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Characteristics of Movement and Factors Affecting the Choice of Mode of Transport of Community on the Bank of Musi River of Palembang City of South Sumatra

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Abstract. Palembang City is one of the cities having the largest river in Indonesia and it should be able to take advantage of river transportation as an alternative choice. Inadequate availability of river transport facilities and infrastructures makes the people prefer other modes of land transportation rather than using river transportation. In addition, the development planning of river transportation such as the development of river taxi is less successful because it is not yet based on the movement pattern of the origin of the community travel destination. Based on the above matter, this study was conducted. The aim of the study was to find out the characteristics and factors affecting the mode choice of the community living along the bank of Musi River of Palembang City to be the basis of the development of river transportation system in Palembang City. The selected modes were motorcycles, cars, city transports, and ketek (motorized boats). Survey of home interviews was conducted to determine the origin of the destination and characteristics of travel was conducted in 30 villages located on the banks of Musi River. Field survey was conducted to determine the conditions and types of existing river transportation facilities and services. The results show that only 5.3 % of the occurrence movement used river transportation, the rest used motorcycles (69.1%), urban transport (15.9 %) and cars (9.7%), with the travel range less than 10 minutes and 10 - 20 minutes as much as 43.2 % and 29 % of the total trips. From the socioeconomic profile of the community, it is found that most of the people living along the Musi River have low and middle incomes with the largest types of jobs as workers, students, shop owner, and housewives. The peak movement time for the movement of river transport occurs at 7:00 - 8:00, 10:00 - 11:00 and 16:00 - 17:00 with the movement of origin of the destination of river transportation is known to be 50% at the traditional market center of Dermaga of 16 Ilir. Types of river transportation used for short trips are large, medium and small motorized boats. While for longer trips there are large and medium size speedboats. The statistical analysis results showed that the parameters affecting the mode choice of the community living along the bank of Musi River were age, occupation, monthly income, house types, and travel time.

INTRODUCTION

Palembang City is the capital city of South Sumatra Province traversed by Musi River which is one of the biggest rivers in Sumatra Island. In Indonesia, river transport develops naturally due to its geographical condition with lots of rivers. The river transport is nowadays still very beneficial for reaching areas which are not connected yet by land transport.

In big cities in which rivers traverse, a river transport is supposed to be an alternative mode of transportation, particularly for the people living along the river banks. In Palembang City there are about 25% of 1.8 million people living in sub districts along Musi River. However, the percentage of people using river transports is still very low.

This article discusses the characteristics of users and travel, types of river transportation facility, and characteristics of mode choice of the community living along the Musi River banks of Palembang City. It aims to use the results as a base of future river transport development.

LITERATURE REVIEW

Transportation mode choice has been attracting attention of many researchers. Many research papers have been published on various issues concerning transportation mode choices. Buehler (2011) [1], for example, compared what determined people's choice of transport mode in Germany and the United States, see also Corpuz (2007) [2], Roberts (2012) [3], and Chee and Fernandez (2013) [4]. Nkegbe, et al. (2012) investigated how university students in Ghana chose transport mode. Furthermore, modeling mode choice using different factors from personal and demographic characteristics to socio-economic levels is also of interest [5]. Khan, et al. (2007) developed passenger mode choice models based on socio-economic group in sub-urban town [6]. Binomial and multinomial logistic regression and artificial neural networks are often used for this purpose, see, for instance, Rajalakshmi (2013) [7], Tejaswi, et al. (2015) [8], and Miskeen, et al. (2013) [9]

METHODS

The research locations covered kelurahan (sub – sub district) at Musi River banks which potentially have the river transports. There are 30 kelurahan having potential river transport given in Fig. 1.

Home interview survey by Arliansyah, et, al. (2015) [10] was conducted at 1890 households or 2.5% of the number of the households in the study area in order to collect the data of social and economic characteristics of the community, travel pattern, and mode choice . Besides, field survey was conducted to inventories and find out the conditions of the existing river transport facilities and infrastructures. Statistical analyses were conducted to get the factors affecting the mode choice.
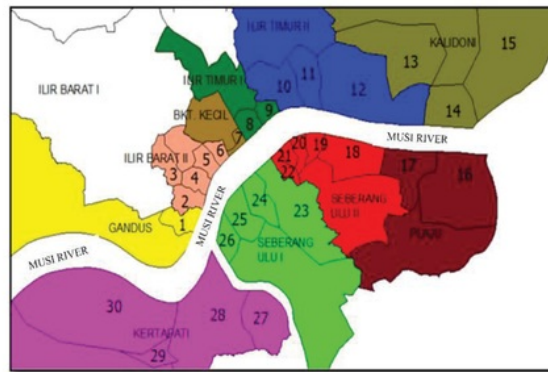

FIGURE 1. Map of study location

RESULTS AND DISCUSSION

Summary of the data of survey result is given in Table 1. The following are the discussions of the characteristics of users, travel, and mode choice:

Social and Economic Characteristics

The social and economic conditions of the people living along the Musi River were age range, income, and occupation types as follows:

- The most age range was the one above 25 years old (67.7%), and then it was followed by the one ranging from 13 to 18 years old (14.7%). The age range between 19 and 25 years old was 13.6% and that of less than 12 years old was 4%.
- The occupation as employees was the most job proportion of 21.6%. The students could be said as a profession without any earnings by 21.3%, the occupation as a store owner was 16.3%, and housewives by 9%. There were 4.4 % of the whole population having no jobs.

TABLE 1. Data Summary

Variables	Categories	Transportation Mode								Total	%
		Motorbike		Car		Angkot		Ketek			
		Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Gender	Male	1870	70.6	287	11.3	275	10.8	115	4.5	2547	66.6
	Female	773	60.4	85	6.6	334	26.1	87	6.8	1279	33.4
Age	< 12 years	54	35.1	11	7.1	88	57.1	1	0.6	154	4.0
	13 -18 years	362	64.2	15	2.7	181	32.1	6	1.1	564	14.7
	19 - 25 years	395	76.1	37	7.1	70	13.5	17	3.3	519	13.6
	> 25 years	1832	70.8	309	11.9	270	10.4	178	6.9	2589	67.7
Occupation	Govt. Employee	25	48.1	24	46.2	1	1.9	2	3.8	52	1.4
	Professional	168	68.6	63	25.7	12	4.9	2	0.8	245	6.4
	Self Employed	461	73.8	75	12.0	59	9.4	30	4.8	625	16.3
	Pvt. Employee	650	78.6	121	14.6	35	4.2	21	2.5	827	21.6
	Handyman	109	86.5	6	4.8	11	8.7	0	0	126	3.3
	Daily Wage	265	76.1	4	1.1	49	14.1	30	8.6	348	9.1
	Private Driver	14	60.9	4	17.4	4	17.4	1	4.3	23	0.6
	Public Driver	45	51.7	5	5.7	17	19.5	20	23.0	87	2.3
	Office Boy	62	73.8	0	0	20	23.8	2	2.4	84	2.2
	Farmer/Fisher/Breeder/Craftsman	8	44.4	0	0	0	0	10	55.6	18	0.5
	Security	60	93.8	4	6.3	0	0	0	0	64	1.7
	Student	500	61.3	33	4.0	281	34.4	2	0.2	816	21.3
	Housewife	174	50.6	13	3.8	91	26.5	66	19.2	344	9.0
	Unemployed	102	61.1	20	12.0	29	17.4	16	9.6	167	4.4
Monthly Income	< Rp. 1.500.000	352	55.9	9	1.4	207	32.9	62	9.8	630	16.5
	Rp. 1.500.000 - Rp. 3.000.000	814	69.9	25	2.1	243	20.9	82	7.0	1164	30
	Rp. 3.000.000 - Rp. 4.000.000	705	82.8	25	2.9	85	10.0	36	4.2	851	22.2
	Rp. 5.000.000 - Rp. 6.000.000	330	71.4	85	18.4	33	7.1	14	3.0	462	12
	Rp. 6.000.000 - Rp. 7.000.000	164	71.0	46	19.9	17	7.4	4	1.7	231	6.0
	Rp. 7.000.000 - Rp. 8.000.000	82	73.9	24	21.6	5	4.5	0	0.0	111	2.9
	Rp. 8.000.000 - Rp. 9.000.000	59	77.6	17	22.4	0	0	0	0	76	2.0
	Rp. 9.000.000 - Rp. 10.000.000	61	46.2	57	43.2	14	10.6	0	0.0	132	3.5
	>Rp. 10.000.000	76	45.0	84	49.7	5	3.0	4	2.4	169	4.4
Household Size	1 - 3 persons	858	71.1	123	10.2	148	12.3	78	6.5	1207	31.5
	4 - 6 persons	1690	68.8	235	9.6	417	17.0	116	4.7	2458	64.2
	7 - 9 persons	95	59.0	14	8.7	44	27.3	8	5.0	161	4.2
House Type	Bamboe	4	33.3	2	16.7	6	50.0	0	0	12	0.3
	Wood	649	60.9	18	1.7	275	25.8	124	11.6	1066	27.9
	Semi Concrete	672	80.2	21	2.5	125	14.9	20	2.4	838	21.9
	Concrete	1318	69.0	331	17.3	203	10.6	58	3.0	1910	49.9
No. of Vehicles Owned	0	69	22	5	1.6	184	59	53	17.0	311	8.1
	1 – 3	2294	74	265	8.6	392	13	145	5	3096	80.9
	4 – 6	230	66.3	90	25.9	23	6.6	4	1.2	347	9.1
	7 – 9	30	68.2	12	27.3	2	4.5	0	0	44	1.2
	> 9	20	71.4	0	0	8	28.6	0	0	28	0.7
Travel Time	< 5 min	186	49.2	6	1.6	120	31.7	66	17.5	378	9.9
	5 - 10 min	908	71.2	55	4.3	241	18.9	71	5.6	1275	33.3
	10 - 20 min	761	68.3	126	11.3	178	16.0	50	5	1115	29
	20 - 30 min	323	71.5	83	18.4	35	7.7	11	2.4	452	11.8
	> 30 min	465	76.7	102	16.8	35	5.8	4	0.7	606	15.8
OD Water Connectedness	Yes	1276	61.7	228	11.0	361	17.5	202	10	2067	54.0
	No	1367	77.7	144	8.2	248	14.1	0	0	1759	46.0
Total		2643	69.1	372	9.7	609	15.9	202	5.3	3826	100

- The most percentage of community income was in the range of monthly income of between IDR 1.5 million and IDR 3 million (30%), that of between IDR 3 million and IDR 4 million was 22.2%, and that of less than IDR 1.5 million was 16.5%. In summary, most of the people living along the Musi River belong to a low economic community.

Characteristics and Travel Pattern of the Community

The characteristics and travel pattern of the community living along the Musi River are described as follows:

- The mode transport used was dominated by motorcycles by 69.1% followed by city transport by 15.9% and personal cars by 9.7%. There were only 5.3% of the people using river transport. It indicates that although the people reside in the banks of Musi River, very few of them take river transport.

TABLE 2. Types of river transport facility

Mode Type	Ketek Type	Capacity	Engine Specification	Picture
Big Speed Boat	2 m x 6 m	18 Person	200 PK	
Small Speed Boat	1.2 m x 4 m	10 person	40 - 60 PK	
Big Ketek	3 m x 7.5 m	25 Person	20 - 30 PK	
Medium Ketek	2 m x 6 m	20 Person	10 - 20 PK	
Small Ketek	1.5 m x 1.5 m	10 Person	5-10pk	

- The most travel time taken was the one between 5 and 10 minutes by 33.3%, followed by that of between 10 and 20 minutes by 29.1%, and that of more than 30 minutes by 15.8%. The percentages of travel time between 20 – 30 minutes and less than 5 minutes were 11.8% and 9.9% respectively. It is obvious that most of the travel time taken was a short time below 10 minutes by 43.2% and it was dominated by motorcycles.

Characteristics of River Transport Movement

- The survey data of the origin of travel destination showed that the rush hours of river transport movement occurred in the morning from 7:00 to 8:00 WIB (Western Indonesian Time) and from 10:00 to 11:00 WIB, and in the afternoon from 16.00 to 17.00 WIB. The main origin and destination of the travel was Kelurahan 16 Ilir, the trading center of Palembang City from which 50% of the travel came from and went to this place.
- The river transport facility used is shown in Table 2. Ketek is an engine public boat that can carry up to 20 passengers at once depending on the size of the boat. Ketek operate along the Musi iver.

The ketek transport facility serves in city transport of Palembang City according to the passengers' destination with the cost previously agreed depending on the distance and travel time. The speed boat facility uses a higher engine specification with more speed. It is used particularly for traveling out of Palembang City.

Characteristics of Mode Choice

Variable of interest Y is transportation mode and has four categories: motorbike, car, angkot, ketek. Angkot is a public city car, kind of small minibus that can carry up to 12 passengers. Explanatory variables are travel time (X_1), house type (X_2), monthly household income (X_3), household size (X_4), number of vehicles owned (X_5), age (X_6), gender (X_7), occupation (X_8), and water connectedness (X_9). Table 3 shows the frequency distribution in each category within explanatory variables across transportation modes. Note that males are twice as many as females in the sample.

Students and private transportation modes dominated our respondents (43.9%). Moreover, about 81% respondents had $1 - 3$ vehicles. It was also observed that a motorbike was the most favorite mode of transportation for most respondents (about 70 %). This is understandable because motorbikes are very affordable. More males rode motorbikes than females did because there were many as females in the sample. Note that more than 5% respondents took ketek as a transportation means. Although a motorbike was much more popular, ketek was still used by the people whenever the origin and destination were connected by waterways. More people with lower income took ketek even though they had private vehicles. Older people seemed to take ketek more than the younger ones did.

Contingency table or cross tabulation was used to display frequency distribution of variables. This table shows how frequency of each level of response variable Y is distributed among categories of each influencing variable X. Chi-square test was then used to assess the relationship between the variables. If there exists a relationship between the variables, coefficients based on chi-square statistic were used to measure how strong the relationship is. Contingency analysis is summarized in Table 3. From this table it shows that Chi-square test is significant ($p<0.005$) for all explanatory variables. This indicates that all variables are significantly influential in people's choosing of transportation mode. Contingency coefficients which measure the strength of relationship, however, show that the relationship is not very strong. Only five explanatory variables have fairly strong relationship with response variable; i.e., age, occupation, monthly income, house type, and travel time. Limtanakool, et al. (2006) [11] also found that travel time is indeed one of important considerations in transport mode choice. Cost is another important factor affecting transport mode choice (Frank, et al., 2008 [12]) and this is related to household monthly income, which in some ways is also related to occupation. In general, people with higher income tend to have concrete houses rather than wooden houses. This explains why house type is one of the influential factors in transport mode choice.

TABLE 3. Contingency analysis

| Variable | Chi square | | | Contingency Coefficient | | | | |
	df	Value	Asympt. Sig. (2-sided)	Value	Max Value	Normalized	Approx. Sig.	Remarks
Gender	3	173.42	0.000	0.208	0.783	0.266	0.000	low
Age	9	428.87	0.000	0.317	0.866	0.366	0.000	Fair
Occupation	39	987.77	0.000	0.453	0.914	0.496	0.000	Fair
Monthly Income	24	1025.38	0.000	0.46	0.904	0.509	0.000	Fair
Household Size	6	33.31	0.000	0.093	0.841	0.111	0.000	Very Low
House Type	9	479.32	0.000	0.334	0.866	0.386	0.000	Fair
No. Of Vehicle Owned	12	756.37	0.000	0.406	0.880	0.232	0.000	Weak
Travel Time	12	425.19	0.000	0.316	0.880	0.359	0.000	Fair
OD Water Connectedness	3	221.71	0.000	0.234	0.783	0.299	0.000	Low

In terms of proportional reduction of error, Table 4 presents Goodman-Kruskal's index of predictive association (λ) for each explanatory variable. This index measures how much predictive error is reduced if a particular explanatory variable is taken into account when predicting the response variable. In our case it seems that knowing explanatory variables does not so much help in predicting response variable, except Age and Number of Vehicles Owned which reduce errors about 3% and 10%, respectively.

TABLE 4. Proportional reduction of error

Explanatory Variable	Lambda
Gender	0.000
Age	0.029
Occupation	0.002
Monthly Income	0.007
Household Size	0.000
House Type	0.002
Number of Vehicle Owned	0.097
Travel Time	0.000
OD Water Connectedness	0.000

CONCLUSION

1. Although motorbike is much more popular, ketek is still taken by the people whenever origin and destination are connected by waterways. More people with lower income take ketek even though they own private vehicles. Older people seem to take ketek more often than the younger ones do
2. Age, occupation, monthly income, house type, and travel time are among important factors in determining transport mode choice.

REFERENCES

1. R. J. Buehler, Transp. Geogr **19**, 644–57 (2011).
2. G. Corpuz, *30th Aust. Transp. Res. Forum,* (2007).
3. K. Roberts, J. Purs, Undergrad. Res. Univ. Tenn. 4, **1**, 41-52 (2012).
4. W. L. Chee, and J. L. Fernandez, Procedia Soc. Behav. Sci. **91**, 120 – 7 (2013).
5. Nkegbe. P. K, Kuunibe. N, and Mumin. Y. A, Int. J. Bus. Soc. Sci. **3**(20), 136-42 (2012).
6. Khan. O, Kruger. J, and Trivedi. T, *30th Aust. Transp. Res. Forum,* (2007).
7. P. Rajalakshmi, Int. J. Innov. Res. Sci. Eng. Technol. **2**(1), 360-9 (2013).
8. G. Tejaswi, S. A. Kumar, Aramesh, and M. Kumar, Int. J. Res. Eng. Technol. **4**(13), 311-4 (2015).
9. M. A. A. B. Miskeen, A. M. Alhodiari, and R. A. A. Rahmat, Int. J. Civ. Environ. Struc. Constr. Archit. Eng. **7**(9), 636-45 (2013).
10. J. Arliansyah, Y. Hartono, and Y. Hastuti, Final Rep. Natl. Grants Strategy 2016, (2016).
11. N. Limtanakool, M. Dijst, and T. Schwanen, J. Transp. Geogr, **14**, 327–41 (2006).
12. L. Frank, M. Bradley, S. Kavage, J. Chapman, and T. K. Lawton, Transp. **35**(1), 37-5 (2008).

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