ASIAN JOURNAL OF ENGINEERING, SOCIAL AND HEALTH

Volume 4, No. 8 August 2025
p-ISSN xxxx-xxxx | e-ISSN 2980-4841
https://ajesh.ph/index.php/gp

Analysis of the Coefficient for 9 Cost Components to Implementing Construction Safety Management Systems on Flats Building Development Projects Based on Surat Edaran Direktur Jenderal Bina Konstruksi Number 68 Years of 2024

Erwin Kesuma
Universitas Indonesia, Indonesia
Emails: erwinkesuma90@gmail.com

ABSTRACT:
he Indonesian government targets reducing the housing backlog to 5.4 million units by 2024, including the provision of housing for State Civil Apparatus (ASN) in the Capital City of the archipelago (IKN). However, the high demand for apartment construction is confronted by the problem of construction accidents, which still occur frequently, with 30 cases recorded during 2018–2020. This study aims to analyze the coefficient of nine cost components for the implementation of the *Construction Safety Management System* (SMKK) in apartment construction projects based on the *Surat Edaran Direktur Jenderal Bina Konstruksi Nomor 68 Tahun 2024*. Using a qualitative approach for risk identification and a quantitative approach for cost calculation, the study collected data through document reviews and expert validation employing the Delphi method. The results showed that the ideal cost coefficient of SMKK was 1.1990% of the total project cost (range 1.0791%–1.3189%), with the total cost of SMKK for the research sample reaching Rp9.6 billion out of the total project value of Rp801 billion. These findings not only provide accurate quantitative guidelines for construction safety cost planning but also represent the first study to develop a measurable coefficient for the cost components of SMKK in Indonesia, thereby contributing to improved safety performance in apartment construction projects.

Keywords: Cost of Safety; flats standard WBS; risk

INTRODUCTION

The need for housing is one of the basic human needs alongside clothing and food. However, in 2021, Indonesia still experienced a housing supply deficit of 7.6 million units (Hines, 2024). The government's target is to reduce this backlog to 5.4 million units by 2024 through the 2020–2024 Housing Strategic Plan, which includes the provision of 875,000 housing units and financing for 1,350,000 units (Bappenas, 2021; World Bank, 2020). Within this provision scheme, the Directorate General of Housing Provision targets the construction of 51,340 units of flats. Nevertheless, the realization in 2022 only reached 3,880 units, leaving a shortfall of 25,833 units from the target (PUPR, 2023; Nugraha & Hakim, 2022). This project also aims to address housing needs for the State Civil Apparatus (ASN) in the National Capital City of the Archipelago (IKN),

Indonesia's vision 2045 project guided by principles of environmentally friendly design and accessibility (Yuniarti et al., 2022; Halim & Rukmana, 2023; Azka et al., 2021).

Meanwhile, construction projects in Indonesia continue to face the problem of work accidents. The Ministry of Manpower reported 162,327 cases of work accidents from January to May 2024, with an increasing trend of JKK claims annually—particularly in the construction sector. The *SMKK Guidelines System* that regulates construction safety is expected to serve as a guideline for the implementation of SMKK costs by both the Ministry and the private sector. However, in practice, the allocation of SMKK costs has not yet been fully or properly implemented. Several regulations on SMK3 financing in the construction sector exist, covering various cost aspects of K3 (occupational safety and health), but their implementation remains suboptimal.

Financial management plays an important role in decision-making related to occupational safety, and safety cost calculations must consider multiple factors, including minimum wage and inflation. Previous research has shown that proper prevention implementation can reduce the number of work accidents, and the use of Work Breakdown Structure (WBS) can aid in cost management and project execution.

By focusing on the application of the ideal SMKK cost components for apartment construction based on the latest regulations, this study aims to provide relevant solutions to improve safety and efficiency in construction projects in Indonesia.

In this literature review, research from various journals, theses, and studies related to the cost of implementing the *Construction Safety Management System* (SMKK), estimated prevention costs, and safety supervision in building construction are comprehensively discussed. Several important findings include: the highest rate of work accidents in apartment projects occurs during work progress stages of 40–50% and 60–70%, especially in architectural work (Yang et al., 2021); main factors affecting SMKK cost include the allocation of safety labor, the number of safety nets, and the level of construction difficulty (Ahn et al., 2021); the average return on investment of SMKK is positive, with a coefficient of 1.34% (Cameron & Yanar, 2022); the increase in SMKK costs is driven by three main factors: rising wages, inflation-related adjustment limitations, and higher demand for safety items (Baek et al., 2020); cost analysis aids in understanding accident-related expenses (Georgeta et al., 2016), although many contractors only apply the basics of K3 and neglect hazard prevention training (Gurcanli et al., 2015); financial management is crucial in safety-related decision-making, including the identification of safety cost components (Ibarrondo-Davila et al., 2015); the Activity-Based Costing (ABC) method provides detailed information on activity costs to support decision-making (Khataie et al., 2011), while WBS is fundamental for project planning and risk management (Devi & Reddy, 2012); activity-based risk identification is key for efficient K3 management planning (Park & Kim, 2012); cost components of SMK3 that affect risk control include safety equipment and evacuation facilities (Devi, 2017); previous research has developed WBS standards for high-rise building architectural work categorized by level and type of work (Rianty et al., 2017). Variables from these previous studies serve as interrelated supports in this study.

From the problem formulation, the purpose of this study is to identify potential hazards and risk control measures in apartment building construction, the project's risk control goals and programs, and current K2 cost needs, while analyzing the coefficients of the nine cost components of SMKK implementation.

This research is expected to benefit various parties: for academics, by providing additional insight into construction safety cost analysis, especially in high-rise building projects; for practitioners, by offering input for arranging construction safety costs and reducing work accident claims; and as a reference and regulation guideline in calculating SMKK cost components during the tender process and construction implementation. Additionally, this research aims to be a valuable academic document for the University of Indonesia's academic community and serves as a graduation requirement for the author in the field of Construction Safety Engineering Management.

The novelty of this research lies In the calculation of the coefficients for nine SMKK cost components—coefficients that have never before been established in Indonesian regulations or standards—providing accuracy in construction safety cost estimation for apartment building projects. The results are expected to serve as a guideline for calculating the ideal amount of K2 costs to ensure safe construction implementation. Unlike previous research, this study provides measurable coefficients for each SMKK cost component, allowing accurate cost allocation and component functionality.

RESEARCH METHOD

The research was carried out qualitatively to identify risks and control programs, as well as quantitatively to determine the cost and coefficient of implementing SMKK. The research variables were grouped into independent variables, such as the cost component of implementing SMKK, and bound variables, which included the accuracy of construction safety costs. The research instrument in the form of a questionnaire was used to measure the value of the variable, with content validation to ensure the accuracy of the measurement. Data collection involves primary and secondary data, using the Delphi method for expert validation carried out through several stages of communication of opinions. Data analysis plays an important role in solving research problems by using the Delphi method to get input from experts, as well as conducting analysis related to the risks and costs of implementing SMKK. This research process aims to improve safety and efficiency in apartment building construction projects in Indonesia through a systematic and data-based approach.

RESULTS AND DISCUSSION

Data Analysis

The data analysis in this study was carried out to answer the research questions that had been formulated previously. The analysis approach includes several main aspects, namely: analysis of risk data on apartment building construction project activities, data analysis related to the goals and risk control programs of the apartment building construction project, construction safety cost

analysis in the apartment building construction project, and analysis of the ideal coefficient data from the nine components of the SMKK implementation cost that are relevant to the apartment building construction project.

The initial stage in this process is to collect secondary data from the RKK document for the construction of national flats which is an input in this study. The data taken were IBPRP and the planning cost of implementing SMKK from each research sample object. After the data is collected, it is followed by data analysis by validating the data obtained, starting with validating the risk data of the project activities of the construction of apartment buildings, the goals and risk control programs of the apartment building construction project, as well as data on the implementation of SMKK for the construction of apartment buildings. This validation process aims to ensure that the data used has a high level of accuracy, relevance, and suitability with the research context.

To guarantee the quality of validation, the experts involved in this process are selected based on strict criteria. These experts must have a professional background and be practitioners in the field of Construction Safety and have at least 10 years of professional experience on building projects. The selection of these criteria is based on the need to ensure that the input and views provided are supported by adequate academic knowledge as well as significant practical experience in the relevant field.

Table 1. Description of the Research Expert Profile

No	Expert	Position	Affiliate	Final Education	Experience
1	Expert 1	Senior Vice President of Operations Division 1	PT. Brantas Abipraya	S2	31 Years
2	Expert 2	Senior Vice President of Production Department	PT. Brantas Abipraya	S3	20 Years
3	Expert 3	Vice President of QHSE Operations Division 1	PT. Brantas Abipraya	S2	20 Years
4	Expert 4	QHSE Vice President QHSE Department	PT. Brantas Abipraya	S2	22 Years

Source: Processed Author, 2025

After validation of the risk data on the construction project activity of the apartment building, the goals and risk control programs of the apartment building construction project, as well as the data on the cost of implementing SMKK for the apartment building construction project

Analysis of Risk Data for Apartment Building Construction Project Activities

The risk analysis in this study is based on work activities in the WBS national flats construction project. These activities are identified to identify potential hazards and risks that may affect the implementation of the project. The identified risks became the X1 variable in this study. The analysis used secondary data from the IBPRP report on three samples of construction work for apartment buildings.

The process to obtain risk data Is carried out through validation by Involving consultation with experts who have competence in the field of apartment building construction. This validation

aims to ensure that the selected activities are relevant to the risk assessment to be carried out. With this approach, research can produce more accurate risk analysis and in accordance with field conditions.

The consultation step with experts allows the formulation of work activities that are the focus of risk analysis. Experts provide input regarding potential hazards and risks that may occur in each activity in the construction project of an apartment building. The opinions of these experts are an important foundation in developing a risk assessment framework.

The results of the validation and consultation process are presented in the form of a table that contains the work activities and their level of risk. The presentation in the form of a table aims to provide a systematic and structured picture of the identified risks, so as to facilitate the further evaluation process. An example of the results of expert validation can be seen in Table 4.2, the input data in this process is the WBS and the risk description of each type of work on each research sample object. From the input data, it is continued by validating each type of work and risk description by experts so that conclusions are obtained that state the suitability of the construction work of apartment buildings in accordance with the research limitations. The final results of the analysis of the suitability of the construction activities of apartment buildings, hazard identification, and risks by experts are attached in Appendix 14.

Table 2. Examples of Expert Validation Results

Project Name : CONSTRUCTION OF IKN ASN FLATS
Prototype Type : CONSTRUCTION OF TYPE 96 FLATS
Floor : 12 FLOORS
Location : IKN NUSANTARA

WBS LEVEL 1	WBS LEVEL 2		WBS LEVEL 3		WBS LEVEL 4		WBS LEVEL 5		Potential Hazards	Source of Danger	Conclusion
CONSTRUCTION OF IKN ASN FLATS	STANDARD ARCHITECTURAL WORK	5	PODIUM FLOOR ARCHITECTURAL WORK	5.1	PRACTICAL WALL & CONCRETE PAIRING WORK	5.11	Work of light brick wall pairs ± 7.5 cm	5.111	Falling from a height	Method	Appropriate
									Inhalation/absorption of harmful substances into the body through respiration/skin	Environment	Appropriate
									Overload of vertical conveyors	Machine	Appropriate
									Collapsed material arrangement	Material	Appropriate

Source: Processed Author, 2025

Target Data Analysis and Risk Control Program for Apartment Building Construction Projects

The analysis of targets and risk control programs in the construction of apartment buildings is based on the initial control of the X1 variable of the research that is the input in this process, namely the risks identified in the IBPRP report from three samples of apartment building construction work. The data has been validated by experts to ensure its accuracy.

Risk control objectives are formulated by explaining the relevant descriptions and benchmarks. The control program includes a description of activities, resource allocation, implementation schedule, monitoring mechanisms, achievement indicators, and the division of responsibilities in its implementation.

Data on risk control objectives and programs are further validated in consultation with competent experts. The purpose of this consultation is to ensure the suitability between the goals and risk control programs with the project conditions, as well as as the basis for calculating the X2 variable in the next research, namely the 9 components of the cost of implementing SMKK.

Cost Analysis of K2 Apartment Building Construction Project

The analysis of K2 costs in the construction of flats was carried out by evaluating the X2 variable, namely the cost planning of the implementation of SMKK. The input data came from the RKK document of three samples of the construction project of the flats. Cost planning is structured based on the goals and risk control programs set for each project.

The cost planning data for the implementation of the SMKK is collected and validated by experts to ensure its accuracy and relevance. This validation was carried out to align the data with the actual conditions in the field as well as the specific needs of the apartment building construction project. The validation process also ensures data consistency between project samples

Further analysis was carried out by calculating the needs of the subcomponents of the cost of implementing SMKK. This calculation is based on the results of consultations with three experts, with reference to the most votes from the experts' choices. This approach ensures that the cost analysis reflects priorities and recommendations supported by professional expertise.

After the elimination of unapproved subcomponents in the validation process by experts, it is followed by validation of volume needs by experts according to the characteristics of the research sample object which is then used as the basis for analysis.

After validation, the RAB of the application of the SMKK of the research sample object is calculated by calculating the unit price based on the latest reference and market price. The unit price is then multiplied by the volume of each subcomponent that has been approved by the expert. From the results of the calculation, the total cost of implementing SMKK for the construction project of the Flats building for the object of the research sample amounted to Rp. 9,614,692,501. The results of the calculation of each subcomponent have been validated by three experts and all experts agree and agree that the c"st i' In accordance with the object of the research sample.

Data Analysis of the 9 Coefficients of the Implementation of SMKK Apartment Building Construction Project

The analysis of the ideal coefficient data for the nine components of the cost of implementing SMKK in the construction project of flats which is the X2 variable in this study is by comparing the costs of each component of the implementation of SMKK that has been analyzed with the value of the work, in which case the expert determines using the middle value of the cost of building a flat building from three research sample objects. This calculation aims to determine the ideal percentage of each component of the implementation of SMKK to the total cost of building a flat. Experts validate to provide a tolerance of ±10% of the calculated coefficient for the cost planning of SMKK implementation. This tolerance provides acceptable flexibility in preparing the cost budget of SMKK, while maintaining the accuracy and relevance of the calculation to the needs of the field.

The results of the analysis of the ideal coefficient for the nine components of the cost of implementing SMKK in the project of the construction of new flats which are state flats were obtained at 1.1990% with a tolerance range of the minimum to maximum coefficient percentage between 1.0791% to 1.3189%. The researcher validated the final results of the percentage of each component of the cost of implementing SMKK to 3 experts, the three experts agreed and agreed with the final results that had been analyzed. The results of expert validation of the ideal coefficient data and the tolerance range of the minimum and maximum 9 components of the cost of implementing the SMKK for the apartment building construction project are listed in Table 3. And Table 4 With this ideal coefficient, experts agree and agree that it can improve construction safety performance and increase the accuracy of K2 costs for the construction of apartment buildings.

Table 3. Ideal Coefficient Data Analysis 9 Components of the Cost of Implementing SMKK Apartment Building Construction Project

No	Components of SMKK Implementation	Cost	Coefficient/Percentage of Sub Components	Expert 1	Expert 2	Expert 3	Result
1	Preparation of SMKK Implementation Documents	IDR 346,342,800,00	0,0432%	Agree	Agree	Agree	Valid
2	Socialization, Promotion, and Training	IDR 1,763,124,500,00	0,2199%	Agree	Agree	Agree	Valid
3	Work Protective Equipment and Personal Protective Equipment	IDR 2,055,892,415,87	0,2564%	Agree	Agree	Agree	Valid
4	Insurance	IDR 801.886.800.00	0,1000%	Agree	Agree	Agree	Valid
5	Construction Safety Personnel	IDR 1,078,868,000,00	0,1345%	Agree	Agree	Agree	Valid
6	Facilities, Infrastructure, and Medical Devices	IDR 189,179,600,50	0,0236%	Agree	Agree	Agree	Valid
7	Traffic Signs and Equipment	IDR 213,965,828,40	0,0267%	Agree	Agree	Agree	Valid
8	Consultation with Experts Related to Construction Safety	IDR 24,345,822.53	0,0030%	Agree	Agree	Agree	Valid
9	Activities and Equipment Related to Construction Safety Risk Control	IDR 3,141,086,734,00	0,3917%	Agree	Agree	Agree	Valid
	TOTAL	**IDR 9,614,692,501,30**	**1,1990%**				**Valid**

Source: Processed Author, 2025

Table 4. Data Analysis of Cost Tolerance Range and Percentage 9 Cost Components of the Implementation of SMKK Apartment Building Construction Project

No	Components of SMKK Implementation	Minimum Cost Range (±10% of Ideal Cost)	Ideal Cost	Maximum Cost Range (±10% of Ideal Cost)	Minimum Coefficient Range (±10%)	Coefazine Ideal	Maximum Coefficient Range (±10%)	Package 1	Package 2	Package 3	Result
1	Preparation of SMKK Implementation Documents	IDR 311.708.520	IDR 346,342,800	IDR 380,977,080	0,0389 %	0,0432 %	0,0475 %	Appropriate	Appropriate	Appropriate	Valid
2	Socialization, Promotion, and Training	IDR 1,586,812,050	IDR 1,763,124,500	IDR 1,939,436,950	0,1979 %	0,2199 %	0,2419 %	Appropriate	Appropriate	Appropriate	Valid
3	Work Protective Equipment and Personal Protective Equipment	IDR 1,850,303,174	IDR 2,055,892,415,87	IDR 2,261,481,657	0,2307 %	0,2564 %	0,2820 %	Appropriate	Appropriate	Appropriate	Valid
4	Insurance	IDR 721.698.120	IDR 801.886.800	IDR 882,075,480	0,0900 %	0,1000 %	0,1100 %	Appropriate	Appropriate	Appropriate	Valid
5	Construction Safety Personnel	IDR 970,981,200	IDR 1,078,868,000	IDR 1,186,754,800	0,1211 %	0,1345 %	0,1480 %	Appropriate	Appropriate	Appropriate	Valid
6	Facilities, Infrastructure, and Medical Devices	IDR 170,261,640	IDR 189,179,600,50	IDR 208.097.561	0,0236 %	0,0262 %	0,0288 %	Appropriate	Appropriate	Appropriate	Valid
7	Traffic Signs and Equipment	IDR 192,569,245	IDR 213,965,828,40	IDR 235,362,411	0,0240 %	0,0267 %	0,0294 %	Appropriate	Appropriate	Appropriate	Valid
8	Consultation with Experts Related to Construction Safety	IDR 21,911,240	IDR 24,345,822.53	IDR 26,780,405	0,0027 %	0,0030 %	0,0033 %	Appropriate	Appropriate	Appropriate	Valid
9	Activities and Equipment Related to Construction Safety Risk Control	IDR 2,826,978,060	IDR 3,141,086,734	IDR 3,455,195,408	0,3525 %	0,3917 %	0,4309 %	Appropriate	Appropriate	Appropriate	Valid
	TOTAL	IDR 8,653,017,749,17	IDR 9,614,692,501,30	IDR 10,576,367,253	**1,0791 %**	**1,1990 %**	**1,3189 %**				**Valid**

Source: Processed Author, 2025

Findings and Discussion

The findings and discussions discussed in this sub-chapter are the results of the analysis that has been carried out from each RQ of the research, namely findings and discussion for the risk of apartment building construction project activities, the goals and risk control programs of the apartment building construction project, the cost of K2 of the apartment building construction

project, and the ideal coefficient of the 9 components of the cost of implementing the SMKK of the apartment building construction project.

Findings and Discussion of Risk Activities of Apartment Building Construction Projects

After a risk analysis was carried out on the data of the apartment building construction project, validation was carried out by experts regarding the type of work in the WBS as well as the identification of hazards and risks based on secondary data from IBPRP on three samples of apartment building construction work. Based on the validation results, experts found that 15 of the 374 types of work in the processed data sample were irrelevant to the context of the construction work of apartment buildings. This type of work comes from the work of the Preparation Division and the Structure Division, namely Insurance work and Pile Foundation work, and several other types of foundations besides the Borpile Foundation. This is in accordance with the characteristics of the soil in the IKN, the majority of which are hard soil that is impermeable.

Thus, the number of types of work that are valid for activity risk analysis in the construction project of flats becomes 359 types of work. These types of work are grouped into four groups of work that will be the basis for further studies related to the goals and risk control programs of the apartment building construction project.

Findings and Discussion of Objectives and Risk Control Programs for Apartment Building Construction Projects

After an analysis of the objectives and risk control programs in the apartment building construction project, it was found that 15 of the 374 types of work in the processed data sample were not in accordance with the context of the apartment building construction work according to the experts' validation. This encourages the need to develop risk control goals that are more specific and relevant to the needs of the project.

As a follow-up, risk control objectives are formulated in detail, including clear descriptions and benchmarks. In addition, the risk control program is prepared to explain in detail the activities carried out, resource needs, implementation schedules, forms of monitoring, achievement indicators, and responsibilities of related parties. This approach is expected to be able to ensure the effectiveness of risk management in the construction project of flats and become the basis for planning the cost of implementing SMKK.

Findings and Discussion of Construction Safety Costs for Apartment Building Construction Projects

After identifying the three data objects of the research sample, it was found that the largest cost planning for the implementation of SMKK was in the components of Activities and Equipment related to construction safety risk control and APK & PPE.

Based on the validation carried out by experts to ensure the relevance of the K2 cost sub-component to the construction project of the flats, it was found that of the total 120 subcomponents of the cost of implementing SMKK listed in the Circular Letter of the Director General of Construction Development Number 68 of 2024, only 81 sub-components are relevant to the construction work of apartment buildings. This validation aims to ensure the relevance of the sub-component of the cost of implementing SMKK in construction safety in the construction project of apartment buildings.

From the subcomponents that have been validated, the researcher validates the volume and unit price of each subcomponent of the cost component of the SMKK implementation to ensure the suitability of needs and price realism. The cost of implementing SMKK for the construction of flats with the limitations of the research sample object in the form of the construction of a new apartment building, the number of workers, management, and guests that have been validated to experts, and the work in the high-risk category was obtained at Rp. 9,614,692,501. The cost of each component of the implementation of the SMKK sample of the research object can be seen in Table 5.

Table 5. Ideal Cost of each SMKK Component Research Object Sample

No	Components of SMKK Implementation	Cost
1	Preparation of SMKK Implementation Documents	IDR 346,342,800,00
2	Socialization, Promotion, and Training	IDR 1,763,124,500,00
3	Work Protective Equipment and Personal Protective Equipment	IDR 2,055,892,415,87
4	Insurance	IDR 801.886.800.00
5	Construction Safety Personnel	IDR 1,078,868,000,00
6	Facilities, Infrastructure, and Medical Devices	IDR 189,179,600,50
7	Traffic Signs and Equipment	IDR 213,965,828,40
8	Consultation with Experts Related to Construction Safety	IDR 24,345,822.53
9	Activities and Equipment Related to Construction Safety Risk Control	IDR 3,141,086,734,00
	TOTAL	**IDR 9,614,692,501,30**

Source: Processed Author, 2025

Findings and Discussion of the Ideal Coefficient of the 9 Components of the Cost of Implementing SMKK Apartment Building Construction Project

After calculating the RAB for the implementation of SMKK for the construction work of the apartment building, an analysis was carried out to determine the proportion of the cost of implementing the SMKK to the total cost of building the flat, thus resulting in the cost coefficient of implementing the ideal SMKK that has been validated by experts.

The results of the analysis of the ideal coefficient for the nine components of the cost of implementing SMKK in the construction project of apartment buildings were obtained at 1.1990%.

The coefficient of the nine components of the cost of implementing SMKK was obtained at 1.1990% with a tolerance of ±10% of the coefficient, a coefficient range of 1.0791% - 1.3189%. The coefficient applies to the construction project of a flat, with the object limitation being the construction of a new apartment building, with the number of workers, management, and guests that has been validated to experts. The coefficient was obtained by comparing the cost of each component of the implementation of the SMKK sample of the research object with the cost of

building flats that have been validated by experts. The minimum coefficients, Ideal Coefficients and Maximum Coefficients of each component can be seen in Table 6

Table 6. Coefficient of 9 Components of the Cost of Implementing SMKK

No	Components of SMKK Implementation	Minimum Coefficient Range/ Sub Component Percentage (±10% of Ideal Coefficient)	Coefficient/ Percentage of Ideal Sub Components	Maximum Coefficient Range/ Sub Component Percentage (±10% of Ideal Coefficient)
1	Preparation of SMKK Implementation Documents	0,0389%	0,0432%	0,0475%
2	Socialization, Promotion, and Training	0,1979%	0,2199%	0,2419%
3	Work Protective Equipment and Personal Protective Equipment	0,2307%	0,2564%	0,2820%
4	Insurance	0,0900%	0,1000%	0,1100%
5	Construction Safety Personnel	0,1211%	0,1345%	0,1480%
6	Facilities, Infrastructure, and Medical Devices	0,0236%	0,0262%	0,0288%
7	Traffic Signs and Equipment	0,0240%	0,0267%	0,0294%
8	Consultation with Experts Related to Construction Safety	0,0027%	0,0030%	0,0033%
9	Activities and Training Related to Construction Safety Risk Control	0,3525%	0,3917%	0,4309%
	Coefficient Value	**1,0791%**	**1,1990%**	**1,3189%**

Source : Processed Author, 2025

With the existence of an ideal coefficient of 9 components of the cost of implementing SMKK, it is hoped that it can improve construction safety performance and make the accuracy of K2 costs for the construction of apartment buildings higher.

After analysis was carried out and the ideal coefficient was obtained for each component of the SMKK implementation, the results showed that the majority of the three sample objects had a negative coefficient. These findings indicate that there are shortcomings or weaknesses in safety planning applied to each component of the SMKK. This condition can be further explained through the following example:

a. The planned insurance cost in the object of research sample 2 shows an amount of Rp. 2,999,627,189, with a percentage of 0.1848% of the total project value. This percentage shows

a deviation of 0.0848% compared to the ideal coefficient that should be applied. This can be known because in the object of the research sample, the insurance cost component includes the calculation of BPJS costs that are included as part of the insurance component, thus affecting the overall cost

b. The cost for Work Safety Equipment and Personal Protective Equipment analyzed in the sample of research object 2 showed a total cost of Rp. 2,114,318,633, with a percentage of 0.1302% of the total project budget. However, there is a negative deviation of -0.1261% when compared to the ideal coefficient that has been determined. This condition occurs because the volume of work on the research sample object is relatively high risk and the number of project personnel and guests who come to visit, so that the necessary cost allocation is higher. The deviation of the coefficient/percentage of the cost component of the implementation of the ideal SMKK with the object of the research sample can be seen in Table 5.3.

Table 7 Deviation of Coefficient/Percentage of Cost Components for Implementing Ideal SMKK with Research Sample Objects

No	Komponen Penerapan SMKK	Hasil Penelitian		Objek Sampel Penelitian 1			Objek Sampel Penelitian 2			Objek Sampel Penelitian 3		
		Biaya Ideal	Koefisien/Persentase Sub Komponen Ideal	Pembangunan Rumah Susun ASN 1	Koefisien/Persentase Sub Komponen Biaya Penerapan SMKK	Deviasi	Pembangunan Rumah Susun ASN 4	Koefisien/Persentase Sub Komponen Biaya Penerapan SMKK	Deviasi	Pembangunan Hunian Vertikal TNI	Koefisien/Persentase Sub Komponen Biaya Penerapan SMKK	Deviasi
Komponen Biaya SMKK Pembangunan Gedung Rumah Susun		**Rp 801.886.800.000,00**		**Rp 1.872.546.514.000,00**			**Rp 1.623.498.638.000,00**			**Rp 801.886.800.000,00**		
1	Penyiapan Dokumen Penerapan SMKK	Rp 346.342.800,00	0,04319%	Rp 6.400.000,00	0,0003%	-0,0428%	Rp 52.000.000,00	0,0032%	-0,0400%	Rp 6.400.000,00	0,0008%	-0,0004
2	Sosialisasi, Promosi, dan Pelatihan	Rp 1.763.124.500,00	0,21987%	Rp 2.766.930.000,00	0,1478%	-0,0721%	Rp 120.750.000,00	0,0074%	-0,2124%	Rp 2.766.930.000,00	0,3451%	0,0013
3	Alat Pelindung Kerja dan Alat Pelindung Diri	Rp 2.055.892.415,87	0,25638%	Rp 1.791.950.000,00	0,0957%	-0,1607%	Rp 2.114.318.633,00	0,1302%	-0,1261%	Rp 1.791.950.000,00	0,2235%	-0,0003
4	Asuransi	Rp 801.886.800,00	0,10000%	Rp 1.409.543.359,00	0,0753%	-0,0247%	Rp 2.999.627.189,55	0,1848%	0,0848%	Rp 1.409.543.359,00	0,1758%	0,0008
5	Personel Keselamatan Konstruksi	Rp 1.078.868.000,00	0,13454%	Rp 665.000.000,00	0,0355%	-0,0990%	Rp 1.140.000.000,00	0,0702%	-0,0643%	Rp 665.000.000,00	0,0829%	-0,0005
6	Fasilitas Sarana, Prasarana, dan Alat Kesehatan	Rp 189.179.600,50	0,02359%	Rp 799.440.000,00	0,0427%	0,0191%	Rp 155.000.000,00	0,0095%	-0,0140%	Rp 799.440.000,00	0,0997%	0,0008
7	Rambu dan Perlengkapan Lalu Lintas	Rp 213.965.828,40	0,02668%	Rp 227.000.000,00	0,0121%	-0,0146%	Rp 384.102.500,00	0,0237%	-0,0030%	Rp 227.000.000,00	0,0429%	0,0002
8	Konsultasi dengan Ahli Terkait Keselamatan Konstruksi	Rp 24.345.822,53	0,00304%	Rp 60.000.000,00	0,0032%	0,0002%	Rp 15.000.000,00	0,0009%	-0,0021%	Rp 60.000.000,00	0,0075%	0,00004
9	Kegiatan dan Peralatan Terkait PengendalianRisiko Keselamatan Konstruksi	Rp 3.141.086.734,00	0,39171%	Rp 528.880.000,00	0,0282%	-0,3635%	Rp 1.060.150.000,00	0,0653%	-0,3264%	Rp 528.880.000,00	0,0660%	-0,0033
TOTAL		**Rp 9.614.692.501,30**	**1,1990%**	**Rp 8.255.143.359,00**	**0,4409%**	**-0,7582%**	**Rp 8.040.948.322,55**	**0,4953%**	**-0,7037%**	**Rp 8.255.143.359,00**	**1,0441%**	**-0,1550%**

Source: Processed Author, 2025

CONCLUSION

Based on the validation and analysis of the Work Breakdown Structure (WBS) activities for three Flats building projects, 359 out of 374 planned work types were deemed relevant and grouped into four main clusters to identify potential risks and hazards. The study emphasized the importance of clear objectives with measurable benchmarks to guide effective risk control programs, which involve detailed planning of resources, schedules, monitoring, and responsibilities. Among 120 SMKK cost subcomponents, 81 were applicable to the Flats construction in the IKN, with the total SMKK implementation cost for a 12-storey flat project amounting to approximately Rp 9.61 billion from a total project value of Rp 801.89 billion. This corresponds to an ideal safety cost coefficient of 1.1990% ±10%, ranging from 1.0791% to 1.3189%, aligning with expert opinions that regard this coefficient as accurate and reflective of the project's safety requirements. The findings suggest that applying this coefficient can enhance construction safety performance and improve the precision of safety cost allocation (K2) for Flats building projects. For future research, it is recommended to validate and refine this coefficient across diverse project types and sizes, assess its adaptability to varying risk levels, and explore

integration with real-time safety monitoring systems to further optimize cost-efficiency and hazard mitigation in construction safety management.

REFERENCES

Azka, A., Zaki, A., & Fahmi, M. (2021). Strategic planning for sustainable urban housing development in Indonesia. *Journal of Urban Planning and Development, 147*(4), 05021034. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000690

Bappenas. (2021). *Rencana strategis Kementerian PPN/Bappenas 2020–2024: Pembangunan perumahan dan permukiman*. Kementerian PPN/Bappenas. https://perumahan.bappenas.go.id/

Devi, A. (2017). *Analisa hubungan biaya SMK3 dan kinerja K3 pada proyek konstruksi bangunan gedung untuk meningkatkan kinerja K3*.

Devi, T., & Reddy, V. (2012). Work breakdown structure of the project. *International Journal of Engineering Research and Applications, 2*.

Gurcanli, G. E., Bilir, S., & Sevim, M. (2015). Activity based risk assessment and safety cost estimation for residential building construction projects.

Halim, S., & Rukmana, D. (2023). Green city development for Nusantara capital city: Environmental challenges and opportunities. *Sustainability, 15*(2), 1231. https://doi.org/10.3390/su15021231

Hines, T. (2024). *Supply chain strategies: Demand driven and customer focused*. Routledge.

Ibarrondo-Davila, M. P., Lopez-Alonso, M., & Rubio-Gamez, M. C. (2015). Managerial accounting for safety management: The case of a Spanish construction company.

Khataie, A., Bulgak, A., & Segovia, J. (2011). Activity based costing and management applied in a hybrid decision support system for order management. *Decision Support Systems*.

Latief, Y. (2010). *Bahan kuliah metodologi penelitian*. Universitas Indonesia.

Li, D., & Lu, M. (2015). Automated generation of work breakdown structure and network model for earthwork project planning: A flow network-based optimization approach. *Journal of Construction Engineering and Management*.

Nugraha, D., & Hakim, R. A. (2022). Evaluasi pembangunan rumah susun dalam mengurangi backlog perumahan: Studi kasus DKI Jakarta. *Jurnal Tata Kota dan Daerah, 14*(1), 65–78. https://doi.org/10.14710/tatakota.14.1.65-78

Park, C., & Kim, H. (2012). A framework for construction safety management and visualization system. *Automation in Construction*.

PUPR (Kementerian Pekerjaan Umum dan Perumahan Rakyat). (2023). *Laporan kinerja Direktorat Jenderal Penyediaan Perumahan tahun 2022*. Kementerian PUPR. https://perumahan.pu.go.id/

Rianty, M., Latief, Y., & Suratman. (2017). Pengembangan standar WBS (Work Breakdown Structure) untuk perencanaan kualitas pekerjaan arsitektur bangunan tinggi berbasis risiko.

World Bank. (2020). *Indonesia public expenditure review: Realizing the promise of housing for all*. World Bank. https://doi.org/10.1596/978-1-4648-1640-7

Yang, K., Kim, K., & Go, S. (2021). Towards effective safety cost budgeting for apartment construction: A case study of occupational safety and health expenses in South Korea.

Yuniarti, D., Kurniasih, L., & Wibowo, A. (2022). Housing provision policy for civil servants in Indonesia's new capital city: A case of integrated planning. *International Journal of Housing Policy, 22*(3), 411–428. https://doi.org/10.1080/19491247.2021.1965781