Cost Analysis Of Improving Urban Railway Services On Arjonegoro Commuter

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Abstract

Improvement of train services will always develop along with the development of passenger demand. Likewise, in the case of the Arjonegoro Train, one of the mainstay urban trains in East Java. The development of local trains, especially the Arjonegoro Train, triggers the public's desire to receive optimal service. The increasing expectations of passengers can be the basis for planning to improve train services. However, every improvement plan also requires a mature budget and cost design so that the plan can be implemented properly. The data used in this study are primary and secondary data. A total of 199 respondents were successfully obtained as primary data. This study uses descriptive analysis methods and literature studies in determining the service improvements needed, and the cost of improving these services will be estimated. This study examines the level of passenger satisfaction with six service variables to determine which services need to be improved for the Arjonegoro Train. The results of the study showed that the services with the highest negative sentiment were the availability of seats, availability of travel schedules, availability of platforms, and availability of canopies. These issues can be mitigated by improving services through adding one Trainset and enhancing the platform and canopy at the station, with an estimated cost requirement for improving the Arjonegoro train service of Rp. 110,373,211,939.

Keywords : Service Improvement, Estimated Cost, Train, Arjonegoro.

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Introduction

To meet the needs of railways in East Java, it is important to continue improving railway infrastructure, enhancing service quality, and ensuring transportation safety (Ismail et al., 2020). The government and railway operators also need to pay close attention to passenger needs, including accessibility, affordable ticket prices, and comfort (Sutanto & Purnomo, 2021). Additionally, efforts to integrate railways with other modes of transportation, such as buses and public transit, can improve mobility and connectivity in East Java (Rachmawati et al., 2021). The integration of multi-modal transport systems has proven to enhance overall transportation efficiency and reduce congestion (Chin et al., 2020). Therefore, a holistic approach to infrastructure improvement, service enhancement, and intermodal integration is essential for addressing the growing mobility demands in East Java (Haryanto & Mulyono, 2019).

The development of local trains, especially the Arjonegoro train, has triggered the public's desire to obtain optimal service (Martono et al., 2021). The increasing expectations of passengers can serve as the basis for planning improvements in train services (Ristiana & Santosa, 2020). However, every improvement plan requires a mature budget and cost design to ensure proper implementation (Hendrawan et al., 2020). Effective budgeting and cost management are critical for the sustainable development of public transport infrastructure (Yulianto et al., 2019). Furthermore, clear financial planning is essential to meet the growing demands of passengers while maintaining the long-term viability of transportation projects (Arifin & Hidayat, 2021).

Improvement of railway services is a series of efforts undertaken by operators and the government to enhance the quality of railway transportation services, encompassing time reliability, comfort, safety, ease of access, and user satisfaction (Ibrahim et al., 2020; Wahab et al., 2025). The primary objective is to optimally meet user needs, increase the competitiveness of trains as a mode of public transportation, and support sustainable community mobility (Angelico et al., 2025). According to (Suwardo, 2014), railway services involve not only physical facilities and infrastructure but also operational management, interactions between officers and passengers, and overall system efficiency.

Estimation of railway service improvement costs is the process of calculating or projecting the funding requirements needed to implement programs aimed at enhancing the quality of railway services, including facilities, infrastructure, and operational systems (Papathanasiou et al., 2020). This cost estimation is crucial as a basis for budget planning, investment decision-making, and program efficiency evaluation (Widodo, 2018). In the context of public transportation, cost estimation covers not only capital expenditures, such as procuring new trains or renovating stations, but also operational expenditures, including HR training, facility maintenance, and service system improvements.

Previous studies (Suwardo, 2014; Widodo, 2018) have emphasized that railway service quality depends not solely on physical infrastructure but also on operational management, user experience, and financial feasibility. However, there is limited research specifically focusing on cost estimation frameworks and passenger satisfaction analysis for commuter trains in East Java, particularly for the *Arjonegoro* line. This research fills that gap by combining passenger satisfaction measurement with cost estimation to optimize service enhancements.

The purpose of this study is to address these issues by measuring the level of passenger satisfaction with the *Arjonegoro Commuter Train* service and calculating the estimated cost for service optimization in response to the development of passenger occupancy levels. The results of this analysis are expected to provide a solid foundation for future policy decisions regarding the *Arjonegoro Commuter* service. The benefits of this study include offering a data-driven basis for decision-making, improving budget allocation, increasing service competitiveness, and supporting sustainable public transportation development in East Java.

Method

This study employed descriptive analysis and literature review methods to identify necessary service improvements and estimate their associated costs. The research focused on passengers of the *Arjonegoro* train in East Java. The population consisted of all *Arjonegoro* train passengers, while the sample included those passengers who were successfully surveyed. The study was conducted in East Java.

Primary data were collected over seven full days and then validated against secondary data, which were also collected and analyzed within an estimated seven-day period. Both primary and secondary data were utilized in the data collection process.

Primary data gathered passenger satisfaction regarding six service variables: availability of travel schedules, availability of seats, boarding area, waiting room, station platform, and station canopy. These variables were measured using a 1–5 Likert scale, where 1 indicated "Very Dissatisfied" and 5 indicated "Very Satisfied."

A mixed-method approach combining quantitative and qualitative techniques was used. The study also applied forecasting methods to predict future demand. The forecasting results guided the identification of major stations served by the *Arjonegoro* train and prioritized service improvements at those stations. Furthermore, the forecast informed the anticipated passenger facility needs to accommodate demand growth in the coming years.

Results And Discussion

Service Satisfactory

The results of the descriptive analysis show that most respondents feel satisfied with the service performance of Arjonegoro Train. However, there are still some negative sentiments in the survey results, making it necessary to measure which services get the most negative sentiments so that improvements can be made to the service.

Table 1. Respondent Negative Sentiments

No	Services	Very Unsatisfied	Unsatisfied	Total
1	Seat Availability	9	26	35
2	Schedule Availability	5	28	33
3	Station Canopy	6	25	31
4	Station Platform	3	22	25
5	Waiting Room	3	19	22
6	Boarding Area	1	5	6

The table 1 above shows that the services with the highest negative sentiment are the availability of seats and the availability of travel schedules. Both of these services can be improved by adding the number of facilities and operating schedules of the Arjonegoro train. Meanwhile, improvements to the canopy and station platform can also be proposed considering that the passenger boarding and alighting service is highly dependent on the condition of the platform and canopy at the station. This service improvement will be carried out through a literature study regarding the suitability of this service improvement plan with existing conditions. The results of the descriptive

analysis show that Arjonegoro train passengers have the highest negative sentiment on the availability of seats and the availability of schedules of the Arjonegoro train. From secondary data, it was found that the average daily passengers on the Arjonegoro train were around 510 passengers with only 1 Train facility operating. With the Arjonegoro train capacity of 384 passengers, the need for facilities can be calculated as follows (Aryomukti et al., 2022).

$$Train\ Needs = \frac{Passengers}{Capacity}$$
$$Train\ Needs = \frac{510}{384} = \ \sim 2\ Trains$$

Service improvement in the form of additional facilities and Arjonegoro train schedules can be a solution to improve services to overcome these negative sentiments. The improvement plan will be analyzed through literature studies to determine whether the plan can be implemented in the following details:

Table 2. Route Capacity

Line	Program	Capacity	Available
Bojonegoro – Babat	60	188	128
Babat – Lamongan	68	232	164
Lamongan - Kandangan	68	268	200
Kandangan – Pasarturi	78	306	228
Pasarturi – Surabaya Kota	34	127	93
Surabaya Kota – Gubeng	85	230	145
Gubeng – Wonokromo	112	356	244
Wonokromo - Sidoarjo	58	89	31

From the results of the literature study above, it can be seen that the condition of the crossing capacity on the route passed by the Arjonegoro train still allows for the addition of the Arjonegoro train travel schedule. The addition of 2 round trips between Bojonegoro - Sidoarjo is still possible in terms of crossing capacity but requires additional facilities so that this plan can be implemented. The addition of these facilities also requires a fairly large investment value and needs to be calculated to estimate the costs required for the addition of these facilities.

Estimation of Railway Service Improvement Costs
The results of the descriptive analysis and literature study in the previous section indicate that it is necessary to improve services in the form of additional facilities for the Arjonegoro train to increase the travel schedule and seat availability. The addition of these facilities needs to be calculated in terms of estimated procurement costs. However, before that, it is also necessary to consider whether the current transport capacity has exceeded capacity and also measure the increase in passenger demand for the

Arjonegoro train in the next 15 years. Secondary data from PT KCI region 8 in the form of average daily passenger data for the Arjonegoro train from the first time it operated (June 2023) to April 2025 is the initial data for forecasting using the Ordinary Least Square (OLS) method until the following forecast equation is obtained:

$$Y = 22{,}6x + 464{,}46$$
$$Y = Passengers\ Average$$
$$x = Years$$

From the equation above, the average number of daily passengers for the Arjonegoro train in the next 15 years can be estimated as follows:

Table 3. Passengers Average Forecasting

Years	Passengers
2025	510
2026	532
2027	555
2028	578
2029	600
2030	623
2031	645
2032	668
2033	691
2034	713
2035	736
2036	759
2037	781
2038	804
2039	826

From the forecast results in table 3 above, it shows that in 2025 alone, the average daily passengers of the Arjonegoro train have exceeded the maximum capacity of its facilities, which is only 384 passengers. This condition shows that the Arjonegoro train is too crowded and requires immediate addition of facilities. The addition of just one trainset is enough to meet the demand for the Arjonegoro train until 2037, which will only exceed the capacity of the 2 Arjonegoro train facilities.

From the results of the previous analysis, it was found that an immediate addition of 1 Arjonegoro trainset was needed to meet the demand from passengers. Calculation of estimated costs is needed to be able to measure the value of increasing the number of these facilities. The price of 1 KRD Trainset made by PT. INKA (Persero) obtained from the history of the Makpar (Makassar - Parepare) facility procurement contract is Rp. 55,450,000,000 (Fifty-Five Billion Four Hundred Fifty Million Rupiah), so it can be concluded that the cost requirement for improving the Arjonegoro train service in the form of adding 1 Trainset is Rp. 55,450,000,000.

In addition to the increase in the form of adding 1 Trainset, this study will also take into account the cost of improving the platform and canopy at the stations crossed

by the Arjonegoro train, namely the stations on the Bojonegoro - Surabaya Pasarturi route. The estimated cost of the above improvements will be calculated using historical data on the latest development in the East Java region as follows.

Tabel 4. Estimation of Station Improvement Cost

No	Station	Cost
1	Bojonegoro	Rp8.566.182.887
2	Kapas	Rp4.266.849.060
3	Sumberrejo	Rp3.988.270.960
4	Bowerno	Rp543.453.588
5	Babat	Rp71.330.619
6	Pucuk	Rp725.513.826
7	Lamongan	Rp2.154.234.221
8	Duduk	Rp621.651.556
9	Cerme	Rp674.761.113
10	Benowo	Rp5.790.245.054
11	Kandangan	Rp14.301.243.511
12	Tandes	Rp9.244.474.152
13	Pasarturi	Rp1.677.821.787
	Total	**Rp54.923.211.939**

From the results in table 4 above, the total estimated cost of improving the Arjonegoro train service can be calculated, both from adding facilities and improving the platform and canopy at the station with a budget requirement of Rp. 110,373,211,939 (One Hundred Ten Billion Three Hundred Seventy-Three Million Two Hundred Eleven Thousand Nine Hundred Thirty-Nine Rupiah).

Conclusion

The analysis of this study concluded that the performance of the *Arjonegoro* Train service can be enhanced by adding one KRD Trainset to accommodate increasing passenger demand, along with upgrading the station canopy and platform to facilitate boarding and alighting. The estimated cost for these improvements is approximately IDR 110.37 billion. For future research, it is recommended to explore the long-term operational impacts and passenger satisfaction following these upgrades, as well as to investigate the integration of additional service enhancements and multimodal connectivity to further optimize urban railway performance in East Java.

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