Identify The Costs That Influence The Planning And Implementation Of Construction Projects In Bali

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Abstract. In the implementation of a project, the real activities of the project activities are located at the work stage or commonly called project realization. This realization stage is one of the stages that is carried out based on the planning that has been done at the beginning of the activity. The planning process is usually carried out with various activities, including drawing planning, work breakdown, resource selection, scheduling and cost estimation calculations. Estimation activities are one of the main processes in a construction project to determine the amount of funds that must be provided for a building. Before estimating costs, knowing the fees required to implement a construction project is necessary. Price is one of the most essential elements that must be present and prepared in a project. Without costs, the project cannot be implemented even if other resource elements are met. A detailed explanation of the types of expenses is beneficial from the start of the project cost estimation process. Therefore, in this research, identification was carried out regarding the types of costs required in project implementation. Based on the results of data analysis carried out using the Analytical Hierarchy Process (AHP) method, the results showed that the essential costs in the planning process and implementation of construction projects after the Covid-19 pandemic were material costs with a percentage of 29.4%, followed by labour costs with a ratio of 21.2%, equipment costs are in third position with a balance of 20.8%, fourth position is general costs at 16.5% and the last is overhead costs with a percentage of 12.0%.

Keywords: identification; type of cost; construction project; bali

1. Introduction

The planning process for project implementation is essential and must be addressed in realizing project implementation. Construction project activities also cannot be carried out if the project's main elements are not considered, namely cost, quality and time or implementation schedule. Implementing a construction project depends on fees, which are the central element in the planning, which is made following cost estimates. When carrying out the cost estimation process, it is essential to know the types of costs that need to be considered. Cost estimates are usually required during the planning process when preliminary decisions regarding the project must be determined. Then, they are necessary for budgetary purposes, and calculations are also needed at the project development stage in the design and construction processes [1].The accuracy of construction cost estimates should increase as the project changes, from planning and design to the final calculation at the time of project completion. However, before cost planning is carried out, explaining the types of costs required in planning and implementing the

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project is necessary. In the past 3 (three) years, the world of construction in Indonesia, especially in Bali, has been quite affected by the COVID-19 pandemic that has occurred in the world. Therefore, the impact of the pandemic on the world of construction has also become a source of renewal for cost studies, which influence the project cost estimation process from the planning to project implementation stages. Based on this, research was carried out regarding the costs required in implementing construction projects, especially in Bali. This needs to be done so that the project cost estimation process can be carried out accurately, in detail and efficiently.

2. Method

Generally, the research methods used are presented in the flow chart.

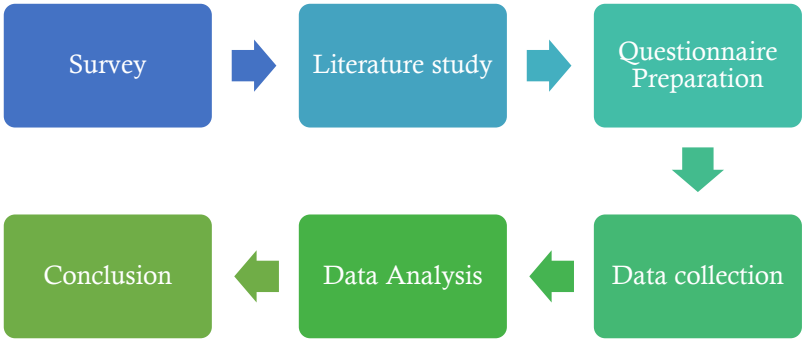

Figure 1 Research flow chart

In this study, the results of the questionnaires that have been distributed and filled out by respondents are then tabulated and the data is processed using the AHP method. In this method, the final result obtained is the weighting of each factor which will then be made in the form of a ranking.

3. Result and Discussion

Based on surveys and data collection on several construction service actors in Bali, several types of costs required in project implementation have been obtained, including Direct costs consisting of material costs, wage costs and equipment costs. Meanwhile, indirect costs consist of overhead costs incurred to support the realization of a job. Meanwhile, general prices include the costs of repairs and handling the impact of construction accidents. To facilitate the tabulation and processing of data related to construction project costs, several types of expenses obtained are assumed to be included in the notation code as follows:

- Material costs = A
- Labour costs = B
- Equipment costs = C
- Overhead costs = D
- General costs = E

The results of the pairwise comparisons between each factor will be described in an algebraic matrix that obtains 10 pairwise comparisons which will then be formed into a matrix. The presentation of the results of the matrix calculation of the 10 pairwise comparisons that occur is presented in the form of a matrix in the following table.

Table 1. Pairwise comparison matrix

Factors	A	B	C	D	E
A	**1,000**	0,683	1,578	1,240	1,209
B	1,464	**1,000**	1,295	3,219	1,513
C	0,634	0,772	**1,000**	1,515	1,897
D	0,806	0,311	0,660	**1,000**	0,590
E	0,827	0,661	0,527	1,694	**1,000**
Total	**4,732**	**3,427**	**5,060**	**8,668**	**6,209**

The next calculation is to perform matrix normalization [3]. In addition to performing matrix normalization, calculations on eigenvectors are also performed. The main eigenvector is obtained by averaging the sum of each row of the matrix. So the results of matrix normalization and eigenvector values are as follows:

Table 2 Normalization and eigenvectors

Factors	A	B	C	D	E	Total	Eigen Vectors
A	0,211	0,199	0,312	0,143	0,195	**1,060**	**0,212**
B	0,309	0,292	0,256	0,371	0,244	**1,472**	**0,294**
C	0,134	0,225	0,198	0,175	0,305	**1,037**	**0,207**
D	0,170	0,091	0,130	0,115	0,095	**0,602**	**0,120**
E	0,175	0,193	0,104	0,195	0,161	**0,828**	**0,166**
Total	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**5,000**	

With the results of the eigenvector values that have been obtained, then continue by calculating the maximum λ obtained by multiplying the total matrix of the pairwise comparison matrix by the main eigenvector value. Where the calculation results are as follows:

Table 3. Maximum lambda calculation

1,000	0,683	1,578	1,240	1,209		0,212	1,090
1,464	**1,000**	1,295	3,219	1,513		0,294	1,512
0,634	0,772	**1,000**	1,515	1,897	x	0,207	= 1,066
0,806	0,311	0,660	**1,000**	0,590		0,120	0,618
0,827	0,661	0,527	1,694	**1,000**		0,166	0,849
4,732	**3,427**	**5,060**	**8,668**	**6,209**			**5,134**

Based on the results of these calculations, the maximum lambda value obtained is 5.134. The next thing to do is calculate the consistency ratio. Measuring the consistency of a matrix

itself is based on the maximum eigenvalue. Thomas L. Saaty has proven that the consistency index of an ordered matrix can be obtained using the following formula [4]:

Consistency index (CI) = (λ maximum – n) / (n – 1)

information:

λ = lambda value

n = number of criteria/factors

So based on the formula above, the CR value is as follows:

Consistency Index (CI) = (λ maximum – n) / (n – 1)

= (5,134 – 5) / (5 – 1) = 0,033

Ratio Index = 1,12

Consistency ratio (CR) = CI / RI

= 0,033 / 1,12 = 0,030

The data processing carried out obtained a CR value of 0.030. It can be concluded that if CR <0.1, then it is declared consistent. The next stage is to carry out the matrix iteration process, where the matrix iteration process is carried out to obtain the weight value for each factor. Iteration is carried out until a difference of 0.000 is found in the eigenvector value. The following are the results of iteration on the algebraic matrix presented in the following table:

Table 4. First Iteration of the Matrix

Factors	A	B	C	D	E	Total	Eigen Vectors 1
A	5,000	3,769	5,496	9,117	7,175	30,556	0,212
B	7,597	5,000	7,823	12,778	9,152	42,349	0,294
C	5,189	3,702	5,000	9,514	6,622	30,026	0,209
D	2,974	2,072	3,306	5,000	3,877	17,230	0,119
E	4,322	2,820	4,334	7,340	5,000	23,816	0,165
Total	25,082	17,362	25,958	43,749	31,827	**143,978**	

Table 5. Second Iteration of the Matrix

Factors	A	B	C	D	E	Total	Eigen Vectors 2
A	140,277	97,154	145,673	244,276	177,987	805,368	0,212
B	194,124	134,871	201,882	338,636	247,377	1116,890	0,294
C	136,930	94,959	142,624	238,349	174,220	787,082	0,208
D	79,399	55,102	82,419	138,507	100,973	456,399	0,120
E	108,968	75,742	113,420	190,075	138,985	627,190	0,165
Total	659,699	457,827	686,019	1149,842	839,543	3792,929	

Table 6. Third Iteration of the Matrix

Factors	A	B	C	D	E	Total	Eigen Vectors 3
A	97275,018	67505,898	101145,227	169552,054	123783,391	559261,587	0,212
B	134900,199	93616,803	140267,502	235133,641	171662,244	775580,388	0,294
C	95080,607	65983,092	98863,687	165727,110	120991,176	546645,672	0,208
D	55120,244	38251,817	57313,260	96075,648	70141,136	316902,105	0,120
E	75756,464	52572,790	78770,644	132044,968	96401,128	435545,994	0,165
Total	458132,531	317930,399	476360,320	798533,421	582979,075	2633935,746	

Table 7. Difference between Vector Eigenvalues 1 and 2

Factors	Eigenvectors 1	Eigenvectors 2	Difference
A	0,212	0,212	0,000
B	0,294	0,294	0,000
C	0,209	0,208	-0,001
D	0,119	0,120	0,001
E	0,165	0,165	0,000
Total	1,000	1,000	

Table 8. Difference between Vector Eigenvalues 2 and 3

Factors	Eigenvectors 2	Eigenvectors 3	Difference
A	0,212	0,212	0,000
B	0,294	0,294	0,000
C	0,208	0,208	0,000
D	0,120	0,120	0,000
E	0,165	0,165	0,000
Total	1,000	1,000	

The final stage in calculating the type of costs required in project implementation is to determine the weight of the elements and ranking. The results of the weighting of each factor are as follows:

Table 9. Weighting and Ranking of Cost Types

	Factors	Bobot	Ranking
A	Labour costs	0,212 (21,2%)	**2**
B	Material costs	0,294 (29,4%)	**1**
C	Equipment costs	0,208 (20,8%)	**3**

D	Overhead costs	0,120 (12,0%)	**5**
E	General costs	0,165 (16,5%)	**4**

4. Conclusion

Based on the weights and rankings that have been carried out, it can be concluded that the most important order of costs in the process of planning and implementing construction projects after the Covid-19 pandemic is material costs with a percentage of 29.4%, followed by labour costs with a ratio of 21.2%, then equipment costs are in the third position with a balance of 20.8%, the fourth position is general costs at 16.5%, and the last is overhead costs with a percentage of 12.0%.

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