

Ferry Tariff Adjustment Strategy for the Tanjung Serdang–Batulicin Strategic Route: Integrating Vehicle Operating Costs and User Psychological Thresholds

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ABSTRACT

Ferry transportation on the Tanjung Serdang–Batulicin route serves as a strategic logistical infrastructure, connecting Laut Island with the mainland of Kalimantan. Fluctuations in operational expenditures in the maritime sector require an adaptive tariff structure to ensure service sustainability while maintaining user affordability. This study aims to evaluate tariff feasibility by integrating analyses of Vehicle Operating Cost (VOC) and Willingness to Pay (WTP). Utilizing a quantitative descriptive method, data were gathered from 250 respondents through primary surveys and technical operational observations of the KMP Kerapu III fleet. The analytical results reveal that VOC-based tariffs are significantly higher than the current prevailing rates across all vehicle categories. Conversely, the average user WTP is consistently lower than the VOC values, indicating a substantial gap between service production costs and the public's payment threshold. Negative perceptions of port facility quality and wait-time efficiency predominantly drive this low WTP. This research recommends that tariff adjustment policies be integrated with the enhancement of Minimum Service Standards (MSS) as a strategic instrument to shift the users' psychological thresholds (WTP) toward the operational economic value.

Keywords: *Tariff Adjustment; VOC; Willingness to Pay; Ferry Transportation.*

1. Introduction

Ferry transportation represents a strategic sector that integrates socio-economic activities, particularly within archipelagic nations such as Indonesia [20], [21]. Serving as a logistical lifeline, ferry services facilitate not only passenger mobility but also ensure the seamless distribution of commodities across regions separated by water [9], [14]. On the Tanjung Serdang–Batulicin route, the sustainability of this service is paramount, as it serves as a vital artery for the supply of basic necessities and energy to the Kotabaru Regency [13], [21]. Nevertheless, the effectiveness of these operations is highly contingent upon tariff-setting policies that can balance the interests of both operators and service users [12].

The fundamental challenge arises when escalating operational costs, driven by economic dynamics, are not met with proportional tariff adjustments [2], [4]. Conversely, excessively high tariffs often face public resistance, as they are perceived to be incongruent with the quality of service provided, including facility conditions and waiting times [5], [22]. Technically, a comprehensive tariff evaluation requires integrating Vehicle Operating Cost (VOC) analysis to map the actual financial burden on service providers [6] and the Willingness to Pay (WTP) approach to measure the threshold of public readiness to fund the service [11], [15].

Despite extensive research on tariff structures, a research gap persists regarding this strategic route, specifically regarding the discrepancy between the economic costs operators incur and the perceived value users place on it [16]. Frequently, even when the public possesses the economic capacity, their Willingness to Pay (WTP) remains low due to substandard minimum service levels

[8], [10]. This situation raises critical questions regarding the actual VOC values compared to existing tariffs, as well as the WTP thresholds influenced by service quality. Furthermore, it is essential to identify a fair policy equilibrium that maintains business viability for operators while respecting the purchasing power of service users [16], [20]. Consequently, this study aims to evaluate tariff feasibility by comparing VOC and WTP to determine an equitable policy compromise. The findings are expected to serve as a reference for adaptive tariff management across strategic crossing routes in South Kalimantan [18], [20].

2. Materials and Methods

This study employs a quantitative approach by integrating primary and secondary data. Primary data were collected by distributing questionnaires to 250 respondents, a sample size determined using the Isaac & Michael sampling technique with a 10% margin of error. Secondary data, comprising technical specifications of the vessel (KMP Kerapu III), annual operational expenditures, and passenger manifest records, were obtained from the vessel operators and relevant authorities.

The data analysis was conducted comprehensively through two primary stages:

1. VOC Analysis: In accordance with Ministerial Regulation (PM) No. 66 of 2019, the Vehicle Operating Cost (VOC) was calculated by dividing the total operational costs by the Number of Production Units (PU) to determine the base cost per mile or per route.
2. WTP Analysis: This was calculated based on the mean Willingness to Pay (WTP) values across service user categories. This analysis aims to identify the acceptable tariff threshold from the public's perspective.

Population and Sample

The study population comprises 3,000 individuals from both Tanjung Serdang and Batulicin ports. A purposive sampling method was employed, in which respondents were selected based on predefined criteria set by the researcher. To mathematically determine the appropriate sample size for the population in South Kalimantan, this study used the Isaac and Michael sampling table presented in Table 1.

Table 1. Determination of Sample Size

N	S		
	1%	5%	10%
2800	537	310	247
3000	543	312	248
3500	558	317	252
4000	569	320	254
4500	578	323	255
5000	586	326	257
6000	598	329	259
7000	606	332	261
8000	613	334	263
9000	618	335	263
10000	622	336	263
15000	635	340	266
20000	642	342	267
30000	649	344	268

Source: Sugiyono 2019

Description:

S = Number of respondents

N = Total population

The sample size was determined using the Isaac and Michael table with a 10% margin of error, resulting in a minimum requirement of 248 respondents. For this study, the sample was rounded to 250 respondents to ensure higher data reliability.

Willingness to Pay (WTP) Calculation

The WTP is calculated using the average value of respondents' willingness to pay, as expressed in the following formula:

$$WTP = \frac{\sum WTP_i}{n}$$

Description:

WTP = The mean Willingness to Pay value (Rp276.975), as detailed in Table 4.

WTP = The specific tariff value respondents are willing to pay:

T1 is Rp20,955, T2 is Rp74,740, T3 is Rp229,478, T4 is Rp339,706, and T5 is Rp720,000.

N = Number of respondents: 250

Load Factor Calculation

The load factor is the ratio of utilized capacity to a vessel's total available capacity during a specific operational period. This metric is essential for assessing the operational efficiency of both passenger and cargo vessels. The analysis of the load factor is detailed as follows:

Load Factor Analysis Based on Secondary Data (Annual Data)

The load factor is calculated to determine the capacity utilization rate during an operational period using the following formula:

$$LF = \frac{\text{Utilized Capacity}}{\text{Total Capacity}} \times 100\%$$

Based on the secondary data analysis, the load factor values for KMP Kerapu III are identified as follows:

1. Passenger Load Factor:
 - Arrival (Unloading): 66%
 - Departure (Loading): 79%
2. Vehicle Load Factor:
 - Arrival (Unloading): 57%
 - Departure (Loading): 71%

3. Results and Discussions

Based on the computational results, the Vehicle Operating Cost (VOC) is found to be significantly higher than the currently implemented tariffs. Several critical factors contribute to this phenomenon. First, there has been a substantial increase in the cost of operational components and spare parts, which has not yet been reflected in the existing tariff structure. Second, government policy regarding tariff determination tends to prioritize public affordability over the full fulfillment of the operator's economic costs. Third, the VOC analysis for the Tanjung Serdang–Batulicin route, conducted in accordance with Ministerial Regulation (PM) No. 66 of 2019, reveals that the annual load factor for KMP Kerapu III ranges from 66% to 79% for passengers and from 57% to 66% for vehicles. These utility metrics serve as the primary basis for determining the unit production cost per mile. Fourth, the low Willingness to Pay (WTP) among service users—largely driven by the perceived inadequacy of supporting port facilities—creates a constraint for operators. Consequently, independent tariff adjustments are difficult to implement without a prior and demonstrable improvement in service quality.

Total Annual Operational Cost

1. Total Annual Operating Cost
 - = Direct Cost + Indirect Cost
 - = Rp.8.647.498.934 + Rp 4.257.600.000
 - = **Rp 12.905.098.935**
2. Cost per Unit of Production (per Mile)
 - = $\frac{\text{Total Annual Operating Cost}}{\text{Total Annual Production}}$
 - = $\frac{12.905.098.935}{5.097.164}$ = **Rp. 2.532**

Table 2. Results of Tariff Calculation Based on Vehicle Operating Costs(VOC)

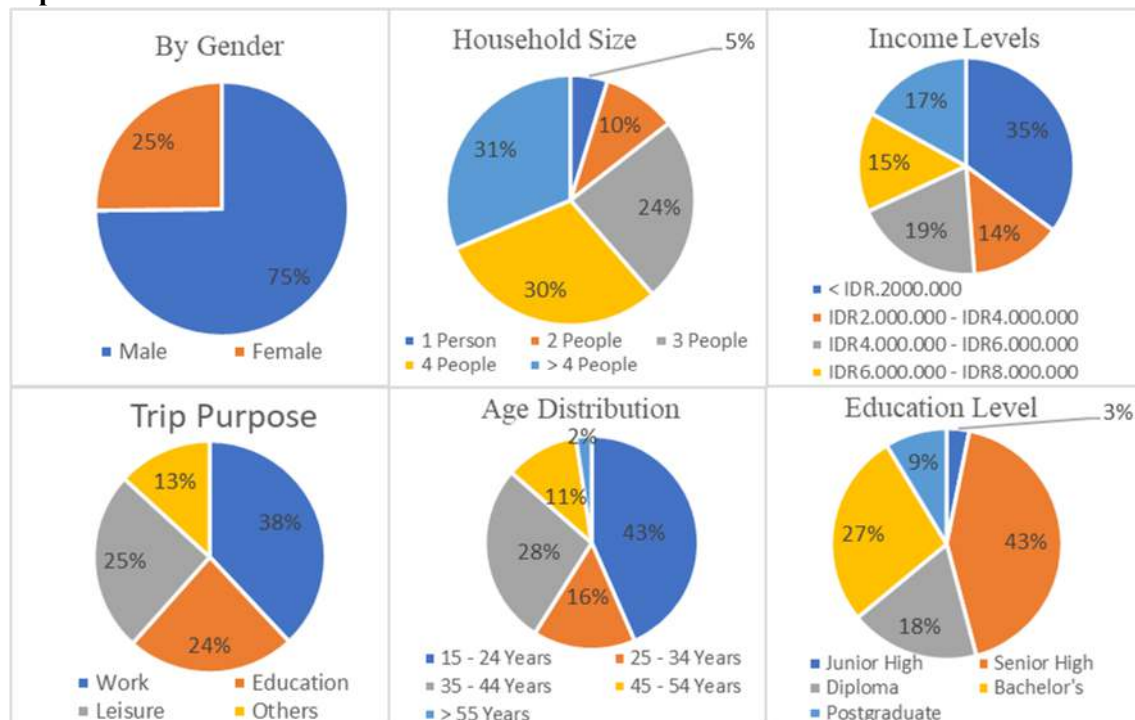
Ticket Type	Existing Tariff (Rp)	Calculated Tariff (Rp)	Difference (Rp)
Dewasa Ekonomi	11.500	12.660	1.659
Vehicle Class I	15.000	28.232	12.732
Vehicle Class II	31.000	50.893	24.315
Vehicle Class III	88.000	109.762	19.983
Vehicle Class IV A	205.000	406.259	201.259
Vehicle Class IV B	187.000	421.072	232.072
Vehicle Class V A	345.000	765.677	420.677
Vehicle Class VB	315.000	779.223	464.223
Vehicle Class VI A	560.000	1.272.457	712.457
Vehicle Class VI B	555.000	1.306.385	751.385
Vehicle Class VII	1.700.000	1.711.759	1.711.759
Vehicle Class VIII	1.090.000	2.389.575	1.299.575
Vehicle Class IX	3.075.000	3.452.888	377.888
Total	8.177.500	12.706.842	6.229.994

Source: The findings of the 2026 analysis

The analysis indicates that ferry transportation tariffs calculated based on Vehicle Operating Costs (VOC) are significantly higher than the currently prevailing rates. This finding suggests that the existing tariff structure does not fully reflect the actual operational expenditures required to sustain ferry transportation services.

These findings are consistent with previous research, which demonstrates that in several ferry transport services, the implemented tariffs are frequently lower than the actual operational costs due to considerations of public affordability.

Respondent Characteristics



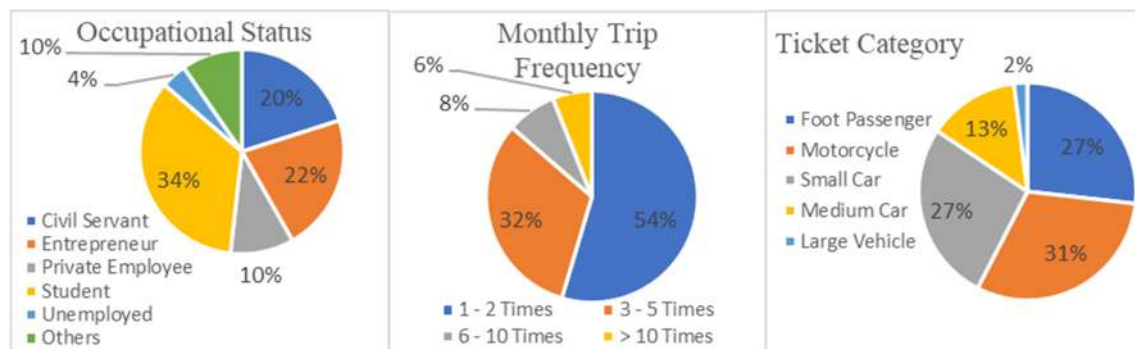


Figure 2. Respondent Characteristics
Source: The findings of the 2026 analysis

Willingness to Pay (WTP) Analysis Results

Table 3. WTP Values by Occupational Category

No	Occupation Category	Total Tariff Value (Rp)	Number of Respondents	Average WTP (Rp)
1	Civil Servant	17.555.000	50	351.100
2	Entrepreneur	17.562.000	54	325.222
3	Private Employee	3.624.500	26	139.404
4	Student	5.412.500	86	62.936
5	Unemployed	726.000	10	72.600
6	Others	1.236.500	24	51.521
	Jumlah		250	Rp.1.002.783

Source: The findings of the 2026 analysis

Based on the analysis results presented in Table 3, the WTP values across occupational categories reflect the average fare users expect for ferry services, consistent with their preferences. The WTP values were obtained from questionnaire data collected from ferry service users. The findings indicate that the highest WTP is observed among civil servants, at Rp 351,100, while the lowest WTP is observed in the "other" category, at Rp 51,521.

Table 4. WTP Values by Tariff Group Category

No	Category	Existing Tariff (Rp)	Average WTP (Rp)
1	T1	11.500	20.955
2	T2	31.000	74.740
3	T3	205.000	229.478
4	T4	345.000	339.706
5	T5	800.000	720.000

Source: The findings of the 2026 analysis

Based on the analysis of ferry passenger Willingness to Pay (WTP) across all categories presented in Table 4, the findings indicate that WTP values consistently fall below the calculated Vehicle Operating Costs (VOC). This disparity, further illustrated by the cumulative percentage graph and simulation table, shows that the actual operational costs of ferry services exceed users' payment thresholds. Such a trend suggests a misalignment between operational requirements and public valuation. Specifically, the data indicate that passengers—despite having high Ability to Pay (ATP)—are unwilling to contribute financially. This reluctance is largely driven by subjective

perceptions of service quality, particularly regarding comfort levels and wait-time efficiency, which currently fail to meet passenger expectations. Comprehensive details are provided in Figure 2 and Table 5.

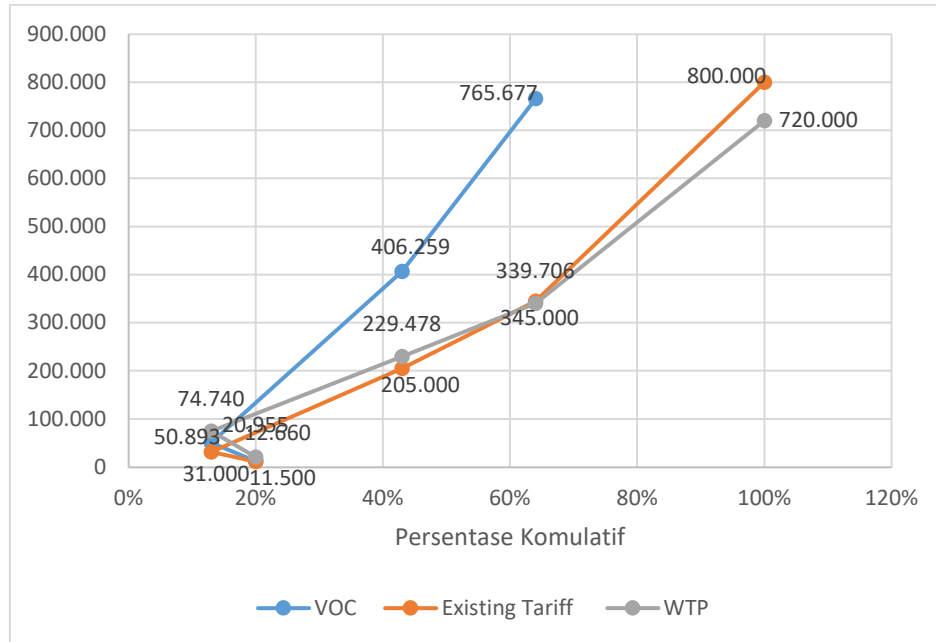


Figure 3. Cumulative Percentage Graph
Source: The findings of the 2026 analysis

In this context, ferry users on the Tanjung Serdang–Batulicin route can be categorized as choice riders. This designation arises because users select this mode of transportation based on their ability to pay and the availability of alternative options, while remaining critical of the value received relative to the fare paid. A detailed comparison of the existing tariff, the tariff calculated based on Vehicle Operating Costs (VOC), and the average Willingness to Pay (WTP) is presented in Table 5.

Table 5. Simulation

Vehicle Category	Existing Tariff (Rp)	VOC-Based Tariff (Rp)	Average WTP (Rp)
Passenger (T1)	11.500	12,660	20.955
Motorcycle (T2)	31.000	50.893	74.740
Small Car (T3)	205.000	406.259	229.478
Medium Car (T4)	345.000	765.677	339.706
Large Vehicle (T5)	800.000	1.272.457	720.000

Source: The findings of the 2026 analysis

The data presented in Table 5 confirm that the public's Willingness to Pay (WTP) remains consistently below the calculated Vehicle Operating Costs (VOC) across nearly all vehicle categories. This discrepancy indicates that tariff determination cannot rely solely on economic capacity variables; rather, it is heavily influenced by user perceptions of service quality.

Critical factors, including onboard facility comfort, port service standards, departure punctuality, and travel safety, drive respondents' WTP levels. A positive correlation exists: improvements in service quality are expected to raise the WTP threshold toward the service's economic value. Consequently, tariff adjustment policies for the Tanjung Serdang–Batulicin route must be implemented simultaneously with the enhancement of Minimum Service Standards (MSS) to ensure both operational sustainability and user satisfaction.

These findings align with previous studies demonstrating that elevating transportation service quality significantly impacts public willingness to pay for public transit fares. Thus, ferry transport tariff policies should integrate operational costs and economic capability with tangible service improvements.

This study identifies a substantial gap between VOC and user WTP, suggesting that tariff adjustments cannot be implemented unilaterally based solely on operator production costs. Instead, adjustment strategies must be integrated with the fulfillment of the Minimum Service Standards mandated by PM No. 62 of 2019.

Strategic recommendations include enhancing service quality regarding port facility comfort and operational headway punctuality. Such improvements serve as a means to shift users' psychological WTP thresholds toward the economic values required by operators. Ultimately, any tariff increase will likely gain better public acceptance if accompanied by perceived value for money through superior service delivery.

4. Conclusions

Service users are predominantly male (75%), with the majority falling within the productive age group of 15–24 years (43%). Regarding educational background, senior high school graduates constitute the largest segment (43%), while occupationally, students (34%) and entrepreneurs (22%) are the most prevalent groups. Crossing activities are identified as a routine necessity, with 54% of respondents traveling 1–2 times per month, primarily driven by work-related commitments (38%) and tourism (25%).

The total annual operational cost for the KMP Kerapu III fleet is calculated at IDR 12,905,098,935. Technical analysis reveals that tariffs derived from Vehicle Operating Costs (VOC) are significantly higher than the current applicable rates across all vehicle categories. This discrepancy suggests that existing tariffs do not fully reflect actual production costs, largely due to fluctuations in the prices of operational components.

The average Willingness to Pay (WTP) among users is consistently lower than the calculated VOC values. The lowest WTP was observed in the economy passenger category (T1) at IDR 20,955, while the highest was recorded in the large vehicle category (T5) at IDR 720,000. This low WTP is influenced by negative user perceptions regarding service quality, specifically inadequate port facilities and suboptimal wait-time efficiency.

Annual operational performance indicates a passenger Load Factor of 66% to 79%, while the vehicle Load Factor ranges from 57% to 66%. Although fleet utility is technically classified as stable, the imbalance between outbound and inbound cargo volumes poses a challenge to optimizing the service provider's operational revenue.

This study concludes that a significant discrepancy exists between the operational economic value and the psychological threshold of service users on the Tanjung Serdang–Batulicin ferry route. Technically, the tariffs derived from the Vehicle Operating Cost (VOC) calculations are substantially higher than the existing tariffs across all vehicle categories. Although the users possess adequate Ability to Pay (ATP), their Willingness to Pay (WTP) remains low and falls below the VOC value. This condition is heavily influenced by the demographic profile, which is dominated by the early productive age group (15–24 years), as well as the perception of sub-optimal service quality.

These findings indicate that tariff adjustment strategies cannot be implemented solely based on rising operational costs. Policy adjustments must be integrated with enhancements to Minimum Service Standards (MSS), particularly regarding facility comfort and waiting time efficiency, to shift the public's WTP toward the service's economic equilibrium. Consequently, the sustainability of the ferry service as a logistical lifeline can be maintained through a balanced approach between the operators' need for cost recovery and the satisfaction of the service users.

References

- [1] J. Junaidi, I. Gani, and A. Noor, "Analisis transportasi darat terhadap pertumbuhan ekonomi di provinsi kalimantan timur Analysis of land transportation on economic growth in the province of east kalimantan," vol. 17, no. 2, pp. 264–269, 2020.



- [2] P. Kapal, F. Untuk, D. Penyeberangan, and D. Dan, "Perancangan kapal ferry untuk daerah penyeberangan dili dan pulau atauru (timor-leste)," pp. 211–216, 2013.
- [3] S. Kasus and K. M. P. Legundi, "STANDART PELAYANAN MINIMAL (SPM) DAN SISTEM LASING PADA KAPAL RO-RO UNTUK KESELAMATAN TRANSPORTASI PENYEBRANGAN LAUT," vol. 20, no. 1, pp. 26–31, 2018.
- [4] M. Operasional, P. Penyeberangan, and B. Tanjung, "Media Ilmiah Teknik Sipil , Volume 10 , Nomor 1 , Desember 2021 : 69-77 Media Ilmiah Teknik Sipil , Volume 10 , Nomor 1 , Desember 2021 : 69-77," vol. 10, no. 1, pp. 69–77, 2021.
- [5] F. Misdalena, "EVALUASI TARIF BERDASARKAN BIAYA OPERASIONAL KENDARAAN (BOK), ABILITY TO PAY DAN WILLINGNESS TO PAY Kota Palembang yang merupakan Ibu Kota," vol. 12, pp. 63–72, 2024.
- [6] P. Bima, "Evaluasi kinerja operasional sarana dan prasarana angkutan penyeberangan laut tradisional di pelabuhan bima," vol. 8, no. 1, 2024.
- [7] P. Bima, "Analisis biaya oprasional kendaraan perahu tradisional terhadap faktor ability to pay di pelabuhan bima," vol. 8, no. 1, 2024.
- [8] R. Hidayat Dairi and A. Saputra, "ANALISIS ABILITY TO PAY (ATP) DAN WILLINGNESS TO PAY (WTP) PENGGUNA JASA TRANSPORTASI LAUT RUTE WANGCI-LASALIMU," *J. Ilm. Multi Disiplin Ilmu*, vol. 8, pp. 114–127, 2024.
- [9] A. Machdor, "KM . Expres Bahari Lintas Palembang-Muntok di Pelabuhan Boom Baru," ., vol. 4, no. 4, pp. 147–153, 2016.
- [10] K. Smart, I. Kota, and N. Ikn, "Konsep Smart Port di Ibu Kota Negara (IKN) Indonesia," *J. Penelit. Transp. Laut*, vol. 23, pp. 77–94, 2021.
- [11] L. Rahmasari, "Exploring Consumer Behavior in Maritime Transportation: Price, Facilities, And Timeliness Factors Impacting Purchasing Decisions on The Semarang – Lampung Ship Route," vol. 0696, 2024.
- [12] G. I. Wahyudi, E. Nurhidayati, and A. Wulandari, "Analisis penggunaan angkutan penyeberangan di kabupaten kubu raya 1. 2.,," pp. 1–6.
- [13] J. S. Bangunan, "Analisis Perhitungan Biaya Transportasi Kapal Penumpang Pada KM. Dharma Kartika VII PT. Dharma Lautan Utama Cabang Semarang," *J. SAINS BANGUNAN*, vol. 1, no. 1, pp. 32–48, 2024.
- [14] N. Ainuddin, G. Meno, G. Air, G. Meno, and M. Kelautan, "EVALUASI KELAYAKAN TARIF ANGKUTAN PENYEBERANGAN (PELAYARAN RAKYAT) DI KAWASAN WISATA GILI PEMENANG LOMBOK UTARA," vol. 2, no. 2, pp. 172–181, 2015.
- [15] M. Ardiansyah and S. Toelle, "Kemampuan Membayar dan Kesiediaan Membayar Pengguna Jasa Kapal Rute Kendari - Wanci Ability to Pay and Willingness to Pay Ship Service Users for the Kendari - Wanci Route," vol. 12, no. 03, pp. 261–274.
- [16] N. Februari, "Jurnal Talenta SipilEvaluasi Tarif Angkutan Feeder Wirawiri Suroboyo FD01 Berdasarkan Aspek Biaya Operasional Kendaraan (BOK), Willingness To Pay (WTP), Dan Ability To Pay (ATP)," *J. Talent. Sipil*, vol. 8, no. 1, pp. 129–139, 2025, doi: 10.33087/talentsipil.v8i1.684.
- [17] S. Kasus, T. Grab, D. Taksi, Q. Di, and K. Tasikmalaya, "Akselerasi : Jurnal Ilmiah Teknik Sipil Akselerasi : Jurnal Ilmiah Teknik Sipil," no. 2, pp. 11–18, 2020.
- [18] F. D. Fasha, F. Teknik, P. Studi, and T. Sipil, "Analisis Ability To Pay dan Willingness To Pay Kapal Penyebrangan Eksekutif Rute Bakauheni-Merak," pp. 34–38, 2000.
- [19] A. Kumalawati, M. M. Uwa, and H. Rizal, "Analisis Kemampuan Membayar (Ability To Pay) dan Keinginan Membayar (Willingness To Pay) Penumpang pada Rute Penyeberangan," vol. 36, no. 2, pp. 54–65, 2024.
- [20] A. B. Saputra, "Analisis Tarif Angkutan Umum Berdasarkan Biaya Operasional Kendaraan , Ability To Pay dan Willingness To Pay," vol. 07, pp. 1–8, 2021.
- [21] U. Amriardi, "STUDI KEBERLANJUTAN LAYANAN ANGKUTAN PENYEBERANGAN WILAYAH KEPULAUAN," *J. Wave*, vol. 13, pp. 69–82, 2020.

- [22] P. W. Nariendra, J. Juanita, A. Wiwit, and P. Saputri, “ANALISIS TARIF ANGKUTAN UMUM RUTE MANADO – LIKUPANG BERDASARKAN ABILITY TO PAY (ATP) DAN WILLINGNESS TO PAY (WTP) DI PROVINSI SULAWESI UTARA,” vol. 22, no. 2, pp. 107–114, 2021.