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STUDY OF CONSTRUCTION SAFETY MANAGEMENT ON THE PERFORMANCE OF CONSTRUCTION PROJECTS (CASE STUDY AT THE NATIONAL ROAD IMPLEMENTATION CENTRAL SULAWESI)

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ABSTRACT

Construction safety is all engineering activities to support construction work in realizing the fulfilment of security, safety, health, and sustainability standards that ensure construction engineering safety, labour safety and health, public safety, and the environment. The author's initial review found that the performance of construction projects at the Central Sulawesi National Road Implementation Centre was not optimal. The purpose of the study was to determine the application and influence of construction safety management elements in improving construction project performance. Descriptive research conducted data collection on Project Owners, Consultants, and Construction Service Providers with a sample of 40 respondents and then performed multiple linear regression analyses of the data. The results of the analysis show simultaneously that the variables in CSMS are Leadership and Workers Participation in Construction Safety (X1), Construction Safety Planning (X2), Construction Safety Support (X3), Construction Safety Operations (X4), and Construction Safety Performance Evaluation (X5) which is observed simultaneously have a significant effect on the Construction Project Performance Improvement. It also shows that the implementation of construction safety management can improve the performance of construction projects from the perspective of cost, quality, and time of a construction project.

KEYWORDS: *Construction Safety, Project Performance, Construction Projects*

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INTRODUCTION

The government's attention to the world of construction services in the field of security and safety in Indonesia continues to be increased by the mandate of Law No. 2 of 2017 concerning Construction Services. In the world of construction services, field application is carried out following existing guidelines, regulations, and standardization. One of them is the existence of a Construction Safety Management System (CSMS) to ensure the realization of construction safety. This of course should meet the standards of security, safety, health, and sustainability. But the fact is that building and implementing it is not an easy thing. The application of work safety on projects is a matter of habit carried out by construction actors. In this case, it concerns the habits of many people, starting from the project owner (owner), top management of the company, management at the middle level, implementers in the field, to workers who do various menial and dangerous jobs.

The Construction Safety Management System called CSMS is part of the construction work implementation management system to ensure the realization of construction safety. Construction safety is all engineering activities to support construction work in realizing the fulfilment of security, safety, health, and sustainability standards that ensure construction engineering safety, labour safety and health, public safety, and the environment.

From the results of the initial review, the authors found that the performance of construction projects at the Central Sulawesi National Road Implementation Centre was not as expected/optimal, whereas the physical implementation ideally the physical realization every month was by the plan or the realization was greater than the plan.

This research tries to formulate the problem as follows:

- How is construction safety management improving the performance of construction projects at the Central Sulawesi National Road Implementation Centre?
- How is the influence of elements of the Construction Safety Management System (CSMS) in improving project performance based on time efficiency, cost, and quality of work on construction projects at the Central Sulawesi National Road Implementation Centre?

Based on this background, the research objectives can be a formula as follows:

- To find out the implementation of Construction Safety management in improving the performance of construction projects within the Central Sulawesi National Road Implementation Centre.
- To determine the effect of construction safety management elements in improving construction project performance based on time efficiency, cost, and quality/quality of work at the Central Sulawesi National Road Implementation Centre.

METHOD

This type of research is descriptive research. This research is located on a construction project that is within the scope of the Central Sulawesi National Road Implementation Centre with a working area in Central Sulawesi Province.

By using multiple linear regression analysis, the dependent variable in this study is the Construction Project Performance Improvement (Y), which can be defined as everything that is expected to be achieved in working on a project, by meeting or completing all project requirements, which the indicators consist of:

- Cost
- Quality
- Time

Table 1: Operationalization of Research Variables

Variables	Dimension	Indicator
Leadership and Participation in Construction Safety (X1)	Leadership's concern for external and internal issues	CSMS management organizations, and must appoint a person in charge who has competence in their field
	CSMS management organization	The structure, duties, authorities, and responsibilities of the CSMS management organization
	Construction safety commitment and worker participation	Construction safety policy and signed by the highest leadership of the service provider
		Communication to all stakeholders, both internal and external stakeholders
		Involvement of the leadership in increasing worker participation in the implementation of Construction Safety and ensuring the performance of CSMS is by the targets and programs that have been set
Construction Safety Planning (X2)	Hazard identification, risk assessment, controls, and opportunities	Hazard Identification, Risk Assessment, Control and Chance of a hazard and conduct a review when an accident occurs
		Job Safety Analysis for work with medium and high-risk Construction safety, work that is rarely done, and work that uses special tools
	Action plans contained in the goals and programs	Measurable construction safety objectives consistent with policies at each function and stage of construction work
		Construction safety program based on the target on and off the program implemented
	Compliance with standards and laws and regulations	Standards related to the procurement of Personal Protective Equipment (PPE) and Work Protective Equipment (APK)
Construction Safety Support (X3)	Resources in the form of equipment, materials, and costs	Resources needed for implementation, maintenance, and continuous improvement and allocation of SMKK costs for each construction activity
	Competence	Quality and quantity requirements of building materials, dimensions of building materials, material installation procedures, and other requirements that construction work providers must meet
	Concern	Workers know the policies and objectives and procedures for communication on construction safety in the field
	Communication	
	Documented information	Manuals, procedures, working drawings, work instructions, and, other documents required in the workplace
Construction Safety Operations (X4)	Operation planning and control	Responsible for each stage of work
		Control of construction safety risks by eliminating hazards; the non-hazardous replacement of processes, operations, materials, or equipment; performing engineering; performing administrative control; and use of adequate personal protective equipment
	Emergency preparedness and response	PPE, APK according to hazard conditions and the number of workers in the field
		Facilities for workers such as: Adequate barracks, canteens, and toilets according to applicable regulations
		5R Program (Concise, Neat, Clean, Take Care, and Diligent)
		Operational control on the management of labour social protection
		Procedures for receipt and storage as well as transfer and use of materials in the field.
		First aid for accidents (P3K) as well as first aid kits and the event of an emergency must report serious accidents, cases of death, and dangerous incidents to the relevant parties

Table 1 Contd.,

Construction Safety Performance Evaluation (X5)	Monitoring and evaluation	Monitoring related to construction safety implementation and compliance evaluation
		All equipment that requires precision in measurement is calibrated
		Construction safety performance is measured according to applicable standards
		Document monitoring and measurement results
	Management review	Internal audit related to the implementation of construction safety
		Document the results of the internal audit
	Construction safety performance improvement	Construction safety management review for continuous improvement
Construction Project Performance Improvement (Y)	Cost	Completion of projects by predetermined costs
		There are no additional costs due to construction accidents
	Quality	Completion of the project by the quality that has been set.
		The creation of zero accidents
		The creation of the minimum possible impact on the environment around the project.
	Time	Completion of the project meets the predetermined timeframe.
		Workers working time is not affected by the incident

RESULTS AND DISCUSSIONS

The questionnaires distributed in this study were as many as 40 questionnaires, on the Reconstruction and Rehabilitation of the Tompe - In Palu City - Surumana Road and Reconstruction and Rehabilitation of the Palupi - Simoro - Kalukubula - Kalawara, Biromaru - Palolo Roads, this is by the number of existing subjects. This study cone consists of owner, a team of supervisory consultants, and a team of construction service providers. Therefore, the following will describe some characteristics of respondents in general according to age, gender, and, lastly education.

Table 2: Characteristics of Respondents Based on Gender

No	Gender	Amount	Percentage
1	Man	24	60%
2	Woman	16	40%
Total		**40**	**100%**

Table 3: Characteristics of Respondents Based on Age

No	Age	Amount	Percentage
1	20-29 years	7	17.5%
2	30-39 years	19	47.5%
3	40-49 years	10	25%
4	>50 years	4	10%
Total		**40**	**100%**

Table 4: Characteristics of Respondents Based on Last Education

No	Education	Amount	Percentage
1	SMA	-	-
2	Diploma	2	5%
3	S1	34	85%
4	S2	4	10%
Total		**40**	**100%**

Validity Test

Validity is to measure the validity or validity of a questionnaire, in other words, this test is carried out to test the validity of each statement item in measuring the variables. Validity testing in this study was conducted by correlating the score of each item statement addressed to the respondent with the total score for all items.

Table 5: Independent Variable Validity Test (X)

Variables	Question Items	r Count	r Table	Note
Leadership and Participation in Construction Safety (X1)	X1.1	0.642	0,312	Valid
	X1.2	0.456	0,312	Valid
	X1.3	0.626	0,312	Valid
	X1.4	0.620	0,312	Valid
	X1.5	0.604	0,312	Valid
Construction Safety Planning (X2)	X2.1	0.740	0,312	Valid
	X2.2	0.753	0,312	Valid
	X2.3	0.757	0,312	Valid
	X2.4	0.630	0,312	Valid
	X2.5	0.469	0,312	Valid
Construction Safety Support (X3)	X3.1	0.592	0,312	Valid
	X3.2	0.553	0,312	Valid
	X3.3	0.716	0,312	Valid
	X3.4	0.703	0,312	Valid
Construction Safety Operations (X4)	X4.1	0.468	0,312	Valid
	X4.2	0.486	0,312	Valid
	X4.3	0.674	0,312	Valid
	X4.4	0.711	0,312	Valid
	X4.5	0.480	0,312	Valid
	X4.6	0.617	0,312	Valid
	X4.7	0.299	0,312	Valid
	X4.8	0.528	0,312	Valid
Construction Safety Performance Evaluation (X5)	X5.1	0.564	0,312	Valid
	X5.2	0.479	0,312	Valid
	X5.3	0.554	0,312	Valid
	X5.4	0.469	0,312	Valid
	X5.5	0.366	0,312	Valid
	X5.6	0.576	0,312	Valid
	X5.7	0.500	0,312	Valid

Table 6: Project Success Validity Test (Y)

Variables	Question Items	r Count	r Table	Note
Construction Project Performance Improvement (Y)	Y1	0.566	0,312	Valid
	Y2	0.598	0,312	Valid
	Y3	0.520	0,312	Valid
	Y4	0.578	0,312	Valid
	Y5	0.589	0,312	Valid
	Y6	0.501	0,312	Valid
	Y7	0.235	0,312	Valid

Reliability Test

After testing the validity of the data, then proceed with testing the reliability of the data. This test is carried out to analyze data or research instruments, in the form of statement items (questionnaires), whether reliable or not reliable. A reliable research instrument means that the instrument can be used several times to measure the same object.

Table 7: Reliability Test Results

No	Variables	Cronbach's Alpha (a)	Cronbach's Alpha Required	Note
1	Leadership and Participation in Construction Safety (X1)	0.714	>0,6	Reliable
2	Construction Safety Planning (X2)	0.766	>0,6	Reliable
3	Construction Safety Support (X3)	0.747	>0,6	Reliable
4	Construction Safety Performance Evaluation (X5)	0.713	>0,6	Reliable

Multiple Linear Analysis Results

Table 8: Multiple Regression Test Results

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.596	3.755		2.691	0.043
	Worker Leadership and Participation	0.213	0.103	0.199	2.076	0.042
	Construction Safety Planning	0.248	0.181	0.201	1.898	0.016
	Construction Safety Support	0.266	0.140	0.185	1.769	0.002
	Construction Safety Operation	0.265	0.114	0.175	2.577	0.027
	Construction Safety Performance Evaluation	0.363	0.145	0.331	2.508	0.015

a. Dependent Variable: Construction Project Performance Improvement

$Y = b_o + b_1X_1 + b_2X_2 + ...+ b_nX_n + e$

$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$

$Y = 5{,}596 + 0{,}213X_1 + 0{,}248X_2 + 0{,}266\ X_3 + 0{,}265X_4 + 0{,}363X_5 + e$

From the form of the description above, it shows that the independent variables analyzed are Leadership and Workers Participation in Construction Safety (X1), Construction Safety Planning (X2), Construction Safety Support (X3), Construction Safety Operations (X4), and Construction Safety Performance Evaluation (X5) has a positive relationship

with the variable Construction Project Performance Improvement (Y) at the Central Sulawesi National Road Implementation Centre.

Simultaneous Effect Test (F Test)

Testing the effect of independent variables together on the dependent variable using the F test. The results of statistical calculations show the calculated F value = 11.527 > F table (2.36) at the 95% confidence level (α = 0.05), then it is proven that all independent variables in this case Leadership and Workers Participation in Construction Safety (X1), Construction Safety Planning (X2), Construction Safety Support (X3), Construction Safety Operations (X4), and Construction Safety Performance Evaluation (X5) were observed a simultaneously significant effect on the dependent variable, in this case, is the Construction Project Performance Improvement.

Partial Effect Test (T-Test)

- In the variable of Leadership and Workers' Participation in Construction Safety (X1), from the results of data analysis, the t-count value is 2.076 so the value is considered greater than the t-table value, which is 1.306. On this basis, it is stated that the variable of Leadership and Worker Participation in Construction Safety (X1) which is partially observed has a very significant effect on the dependent variable which in this case is the Improvement of Construction Project Performance.
- In the Construction Safety Planning variable (X2), from the results of data analysis, the t-count value is 1.898 so the value is considered greater than the t-table value, which is 1.306. On this basis, it is stated that the Construction Safety Planning (X2) partially observed has a significant effect on the dependent variable which in this case is the Construction Project Performance Improvement.
- On the Construction Safety Support variable (X3), from the results of data analysis, the t-count value is 1.769 so the value is considered greater than the t-table value, which is 1.306. On this basis, it is stated that the Construction Safety Support variable (X3) partially has a significant effect on the dependent variable which in this case is the Construction Project Performance Improvement.
- In the Construction Safety Operations variable (X4), from the results of data analysis, the t-count value is 2.577 so the value is considered greater than the t-table value, which is 1.306. On this basis, it is stated that the partially observed Construction Safety Operations (X4) has a very significant effect on the dependent variable which in this case is the Construction Project Performance Improvement.
- In the Construction Safety Performance Evaluation variable (X5), from the results of data analysis, the t-count value is 2.508 so the value is considered greater than the t-table value, which is 1.306. On this basis, it is stated that the Construction Safety Performance Evaluation (X4) partially has a very significant effect on the dependent variable which in this case is the Construction Project Performance Improvement.

DISCUSSION

Worker Leadership and Participation in Construction Safety

The service provider has a construction safety policy and has established a CSMS management organization by appointing a person in charge who has competence in their field and writing makes the composition, duties, authorities, and responsibilities of the CSMS management organization. Construction safety commitments are communicated to all stakeholders, both internal and external stakeholders. Service Provider Leaders are also involved in increasing worker participation in the implementation of Construction Safety by conducting outreach to workers to ensure that the performance of CSMC is by the established targets and programs.

Construction Safety Planning

The planning carried out by the service provider is to make a schedule of activity plans consisting of several activities such as hazard identification, risk assessment, control, and the opportunity for hazards to occur as well as conducting a review when an accident occurs. Job Safety Analysis (Job Safety Analysis) for work with medium and high-risk Construction Safety, work that is rarely done, and work that uses special tools. Service Providers set standards related to the procurement of Personal Protective Equipment (PPE) and Work Protective Equipment (APK).

Construction Safety Support

The Service Provider prepares the necessary resources for the implementation, maintenance, and continuous improvement as well as the allocation of CSMS costs for each construction activity. The presence of construction safety personnel (Construction Safety Officer / Construction K3 Expert) who are competent and certified. The existence of manuals, procedures, working drawings, work instructions, and documents required in the workplace.

Construction Safety Operation

With the person in charge of each stage of the work, the Service Provider controls construction safety risks by eliminating hazards; the non-hazardous replacement of processes, operations, materials, or equipment; performing engineering; performing administrative control; and use of adequate personal protective equipment. Availability of PPE, and APK according to hazard conditions and the number of workers in the field to minimize risks due to work. Facilities for workers such as barracks, canteen, adequate MCK. Implement the 5R program (Concise, Neat, Clean, Care, and Diligent) and control operations on the management of social protection of the workforce. Service Providers provide and prepare first aid for accidents (Medical Aid) and first aid kits and deal with emergencies.

Construction Safety Performance Evaluation

The Service Provider monitors the implementation of construction safety and evaluates compliance and ensures that all equipment that requires accuracy in measurements is calibrated. The Service Provider ensures that construction safety performance is measured according to applicable standards and documents the results of monitoring and measurement. The Service Provider conducts construction safety management reviews for continual improvement.

The applied CSMS is applied to all elements in an integrated manner between machines, humans, materials, and the environment, resulting in zero accidents.

CONCLUSION

- The results of the study indicate that the implementation of Construction Safety management affects improving the performance of construction projects at the Central Sulawesi National Road Implementation Centre, which in the analysis results show the calculated F value obtained in this study (F = 11.527) is greater than F table (2, 36) at the 95% confidence level (α = 0.05). In this regard, the proper implementation of a construction project at the Central Sulawesi National Road Implementation Centre can certainly improve performance from the perspective of cost, quality, and time of a construction project.
- The T-test results show that partially the elements of the Construction Safety Management System (CSMS) affect improving the performance of construction projects at the Central Sulawesi National Road Implementation Centre, this can be seen from the results of other analyzes: which show the t value for each of these variables is greater than t table (1,306) at the 95% confidence level (α = 0.05).

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