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Cost Overruns Workshop Construction Project

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Abstract. Every construction project implementation requires good project management, which aims to avoid or minimize project risks that may occur, including the risk of cost overruns and delays in work implementation time. Cost overruns can be said to be a quantity where the actual costs exceed the estimated planned costs with costs measured in terms of currency and price stability. The frequency, size, and distribution of costs must be taken into account as part of the assessment of cost overruns for a particular type of investment. Short observations through direct interviews with implementing contractors and real data are data obtained and analyzed, followed by a questionnaire to find the causes of cost overruns. Cost overruns occurred in 32 workshop construction projects with the largest cost overruns at SPBU K amounting to 52.277%. The causes of cost overruns based on Relative Importance Index calculations are errors and mistakes in controlling project costs, incomplete project data and information changes to drawings or designs during fieldwork by the owner, incorrect material and wage cost planning estimates, and frequent work delays.

INTRODUCTION

Every construction project implementation requires good project management, which aims to avoid or minimize project risks that may occur, including the risk of cost overruns and delays in work implementation times [1]. The existence of the construction industry has an indirect impact on the development of construction projects. This is supported by the development of construction projects which are increasing from time to time based on people's interest and purchasing power to meet their needs for construction projects, in this case, the construction of workshops where workshops are needed to help handle motorbikes or cars. The ability to make accurate cost estimates is very important. important for the success of workshop construction. Various independent organizations and management practitioners have made various efforts to reduce the risk of cost overruns in workshop construction projects, however, the problem of cost overruns is still one of the problems in construction projects and has been budgeted by the owner as a form of commitment to project implementation. Cost overrun is defined as the difference between actual costs and estimated costs. Cost overruns are the percentage difference between settlement and contract bid costs [2]. Cost overruns can be said to be a quantity where the actual costs exceed the estimated planned costs with costs measured in currency and price stability. The frequency, size, and distribution of cost overruns should be taken into account as part of the cost overrun assessment for a particular investment [3]. The ability to make accurate cost predictions is critical to success project implementation ([4]). In an effort to assess the likelihood of cost overruns and implement mechanisms to reduce their impact, several techniques have been proposed [4].

METHODOLOGY

This research uses real data from contractors to obtain the percentage of cost overruns for workshop construction projects accompanied by direct interviews with implementing contractors to find the causes of cost overruns, a questionnaire is distributed to parties who are competent to answer the questionnaire. 41 respondents returned the questionnaire. Cost overrun calculations are based on data from the Cost Budget Plan and Implementation Budget

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Plan for each gas station workshop construction project. The causes of cost overrun consist of various sources mentioned in Table 1 which consist of 7 categories, namely: Cost estimation, implementation and work relations, human resources, materials, equipment, implementation time, and financial aspects and project documents

TABLE 1. Draft Questionnaire

No.	Category		Variable	Citation
1	Estimated costs	1.	Incomplete Project Data and Information (When Aanwijzing)	[3]
		2.	Planning Wrong Estimates of Material Costs and Wages	interview
		3.	Errors and mistakes in Controlling Project Costs	[5] [6]
		4.	Not considering unexpected costs	
		5.	Frequent changes to drawings or designs during the implementation of fieldwork by the owner	
2	Implementation and Work Relations	6.	Poor coordination between site managers and project workers in the field	[7]
		7.	Incompetent Project Supervision in the Field	interview
		8.	Many works have to be redone or repaired because they are defective or wrong	[8]
3	Human Resources	9.	Poor Work Ethic of Workers Which Causes Negligence in Project Work	[8]
		10.	Poor Productivity and Quality of Human Resources	[7]
		11.	Amount of Human Resources Wages or Salaries	[6]
4	Material	12.	Not taking into account national economic inflation and the escalation of material price increases	[9] Interview
		13.	Manipulation occurs in project logistics (in collaboration with material suppliers) so that the number of material deliveries is excessive or insufficient	[7]
		14.	Poor Material Quality Control and Management	[6]
		15.	Delay or lack of material supply during implementation	[8]
		16.	Weak logistics supervision resulting in loss of materials	
		17.	There is no scheduling in material procurement	
5	Equipment	18.	High equipment rental or purchase prices due to not carrying out a survey first	[9]
		19.	High equipment mobilization or demobilization costs due to not being careful in observing the project location	[7]
		20.	There is damage to the equipment used	[8]
6	Execution time	21.	Work delays often occur	[5]
		22.	Drawing and implementation instructions are not understood by project workers, resulting in incorrect or incorrect work occurring	interview
		23.	Project scheduling that is not on target	[6]
		24.	Bad Weather Conditions	[10]

No.	Category	Variable	Citation
7	Financial Aspects and Project Documents	25. Delay in the payment process from the owner	[10]
		26. Incomplete Contract Documents	[7]
		27. Short-term contract duration planning that is too forced	[5]

RESULTS AND DISCUSSION

Cost Overrun calculations for 32 workshop construction projects were obtained using the following data with one of the following calculations. Based on the category, the frequency of cost overruns, and their jobs at SPBU A workshop after grouping is electrical with 18 jobs, followed by structure with 8 jobs, architecture with 3 jobs, preparation and others with 2 jobs each. Details of the grouping of work categories cost overrun for the gas station workshop A project from the work contract of Rp. 253,585,658,000.00 is shown in Table 2. With a number of cost overruns in the preparation category of 0.489%, the same goes for architectural work of 1.410%. And so on until the electrical work has a cost overrun of 14.597% which is the largest group category and so on until the electrical work has a cost overrun of 14.597% which is the largest group category and so on until the electrical work has a cost overrun of 14.597% which is the largest group category, so the basic contract budget changes to Rp. 307,376,873,000 and there was a cost increase of Rp. 53,791,215,000.00.

TABLE 2. Cost Overruns Project SPBU A

No.	Work description	Work cost overruns budget (Rupiahs)
	A. PREPARATION	
1.	Dismantle canteen	300.000,00
2.	Excavation area for slab lube bay and backfilling	940.800,00
	Total preparation budget	1.240.800,00
	Preparation percentage	0,489%
	B. ARCHITECTURE	
1	Epoxy 1500 micron	1.224.000,00
2	Repaint standee menu	800.000,00
3	New wall with white Lysaght	1.550.295,00
	Total architectural budget	3.574.295,00
	Architecture percentage	1,410%
	C. STRUCTURE	
1	Chipping hook existing ramp before epoxy	520.000,00
2	Formworks slab	1.073.500,00
3	Wire mesh M 10-1 layer slab	3.353.390,00
4	Concrete Fc 20.75 MPa slab	6.782.800,00
5	Repair concrete 50 mm using Sika bonding slab lube bay and ramp	13.995.400,00
6	Demolish concrete for concrete oil chamber	572.500,00
7	Metal plate cover and small lube cover	2.660.000,00
8	Steel bike ramp	1.500.000,00
	Total budget structure	30.457.590,00
	Structure percentage	12,011%
N	**Work description**	**Work cost overruns budget (Rupiahs)**
	D.ELECTRICAL	
1	MCB box for lube bay	2.500.000,00
2	DB PANEL	22.500.000,00
3	NYFGBY 4x10 mm² from MSB to DB-Service Bay	3.675.000,00

No.	Work description	Work cost overruns budget (Rupiahs)
4	NYA 1c x 10 mm² for grounding panel	825.000,00
5	Excavation and backfill	600.000,00
6	Repair green area	2.500.000,00
7	Supply and install TCW060 C 2xTLED master 15,5 W ultra output IP54 4000K with emergency battery	1.300.000,00
8	Switch 1 pole	100.000,00
9	Switch 2 pole	360.000,00
10	Socket outlet 3 phase 16 A 5 pin	1.200.000,00
11	Socket outlet 15 A 3 pin	400.000,00
12	Socket outlet 13 A 2 pin	260.000,00
13.	Cabling NYM 3x2,5 mm² for TCW060 C 2xTLED Master 15,5W ultra output IP54 4000K with emergency	204.000,00
N	**Work description**	**Work cost overruns budget (Rupiahs)**
14.	Cabling NYM 3x2,5 mm² for switch 1 pole	340.000,00
15.	Cabling NYM 3x2,5 mm² for switch 2 pole	476.000,00
16.	Cabling NYM 3x2,5 mm² for socket outlet 15 A 3-pin	340.000,00
17.	Cabling NYM 3x2,5 mm² for socket outlet 13 A 2 pin	374.000,00
18.	Cabling NYY 5x2,5 mm² for socket outlet 3 phase 16 A	1.000.000,00
	Total budget *electrical*	37.016.500,00
	Electrical percentage	14,597%
	E. OTHERS	
1	Compressor	17.450.000,0
2	Seating	2.600.000,00
	Total budget *others*	1.240.800,00
	Others percentage	7,907%

The most common cost overruns based on type of work

The most common cost overruns based on type of work can be seen in Figure 1.

1. Gas Station A experienced work that experienced the largest cost overruns in work: Electrical at 14.597%
2. Gas Station B experienced work that experienced the largest cost overruns on work: Electrical at 23.023%
3. Gas Station C experienced work that experienced the largest cost overruns in work: Electrical: 18.898%
4. SPBU D experienced work that experienced the largest cost overruns in electrical work: 40.36%
5. SPBU E experienced work that experienced the largest cost overruns in electrical work: 15.376%
6. SPBU F experienced work that experienced the largest cost overruns in electrical work: 25.275%
7. Gas Station G experienced work that experienced the largest cost overruns in electrical work: 16.165%
8. Gas Station H experienced work that experienced the largest cost overruns on Structure work: 46.512%
9. SPBU I experienced work that experienced the largest cost overruns in electrical work: 13.671%
10. SPBU J experienced work that experienced the largest cost overruns in electrical work: 23.243%
11. SPBU K experienced work that experienced the largest cost overruns in structure work: 52.277%
12. SPBU L experienced work that experienced the largest cost overruns in structure work: 28.425%
13. Gas Stations experience work that experiences the largest cost overruns in electrical work: 21.23%
14. SPBU N experienced work that experienced the largest cost overruns in electrical work: 21.37%
15. SPBU O experienced work that experienced the largest cost overruns in electrical work: 18.225%

16. SPBU P experienced work that experienced the largest cost overruns in structural work at 34.932%
17. Gas Station Q experienced work that experienced the largest cost overruns on structure work at 21.159%
18. R gas station experienced work that experienced the largest cost overruns in electrical work: 23.064%
19. SPBU S experienced work that experienced the largest cost overruns in electrical work: 27.190%
20. SPBU T experienced work that experienced the largest cost overruns in electrical work: 21.819%
21. SPBU U experienced the largest cost overruns in electrical work: 16.613%
22. SPBU V experienced work that experienced the largest cost overruns in electrical work: 18.153%
23. SPBU W experienced work that experienced the largest cost overruns in electrical work: 9.993%
24. SPBU X experienced work that experienced the largest cost overruns in electrical work: 10.942%
25. Gas Station Y experienced the largest cost overruns in electrical work: 24.031%
26. SPBU Z experienced work that experienced the largest cost overruns in electrical work: 25.145%
27. Gas Station AA, the work that experienced the largest cost overruns in electrical work: 35.482%
28. SPBU AB is the work that experienced the largest cost overruns in structural work: 29.227%
29. AC gas stations experienced work that experienced the largest cost overruns in structural work: 23,157%
30. AD gas station works that experienced the largest cost overruns in electrical work: 24.267% %
31. Gas Station AE, the work that experienced the largest cost overruns in structure works: 37.299%
32. AF gas station, the work that experienced the largest cost overruns in electrical work: 21.932 %

Thirty two works experience cost overruns, including preparation, structure, architecture, electrical, and others. Of the 32 works that experienced the most cost overruns per each work was electrical work, but the one that experienced the biggest change was structural work at Gas Station K, which is up to 52.277%.

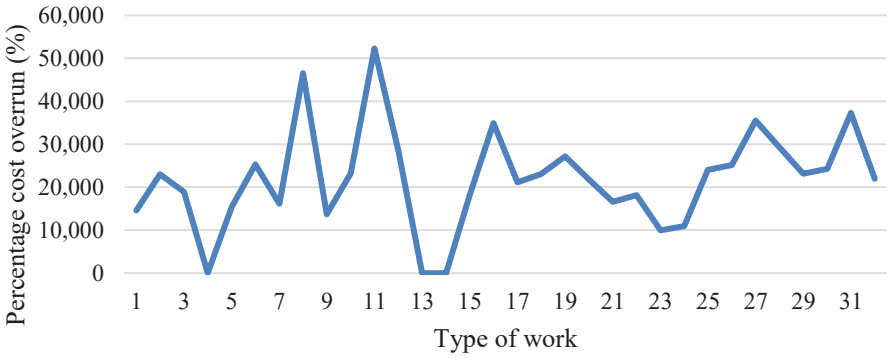

FIGURE 1. Cost Overrun of Each Project

Determine the causes of cost overruns

Determining 27 the cause of cost overruns is determined by determining the validity test and reliability test.

Validity Test

The total validity test results that passed based on SPSS were 23 causal indicators with recap results as follows:
Variables:
1. Cost estimation: 5 indicators
2. Implementation and Work Relations: 2 indicators
3. Human resources: 2 indicators
4. Material: 6 indicators
5. Equipment: 2 indicators
6. Implementation Time: 4 indicators
7. Financial aspects and project documents: 2 indicators

Reliability Test

The total reliability test results that pass based on SPSS are the causes with the following recap results of 21 indicators causing cost overruns, where the variables are as follows.

1. Cost estimation: 5 indicators
2. Implementation and Work Relations: 2 indicators
3. Human resources: 2 indicators
4. Material: 6 indicators
5. Implementation Time: 4 indicators
6. Financial aspects and project documents: 2 indicators

TABLE 3. Overall RII Calculation

Variable	RII	Indicator	Overall	Per group	Description
X1	0,845	X1.1	2	2	Incomplete project data and information (when Aanwijzing)
	0,841	X1.2	4	4	Planning erroneous estimates of material costs and wages
	0,857	X1.3	1	1	Mistake and errors in controlling project costs
	0,793	X1.4	10	5	Take into account unexpected costs
	0,842	X1.5	3	3	Changes to drawings or designs during the implementation of fieldwork by the owner
X2	0,756	X2.1	19	1	Poor coordination between site managers and project workers in the field
	0,793	X2.2	11	2	Incompetent project supervision in the field
X3	0,748	X3.1	20	2	Poor work ethic of workers which causes negligence in project work
	0,768	X3.2	15	1	Poor productivity and quality of human resources
X4	0,813	X4.1	6	1	National economic inflation and escalation of material price increases
	0,772	X4.2	14	5	Manipulation of project logistics (in collaboration with material suppliers) so that the amount of material delivered is excessive or insufficient
	0,796	X4.3	9	3	Poor control and control of material quality
	0,764	X4.4	17	6	Late or lack of material supply
	0,780	X4.5	12	4	Weak logistics supervision
	0,808	X4.6	9	2	Scheduling in material procurement
X6	0,817	X6.1	5	1	Work delays often occur
	0,760	X6.2	18	3	Drawing and implementation instructions are not understood by project workers
	0,813	X6.3	7	2	Project scheduling that is not on target
	0,726	X6.4	21	4	Bad weather conditions
X7	0,776	X7.1	13	1	Late payment process from the owner
	0,768	X7.2	16	2	Incomplete contract

Based on the importance factors, it is found that the five main factors have a very high level of importance, that can be seen on Table 4.

TABLE 4. Ranking and Level of Importance Cause of Cost Overruns

Ranking	Indicator	RII	Level of Importance
1	Statement X1.3	0.857	Very high
2	Statement X1.1	0.845	Very high
3	Statement X1.5	0.841	Very high
4	Statement X1.2	0.841	Very high
5	Statement X6.1	0.817	Very high

The causes of cost overruns calculated using the Relative Importance Index (RII) and resulting in the highest rating as well as cross-checks with related parties (in this case contractors for 32 workshop construction projects) are:

a. Errors and mistakes in project cost control
   Errors and mistakes in controlling project costs lead to poor governance which causes cost overruns as in Love et al, 2013 research which discussed the problem of hospital construction in Perth. To improve cost control, strategies must be implemented to prevent cost overruns [4].
b. Project data and information are incomplete
   Incomplete project data and information cause many changes and result in premature tender documents which are the main root cause of cost overruns in Rosenfeld's research, 2014 [11].
c. Changes to drawings or designs during fieldwork by the owner
   Changes in drawings or designs for implementing fieldwork proposed by the owner cause cost overruns [12]. Changes in design are one of the causes of cost overruns in mega transportation projects in Hong Kong.
d. Incorrect material planning and wage cost estimates
   Inappropriate raw material planning and wage cost estimates lead to inaccurate cost estimates, and cost estimates greatly influence cost overruns in the United States ([13]).
e. Work delays often occur
   Delays in work often occur, causing time extensions which cause cost overruns on workshop construction projects. The length of project implementation is the main reason for cost overruns according to the Federal Transit Administration, 2019 on projects in the United States [13].

CONCLUSION

Based on the analysis and discussion above, it can be concluded:

1. The cost overruns that occur in each project are not the same between one project and another, with the highest cost overruns of 52.277% being the SPBU K project 32 jobs experienced cost overruns, including preparation, structure, architecture, electricity, and others. Of the 32 jobs, the one that experienced the most cost increases was the electrical work, but the one that experienced the biggest change was the structural work at SPBU K.
2. The causes of cost overruns calculated using RII and resulting in the highest assessment and cross-check with related parties are:
   a) Errors and mistakes in controlling project costs
   b) Project data and information are incomplete
   c) Changes to drawings or designs during fieldwork by the owner
   d) Incorrect material planning and wage cost estimates
   e) Work delays often occur

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