan Kesehatan Kerja (K3) Yang Mempengaruhi Kecelakaan Kerja Pada Proyek Pembangunan Gedung KANWIL DJKN Kalimantan Timur dan Utara	2021
17	Hikmah Maya Sari	Manajemen Risiko Keselamatan Kerja Pada Penyelenggaraan Proyek Konstruksi Dalam Masa Pandemi Covid-19	2021
18	Alvhireal Bella Vheatrieze A, Katarina Rini Ratnayanti	Tinjauan Manajemen Risiko Pra Konstruksi, Pelaksanaan Konstruksi, dan Pasca Konstruksi Pada Proyek Pembangunan Gedung Student Center Politeknik Negeri Indramayu	2021
19	Utama Dewi Arman, Afrilda Sari, Rita Nasmirayanti	Analisis Resiko Keselamatan Konstruksi Pada Proyek Pembangunan Gedung Asrama Haji Padang Pariaman	2021
20	Ivan Ahmad Alfarezi, Jojok Widodo Soetjipto, Syamsul Arifin	Analisis Risiko Keselamatan Dan Kesehatan Kerja (K3) Pada Masa Pandemi Covid-19 Dengan Metode Bowtie Analysis	2021
21	Nyoman Martha Jaya, G.A.P Candra Dharmayanti, Dewa Ayu Retnoyasa Ulupie Mesi	Manajemen Risiko K3 (Keselamatan Dan Kesehatan Kerja) Pada Proyek Pembangunan Rumah Sakit Bali Mandara	2021
22	Muhammad Afiq	Manajemen Risiko Pada Proyek Pembangunan Gedung Asrama Mahasiswa Uin Walisongo Tahun 2021	2021
23	Hanif Farhan Setya Rama, Adwitya Bhaskara	Analisis Risiko Kecelakaan Kerja Pada Proyek Pembangunan Dengan Metode Fmea Dan Hazop	2021

3.3.1 Risks involved in building construction projects in Indonesia (RQ1)

Some descriptions related to risks in construction projects in Indonesia, in the study (Bria & Loden, 2016), non-technical external risks due to environmental factors (disturbances in the form of gas, dust, fog, rain, wind, and storms), technical project risks in the form of work safety with the main criteria for causing work accidents such as human factors (workers do not wear personal protective equipment, lack of coordination, inexperienced workers, weak management supervision of workers), construction factors (slippery work floor surface), material factors (damaged equipment, incomplete K3 signs, inadequate quality and quantity of PPE), hazard factors (inappropriate positioning of equipment).[17]

In the study (Vheatrieze & Ratnayanti, 2021), internal technical risks there are risks in the form of discrepancies in the technical specifications of the material / tool used, survey errors, equipment damage. Technical project risks regarding occupational safety and health are contained in the construction method factors in the stages before construction, during construction, and after construction work.[18]

From the journals obtained and *reviewed* related to the identification of risks for building construction projects in Indonesia in the 2016-2021 period, the most risk categories were obtained, namely technical project risks in the form of accident risks and occupational safety (collected 23 journals that

mentioned the identification of technical projects). The research data was analyzed by creating a table, as shown in Table 2, summarizing the literature review for identifying risks in construction projects in Indonesia.

Table 2. Summary example *of literature review* identification of risks in building construction projects in Indonesia.

No.	Journal identity	Region/city	Risk Category						Result
			Internal		External		Project		
			T	NT	T	NT	T	NT	
1	(Bria & Loden, 2016)	Kupang	-	-	-	✓	✓	-	a. Technical project risks; safety risks of workers with causes of human factors, construction factors, Material factors, b. Non-technical external risks; environmental factors (disturbances in the form of gas, dust, fog, rain, wind, storms)
2	(Vheatrieze & Ratnayanti, 2021)	Indramayu	✓	-	-	-	✓	-	a. Technical internal risks; in the form of non-conformity of technical specifications of materials / tools used, survey errors, equipment damage, b. technical project risks; occupational safety and health risks.

Source: Author's Analysis, 2022

The number of each journal that discusses the identification of such risks is found in Figure 2. There were 23 journals from the overall research data that recorded identifying technical project risks, 3 journals identifying non-technical external risks and technical internal risks, 2 journals identifying technical external risks and no journals identifying non-technical internal risks and non-technical project risks were found.

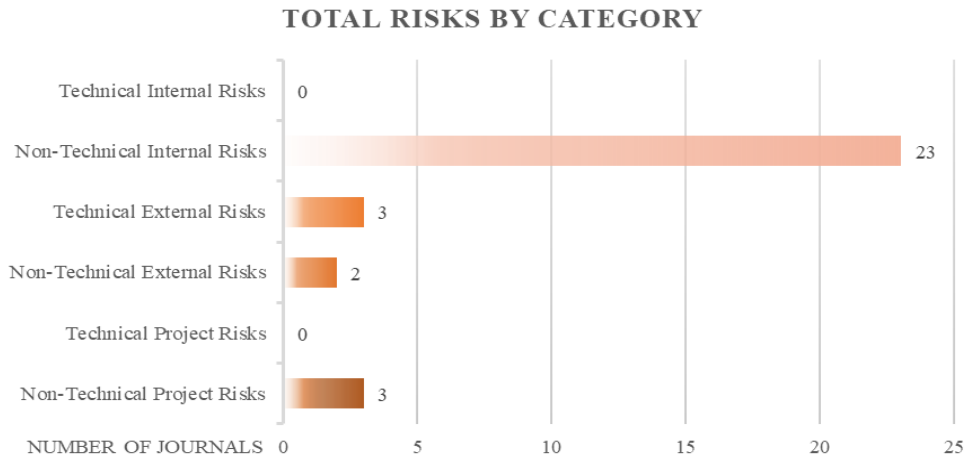

Figure 2. *Bar chart* review journal identification risks to building construction projects in Indonesia
Source : Author's analysis, 2022

3.3.2 Categories of risk levels contained in building construction projects in Indonesia (RQ2)

An overview of the level of risk in building construction projects in Indonesia, Research (Yuliani, 2017), wrote down the category of extreme risk levels contained in the work of upper structures with material lifting activities using *tower cranes*, there is a risk of material falling from a height and overwriting workers.[19]

The research (Ichwan & Mirdan, 2019), writes for the category of extreme risk levels in the form of upper structural work in the form of material falling from a height and falling on workers and on roof work in the form of workers / facilities falling from a height.[20]

The results of the research data obtained and *then reviewed* are obtained from the results of risk assessment where the level of risk that arises in building construction in Indonesia is for the category of extreme risk level (out of 23 journals there are 6 journals that assess risk at extreme risk level). Table 3 shows a summary example of a *literature review* of risk assessment on building construction projects in Indonesia.

Table 3. Summary example *of literature review of* risk assessment on building construction projects in Indonesia.

No.	Journal Identity	Region/City	Risk Assessment				Result
			Extreme	High	Medium	Low	
1	(Yuliani, 2017)	Jakarta	✓	✓	✓	✓	a. Extreme risk: getting hit by falling materials from a height. b. High risk: being injured while working with pipes. c. Medium risk: falling into an excavation pit. d. Low risk: respiratory distress.
2	(Ichwan & Mirdan, 2019)	Bekasi	✓	✓	✓	✓	a. The risk is extreme as workers and facilities may be crushed by materials. b. The risk is high due to the potential falling of materials, workers, or facilities from heights. c. The risk is moderate as workers may get injured during work and may experience skin irritation due to dust. d. The risk is low as framework may fall on workers or facilities, or they may be struck.

Source: Author's Analysis, 2022.

The number of each journal that discusses the level of risk there are 20 journals from the overall research data that assess moderate risk levels, 19 journals assess risks with low risk levels, 16 journals assess risks with high risk levels, and 6 journals assess risks with extreme risk levels. Figure 4 shows a review of the risk assessment journal on building construction projects in Indonesia, namely low risk level, medium risk level, high risk level, and extreme risk level.

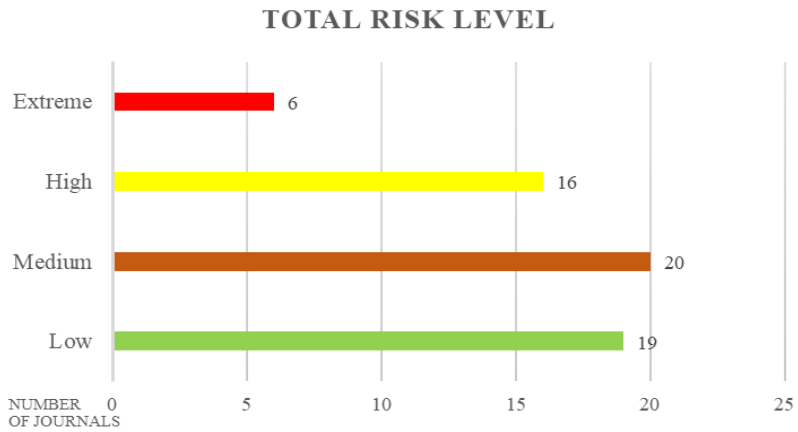

Figure 4 *Bar* chart review of risk assessment journals on building construction projects in Indonesia
Source: Author's Analysis, 2022.

3.3.3 Risk control in building construction projects in Indonesia (RQ3)

An overview related to risk control in building construction projects in Indonesia, In the study (Yuliani, 2017), wrote that risk control carried out in the form of PPE and administrative control to reduce existing risks towards zero accident is a daily K3 inspection in all construction project work processes, providing correct and good work guidelines to workers in the field, installing SOP in the work area, installation of barrigation, traffic cones, K3 signs and others to avoid work accidents.[19]

In the study (Ichwan & Mirdan, 2019), mentioned risk control in the form of administrative by installing notice boards about K3 work, paired signs containing information about project work, providing rescue routes for workers in the project and reducing the risk of accidents at work.[20]

From the journals obtained and *reviewed* obtained from the results of risk control the most widely used in building construction projects in Indonesia is administrative control with SOPs doing good and correct, evaluating activities with a certain period of time to notify about K3 each element of the construction project. (recorded from 23 journals obtained 22 journals that carry out administrative control). Table 4 shows a summary example of a risk control *literature review* on building construction projects in Indonesia.

Table 4. Summary example of literature review of risk control on building construction projects in Indonesia.

No.	Journal Identity	Region/City	Risk Control					Result
			Elim	Sub	Eng	Adm	APD	
1	(Yuliani, 2017)	Jakarta	-	-	-	✓	✓	Perform daily OHS inspections of all equipment and instruct workers based on relevant SOPs. Follow established procedures, including setting up barricades, traffic cones, and safety signs.
2	(Ichwan & Mirdan, 2019)	Bekasi	-	-	-	✓	-	Administratively install safety signs, K3 signs, or rescue route information to improve safety.

Source: Author's Analysis, 2022.

The number of each journal that mentions the K3 risk control process is contained in Figure 5, showing a review of risk control journals in building construction projects in Indonesia, namely elimination risk control, substitution risk control, *engineering* control risk control, administrative risk control and PPE control.

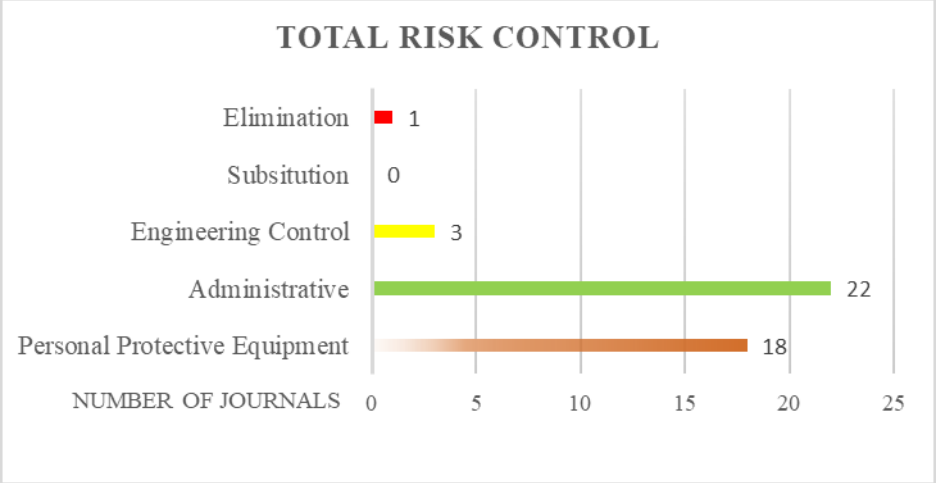

Figure 5 *Bar* chart review of risk control journals on building construction projects in Indonesia
Source: Author's Analysis, 2022.

The analysis of journal literature studies on OHS risk management in building projects in Indonesia revealed that the most effective risk controls were administrative control and personal protective equipment. The highest risk level was attributed to moderate risk, especially administration and PPE. The author analyzes the suitability of the risk level and risk control based on literature studies from various journals, following the AS/NZS 4360 standard, to provide advice in case the risk control does not align with the level of risk. The analysis results on the efficacy of risk control for journals with risk levels ranging from extremely high to low indicate that administration and personal protective equipment are necessary to implement risk control. However, for the highest risk levels, elimination and substitution controls need to be implemented.

4. CONCLUSIONS

The results of the research on the *literature review* of occupational health and safety risk management (k3) analysis on building construction projects in Indonesia for the 2016-2021 period, the following conclusions were obtained:

a. The results of the literature study analysis from the overall research data were 23 journals, identified the risks of technical projects as many as 23 journals in the form of accident risks and occupational safety. There are 3 journals of technical internal and non-technical external risks, such as the risk of construction equipment / technology and project sites as well as weather factors that can hinder project work. There are 2 journals that identify technical external risks in the form of risks of rising prices of building materials during the construction implementation period, and no journals are found that identify non-technical internal risks and non-technical project risks.
b. The results of the literature study analysis from the overall research data were 23 journals, there were 20 journals that assessed risk with a moderate risk level, 19 journals assessed risk with a low risk level, 16 journals assessed risk with a high risk level, and 6 journals assessed risk with extreme risk levels.
c. The results of the literature study analysis from the overall research data were 23 journals, it was recorded that 22 journals carried out administrative control such as conducting daily K3 inspections for all equipment, providing instructions to workers according to SOPs and K3 training for workers; 18 journals control personal protective equipment using PPE in accordance with applicable SOPs; 3 journals control *engineering control* by modifying the protective needs that

have been used with applicable regulations; 1 journal that controls elimination by cleaning the project area from scattered material waste, and no journal is found that controls substitution.

REFERENCES

[1] I. A. Alfarezi *et al.*, 'Jurnal Teknik Sipil Analisis Risiko Keselamatan Dan Kesehatan Kerja (K3) Pada Masa Pandemi Covid-19 Dengan Metode Bowtie Analysis'.

[2] A. Budhiyanto and O. Atmaja, 'Angka Kecelakaan Kerja di Indonesia Masih Relatif Tinggi', *https://www.suara.com/foto/2022/02/10/180926/angka-kecelakaan-kerja-di-indonesia-masih-relatif-tinggi?page=4*, Feb. 2022. https://www.suara.com/foto/2022/02/10/180926/angka-kecelakaan-kerja-di-indonesia-masih-relatif-tinggi?page=4 (accessed Dec. 30, 2022).

[3] G. Eka Sastrawan *et al.*, 'Analisis Manajemen Risiko Pelaksanaan Konstruksi Gedung Pada Pembangunan Gedung Satlantas Polres Badung'.

[4] Project Management Institute., *A guide to the project management body of knowledge (PMBOK guide)*.

[5] M. K. Ardiansyah, S. Irawan, and H. H. Purba, 'Identifikasi Faktor Risiko Keselamatan Pada Proyek Konstruksi Bangunan Gedung di Indonesia dalam 10 Tahun Terakhir (2011-2021): Kajian Literatur', *Jurnal Teknologi dan Manajemen*, vol. 20, no. 1, pp. 45–58, Feb. 2022, doi: 10.52330/jtm.v20i1.46.

[6] A. E. Fahlevi, A. Ismail, and A. Susetyaningsih, 'Analisis Manajemen Risiko Pelaksanaan Proyek Konstruksi'. [Online]. Available: http://jurnal.sttgarut.ac.id/

[7] P. Jurnal *et al.*, 'Analisa Manajemen Risiko K3 Dalam Industri Manufaktur Di Indonesia: Literature Review', vol. 5, no. 1, 2021.

[8] M. M. Sivagami and M. Sarath, 'RISK Management In Construction: A Literature Review', *International Research Journal of Engineering and Technology*, vol. 510, 2008, [Online]. Available: www.irjet.net

[9] A. Doko Ibrahim, B. Adama Kolo, and H. Adaviriku Ahmadu, *Review of risk management studies: towards a frame of reference for large projects SEE PROFILE*. [Online]. Available: https://www.researchgate.net/publication/354005742

[10] A. Agusman, H. B. Prasetya, and H. H. Purba, 'Tinjauan dan Analisis Risiko dalam Proyek Konstruksi Bangunan: Studi Literatur', *Jurnal Teknologi dan Manajemen*, vol. 19, no. 2, pp. 41–52, Aug. 2021, doi: 10.52330/jtm.v19i2.29.

[11] Ervianto Wulfram, *Manajemen Proyek Konstruksi*, 3rd ed. Yogyakarta: ANDI, 2005.

[12] M. Labombang, 'Manajemen Risiko Dalam Proyek Konstruksi'.

[13] E. K. Zavadskas, Z. Turskis, and J. Tamošaitiene, 'Risk assessment of construction projects', *Journal of Civil Engineering and Management*, vol. 16, no. 1, pp. 33–46, Mar. 2010, doi: 10.3846/jcem.2010.03.

[14] OHSAS Project Group., *Occupational health and safety management systems : requirements*. OHSAS Project Group, 2007.

[15] 'Perbandingan Standar Manajemen Risiko Australia / New Zealand Standard AS/NZS 4360:2004 dengan COSO Enterprise Risk Management 2004'.

[16] R. S. Wahono, 'A Systematic Literature Review of Software Defect Prediction: Research Trends, Datasets, Methods and Frameworks', *Journal of Software Engineering*, vol. 1, no. 1, 2015, [Online]. Available: http://journal.ilmukomputer.org

[17] T. Avila Bria and O. Loden, 'Manajemen Risiko Keselamatan Dan Kesehatan Kerja (K3) Pada Proyek-Proyek Konstruksi Di Kota Kupang'.

[18] A. A. Bella Vheatrieze and K. Rini Ratnayanti, 'Tinjauan Manajemen Risiko Pra Konstruksi, Pelaksanaan Konstruksi, dan Pasca Konstruksi Pada Proyek Pembangunan Gedung Student Center Politeknik Negeri Indramayu'.

[19] U. Yuliani, 'Manajemen Risiko Keselamatan Dan Kesehatan Kerja (K3) Pada Infrastruktur Gedung Bertingkat', 2017.

[20] M. N. Ichwan, 'Analisis Resiko Bahaya Keselamatan Dan Kesehatan Kerja (K3) Padaproyek Pembangunan Grand Kamala Lagoon-Barclay Tower', 2019.