Investigate Park and Ride performance assessment for the better sustainable urban transportation in Surabaya

F R Widayanti* and A R Pattisinai
Department of Civil Engineering, Faculty of Engineering, Universitas Negeri Surabaya, Jl. Ketintang, Ketintang, Surabaya, Indonesia, 60231

*fitriwidayanti@unesa.ac.id

Abstract. Parking lots on the side of the road result in a decrease in the capacity of the road, therefore it is necessary to provide Park and Ride (P&R) parking building facilities. The existence of parking building facilities must support the safety and smooth traffic. In addition to smooth traffic, an evaluation is also important to determine the quality of service in order to meet user expectations of parking facilities. The method used in this research is Importance Performance Analysis. The purpose of this study was to determine the assessment of the quality of service from the Mayjen Sungkono Surabaya Parking Building in terms of user perception. The questionnaire survey was conducted in the Mayjen Sungkono Surabaya parking building with a sample of 120 respondents. The results showed that parking building users were not satisfied with the services of the Mayjen Sungkono Surabaya parking building manager, one of which was in terms of reliability, namely the ability of officers to explain the service process of parking facilities.

1. Introduction
Surabaya is the second metropolitan city in Indonesia with a population of 3 million. The large population in an area will have an impact on increasing vehicle ownership. Increased use of private vehicles is a reflection of urban mobility [1]. The result is an increase in the demand for road space for traffic activities, including the need for parking lots. The function of the parking facility is one of the traffic control devices. Parking has become a serious problem in urban areas as a result of urban development. Parking lots in the city center are often inadequate, therefore a parking management system is needed [2-4]. The lack of available parking lots results in certain locations in the body of the road or using part of the pavement used as parking. This results in a decrease in road capacity so that traffic flow constraints and road use become ineffective. Traffic congestion and high air emissions in the city center become a major challenge of sustainable transportation development [5,6]. To overcome these problems, Park and Ride (P&R) facilities can be one of the solutions to the implementation of the Transport Demand Management (TDM) strategy that is widely used in several large cities. P&R is the right strategy for transportation problems in metropolitan cities for the development of sustainable urban transportation, P&R can positively improve efficiency by reducing the use of private transportation[7,8]. According to the Collin English Dictionary, the P&R is a transportation system created to encourage people to park their private vehicles some distance from the city center and continue their journey by using public transportation to get to the city center [9]. The P&R facility initially appeared to
accommodate private motorists who otherwise found parking locations around the train station and settlements in the city center [10]. P&R facilities are starting to be in great demand in transportation strategies because they are environmentally friendly [11]. The implementation of the first P&R facility in the city of Surabaya is in the Mayjen Sungkono section which was completed in early 2017. There are no specific guidelines for evaluating the feasibility of the P&R facility. The literature published to date only covers aspects of the analysis of P&R facility planning [12]. Many other attributes need to be analyzed to see the extent to which users are willing to use the P&R facility [13]. Due to the absence of specific guidelines regarding the P&R facilities, an evaluation was conducted at Mayjen Sungkono's P&R building. Evaluation is carried out for how the quality of services provided by managers to users.

Customer satisfaction is known from the results of performance comparisons and expectations that are assessed from the user's perception when using service products. The user evaluates service products actively or passively. User satisfaction is adjusted for the number of variables that are relevant to satisfaction. The analysis is focused on getting variables that are considered important by service users and used as a reference for improvement. The satisfaction level parameter is then applied to the Quadrant which describes the level of customer satisfaction in the form of four quadrants [14]. Customer satisfaction has a positive impact on company valuation. From these assessments, companies can take steps to make continuous management improvements, so they can increase profits and provide maximum quality in the company's service quality competition. Service quality and customer satisfaction are interrelated, although both are concepts that compare the expectations of quality and service performance received by customers in the field [15].

The purpose of the evaluation of Mayjen Sungkono's P&R building was to find out how the quality of service provided by managers to users was used as a recommendation for further P&R construction in the city of Surabaya.

2. Method
This research uses a survey method which is done by collecting information through questionnaires and interviews with respondents.

2.1. Questionnaire planning
This study uses the variable level of customer satisfaction as the main variable which is then examined with the specified control variables, namely tangible, reliability, responsiveness, assurance, and empathy. To measure the answers to the variables used 5 (five) level scale or weight assessment of the level of performance of management services and expectations of parking users Mayjen Sungkono Surabaya. Scale to describe satisfaction and weighting starting from: Not good = 1, Poor = 2, Good enough = 3, Good = 4, Very good = 5, while the scale to describe expectations and weighting starts from: Not important = 1, Less important = 2, Quite important = 3, Important = 4, Very important = 5. The variables used in this study are shown in Table 1.

| Variable | Indicator | Indicator | Indicator | Indicator | Indicator | Indicator | Indicator |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Tangible | Parking building location affordability (X1) | Parking building accessibility (X2) | Parking building capacity (X3) | Parking information system (X4) | Fair attitude of officers to users (X5) | Parking directing service officer (X6) | Reliability of delivering information (X7) | The ability to explain the service process (X8) |

Table 1. Variable component dimensions of service quality.
Table 1 shows the variables and indicators used as a reference in preparing the research questionnaire instrument.

2.2. Importance Performance Analysis (IPA)

IPA analysis is done by calculating the total score of service performance and the interests of Mayjen Sungkono Surabaya parking lot users for each variable. Calculations of average performance scores and average importance scores will be specified in the Importance Performance Matrix. Satisfaction and importance scores are known based on the results of questionnaire calculations. The score calculation is also used to determine the suitability between satisfaction and importance for each variable used. The level of conformity is the result of a comparison between the expectations and interests of Mayjen Sungkono Surabaya parking users for each variable. To calculate the suitability level using a formula (1):

\[ T_{ki} = \frac{X_i}{Y_i} \times 100\% \]  

Where, T_{ki} is respondent’s level of compatibility, X_i is performance assessment score, and Y_i is score of assessment of the interest of service users.

The horizontal axis (X) is the result of calculating the level of implementation, while the vertical axis (Y) is the result of calculating the level of importance. Calculate the X and Y axis values using formulas (2) and (3):

\[ \bar{X} = \frac{\sum X_i}{n} \quad \bar{Y} = \frac{\sum Y_i}{n} \]  

Where, \( \bar{X} \) is the average performance/satisfaction assessment level indicator -i, and \( \bar{Y} \) is the average level of interest/hope indicator -i, and n is the number of respondents.

The next step is to calculate the average level of importance and performance for all indicators, to calculate the average level of importance and performance for all indicators, using formula (3):

\[ \bar{X} = \frac{\sum_{i=1}^{n} \bar{X}_i}{k} \quad \bar{Y} = \frac{\sum_{i=1}^{n} \bar{Y}_i}{k} \]  

(3)
Where, $\bar{X}$ is the total average rate of appraisal of performance/satisfaction of indicator $i$, $\bar{Y}$ is the total average level of interest assessment/expectation attribute $i$, and $K$ is a number of questions in the questionnaire.

3. Results and discussion

The results of the calculation of each indicator that affects the satisfaction of parking building users will be described in four quadrants of the Importance Performance Matrix. The Importance Performance Matrix is based on a table of average performance scores and importance scores shown in Table 2.

| No. | Notation | P (X) Performance | P (Y) Interest | P ($\bar{X}$) Performance | P ($\bar{Y}$) Importance |
|-----|----------|-------------------|----------------|---------------------------|-------------------------|
| 1   | X1       | 207               | 567            | 1.73                      | 4.73                    |
| 2   | X2       | 197               | 572            | 1.64                      | 4.77                    |
| 3   | X3       | 203               | 569            | 1.69                      | 4.74                    |
| 4   | X4       | 136               | 571            | 1.13                      | 4.76                    |
| 5   | X5       | 307               | 571            | 2.56                      | 4.76                    |
| 6   | X6       | 243               | 561            | 2.03                      | 4.68                    |
| 7   | X7       | 161               | 470            | 1.34                      | 3.92                    |
| 8   | X8       | 156               | 528            | 1.30                      | 4.40                    |
| 9   | X9       | 164               | 542            | 1.37                      | 4.52                    |
| 10  | X10      | 272               | 560            | 2.27                      | 4.67                    |
| 11  | X11      | 167               | 565            | 1.39                      | 4.71                    |
| 12  | X12      | 136               | 562            | 1.13                      | 4.68                    |
| 13  | X13      | 196               | 567            | 1.63                      | 4.73                    |
| 14  | X14      | 195               | 559            | 1.63                      | 4.66                    |
| 15  | X15      | 195               | 549            | 1.63                      | 4.58                    |
| 16  | X16      | 195               | 569            | 1.63                      | 4.74                    |
| 17  | X17      | 162               | 560            | 1.35                      | 4.67                    |
| 18  | X18      | 132               | 558            | 1.10                      | 4.65                    |
| 19  | X19      | 263               | 564            | 2.19                      | 4.70                    |
| 20  | X20      | 196               | 572            | 1.63                      | 4.77                    |

| Average | ($\bar{X}$) | ($\bar{Y}$) |
|---------|-------------|-------------|
|         | 1.62        | 4.64        |

From Table 2 it is known that the average value of service performance is 1.62, while the average value of importance is 4.64. This shows that there are still many respondents who are not satisfied with the service of the P&R facility. Based on the results of calculations in Table 3, the level of satisfaction and importance will be mapped into the Cartesian Importance Performance Matrix diagram shown in Figure 1.
Based on figure 1 it is known that the indicators located in quadrant A indicate that the variable dimensions of parking building services are very important according to user perceptions, but do not have good quality that is X4, X12, X17 and X18.

From quadrant figure 1 it is also known that there are three indicators which are considered to be in low priority or located in quadrant C, so it needs to be improved. These indicators are X7, X8 and X9.

Many variables and indicators can form the basis of user interest in the P&R facility. However, there are three main attributes that are closely related to P&R requests, namely parking capacity, parking fees, and service facility attributes [16].

4. Conclusion
The quality of parking building services on Mayjen Sungkono Surabaya Street in terms of the level of performance and importance, the total score of 4.64 is greater than the total performance score of 1.62. This shows that in general parking building users are not yet satisfied with the services of Mayjen Sungkono Surabaya's P&R building manager. From the analysis results it is known that the level of service level with the lowest value is the X4 indicator (Parking Information System) which is at the same time the expectation of the user to immediately get priority in improvement. For the results of the analysis with the highest value, the indicator X15 (Supporting Facilities) where the indicator is not too important for the user, but it is well available.

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