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Conceptual Cost Estimation (CCE) Analysis for The Construction of Additional Joint Lecture Building (GKB 3) at State University of Malang

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ABSTRACT

Cost estimation plays a crucial role in ensuring the feasibility and success of construction projects. However, producing accurate estimates, particularly in the early conceptual stages, remains a challenge due to limited information. This study addresses the issue by analyzing the cost estimation process for the construction of the Joint Lecture Building (GKB 3) at State University of Malang. The objective of this study is to provide an accurate and systematic cost estimation to support the construction planning of GKB 3. The study employs a conceptual cost estimation (CCE) method. Data were obtained from field surveys (primary data) and relevant regulatory standards, technical documents, and unit prices (secondary data). Key inclusion criteria include projects categorized under multi-story educational buildings. Analytical descriptive methods were used to process the data. The results indicate that the total building area for GKB 3, spanning nine floors, is 29,932 m², with an estimated cost of IDR 865,037,221,000. This amount includes standard costs, non-standard costs, and Value Added Tax (VAT). Standard costs were calculated using the building's area, multiplying factors, and unit price standards. Non-standard costs, such as installations for air conditioning, elevators, and fire protection systems, were estimated based on regulatory guidelines and their respective percentages of standard costs. In conclusion, the study highlights the importance of employing systematic and regulation-based estimation methods to achieve accurate cost calculations. This approach ensures efficient resource allocation and supports strategic planning for the construction of educational infrastructure.

Introduction

Educational infrastructure development, such as lecture buildings, is one of the strategic factors in improving the quality of higher education in Indonesia. State University of Malang (UM) as one of the leading universities in Indonesia continues to strive to meet the needs of educational support facilities. The Joint Lecture Building (GKB) 3 is planned to support the increase in learning space capacity while creating a conducive learning environment for students.

Cost estimation is one of the crucial first steps in the development process. According to Hendrickson (2000), accurate cost estimation is essential to ensure project

feasibility and efficient resource allocation. However, the main challenge in the planning stage is how to produce an effective cost estimate with limited information. In this context, *conceptual cost estimation* is a relevant method as it allows estimating project costs based on key parameters such as building area and construction type without full design details (Dagostino, 2004; Jumas, 2020; Smith, 2014).

In addition, previous research by Sugiyarto (2019) showed that inaccurate cost estimation can lead to overbudgeting or underbudgeting which impacts the sustainability of the project. Therefore, the use of systematic and data-driven methods in the early stages, such as *conceptual cost estimation*, needs to be further researched to ensure project success, especially in the construction of educational buildings such as GKB 3 State University of Malang.

Accurate cost estimation is crucial in construction projects to ensure project feasibility and optimize resource allocation. According to Hendrickson (2000), early-stage cost estimation significantly influences the success of a project. However, achieving accurate estimates in the conceptual stage is challenging due to limited project details (Ariestadi, 2024; Smith, 2014). Recent studies, such as those by Lee et al. (2023), emphasize the need for data-driven and regulation-based cost estimation methods to address this gap. Furthermore, Sugiyarto (2019) found that inaccurate cost estimation often leads to project inefficiencies, including overbudgeting or underbudgeting, which can threaten project sustainability.

This research seeks to address these challenges by utilizing the Conceptual Cost Estimation (CCE) method, a systematic approach that provides reliable cost estimates based on key parameters such as building area, type, and regulatory standards, even in the absence of complete design details. Unlike previous studies, this research focuses on applying the CCE method specifically to the construction of a large-scale educational facility in Indonesia. The study not only adheres to existing regulations, such as Malang Mayor Regulation No. 48 of 2023, but also incorporates the latest updates on unit price standards and construction policies, ensuring relevance and accuracy.

The novelty of this research lies in its integration of conceptual cost estimation with a comprehensive consideration of non-standard cost components, such as green building infrastructure and facilities for persons with disabilities. This approach provides a more detailed and holistic framework for cost estimation, which has not been thoroughly explored in previous studies.

This research is expected to contribute to both practical and theoretical advancements by offering a robust model for cost estimation in large-scale educational construction projects. Furthermore, it provides valuable insights for policymakers and practitioners in the construction and higher education sectors. To analyze the cost estimation of the construction of the Joint Lecture Building (GKB 3) of State University of Malang by using the conceptual cost estimation method.

Method

Research Location

This research was conducted at the State University of Malang, located in Malang, East Java. The object of the research was the construction project of the Joint Lecture Building (GKB 3) in the area of Gedung Sasana Budaya (A 13) around the entrance gate of Jl. Semarang which is one of the main infrastructures being built to meet the needs of lecture facilities on the campus.

Source: Google Earth, 2024

Types and Sources of Data

a). Primary Data

Primary data in this study was obtained directly from the first source through field observations and information collection related to the construction project of an additional Joint Lecture Building (GKB 3). Primary data collection methods include **Site Area Survey** involving direct observation at the project site to determine the land area, physical condition, and boundaries of the Basic Building Coefficient (KBD).

b) Secondary Data

Secondary data is obtained from sources that have been previously available and are relevant to this research. Types of secondary data include:

1. Official Regulations and Policies

- PUPR Regulation No. 22/PRT/M/2018 (Building Category).
- Decree of the Minister of PUPR No. 1044/Kep/M/2018 (Building Multiplier Factor).
- Malang Mayor Regulation No. 48 of 2023 (Building Unit Price Standard).

2. Land Area and Topography Data

3.3 Research Methods

This research uses an **analytical descriptive** approach to analyze the cost estimation of the construction of the Joint Lecture Building (GKB 3) of State University of Malang using the ***Conceptual Cost Estimation (CCE)*** method**.** The ***Conceptual Cost Estimation*** method was chosen because of its ability to provide a fairly accurate estimate of construction costs even though the project is still in the concept stage. The analysis is carried out using the **Highest Unit Price Standard (SHST)** which is relevant to the type of building being built, as well as considering external factors such as material and labor prices.

Data Collection Technique

Data collection techniques in this study were carried out through several methods to ensure the accuracy of the cost estimation of the construction of the Joint Lecture Building (GKB 3). These methods include:

1. **Field Survey**
   Conducted to obtain direct information about the project location, land area, and surrounding environmental conditions. This data is used to determine the Basic Building Coefficient (KBD) and support the calculation of the total building area.

2. **Document Study**
   Collecting secondary data from relevant regulations, technical documents, and cost standards, such as:
   a) PUPR Regulation No. 22/PRT/M/2018.
   b) Decree of the Minister of PUPR No. 1044/Kep/M/2018.
   c) Malang Mayor Regulation No. 48 of 2023.

3. **Expert Interviews**
   Discussions with construction consultants and technical planners to validate the estimation methods and assumptions used, such as multipliers and non-standard cost details.

4. **Satellite Data Processing**
   Using Google Earth to determine the land area of the project and integrating this data into the cost estimation calculation.

Cost Estimation Analysis Process

The cost estimation analysis process in this study was carried out in stages to ensure accurate and standardized calculations. The stages of the process are:

1. Calculating the Building Area

The maximum ground floor area is obtained as follows

$$LDM = \text{Land Area} \times KBD$$

To calculate the total building area for 9 floors

$$GFA = \text{Number of Lintai} \times LDM$$

2. Estimating Standard Cost

Standardized costs are calculated using the following formula

Cost Standard = Building Area x Coefficient or multiplying factor for the number of floors of the building x Coefficient or multiplying factor for the function of the building or space x SHST according to the building classification

3. Estimating Non-Standard Costs

Non-standard costs are calculated based on a certain percentage of standard costs

4. Calculating Physical Construction Cost

The physical construction cost is calculated using a formula:

Physical Construction Cost = Standard Cost + Non Standard Cost

5. Calculating Other Costs

Other cost components, such as the cost of technical planning, supervision, construction management, and activity management, are calculated at a certain percentage of the physical construction cost.

6. Total Development Cost

Development Cost = Physical Construction Cost + Construction Planning Cost + Construction Supervision Cost + Activity Management Cost + Construction Management Cost

Results and Discussion

Calculating the Total Building Area

In accordance with the development plan for 9 floors we can refer to the Malang City Regional Regulation Number 6 of 2022 Article 85 paragraph (2) letter a point 1. The maximum KBD is 80%. In this development plan, the KBD value to be used is 70%. So that the maximum ground floor area is obtained as follows:

LDM = Land Area x KBD

= 4751 x 70%

= 3226 m^2

To calculate the total building area for 9 floors

GFA = 9 floors x 3226 m^2 = 29932 m^2

Calculating standard cost

- Based on Table 2.1 the multiplier factor for a 9-story building is 1.393.
- Based on Table 2.2 the most relevant coefficient for the Shared Lecture Hall is 1.15 from the standard building price.
- Based on Malang Mayor Regulation Number 48 of 2023. SHST for non-simple new building construction is IDR 6,090,000/m^2.

Cost Standard = Building Area x Coefficient or multiplying factor for the number of floors of the building x Coefficient or multiplying factor for the function of the building or space x SHST according to the building classification

= 29932 x 1.393 x 1.15 x 6090000

= Rp 292,010,338,694

= IDR 292,010,339,000 **(Rounded)**

Non-Standard Costs

The calculation analysis for Non-Standard costs can be seen in the following table:

Table 1. Analysis of Non-Standard Cost Calculation

No.	Item	Percentage	Cost (Rp)
	Cost = Percentage * Standard Cost		
1	Air Conditioning Equipment	10%	IDR 29,201,033,869
2	Elevator and	14%	IDR 40,881,447,417
3	Sound System	4%	IDR 11,680,413,548

No.	Item	Percentage	Cost (Rp)
4	Telephone and telephone communication connection devices	3%	IDR 8,760,310,161
5	Information and Technology Installation	11%	IDR 32,121,137,256
6	Electrical	12%	IDR 35,041,240,643
7	Fire Protection System	12%	IDR 35,041,240,643
8	Lightning Protection	2%	IDR 5,840,206,774
9	Wastewater Treatment Plant	2%	IDR 5,840,206,774
10	Interior (including *fixed furniture*)	25%	IDR 73,002,584,674
11	Combustion Gas	2%	IDR 5,840,206,774
12	Medical gas	4%	IDR 11,680,413,548
13	Termite Hazard Prevention	3%	IDR 8,760,310,161
14	Foundation	12%	IDR 35,041,240,643
15	Facilities for people with disabilities or special needs	5%	IDR 14,600,516,935
16	Environmental facilities or infrastructure	8%	IDR 23,360,827,096
17	Licenses other than Building Approval (PBG)	1%	IDR 2,920,103,387
18	Land preparation and maturation	3.5%	IDR 10,220,361,854
19	*Green Building*	9.5%	IDR 27,740,982,176
20	Utility Connection	2%	IDR 5,840,206,774
	Total	145%	IDR 423,414,991,107

Source: Analysis of Kevin Abdullah Alrasyid, 2024)
So obtained for the total non-standard cost is IDR 423,414,991,107.
Rounded to IDR**423,414,991,000**

Physical Construction Cost

The physical construction cost is calculated using a formula:

Physical Construction Cost = Standard Cost + Non Standard Cost
= IDR 292,010,339,000 + IDR 423,414,991,000
= Rp715,425,330,000

Other cost components

Other cost components, including; technical planning costs, technical supervision, construction management and activity management. For the amount of other component costs, it is calculated based on the percentage (%) of the cost of each component which will be adjusted to the classification of state buildings as in the Decree of the Minister of Public Works and Public Housing Number 943 / KPTS / 2024 on the calculation of interpolation of planning costs. supervision / construction management for physical construction costs of more than Rp. 500,000,000,000.- (five hundred billion rupiah), the calculation uses a fixed formula as follows:

In accordance with Table 2.3 above, the Percentage of Development Cost Components is as follows:

- Construction Planning Fee

Planning Cost = 2.32% × Rp715,425,330,000 = Rp16,597,867,651

= IDR 16,597,868,000

(Rounded)

- Construction Supervision Fee

  Supervision Cost = 1.66% × Rp715,425,330,000 = Rp11,876,060,475

  = IDR 11,876,060,000

  (Rounded)

- Activity Management Fee

  Management Fee = 2.80% × Rp715,425,330,000 = Rp20,031,909,234

  = IDR 20,031,909,000
  (Rounded)

- Construction Management Fee

  Management Fee = 2.15% × Rp715,425,330,000 = Rp15,381,644,591

  = Rp15,381,645,000

  (Rounded)

Total Development Cost

Development Cost	=	Physical Construction Cost + Construction Planning Cost + Construction Supervision Cost + Activity Management Cost + Construction Management Cost
	=	Rp715,425,330,000 + Rp16,597,868,000 + Rp11,876,060,000 + Rp20,031,909,000 + Rp15,381,645,000
	=	IDR 779,312,812,000
11% VAT	=	IDR 85,724,409,000
Grand Total	=	Rp 779,312,812,000 + Rp 85,724,409,000
	=	IDR865,037,221,000

The total estimated construction cost of the Joint Lecture Building (GKB 3) in Malang City is **IDR 865,037,221,000 (Rounded).**

Discussion

The results showed that the cost estimation process for the construction of the Joint Lecture Building 3 (GKB 3) was carried out with a systematic approach and in accordance with regulations. The building area calculated based on the land area and the Basic Building Coefficient (KDB) resulted in a total building area of 29,932 m². The standard cost calculation was carried out by multiplying the building area by the multiplying factor for multi-storey buildings (1.393), building functions (1.15), and the Standard Highest Unit Price (SHST) set at Rp6,090,000/m². Non-standard cost components, such as the installation of air conditioning, elevators, interiors, and fire protection systems, are calculated using a certain percentage of the standard cost according to the Decree of the Minister of PUPR.

In addition, other cost components such as construction management, supervision, and technical planning were also calculated based on a certain proportion of the total

physical cost. A Value Added Tax (VAT) of 11% was then added to obtain a final total estimate of IDR865,037,221,000. This process demonstrates the importance of implementing relevant regulations, such as Permen PUPR No. 22/PRT/M/2018 and Malang Mayor Regulation No. 48 of 2023, in producing accurate cost calculations.

Conclusion

The cost estimation of the construction of the Joint Lecture Building 3 (GKB 3) of State University of Malang using the *conceptual* cost *estimation* method resulted in a total cost of Rp865,037,221,000, with an accurate and comprehensive regulatory-based approach.

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