ARPN Journal of Engineering and Applied Sciences

INFLUENCE OF IN-VEHICLE TIME OF PRIVATE CARS TO PUBLIC TRANSPORTS IN THE CHOICE OF RIVER TRANSPORT MODES

Iphan F. Radam[1], Bambang Haryadi[2] and Bagus H. Setiadji[3]
[1]Study Program of Civil Engineering, Lambung Mangkurat University, Banjarmasin, Indonesia
[2]Department of Civil Engineering, Semarang State University, Semarang, Indonesia
[3]Department of Civil Engineering, Diponegoro University, Semarang, Indonesia
E-Mail: ifradam@unlam.ac.id

ABSTRACT

This study aims to look at the extent to which the differences in-vehicle time between private cars and public transports in influencing the probability of choice of public transport on rivers. Emphasizing the river's public transport is due to the policy of the local government to revive this form of public transport as the city transportation's icon. One of the habits to increase the choice of one mode is to improve its services and appeal, when one of the causes why trip makers are more likely to use private cars since the time of the vehicle took is faster than public transports. An analysis using the approach of multinomial logit models that competed with other modes of public transports is a river-based public transports, land public transports, and private cars. From the analysis' results obtained, it can be concluded that river-based public transports will be able to be wanted and return to compete with private cars, not only by improving the image and services but also one other factor that must be considered which is, in-vehicle time (IVT) from private cars toward public transportation. If the condition of the river public transports has been improved and enhanced, meaning their image and the service, then with the fastest travel time and with the same fare, the probability of choice will be increased by 0.20 on the existing condition (the IVT of private cars is faster). When the IVT of private cars is the same, then the probability of choice will be increased to 0.38, and increase again to 0.43 when the IVT of private cars is longer than what public transports has. Of the three conditions of the IVT of private cars, river-based public transport showed a balance of choice with a private cars when the IVT of private cars is the same to public transports.

Keywords: mode choice, in-vehicle time, service, river-based public transport.

INTRODUCTION

Public transports in Banjarmasin in addition of being served by land / on a road transports, it is also served with a river-based transportations, such as boats and *kelotok* (motorboats). Banjarmasin will not be separated without its signature river-based transports. The documentary made by Ochse in 1925 illustfares that Banjarmasin, since the Dutch colonial era, is well-known as the 'Venice of the East Indies' [1]. Activities of people civilization at the time were dominated by river transports both as daily trips as well as transportation of commercial activities [2]. But in its development in recent days, it is very unfortunate that the publics' interest in using the river transportation decreased compared to the use of land transportation.

A treatment of the development of river transports should be a comprehensive action on arising issues of among shipping capacity, type of ship, competition, management, technical equipment, and security systems [3]. Therefore, to increase interest in the transport users need to at least be addressed, for example on the good condition of the vehicle as well as the quality of service by providing a new alternative of river transportation. From the conditions of the vehicle, such as the maintained cleanliness of vehicle, the humble drivers (the perception of safety), and how comfortable the cars are, with cool temperatures, these become an influential factor in the choice [4]. Similarly, the condition of the transit spot, the transport itself, and the easiness to choose stops, these are just as important [5]. Radam *et al.* showed that there are four criteria dominantly affect the interests of river-based transports' users in Banjarmasin; i.e. the vehicle can protect passengers from internal disturbances (safety criterion), protect them from external disturbances (protection criterion), has a good appeal (image) that do not come off as "cheesy" (utilization criterion), as well as provide a quiet and enjoy for passengers during the ride (comfort criterion) [6]. In terms of public transport services, the purpose is so that they can compete, at least by an implementation of scheduled departures time (punctual) for the transports, a proved safety and security, as well as the easiness of the transports' accessibility [7]. The exact departure times have to be at least be implemented with departures information which includes the time and frequency [5] [8]. It is without a doubt when unreliable public transport services, have a low frequency or lack of comfort, people tend to switch to choose their own cars instead, because they do not consider public transports as a valid alternative to them [9].

Apart from the factor of public transport itself, the tendency of trip makers in choosing is also influenced by other modes, particularly ones which mainly competed toward the use of private cars. It is a popular argument for the use of the car due to the factors of its convenience, speed, comfort, and individual freedom [10]. Of these four factors, psychologically, factors of convenience, comfort, and individual freedom can be accommodated by providing optimum services in accordance with the will of its users, while the speed factor is dependent upon the pattern of operations. In terms of the speed factor of public transport against private cars, it can be described with a term 'in-vehicle time' (IVT) [5], while on the in-vehicle

ARPN Journal of Engineering and Applied Sciences

time of public transports, it is likely to be longer, equal to, or faster than the in-time-vehicle on the use of private cars. Other than the issues of the city of Banjarmasin which is interested to revive the river transportations as public transport, it is not necessarily done just by improving the service factor and image of the transport alone but there needs to be considered to what extent the effective improvement in the conditions of the IVT in different transportation to private cars. This IVT factor is exactly the basis of this research to understand to what extent it will influence a travel behavior in determining a mode choice; river-based public transport, land public transport, or private cars.

METHODOLOGY

Analysis used in this research is discrete choice logit model. The competed modes are river-based public transport (RPuT), land public transport (LPuT), and private cars (PrC). The target respondents were captive and choice passengers with the same ride length. The type of data used is Stated Preference data. The data retrieval technique used in this research is proportional simple random sampling.

Logit model approach

Logit model is a non-linear probability model which results in an equation with the categorical dependent variable. The most basic categories used are binary values such as the numbers 0 and 1 which represents the existence of a category. A regression equation of Logit model is acquired from the derivation of probability equation from the to-be-estimated categories. The application of Logit model in the transportation analysis is mainly in the choice of the mode that is based on the theory of discrete choice mode [11], the development of this Logit model has resulted in some of the approaches that are valuable and has been the method most widely used than other methods especially for discrete choice analysis [12] [13]. The discrete choice model describes the choice of policy makers to some alternatives. More specifically, Ortúzar and Willumsen define discrete choice models as an opportunity for each individual in choosing an option due to a function of their socio-economic characteristics and appeal of such options [14]. Each model is usually preceded by building an initial hypothesis as a formula for determining the characteristics to be a function of choices. The hypothesis underlying the discrete choice model with regard to the choice situation, especially individual choice toward any alternative offered is usually expressed by the measure of attractiveness or utility [11]. Utility is a special measure for someone in evaluating and determining the best alternative option. Utility is a attribute function of the alternatives according to the characteristics of the decision maker. Therefore, the utility is a set of options that become the 'decision rule' in a discrete choice model [15].

Measures of goodness of fit model

The measurement of the goodness of fit model is the result of a statistical test which shows the accuracy of the formed model is closer to the observed data. In the case of a qualitative response model, the accuracy can be assessed both in terms of the fit between the calculated probability and the frequency of observed response or in terms of the ability of the model in predicting observed responses [16]. In terms of consistency and statistical characteristics in the Logit model, hence the resulted value of ρseudo-R^2 can explain the measurement of the model both on the practical and theoretical aspects. An elaboration of ρseudo-R^2 has a different interpretation by the coefficient of determination (R^2) in a linear regression model [7] [16] [17]. The model is said to have a relatively good accuracy, when the condition of ρseudo-R^2 is higher than 0.2 [18], whereas Hensher *et al.* provides limits totaling more than 0.3 [7]. Radam *et al.* did a combination between OLS Scale correlation (Guildford's scale) and Domencich & McFadden Graphic, then the value of ρseudo-$R^2 \geq 0.21$ shows an actual relationship with a strong degree of correlation on the obtained model [19].

Other than the value of ρseudo-R^2, a P-value approaching 0 ($\alpha < 0.05$) is usually used to indicate that the attributes (independent variables) that are reviewed are valid for use. Attributes' algebra marks on the resulted model should meet the logical criteria, such as attributes inversely with the dependent variable is (-) and when it should be proportional to (+), for example, travel time has algebraic sign (-) due to the longer travel time is usually the smaller the probability of choice is, as well as with the case of travel cost [19].

Stated preference techniques

Stated preference (SP) technique is a method that uses a choice of individual respondents' statements about their choice within a set of options to estimate the utility function [20]. SP technique has a distinct characteristic, which is the use of experimental design to build an alternative or hypothetical scenario with attributes that influence the situation (hypothetical situation) which is then presented to respondents [21]. This hypothetical scenario is subsequently used as a forecasting tool that is applied in the choice set as a way of estimating the utility function in discrete choice model [22]. In general, the analysis used in the study using SP techniques is Discrete Choice Model, which is a probabilistic model where the value of each respondent's preferences is related to other options in a set of offered alternatives [19].

ANALYSIS AND RESULT

Model analysis of mode choice

The model of mode choice among river-based public transport, land public transport, and private cars is designed based on *multinomial logit models* (MNL) approach as the non-linear probability model choice. The analysis process to get the model of mode choice it takes is 1) modeling the basic utility equation of every option which includes all the attributes, 2) estimating utility equation by trial and error combinations of influencing attributes, and 3) testing the utility model and attributes (*goodness of fit*) with test indicators value such as ρ*seudo*-

ARPN Journal of Engineering and Applied Sciences

$R^2 \geq 0.21$, P-value < 0.05, and the algebra logicality mark. The data used for the analysis is data of mode choice which is divided into 18 sets of options with a total sample of 220 respondents. Based on the minimum number of samples required Bliemer *et al.* [23], the requirement has been met, more than 12 sets of choices with sample measurement at least 100 respondents. The target respondents were trip makers who live along the river bank and nearby the road so that they had been familiar with the three modes.

The form of basic equations of choice probability among river-based public transport, land public transport, and private cars is described as follows:

$$P_i = \frac{\exp(U_i)}{\exp(U_{RPuT}) + \exp(U_{LPuT}) + \exp(U_{PrC})}$$

where:

P_i = Probability of choice, which were reviewed (river-based public transport, land public transport, or private cars)

U_i = Utility equation in terms of modes (river-based public transport, land public transport, or private cars)

U_{RPuT} = Equation of river-based public transports' utility

U_{LPuT} = Equation of land public transports' utility

U_{PrC} = Equation of private cars' utility

The form of utility of each mode refers to the following basic equation:

$$U_i = \theta_0 + \theta_1 X_1 + \theta_2 X_2 + \ldots + \theta_n X_n$$

where θ_0 is a constants, $\theta_1, \theta_2, \ldots, \theta_n$ is a coefficient of independent variable or attributes, and $X_1, X_2, \ldots, X_n$ is reviewed attributes, including:

X_1 = Attributes of travel time of each mode (minutes)

X_2 = Attributes of travel costs / fares of each mode (in IDR)

X_3 = Dummy attributes of IVT's condition of private cars toward public transportation, with an assessment for the IVT's condition of private cars when it is slower than the land public transport = 0, IVT's private cars is equal to land public transport = 1, and IVT's private cars is faster than land public transport = 2

X_4 = Dummy attributes of condition (physical and services) of river-based public transports, with an assessment for the condition of the existing river transportations = 0 and the condition of planned river transportations = 1

The physical condition of the existing river transportation and offered plans is as illustrated in Figure-1. The typical river-based public transport plan used is the result of studies which were already carried out in the same study area. In general, the planned river-based public transport has the type of double hull, has entry/exit accesses which can be done from the front or back, has a standard 25 km/hour for the speed of the desired, has the side of the boat that makes it possible to design an open or closed vehicle, allows passengers to stand at the time of river transportation in operation, whose type of load allows for bicycles, has the under position for passenger above the water surface, and has the position of captain in the middle of the back of rising with tarps[6].

Figure-1. The physical condition of the existing and planned river-based transports.

In terms of services, planned river transports are assumed to be able to meet the 15 criteria of the (Indonesian) National Transportation System: guaranteeing the safety, accessibility, integrated, sufficient capacity, regulated, smoothly and fast, easy, punctual, comfortable, affordable fares, orderly, safe, low pollution, low public burden, and high utility.

Furthermore, in the analysis process to get the best model of mode choices, this research used LIMDEP software. The result of the analysis of the best model for estimation parameters is shown in Table-1.

Table-1. Parameter estimation.

Variable	estimate	P-Value
Travel time	- 0.18736	0.000
Travel cost	-0.00097	0.000
Factor of IVT	1.51088	0.000
Condition of RPuT	1.47801	0.000
Constanta of RPuT	8.13704	0.000
Constanta of LPuT	8.04353	0.000
ρ*seudo*-R^2	0.23704	
Adj. ρ*seudo*-R^2	0.23646	

From Table-1 above, it shows all P-Values of each attribute of < 0.05, this means that in terms of partially reviewed attributes, it shows a significant effect on the independent variables. The algebra mark of travel time and travel cost attributes is (-), it corresponds because the longer travel time or the greater the applied fares will reduce the level of choice, as well as the condition factor of river-based public transport that includes (+) which means that their physical reparation and provided service will increase the choices on river-based public transport modes, and IVT factor (+) which means the better value IVT of private cars compared to public transport passengers is, the more likely it is for users to choose a

VOL. 12, NO. 11, JUNE 2017 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

private cars. Judging the value of the correlation model (ρ*pseudo*-R^2), it has shown a real relationship with a strong degree of correlation ($\geq$ 0.21).

Furthermore, from the estimated parameters, utility equation of each option can be established as follows:

U_{RPuT} = 8.13704 - 0.18736*tr1 - 0.00097*cs1 + 1.47801*ser
U_{LPuT} = 8.04353 - 0.18736*tr2 - 0.00097*cs2
U_{PrC} = 1.51088*IVT

where:
tr_i = travel time
cs_i = travel cost
ser = the factor of river-based public transport conditions
IVT = condition of IVT's private cars compared to public transports

The IVT influence on the choice of the existing RPuT

From the field data, it is known that the average trip maker undergo their daily mobility using public transports either by river or land in the city which in the approximate distances of ± 4 km. The average travel time for the distance is between 15 to 20 minutes. The travel time of RPuT is faster than LPuT because its mobility is not as tight-on-schedule as on land that has been heavily influenced by the mobility of other cars. But the waiting time and getting-on-and-off time of RPuT passengers are still less than good so that the RPuT will approximately take longer than 2 minutes than LpuT took for the same distance. Fares applied to both the public transports are the same IDR 5000 by plate. Based on existing data, it can be seen that the bigger tendency for trip makers in selecting existing RPuT in the conditions of IVT's a private vehicle, which can be seen in Table-2.

Table-2. The probability of choice based on changes in travel time and IVT's private cars (existing condition).

Travel time (minute)		Probability (IVT's PrC is faster)			Probability (IVT's PrC is equal)			Probability (IVT's PrC is longer)		
RPuT	**LPuT**	**RPuT**	**LPuT**	**PrC**	**RPuT**	**LPuT**	**PrC**	**RPuT**	**LPuT**	**PrC**
22	20	0.02	0.03	0.95	0.08	0.10	0.82	0.22	0.29	0.50
21	19	0.02	0.03	0.94	0.09	0.12	0.79	0.24	0.31	0.45
20	18	0.03	0.04	0.93	0.11	0.14	0.76	0.26	0.34	0.41
19	17	0.03	0.05	0.92	0.12	0.16	0.72	0.27	0.36	0.36
18	16	0.04	0.05	0.91	0.14	0.18	0.68	0.29	0.39	0.32
17	15	0.05	0.06	0.89	0.16	0.21	0.64	0.31	0.41	0.28

From Table-2, it appears that on the conditions of IVT's PrC, when it is faster than LPuT, there is a dominant tendency for trip makers to prefer private cars compared to both public transport modes, nor when the IVT of PrC is equal to LPuT. The competition of the three modes began to appear visibly when IVT's PrC is longer than LPuT. In these conditions, the visible balance of choices can be achieved if the travel time of RpuT is approximately between 17 to 19 minutes and LPuT between 15 to 17 minutes. The application of these conditions to current situation is difficult, when in reality, for a distance of 4 km; they can be reached by private cars within less than 15 minutes. Alternatively, in the sense that the should be a necessary traffic management that make travel time by private vehicle to become longer. In general, the probability for both modes of public transport is seen that as a result of a less interesting image and the lack of good public transport services which resulted in higher tendency for trip makers to choose land public transports for all of the conditions of IVT's PrC.

Judging from the influence of IVT's PrC on the probability of choice of the existing RpuT, it has a very significant impact. This can be illustrated as in Figure-2.

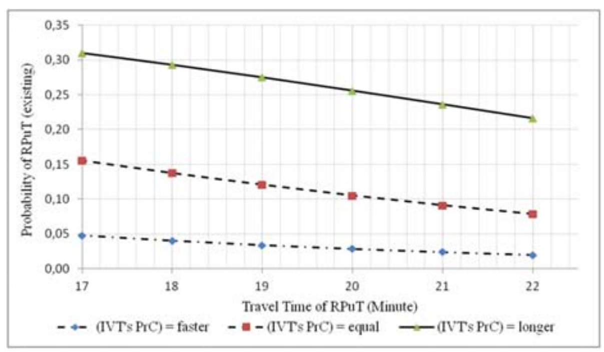

Figure-2. Probability choice of existing river-based public transports.

In Figure-2, the obvious influence of IVT's PrC is significant to the change of the probability choice of existing RPuT for any changes in travel time. At the condition where RPuT has fastest travel time, changes in IVT's PrC from the fastest to be equal to the public transportation will increase the probability of existing RpuT by 0.06. The elasticity of the increase in probabilities in these conditions is as high as -0.01 for the increase in each travel time per minute. The increase in the probability of existing RPuT is even higher when IVT'S

ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

PrC can be longer by at least 0.20 with elasticity due to increased travel time of -0.0133 per minute.

The IVT influence on the choice of the planned RPuT

As explained previously, Planned RPuT in question is the new river-based public transports by establishing improvements on the image/shape of the vehicle and an increase in its service. On the planned condition, it is expected that there would be no difference in travel time between the two modes of public transport, equally between the 15 to 20 minutes. Applied fares have to remain unchanged for both the public transports in the amount of IDR 5000. Changes in the probability of each mode as a result of the operation of planned RPuT for each condition of IVT'S PrC is shown in Table-3.

Table-3. The probability of choice based on changes in travel time and IVT's private cars (planned condition).

Travel time (minute)		**Probability** (IVT's PrC is faster)			**Probability** (IVT's PrC is equal)			**Probability** (IVT's PrC is longer)		
RPuT	**LPuT**	**RPuT**	**LPuT**	**PrC**	**RPuT**	**LPuT**	**PrC**	**RPuT**	**LPuT**	**PrC**
20	20	0.12	0.02	0.86	0.35	0.07	0.58	0.64	0.13	0.23
19	19	0.14	0.03	0.84	0.39	0.08	0.53	0.66	0.14	0.20
18	18	0.16	0.03	0.81	0.43	0.09	0.48	0.69	0.14	0.17
17	17	0.18	0.04	0.78	0.47	0.10	0.44	0.71	0.15	0.15
16	16	0.21	0.04	0.74	0.50	0.10	0.39	0.73	0.15	0.12
15	15	0.24	0.05	0.71	0.54	0.11	0.35	0.74	0.15	0.10

From Table-3, the tendency for the trip makers to choose PrC is still dominant in the conditions of faster IVT's PrC than LPuT. The improvement of service quality and the image of the RPuT vehicles increase competition with the PrC in the condition of IVT's PrC being equal to LPuT. On the condition of said IVT's PrC, the choice balance between planned RPuT and the PrC can occur when travel time of planned RpuT takes between 17 to 18 minutes. Trip makers are seen with increasing tendency towards this RPuT if the condition of IVT's PrC is getting slower from LPuT. In general, the trend of trip makers to choose LPuT is very low for all conditions of IVT's PrC. This is due to basically the target respondents in this study is trip makers familiar with the river transportations, so that with the improvement of the RPuT's image and service, they would prefer RPuT than LPuT.

As with the existing conditions, the influence of IVT's PrC on conditions of this planned RPuT also has a very significant impact. Furthermore, the influence on the condition of IVT's PrC toward the probability of choice favoring planned RPuT is presented in Figure-3.

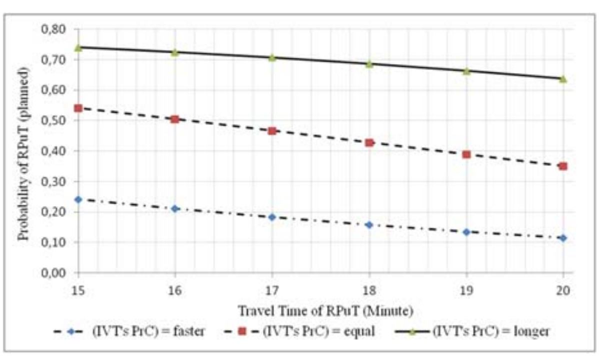

Figure-3. Probability choice of planned river-based public transports.

In Figure-3, it is clear that due to changes in IVT's PrC, the margin of improvement of the probability of choices for planned RPuT is higher than the existing RPuT. On the condition of the travel time of planned RPuTs, it can be reached within 15 minutes; the change of the IVT's PrC from the fastest to one equal to LPuT will increase the probability of RPuT by 0.30 with the elasticity of -0.0126 in each minute. When IVT's PrC is longer than the initially fast one, the tendency for choice of RPuT increases sharply, reaching 0.50 with the 0.0047 elasticity due to the increase in travel time per minute.

CONCLUSIONS

From the analysis, it can be seen that in reviving the interest in the choice of river-based public transports, that are not in demand anymore and can again compete with private cars, not only does it need structural factors (travel time and travel cost) and service factors that must be improved, but one also must understand how the length of in-vehicle time (IVT) from private cars to public transportation.

It is undeniable that the advantage of using private cars is the faster IVT than public transports. This can be seen in the existing condition in which the probability of choice of both competed public transports could not compete with private cars when the IVT of private cars is still shorter. The tendency of both choices of public transports is only 0.11 at most at the normal time. The dominance of choice for private cars is still high when the IVT of private cars is equal to public transportation. The increase in the probability of choice for the both public transports only reaches 0.37 at the highest. The probability of choices of the three modes can only be balanced if the IVT of private cars is longer.

The improvement of the physical image of the vehicle and an improvement of river-based public transport services at the very least increases the probability of choice for public transports itself. This is seen at the condition of the fastest travel time river-based public transports, at the same fare, the probability of river-based public transports is increased by 0.20 (IVT's PrC is faster / existing conditions), 0.38 (IVT's PrC is equal), and 0.43 when the IVT of private cars is longer than public transport. Of the three conditions of the IVT's private cars, river-based public transports began to show a balance of choice toward private vehicle when the IVT of private cars is equal to public transports. In the sense that if we rely solely on image improvement and river-based public transport services alone, it would be difficult to make such transport to compete, especially against private cars.

Moving from the local government program that intends to revive river transportation along the riverbanks in Banjarmasin, it is necessary for a policy to accommodate these needs; first, it needs an improvement of physical image of river-based public transport such as explained by Radam *et al.* [6]. Secondly, there needs to improve services by providing a guarantee of safety, high accessibility, integrated, sufficient capacity, regulated, smoothly and fast, easy, punctual, convenient, affordable fares, orderly, secure, low pollution, low public burden, and has a high utility. Lastly, the local government can guarantee the same IVT of public transport with private cars. There needs to design IVT of private cars from being faster than the public transport, it would need to reform the management of network traffic, such as creating a mileage of private cars to be farther than the public transport to the area with the same origin distance or provide "bus priority" so that the public transports became faster. The faster the mobility grows, the shorter time in the vehicle is.

ACKNOWLEDGMENTS

This research is sponsored by the Engineering Faculty - Lambung Mangkurat University. The authors also would like to extend their gratitude to the Civil Engineering Doctoral Study Program - Diponegoro University, for the provided support.

REFERENCES

[1] Ochse I. A. (Director). 1925. Mahamoelia - de Maha-cyclus series, Documentaire film [Motion Picture]. Haarlem: NIFM polygon.

[2] Petersen E. 2000. Jukung-Boats from the Barito Basin, Borneo, the Viking Ship Museum. Denmark: Roskilde.

[3] Duan S., Yu G., Xing H. & Wu Z. 2010. Inland Waterway Transport in China: Situation and Problems. In J. Zhang, L. Xu, X. Zhang, P. Yi, & M. Jian (Ed.). Proceedings of the 2010 International Conference of Logistics Engineering and Management (ICLEM). Chengdu, China: American Society of Civil Engineers.

[4] dell'Olio L., Ibeas A. & Cecin P. 2011. The Quality of Service Desired By Public Transport Users. Transport Policy. 18(1): 217-227.

[5] Paulley N., Balcombe R., Mackett R., Titheridge H., Preston J., Wardman M., Shires J. & White P. 2006. The Demand for Public Transport: The effects of Fares, Quality of Service, Income and Car Ownership. Transport Policy. 13(4): 295-306.

[6] Radam I. F., Mulyono A. T. & Setiadji B. H. 2014. Typical river transport for Banjarmasin based on the criteria of the National Transportation System. International Refereed Journal of Engineering and Science (IRJES). 3(8): 28-37.

[7] Hensher D. A., Rose J. M. & Greene W. H. 2005. Applied Choice Analysis: A Primer. New York: Cambridge University Press.

[8] Grdzelishvili I. & Sathre R. 2011. Understanding the urban travel attitudes and behavior of Tbilisi residents. Transport Policy. 18(1): 38-45.

[9] Beirão G. & Cabral J. S. 2007. Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy. 14(6): 478-489.

[10] Anable J. 2005. Complacent Car Addicts' or 'Aspiring Environmentalists? Identifying travel behaviour segments using attitude theory. Transport Policy. 12(1): 65-78.

[11] Sheffi Y. 1992. Urban Transportation Network: Equilibrium Analysis with Mathematical Programming Method. Englewood Cliffs, NJ: Prentice Hall Inc.

[12] Ben-Akiva M. & Lerman S. R. 1985. Discrete Choice Analysis: Theory and Application to Travel Demand. Cambridge: The MIT Press.

[13] Train, K. 1986. Qualitative Choice Analysis: Theory, Econometrics, and Application to Automobile Demand. Cambridge: The MIT Press.

[14] Ortúzar J. d. & Willumsen L. G. 1994. Modelling Transport (2nd ed.). Chichester, England: John Wiley & Sons Ltd.

[15] Ben-Akiva M. & Bierlaire M. 2003. Discrete choice methods and their applications to short term travel decisions. In R. W. Hall (Ed.), Handbook of Transportation Science (2nd ed., pp. 7-38). New York: Kluwer Academic Publishers.

ARPN Journal of Engineering and Applied Sciences

[16] Domencich T. A. & McFadden D. 1975. Urban Travel Demand: A Behavioral Analysis. Amsterdam: North-Holland Publishing Company.

[17] Hoetker G. 2007. The use of logit and probit models in strategic management research: critical issues. Strategic Management Journal. 28: 331-343.

[18] Clark W. A. & Hosking P. L. 1986. Statistical methods for geographers. New York: John Wiley and Sons.

[19] Radam I. F., Mulyono A. T. & Setiadji B. H. 2015. Influence of service factors in the model of public transport mode: a Banjarmasin - Banjarbaru route case study. International Journal for Traffic and Transport Engineering. 5(2): 108-119.

[20] Kroes E. P. & Sheldom R. J. 1988. Stated Preference Method: An Introduction. Journal of Transport Economics and Policy. XXII(1): 11-25.

[21] Hensher D. A. 1994. Stated Preference Analysis of Travel Choice: The State of Practice. Transportation. 21: 107-133.

[22] Leitham S., McQuaid R. W. & Nelson J. D. 2000. The influence of transport on industrial location choice: a stated preference experiment. Transportation Research Part A: Policy and Practice. 34: 515-535.

[23] Bliemer M. C., Rose J. M. & Hensher D. A. 2009. Efficient stated choice experiments for estimating nested logit models. Transportation Research Part B: Methodological. 43(1): 19-35.