Analysis of financial feasibility installing parking meters in Gianyar Regency (case study: Jalan Ngurah Rai – Gianyar)

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Abstract: The increase in the number of motorized vehicles in Gianyar Regency has an impact on parking needs, as is the case on Jalan Ngurah Rai, Gianyar Regency. The data used in this research includes primary data obtained through parking inventory surveys, parking patrol surveys, and secondary data in the form of parking PD income data, parking meter price data, obtained from the Gianyar Regency Transportation Service. Parking characteristics for motorcycles are: parking inventory 95 SRP, parking volume in the 14-hour survey was 2147 vehicles, parking duration was 0.9318 hours, the parking capacity is 102 vehicles/hour, the parking provision is 1356 vehicles, and the parking index is 1,148. Parking characteristics for light vehicles are: parking inventory 88 SRP, parking volume in the 14-hour survey was 837 vehicles, parking duration was 1.0182 hours, the parking capacity is 85 vehicles/hour, the parking provision is 1128 vehicles, and the parking index is 0.92. The financial feasibility analysis for scenario 1 (fixed rate LV= 2000/one parking, MC= 1000/one parking) it is obtained that NPV = 3,153,280,747 > 0, BCR = 1,634 > 1, and IRR = 51% > MARR= 20%. For scenario 2 (fixed parking rate, LV=3000/hour, MC= 2000/hour) we get NPV = 8,998,418,237 > 0, BCR = 2,810 > 1, and IRR = 136%> MARR= 20%. For scenario 3 (fixed parking rate, first hour LV= 3000, MC= 2000, 1 hour later increase in LV= 2000/hour, MC= 1000/hour) obtained NPV = 11,625,402,449 > 0, BCR= 3,338 > 1, and IRR= 174%> MARR= 20%.

Keywords: financial feasibility, parking characteristics, parking meters

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Introduction

Currently, most parking payment systems are still carried out conventionally. Conventional parking payments are made by paying the parking attendant using a ticket [1]. Income from the parking sector contributes to Regional Original Income (PAD), but there is a leak in the conventional system and will affecting Regional Original Income [2]. On the other hand, one of the causes. The high number of leaks that occur is due to an unorganized parking system [3]. New policies regarding more efficient parking management solutions need to be implemented, one of them is by implementing an Electronic Parking Terminal (TPE) system [4].

With the development of technology, parking problems can be overcome with the use of the Electronic Parking Terminal [5]. Use of Parking Terminal Electronics must be carried out based on local regional regulations for determine which roads or areas the Parking Terminal will be implemented on Electronic [6]. In regional regulations must also be formulated the amount of fines for violations of parking provisions [7]. Key to success the use of Electronic Parking Terminals is a law enforcement application strict against parking violations [8]. In Indonesia, electronic parking terminals already exist used in roadside parking areas in Jakarta, Bandung, Bali and Palembang [9].

Jalan Ngurah Rai in Gianyar Regency is very close to the center Shopping [10]. The many shops on Jalan Ngurah Rai create attraction travel that affects parking on Jalan Ngurah Rai [11].

Jalan Ngurah Rai is one of the roads with the highest parking revenue in the City Gianyar, so there is potential for implementing an Electronic Parking Terminal [12].

To overcome this parking problem as a first step is needed there is a study regarding parking [13]. Therefore, a study is needed regarding Analysis of Parking Characteristics and Financial Feasibility of Implementation Electronic Parking Terminal on Jalan Ngurah Rai, Gianyar Regency.

Methodology

The research steps were carried out in stages including preliminary studies, identification of problems and determination of research objectives, literature study, data collection including primary data including: parking inventory survey data on the number of parking facilities available [14]. Parking spaces with a standard SRP size of 2.5 x 5 m for light vehicles and 0.75 x 2 m for motorcycles and parking patrol surveys can obtain data regarding parking characteristics, including: number of parked vehicles (parking volume), parking accumulation, and vehicle parking time, and secondary data includes: Data Parking rates are obtained from the Gianyar Regency Regional Government [15]. Prices for parking meters are obtained from the Gianyar Regency Transportation Service. The cost of installing CCTV cameras was obtained from installation data by the Gianyar Regency Transportation Service in 2018. The 2018 Gianyar Regency UMK level was used to determine the salary of parking attendants, with a 2 shift system. Inflation rate for the last 7 years from BPS [16]. The growth rate of the population aged 17-75 years obtained from BPS is used to predict the increase in vehicle parking volume. The loan interest rate is obtained from the reference interest rate from Bank Indonesia. Parking meter network system in Gianyar Regency. The applicable Tabanan Regency Parking Rates are in accordance with the Gianyar Regency Regional Regulations.

Results and Discussions

Parking Characteristics Analysis

The existing parking system on Jalan Ngurah Rai-Gianyar is a roadside parking system. Parking spaces on Jalan Ngurah Rai-Gianyar are divided into parking spaces for motorcycles and light vehicles. The results of the parking inventory survey can be seen in Table 1.

Table 1. Parking inventory on Jalan Ngurah Rai-Gianyar

No	Type of Vehicle	Length (m)	Parking Angle Degree (°)	Plot Size (m²)	Plot Estimate
1	Light Vehicles	35	90	-	14
2	Light Vehicles	185	45	-	74
3	Motorcycles	71.25	45	-	95

Based on Table 1 the number of parking lots on Jalan Ngurah Rai - Gianyar is obtained from the number of light vehicles when the special light vehicle parking space is fully filled, namely 14 SRP in length 35 m road with a parking angle of 90 degree, and for a parking angle of 45 degree as much as 74 SRP with a road length of 185 m. The number of motorcycles parking lots is 95 with a road length of 71.25 m with a parking angle of 45 degree. In this parking space there are no lines/markings for parking spaces for motorcycles, therefore the number of parking lots is obtained when the parking space is fully occupied by parked vehicles.

Parking Volume

From the survey results, it can be seen that the total volume of vehicles parked during the 10 hours of observation of the Jalan Ngurah Rai - Gianyar section is as shown in Table 2.

Table 2. Volume of parked vehicles

No	Type of Vehicle	Total Vehicle Volume during the Survey (vehicles)	Average Volume (vehicles/hour)
1	Light Vehicles	837	59
2	Motorcycles	2147	153

From Table 2 it can be seen that the total volume of light vehicles parked on the Jalan Ngurah Rai - Gianyar section is 837 vehicles with the average vehicle parked every hour being 59 vehicles/hour. Meanwhile, the total volume of motorcycles parked is 2147 vehicles with the average vehicle parked every hour being 153 vehicles/hour.

Parking Accumulation

From the survey results, it can be seen the accumulation of vehicles parked every 1 hour. The highest accumulation at each survey time can be seen in Table 3.

Table 3. Parking accumulation

No	Type of Vehicle	Times (hours)	Accumulation (vehicles/hour)
1	Light Vehicles	13.00 – 14.00	78
2	Motorcycles	19.00 – 20.00	117

Table 3 can be seen that the highest accumulation on Jalan Ngurah Rai - Gianyar for light vehicles at 13.00 – 14.00 WITA is 78 vehicles. The highest accumulation of motorcycles occurred at 19.00 – 20.00 WITA amounting to 117 vehicles.

Parking Duration

From the results of the survey that has been carried out, the average parking time can be analyzed. Average Parking Time can be seen in Table 4.

Table 4. Parking duration

No	Type of Vehicle	Average Parking Duration (hours)
1	Light Vehicles	1.0376
2	Motorcycles	0.9318

Based on Table 4, the average parking duration during the 14 hours survey period was 0.9318 hours for motorcycles and 1.0376 hours for light vehicles.

Parking Time Distribution

The distribution of parking time for light vehicles on Jalan Ngurah Rai - Gianyar is determined by the largest percentage for the duration parking for 0 – 1 hour is 77.4% and motorcycles for 0 – 1 hour namely 85.7%.

Table 5. Parking time distribution

Parking Time (hours)	Parking Time Distribution	
	Light Vehicles	**Motorcycles**
1	77.4	85.70
2	15.89	6.80
3	2.63	2
4	0.84	1.35
5	0.60	1.07
6	0.60	0.88
7	0.36	0.28
8	0.12	0.37
9	0.12	0.14
10	0.12	0.23
11	0.36	0.28
12	0.6	0.28
13	0.12	0.23
14	0.24	0.37

From Table 5, it can be seen that vehicles parked on Jalan Ngurah Rai - Gianyar are parked within a period of 14 hours.

Parking Turnover

From the survey results, the parking turnover rate can be found using the Parking Turnover Rate formula. In Table 6 are the results of calculating the parking turnover rate.

Table 6. Parking turnover

Type of Vehicle	Number of Vehicles (Nt)	Number of Plots (S)	Survey Time (T)	Parking Turnover Rate (TR=Nt/(S*T))
	vehicles	vehicles	hours	hours
Light Vehicles	837	88	14	0.672
Motorcycles	2147	95	14	1.614

From Table 6 it can be seen that the level of parking turnover on the road section Ngurah Rai-Gianyar for light vehicles is 0.672 hours and the motorcycles parking turnover rate is 1.614 hours, which means that every hour 1 (one) plot serves more than 1 (one) vehicle.

Parking Capacity

From the survey and data analysis, the parking capacity at the survey location was obtained as shown in Table 7.

Table 7. Parking capacity

Type of Vehicle	Number of Plots (S)	Average Parking Duration (D)	Parking Capacity (KP=S/D)
	vehicles	hours	vehicles/hours
Light Vehicles	88	1.0376	85
Motorcycles	95	0.9318	102

From Table 7 above you can see the parking capacity on Jalan Ngurah Rai - Gianyar can accommodate 85 vehicles/hour for light vehicles and 102 vehicles/hour for motorcycles.

Parking Supply

From Table 8 you can see the results of the analysis of the amount of parking space provision during the 10 hour survey.

Table 8. Parking supply

Type of Vehicle	Survey Time (T)	Average Parking Time (D)	Number of Plots (S)	Insuffiency Factor (f)	Parking Supply Ps = $\frac{(S*T*f)}{D}$
	hours	hours	vehicles		vehicles
Light Vehicles	14	1.0376	88	0.95	1,128
Motorcycles	14	0.9318	95	0.95	1,356

From Table 8 it can be seen that the parking supply on Jalan Ngurah Rai - Gianyar during the 14 hours survey for light vehicles was 1,128 vehicles and motorcycles amounting to 1,356 vehicles.

Parking Index

The following is the highest parking index for motorcycles and light vehicles in Table 9.

Table 9. Parking index

Type of Vehicle	Times	Parking Accumulation	Parking Capacity	Parking Index
Light Vehicles	13.00-14.00	78	85	0.920
Motorcycles	19.00-20.00	117	102	1.148

From Table 9 above, it can be seen that parking conditions based on peak accumulation on Jalan Ngurah Rai - Gianyar for motorcycles have a parking index of more than 1 (one). This shows that the need for parking spaces at peak conditions exceeds the existing parking capacity. So parking capacity cannot accommodate parking demand during peak hours. Meanwhile, light vehicles have a parking index of less than 1 (one). This shows that there is no need for parking spaces at peak conditions exceeds existing parking capacity. So the parking capacity can accommodate parking demand during peak hours.

Parking Revenue

Revenue is obtained by multiplying the parking fee by the volume of vehicles parked in a certain time period. Created 3 parking rate scenarios that will be used in installing parking meters.
1 Alternative 1 obtains an average annual parking income of IDR 1,092,733,755.-
2 Alternative 2 obtains an average annual parking income of IDR 1,878,488,872.-
3 Alternative 3 obtains an average annual parking income of IDR 2,256,742,579.-

Investment Costs

The costs incurred in installing parking meters are classified into three, namely Initial Investment Costs with a Sub Total of IDR 952,058,920, Operational Costs with a Sub Total of IDR 505,120,000, and Maintenance Costs with a Sub Total of IDR 160,799,928.

Financial Feasibility Analysis

Financial feasibility analysis is carried out with the aim of evaluating financial feasibility. The methods used are NPV, BCR, and IRR. The results of the financial feasibility analysis can be seen in Table 10.

To find NPV, BCR, and IRR, use the equation:

$$BCR = \frac{PWB}{PWC} \tag{1}$$

$$NPV = PWB - PWC \tag{2}$$

IRR is determined by comparing the IRR value with MARR. In this study, the MARR value was determined at 20% per year. For MARR. In this study, the MARR value was determined at 20% per year. For to calculate the IRR value using the try method to calculate the IRR value using the Try and error method.

Table 10. Financial feasibility of all three alternatives

	Alternative 1	**Alternative 2**	**Alternative 3**
NPV	Rp 3,153,280,747	Rp 8,998,418,237	Rp 11,625,402,449
BCR	1.634	2.81	3.34
IRR	51%	136%	174%

Payback Period Method

All alternatives get decent analysis results. So for alternative 1 the payback period is 2 years in 2021, for alternative 2 the payback period is 1 year in 2020, and alternative 3 the payback period is less than 1 year in 2020. This means in those years there has been a return on investment capital.

Sensitivity Analysis

Sensitivity analysis on the installation of parking meters on Jalan Ngurah Rai-Gianyar was carried out by analyzing the sensitivity of benefits and costs, with three (3) sensitivity scenarios, namely: (1) With fixed benefits and increasing costs. (2) With decreasing benefits and increasing costs. (3) With decreasing benefits and increasing costs. Based on the sensitivity analysis calculations that have been carried out, the sensitivity analysis results are obtained in Table 11.

Table 11. Sensitivity analysis of the three scenarios

Scenario	Description	
	Benefit	**Cost**
1	Still	Go on 38%
	Down 29%	Still
	Down 16%	Go on 16%
2	Still	Go on 140%
	Down 58%	Still
	Down 41%	Go on 41%
3	Still	Go on 180%
	Down 65%	Still
	Down 48%	Go on 48%

Conclusion

From the results of calculations and analysis it can be concluded as follows: Parking Characteristics; For light vehicles, the total number of stalls obtained was 14 vehicles at an angle of 90 degrees, and 74 vehicles at an angle of 45 degrees, the parking volume during the 10 hour survey was 837 vehicles, the average accumulation of parking was 78 vehicles/hour, the duration of parking was 1.036 hours, parking turnover of 0.672 hours, parking capacity of 85 vehicles/hour, parking supply of 1128 vehicles, and parking index of 1.148. For motorcycles, the total number of stalls was found to be 95 vehicles at an angle of 45 degrees, the parking volume during the 10 hours survey obtained a parking volume of 153 vehicles, the average accumulated parking was 117 vehicles/hour, the parking duration was 0.9318 hours, parking turnover was 1.614 hours, parking capacity was 102 vehicles/hour, parking supply was 1356 vehicles, and the parking index was 0.920. Financial Feasibility of installing parking meters; Of the three parking rate alternatives that have been analyzed, the three parking rate alternatives meet the requirements for investment worth implementing, namely NPV > 0, BCR > 1, and IRR > interest rate. For the payback period, the payback period for scenario 1 is 2 years in 2021, for scenario 2 the payback period is 1 year in 2020, and for scenario 3 the payback period is less than 1 year in 2020. Sensitivity Analysis: Based on the sensitivity analysis calculations that have been carried out, the following sensitivity analysis results are obtained; For the sensitivity of scenario 1, with investment costs rising up to 38% and fixed income the investment is categorized as not feasible. Thus, with income decreasing by 29% and investment costs remaining the same, and with income decreasing by 16% and investment costs increasing by 16%, the investment is categorized as not feasible. This is because NPV < 1, BCR < 0, and IRR < interest rate. For the sensitivity of scenario 2, with investment costs rising up to 140% and fixed income the investment is categorized as not feasible. Thus, with income decreasing by 58% and investment costs remaining the same, and with income decreasing by 41% and investment costs increasing by 41%, the investment is categorized as not feasible. This is because NPV < 1, BCR < 0, and IRR < interest rate. For the sensitivity of scenario 3, with investment costs rising up to 180% and fixed income the investment is categorized as not feasible. Thus, with income decreasing by 65% and investment costs remaining the same, and with income decreasing by 48% and investment costs increasing by 48%, the investment is categorized as not feasible. This is because NPV < 1, BCR < 0, and IRR < interest rate.

Acknowledgments

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