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Feasibility Analysis of Public Service Mall Development in Sungai Penuh City

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ABSTRACT

The implementation of sustainable development, as mandated by the global SDGs agenda, should be applied across various sectors, including in the context of urban development. This principle can be realized through efficient development practices, focusing on optimal land use and building efficiency. A Public Service Mall (MPP) of Sungai Penuh City intended to be constructed on an idle government-owned land in the city center. This study aims to evaluate the feasibility of establishing the MPP in Sungai Penuh City legally and physicaly and also providing technological alternatives that could optimize the total asset value. The feasibility assessment from legal and physical perspectives is conducted using the Highest And Best Use (HBU) method. Additionally, a Life Cycle Cost (LCC) analysis is performed to determine the MPP's total asset value, facilitating recommendations for optimal technology. The results indicate that constructing the MPP on idle land is feasible. The LCC analysis also suggests that implementing environmentally friendly technologies, such as Solar Power Plants (PLTS) and Rainwater Harvesting (PAH), could enhance the energy efficiency of the MPP in Sungai Penuh City.

INTRODUCTION

Government assets or also called public assets are facilities owned by the government and are needed in the administration of government. These assets must be managed properly to ensure the acquisition of benefits through the sustainability of sustainable asset operations. This can be achieved through the implementation of asset management from the planning stage. At the planning stage, strategies are formed to ensure the optimalization, effectiveness and efficiency of asset management. Strategies are developed through a series of studies and analyses that are tailored to the needs of the organization. An asset management framework for managing the public sector of organizational assets helps in achieving asset efficiency and effectiveness. This is done by increasing the efficiency of facility use, minimizing operational costs, and by knowing the highest and best use of an asset among other benefits (Ngwira & Manase, 2016). Achieving the efficiency and effectiveness of these assets can also contribute significantly to the achievement of sustainable development.

The development of an asset management framework in the public sector is essential to improve the efficiency and effectiveness of assets which ultimately contribute to sustainable development. This framework facilitates optimal utilization of facilities, reduces operational costs, and identifies the highest and best use of assets. Integration of strategic asset management practices can significantly improve public service delivery and organizational performance. Effective asset management requires coordination of life cycle management, integrating operational and business systems to improve performance and sustainability (Dwight & El-Akruti, 2009).

Governments must adopt a strategic approach to asset management, addressing barriers such as fragmentation and complexity to maximize asset value (Too, 2012). Engaging stakeholders in the asset management process is essential to align strategies with local needs and improve decision-making outcomes (Rich-Mahadkar, 2015). A comprehensive framework should also include cross-agency collaboration to ensure cohesive asset governance and management practices (Brown et al., 2014). While the benefits of an asset management framework are significant, there are challenges such as resistance to change and lack of awareness of best practices that can hinder its implementation. These issues need to be addressed so that the full potential of asset management in achieving sustainable development can be realized. The principle of sustainable development in the construction sector requires the implementation of development that is in accordance with its land use and is able to implement energy conservation throughout its life cycle. Therefore, it is necessary to conduct a feasibility study on the development plan for the Public Service Mall in Sungai Penuh City to ensure that its implementation is in accordance with the land use stipulated in the City Spatial Plan.

The HBU analysis method is used to ensure that development is in accordance with the planned land function (Susanto & Utomo, 2019). HBU analysis is widely used in optimizing vacant land, research results show that mixed-use buildings are almost always the highest and best alternative use (Putra & Makhfatih, 2014) (Utami & Utomo, 2015) (Siregar, 2017). This analysis is also often carried out side by side with LCC analysis (Utomo et al., 2017) (Manbait & Ciptono, 2017). The aim is to provide information in terms of feasibility and total costs during the asset's life cycle. LCC analysis is used to obtain information related to the total cost of ownership of an asset (Berawi et al., 2018) (Dwaikat & Ali, 2018) (Pernetti et al., 2021). This information will really help stakeholders in decision making (Korpi & Ala-Risku, 2008) (Bogenstätter, 2000) (Emekci & Tanyer, 2018). LCC analysis is also used in comparing alternative policies or alternative conventional building projects with green buildings (Orfanidou et al., 2023). With this LCC analysis, a strategy can be formed to optimize assets.

METHOD

This study aims to apply the Highest and Best Use (HBU) and Life Cycle Cost (LCC) methods in order to optimize the Public Service Mall in Sungai Penuh City. This study focuses on the legal and physical feasibility analysis and the analysis of the cost of living of the Public Service Mall. The feasibility analysis refers to the HBU concept. The main requirement that must be met by the legal aspect in the HBU analysis is that the land to be utilized must be legally permitted. The analysis will be carried out by considering the provisions and regulations in force in Sungai Penuh City in this case will refer to the RDTR and RTBL documents.

The data required from the RDTR document is zoning data or permitted use type. Furthermore, Building Code data is required which functions to determine the maximum capacity of space utilization. Building Code data includes information on Building Boundary Lines (GSB), Basic Building Coefficient (KDB), Building Floor Coefficient (KLB), and Basic Green Coefficient (KDH), which are obtained from Sungai Penuh City Regional Regulation Number 5 of 2012 concerning the Sungai Penuh City Spatial Plan for 2011-2031 and Sungai Penuh City Regional Regulation Number 5 of 2020 concerning the Sungai Penuh City Detailed Spatial Plan for 2020-2040. Physical aspect analysis is carried out by considering indicators such as land size, utilities, accessibility, and alternative designs. The data required to conduct a physical aspect analysis is obtained from the results of a field review by considering the Site Plan for the Development of the Public Service Mall obtained from the Planning Document. This physical aspect analysis is carried out to ensure that the property to be developed is in an adequate location.

Analysis of costs incurred during the life cycle of the construction of the Public Service Mall is carried out using LCC analysis. LCC analysis is carried out to estimate economic costs during the life cycle of the Public Service Mall. The variables used as references in calculating LCC include Initial Costs, Operating Costs, Maintenance/Replacement Costs, and Demolition Costs. The method used in this LCC analysis is the current value (Present Value) in the reference year or base year with the basis for measuring costs using constant dollars. Constant dollars are adjustments to the value of money used to compare the value of money from one period to another, where the value of money is considered unaffected by changes in time. Sensitivity Analysis will be carried out to identify LCC parameters that are sensitive to changes, so that steps can be taken to optimize the building.

RESULT

Legal aspect eligibility Study

Based on Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2012 Tentang Rencana Tata Ruang Wilayah Kota Sungai Penuh Tahun 2011-2031, it is known that the Former Minum Kawo Square of Sungai Penuh City is located in the goods/services trade zone. This is reinforced by Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2020 Tentang Rencana Detail Tata Ruang Kota Sungai Penuh Tahun 2020-2040 and the Building and Environmental Planning Plan for the Sub BWP City Center. Based on the Sungai Penuh City RDTR Spatial Pattern Map, the Former Minum Kawo Square of Sungai Penuh City is located in Block 31 and is included in the Trade and Services Zone - City-Scale Trade and Services Sub Zone (K1). Referring to the ITBX Table of Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2020, office and banking activities are types of activities that are permitted in the K1 zone. So it can be concluded that the construction of the Public Service Mall does not violate legal zoning provisions and is feasible to be implemented on the Former Minum Kawo Square of Sungai Penuh City as assessed from the provisions of its land use. Development in accordance with legal zoning provisions is needed to control land use and development.

The Building Code of the Public Service Mall consists of Building Boundary Line (GSB), Basic Building Coefficient (KDB), Building Floor Coefficient (KLB), Basic Green Coefficient (KDH) and Building Height. The GSB of the Public Service Mall will refer to the Building Regulation Provisions of Regional Regulation in Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2020 for the Trade and Services category (K1) while the KDB, KLB, KDH and Maximum Building Height will refer to the Intensity of Space Utilization of Regional

Regulation in Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2020. Based on the results of measurements in the field, it is known that the Former Minum Kawo Square of Sungai Penuh City has an area of 2,925.28 m^2 where the length of each side is 57.4 m x 51.55 m x 56.71 m x 50.64 m. On this land, a Public Service Mall will be built consisting of 2 floors where Floor 1 has an area of 1,144 m^2 (26 m x 44 m) and Floor 2 is 880 m2 (20 m x 44 m). This size will be the basis for conducting GSB, KDB, KLB and KDH analysis.

Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2016 concerning Building Construction, the Building Boundary Line (GSB) is an imaginary line on a plot or site that indicates the minimum limit for building construction. This line is calculated from the squroad boundary line, river bank, beach edge, high voltage network, or plot/site boundary. Thus, GSB is the outermost boundary permitted by the government to construct buildings. Fulfillment of GSB provisions is expected to create orderly and orderly city conditions. Based on the measurement results, the outermost distance of the Sungai Penuh City MPP building to the land boundary is 4.9 meters (rear side), 3.97 meters (left side), 3.6 meters (right side), and 25.88 meters (front side). Thus it can be concluded that the construction of this Public Service Mall has fulfilled the established GSB provisions.

Basic Building Coefficient (KDB) is defined as the percentage comparison between the total area of the ground floor of a building and the area of land/land controlled, which of course is adjusted to the spatial plan and building and environmental plan. This means that KDB regulates the maximum area of the ground floor of a building to the land. The KDB of the Sungai Penuh City Public Service Mall is 39.11%. This KDB value is smaller than the maximum limit required, which is 75%. The Building Floor Coefficient (KLB) is the percentage comparison between the total area of a building and the area of land or planning area controlled in accordance with the City's RTBL document. In simple terms, KLB describes the comparison between the total area of a building and the area of land. This KLB determines the maximum limit of the building area that can be built on a plot of land. The KLB of the Sungai Penuh City Public Service Mall is 0.69 with the maximum limit required being 3.0.

The Green Area Coefficient, hereinafter abbreviated as KDH, is a percentage comparison between the total area of open space outside the Building that is designated for parks/greening and the area of plotted land/planning area controlled according to the spatial plan and building and environmental plan (Regulation of Sungai Penuh City in Peraturan Daerah Kota Sungai Penuh Nomor 5 Tahun 2016). The KDB of the Sungai Penuh City Public Service Mall is 60.89%. This KDH value has exceeded the minimum KDH limit required in the K1 zone, which is 10%. According to Selamat et al. (2022) there is a high need for public green open spaces for the community. This can certainly be achieved by implementing KDH.

Based on the results of the GSB, KDB, KLB and KDH analysis that has been carried out, it can be concluded that the planning for the Development of the Public Service Mall on the Former Minum Kawo Square of Sungai Penuh City has met the applicable provisions. The implementation of development that has been adjusted to the applicable Building Code will produce an orderly and neat city layout. The building code was formed with the aim of providing minimum limits to ensure the safety, quality and efficiency of buildings. The implementation of development that complies with the applicable building code is also very important to create an orderly and neat city layout. Building codes are designed to set minimum standards that ensure safety, quality and efficiency in construction that directly affects the urban environment. Building regulations shape the physical form and pattern of a city, thus affecting its character and functionality. A new framework developed to enhance urban identity and address local needs shows the importance of context-specific regulations (Samir et al., 2019). Effective implementation of the Building Code significantly reduces the risk of loss by up to 72% (Czajkowski et al., 2017). Building Code implementation is crucial in disaster risk reduction especially in earthquake prone areas, where vulnerable buildings pose significant risks (Guragain et al., 2018). Building Code also serves as a determinant of health, influencing safety and well-being in various types of buildings, from homes to health care facilities (Chauvin et al., 2016). Conversely, rigid application of Building Code sometimes ignores local conditions leading to a disconnect between regulations and community needs (Ya-Hui, 2005).

Physically aspects eligibility study

Based on the analysis of physical aspects that have been carried out, it can be concluded that the Former Minum Kawo Square of Sungai Penuh City is located in a strategic location, namely in the city center and close to the center of trade and service activities. The construction of a Public Service Mall on this land will greatly support the smooth running of public services, considering that the city government offices are not yet centralized in one location. With the presence of a Public Service Mall at this location, the public will find it easier to access information and services, especially licensing services. The MPP located in the city center facilitates easier access for residents to various public services, reducing travel time and costs (Afifah et al., 2024). In addition, the centralized location of the Public Service Mall is also very helpful in reducing CO concentrations in Sungai Penuh City. This is because the more vehicle activity in a location, the higher the concentration of pollutants (Muhammad et al., 2022).

Life Cycle Cost (LCC) Analysis

The LCC costs to be calculated from this Public Service Mall consist of initial costs, operational costs, maintenance and replacement costs, and demolition costs. LCC analysis will be carried out on the planning of the Sungai Penuh City Public Service Mall with the reference year of the research being in June 2022 when the planning document for this Public Service Mall was prepared. The service life of this Public Service Mall Building follows Peraturan Pemerintah Nomor 16 Tahun 2021, which is 50 years with a study period of 50 years. The discount rate used is the real discount rate. The real discount rate obtained is 3.3%.

The LCC of Public Service Mall is obtained by adding up the Present Value of investment costs, operating costs, maintenance and replacement costs, and demolition costs. The total LCC of the Public Service Mall of Sungai Penuh City can be seen in Table 1.

Table 1 Total *Life Cycle Cost* (LCC)

No.	Cost Description	PV
1	initial costs	21.261.434.000,00
2	operational costs	5.307.156.339,00
3	maintenance and replacement costs	11.008.087.826,29
4	demolition costs	419.349.835,17
	Total	37.996.028.000,45

Based on table 1, it is known that the total LCC of the Sungai Penuh City Public Service Mall is IDR 37,996,028,000, - with the initial cost as the largest percentage of the LCC of the Sungai Penuh City Public Service Mall followed by maintenance and replacement costs. In the initial cost, there is a construction cost component in the procurement of the Sungai Penuh City Public Service Mall, while in the maintenance and replacement costs there are costs required to maintain the physical reliability of the building so that it remains functional during its planned life. The same results were also obtained by Petrovi´c, et al. (2021) where the results of a study conducted on residential houses in Sweden showed that the initial cost in the form of construction costs was the largest cost of the total LCC followed by labor costs. In the operational cost category, maintenance and replacement costs obtained the largest percentage of the total LCC followed by energy consumption costs. The LCC Percentage Diagram of the Public Service Mall can be seen in Figure 1.

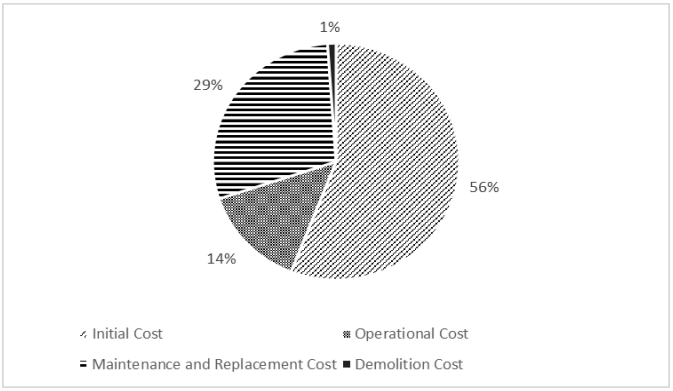

Figure 1 Public Service Mall LCC Percentage Diagram

LCC analysis represents the calculation and estimation of costs that will be incurred in the future so that it contains a lot of uncertainty. According to Petrovi´c, et al. (2021), one way to reduce uncertainty is to investigate various alternatives. This step is expected to reduce the risk of assessment. Therefore, secondary analysis needs to be carried out to test various parameters and investigate various alternative changes that exist.

Sensitivity analysis

Sensitivity analysis is a method used to test the impact of changes caused by uncertainty on the entire system. Sensitivity analysis is often referred to as a secondary analysis for LCC analysis (Mowbray et al., 2022). By conducting a sensitivity analysis, additional information can be identified that is needed to obtain the most significant assumptions that are sources of uncertainty (such as discount values, design life, maintenance and replacement, etc.). This analysis is also carried out to determine the flexibility of a variable or variables that really need to be considered in an LCC analysis period (Salvado et al., 2018). In addition, due to the nature of economic parameters that are difficult to predict, sensitivity analysis is generally used to reduce the risk of LCC assessment (Petrovi´c, et al., 2021).

Sensitivity analysis will be applied to each parameter of the Public Service Mall LCC with the aim of determining the parameters of the Public Service Mall LCC that are susceptible to change. The LCC parameters that will be analyzed through sensitivity analysis are Initial Cost, Operating Cost, Maintenance and Replacement Cost, Demolition Cost, i value or discount value, design life, and durability of the Public Service Mall components. According to Morris et al. (2014), sensitivity analysis will be more informative if there are a number of different assumptions. So this sensitivity analysis will be carried out by providing changes to the LCC parameters in the form of adding variables of x% with a range of 5% where the change variables will be given starting from -25% to +25%. The results of the sensitivity analysis can be seen in Figure 2.

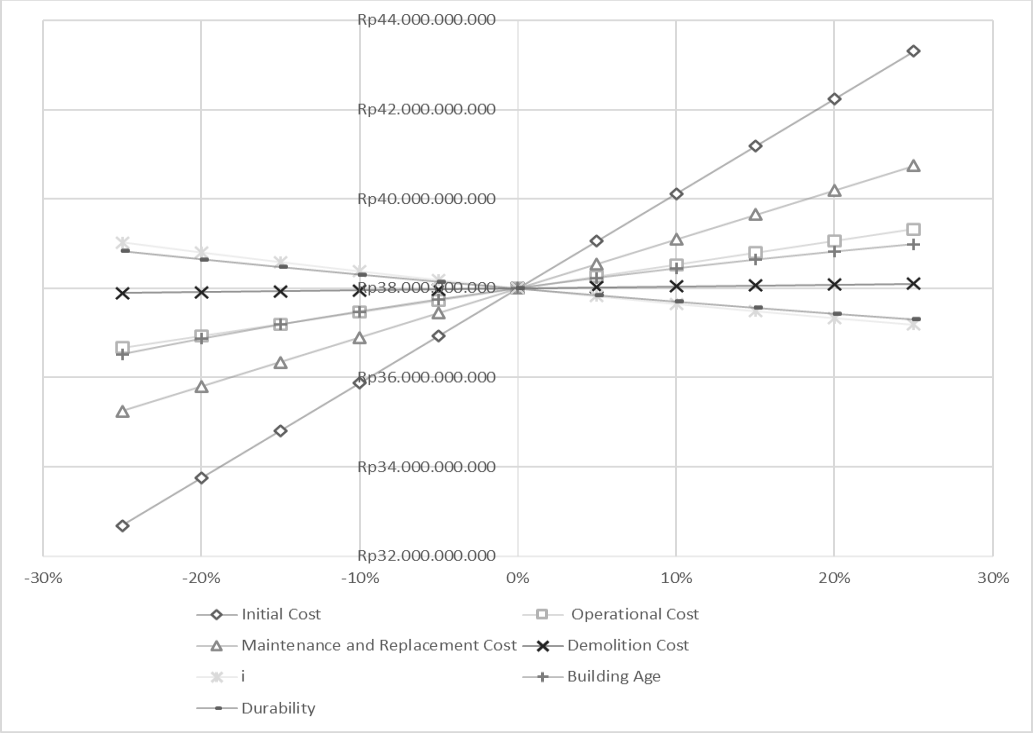

Figure 2 LCC Sensitivity Analysis Diagram of Public Service Mall

Based on the Sensitivity Analysis Diagram of the LCC of the Public Service Mall in Sungai Penuh City, it can be seen that the three parameters that are most susceptible to change are Initial Cost, Maintenance and Replacement Cost, and Operating Cost. Meanwhile, the Demolition Cost does not have a significant effect on the total LCC of the Public Service Mall. When viewed from the Total LCC of the Public Service Mall (Table 1), it is known that the Initial Cost, Maintenance and Replacement Cost and Operating Cost are the three elements that have the largest percentage of the Total LCC of the Public Service Mall, namely 56%, 29% and 14%. Building maintenance costs are calculated at 10% of the Initial Cost so it can be concluded that the Initial Cost and Maintenance and Replacement Cost are interrelated. Initial Cost consists of Planning Cost, Construction Cost and Supervision Cost. Maintenance and Replacement Cost consists of Building Maintenance Cost and Component Replacement Cost. While Operating Cost consists of Water Cost and Electricity Cost.

DISCUSSION

The building design of the Sungai Penuh City Public Service Mall has met several characteristics of green construction but has not maximized the potential of existing resources. Judging from its planning documents, the Public Service Mall has been planned to use environmentally friendly electrical components and use local materials. However, the principle of energy saving has not been optimally planned in this Public Service Mall. Energy saving is part of the principle of sustainable development that not only has a positive impact on the environment but also on the quality of the building itself. The results of the sensitivity analysis show that energy consumption costs contribute greatly to the total LCC of the Public Service Mall. The energy consumption costs of this Public Service Mall consist of electricity needs and water needs. Reducing electricity needs can be reduced through the application of renewable energy sources such as Rooftop Solar Power Plants, while reducing water needs can be done through the application of PAH systems and water pressure regulation. Rooftop Solar Power Plants are an alternative renewable energy source that currently receives full support from the government. Based on ESDM Regulation Number 49 of 2018, 100% of the maximum capacity of Rooftop Solar Power Plants is 100%

of the customer's connected power. This means that with a connected power of 11,000 VA or 8,800 Watts, the Public Service Mall will require a Rooftop PLTS with a capacity of 8.8 kWp.

The recommended Rooftop PLTS is a Rooftop PLTS with an on-grid system connected to the PLN distribution network. This system was chosen because there are no office activities at night so that nighttime energy needs are sufficient to be taken from the PLN distribution network. The Rooftop PLTS package with a capacity of 10 kWp can be obtained at a price of IDR 255,000,000 to IDR 289,000,000. On average, PLTS can maintain its efficiency for 25 to 30 years (Chowdhury et al., 2020; Okorieimoh et al., 2020). The installation of Rooftop PLTS is expected to reduce the daytime energy needs of the Public Service Mall. The existence of a reciprocal scheme offered by ESDM Regulation Number 49 of 2018 provides benefits where the energy produced by the Rooftop PLTS will reduce PLN bills by 65%. Alternative energy for water sources can be obtained through the dual system PAH. This system utilizes rainwater that has been collected for water needs such as toilet flushing. The Public Service Mall is planned to have 2 tanks with a capacity of 1000 liters which are used to collect water from PDAM. Assuming 1 tank is used as a rainwater collection tank, it is estimated that the cost of water needs can be saved up to 50%. Another step that can be used for water conservation is to regulate water pressure and recycle grey water. With the regulation of water pressure and recycle grey water on the plumbing components, water consumption can be reduced according to its needs. The application of renewable energy will reduce the carbon footprint generated by activities in a building (Herawati et al., 2024). Comparison of Total LCC with the use of renewable energy sources (EBT) in the form of Rooftop PLTS and PAH Systems can be seen in Table 2.

Table 2 Comparison of Total LCC with the Use of New and Renewable Energy (EBT)

No.	Uraian Biaya	MPP	MPP + EBT
1	Initial Cost	21.261.434.000	21.550.434
	Planning Fees	301.200.000	301.200.000
	Supervision Fee	840.234.000	840.234.000
	Development Cost		
	a. Budget Plan	20.120.000.000	20.120.000.000
	b. Rooftop PLTS	-	289.000.000
2	Operational Cost	5.307.156.339	3.433.713.085
	a. Electricity	5.200.899.441	3.380.584.636
	b. Water	106.256.898	53.128.449
3	Maintenance and Replacement Cost	11.008.087.826	11.136.436.032
	a. Maintenance	6.705.977.933	6.705.977.933
	b. Replacement	4.302.109.893	4.430.458.100
4	Demolition Costs	419.349.835	419.349.835
	Total	**37.996.028.000**	**36.539.932.953**

The calculation results show that the use of renewable energy sources in the form of Rooftop PLTS and dual system PAH can help reduce the total LCC value by 3.83%. The use of this renewable energy source requires higher investment costs or initial costs but results in lower operating costs. Based on the LCC comparison graph, it can be seen that operating costs have experienced a significant reduction of 35.30%. This finding supports the theory of Orfanidou, et al. (2023), Chai & Li (2018), Hoznik & Ruzzier (2016) and Tjenggoro & Prasetyo (2018) where the use of green products requires higher investment costs compared to conventional products. However, in return it generates benefits through efficient use of energy so that it can reduce operating costs which is in line with the theory of Cherrafi et al. (2018) and Hermundsdottir & Aspelund (2020).

CONCLUSION

Sungai Penuh City which, almost of all, is Kerinci Seblat National Park (TNKS), leaves only 9.5% of the effective urban area. This condition certainly forces the Regional Government to be able to develop the city as well as possible while still implementing the principles of sustainable development. One of the steps taken by the Regional Government of Sungai Penuh City is to re-utilize idle land into a Public Service Mall. This is the background to writing this research.

This study aims to determine the feasibility of building a Public Service Mall from a legal and physical perspective. This feasibility analysis is important because in the principle of sustainable development, land use must be carried out in accordance with its function. In addition, this study was also conducted to determine the total ownership during the planned life of the Public Service Mall through LCC analysis. By conducting this analysis, recommendations for strategies for optimizing the Public Service Mall can be provided.

The results of the study indicate that the Public Service Mall of Sungai Penuh City has met the required legal and physical feasibility indicators so that it is considered feasible to be established on the Former Minum Kawo Square of Sungai Penuh City. The research findings show that the application of renewable energy sources requires a higher investment cost but provides a return in the form of a significant reduction in operational costs or energy needs. The strategy that can be conducted is by implementing renewable energy sources in the form of Rooftop PLTS and dual system PAH.

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