Analysis of Mitigation Strategies against the Risk of Cost-Overrun during Implementation of Construction Projects

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Abstract

Implementation of construction projects often experiences differences with field conditions planning. This discrepancy can be in the form of complexities and difficulties in the implementation of a construction project that can affect the increase in time and project costs. The cost that cannot be controlled in the implementation of construction project may cause a risk of cost overrun. This study aims to analyse the "mitigation strategy" against the risk of cost overruns in the implementation of construction projects. Data purposive responses were collected by survey method. After fulfilling statistical tests for questionnaire validity and data reliability, then a mitigation strategy analysis is continued against the risk of project cost overruns using the SWOT method (Strength, Weakness, Opportunity, and Threat). SWOT analysis shows "interaction" between internal factors (Strength and Weakness) with external factors (Opportunity and Threat). The amount of interaction weight indicates the priority of mitigation strategies between S-O (Strength-Opportunity), S-T (Strength-Threat), W-O (Weakness-Opportunity), and W-T (Weakness-Threat). The criteria for the value of each mitigation strategy are calculated from the smallest weight (1 is not important) to the largest (5 is very important). A calculation result of the S-O has the highest weight of 4.34. Thus, the implementation and improvement for the mitigation strategy of Strength-Opportunity (S-O) is a priority to overcome the risk of project cost overruns during the construction implementation stage.

Index Terms: construction project, cost overruns, strategy analysis, SWOT method, risk mitigation.

1. Introduction

The project is an activity carried out to achieve certain goals, limited by time and resources, while construction is all activities of building a building. Construction projects are an effort to achieve results in the form of buildings or infrastructure. Construction activities can be said to be successful if they are able to fulfill their objectives, which are completed on time, according to the costs allocated and meet the quality requirements according to the specified specifications. Costs that cannot be controlled at the time of project implementation are likely to pose a risk of change that causes costs to swell. Cost overruns can occur due to errors in every part of the construction stage.

Increased complexity of development causes construction projects to fail. Therefore, it is necessary to handle the risks involved in implementing construction projects to reduce adverse impacts on participants, namely the risk of cost overruns in the construction project. Examples of real cases in the implementation of construction projects. The first case, the construction project of Tourism Object Arrangement in Bali in 2014 fiscal year. The project experienced cost overruns due to delays in implementation time due to the influence of weather in the project area. The second case was taken from the construction project case for the 2015 Budget year. The project experienced cost overruns due to the large volume of work that was not in accordance with the initial Bill of Quantity (BQ) stated in the tender document. The third case, taken from the case of the construction project of Parking Area Arrangement in 2015. The project experienced cost overruns because the volume of work included in the Bill of Quantity (BQ) was not in accordance with the conditions in the field.

The selection of alternative strategies for handling the risk of cost overruns in the implementation of construction projects can use the SWOT (Strengths, Weaknesses, Opportunities, Threats) method in identifying various factors systematically to formulate a company strategy. This is based on experience and reality according to the results of the sample cases that have been stated that in the implementation of construction projects always found conditions of implementation that are not in accordance with the initial planning.

2. Procedure for Paper Submission

2.1. Risk Management

According to the Oxford Dictionary, risk is defined as the possibility of experiencing danger or suffering. Risk analysis according to Thompson (2018) is a process from identification activities to assessment. Business risk management is managing a company so that it can

realize certain levels of profit and face obstacles that may arise.

2.2. Strategy Management

According to Thomas and Hunger (2010), strategic management is a number of managerial decisions and actions that determine the long-term performance of a company, such as environmental observation, strategy formulation, strategy implementation, evaluation and control. The main objective of the strategy formulation is so that the company can objectively see internal and external conditions, so that the company can anticipate internal and external changes.

2.3. Definition of Cost Overrun

Cost overruns are if the cost or time spent exceeds the estimated amount. Cost overruns can occur due to errors in every part of the construction stage activities, which include the concept development stage, planning stage, auction phase, and construction implementation phase. Thus, if in the construction process there is a deviation in the quality of work, whether due to intentional or not, the risk that must be borne is not small. It is clear that the factors of cost, time, and quality in the construction process have a relationship of interdependence and influence strictly (Dispohusodo, 1996).

2.4. Risk Factor Grouping

Grouping of risk factors for cost overruns in the construction project implementation into SWOT, divided into 2 (two), namely internal factors and external factors.

Internal factors include 2 (two) indicators, namely:
1) Strength indicators
a. Labor experience
b. Ability of labor productivity
c. Good personal relationships between workers in the field
d. Communication between project team members in the field
e. Coordination and supervision in the field
2) Weakness indicators
a. Incomplete project data and information
b.The contractor cannot realize the payment terms according to plan
c. Poor cost control
d. Inaccuracy of estimated costs
e.Too many repetitions of work because of poor quality

External factors include 2 (two) indicators, namely:
1) Opportunity Indicators
a. Availability of raw materials
b. The number of projects handled at the same time
c. Supplier of material that is close to the project area
d. There is a new financial policy from the government
e. Bank interest rates that do not burden the repayment of loans
2) Threat indicators
a. Decline in the exchange rate against foreign currencies
b. Increase in material prices
c. Material theft
d. Late arrival of material by supplier
e. Late schedules due to weather / natural influences.

3. Methodology

The data object used is secondary data (ie implementation reports and literature study results), while primary data involves experts involved in implementing construction projects (Jaya and Pathirage, 2013). Secondary data in the form of construction projects that have been carried out and data obtained from previous research, in the form of: reports, journals and literature studies relating to the factors that cause cost overruns in construction projects. In addition to secondary data there is also primary data in the form of questionnaires. The pilot study involved 22 respondents as primary data collection for testing instruments. After the instrument is valid and reliable, the next primary data collection is carried out.

Questionnaires were distributed using purposive sampling technique totaling 110 respondents. The purposive sampling technique involved those who met certain criteria that deserved consideration for the required sampling. The sample is not taken randomly, but chosen for people who are able to provide "expert judgment", namely people who are considered to understand the problem; have sufficient work experience, viewed from the level of education and position or job duties.

After determining the sample, it was tested for validity and reliability to determine the feasibility of questionnaires and data using the help of Microsoft Excel applications. Test the validity of questionnaires and data reliability, followed by finding answers to problems, namely: first, weighting internal and external factors; second, the matrix method produces a weighting matrix of interactions between internal and external factors. Thus an alternative ranking of mitigation strategies can be determined in the risk of cost overruns in the implementation

of construction projects.

4. Results and Discussion

Table 1 and Table 2, show the results of the analysis of weighting internal and external factors.

Table 1: Internal Weight Scoring of SWOT

External Strategy Factors	Weight (b)	Percentage of Weight BNo=(b/Xoi)*Bo (%)	Urgency (RNo)	Total Scores (SN=BNo*RNo)
Opportunity (O)				
a. Availability of raw materials	**4.43**	13.47	3.46	0.47
b. The number of projects handled at the same time	4.09	12.44	3.43	0.43
c. Supplier of material that is close to the project area	4.21	12.80	3.28	0.42
d. There is a new financial policy from the government	4.03	12.26	2.97	0.36
e. Bank interest rates that do not burden the repayment of loans	4.18	12.71	3.09	0.39
Total O (Xoi)	**20.94**			**2.07**
Threath (T)				
a. Decline in the exchange rate against foreign currencies	**2.25**	6.84	3.08	0.21
b. Increase in material prices	2.52	7.66	3.69	0.28
c. Material theft	2.37	7.21	3.2	0.23
d. Late arrival of material by supplier	2.48	7.54	3.57	0.27
e. Late schedules due to weather / natural influences.	2.32	7.06	3.01	0.21
Total T (Xti)	**11.94**			**1.21**
Xi = (Xoi + Xti)	32.88			
Bo = (Xoi/Xi)*100%	63.69			
Bt = (Xti/Xi)*100%	36.31			
Total Score	3.28			

Table 2: External Weight Scoring of SWOT

Internal Strategy Factors	Weight (b)	Persentage of Weight BNs=(b/Xsi)*Bs (%)	Urgency (RNs)	Total Scores (SN=BNs*RNs)
Strength (S)				
a. Labor experience	4	12.94	3.05	0.39
b. Ability of labor productivity	3.94	12.75	3.94	0.50
c. Good personal relationships between workers in the field	3.7	11.97	3.18	0.38
d. Communication between project team members in the field	3.88	12.55	3.97	0.50
e. Coordination and supervision in the field	3.86	12.49	3.98	0.50
Total Strength - S (Xsi)	**19.38**			**2.27**
Weakness (W)				
a. Incomplete project data and information	2.37	7.67	2.97	0.23
b.The contractor cannot realize the payment terms according to plan	2.46	7.96	3.31	0.26
c. Poor cost control	2.15	6.96	2.95	0.21
d. Inaccuracy of estimated costs	2.35	7.60	3.48	0.26
e.Too many repetitions of work because of poor quality	2.2	7.12	3.34	0.24
Total Weakness - W (Xwi)	**11.53**			**1.20**
Xi = (Xsi + Xwi)	30.91			
Bs = (Xsi/Xi)*100%	62.70			
Bw = (Xwi/Xi)*100%	37.30			
Total Score	3.47			

The results of weighting internal and external factors on the SWOT elements in Table 1 and Table 2 show that the internal

factors of the strength indicators of labor experience indicators have the highest weight of 4.00 and the weakness variable of the poor cost control indicator has the lowest weight of 2.15, meaning that the indicator that most influences the risk of cost overruns based on its weight value. In this case, the indicator of influence strengths to reduce or eliminate the risk of cost overruns. While indicators of weakness affect the risk of cost overruns. on external factors the probability variable of availability of raw materials has the highest weight of 4.43 and the threat variable indicator of the decline in the rupiah exchange rate against foreign currency has the lowest weight of 2.25, meaning that the indicator most influences the risk of swelling costs based on their weight value. In this case, an opportunity indicator influences to reduce or eliminate the risk of cost overruns. While the threat indicator affects the possibility of a risk of cost overruns.

In making a handling strategy, it is applied with a SWOT matrix that will produce 4 alternative strategies, namely Strength-Opportunity (SO), Weakness-Opportunity (WO), Strength-Treat (ST), and Weakness-Threat (WT) functions to make it easier to make combinations each strategy. Then it will be summarized to make it easier to see SWOT strategies such as **Table 3.**

Table 3: Summary of interactions between internal and external factors from SWOT

Strategy - SO	Strategy - WO
Utilizing experienced workforce and good productivity capabilities; foster good personal relationships; improve communication and intensive coordination in the field; striving for the availability of raw materials during the project implementation; prioritizing material suppliers near the project area; utilise the support of new financial policies from the government; carry out preliminary surveys of bank interest rates from financial institutions to support project capital implemented. Thus it will be able to predict how many projects are handled at the same time.	Conduct a survey of material suppliers that are close to the project area; utilizing new financial policies from the government; utilizing bank interest rates that do not burden the repayment of loans; reduce errors due to estimation and poor cost control; anticipate the consequences of the contractor failing to realize payment terms according to plan; find out the availability of raw materials / materials. So that it can overcome the work of quality failure due to incomplete project data and information needs.
Strategy - ST	**Strategy - WT**
Maximizing an experienced workforce; increase labour productivity capabilities; avoid delays in work schedules due to weather effects; prevent delays in material supply from suppliers and maintain good coordination; conduct intensive supervision in the field; creating personal relationships between workers; facilitate access to information on economic fluctuations due to the exchange rate of foreign currencies; and be aware of the theft of material in the field.	Avoid estimates of costs that are less accurate and invalid; improve cost control that is still not good; reduce repetition of work due to technical errors and poor quality; avoid the influence of delays in the completion of work and wasteful use of material. Thus, it must be avoided from the arrival of material by suppliers or due to weather / natural influences, and anticipate material price increases caused by a decrease in the exchange rate of foreign currencies.

The four strategies indicate that, the right strategy to be applied for each indicator of the variables that most influence the risk of cost overruns, namely the strength of the strategy variables that are right to apply are the SO and ST strategies; the strategy weakness variable that is right applied is the WO and WT strategies; Strategic probability variables that are rightly applied are SO and WO strategies, the appropriate threat strategy variables are ST and WT strategies.

From the weighting of internal and external factors in **Table 1** and **Table 2**, the strategy weighting of the four strategy combinations will be weighted according to priorities as in **Table 4**.

Tabel 4: Alternative strategy of SWOT

Priority	Strategy	Weight
I	Strength - Opportunity (SO)	4.34
II	Stength - Threat (ST)	3.48
III	Weakness - Opportunity (WO)	3.27
IV	Weakness - Threat (WT)	2.41

Table 4 shows the order of alternative SWOT strategies, Strength Opportunity (SO) strategy gets priority I with the highest weight value is 4.34, Stength - Threat (ST) strategy gets priority II with a weight value of 3.48, Weakness - Opportunity strategy (WO) gets priority sequence III with a weight value of 3.27, and the Weakness - Threat (WT) strategy gets priority IV with a weight value of 2.41. Because the SO strategy gets priority in order I with the highest weight value of 4.34 it can be proposed as an alternative best strategy for handling the risk of cost overruns.

5. Conclusion

Based on the results of the interaction between internal and external factors of SWOT, there are four combinations of strategies for handling cost overruns risk: Strength-Opportunity (SO) Strategy, Weakness-Opportunity (WO) Strategy, Strength-Threat (ST) Strategy, and Weakness Strategy - Threat (WT) Of the four strategies, the best applied for each indicator of the variables that most influence the risk of cost overruns in the implementation of construction projects are: Strength - Opportunity (SO) strategy.

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