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EFFICIENCY ANALYSIS OF BUILDING PROCUREMENT AND MANAGEMENT PLAN USING THE LIFE CYCLE COSTING METHOD

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ABSTRACT

Trisakti University, in planning the resources needed, including plans for the procurement of goods and services, needs to make analytical calculations regarding these procurements with a comprehensive tool. This study aims to simulate the process of planning the procurement of goods/services by also considering various procurement options for goods/services, especially the required building. The Life Cycle Cost (LCC) method is used to evaluate the costs that must be incurred in the Trisakti University procurement plan. From the simulation results for the procurement of a new 8-storey building with a building area of 14,216 m2, it can be concluded that the most efficient procurement alternative is the procurement of a building with a budgeted value of IDR 152,063,123,498.

1. INTRODUCTION

The planning process is an important stage in the entire process of procuring goods/services to avoid problems such as inefficiency, non-functioning assets, or even state losses in the future. In planning resources needed, including plans to procure goods and services, especially buildings, TRISAKTI UNIVERSITY needs to make analytical calculations regarding these procurements with a comprehensive tool. The planning process for procuring goods/services must also consider various procurement options for the goods/services required. One of the tools that can be used to assess the costs that must be incurred in procuring goods/services is to calculate the Life Cycle Cost (LCC).

[1] States that the LCC model can provide long-term cost-effectiveness measurements of projects rather than just looking at acquisition costs. He said, "The LCC economic model provides better assessment of long-term cost effectiveness of projects than can be obtained with only first cost decisions."

Woodward, (1997) in his research entitled Life Cycle Costing theory, Information Acquisition and Application,stated that LCC focuses on optimizing value for money in physical asset ownership, but its achievement depends on the availability of accurate, relevant, and fast information.

Septia Yudhi Nugraha, (2009) who conducted research on the analysis of the possibility of applying the life cycle costing method in building construction planning at Trisakti University said that from carrying out this analysis, the LCC method can clearly describe the goals to be achieved and the performance to be produced from building construction projects. Based on some of the previous research results above, this study simulates future building procurement so that an overview of how to plan for building asset procurement and the level of efficiency of building procurement options at TRISAKTI UNIVERSITY is calculated using the LCC analysis method[2]

Research by [3] states that asset management must be viewed as a comprehensive cycle starting from vision and strategy development, asset-related programs, delivery, evaluation, performance management, to improvements, management. As part of the asset management cycle, asset maintenance is important because maintenance activities are the longest part of an asset's life cycle so it is necessary to plan properly, especially in allocating maintenance cost[4].

The Total Asset Management Manual (TAM Manual) from the New South Wales Government Asset Management Committee - Life Cycle Costing Guidelines (2003) states that "The Asset Maintenance Strategic Plan aims to proactively manage the risk of the inability of assets to support service delivery strategies. The the outcome is a more productive and reliable asset portfolio within the constraints of available resources". As an integral part of asset management, asset maintenance planning must be carried out in a comprehensive manner simultaneously in the asset management process.

From the understanding of Life Cycle Costing that has been described previously, it can be concluded that LCC is a method that can be used to evaluate projects based on all costs incurred in owning, operating, managing, and eliminating the project by considering the useful time value of money. In making a decision. The objective of LCC analysis is to choose the most cost-efficient approach from a number of alternatives to obtain the lowest long-term cost of ownership. LCC analysis is suitable for evaluating building construction planning alternatives to achieve the desired building performance, for example comfort, safety, corresponding build standards, reliability, or even aesthetic considerations.

According to the NSW Government (2003) there are many models that can be used for LCC analysis. Several models designed to carry out LCC analysis include the Probabilistic LCC Model proposed by [5] which focuses on development design product new, [6] Organizational Model LCC (1991), as well as LCC analysis [7]. In this study, researchers will use the LCC analysis model from Fuller and Petersen because this model is specifically intended for the construction of government buildings.

2. METHODS

This research is a qualitative research with a case study research approach. The object of this research is the planning of building procurement at TRISAKTI UNIVERSITY. The research object is divided into two, namely the building currently used in operational activities at TRISAKTI UNIVERSITY (as a source of ongoing management and maintenance data) and the building procurement plan to be realized in 2018 which is used to simulate efficiency calculations through existing options.

Data Type

The data to be used in this study consists of primary data and secondary data. Primary data is in the form of the results of interviews with researchers to informants from TRISAKTI UNIVERSITY and other relevant agencies. Secondary data is in the form of documents related to procurement, including the TRISAKTI UNIVERSITY RK BMN Needs Plan, TRISAKTI UNIVERSITY BLU Budget Implementation Document, Procurement General Plan (RUP), Terms of Reference (KAK), as well as historical data on operating expenses building within the TRISAKTI UNIVERSITY.

Data collection technique

Primary data collection was carried out through instrumen interview. The form of the interview that will be conducted is in the form of a semi-structured interview, which is included in the in-depth interview category. In-depth interviews are very useful for obtaining information or someone's opinion on an issue in depth, which is carried out more freely with the aim of finding problems more openly and obtaining more in-depth information from the interviewees.

Secondary data collection was obtained through literature study and requests for goods/services procurement data from the Asset Management Section of TRISAKTI UNIVERSITY or field observations via the internet. This literature study is intended to obtain secondary data through sources which include literature books, scientific articles, and internet pages that contain information about asset management and LCC.[8], [9]

Data Management Methods

Processing indicator data measurement results from interviews using triangulation techniques. The purpose of triangulation is to increase one's understanding of the matter being studied, so that triangulation does not determine whether it is wrong or not. As for the processing of research results regarding efficiency, research calculations in LCC analysis. Researchers will use a non-hypothetical simulation research approach, which places more emphasis on testing theories through analyzing the possibility of their application to an agency that has not used the method as described in the theory.[10], [11]

Researchers will compare several alternative procurement costs building from planning until the age of the asset is used up and written off or by life-cycle costing. The alternative variation that the researchers are planning is the procurement of buildings with self-management maintenance and the procurement of buildings with maintenance carried out by third parties. The two alternative variations are treated as input in obtaining the same output, namely a building that can be used optimally during its useful life. Efficiency is assessed by determining which input costs less to obtain the same output.

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3. RESULTS AND DISCUSSION

In carrying out the analysis in this study, the researcher uses three stages, namely by comparing the theories that have been described previously with the facts that occur in the research object, the practice of implementing LCC in government organizations (LCC for government organizations) in several countries, and then the researcher will try to simulate the method Life Cycle Costing analysis on building construction planning at TRISAKTI UNIVERSITY.

This simulation is deemed necessary to assess the possibility of applying the Life Cycle Costing method to development plans at TRISAKTI UNIVERSITY. In this simulation, the researcher conducted an LCC analysis using several project alternatives that could be applied to the implementation of building development planning at TRISAKTI UNIVERSITY, which had slightly different characteristics from the stages of applying the LCC analysis according to the model designed by Fuller and Petersen (1996). Simulation of LCC implementation using several different project alternativesis expected to produce an assessment of which project is the most efficient in terms of cost to be implemented in development planning at TRISAKTI UNIVERSITY. The researcher simulated the use of the LCC analysis method for the planning process for the construction of a new building based on the plan that had been prepared by TRISAKTI UNIVERSITY to support lecture activities at TRISAKTI UNIVERSITY.

Determination of Study Period

For this simile study period, researchers determined 24 years since the planned completion of the new building or from 2020 to 2045. This corresponds to the maximum period according to Fuller and Petersen (1996, 30) which refers to the FEMP rules for LCC analysis (10 CFR 436) is 25 years. The researcher determines the base date in years, namely in 2020. The researcher determines in years because the development is multiyear, assuming payments are made at the end of each year.

Figure 1 Illustration of the study period for the simulation of LCC implementation

Determination of interest rates and inflation

The macroeconomic indicators mentioned in the APBN Financial Notes issued by the Ministry of Finance include economic growth, inflation, 3-month SPN interest rates, exchange rates, Indonesian crude oil prices, crude oil lifting, and gas lifting. In line with the macroeconomic indicators mentioned in the Financial Notes APBN, the determination of the discount rate in this simulation uses the average 3-month SPN interest rate. Because construction is planned to begin in 2018, researchers use the SPN 3 interest rate of 5.3% and inflation of 4.0% according to the basic macroeconomic assumptions used as the basis for preparing the 2017 RAPBN which are still approximate. Thus according to the calculation formula, the real interest that will be used to discount the costs used in the LCC analysis is as follows.[12], [13]

Implementation in Projects

Various the calculations that have been determined in the previous stage will be applied in the simulation. The results of the calculation of Life Cycle Costing at TRISAKTI UNIVERSITY that the researchers carried out using the cost component in alternatives A to alternative E will produce a comparison of alternative Life Cycle Costing costs which can be seen in table 1 Comparison of Calculation Results of Alternative LCC Simulations as shown below.

$$d = \frac{1+D}{1+I} - 1$$

$$d = \frac{1+5,3\%}{1+4,0\%} - 1 = 1,25\%$$

Table 1. Comparison of Alternative LCC Simulation Calculation Results

LCC fee	Component (base case)				
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E

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Acquisition cost	163,074,565,498	163,074,565,498	163,074,565,498	163,074,565,498	163,074,565,498
Score nowacquisition cost	163,074,565,498	163,074,565,498	163,074,565,498	163,074,565,498	163,074,565,498
Cost maintenance	639,336,370; 25 year; 1.25%	3,553,948,176; 25 years; 1.25%	3,553,948,176; 25 years; 1.25%	3,188,197,355; 25 years; 1.25%	3,188,197,355; 25 year; 1.25%
Score now maintenance cost	13,654,478,622	75,902,625,984	75,902,625,984	68,091,187,440	68,091,187,440
Electricity cost	1,115,703,215; 25 year; 1.25%	1.115.703.215 / 25 years; 1.25%	1,115,703,215 ; 25 years; 1.25%	1,115,703,215 ; 25 years; 1.25%	1,115,703,215 ; 25 years; 1.25%
Score nowutility costs - electricity	23,828,373,296	23,828,373,296	23,828,373,296	23,828,373,296	23,828,373,296
Utilization- rental income	246,368,135; 25 year; 1.25%	0; 25 years; 1.25%	246,368,135; 25 year; 1.25%	0	246,368,135; 25 year; 1.25%
Score now Utilization- rental income	5,261,750,442	0	5,261,750,442		5,261,750,442
Cost demolition (disposal)	848,052,051; year 25th; 1.25%	848,052,051; 25th year; 1.25%	848,052,051; 25th year; 1.25%	848,052,051; 25th year; 1.25%	848,052,051; 25th year; 1.25%
Score nowdemolition fee	621,651,107	621,651,107	621,651,107	621,651,107	621,651,107

From the discount calculation for each of the cost components above, the total cost which is the value of the LCC calculation for alternatives A to E is presented in Table 2 below.

Table 2 Comparison of Discount Yields for LCC Cost Components

LCC fee	**Component (base case)**				
	Alternative A	**Alternative B**	**Alternative C**	**Alternative D**	**Alternative E**
Cost Acquisition	163,074,565,498.00	163,074,565,498.00	163,074,565,498.00	163,074,565,498.00	163,074,565,498.00
Cost Maintenance	13,654,478,622.00	75,902,625,984.00	75,902,625,984.00	68,091,187,440.00	68,091,187,440.00
Electricity cost	23,828,373,296.00	23,828,373,296.00	23,828,373,296.00	23,828,373,296.00	23,828,373,296.00
Utilization + rental income	5,261,750,442.00	0.00	5,261,750,442.00	0.00	5,261,750,442.00
Cost demolition	621,651,107.00	621,651,107.00	621,651,107.00	621,651,107.00	621,651,107.00
LCC results	**195,917,318,081.00**	**263,427,215,885.00**	**258,165,465,443.00**	**255,615,777,341.00**	**250,354,026,899.00**

To increase confidence in decision making, it is possible to calculate supporting measures consisting of Net Savings, Savings-to-Investment Ratio (SIR), Adjusted Internal Rate of Return (AIRR), and Payback Period.

Net Savings

The purpose of this measure is to calculate the savings of an alternative compared to the base case. The calculation is done by calculating the difference between the base case and other alternatives.

Table 3. Net Savings

Alternatif	**Nilai LCC**	**NS**
A (base case)	Rp195.917.318.081	(Rp67.509.897.804)
B	Rp263.427.215.885	(Rp62.248.147.362)C
	Rp258.165.465.443	(Rp59.698.459.260)D
	Rp255.615.777.341	(Rp59.698.459.260)E
	Rp250.354.026.899	(Rp54.436.708.817)

Savings-to-Investment Ratio (SIR)

This measure is the relationship between savings and increased investment costs. SIR measurement is used as an option to measure the relationship between increased investment costs and savings that can be made. SIR is a method of measuring the benefit to cost ratio. That is, when the investment costs (which consist of initial acquisition costs minus disposal income) in the alternative case are greater than the base case, then the increase has compensation for the benefits achieved, namely savings. In research researchers, same initial investment. In addition, the option of using third party services in building management also does not result in savings in terms of costs so that in this study the Savings-to-Investment Ratio of each alternative cannot be determined.

Adjusted Internal Rate of Return (AIRR*)*

The calculation of the AIRR measurement is closely related to the calculation of the SIR size. In the previous discussion the researchers were unable to determine the calculation of the SIR. For this reason, AIRR measurement is irrelevant because it cannot be implemented.

Payback Period

This measure is useful for calculating the time required to recover the initial investment costs. There are two ways to calculate it, namely Simple Payback (SPB) and Discounted Payback (DPB). In LCC analysis, DPB is preferred because of the nature of LCC which also discounts costs to present value. However, as was the case with the previous SIR calculations, there were no variations in the initial investment costs carried out by researchers in this study, so that potential savings cannot be identified due to differences in initial investment. Therefore, measurement with Simple Payback (SPB) or Discounted Payback (DPB) cannot be done. Based on the analysis using the LCC formula and the supporting measures described above, the order of the alternatives that the researcher will choose is collected in Table 4.

Table 4 Order of Alternative Choices According to LCC and Supporting Measures

	Sequence/Alternative				
Size	**1**	**2**	**3**	**4**	**5**
LCC	A	E	D	C	B
NS	A	E	D	C	B
sir	-	-	-	-	-
AIRR	-	-	-	-	-
DPB	-	-	-	-	-

Table 4 shows the results of the analysis using the LCC formula as well as supporting measures to be considered as a project implementation plan. However, as mentioned in the theory of LCC analysis, decision making is closely related to certain evaluation objectives or criteria, whether the initial costs are small and the costs of operation, maintenance and other costs are slightly higher or the initial costs are slightly higher but the costs the future is a little more economical, or even the initial costs are much greater with future costs being much more economical. Selection of various technical alternatives that can provide savings at the start of construction as well as long-term savings over the useful life of the asset.

Analysis of the possibility of applying the Life-Cycle Costing method in building construction planning at PKN-STAN

From the simulation results of the LCC method in building construction planning that the author has carried out, in the following the authors describe whether the analysis methods can be compared to meet the indicators of effectiveness and efficiency, namely the ability to achieve goals, performance results as expected, and assess whether the analysis is in accordance with the provisions/regulations that apply in the context of building construction at TRISAKTI UNIVERSITY are as follows:

Ability to achieve goals.

The goals set in planning using LCC analysis can be achieved by applying LCC from the early stages of planning, with a series of preparations that are clear and easy to understand so that the desired goals of a project that is planned to be built can be explained clearly and clearly as the author has stated in simulation. With several alternative designs, it is possible to calculate the total cost of each alternative and evaluate which alternative is the most efficient. The purpose of building a building at TRISAKTI

UNIVERSITY is to provide facilities and infrastructure to support educational activities in accordance with the increasing needs of TRISAKTI UNIVERSITY for the building.

Results/performance as whichexpected.

The result of the LCC analysis is knowing which alternative is the most economical and efficient. Economical and efficient here is defined as the specified cost, obtaining the building assets that provide the best function, or conversely, obtaining the same building with the minimum expenditure. With the simulation carried out, it can be easily known which alternative is most suitable for the performance of the project to be planned to be built. At TRISAKTI UNIVERSITY, the expected result/performance is the availability of a lecture building that can support educational activities at TRISAKTI UNIVERSITY that functions optimally throughout the useful life of the building assets. In order to obtain the desired efficiency, LCC analysis helps analyze costs that may arise from several alternative planned development projects so that alternative projects can be identified which produce the lowest costs but with the same building output.[14], [15]

Process according to the provisions.

Terms which currently in force to regulate the construction of government buildings there is generally nothing against the LCC analysis method, although there are also no specific regulations governing the use of this method. The guideline for government procurement of goods/services does mention a little about a method similar to LCC analysis, namely the Economic Life Cycle Cost system, but the authors explained at the beginning of this chapter that the two methods are completely different.

TRISAKTI UNIVERSITY which implements the Service Agency Financial Management Pattern General have flexibility in managing their finances. On this occasion, the use of LCC as an analytical method in the procurement of lecture buildings at TRISAKTI UNIVERSITY helps in analyzing possible projects that can be used as alternatives in the development planning process at TRISAKTI UNIVERSITY as part of the Business Strategy Plan carried out by TRISAKTI UNIVERSITY. Application of analytical methods LCC in the selection of project alternatives will be give description thoroughly regarding the cost components that are predicted to be incurred during the useful life of the asset so that it can be properly budgeted.

4. CONCLUSION

The Life Cycle Costing (LCC) analysis method, as a calculation tool used in asset management, is a project evaluation method that will be carried out by taking into account all costs arising from ownership, operation, to write-off, all of which have a significant influence as a consideration in a decision-making process.

Applying the LCC analysis method in planning the construction of a new building at TRISAKTI UNIVERSITY, researchers found that this method can clearly describe the goals to be achieved and the performance to be produced. From the implementation of the analysis, it appears that the LCC analysis is able to provide an adequate picture in terms of cost efficiency considerations. The use of the LCC analysis method in building construction plans at TRISAKTI UNIVERSITY can be used as a comparison in evaluating projects that are no only considering the acquisition value of the building, but lifetime costs such as maintenance and upkeep costs directly attributable to the budget.

REFERENCES

[1] H. P. Barringer, “A life cycle cost summary. international conference of maintenance societies (ICOMS-2003),” *Perth. West. Aust.*, 2003.

[2] U. Trisakti, “Penjelasan Rencana Kebutuhan Barang Milik Negara UPKPB: Politeknik Keuangan Negara STAN Tahun 2016,” 2016.

[3] K. Jones and A. D. White, *RICS public sector asset management guidelines: A guide to best practice*. Royal Institution of Chartered Surveyors, 2008.

[4] A. S. Kamaludin, “ANALISIS KEMUNGKINAN PENERAPAN METODE LIFE CYCLE COSTING DALAM PERENCANAAN PENGADAAN BARANG/JASA UNTUK MENINGKATKAN EFISIENSI BIAYA (STUDI KASUS KANTOR PUSAT BADAN PENGAWASAN KEUANGAN DAN PEMBANGUNAN).” Politeknik Keuangan Negara STAN, 2016.

[5] A. P. Silva and A. A. Fernandes, “INTEGRATING LIFE CYCLE COSTING ANALYSIS INTO THE DECISION MAKING PROCESS IN NEW PRODUCT DEVELOPMENT,” in *DS 36: Proceedings DESIGN 2006, the 9th International Design Conference, Dubrovnik, Croatia*, 2006, pp. 1419–1426.

[6] M. D. Shields and S. M. Young, “Managing product life cycle costs: an organizational model,” *J. cost*

Manag., vol. 5, no. 3, pp. 39–52, 1991.
[7] S. K. Fuller and R. P. Stephen, "Life Cycle Costing Manual," *NIST Handb.*, vol. 135, 1995.
[8] R. Haribowo, H. Tannady, M. Yusuf, and G. W. Wardhana, "Analisis Peran Social Media Marketing , Kualitas Produk Dan Brand Awareness Terhadap Keputusan Pembelian Pelanggan Rumah Makan Di Jawa Barat," vol. 3, no. October, pp. 4024–4032, 2022.
[9] R. Agustina, M. Yusuf, O. S. J. Sutiyan, R. Ardianto, and N. Norvadewi, "EMPLOYEE PERFORMANCE MEDIATED QUALITY OF WORK LIFE RELATIONSHIP SATISFACTION ON THE JOB AND ORGANIZATIONAL COMMITMENT," *J. Darma Agung*, vol. 30, no. 2, pp. 589–605, 2022.
[10] W. Kurniadi, L. Natalia, A. Lotte, P. A. Cakranegara, F. Sampe, and M. Yusuf, "HANAN WEDDING PLANNER ' S MARKETING COMMUNICATION STRATEGY FOR INCREASING SALES IN THE COVID-19 PANDEMIC ERA ON THE TIKTOK APP," vol. 11, no. 03, pp. 1359–1364, 2022.
[11] S. Sutrisno, P. A. Cakranegara, F. Asri, M. Yusuf, and J. Sahala, "STRATEGY FOR MSME DEVELOPMENT USING FINANCIAL TECHNOLOGY TO INCREASE CAPITAL AND CONSUMERS," *J. Darma Agung*, vol. 30, no. 2, pp. 677–686, 2022.
[12] M. Yusuf, Z. Afifah Fitriyani, A. Abdilah, R. Ardianto, A. Suhendar, and U. Pertiwi, "THE IMPACT OF USING TOKOPEDIA ON PROFITABILITY AND CONSUMER SERVICE," *J. Darma Agung*, vol. 30, no. 2, pp. 559–573, Aug. 2022, doi: 10.46930/OJSUDA.V30I2.2273.
[13] M. Yusuf, Z. A. Fitriyani, A. Abdilah, R. Ardianto, and A. Suhendar, "THE IMPACT OF USING TOKOPEDIA ON PROFITABILITY AND CONSUMER SERVICE," *J. Darma Agung*, vol. 30, no. 2, pp. 559–573, 2022.
[14] D. G. Woodward, "Life cycle costing—Theory, information acquisition and application," *Int. J. Proj. Manag.*, vol. 15, no. 6, pp. 335–344, 1997.
[15] S. B. Yudhoyono, "PERATURAN PEMERINTAH REPUBLIK INDONESIA NOMOR 23 TAHUN 2005 TENTANG PENGELOLAAN KEUANGAN BADAN LAYANAN UMUM," 2005.