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Occupational Safety and Health Risks in Building Construction Projects : A Systematic Literature Review

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ABSTRACT

Although quite a few studies have focused on Occupational Health and Safety (OHS)-related issues within the context of sustainable building construction projects, there has been dearth of a study developing a management framework to comprehensively identify, analyze, evaluate, and control the safety risks threatening the involved Building Construction Workers. Risk is always present in every construction project. Occupational safety and health risks in building construction projects have various risks and are likely to be affected due to their difficulty and multiple operations and threats. Risk factors are divided into three categories, namely internal factors, projects, and external factors. Three categories above is further divided into two technical and non-technical risk. This paper review 40 selected papers that discuss risk identification and risk management in residential construction projects. Risk factors in residential projects are generally very diverse and give us an idea that the interrelationships between the parties with an interest in the project contribute to the risk factors themselves occurring the course of the project. It has been mentioned that the risk factors that occur in residential projects is something that is commonplace in various countries, in this case contributing to the success of the project. Outline on this paper has succeeded in providing information on the extent to which risk factors are currently occurring and there is a high potential for a change in the percentage of risk factors according to the classifications presented in this journal for other construction projects in the future.

Keywords: *Safety, Health Risks,Building Construction*

ABSTRAK

Meskipun beberapa penelitian telah berfokus pada masalah terkait Kesehatan dan Keselamatan Kerja (K3) dalam konteks proyek konstruksi bangunan berkelanjutan, ada kelangkaan penelitian yang mengembangkan kerangka kerja manajemen untuk mengidentifikasi, menganalisis, mengevaluasi, dan mengontrol keselamatan secara komprehensif. risiko yang mengancam Pekerja Konstruksi Bangunan yang terlibat. Risiko selalu hadir dalam setiap proyek konstruksi. Risiko keselamatan dan kesehatan kerja dalam proyek konstruksi bangunan memiliki berbagai risiko dan kemungkinan besar akan terpengaruh karena kesulitannya serta berbagai operasi dan ancaman. Faktor risiko dibagi menjadi tiga kategori, yaitu faktor internal, proyek, dan faktor eksternal. Tiga kategori di atas dibagi lagi menjadi dua risiko teknis dan non-teknis. Makalah ini mengulas 40 makalah terpilih yang membahas identifikasi risiko dan manajemen risiko dalam proyek konstruksi perumahan. Faktor risiko dalam proyek residensial umumnya sangat beragam dan memberikan gambaran bahwa hubungan timbal balik antara pihak-pihak yang berkepentingan dengan proyek tersebut berkontribusi terhadap faktor risiko itu sendiri yang terjadi pada jalannya proyek. Telah disebutkan bahwa faktor risiko yang terjadi pada proyek residensial merupakan hal yang lumrah di berbagai negara, dalam hal ini turut mendukung keberhasilan proyek tersebut. Secara garis besar makalah ini telah berhasil memberikan informasi sejauh

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mana faktor risiko yang saat ini terjadi dan potensi perubahan persentase faktor risiko yang tinggi sesuai dengan klasifikasi yang disajikan dalam jurnal ini untuk proyek konstruksi lainnya di masa yang akan datang..

Kata Kunci: Risiko, Pemeliharaan, Gedung.

INTRODUCTION

Risk is a measure of the probability and consequence of not achieving a defined project goal (PMBOK in Kerzner, 2017). Risk can be distinguished to several types according to the opinion of experts. According to (Petr, 2017), there are three categories of risks:

1. Internal risk

Internal risk in project construction like resource risk, project member risk, stakeholder's risk, designer risk, contractor risk, subcontractor risk, supplier risk, team risk, construction site risk and documents and information risk

2. External risk

External risk are those that risk is beyond the control of project management team like political risk, economic risk, social risk, and weather risk

3. Project Risk

Project risk construction criteria is time risk, cost risk, work quality, construction risk, and technology risk.

The three categories above are divided into two categories: (a) Technical risk; relates to the assessment of the likelihood that the system embodied in the design when it is built meets the performance requirements, (b) Nontechnical risks; is a risk that can affect a particular project directly, the cause of which is an unplanned and unintended event that results in unwanted deviations.

According to PMBOK (Kerzner, 2017), Risk management is the act or practice of dealing with risk. It includes planning for risk, identifying risks, analyzing risks, developing risk response strategies, and monitoring and controlling risks to determine how they have changed.

Risk management has become more vital for the completion of Occupational safety and health risks in building construction projects due to the increased complexity and the use of modern equipment and techniques (Hedaoo & Pawar, 2021).

RESEARCH METHOD

The methodology used in this paper is a literature review of various studies that discuss occupational safety and health risks in building construction projects. In this paper, a risk assessment was

conducted which was divided into 3 (three) categories that is: (a) Internal risk, (b) Project Risk, and (c) External Risk. Three categories above is further divided into two parts: (a) Technical Risk and (b) Non-technical Risk.

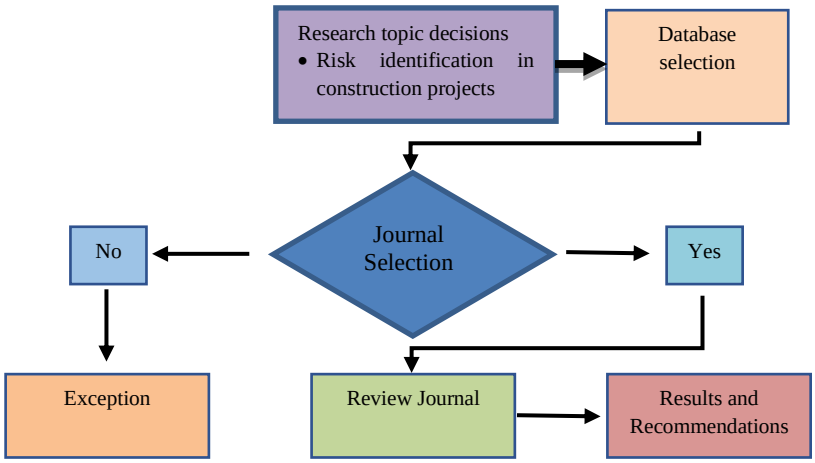
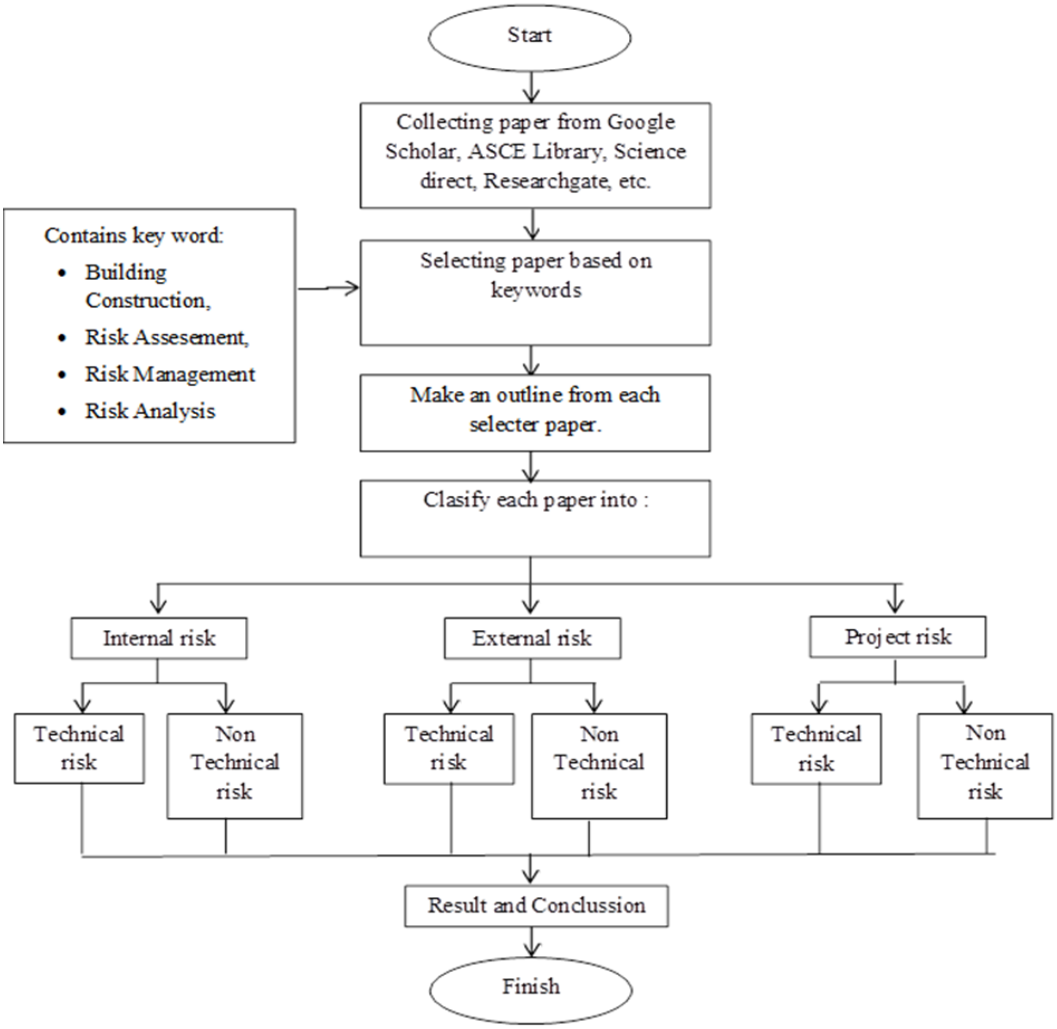


Fig.1 Research Framework

This paper will review 40 selected papers from year 2014 to 2022. The study framework carried out in this research are as shown in Fig. 2.

Fig.2. Research flowchart



RESULTS AND DISCUSSION

List of selected articles from the aspect of Occupational Safety and Health Risks in Building Construction Projects was analyzed (Table 1). Risk factors are divided into three parts, namely internal factors, projects, and external factors..

Table 1. Summary of literature review of risk analysis in residential construction projects

No	Paper Identify	Risk Category						Type of Risk	Result
		Internal		External		Project			
		T	NT	T	NT	T	NT		
1	Dana Aprilia et al (2021)		√	√		√		Construction, Health and Safety,	The Gresik fertilizer company has OSH programs in the form of safety talks, safety induction, safety patrols, drill training, and safety signs to control the hazard of working at height. That has some methods (tools) to control hazards of working at height in the form of JSA, HIRADC, and work permit system and has guidelines for control of the potential hazards of working at heights, namely Standard Operational Procedures.
2	Rizqi Supramulyana Putra et al (2021)	√		√			√	Health and Safety,Quality,	Based on the results of research on occupational stress risk on nurses in the Emergency Room (IGD) Sosodoro Djatiekoesoemo Bojonegoro Hospital, it can be concluded that the risk of occupational stress was experienced by respondents.

3	Monalisa Ma'rifat et al (2021)	√			√		√	Financial, Health and Safety,Quality,	The conclusion of the risk assessment using Job Safety Analysis (JSA) was known from observations and interviews with K3LH management managers, steel work managers, and machine operators in the PT. INKA (Persero). There are 94 hazards identified from 11 existing machines. After controlling, there is only a small number of risks at high risk level, and most of is the hazardsare at a medium risk level and a low risk level. Risk control measures carried out by PT. INKA (Persero) is in accordance with the hierarchy of control such as the use of PPE and the provision of work SOPs
4	Tri Yuliyatin et al (2021)	√		√		√		Health and Safety, Quality,	From the results of research, it was found that there was a strong relationship between noise and an increase in systolic blood pressure, while based on the analysis results, there was a moderate relationship between noise and diastolic blood pressure.
5	Irsyad Yudisianto et al (2021)		√		√		√	Health and Safety,	The main problem in the expedition sub units of PT X is worker fatigue. In addition, the researchers also found that the work position was classified as a high risk. Efforts are needed to reduce worker fatigue and work position risks.
6	Fandita Tonyka Maharani et al (2021)	√		√		√		Health and Safety,	Many of the issues highlighted can be addressed by a good understanding of the risks involved, together with an in-depth risk assessment, utilizing the POPMAR model to frame the activities.

7	Khaerani S. Lestari et al (2021)	√		√		√		Health and Safety,	This research found that vertical trust was the only psychological risk factors that affected workers, while the other factors were not significant because this research was conducted at the beginning of the Covid-19 pandemic, with many policies changing and employee trust to supervisors decreasing.
8	William et al (2021)		√		√	√		Construction, Health and Safety, Environment,	An assessment shall be conducted to determine applicable mitigation measures, such as the utilization of LEV and/or blower to introduce air circulation and fresh air.
9	Nidhi Prasad et al (2021)		√		√	√		Health and Safety,Quality,	Healthcare staff cannot be left unsupported as many of them might be willing to give up their habit if they get any help. This can be a great opportunity for tobacco control measures , effective implementation.
10	Adisyah Fitrah Rahmadini et al (2021)		√	√		√		Health and Safety,	Every blacksmith's work process, from cutting to gilding, has potential dangers those are noise, lighting at worksites, the hot working climate, dust from iron that hits during the cutting and shaping process, grinding material dust, dust from combustion, sharp pieces of iron due to the cutting and shaping process, hitting tools like hammers, grinding stones, the electric current used during the grinding process, working positions, repetitive movements, manual handling when cutting and shaping metal, work pressure to eventuate on workers.

11	Suherdin et al (2021)	√		√		√		Health and Safety,Quality,	Safety commitment and safety communication had a significant effect on safety commitment of workers.To increase safety commitment of workers, company management should develop OHS policies, comply with OHS standards,implement OHS, and improve safety communication.
12	Ni Made Sintya Rani et al (2020)	√		√		√		Construction, Health and Safety,	Based on the results of research, analysis and discussion that has been carried out, it can be concluded: 1. The contractor has planned the SMK3 to be "satisfactory" with an average value of the management subject element of 90.94 ± 3,431 and the worker subject element of 87.53 ± 3,417. 2. The contractor has implemented the SMK3 implementation in the field with a "satisfactory" with an average value of the management subject element of 82.38 ± 0.754 and the worker subject element of 81.90 ± 2.338.

13	Doni Feby Nugroho et al (2018)		√	√		√		Construction, Health and Safety,	In accordance with the formulation of the problem, objectives, hypotheses and discussion of the research results, it can be concluded that: 1. The results of the multiplication risk matrix analysis are obtained: 1) 2 sub-variables categorized as having a moderate risk rating (Medium Risk), namely the equipment and work environment variables. 2) 4 sub-variables categorized as having a high risk ranking (Hight Risk), namely the worker variable and work method. 3) 14 sub-variables that are categorized as having a very high risk rating (very high risk), namely the variables of workers, equipment, work methods and work environment. 2. Control is carried out based on the sub-variables that have the highest risk. Of the 20 sub-variables there are 14 sub-variables that have a high risk. Of the several control methods to reduce risk, control that can be done by administrative means, the use of PPE and elimination.

14	Bobby Rocky Kani et al (2013)		√		√		√	Health and Safety,	Based on the results of research and data processing carried out, it can be concluded: 1) There is still a lack of knowledge about occupational safety and health from workers regarding occupational safety and health. 2) With the existence of an occupational health and safety management system, workers can be slightly avoided from accidents and occupational diseases. 3) The existing occupational safety and health management system can be said to have not been realized properly.
15	Aswan Munang et al (2018)	√		√		√		Construction, Health and Safety,	The results of the research on the construction project of the double track railway project identified as many as 39 (thirty nine risks) have a fairly high risk because they are in direct contact with an active train line so that 19 risks can be identified for unexpected risks. In addition, there are 12 unacceptable risks. Unacceptable risks require risk mitigation to reduce the impact.
16	Nyoman Martha Jaya et al (2021)	√		√		√		Construction, Health and Safety,	Ownership of overall OHS risk is borne by the contractor, namely the officers K3 or SHE Officer who has the responsibility for implementation, control and handling K3 problems in the implementation of the Bali Mandara Hospital Construction.

17	Anak Agung Bayu Dharma et al (2017)	√		√		√		Construction, Health and Safety,	Based on the results of the research that has been done, it can be concluded as follows: 1. There were 275 types of Occupational Safety and Health (K3) risks identified in the Jambuluwuk Hotel & Resort Petitenget .. 2. Of the 45 types of risk that are classified as major risk.
18	Tri Susilawati et al (2019)		√		√	√		Construction, Health and Safety,Quality,	Conclusions that are adjusted to the determination of the objectives of this study. 1. The effect of the application of occupational safety and health (X1) on the performance of the PLTMG Sumbawa construction project (Y) has a positive and significant effect, meaning that the higher the application of K3, the higher the performance of the construction project. 2. The relationship between the implementation of occupational safety and health on the performance of the Sumbawa PLTMG construction project has a significant relationship between the implementation of K3 with the performance of the Sumbawa PLTMG construction project and in the same direction, it means that the higher the application of K3, the higher the performance of the construction project.

19	Jajang Atmaja et al (2018)		√		√	√		Construction, Health and Safety,	1. Control of project occupational safety and health risks in the city of Padang is to comply with and comply with all applicable rules regarding occupational safety and health, both those regulated in laws and regulations from the government. 2. Completeness of body armor and project area is very much needed, both the availability of personal protective equipment, light fire extinguishers and warning signs are very important at the project site, because the project location is a very risky place for work accidents..
20	Wieke Yuni Christina et al (2012)		√	√		√		Construction, Health and Safety,Quality,	The conclusion that can be drawn from the model of the influence of occupational safety and health culture is that work safety culture must start from top management to work safety issues, then the implementation of construction work safety procedures plays an important role in improving construction project performance.
21	Fajar Susilowatiet al (2020)		√		√		√	Construction, Health and Safety,Quality,	These three things must be considered in order to support the successful implementation of the OHS program as a whole so as to create an increase in the quality of life of the workers so that they are able to work as well as possible to improve the performance of the construction project where they work.

22	Widi Hartono et al (2019)		√		√		√	Construction, Health and Safety,	Test results data, data analysis, and discussion of the results of the Risk Management study Occupational Health and Safety with the HIRAC Method, the following conclusions can be drawn: In this research, there are 9 work accident risk variables and 9 job lists that pose a risk, the highest risk is slab formwork work, column installation work, and column reinforcement fabrication.
23	Faridah Ismail, et Al, 2012				√			Construction, Health and Safety,	Defining safety culture, based on behavioural factors frees us to include a host of behaviours as part of the puzzle that creates the cognitive construct of organisational culture. The questionnaire survey approach, identified leadership, organisational commitment, management commitment, safety training and resource allocation as the practices that embed safety culture into the organisational culture.
24	Sulastre Met Zin and Faridah Ismail		√					Construction, Health and Safety,	Safety issue cannot be tackle effectively without interference of employers with a particular pattern of behaviours as important criteria needed to change employee's behaviours. This paper is an initial study with the hope that the finding will leads the establishment of safety indicators for behavioural safety compliance in the construction industry.
25	Nusrul Nisam Husin, et. Al		√					Financial, Construction, Health and Safety,Quality,	This paper elaborates the concept of POE in LCH and factors that constitute to the safety failures in LCH. This paper also discusses on the hierarchy of safety elements and attributes as the design of survey.

26	Furqaan Nai'em, et Al.		√					Financial, Construction , Health and Safety, Environment,	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%)
27	Khrisna Putra Sasmana, 2019	√					√	Construction, Health and Safety,Quality, Environment,	There is the influence of health and safety work (X) against employee performance (Y) it is proven with the value of the importance of 0,004 smaller than the probability of 0,05 and known the value of r square 0,662. as much as This value containing the sense that the influence of health and safety work (X) on performance employees (Y) reached 66,2 % while 33,8 % the performance of employees affected by other variables that are not researched health and safety work (K3)
28	Yuliana Duwi Kusuma Wardhani, 2022		√					Material, Construction, Health and Safety, Environment,	This study was a descriptive study with an observational method for data collection, and this study was cross-sectional. The variable studied was Contractor Safety Management System (CSMS) including CSMS stages and documents.
29	Nur Indah Fatma, Teguh Satrio, 2022		√					Material, Construction, Health and Safety, Environment,	The samples were 45 respondents, obtained through random sampling. The results of the contingency coefficient was 0.436. The majority of call center agents experienced very heavy job stress, specifically those working in the morning shift (53.3%), day shift (40%) and night shift (60%).

30	Andy Mc Carthy, 2016				√			Material, Construction, Health and Safety, Environment,	The intent of the study was to show a measurable and statistically significant decrease in personal DPM exposure on the workgroup using the Upper Confidence Limit (UCL1, 95%) as the indicator.
31	(Cvetković et al., 2021)				√		√	Financial, Time, Health and Safety, Management	Education level, ownership status, and monthly income did not significantly affect individual preparedness for fire protection, personal security, fire risk, and prevention knowledge.
32	(Manzoor et al., 2022)	√		√		√		Health and Safety, Construction	This scenario emphasizes the importance of identifying the safety factors that contribute to accidents in high-rise building projects. It was concluded that by using safety assessment techniques, accidents could be reduced, making the construction project safer.
33	(Manzoor et al., 2022)	√		√		√		Regulatory, Construction, Time,Quality, Management, Environment, Regulatory,	Furthermore, based on the findings, this research recommends that there is a need to take necessary precautionary measures in order to reduce the impact of these factors in the construction of high rise building projects to avoid accidents.
34	(Almohassen et al., 2022)		√		√		√	Financial, Time, Health and Safety, Management, Regulatory	Regarding the changes of the safety procedures, the results showed that there were dramatic changes in the importance for most of them but there were three that were significantly increased to report and control COVID-19 effects and also to ensure that everyone understanded his role to maintain the work during this pandemic.
35	(Chmielewski & Bąk, 2021)	√				√		Financial, Material, Construction, Time, Health and Safety, Management,	The conducted analysis clearly shows that the safety of the structure is determined not only by the size of the vent openings, but also the strength of materials and construction solutions used in

									the building, which is not considered in any of the analysed regulations.
36	(Chang et al., 2021)				√		√	Financial, Construction, Time,Quality,	Cross-laminated timber (CLT) modular construction possesses the advantages of wood, such as excellent carbon storage and thermal insulation, and of modular construction, such as consid-erably reduced construction period and cost as well as high productivity.
37	(Chen et al., 2021)	√		√		√		Financial, Material, Construction, Time,	The building information model (BIM) technology assists in design and construction work to meet rapid construction requirements.
38	(Szer et al., 2022)				√			Health and Safety, Environment,	A stronger correlation occurs for scaffolding structures located in Ł´od´z province, while it is weaker for the results obtained in Lower Silesian province.
39	(Briggs et al., 2022)	√			√		√	Financial, Construction, Time, Health and Safety, Sosio-politic	The contribution this paper addresses are how to employ efficient safety practices and policies during a pandemic in an industrial construction environment.
40	(Iringová & Vandlicková, 2021)	√				√		Material, Construction, Environment,	In model solution will be analyzed non-combustible and mixed construction units.

Of the 40 selected academic papers discussing the risk factors of residential projects with various methods in many different countries with different requirements. Fig. 2 shows publications selected by countries of origin (India, Indonesia, Korea, Iran, China, Turkey, Malaysia, Russia, Nepal, Poland, Spain, Italy, Brazil, United States). Research papers from India are the first to rank the most risk assessments on residential projects, then Indonesia, the United States ranks third.

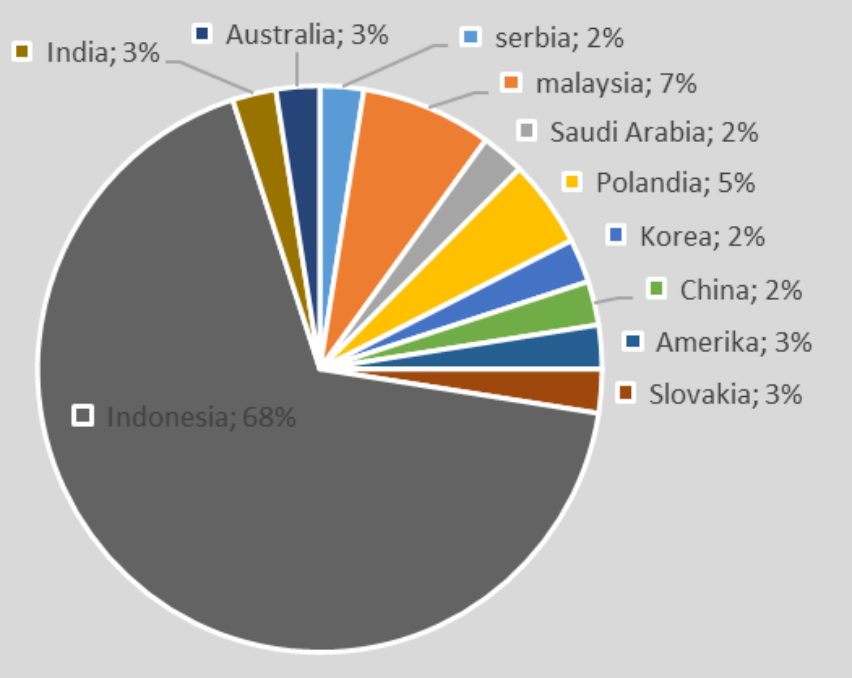


Fig. 2. Research by country

Then from the 40 selected papers, 6 risk categories have been classified, where External Non-Technical Factors ranks risk factors in residential projects, followed by Internal-Technical in second place and Internal Non-Technical in third. From this description, it is illustrated in the Fig. 3, regarding the discussion of risk categories that have been discussed by the selected journal.

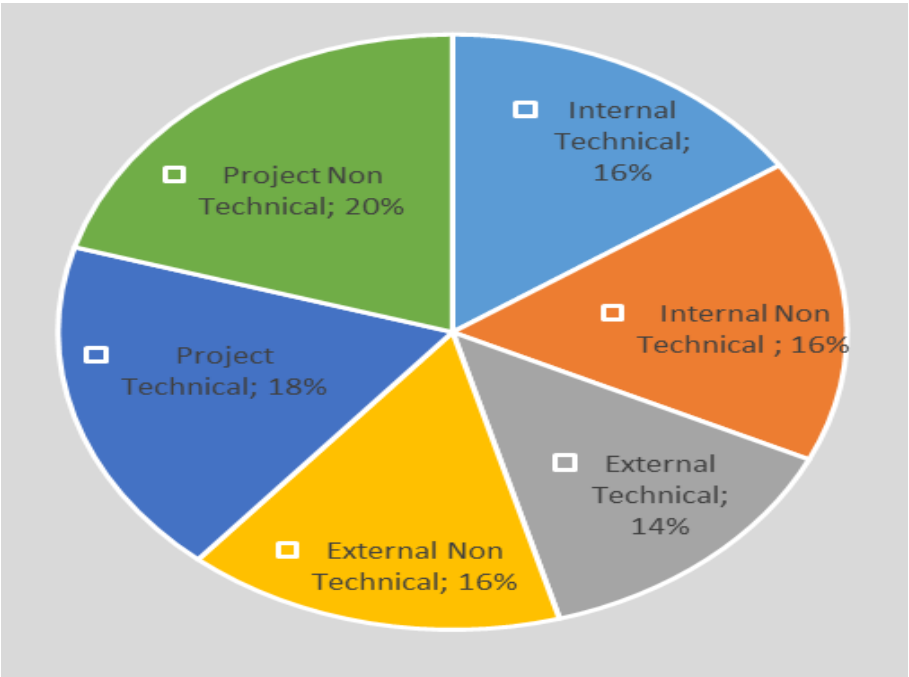


Fig. 3. Risk Category

The types of risks in the construction of different residential project buildings are reviewed and discussed. As shown in Fig. 4, all these types of risk are classified into 10 categories, of which 4 categories of risk types account for the highest percentage:

1. Construction: The construction management system plays a major role in the risk of residential projects. Poor project management is the first major contributor to project risk.
2. Financial: Residential projects and other projects in general, require accurate and precise financial planning and management. If this factor is not carried out, this factor contributes as a significant project risk
3. Quality: The quality of work is something that reflects the success of the project. The risk of work quality is influenced by the type of material or materials used, labor, and a limited schedule.
4. Time: The percentage of time analysis is basically influenced by several factors such as delays in material delivery, inaccuracy in ordering materials, delays in the payment process by the owner, labor shortages, equipment shortages, design changes and a weak schedule control system.

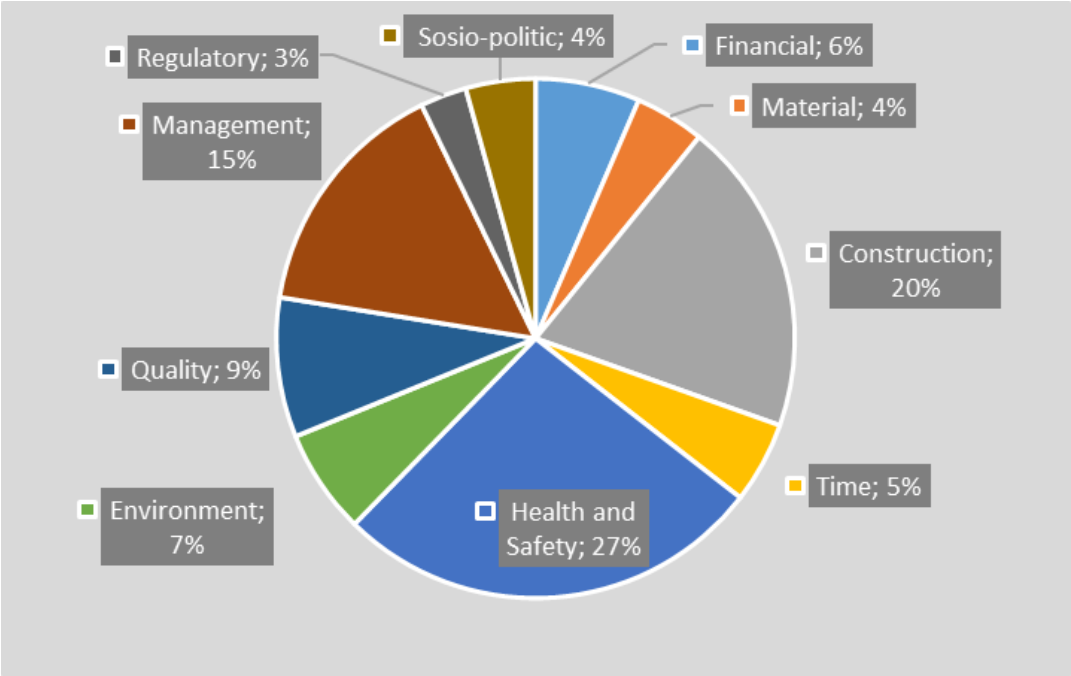


Fig. 4. Types of Risk

CONCLUSION

From the results of the reviews of several journals that have been described previously, the risk factors in residential projects are generally very diverse and give us an idea that the interrelationships between the parties with an interest in the project contribute to the risk factors themselves occurring in the course of the project. Reliable construction management is needed in overcoming and minimizing the risks that occur in this project and is the key. Furthermore, no less important is good financial support, so that the project can run according to the plan that has been made.

From several journals that we have researched, it has been mentioned that the risk factors that occur in residential projects are something that is commonplace in various countries, in this case contributing to the success of the project. Certainly with considering that there is still a lot of literature that discusses risks in projects, this needs to be a concern in planning and implementing projects in the future.

DAFTAR PUSTAKA

Almohassen, A. S., Alkhaldi, M. S., & Shaawat, M. E. (2022). The effects of COVID-19 on safety practices in construction projects. Ain Shams Engineering Journal, xxxx, 101834. https://doi.org/10.1016/j.asej.2022.101834

Aprilia, D., & Ramadhan, A. (2021). Efforts to Control Potential Hazards of Working at Height at a Gresik Fertilizer Company, Indonesia. The Indonesian Journal Of Occupational Safety and Health, 10(3), 331. https://doi.org/10.20473/ijosh.v10i3.2021.331-342

Atmaja, J., Suardi, E., Natalia, M., Mirani, Z., & Alpina, M. P. (2018). Penerapan Sistem Pengendalian Keselamatan dan Kesehatan Kerja pada Pelaksanaan Proyek Konstruksi di Kota Padang. Jurnal Ilmiah Rekayasa Sipil, 15(2), 64–76. https://doi.org/10.30630/jirs.15.2.125

Authors, I. F. O. R. (1845). Journal of Health , Safety and Environment. December 2016, 1–12.

Briggs, B., Friedland, C. J., Nahmens, I., Berryman, C., & Zhu, Y. (2022). Industrial construction safety policies and practices with cost impacts in a COVID-19 pandemic environment: A Louisiana DOW case study. Journal of Loss Prevention in the Process Industries, 76(October 2021), 104723. https://doi.org/10.1016/j.jlp.2021.104723

Chang, S. J., Kang, Y., Yun, B. Y., Yang, S., & Kim, S. (2021). Assessment of effect of climate change on hygrothermal performance of cross-laminated timber building envelope with modular construction. Case Studies in Thermal Engineering,28(December), 101703. https://doi.org/10.1016/j.csite.2021.101703

Che Ibrahim, C. K. I., Manu, P., Belayutham, S., Mahamadu, A. M., & Antwi-Afari, M. F. (2022). Design for safety (DfS) practice in construction engineering and management research: A review of current trends and future directions. Journal of Building Engineering, 52(February), 104352. https://doi.org/10.1016/j.jobe.2022.104352

Chen, L. K., Yuan, R. P., Ji, X. J., Lu, X. Y., Xiao, J., Tao, J. B., Kang, X., Li, X., He, Z. H., Quan, S., & Jiang, L. Z. (2021). Modular composite building in urgent emergency engineering projects: A case study of accelerated design and construction of Wuhan Thunder God Mountain/Leishenshan hospital to COVID-19 pandemic. Automation in Construction, 124(January), 103555. https://doi.org/10.1016/j.autcon.2021.103555

Chmielewski, R., & Bąk, A. (2021). Analysis of the safety of residential buildings under gas explosion loads. Journal of Building Engineering, 43(January). https://doi.org/10.1016/j.jobe.2021.102815

Cristenzein, L. R., & Adhi, K. T. (2021). Factors Related to Work Stress among

Health Office Employees during Covid-19 Pandemic. The Indonesian Journal Of Occupational Safety and Health, 10(3), 389. https://doi.org/10.20473/ijosh.v10i3.2021.389-401

Cvetković, V. M., Dragašević, A., Protić, D., Janković, B., Nikolić, N., & Milošević, P. (2021). Fire Safety Behavior Model for Residential Buildings: Implications for Disaster Risk Reduction. SSRN Electronic Journal, 76(April). https://doi.org/10.2139/ssrn.3974738

Dharma, A. A. B., Putera, I. G. A. A., & Parami, A. A. D. (2017). Manajemen Risiko Keselamatan Dan Kesehatan Kerja (K3) Petitenget Risk Management of Occupational Health and Safety (K3) in the Development Projects of Jambuluwuk Hotel & Resort Manajemen K3. Spektran,5(1), 47–55.

Hartono, W., Sugiyarto, S., & Siwi R, P. (2019). Studi Manajemen Risiko Kesehatan dan Keselamatan Kerja dengan Metode HIRAC (Studi Kasus : Pada Proyek Pembangunan Apartemen Tamansari Amarta Yogyakarta). Matriks Teknik Sipil, 7(2), 133–136. https://doi.org/10.20961/mateksi.v7i2.36508

Husin, H. N., Nawawi, A. H., Ismail, F., & Khalil, N. (2012). Preliminary Survey of Integrated Safety Elements into Post Occupancy Evaluation for Malaysia's Low Cost Housing. Procedia - Social and Behavioral Sciences, 36(June 2011), 583–590. https://doi.org/10.1016/j.sbspro.2012.03.064

Iringová, A., & Vandlicková, D. (2021). Fire safety of an over ground car park building - Model solution. Transportation Research Procedia, 55, 1208–1213. https://doi.org/10.1016/j.trpro.2021.07.101

Ismail, F., Ahmad, N., Janipha, N. A. I., & Ismail, R. (2012). Assessing the Behavioural Factors' of Safety Culture for the Malaysian Construction Companies. Procedia - Social and Behavioral Sciences, 36(June 2011), 573–582. https://doi.org/10.1016/j.sbspro.2012.03.063

Kani, B. R., Mandagi, R. J. M., Rantung, J. P., & Malingkas, G. Y. (2013). Keselamatan Dan Kesehatan Kerja Pada Pelaksanaan Proyek Konstruksi (Studi Kasus: Proyek Pt. Trakindo Utama). Jurnal Sipil Statik, 1(6), 430–433.

Kusuma Wardhani, Y. D. (2022). Implementation of Contractor Safety Management System as a Requirement for Partners at a Petrochemical Company. The Indonesian Journal of Occupational Safety and Health, 11(1), 1–11. https://doi.org/10.20473/ijosh.v11i1.2022.1-11

Kusumaningtyas, N. I. F., & Satrio, T. (2022). Evaluation of the Occupational Health and Safety Implementation in the Pharmacy Laboratory of University X Surabaya. The Indonesian Journal of Occupational Safety and Health, 11(1), 4353.https://doi.org/10.20473/ijosh.v11i1.2022.43-53

Lestari, K. S., Muhamad, A. F., Susanto, A., Putro, E. K., Wilmot, J. C., Savira, Y. M., Listiarini, A., Zulfakar, D., & Sunarno, S. D. A. M. (2021). Psychosocial Risk Factors on Mining Workers Processing Copper and Gold Minerals during Covid-19 Pandemic. The Indonesian Journal Of Occupational Safety and Health, 10(3), 309. https://doi.org/10.20473/ijosh.v10i3.2021.309-315

Ma'rifat, M., Rofifa, A. T., & Martiana, T. (2021). Risk Assessment at the Plate Production Unit (PPL) of PT. INKA (Persero). The Indonesian Journal Of Occupational Safety and Health, 10(3), 316. https://doi.org/10.20473/ijosh.v10i3.2021.316-330

Maharani, F. T., & Lynch, Z. (2021). The Implementation of the POPMAR (Policy, Organising, Planning and Implementing, Measuring Performance, Audit and Reviewing) Model in Occupational Health and Safety Risk Management in an Indonesian Batik Company. The Indonesian Journal Of Occupational Safety and Health, 10(3), 420. https://doi.org/10.20473/ijosh.v10i3.2021.420-432

Manzoor, B., Othman, I., & Waheed, A.

(2022). Accidental safety factors and prevention techniques for high-rise building projects – A review. Ain Shams Engineering Journal, 13(5), 101723. https://doi.org/10.1016/j.asej.2022.101723

Munang, A., RM, F., & Mansur, A. (2018). Manajamen Risiko Keselamatan Dan Kesehatan Kerja (K3) Proyek Pembangunan Jalur Ganda Kereta Api. Applied Industrial Engineering Journal, 2(1), 8–15. https://doi.org/10.33633/aiej.v2i1.2050

Nai'em, F., Darwis, A. M., Noviponiharwani, & Amin, F. (2020). Analysis of work accident cost on occupational safety and health risk handling at construction project of Hasanuddin University the Faculty of Engineering. Enfermeria Clinica, 30, 312–316. https://doi.org/10.1016/j.enfcli.2020.06.070

Nugroho, D. F., Yakin, K., & Bustamin, M. O. (2018). Kajian Risiko Kecelakaan Kerja Terhadap Manajemen Kesehatan Dan Keselamatan Kerja (K3) (Proyek Pembangunan Villa Grand Sinensis PT.Wahana Karya Wijaya). Ge-STRAM: Jurnal Perencanaan Dan Rekayasa Sipil, 1(2), 95–101. https://doi.org/10.25139/jprs.v1i2.1210

Prasad, N., Bharati, D. R., Choudhary, S. K., & Kumar, B. (2021). Exploring the Determinants of Intention to Quit and Awareness Regarding Ill Effects and Control Policies of Tobacco among Health Workers of a Tertiary Care Hospital in North India. The Indonesian Journal Of Occupational Safety and Health, 10(3), 371. https://doi.org/10.20473/ijosh.v10i3.2021.371-377

Putra, R. S., Rahmadhani, T. N., & Hidayat, S. (2021). Factors Related to the Risk of Occupational Stress among Nurses in the Emergency Room at Sosodoro Djatikoesoemo Bojonegoro Hospital. The Indonesian Journal Of Occupational Safety and Health, 10(3), 299. https://doi.org/10.20473/ijosh.v10i3.2021.299-308

Rahmadini, A. F., Andarini, D., Camelia, A., Ermi, N., & Lestari, M. (2021). Occupational Health and Safety Risk Assessment on Informal Workers in Ogan Ilir, South Sumatra. The Indonesian Journal Of Occupational Safety and Health, 10(3), 412. https://doi.org/10.20473/ijosh.v10i3.2021.412-419

Risiko, M., Keselamatan, K., Kesehatan, D. A. N., Pada, K., Jaya, N. M., Dharmayanti, G. A. P. C., Retnoyasa, A., & Mesi, U. (2021). Proyek Pembangunan Rumah Sakit Bali Mandara. 9(1), 29–37.

Sasmana, K. P. (2019). An Analysis of the Impact on the Performance of Work Safety and Health Workers (Case Study: Construction One Galaxy) Surabaya Project. IJIEEB : International Journal of Integrated Education, Engineering and Business, 2(1), 10–15. https://doi.org/10.29138/ijieeb.v2i1.807

Suherdin, S., Widajati, N., & Qomaruddin, M. B. (2021). How to Improve Safety Commitment: A Case Study on a Plastic Manufacturer in East Java. The Indonesian Journal Of Occupational Safety and Health, 10(3), 289. https://doi.org/10.20473/ijosh.v10i3.2021.289-298

Suherdin, S., Widajati, N., & Qomaruddin, M. B. (2021). How to Improve Safety Commitment: A Case Study on a Plastic Manufacturer in East Java. The Indonesian Journal Of Occupational Safety and Health, 10(3), 289. https://doi.org/10.20473/ijosh.v10i3.2021.289-298

Susilawati, T., & Dharmawansyah, D. (2019). Metode Penerapan Keselamatan Dan Kesehatan Kerja Terhadap Kinerja Proyek Konstruksi (Studi Kasus Proyek Pembangkit Listrik Tenaga Mesin Gas Sumbawa). Jurnal TAMBORA, 3(3), 107–114. https://doi.org/10.36761/jt.v3i3.403

Szer, I., Lipecki, T., Szer, J., & Czarnocki, K. (2022). Using meteorological data to estimate heat stress of construction workers on scaffolds for improved safety standards. Automation in Construction, 134(December 2021), 104079. https://doi.org/10.1016/j.autcon.2021.104079

William, W., & Nasri, S. M. (2021). Benzene Exposure on Rig X from Drilling Fluid and Effectiveness of Local Exhaust Ventilation. The Indonesian Journal Of Occupational Safety and Health, 10(3), 343. https://doi.org/10.20473/ijosh.v10i3.2021.343-349

Yatulaini, F., Tualeka, A. R., Jalaludin, J., & Russeng, S. S. (2021). The Relationship between Duration of Benzene Exposure with Liver Enzymes in Car Painting Workshop Workers. The Indonesian Journal Of Occupational Safety and Health, 10(3), 361. https://doi.org/10.20473/ijosh.v10i3.2021.361-370

Yudisianto, I., Tualeka, A. R., & Widajati, N. (2021). Correlation between Individual Characteristics and Work Position with Work Fatigue on Workers. The Indonesian Journal Of Occupational Safety and Health, 10(3), 350. https://doi.org/10.20473/ijosh.v10i3.2021.350-360

Yuliyatin, T., & Ismayatun, S. D. (2021). Relationship of Noise and Individual Characteristics with Blood Pressure of Workers in the Production Area of a Heavy Equipment Component Company in Tegal. The Indonesian Journal Of Occupational Safety and Health, 10(3), 378. https://doi.org/10.20473/ijosh.v10i3.2021.378-388

Zin, S. M., & Ismail, F. (2012). Employers' Behavioural Safety Compliance Factors toward Occupational, Safety and Health Improvement in the Construction Industry. Procedia - Social and Behavioral Sciences, 36(June 2011), 742–751. https://doi.org/10.1016/j.sbspro.2012.03.081