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The Effect Of Smk3 Implementation, Safety Culture And Project Leadership On Ohs Performance In Construction Projects In Dili City, Timor Leste

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ABSTRACT

The construction industry is widely recognized as one of the sectors with the highest levels of occupational risk, particularly in developing countries such as Timor Leste. The implementation of the Occupational Health and Safety Management System (OHSMS/SMK3) in construction projects is often limited to administrative compliance and is not fully supported by a strong safety culture and effective project leadership, resulting in suboptimal Occupational Health and Safety (OHS) performance. Therefore, understanding the interaction among these factors is essential to improving safety outcomes in construction environments. This study aims to analyze the influence of OHSMS implementation, safety culture, and project leadership on OHS performance in construction projects located in Dili City, Timor Leste. The research also examines both direct and indirect relationships among variables, including the mediating role of safety culture and OHSMS implementation. A quantitative research approach was employed using a survey method, in which structured questionnaires were distributed to construction project personnel directly involved in OHS activities. The collected data were analyzed using the Partial Least Square–Structural Equation Modeling (PLS-SEM) technique to evaluate the measurement and structural models. The findings reveal that OHSMS implementation and safety culture have significant positive effects on OHS performance. Project leadership demonstrates a crucial role in strengthening safety culture and enhancing the implementation of OHSMS, while also exerting an indirect influence on OHS performance through these mediating variables. Overall, the results emphasize the importance of integrating systematic, cultural, and leadership approaches to achieve sustainable improvements in occupational health and safety performance within construction projects in Timor Leste.

1. INTRODUCTION

The construction industry is one of the sectors that accounts for the largest number of work accidents, especially in developing countries. The complexity of the field, the rapid change in project conditions, and the involvement of many parties make the implementation of SMK3 a major challenge. Although SMK3 is required by regulations such as Government Regulation No. 50 of 2012, its implementation is often only administrative and has not shown real effectiveness in reducing incidents in the field [1]. Implementation that is only formal without the support of a strong work culture causes safety performance results to not be optimal.

The aspect of safety culture is very important because it affects the internalization of K3 values at every level of the project organization. Safety culture encompasses workers' perceptions, attitudes, and

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active participation in maintaining safety, not just procedural compliance. Studies in Makassar show that the effectiveness of SMK3 is greatly influenced by worker participation and a supportive work environment for safety practices [2]. These findings confirm that the formal SMK3 system will not be effective if it is not supported by a strong work culture [2].

The project leadership factor also plays a crucial role in creating a real safety culture. Transformational, communicative, and visionary leadership in terms of safety has been proven to be able to increase workers' compliance with K3 standards and strengthen the implementation of SMK3. Research on construction company PT Sinai Indonesia found that leadership does not have a significant influence on safety culture partially, but organizational culture has a strong contribution [3]. This shows the need for further research on the interaction between leadership, organizational culture, and the implementation of K3.

Project leadership factors also play an important role in creating a real safety culture. Transformational, communicative, and visionary leadership in terms of safety has been proven to be able to increase workers' compliance with K3 standards and strengthen the implementation of SMK3. Research on construction company PT Sinai Indonesia found that leadership does not have a significant influence on safety culture partially, but organizational culture has a strong contribution [3]. This shows the need for further research on the interaction between leadership, organizational culture, and K3 implementation.

In the context of the city of Dili, Timor Leste, the growth of post-reconstruction infrastructure development raises the urgency for occupational safety in construction projects. Preliminary observations show that the use of PPE is low and the accident reporting system has not been consistently running, while national K3 regulations have not been fully aligned with international standards. The lack of academic literature on the implementation of SMK3 and its supporting factors in Timor Leste reinforces the urgency of this research.

Most research related to SMK3, safety culture, and leadership is focused on countries such as Indonesia and Malaysia, with different contexts and cultures. There is a research gap related to how these three variables interact with each other in the local context of Timor Leste. Thus, this study aims to explore the relationship between the implementation of SMK3, safety culture, and project leadership on the performance of K3 in Dili City through multivariate quantitative analysis.

This research offers novelty in building a conceptual model that combines system variables (SMK3), cultural (safety culture), and managerial (leadership) variables in one analytical framework. Not only delving into structural aspects, this study also examines the social and behavioral dimensions that affect the effectiveness of work safety systems in construction projects.

With this approach, the results are expected to make a comprehensive empirical contribution to the development of more effective and contextual K3 policies in Timor Leste, as well as serve as a reference for contractors, project managers, and policymakers.

2. METHOD

Stages of research

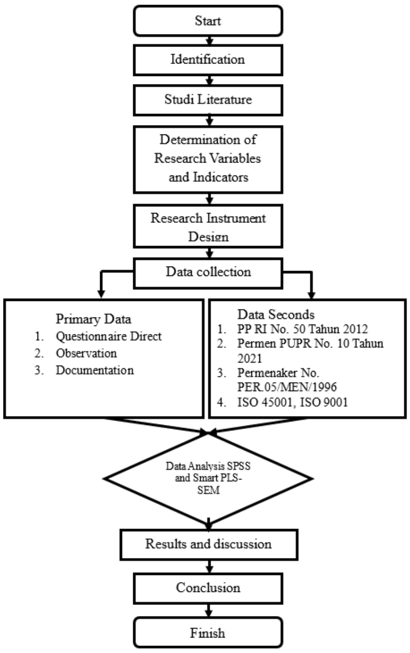

Figure 1. Stages of research

Research Variables

In this study, research variables are determined based on the results of the study Each variable is operationalized into several relevant and measurable indicators to facilitate the process of data collection and research analysis. The determination of indicators is carried out by referring to various national and international standards as well as scientific literature related to occupational safety and health (K3), safety culture, project leadership, and K3 performance. The independent variables in this study include SMK3 Management System (X1), Safety Culture (X2), and Project Leadership (X3), while the dependent variables are K3 Performance (Y). Each variable is described in indicators adopted from credible theoretical and regulatory sources, such as the ILO-OSH 2001 standard, ISO 45001:2018, Government Regulation of the Republic of Indonesia Number 50 of 2012, as well as various expert opinions in the field of occupational safety and organizational management. The details of the variables, indicators, and theoretical sources used in this study are presented in the following table.

Table 1. Research Variables

Research Variables	Indicator	Source
SMK3 Management System (X_1)	K3 Policies and Commitments	ILO-OSH 2001 Permenaker No. 05 Tahun 1996, Ramli, 2010; Sutalaksana, 2018
	Risk Identification and Evaluation	ISO 45001:2018, Ramli (2010)
	Planning and Implementation of K3 Programs	Permenaker No. 05 Tahun 1996, Ramli (2013)
	K3 Training and Competencies	Government Regulation Number 50 of 2012, Goetsch (2011), Suma'mur, 2019
	K3 System Audit and Evaluation	PP RI No. 50, 2012) Goetsch (2011), (Suma'mur, 2019).
Safety Culture (X_2)	Management's Commitment to Safety	PP RI No. 50, 2012) (ILO-OSH 2001), ISO 45001:2018

		Ramli (2010) Goetsch (2011),
	Effective Safety Communication	PP RI No. 50, 2012) ISO 45001:2018 Ramli (2010),
	Occupational Safety & Health Training and Education (K3)	PP RI No. 50, 2012) (ILO-OSH 2001), ISO 45001:2018 Ramli (2010) Goetsch (2011),
	Participation of K3 Workers	PP RI No. 50, 2012) Ramli (2010), Geller (2001) Cooper (2000).
	Attitudes Towards Reporting and Lessons from Incidents	ILO-OSH 2001 Reason (1997) ISO 45001:2018 PP No. 50 Tahun 2012 Ramli (2013),
Project Leadership (X_3)	Transformational Leadership (Vision, Motivation, and Example)	Burns, 1978 Bernard M Bass, 1985
	Transactional leadership (oversight, incentives)	Burns, 1978 Bernard M Bass, 1985
	Decision-making in emergency situations	Klein, 1998 Flin et al., 2008 Reason, 1997
	Direct involvement in K3 programs	ILO, 2001, Goetsch, 2015, Cooper, 2000
	Ability to build team trust	Mayer et al., 1995 Yukl, 2013 Robbins & Judge, 2017
K3 Performance (Y)	Accident Frequency (FR)	Indrayana et al Hanifah dkk
	K3 Procedure Compliance	Susilawati et al. 2022), Firdaus & Hasin (2022)
	Training & Safety Talk	Susilawati et al. 2022), Firdaus & Hasin (2022)
	Routine Audits & Inspections	Susilawati et al. 2022), Firdaus & Hasin (2022)
	Participation and Incident Reporting/Near Incident	Susilawati et al. 2022), Firdaus & Hasin (2022)

3. RESULTS AND DISCUSSION

With the validity test, it is hoped that only the question items that meet the requirements are maintained for the main data collection stage, so that the research instrument can really measure the variables in question precisely and accurately. The following table is the data of the validity test results of the pilot study with SPSS V25 and refers to the R table value of 0.576:

Table 2. SPSS V25 validity test results

		X01	X02	X03	X04	X…..	Total	
X01	Pearson Correlation	1	0,345	.707*	.690*	….....	0,598	Valid
	Sig. (2-tailed)		0,329	0,022	0,027	….....	0,068	
	N	10	10	10	10	….....	10	
X02	Pearson Correlation	0,345	1	0,000	0,524	….....	0,585	Valid
	Sig. (2-tailed)	0,329		1,000	0,120	….....	0,075	
	N	10	10	10	10	….....	10	
X03	Pearson Correlation	.707*	0,000	1	0,488	….....	0,609	Valid

	Sig. (2-tailed)	0,022	1,000		0,153	……..	0,062	
	N	10	10	10	10	……..	10	
X04	Pearson Correlation	.690*	0,524	0,488	1	……..	.716*	Valid
	Sig. (2-tailed)	0,027	0,120	0,153		……..	0,020	
	N	10	10	10	10	……..	10	
X05	Pearson Correlation	.791**	0,218	0,559	.764*	……..	0,591	Valid
	Sig. (2-tailed)	0,006	0,545	0,093	0,010	……..	0,072	
	N	10	10	10	10	……..	10	
X06	Pearson Correlation	0,345	0,524	0,488	0,524	……..	.701*	Valid
	Sig. (2-tailed)	0,329	0,120	0,153	0,120	……..	0,024	
	N	10	10	10	10	……..	10	
X07	Pearson Correlation	.881**	0,284	.830**	.689*	……..	.676*	Valid
	Sig. (2-tailed)	0,001	0,427	0,003	0,028	……..	0,032	
	N	10	10	10	10	……..	10	
X08	Pearson Correlation	0,527	.873**	0,373	0,509	……..	.660*	Valid
	Sig. (2-tailed)	0,117	0,001	0,289	0,133	……..	0,038	
	N	10	10	10	10	……..	10	
X09	Pearson Correlation	.791**	0,218	0,559	.764*	……..	0,591	Valid
	Sig. (2-tailed)	0,006	0,545	0,093	0,010	……..	0,072	
	N	10	10	10	10	……..	10	
X10	Pearson Correlation	.791**	0,218	0,559	.764*	……..	0,591	Valid
	Sig. (2-tailed)	0,006	0,545	0,093	0,010	……..	0,072	
	N	10	10	10	10	……..	10	
X11	Pearson Correlation	0,294	.689*	0,000	0,284	……..	.676*	Valid
	Sig. (2-tailed)	0,410	0,028	1,000	0,427	……..	0,032	
	N	10	10	10	10	……..	10	
X12	Pearson Correlation	0,294	.689*	0,000	0,284	……..	.676*	Valid
	Sig. (2-tailed)	0,410	0,028	1,000	0,427	……..	0,032	
	N	10	10	10	10	……..	10	
X13	Pearson Correlation	0,264	0,509	0,373	0,509	……..	.848**	Valid
	Sig. (2-tailed)	0,462	0,133	0,289	0,133	……..	0,002	
	N	10	10	10	10	……..	10	
X14	Pearson Correlation	0,000	.690*	0,000	0,345	……..	.661*	Valid
	Sig. (2-tailed)	1,000	0,027	1,000	0,329	……..	0,037	
	N	10	10	10	10	……..	10	
X15	Pearson Correlation	0,211	0,408	0,000	0,408	……..	0,582	Valid
	Sig. (2-tailed)	0,558	0,242	1,000	0,242	……..	0,077	
	N	10	10	10	10	……..	10	
X16	Pearson Correlation	0,408	0,563	0,289	0,563	……..	.737*	Valid
	Sig. (2-tailed)	0,242	0,090	0,419	0,090	……..	0,015	
	N	10	10	10	10	……..	10	
X17	Pearson Correlation	0,000	0,582	0,000	0,218	……..	0,580	Valid
	Sig. (2-tailed)	1,000	0,078	1,000	0,545	……..	0,079	
	N	10	10	10	10	……..	10	
X18	Pearson Correlation	0,452	0,530	0,319	0,530	……..	.757*	Valid
	Sig. (2-tailed)	0,190	0,115	0,368	0,115	……..	0,011	
	N	10	10	10	10	……..	10	
X19	Pearson Correlation	0,452	0,530	0,319	0,530	……..	.804**	Valid
	Sig. (2-tailed)	0,190	0,115	0,368	0,115	……..	0,005	
	N	10	10	10	10	……..	10	
X20	Pearson Correlation	0,226	.842**	0,000	0,530	……..	.729*	Valid
	Sig. (2-tailed)	0,530	0,002	1,000	0,115	……..	0,017	
	N	10	10	10	10	……..	10	
X21	Pearson Correlation	0,294	0,527	0,415	0,527	……..	.755*	Valid
	Sig. (2-tailed)	0,410	0,118	0,233	0,118	……..	0,012	
	N	10	10	10	10	……..	10	
X22	Pearson Correlation	0,395	0,327	0,559	0,327	……..	.787**	Valid
	Sig. (2-tailed)	0,258	0,356	0,093	0,356	……..	0,007	
	N	10	10	10	10	……..	10	
X23	Pearson Correlation	0,264	0,145	0,373	0,145	……..	0,604	Valid
	Sig. (2-tailed)	0,462	0,688	0,289	0,688	……..	0,064	
	N	10	10	10	10	……..	10	
X24	Pearson Correlation	0,000	0,218	0,000	0,218	……..	0,624	Valid

	Sig. (2-tailed)	1,000	0,545	1,000	0,545	……..	0,054	
	N	10	10	10	10	……..	10	
X25	Pearson Correlation	0,395	0,327	0,559	0,327	……..	.787**	Valid
	Sig. (2-tailed)	0,258	0,356	0,093	0,356	……..	0,007	
	N	10	10	10	10	……..	10	
X26	Pearson Correlation	0,000	0,218	0,000	0,218	……..	0,624	Valid
	Sig. (2-tailed)	1,000	0,545	1,000	0,545	……..	0,054	
	N	10	10	10	10	……..	10	
X27	Pearson Correlation	0,452	0,530	.639*	0,530	……..	.719*	Valid
	Sig. (2-tailed)	0,190	0,115	0,047	0,115	……..	0,019	
	N	10	10	10	10	……..	10	
X28	Pearson Correlation	0,226	0,530	0,319	0,218	……..	0,624	Valid
	Sig. (2-tailed)	0,530	0,115	0,368	0,545	……..	0,054	
	N	10	10	10	10	……..	10	
X29	Pearson Correlation	0,204	0,282	0,577	0,282	……..	.703*	Valid
	Sig. (2-tailed)	0,572	0,430	0,081	0,430	……..	0,023	
	N	10	10	10	10	……..	10	
X30	Pearson Correlation	0,000	0,488	0,000	0,488	……..	0,624	Valid
	Sig. (2-tailed)	1,000	0,153	1,000	0,153	……..	0,054	
	N	10	10	10	10	……..	10	
Y1	Pearson Correlation	0,494	-0,034	.698*	.648*	……..	.670*	Valid
	Sig. (2-tailed)	0,147	0,926	0,025	0,043	……..	0,034	
	N	10	10	10	10	……..	10	
Y2	Pearson Correlation	0,494	-0,034	.698*	.648*	……..	.670*	Valid
	Sig. (2-tailed)	0,147	0,926	0,025	0,043	……..	0,034	
	N	10	10	10	10	……..	10	
Y3	Pearson Correlation	0,494	-0,034	.698*	0,307	……..	0,597	Valid
	Sig. (2-tailed)	0,147	0,926	0,025	0,389	……..	0,068	
	N	10	10	10	10	……..	10	
Y4	Pearson Correlation	0,316	0,218	0,447	.655*	……..	0,611	Valid
	Sig. (2-tailed)	0,373	0,545	0,195	0,040	……..	0,061	
	N	10	10	10	10	……..	10	
Y5	Pearson Correlation	0,395	0,327	0,559	0,327	……..	.787**	Valid
	Sig. (2-tailed)	0,258	0,356	0,093	0,356	……..	0,007	
	N	10	10	10	10	……..	10	
Y6	Pearson Correlation	.678*	0,094	.639*	.717*	……..	.666*	Valid
	Sig. (2-tailed)	0,031	0,797	0,047	0,020	……..	0,036	
	N	10	10	10	10	……..	10	
Y7	Pearson Correlation	0,395	0,327	0,559	0,327	……..	.787**	Valid
	Sig. (2-tailed)	0,258	0,356	0,093	0,356	……..	0,007	
	N	10	10	10	10	……..	10	
Y8	Pearson Correlation	0,527	-0,145	.745*	0,582	……..	0,624	Valid
	Sig. (2-tailed)	0,117	0,688	0,013	0,078	……..	0,054	
	N	10	10	10	10	……..	10	
Y9	Pearson Correlation	0,527	0,509	.745*	0,509	……..	.748*	Valid
	Sig. (2-tailed)	0,117	0,133	0,013	0,133	……..	0,013	
	N	10	10	10	10	……..	10	
Y10	Pearson Correlation	0,294	0,527	0,415	0,527	……..	.755*	Valid
	Sig. (2-tailed)	0,410	0,118	0,233	0,118	……..	0,012	
	N	10	10	10	10	……..	10	
Total	Pearson Correlation	0,598	0,585	0,609	.716*	……..	1	
	Sig. (2-tailed)	0,068	0,075	0,062	0,020	……..		
	N	10	10	10	10	……..	10	

Based on the results of the Validity Test pilot study with 10 respondents and tested using SPS V25, it was found that 40 test items were declared valid by referring to the R calculation > of the R table (0.576), then a reliability test will be carried out.

Reliability Test

Reliability test is a statistical procedure used to measure the extent to which a research instrument can provide consistent results if tested again under similar conditions. Reliability is important because a reliable instrument will guarantee that the data obtained truly reflects the real situation, not just a coincidence. One of the most commonly used methods is Cronbach's Alpha, provided that a reliability coefficient value of ≥ 0.70 is considered sufficient to declare an instrument reliable, although in exploratory research a value of ≥ 0.60 is still acceptable [4]. Thus, research instruments that meet the reliability requirements will increase the credibility of the data analysis results.

Tabel 3. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X01	156,2000	239,733	0,571	0,967
X02	155,9000	243,211	0,565	0,967
X03	156,2000	243,067	0,590	0,967
X04	155,9000	241,211	0,701	0,966
X05	156,0000	244,222	0,573	0,967
X06	155,9000	241,433	0,685	0,966
X07	156,1000	240,100	0,656	0,966
X08	156,0000	239,111	0,636	0,966
X09	156,0000	244,222	0,573	0,967
X10	156,0000	244,222	0,573	0,967
X11	156,1000	240,100	0,656	0,966
X12	156,1000	240,100	0,656	0,966
X13	156,0000	235,333	0,836	0,965
X14	156,2000	238,400	0,637	0,966
X15	156,0000	238,000	0,548	0,967
X16	156,2000	233,511	0,712	0,966
X17	156,4000	240,711	0,553	0,967
X18	156,1000	234,767	0,736	0,966
X19	156,1000	233,656	0,787	0,966
X20	156,1000	235,433	0,706	0,966
X21	156,3000	238,678	0,739	0,966
X22	156,4000	241,600	0,776	0,966
X23	156,0000	240,222	0,578	0,967
X24	156,3000	245,789	0,612	0,967
X25	156,4000	241,600	0,776	0,966
X26	156,3000	245,789	0,612	0,967
X27	156,1000	235,656	0,695	0,966
X28	156,1000	237,878	0,595	0,967
X29	156,2000	234,400	0,676	0,966
Y30	156,2000	242,844	0,605	0,967
Y31	156,5000	238,056	0,646	0,966
Y32	156,5000	238,056	0,646	0,966
Y33	156,5000	239,611	0,569	0,967
Y34	156,7000	242,011	0,589	0,967
Y35	156,4000	241,600	0,776	0,966
Y36	156,3000	236,900	0,639	0,966
Y37	156,4000	241,600	0,776	0,966
Y38	156,4000	239,822	0,599	0,967
Y39	156,0000	237,333	0,730	0,966
Y40	156,3000	238,678	0,739	0,966

From the results of the reliability test using SPSS V25, Cronbach's Alpha 0.967 was obtained greater than 0.70 so that the questionnaire could be declared quite reliable.

Evaluation of the PLS-SEM Model

Figure 2 below shows the research structural models (inner and outer models) used in the analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM). The model describes the relationship between latent variables consisting of the Implementation of the K3 Management System (X1), Safety Culture (X2), Project Leadership (X3), and K3 Performance (Y). Each variable is measured by a number of indicators represented by yellow checkers, while the relationships between latent variables are depicted through a one-way arrow indicating the direction of influence. In general, this model aims to examine the extent to which project leadership and safety culture affect the implementation of SMK3, as well as how these three variables together affect the performance of K3 in construction projects.

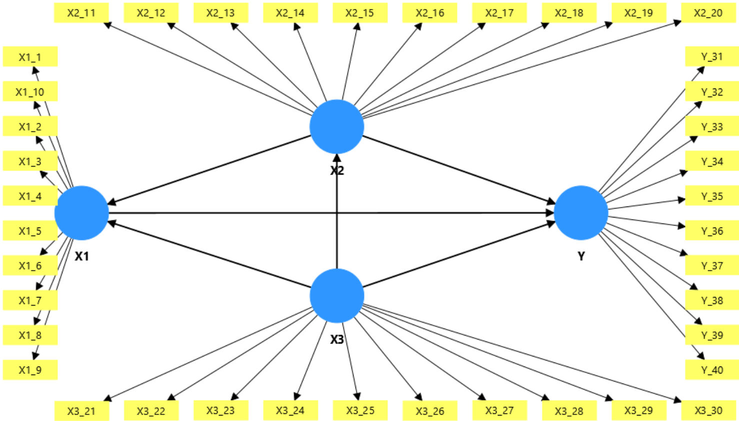

Figure 2. PLS-SEM Model

Reviews Outer Model

Convergent Validity

Convergent validity in the measurement model with the indicator reflective model is assessed based on the correlation between the item score/component score and the construct score calculated using PLS. The reflective size is considered high if it has a correlation of more than 0.70 with the measured construct. However, in the early stages of research or in the development of measurement scales, a loading value between 0.5 to 0.6 is still considered adequate [5]. This value describes how much of a correlation there is between each measurement item (indicator) and its construct. Thus, all outer loading is in the range of 0.5 to 0.6.

Tabel 3. Convergent Validity Outer Loadings (Loading Factor)

	X1	X2	X3	Y
X1_1	0.733			
X1_10	0.830			
X1_2	0.892			
X1_3	0.813			
X1_4	0.829			
X1_5	0.807			
X1_6	0.764			
X1_7	0.683			
X1_8	0.823			
X1_9	0.900			
X2_11		0.848		
X2_12		0.819		
X2_13		0.883		
X2_14		0.747		
X2_15		0.917		
X2_16		0.801		
X2_17		0.801		
X2_18		0.690		
X2_19		0.891		
X2_20		0.909		
X3_21			0.813	
X3_22			0.696	
X3_23			0.835	
X3_24			0.771	
X3_25			0.821	
X3_26			0.889	
X3_27			0.829	

X3_28			0.843	
X3_29			0.635	
X3_30			0.918	
Y_31				0.785
Y_32				0.806
Y_33				0.929
Y_34				0.769
Y_35				0.801
Y_36				0.900
Y_37				0.817
Y_38				0.734
Y_39				0.780
Y_40				0.831

Discriminant Validity

The discriminant validity test is performed to ensure that each latent construct has a clear difference from the others. Based on the test results shown in the correlation matrix between constructs, all correlation values between latent variables are below the value of 0.85. This shows that there is no problem of multicollinearity or overlapping concepts between constructs[6]. Thus, each latent construct can be declared to have good discriminant validity because it is able to represent concepts that are different from each other [7].

Tabel 4. Discriminant Validity

	X1	X2	X3	Y
X1				
X2	0.387			
X3	0.365	0.210		
Y	0.437	0.314	0.470	

Crros Loading

The following table 4 shows the results of the convergent and discriminant validity test through cross-loading analysis between indicators on each latent variable in the research model. This test aims to ensure that each indicator has a higher level of linkage (loading factor) to the construct it is measuring compared to other constructs. Based on the table, each indicator of the K3 Management System (X1), Safety Culture (X2), Project Leadership (X3), and K3 Performance (Y) variables showed the highest loading value on the corresponding construct, indicating that each indicator was able to reflect its latent variables well. This shows that the model has sufficient convergent and discriminant validity, so that the instruments used can be declared reliable and feasible for further structural analysis in the study.

Tabel 5. Crros Loading

	X1	X2	X3	Y
X1_1	0.733	0.324	0.284	0.222
X1_10	0.830	0.310	0.345	0.431
X1_2	0.892	0.375	0.331	0.388
X1_3	0.813	0.337	0.352	0.286
X1_4	0.829	0.244	0.220	0.318
X1_5	0.807	0.256	0.303	0.305
X1_6	0.764	0.304	0.258	0.370
X1_7	0.683	0.195	0.227	0.285
X1_8	0.823	0.366	0.257	0.377
X1_9	0.900	0.337	0.256	0.376
X2_11	0.320	0.848	0.209	0.220
X2_12	0.230	0.819	0.168	0.208
X2_13	0.296	0.883	0.165	0.211
X2_14	0.255	0.747	0.112	0.257
X2_15	0.327	0.917	0.178	0.345
X2_16	0.349	0.801	0.221	0.290
X2_17	0.395	0.801	0.084	0.318

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X2_18	0.132	0.690	0.212	0.103
X2_19	0.368	0.891	0.109	0.268
X2_20	0.384	0.909	0.196	0.331
X3_21	0.245	0.200	0.813	0.356
X3_22	0.332	0.122	0.696	0.424
X3_23	0.301	0.085	0.835	0.326
X3_24	0.209	0.133	0.771	0.303
X3_25	0.295	0.262	0.821	0.402
X3_26	0.275	0.131	0.889	0.420
X3_27	0.374	0.168	0.829	0.382
X3_28	0.232	0.124	0.843	0.358
X3_29	0.173	0.163	0.635	0.202
X3_30	0.343	0.174	0.918	0.475
Y_31	0.346	0.312	0.349	0.785
Y_32	0.468	0.335	0.389	0.806
Y_33	0.416	0.253	0.420	0.929
Y_34	0.307	0.380	0.386	0.769
Y_35	0.299	0.130	0.284	0.801
Y_36	0.281	0.285	0.391	0.900
Y_37	0.318	0.224	0.514	0.817
Y_38	0.359	0.098	0.243	0.734
Y_39	0.317	0.311	0.377	0.780
Y_40	0.290	0.185	0.350	0.831

Output Line Coefficient (Outer Model)

After the measurement model (outer model) is declared to meet the criteria of validity and reliability, the next stage is to test the structural model (inner model). Structural model analysis aims to determine the causal relationship between latent constructs, namely how much influence each independent variable has on the dependent variables in the research model.

Figure 3 below shows the results of the PLS (Partial Least Squares) structural model estimation which illustrates the relationship between constructs, path coefficient values, and R-square values (R^2) in each endogenous variable. The R-square value indicates how much the independent variable is able to explain the variability of the dependent variable, while the path coefficient describes the direction and strength of the relationship between constructs.

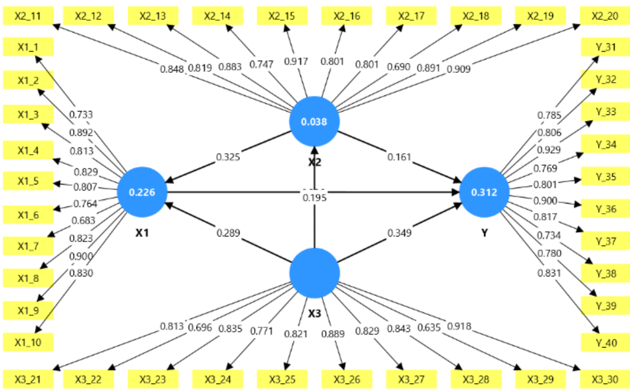

Figure 3 Path Coefficient (Outer Model)

Thus, the image describes the direction of the relationship between variables as follows:

1. Project Leadership (X3) affects Safety Culture (X2), SMK3 Implementation (X1), and K3 Performance (Y).
2. Safety Culture (X2) affects the Implementation of SMK3 (X1) and K3 (Y) Performance.
3. The implementation of SMK3 (X1) also has an influence on K3 (Y) Performance.

The R-square value of each construct is:

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1. X1 is 0.226,
2. X2 is 0.038,
3. Y is 0.312.

These values show that exogenous variables have a fairly strong influence on endogenous constructs, especially on the Performance variable K3 (Y) which can be explained by 31.2% by the construct that affects it.

4. CONCLUSION

Based on the results of data analysis and discussion that has been carried out in the previous chapter, it can be concluded that several important things can be concluded as follows:

1. Project Leadership (X3) has a positive and significant effect on the implementation of the Occupational Safety and Health Management System (SMK3) (X1). This shows that the better the quality of leadership applied in a project, the more effective the implementation of the K3 management system in the work environment. Project leaders who are able to provide example, motivation, and good supervision are proven to increase workers' compliance and awareness of safety procedures.
2. Safety Culture (X2) has a positive effect on the implementation of SMK3 (X1), although the level of influence is moderate. This means that a strong safety culture among workers and management can strengthen the implementation of SMK3 in the field. However, this effect is not very dominant, indicating that other factors such as management policies or resources still play an important role in the successful implementation of the K3 system.
3. Project Leadership (X3) also has a positive and significant influence on Safety Culture (X2). This means that a leadership style that is participatory, communicative, and concerned about safety contributes to the formation of a good safety culture in the project work environment.
4. The implementation of SMK3 (X1) has been proven to have a positive and significant effect on K3 (Y) Performance. This indicates that the better the implementation of the K3 management system in the project, the higher the level of K3 performance achieved, such as a reduction in the number of work accidents, increased compliance with safety standards, and increased work efficiency.
5. Safety Culture (X2) has a positive but insignificant effect on K3 (Y) Performance. These results suggest that while safety culture is important in creating safe behaviors, its direct effect on K3 performance has not been particularly strong. This factor is likely to take longer to make a significant impact through sustained behavioral change.
6. Project Leadership (X3) has a positive and significant influence on K3 (Y) Performance, both directly and indirectly through the mediation variable of SMK3 implementation. This shows that project leaders play a strategic role in improving occupational safety performance through supervision, communication, as well as the implementation of effective management systems.
7. Based on the results of the R-square test, it is known that the research model is able to explain 31.2% variation in the K3 (Y) Performance variable, which means that this model has moderate explanatory power. Meanwhile, the results of the Predictive Relevance (Q^2) test showed that the model had good predictive relevance, especially for the variables of SMK3 Implementation and K3 Performance.

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