

Analysis of influencing factors on using rental bikes at shopping tourism sites in Surakarta

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Abstract. Surakarta as a tourism city has launched green transportation as a program in the government policy. Bikes as a supporting mode of green transportation has not gotten much attention from users, including tourism sites. Therefore, the aim of this study is to obtain the factors which influence the use of tourism bikes in Surakarta in the form of rental bikes. The location of the study was at several shopping tourism sites in Surakarta, namely Pasar Gede, Pusat Grosir Solo, Beteng Trade Center, and Pasar Klewer. The data was collected using a questionnaire with an interview method to the respondents of the visitors of the shopping sites and analyzed with the PCA (Principal Component Analysis) method. The result of the research showed that the weather condition, air pollution, bike track topography, and distance were the main factors which influenced people to use rental bikes in tourism sites of Surakarta.

1 Introduction

Increasing the number of motor vehicles makes many impacts, such as traffic jam, high air pollution, environmental pollution, fuel waste of vehicles, etc. One of the government's efforts to overcome this problem, especially in Surakarta City as a tourist city, is to design a system called green transportation, which is a transportation system that aims to reduce greenhouse gas emissions, air pollution, noise, and reduce poverty and support economic growth [1]. In this case, Pasar Gede, a shopping place in Surakarta, has characteristics that present a sense of place from the symbiosis of relationships between physical places, actors and livelihoods [2].

One of the alternatives to support the green transportation program is by using bicycles. Using bicycles is a priority strategy towards environmentally friendly transportation [3]. Bicycles do not use fuel and do not generate carbon emissions [4], but most road users tend to choose to use motor vehicles that are reach their destination faster regardless of the impact that will be generated. The impact is global warming, non-renewable energy / resources, inorganic respiratory and organic respiratory, which is the largest contributor of the total impact on the environment [5]. A solution to overcome these effects is bicycle rental.

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The bicycle rental program is the most common method of providing bicycles for tourists in recreational areas [6]. In this case, many things need to be considered in supporting the program. One way to support the program is by knowing the reason that people use bicycle rental. The influencing factors consist of the socioeconomic characteristics of the community, the habits of bicycle users and driving habits, as well as the location of bike stations or bicycle shelters [7]. The use of rental bikes is also influenced by household income, location of bicycle rental stations, and user perceptions about bicycle distribution [8]. In addition, factors affecting the use of bicycles are demographic characteristics, bicycle infrastructure facilities, land use characteristics and imbalances of bike disposal operational systems that are affected by the peak usage times of bike land use characteristics, and bicycle infrastructure facilities [9].

Therefore, this study aims to determine the most influential factors in the use of rental bikes at shopping sites in Surakarta City, among others, in Pasar Gede, Solo Wholesale Center, Beteng Trade Center, and Klewer Market. These very influential factors are what need attention to lease bike planning for the realization of environmentally friendly transportation.

2 Research method

2.1 Bicycle rent

Bicycle rental is a mode of transportation for short distance travel, for example from residence or stay, to a shopping location or bus stop and train station. A special station is provided to pick up the bike and return it at another station closest to the user's destination [10].

Factors that can influence the selection of modes that consists of the first four factors that characterize road users consist of vehicle ownership, ownership of driving license, household structure, and income. The second factor is the characteristic of movement which consists of the purpose of movement, the time of movement, and the distance of movement. The third factor is the characteristics of transportation mode that consists of travel time, transportation cost, availability of space and fee parking, security, comfort, and reliability. The fourth factor is the characteristics of a city or zone consisting of distance from the city center and population density [11].

2.2 Variables factor of using rental bicycles

Factors of the usage of rental bicycles consist of social economic characteristics, bicycle user habits, location of bike stations or shelter, social economic characteristics, bicycle ownership, BIXI (bike sharing) membership, fear of loss of bike, unbearable bike maintenance, and shelter location [7]. The use of bicycle rental is also influenced by travel mode, frequent use of bike sharing, station or shelter location, eco-friendly, bike sharing publications, travel time (<30 minutes), gender, easiness of route, and time spent traveling [8]. Other factors include weather, air pollution conditions, bike trail topography, mileage, demographic line capacity, bicycle infrastructure, land use characteristics, peak use times, land use characteristics, and bicycle infrastructure facilities [9]. The next factor is bike lanes, signs for bicycles [12], maps or routes for cyclists, and bike operators. And then the next factor is the cost of renting a bike, the ease of access using an application for bike rental and ease of understanding of the instructions on the application [13].

2.3 Method

The data in this study is collected by an interview using questionnaires in a shopping tour in Surakarta City. The data analysis technique used is factor analysis, which is a multivariate statistic analysis technique used to reduce and conclude the variables into factors.

The factor analysis method uses the principal component analysis of PCA (Principal Component Analysis), which is a statistical technique to change most of the original variables that correlate one with another into a set of new variables smaller and independent (no longer correlated). So, the main component analysis is useful for reducing data, making it easier to interpret the data [14].

This study is to research the aspect where there are environmental conditions consisting of weather, air pollution conditions, bike topography, mileage, bike lane capacity, separator with other modes [9]. Aspects of support facilities consists of bicycle paths, signs for bicycles [12], maps or routes for cyclists, and bike operators [8]. Aspects of service levels consists of bicycle rental fees, ease of access using applications for rent bikes and ease of understanding instructions on applications [13].

3 Equations and mathematics

3.1 Validity and reliability test

In this study validity is calculated using df (degree of freedom) with the formula $df = n - 2$, and with alpha 5%. If the r count is much larger than the r table and the value of r is accepted, then the question item is to be valid [15]. This data obtained the value of r table, which is 0,1966, and the value of r count is larger than r table so the question item is valid and the alpha value of 0.679 is more than 0,6, which means it has sufficient reliability.

3.2 Factors analysis

After ensuring that the data used is eligible, then PCA analysis can be continued. PCA analysis begins by calculating the correlation value between variables. In this analysis, the correlation of each variable is formed in a correlation matrix. The formation of a new variable is based on more than one eigenvalue. The results of the calculation of eigenvalues and variance can be seen below.

From Table 1, it can be seen that there are four main factors that represent eigenvalue value that has a value of more than 1. These four factors have eigenvalue sequential. The first prequel component has an eigenvalue of 3.056 (variance of 23,509%). The second predictor component has an eigenvalue of 2.727 (variance of 20,973%). The principal third component has an eigenvalue of 2,003 (variance of 15,411%). The fourth principal component has an eigenvalue of 1.118 (variance of 8,602%). These fourth principal components are able to explain the data diversity of 68,495 % seen from % total variance. To determine the new five variables that are very influential on using bicycles then rotation matrix factor.

Table 1. Eigen value of main component analysis result (PCA).

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
Weather	3.056	23.509	23.509
air pollution	2.727	20.973	44.483
topography line	2.003	15.411	59.893
Mileage	1.118	8.602	68.495
capacity line	0.989	7.611	76.106
barrier modal	0.935	7.191	83.297
availability bicycle line	0.659	5.066	88.364
bike signs	0.450	3.464	91.828
bicycle map	0.420	3.234	95.062
bicycle operator	0.276	2.125	97.187
rental fee	0.206	1.585	98.772
easy of application access	0.123	0.945	99.716
easy of application instruction	0.037	0.284	100.00

(source: Setyowati¹.E. et al. 2018)

Table 2. Rotated component matrix.

Variable	New Component			
	1	2	3	4
weather	0.821	0.021	0.059	0.029
air pollution	0.818	-0.022	-0.044	-0.070
topography line	0.779	-0.022	-0.038	-0.075
mileage	0.859	-0.022	-0.002	-0.014
capacity line	0.427	0.139	0.634	0.214
barrier modal	0.053	0.068	0.817	0.278
availability bicycle line	-0.011	-0.088	0.130	0.826
bike signs	-0.087	0.110	0.156	0.834
bicycle map	-0.127	-0.097	0.637	0.046
bicycle operator	-0.062	0.151	0.746	-0.005
rental fee	0.265	0.577	0.260	-0.088
easy of application access	-0.109	0.957	0.001	0.053
easy of application instruction	-0.114	0.953	-0.02	0.043

(source: Setyowati¹.E. et al. 2018)

In Table 2, the correlation relationship between the original variable and the new variable (principal component) formed with PCA is called the loading value. The value of loading taken above is 0.5 which is considered to be able to explain the variables that affect people using the bike. Variables whose value is below 0.5 are considered less influential in the use of bicycles. The newly formed variable has represented 13 variables in the original data. Then Table 3 will show in detail the variables that affect the use of bicycles.

Table 3. Summary of main component analysis (PCA).

Factor	Eigenvalue	Varian value (%)	Variable	loading factor
1	3.056	23.509	weather	0.821
			air pollution	0.818
			topography line	0.779
			mileage	0.859
2	2.727	20.973	rental fee	0.577
			easy of application access	0.957
			easy of application instruction	0.953
3	2.003	15.411	capacity line	0.634
			barrier modal	0.817
			bicycle map	0.637
			bicycle operator	0.746
4	1.118	8.602	availability bicycle line	0.826
			bike signs	0.834

(source: Setyowati¹.E. et al. 2018)

In Table 3. the first component principal has a variance percentage value of 23.509%. At the value of the loading variable forming the first component principal is the weather 0.821; air pollution 0.818; topography line 0.779%; mileage 0.859%. The second component principal has a value of variance percentage of 20.973%. At the value of the loading variable forming principal second component that are rental fee 0.577; ease of application access 0.957; ease of application instruction 0.953. Principal third component has the value of variance percentage as much as 15.411%. At the loading value variable forming principal third component that are capacity line 0.634; barrier modal 0.817; bicycle map 0.637; bicycle operator 0.746. Principal fourth component has a value of variance percentage as much as 8.602%. At the loading value of the forming variable principal component of the fourth are availability bicycle line 0.826; bike signs 0.834.

4 Conclusions

The results of the data obtained are four new variables that determine the factors that affect the influence of tourists using bicycle rental in shopping in Surakarta. The four new variables formed will be able to explain from the total variant of 68.495%. The four new variables include weather. air pollution. topography of bike lanes. and mileage. From the previous study it is stated that the result of factor analysis found 6 main factors namely the factors of pleasure. physical and environment. safety. convenience. personal barriers. and necessity. While the most important results of the cycling facility sequence are the lane. bicycle route. parking. bicycle parking in the terminal or station. rules that support cycling. bike repair. bike shop. bicycle rental and public bike. bike sharing. bus with shelf for bicycles. bicycles for equipment at terminals or stations. and bathing places for cyclists at work [16].

It is expected that further research will be conducted to improve the arrangement of better transportation system. convenient. safe. and environmentally friendly by using bicycles.

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