Chapter 6
Paratransit-Adaptive Transportation Policies for Transition to Sustainability in Developing Countries

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Abstract Paratransit in developing countries is currently an essential travel mode that provides jobs for low-income earners, but current paratransit systems are neither socially nor environmentally sustainable. This study emphasizes the importance of paratransit-adaptive transportation policies for transition to sustainability. The case studies reveal unique policy directions for the redesign of paratransit systems in developing countries according to travelers' behavior, drivers' job choice, and quality of life. It is concluded that simply eliminating paratransit services from transportation systems in developing countries may resolve the environmental issues that they cause but will surely result in more serious social issues, such as unemployment among paratransit drivers and mobility difficulties for the transportation poor. In particular, it is argued that international agencies and other donors should assist endogenous development among recipients based not only on easily applied but old-fashioned and less scientific methods but also especially on modern scientific methods adapted to local contexts.

Keywords Capability • Employment • Paratransit • Quality of life • Transport policy

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6.1 Controversies Over Paratransit in Developing Countries

In the developing world, the slow pace of public transportation systems' improvement for reasons such as a lack of sufficient financial sources caused by poor economic development, the "pro-car" attitude of governmental sectors, and difficulties in gaining public acceptance of "anti-car" policies has forced urban residents unable to afford private transport to rely increasingly on paratransit. According to Cervero and Golub (2007), over half of all public transport trips are served by paratransit.

The concept of paratransit is quite different between developed and developing countries. In developed countries, paratransit usually refers to demand-responsive and door-to-door transport services exclusively for the elderly and disabled. In developing countries, paratransit is characterized by ill-equipped vehicles but cheaper fares, flexible routing but disorderly management, and dangerous driving but convenient access. There are various paratransit modes from pedicabs and motorcycles to van-type minibuses that are operated by individuals and small companies that adapt their routing and scheduling to individual users' desires to varying degrees. Paratransit operators take the role of "gap filler" between conventional buses and private automobiles (Shimazaki and Rahman 1996; Cervero and Golub 2007). The use of paratransit provides developing countries with several advantages, such as mobility—especially for the poor—jobs for unskilled people, feeder connections between neighborhoods and trunk routes, flexibility and sensitivity to changing markets. On the other hand, paratransit also contributes greatly to issues such as traffic congestion, accidents and environmental pollution (Cervero 2000). The aberrant stopping behavior of mixed traffic with paratransit vehicles has been cited as a major reason for disorder in traffic systems (Anwar et al. 2011; Weningtyas et al. 2012a), creating pressure to eliminate rather than to try to improve it (Joewono and Kubota 2005). Despite paratransit's important role in the urban public sector of developing countries, paratransit drivers' economic sustainability is at stake. Current paratransit systems in developing cities are neither socially nor environmentally sustainable (Weningtyas et al. 2012b).

Because of the above features of paratransit in developing countries, opinions on such services are sharply polarized. Guillen and Ishida (2004) showed that inadequacy of either national or local policies has resulted in various auto-tricycle types of paratransit becoming prevalent. Diaz and Cal (2005) evaluated the impact of government regulation on the sustainability of FX (the Toyota Tamaraw FX Asian utility vehicles) types of paratransit based on a financial analysis and found a rational allocation of the service in the Philippines. Walters (2008) conducted an overview of public transport policy developments in South Africa, especially paratransit (minibus taxi) industry recapitalization programs. Her study emphasized the challenge of integrating various modes to create seamless public transport services. Schalekamp et al. (2009) evaluated three international cases of increasing paratransit regulation or incorporating paratransit into official operations and drew conclusions on the scale, timeframe and operational and institutional contexts of paratransit integration processes in the planning of public transport systems in Cape Town in South Africa and Dar es Salaam in Tanzania. On the other hand, there are studies that

emphasize the role of enhancing service quality and user satisfaction to promote paratransit usage by reducing its negative effects (e.g., Joewono and Kubota 2007a, b; Tangphaisankun et al. 2009).

6.2 Quality of Life and Transportation

One of the most important purposes of transport policies is to improve people's quality of life (QOL) directly or indirectly, irrespective of a country's level of development. In line with this goal, improved levels of transportation services might allow travelers to enjoy their trips, and the accumulation of pleasant experiences may make people feel satisfied with their daily lives. In this sense, policy makers are required not only to satisfy people's basic mobility needs but also to find opportunities to improve travelers' QOL.

As a unique travel mode in developing countries, paratransit improves the necessary and highly valued mobility, especially for the poor (Cervero 2000). It also faces the challenge of retaining and attracting passengers, which is crucial for its future existence (Joewono and Kubota 2007a, b). Passengers' public transport choices depend on their perceptions of service quality (TRB 1999; Friman et al. 2001; Friman and Garling 2001). Service quality is a measure of actual service level relative to customer expectations, while quality service means conforming to customer expectations on a consistent basis (TRB 1999). Existing studies have confirmed that perceptions of paratransit service quality contribute to its use (Joewono and Kubota 2007a, b; Tangphaisankun et al. 2009; Tarigan et al. 2010).

QOL is defined differently in various disciplines, and there is no unified method of measuring it, but it is known that subjective elements play a major role in its measurement; in particular, life satisfaction and happiness are two of the core attributes (Phillips 2006). Life satisfaction is an overall assessment of feelings and attitudes about one's life at a particular point in time and ranges from negative to positive. It is one of three major indicators of subjective well-being: life satisfaction, positive affect, and negative affect (Diener and Lucas 1999). The literature reveals that life can be construed as a general combination of many specific domains. Life satisfaction can be understood as the result of satisfaction in the domains of life, such as health, economy, job, family, friendship, and personal and community environment (Rojas 2006). One important domain is work. Life satisfaction is identified as significantly related to job satisfaction (Ghiselli et al. 2001). Feelings about work are transferred to general life in affective spillover processes, while individuals review their current work and life utilities rationally in cognitive appraisal (Song et al. 2008). The need for happiness is deeply felt by humans and reflects the level of positive or negative affect perceived from daily experiences. Life satisfaction and happiness constitute a significant part of subjective QOL (Ventegodt et al. 2003). One study only infers that comfort-related characteristics are placed second in service quality priorities regarding negative experiences, which indirectly indicates QOL as the second consideration in service quality of paratransit (Joewono and Kubota 2007a, b).

6.3 Objectives of This Study

Given the salient features of paratransit, it is urgent that appropriate decisions be made regarding its position within the transportation systems of developing cities; that is, paratransit either should be limited or even eliminated because of its negative impact or should be used more effectively because of its positive impact. Therefore, this research intends to undertake a comprehensive analysis of both demand and supply of paratransit systems in developing cities. The analysis has the following objectives.

1. To evaluate the effects of availability of paratransit as a major access/egress mode, and to identify captive travel modes for paratransit users.
2. To clarify the cause–effect relationships of paratransit users' perceptions on service quality, happiness during travel and satisfaction with life.
3. To analyze paratransit drivers' job choice behavior under various policy interventions, and to identify the influential factors and whether there are "captive jobs" for paratransit drivers.
4. To clarify the cause–effect relationships regarding paratransit drivers' jobs, reasons for drivers' job choices, their businesses and their QOL.

6.4 Travel Mode Choice Analysis for Redesign of Paratransit Systems in Developing Countries

To mitigate the negative aspects of paratransit in developing countries and to make effective use of its advantages, the current transportation systems require thorough redesign, not complete elimination. To meet this challenge, a better understanding of its passengers' travel mode choice behavior is important. To date, various policies and plans have been proposed by international agencies and local governments. Supply-oriented philosophy has dominated debates, and users' choices have unfortunately been neglected. To resolve the current traffic issues in developing countries, policies to increase transportation supply are crucial; however, the benefits will be limited without sufficient measures to target travel demand. Therefore, this part of the study will investigate how paratransit users in developing countries would behave under different policy scenarios reflecting a variety of travel modes and the decision-making mechanisms specific to paratransit users. The Jabodetabek Metropolitan Area (JMA) in Indonesia was selected because of the popularity of various types of paratransit. A stated preference (SP) approach was adopted to incorporate the influence of various possible policies in a logical manner.

6.4.1 Features and Issues of Paratransit in Jabodetabek Metropolitan Area

The main paratransit modes in the JMA are *becak*, *ojek*, *bajaj*, and *angkot*, which constitute a hierarchy of services complementary to the inadequate official public

Fig. 6.1 Typical paratransit vehicles in Jabodetabek metropolitan area, Indonesia

transportation system (see Fig. 6.1). A *becak* is a three-wheeled pedaled bicycle taxi offering door-to-door neighborhood services for a negotiable fare. They are banned in DKI Jakarta but not in other places in the JMA (Cervero 2000). An *ojek* is a motorcycle taxi hired for a negotiated fare. It also provides door-to-door connectivity but with the advantages of greater speed and travel range compared with a *becak*. It is actually a private vehicle but for public use, so it is an entirely illegal public transport mode. A *bajaj* is a sort of registered auto-rickshaw taxi with three wheels that also offers a door-to-door service for a negotiated fare. Additionally, it is allowed to cross major roads but cannot travel on them in DKI Jakarta. An *angkot* is a popular public mode with a fixed route but without a fixed schedule. It follows a designated route in the city's network. Additionally, various types of cars and vans with a capacity of 12–16 seats are used as *angkot* (Joewono and Kubota 2007b).

6.4.2 Stated Preference Survey

Because of the constraints of income and insufficient transportation supply in developing cities, the availability of travel modes may affect people's daily mobility significantly, and many travelers may be captive to specific travel modes. However, this has not been thoroughly examined in the context of developing countries. To fill this gap, this study conducted an SP survey (Kroes and Sheldon 1988; Polak and Jones 1997; Hensher 1994) in the JMA with respect to the above four types of paratransit and five official travel modes; i.e., train, mass rapid transit (MRT), bus, bus rapid transit (BRT), and car.

Attributes included in the SP survey of this study were specified based on the current situation, opinions of local experts, and a literature review. As a result, 14 attributes were included: nine attributes concerning the availability of travel modes (five for access modes, two for egress modes, and two for major travel modes together with their travel time), three attributes of travel time for the major travel modes: train, BRT, and bus, and the other two attributes of trip purpose and trip distance, respectively. MRT was also introduced as a main travel mode but with travel time fixed with respect to trip distance. Each of the above attributes had two or three levels. The cost of each travel mode was fixed according to trip distance, and walking is considered to be available as both an access and egress mode. Based on an orthogonal fractional factorial design, 27 SP profiles were obtained. To reduce the burden on respondents, the 27 SP profiles were further randomly grouped into

nine balanced blocks, and each respondent was only asked to answer one block with three SP questions, each of which included 4–6 main travel mode options. The main modes were train, MRT, bus, BRT, *angkot* and car.

The questionnaire including the above SP questions consisted of five parts. The first part began with questions about paratransit use and the corresponding evaluations of service quality. The second part investigated household vehicle ownership and usage. In the third part, respondents were asked to report their individual characteristics, their use of vehicles owned by households, their happiness perceived when conducting trips, and their satisfaction with life (life satisfaction). A 1-day trip diary was recorded for the fourth part. Finally SP questions about travel mode choice were included. Before the SP question, there is a brief introduction to MRT, which does not currently exist. Note that the data collected are also used in the analysis in Sect. 6.5.

A home interview survey was conducted from February to March 2010 for people living in the JMA who had used any type of paratransit, and the questionnaires from 702 respondents and 2,106 SP profiles (702 respondents * 3 SP profiles per respondent) were collected. When invalid samples were excluded, 1,902 samples were used for this study. In the sample, the proportions of males and females were almost the same: 33.8 % of respondents were company officers, 31.3 % were students, 15.7 % were government officers, and 7.4 % were self-employed. The household income of 23.4 % of respondents was less than 2.0 million Rp (Indonesia rupiah), 36.9 % between 2.0 and 4.0 million Rp, 21.0 % between 4.0 and 6.0 million Rp, and 18.7 % higher than 6.0 million Rp.

When it was conducted, this was the first comprehensive SP survey in the literature to examine the use of paratransit in developing cities.

6.4.3 Capturing Factors of Travel Mode Choice Behavior

To represent people's travel mode choice behavior clearly, a dogit model (Gaudry and Dagenais 1979) is adopted. Its general form can be expressed as follows:

$$P_{ni} = \frac{e^{V_{ni}} + \theta_i \sum_j e^{V_{nj}}}{(1 + \sum_j \theta_j) \sum_j e^{V_{nj}}}, i, j = 1, 2, \ldots, I \tag{6.1}$$

where n and i (or j) indicate traveler and choice alternative, respectively, P_{ni} refers to the probability that traveler n chooses travel mode i from I travel modes, V_{ni} is the deterministic term of the utility function of travel mode i, and θ_i means the (nonnegative) captivity parameter specific to a travel mode i (the larger the value of θ_i, the greater captivity to travel mode i). Alternative-specific attributes, availability of travel modes for access/egress and as main modes as well as individual attributes are included in V_{ni}.

The model estimation results are shown in Table 6.1. Model accuracy, indicated by McFadden's rho-squared, is 0.092. This is not sufficiently high to predict behavior

Table 6.1 Estimation results of Dogit model for travel mode usage behavior

Parameter		Train	MRT	Bus	BRT	*Angkot*	Car
Constant term			−1.92	2.53	−4.63		
Level of service	Travel time	−1.02**					
	Travel cost	−1.57**					
Individual attributes							
Male (yes: 1, no: 0)			−8.86*	−1.42	0.12	−1.08	−2.23
Government officer (yes: 1, no: 0)			15.6**	7.76 *	−3.08	−20.83	5.86 **
Student (yes: 1, no: 0)			2.75	5.01	2.38	1.35	9.33**
Household monthly income less than 2 million Rp (yes: 1, no: 0)			1.29	6*	2.92	9.8	−15.79
Availability of travel mode							
Becak as ACCESS modes to (yes: 1, no: 0)			−2.92	2.45	−1.34	−13.48**	
Ojek/bajaj as ACCESS modes to (yes: 1, no: 0)			−20.7	−1.14	−2.38	−11.94	
Angkot as ACCESS modes to (yes: 1, no: 0)			5.92	6.85*	1.58	−1.98	
Ojek as EGRESS modes to (yes: 1, no: 0)			3.18	−6.46*	−2.8	6.83	
Bajaj as EGRESS modes to (yes: 1, no: 0)			−9.93**	−4.36	0.69	−2.64	
Of *angkot* as MAIN modes to (yes: 1, no: 0)			−0.22	−7.71**	2.44		
Car as MAIN modes to (yes: 1, no: 0)			−6.11*	2.13	0.05	−4.36	
Captivity parameters		1	0.4***	0.75***	0.71***	0.92***	0.32***
Initial log likelihood		−3163.79					
Converged log likelihood		−2871.24					
McFadden's Rho-Square at zero		0.092					
Sample		1,902					

*, **, *** represent 90 %, 95 % and 99 % significance levels, respectively

but is acceptable for examining the influence of the availability of paratransit and cars on travel mode usage behavior and for identifying captive travel modes.

Availability of paratransit modes is classified according to two modes: access/egress mode and main mode. From Table 6.1, it is found that small paratransit

vehicles—*becak*, *ojek* and *bajaj*—either have no effect on the use of some main modes, indicated by insignificant parameters, or have a negative influence on main mode usage. *Becak* as an access mode has a significantly negative effect on the use of *angkot* as a main mode, and *ojek* and *bajaj* as egress modes also have obvious negative impacts on the main modes of bus and MRT, respectively. Such negative influences reduce the utility of the corresponding main modes. It may be inferred that paratransit users do not need to take access/egress modes to or from the main mode and/or to reduce transport fees by avoiding transfer by paratransit compared with walking. It is confirmed that using large paratransit vehicles (i.e., *angkot*) as an access mode promotes the use of buses as a main mode. This accords with the current situation in the JMA (*angkot* and bus combinations are quite common). The effects of availability of the main modes of *angkot* and car reveal that *angkot* and buses would still compete fiercely, just as they do currently. The estimation result regarding the availability of cars suggests that the introduction of an MRT would effectively reduce car use. This may be because an MRT can provide a very high level of service compared with other public modes.

With regard to captivity, it is surprising that paratransit users are captive with different probabilities to all travel modes, indicated by all statistically significant captivity parameters. Among all modes, travelers are most captive to trains. SP survey results show that the chosen shares for trains, MRT, buses, BRT, *angkot* and cars are 30 %, 10 %, 18 %, 21 %, 14 % and 6 %, respectively, where train travel enjoys the largest share. The highest share for trains may be because fares are lowest and the travel time moderate among the six main modes in the hypothetical choice scenarios. *Angkot* is the second main mode in terms of captive use when they are available. Perhaps this is attributable to having the shortest travel time over short distances and the third cheapest fare. Buses and MRT follow *angkot* in sequence. Although buses take third place, indicated by the third largest parameter, the difference in terms of captivity could be neglected, as revealed by parameters of 0.75 and 0.71. It is natural that MRT is the least captive form of travel among the public modes because it is the most expensive mode, and people are not familiar with it. Cars are last on the list because of the huge financial investment, especially for the poor. The order of magnitude of captive parameters generally coincides with the order of fares, which indicates that fare will remain a very important influence on mode choice behavior in future.

As for the main indicators of service quality, travel time and travel cost are statistically significant at the 95 % level (all the parameters are logically negative), indicating that such service factors are always important in travel mode decisions. In terms of paratransit users' individual attributes, females have a strongly negative attitude toward MRT. Government officers tend to choose car, MRT and bus, probably because their living standards are generally better than those of other people in developing countries, and they can therefore afford a private mode (car) and more expensive improved transit systems such as MRT and buses (MRT and buses are the first and second most expensive main public modes in the SP design, respectively). Surprisingly, students also prefer cars, suggesting that they have high expectations for the future. Although buses and *angkot* currently compete fiercely, the model results reveal that people with the lowest income will clearly prefer buses in future.

6.4.4 Policy Implications

Dogit model estimation results reveal that *bajaj*, *ojek* and *becak* as access and/or egress modes have no impact or a significant negative impact on the use of main modes. This implies that the use of small paratransit vehicles as access/egress modes does not promote public transport for current paratransit users. If this conclusion remained true in analyses of large-scale survey data, it would mean that reorganizing small paratransit networks as feeders of official public transport networks should not be included in policy menus to realize transitional sustainability. However, as the latter part of this chapter explains, because many low-income people in developing countries drive such small paratransit vehicles, it is necessary to keep such vehicles for a certain time to supply job opportunities to low-income people and to secure social stability. It seems better to position such vehicles as main modes at the community and neighborhood levels (i.e., for short-distance trips) rather than as access/egress modes. Generally, communities and neighborhoods are much larger in developing megacities like the JMA. This argument may also be supported by the fact that budget limitations in developing countries make it almost impossible to service urban transportation networks mainly with MRT and BRT, which are environmentally friendly and efficient.

Because the combination of *angkot* and buses is preferred in the present and this will remain true in future, policies to improve *angkot* service quality (e.g., introducing new types of vehicles and improving networks) should be promoted.

Although statistically insignificant, the constant term of BRT is negative and much larger than other mode-specific constant terms, indicating that unobserved factors tend to keep paratransit users away from BRT. This may reflect unsatisfactory service aspects of BRT transport. This observation also applies to MRT but not to buses, for which the constant term is positive. Considering the above findings, policy makers in the JMA should pay careful attention to the negative aspects of BRT and MRT in the daily operation and future expansion of their networks.

6.5 Paratransit Service Quality and Users' Quality of Life

Paratransit in developing countries satisfies a large number of people's various mobility needs. It is true that paratransit services supported by ill-equipped vehicles, low-skilled drivers, and disorderly management in a mixed traffic environment cannot meet adequate service standards in developed countries. It is known that people's lives and behavior depend on context. It is therefore reasonable that people in developing countries expect less from transport services than those in developed countries. Because it is unlikely that they have *no* expectations, people in developing countries also patronize paratransit services based on evaluations of their own satisfaction, but paratransit has become an indispensable part of transportation systems, so people rely heavily on it in their daily lives. Therefore, people's accumulated experience of paratransit may have a significant influence on their QOL.

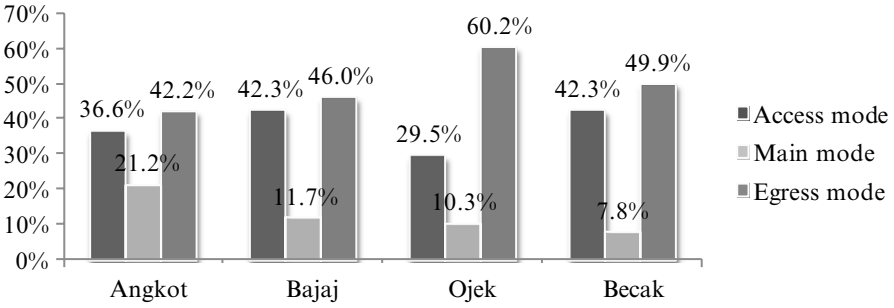


Fig. 6.2 The role of paratransit in people's daily mobility

Unfortunately, little research has been conducted with respect to the relationship between transport services and QOL, especially in developing countries. Motivated by this research gap, this section investigates the cause–effect relationships among paratransit users' perceptions of service quality, happiness during travel, and life satisfaction (a typical QOL indicator).

6.5.1 Data

In this section, the questionnaire survey data collected in the previous section are used, and four typical types of paratransit—*angkot*, *bajaj*, *ojek*, and *becak*—are targeted. Related to this part of the study, the questionnaire items include: (1) individual characteristics such as age, gender, job, and household monthly income; (2) respondents' perceptions of paratransit service performance (i.e., service quality); (3) paratransit use for daily trips (frequency and use of paratransit to access other modes, main modes of travel and the egress from other modes); (4) happiness when traveling for different purposes; and (5) life satisfaction in various domains. For items (2), (4), and (5), respondents were asked for their subjective responses on five-point scales (service quality and life satisfaction: "1: very dissatisfied … 5: very satisfied"; happiness during travel: "1: very unhappy … 5: very happy").

Our survey results show that most respondents use *bajaj*, *ojek* and *becak* very infrequently, but 34.0 % of respondents use *angkot* almost every day. Figure 6.2 reveals that respondents use several types of paratransit for various functions simultaneously. The use of *bajaj* and *becak* for both access and egress are similar. In contrast, they are reluctant to use *bajaj*, *ojek* and *becak* as main modes of travel. *Ojek* is used mainly for egress from other modes (61.3 %). *Angkot* is preferred as a main mode (21.2 %).

Users' perceptions on service quality of paratransit are shown in Table 6.2, where the two highest scores are in bold and the two lowest scores are in italics for each type, respectively. Users are most satisfied with the operational frequency and fares for *angkot,* but they do not like the drivers' manner and are concerned about air

Table 6.2 Satisfaction level of paratransit services

	Angkot		Bajaj		Ojek		Becak	
Service aspects	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Fare	**3.11**	0.82	2.67	0.65	2.79	0.78	2.95	0.75
Travel time	2.77	0.87	2.71	0.77	**3.69**	0.77	*2.55*	0.79
Punctuality	2.61	0.87	2.69	0.78	**3.65**	0.81	*2.51*	0.83
Convenience	2.73	0.88	2.29	0.76	3.01	0.71	3.10	0.82
Comfort	2.76	0.78	2.59	0.73	3.14	0.77	2.96	0.74
Connectivity to other modes	3.09	0.79	**2.88**	0.77	3.28	0.80	2.86	0.78
Traffic safety	2.74	0.83	2.54	0.77	*2.70*	0.73	3.02	0.81
Security (criminal)	2.53	0.83	2.58	0.79	2.74	0.75	2.89	0.79
Operation frequency	**3.20**	0.85	2.79	0.73	3.29	0.78	2.67	0.78
Operation routes	3.03	0.83	2.78	0.77	3.38	0.81	2.70	0.74
Operation hours	3.05	0.81	**2.86**	0.73	3.35	0.82	2.72	0.74
Coverage area	3.03	0.79	2.70	0.74	3.31	0.80	2.70	0.76
Travel information	2.93	0.82	2.67	0.72	3.05	0.76	2.75	0.71
Driver manner	*2.41*	0.85	2.37	0.79	2.84	0.79	2.97	0.72
Air pollution caused	*2.45*	0.90	*1.84*	1.01	*2.72*	0.80	**3.59**	1.26
Noise caused	2.52	0.82	*1.79*	1.06	2.78	0.74	**3.56**	1.24
Sample size (persons)	453		428		457		371	

pollution. *Bajaj* users give the highest scores for the connectivity of paratransit to other travel modes and hours of operation. However, the air pollution caused by *bajaj* is perceived as unsatisfactory. It is quite reasonable for users to evaluate travel time and punctuality for *ojek* highly in terms of service. The lowest score for traffic safety indicates the users' concern about the stability of motorcycles, potential accidents and high risk of physical injury. Because a *becak* is pedaled, it naturally receives the highest scores for the service in terms of air pollution and noise; in contrast, users give it the lowest evaluation on punctuality and travel time.

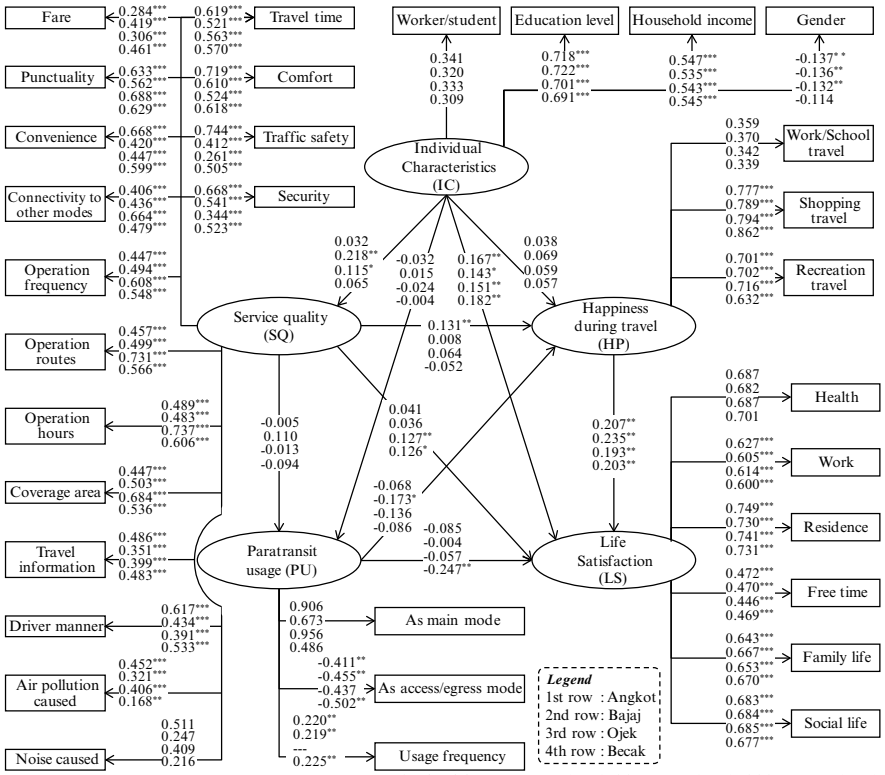
6.5.2 Observations Based on a Cause–Effect Analysis

A structural equation model (SEM) with latent variables (Jöreskog and Sörbom 1989) is used to capture the complicated cause–effect relationships in evaluations of "service quality," "paratransit usage," "happiness during travel," "life satisfaction," and "individual characteristics," which are described as latent variables. Needless to say, paratransit provides the service of transporting passengers. It is natural to assume that "service quality" influences "paratransit use," and the better the service, the more frequently it is used (direct effects). Users experience the service when using paratransit on a daily basis, and word-of-mouth information from other passengers may engender feelings during travel. Both real-time and accumulated experience may affect "happiness during travel," where the influence of the former is called a "direct effect" (from "service quality" to "happiness during travel") and

that of the latter an "indirect effect" (from "service quality" to "paratransit use" and then to "happiness during travel"). Paratransit is for participating in various daily activities, which satisfy users' needs and consequently influence their satisfaction with life. This is described as the direct effect from "paratransit usage" to "life satisfaction." "Life satisfaction" may be influenced by various environmental factors, among which the service provided by paratransit may be included. This motivates us to introduce the direct effect from "service quality" to "life satisfaction." "Life satisfaction" is usually influenced by various psychological factors, among which "happiness during travel" is included as one element. The above expected cause–effect relationships probably differ across individuals. To represent such individual heterogeneity, the direct effects of "individual characteristics" on the other four latent variables are also assumed. The estimation results of the SEM with the above cause–effect structures are shown in Fig. 6.3. The overall goodness-of-fit indices (GFI (AGFI), for *angkot*, *bajaj*, *ojek* and *becak* are 0.789 (0.755), 0.791 (0.757), 0.791 (0.756), and 0.800 (0.767), respectively) together with statistical performance and parameter signs support the assumed model structures.

Positive direct effects between the three subjective evaluation indicators of "life satisfaction," "happiness during travel" and "service quality" are observed, except for *becak*, for which the direct effect from "service quality" to "happiness during travel" is negative but statistically insignificant. The negative effect for *becak* is probably because it is a pedal tricycle, and consequently, users may feel unhappy when using it. From "service quality" to "happiness during travel," the direct effect is only confirmed for *angkot*. This may be because the other three types of paratransit can only provide the most fundamental transport service with ill-equipped vehicles and an extremely narrow riding space, which may bring little pleasure to users. This is partially supported by the lower evaluation scores for service quality for *bajaj* and *becak*. Although the scores of a majority of service quality items for *ojek* are higher than those for *angkot*, the higher satisfaction levels may be because of lower expectations, which are not high enough to make people feel happy. "Service quality" only influences "life satisfaction" for *ojek* and *becak*, and this may be because these two types are the most commonly used for routine trips. The direct effect from "paratransit usage" to "life satisfaction" is confirmed only for *becak*. This is probably because *becak* is always used for the most essential short trips. As expected, "happiness during travel" significantly influences "life satisfaction" for all four types of paratransit.

Among the standardized total effects, "happiness during trip" shows the highest influence on "life satisfaction" for *angkot*, *bajaj*, and *ojek* users, and is much greater than that of "service quality." It is also found that the improved service quality in each aspect enhances life satisfaction, and government/company officers or male students with higher education levels and household monthly incomes feel more satisfied with their lives. Among the three aspects of "happiness during travel," enhancing happiness during travel for work or school contributes most to "life satisfaction." For "service quality," cost of fare has the strongest influence on "life satisfaction" for *angkot* users, followed by connectivity to other modes, coverage areas, operational frequency, travel information, air pollution caused by paratransit, and operation routes. It is a new finding that air pollution caused by *angkot* has a higher influence on life satisfaction than many aspects of paratransit service. Similar rankings for



(*: significant at 10% level; **: at 5% level; ***: at 1% level)

(STE: Standardized total effects)

STE	Angkot				Bajaj				Ojek				Becak			
	IC	SQ	PU	HP	IC	SQ	PU	HP	IC	SQ	PU	HP	IC	SQ	PU	HP
SQ	0.032				0.218				0.115				0.065			
PU	-0.032	-0.005			0.039	0.110			-0.026	-0.013			0.002	0.094		
HP	0.044	0.132	-0.068		0.064	-0.110	-0.173		0.070	0.066	-0.136		0.054	-0.060	-0.086	
LS	0.180	0.069	-0.100	0.207	0.166	0.034	-0.036	0.235	0.181	0.140	-0.083	0.193	0.200	0.090	-0.264	0.203

Fig. 6.3 Estimation results of the structural equation model

the service aspects of *bajaj*, *ojek* and *becak,* crucially influencing "life satisfaction," are also confirmed.

"Happiness during travel" is most influenced by "paratransit usage," except for *angkot*. Using paratransit as a main mode reduces the happiness experienced during a trip as well as life satisfaction; however, using paratransit as an access/egress mode improves happiness during a trip and the resulting life satisfaction. Furthermore, using paratransit more frequently reduces the feeling of happiness during travel. "Happiness during travel" is unfortunately not influenced by "individual characteristics." The observation about the influence of "service quality" on "life satisfaction" is also applicable to "happiness during travel" for *angkot*.

"Service quality" is only influenced by "individual characteristics" for *bajaj* and *ojek*. For these two services, gender shows the highest influence on service quality, followed by identification as a worker/student. Females, workers and students evaluate

service quality higher than males and those with other types of employment status, respectively. Paratransit usage does not show any clear differences across individuals because the direct effects from "individual characteristics" to "paratransit usage" are insignificant for all four types of paratransit.

6.5.3 Policy Implications

Because of the disorderly management of paratransit systems and the resulting troublesome issues, experience in developed countries may suggest that it is better to remove the paratransit services from official transportation systems in developing countries at some point. Unfortunately, it is almost impossible to remove paratransit considering its popularity, insufficient official transportation services, and employment opportunities for low-income earners. To achieve the eventual goal of sustainable urban and transportation development in developing countries, the transitional process cannot be ignored. A "frog leap" also needs public acceptance. Paratransit will still continue to play an important and indispensable role in transportation systems in developing countries until the sufficient official public transportation services are provided and the employment issues of the "paratransit industry" are resolved. Therefore, policy makers are required to focus on the issues in the transitional process to sustainable development.

This case study confirms that QOL matters in paratransit transportation issues, as does service quality. Although happiness during travel is only influenced by service quality for *angkot* and *bajaj*, it influences the life satisfaction for all four paratransit types. This confirms that for all paratransit types, service quality has indirect effects on the life satisfaction of passengers. This means that improved transport services may improve people's QOL. Service standards adapted to the contexts of developing countries should be established, and the corresponding evaluation and monitoring procedure should be introduced. Because paratransit as a main travel mode does not positively influence life satisfaction, paratransit systems should be reorganized to support official transportation systems. During the transitional process, the environmental performance of paratransit vehicles should be improved. In addition to the most fundamental aspect of fares, the importance of travel information provision should be emphasized. This can be well supported by the rapid progress of information and communication technologies in developing countries, especially among the younger generation.

6.6 Paratransit Drivers' Job Performance and Life Satisfaction

Paratransit drivers, as a low-income group in developing societies, play a significant role in offering vital daily transport services in developing cities. During the transitional period of sustainable development in developing countries, policy

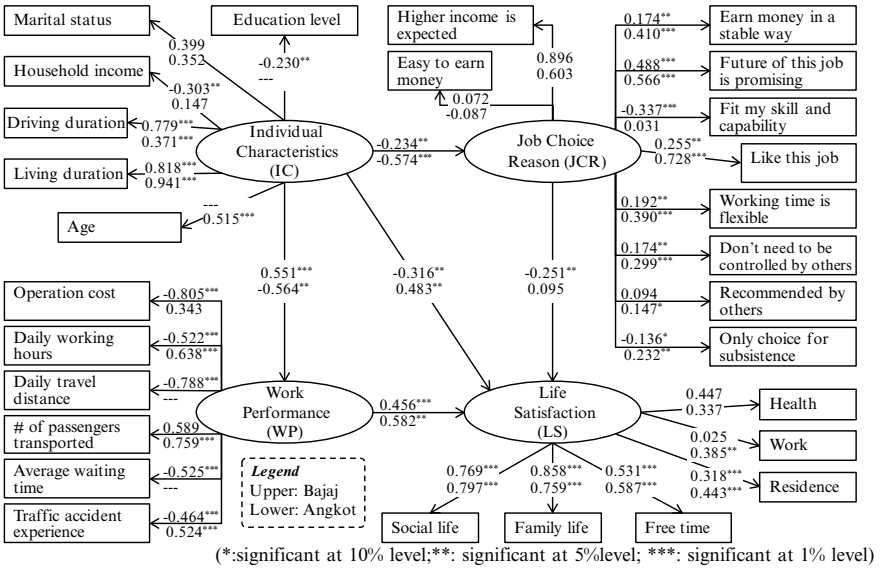
Table 6.3 Profiles of paratransit drivers participated in the survey

Individual characteristics		Bajaj drivers		Angkot drivers	
		# of samples	%	# of samples	%
Gender	Male	194	100.0	205	100.0
Age	<30 years old	39	20.1	21	10.2
	30–39 years old	67	34.5	99	48.3
	40–49 years old	52	26.8	70	34.1
	≥50 years old	36	18.6	15	7.4
Marital status	Single	24	12.4	14	6.8
	Married	170	87.6	191	93.2
Education level	Elementary school or below	60	30.9	15	7.3
	Secondary school	93	47.9	78	38.0
	High school or above	41	21.2	112	54.7
Household monthly income	<1.0 Indonesian rupiah (Rp)	43	22.2	30	14.6
	1.0–2.0 Indonesian rupiah (Rp)	117	60.3	95	46.3
	>2.0 Indonesian rupiah (Rp)	31	16.0	79	38.5
	Missing	3	1.5	1	0.6
# of paratransit drivers surveyed		194		205	

makers should pay more attention to paratransit drivers' lives for the smooth operation of transportation systems. However, research related to paratransit drivers' job conditions and their operations is quite rare. To fill this gap, this study aims to clarify the relationships between paratransit drivers' job performance and life satisfaction to provide useful insights into the policy decisions about transitional sustainability.

6.6.1 Stated Job Choice Survey

A questionnaire survey was conducted by face-to-face interviews in the JMA from February to March 2010. The targeted respondents were drivers of four typical forms of paratransit: *angkot*, *bajaj ojek* and *becak*. The questionnaire consisted of seven parts. The first part began with the requirement to complete the drivers' 1-day diary of transporting passengers. The second part investigated the profiles of their passengers. Questions about the basic information of the paratransit vehicles in current use were included in the third part. The fourth part contained questions about the current job conditions and reasons for choosing this job. The fifth part consisted of a series SP questions about future job choices under various policy interventions (for details, refer to Sect. 6.7). The final two parts collected paratransit drivers' individual information and their family information, respectively. The total number of valid responses was 799. The individual characteristics of each type of paratransit driver are summarized in Table 6.3. Below, only *bajaj* and *angkot* drivers will be discussed.



(*:significant at 10% level;**: significant at 5%level; ***: significant at 1% level)

Standardized total effects	Bajaj				Angkot			
	IC	JCR	WP	LS	IC	JCR	WP	LS
JCR	-0.234				-0.574			
WP	0.551				-0.564			
LS	-0.005	-0.251	0.456		0.100	0.095	0.582	
Satisfaction with social life	-0.004	-0.193	0.351	0.769	0.080	0.076	0.464	0.797
Satisfaction with family life	-0.004	-0.216	0.392	0.858	0.076	0.072	0.442	0.759
Satisfaction with free time	-0.003	-0.134	0.242	0.531	0.059	0.056	0.342	0.587
Satisfaction with residence	-0.002	-0.080	0.145	0.318	0.044	0.042	0.258	0.443
Satisfaction with work	0.000	-0.006	0.011	0.025	0.039	0.037	0.224	0.385
Satisfaction with health	-0.002	-0.112	0.204	0.447	0.034	0.032	0.196	0.337

Fig. 6.4 Estimation results of structural equation model with latent variables

6.6.2 Hypotheses

In this section, paratransit drivers' life satisfaction is analyzed by investigating its relationships with reason for job choice, work performance and drivers' individual characteristics. The hypotheses of this analysis are: (1) paratransit work performance has a positive influence on life satisfaction, (2) job choice reason has a significant influence on life satisfaction, which differs across types of paratransit drivers, and (3) job choice reason, work performance and life satisfaction are heterogeneous across drivers. To capture the above complex cause–effect relationship, a SEM is used with latent variables representing "job choice reason," "work performance," "life satisfaction" and "individual characteristics." Observed variables related to each latent variable and the overall model estimation results (both direct and total effects) are shown in Fig. 6.4.

6.6.3 Findings and Policy Implications

Our assumed model structure is statistically supported by acceptable goodness-of-fit indices (GFI (AGFI): 0.727 (0.676) for *bajaj* drivers and 0.707 (0.649) for *angkot* drivers), statistical significance, and expected signs of the parameters included in the model.

"Life satisfaction" is significantly affected by "work performance," "job choice reason" and "individual characteristics" for two types of paratransit drivers, but "job choice reason" has no significant effect on *angkot* drivers. Among standardized total effects, "work performance" shows the highest influence on "life satisfaction" for both *bajaj* and *angkot* drivers, and this influence is much greater than those of "individual characteristics" and "job choice reason." The most strongly influenced life domains are family life and social life, and the least influenced are work for *bajaj* drivers and health for *angkot* drivers. As for the influence of observed variables described by exogenous latent variables on life satisfaction, a smaller absolute parameter value indicates a larger influence. The most influential factor of "work performance" in "life satisfaction" is traffic accidents experienced by *bajaj* drivers and operational cost for *angkot* drivers, followed by daily working hours for both. The least influential factor is operating cost for *bajaj* drivers and number of passengers transported for *angkot* drivers. Waiting time influences *bajaj* drivers but is not relevant to *angkot* drivers. Surprisingly, number of passengers transported is not significant in the *bajaj* drivers' evaluation. Daily travel distance is not relevant to *angkot* drivers' evaluations of work performance, probably because *angkot* routes are fixed. Focusing on the most influential traffic accident experience, the *bajaj* drivers' experience negatively influences life satisfaction, but *angkot* drivers show the opposite trend. Because a *bajaj* is a three-wheel paratransit vehicle and has no fixed routes, driving one is less stable and more risky than driving an *angkot*. In contrast, because an *angkot* is a bus-type paratransit vehicle and its routes are fixed, drivers are more familiar with routes than *bajaj* drivers and consequently may become more careless during driving. It is especially important that *angkot* drivers need to collect passengers while driving. These features probably lead to more accidents caused by drivers. In this sense, for both types of drivers, policies to improve paratransit services should focus on traffic safety. To improve drivers' life satisfaction further, policies to reduce operation cost, working hours, driving distances, and waiting times for *bajaj* drivers and to collect passengers effectively for *angkot* drivers should be promoted.

Among the reasons for this job choice (note that a smaller absolute parameter value indicates a stronger influence on life satisfaction), "only choice for subsistence" (i.e., capability), "don't need to be controlled by others" (i.e., freedom), and "earn money in a stable way" (i.e., stability) are the most important factors affecting the life satisfaction of *bajaj* drivers, and "recommended by others" (i.e., job reputation and reliability), "only choice for subsistence," and "don't need to be controlled by others" are most important for *angkot* drivers' life satisfaction. The stronger influence of capability on life satisfaction suggests that regulating paratransit in developing countries may deprive drivers of the only means of earning money for subsistence.

In this sense, it is extremely important to secure their jobs by mitigating the negative aspects of paratransit to increase public acceptance of transportation policies.

Because "individual characteristics" influence all other three latent variables, the revealed cause–effect relationships differ significantly across drivers. Therefore, policy decision makers should pay careful attention to such heterogeneity. In other words, there are no "one size fits all" policies that are applicable to every driver. Policies focusing on different types of paratransit drivers are required. Accordingly, Fig. 6.4 suggests that education level and household income are more important in improving *bajaj* drivers' work performance and life satisfaction than other factors, while the most influential factor for *angkot* drivers is driving duration, followed by age. It is obvious that effective paratransit policies are different for the two segments of drivers. For *angkot* drivers, policies supporting younger drivers' jobs could effectively improve their QOL. In contrast, policies to increase household income by securing job opportunities would be more effective in improving *bajaj* drivers' QOL.

6.7 Paratransit Drivers' Job Choice and Sustainable Policies: A Case Study in Jabodetabek Metropolitan Area

In Sect. 6.6, paratransit drivers' job behavior was analyzed with a focus on work performance and life satisfaction. It was revealed that drivers' lives should be properly considered in policy decisions on the future paratransit systems in developing countries. Effective and socially acceptable paratransit policy makers need better understanding of paratransit drivers' future employment under various policy interventions for sustainable urban development. For this purpose, an SP survey was implemented in the JMA, together with the survey explained in Sect. 6.6 of *angkot*, *bajaj*, *ojek*, and *becak* drivers.

6.7.1 Profiles of Paratransit Drivers in the JMA

The profiles of four types of paratransit drivers are illustrated in Table 6.4. All paratransit drivers are male. *Becak* drivers are younger, corresponding to the obvious feature of the *becak* job that it is a physically demanding job that is not suitable for older people. The *bajaj* drivers show the opposite trend. *Ojek* drivers are a little older than *becak* drivers. The ages of *angkot* drivers are concentrated in the range from 30 to 49 years old. Generally, most *ojek* drivers are single, inferred by the highest share of single status in marital status among the four types of paratransit drivers, among whom an overall proportion of approximately 26 % are single. Single people are most likely to be *becak* drivers, probably because their education level is low and they are less skilled. In contrast, the proportions of single people are lower among *bajaj* and *angkot* drivers. The proportions of drivers with children follow the order: *angkot* drivers > *bajaj* drivers > *becak* drivers > *ojek* drivers.

Table 6.4 Profiles of four types of paratransit drivers

Driver Characteristics		*Becak*		*Ojek*		*Bajaj*		*Angkot*	
		No.	%	No.	%	No.	%	No.	%
Gender	Male	192	100	208	100	194	100	205	100
Age	<30 years old	67	34.9	73	35.1	39	20.1	21	10.2
	30–39 years old	76	39.6	74	35.6	67	34.5	99	48.3
	40–49 years old	43	22.4	45	21.6	52	26.8	70	34.1
	>50 years old	6	3.1	16	7.7	36	18.6	15	7.3
Marital status	Single	47	24.5	54	26.0	24	12.4	14	6.8
	Married	145	75.5	154	74.0	170	87.6	191	93.2
	Has children	138	71.9	137	65.9	160	82.5	185	90.2
Education level	Elementary school or below	98	51.0	18	8.7	60	30.9	15	7.3
	Secondary school	89	46.4	76	36.5	93	47.9	78	38.0
	High school or above	5	2.6	114	54.8	41	21.1	112	54.7
Paratransit job monthly income	<1 million Rp	165	85.9	66	31.7	57	29.4	29	14.1
	1–2 million Rp	17	8.9	112	53.8	132	68.0	107	52.2
	>2 million Rp			29	14.0	5	2.6	69	31.7
	Missing	10	5.2	1	0.5			4	2.0
Household monthly income	<1 million Rp	145	75.5	57	27.4	43	22.2	30	14.6
	1–2 million Rp	15	7.8	94	45.2	117	60.3	95	46.3
	>2 million Rp			55	26.4	31	16.0	79	38.6
	Missing	32	16.7	2	1.0	3	1.5	1	0.5
Living district	DKI Jakarta	22	11.5	121	58.2	183	94.3	143	69.8
	Other places	161	83.8	79	38.0	7	3.6	40	19.5
	Missing	9	4.7	8	3.8	4	2.1	22	10.7
Vehicle ownership	With a vehicle	97	50.5	201	96.6	2	1.0	24	11.7
	Without a vehicle	95	49.5	7	3.4	192	99.0	181	88.3
Number of paratransit drivers surveyed		192		208		194		205	

In terms of education level, *ojek* and *angkot* drivers clearly have similar levels of education, which is the highest among the four types of drivers and is followed by *bajaj* drivers and *becak* drivers in that order. Predictably, people with better education obtain better salaries, and this is seen in the order of paratransit job average monthly income (take home pay): *angkot* drivers > *ojek* drivers > *bajaj* drivers > *becak* drivers.

Residential districts of the four types of drivers reflect the current distributions of their businesses as paratransit drivers. The high percentage (83.8 %) of *becak* drivers living outside DKI Jakarta reflects the ban on *becak* businesses there, and only a few *becak* drivers struggle at the fringes. *Ojek* and *angkot* are quite common modes in the JMA, and the higher proportion of these vehicles in DKI Jakarta than in surrounding areas is partly attributable to both greater population density and survey location. However, the operations of *bajaj* drivers are only conducted in DKI Jakarta, which is indicated by the fact that 99 % of them live there.

Vehicle ownership clearly shows that approximately half of *becak* drivers own their own vehicle. As expected, almost all *ojek* drivers (96.6 %) own their vehicles, while most *bajaj* and *angkot* drivers do not—99.0 % and 88.3 %, respectively.

6.7.2 Paratransit Drivers' Responses to Policy Interventions

An SP survey was designed to explore a sustainable paratransit system from the viewpoint of drivers' job choices. The policy intervention is viewed from both social and environmental perspectives. Questions for drivers from the social perspective focus on the future availability of the respondent's current job (yes or no: "no" means that the job will be prohibited by the government), employment opportunity (two or three levels: defined as percentage of available job positions compared with the respondent's current job) and employment status (two options: self-employed vs. union member, employed by a company). From the environmental perspective, respondents are asked about vehicle fuel type (two forms: gasoline vs. CNG or electricity) and subsidy for low-emission vehicles (new vehicle types) (three levels: no subsidy, low and high levels). Other factors included in the SP design are operational costs of paratransit (two levels: low and high) and salary (two or three levels based on respondents' current salary). Monthly income is traded off against the saving in operational cost of new vehicles. It is expected that through such policy interventions, current paratransit drivers can be effectively persuaded to shift to new paratransit modes, so that the government can make a comprehensive and sustainable urban transportation plan to cover all transport services.

An orthogonal fractional factorial design results in 16 SP profiles, which are further randomly grouped into four balanced blocks. Each driver in the survey was only asked to answer one block with four SP questions, each of which includes two to four job options. Before each question, new types of jobs are briefly described, and expected salaries for various employment opportunities are calculated and shown in the questionnaire. The resulting sample size is 715 for *becak* drivers, 671 for *ojek* drivers, 684 for *bajaj* drivers, and 612 for *angkot* drivers. It is found that the majority of respondents prefer the same driver job with better conditions (*angkot* drivers: 51.2 %; *bajaj* drivers: 69.2 %; *ojek* drivers: 77.5 %), except *becak* drivers (74.3 % would prefer a job as a new *ojek* driver), and 44.7 % of *angkot* drivers would also prefer to be an *ojek* driver. This finding suggests that paratransit drivers are quite captive to their current jobs but desire to change their job conditions. This higher captivity also suggests that they have no other choices. Reflecting this observation, this study adopts the same dogit model (Gaudry and Dagenais 1979) as in Sect. 6.4.

The factors that are assumed to influence job choices are classified into job attributes and individual characteristics. The estimation results are shown in Tables 6.5 and 6.6. For four types of paratransit drivers, dogit models capture well their job choice behavior in response to the various assumed policy interventions in terms of goodness-of-fit indicators (adjusted McFadden's rho-squared at zero) ranging from 0.185 to 0.431. Dogit models further confirm that there is "a captive job" for each type of driver. *Becak* drivers, *ojek* drivers and *angkot* drivers have significant preferences for "new *ojek* driver" jobs, reflected by 90 % or higher confidence intervals, and *bajaj* drivers are significantly captive to "new *bajaj* driver" jobs, indicated by a 99 % confidence interval.

Table 6.5 Estimation results of *becak* drivers' and *ojek* drivers' stated job choice

Becak driver job choice			Ojek driver job choice		
Explanatory variable	Parameter	*t*-statistic	Explanatory variable	Parameter	*t*-statistic
Alternative specific constant			*Alternative specific constant*		
Ojek	−0.446	−0.364	Ojek	0.241	0.196
Bajaj (as reference)	–	–	Mix of Bajaj and Becak (as reference)	–	–
Current job	6.120	3.517	Current job	−4.896	−1.601
Ojek, Bajaj, current job			*Ojek, mix of Bajaj and Becak, current job*		
Operation cost	0.243	2.358	Operation cost	−0.277	−1.258
Employment status (1: union member; 0: self-employed)	0.950	1.218	Employment status (1: union member; 0: self-employed)	0.663	1.225
Employment opportunity	3.380	5.530	Employment opportunity	5.865	3.686
Salary	0.199	0.106	Salary	2.889	0.954
Fuel type (1: electricity for ojek; CNG for bajaj; 0: gasoline)	0.435	0.735	Fuel type (1: electricity for ojek; CNG for bajaj; 0: gasoline)	0.129	0.264
Subsidy	10.255	1.796	Subsidy	5.462	1.010
Ojek			*Ojek*		
Age	0.065	2.103	Marital status (1: married; 0: single)	−0.244	−0.473
Current job (Becak driver)			Age	0.009	0.279
Age	−0.141	−2.921	Household income (less than 1 million Rp)	−1.346	−2.719
Theta			Living in DKI Jakarta (1: yes; 0: no)	0.567	1.214
Ojek	0.795	3.100	*Current job (ojek driver)*		
Bajaj (as reference)	–	–	Marital status (1: married; 0: single)	−4.383	−2.290
Current job	0.000	0.005	Age	0.358	2.535
Log-likelihood at zero	−643.19		Household income (less than 1 million Rp)	−4.463	−2.496
Log-likelihood at convergence	−401.98		Living in DKI Jakarta (1: yes; 0: no)	−5.612	−2.601
McFadden's rho-squared at zero	0.375		*Theta*		
Adjusted McFadden's rho-squared at zero	0.356		Ojek	1.183	4.090
Sample size (SP profiles)	715		Mix of Bajaj and Becak (as reference)	–	–

(continued)

Table 6.5 (continued)

Becak driver job choice			Ojek driver job choice		
Explanatory variable	Parameter	*t*-statistic	Explanatory variable	Parameter	*t*-statistic
			Current job	0.161	2.462
			Log-likelihood at zero	−610.66	
			Log-likelihood at convergence	−329.18	
			McFadden's rho-squared at zero	0.461	
			Adjusted McFadden's rho-squared at zero	0.431	
			Sample size (SP profiles)	671	

Table 6.6 Estimation results of *bajaj* drivers' and *angkot* drivers' stated job choice

Bajaj driver job choice			Angkot driver job choice		
Explanatory variable	Parameter	*t-statistic*	Explanatory variable	Parameter	*t*-tatistic
Ojek, Bajaj, current job			*Ojek, medium bus, current job*		
Operation cost	−0.352	−3.23	Operation cost	−2.733	−2.53
Employment status (1: union member; 0: self-employed)	0.563	1.09	Employment status (1: union member/ company staff; 0: self-employed)	0.039	0.15
Employment opportunity	0.320	0.47	Employment opportunity	1.251	1.90
Salary	0.088	0.05	Salary	−4.273	−2.49
Subsidy	6.328	1.65	Fuel type (1: electricity for ojek, electricity/ CNG for medium bus; 0: gasoline)	0.079	0.38
Ojek			*Ojek*		
Fuel type (1: electricity; 0: gasoline)	−0.214	−0.46	Subsidy	−4.224	−1.48
Mix of Bajaj and Becak, current job (Bajaj driver)			Education level (high school and above)	−0.474	−1.42
			Living in DKI Jakarta (1: yes; 0: no)	−1.203	−2.64
Marital status (1: married; 0: single)	2.572	4.37	Household income (less than 1 million Rp)	−1.647	−1.48
Education level (secondary school)	−1.071	−3.16	Marital status (1: married; 0: single)	−0.563	−1.15
Education level (high school)	−2.066	−4.71	*Medium bus and current job* (Angkot driver)	–	–
Household income (less than 1 million Rp)	1.025	2.59	*Theta*		

(continued)

Table 6.6 (continued)

Bajaj driver job choice			Angkot driver job choice		
Explanatory variable	Parameter	*t-statistic*	Explanatory variable	Parameter	*t*-tatistic
Household income (1 million to 2 million Rp)	1.464	3.56	Ojek	0.471	1.859
Living in South DKI Jakarta (1: yes; 0: No)	−0.474	−1.19	Medium bus (as reference)	–	–
Living in East DKI Jakarta (1: yes; 0: No)	1.642	4.20	Current job	0.015	0.870
Fuel type (1: CNG; 0: gasoline)	−0.875	−1.35	Log-likelihood at zero	−549.09	
Theta			Log-likelihood at convergence	−435.75	
Ojek (as reference)	–	–	McFadden's rho-squared at zero	0.206	
Mix of Bajaj and Becak	0.517	2.75	Adjusted McFadden's rho-squared at zero	0.185	
Current job	0.000	0.00	Sample size (SP profiles)	612	
Log-likelihood at zero	−614.40				
Log-likelihood at convergence	−397.64				
McFadden's rho-squared at zero	0.353				
Adjusted McFadden's rho-squared at zero	0.327				
Sample size (SP profiles)	684				

As for job attributes, employment opportunities (from the social perspective) and subsidies for low-emission vehicles (from the environmental perspective) are predicted to play a significant role in job choices when paratransit drivers face various policy interventions in the future. Meanwhile, their individual characteristics also influence their job choice behaviors strongly. Among these characteristics, geographical location is regarded as a common significant influence on motorized paratransit drivers. Detailed explanations of each type of driver are given below.

1. Becak Drivers
   In the SP survey, 74.3 % of *becak* drivers chose to be new *ojek* drivers, 14.8 % chose to be new *bajaj* drivers, and nearly 10 % chose to keep their current jobs.

   The statistical significance of the parameters indicates that for the lowest socioeconomic group of paratransit drivers, the most important consideration may be to find work for subsistence, irrespective of wages, vehicle fuel type or employment status of that job in future. *Becak* drivers also pursue changes in their current jobs as motorized vehicle drivers to achieve a higher economic level (inferred from the 95 % significance in the parameter of operational cost). Because the operational costs of *ojek* and *bajaj* are much higher than that of

becak, the positive parameter sign shows the drivers' eagerness to change to a job with a motorized vehicle (but with higher operational costs). The significant *ojek*-specific captivity parameter (*Theta*) further reveals that the "new *ojek* driver" will be the captive job in future for *becak* drivers. It also implicitly confirms their desire to change their current jobs. The statistical significance and parameter sign of subsidies for low-emission vehicles show that *becak* drivers definitely need financial support to purchase a new vehicle. Certainly employment status, fuel type and wage also have positive effects on job choices, although their effects are not obvious (or significant).

As for individual characteristics, only age affects job choices. Older *becak* drivers tend to choose the "new *ojek* driver" job and are more reluctant to continue their current *becak* job.

2. Ojek Drivers

In the SP survey, 77.5 % of *ojek* drivers preferred the same job with better conditions, and only 11.3 % wished to continue their current job without changes.

The statistical significance and parameter sign of employment opportunity confirms the intense competition among *ojek* drivers and between *ojek* drivers and those in other types of paratransit jobs. First, *ojek* jobs have no entry limitation in the sense that anyone who has a motorcycle can engage in this illegal business. Second, *ojek* jobs are the captive jobs for *becak* drivers, *ojek* drivers and *angkot* drivers, as indicated by the statistically significant job-specific captivity parameter (*Theta*). The operational cost, which is quite low for an *ojek*, does not influence the choice of *ojek* driver job, and as a result, the financial saving from the lower operational costs of an electric-powered *ojek* compared with the much larger investment in the purchase of a new motorcycle is not attractive at all, a conclusion partially supported by the insignificant fuel type parameter. Presumably because of the high proportion of *ojek* drivers who own the vehicle, it is not surprising that subsidies for purchase of low-emission vehicles play no further important role. The inherent features of *ojek* jobs are that divers enjoy more freedom in work schedules and face intense competition, which may explain why they have low expectations with regard to wages and do not care about employment status.

In terms of individual characteristics, single *ojek* drivers tend to continue their current job, probably because they cannot afford new vehicles or they wish to save for marriage. Older *ojek* drivers express the intention to retain the current vehicle. *Ojek* drivers with the lowest level of household income (here, less than 1 million Rp) express a strong desire to change their current job, undoubtedly because of dissatisfaction with their current income level. *Ojek* drivers living in DKI Jakarta have an obvious desire to quit their current job in future. This could be because they realize that the living space of the current job is limited by the consistently improving public transportation system, serious pressure from the government in terms of punishing illegal *ojek* operation, and competition with other transport modes. For the "new *ojek* driver job" option, *ojek* drivers in the lowest income group show strongly negative attitudes toward their current jobs.

3. Bajaj Drivers
   In the SP survey, 69.2 % of *bajaj* drivers preferred the same job with better conditions, and only 4.0 % reported a desire to continue with no changes. It is interesting that the "new ojek driver" job is preferred by 25.0 % of the current *bajaj* drivers.

   Operational costs, directly determining the level of wages, significantly affect job choices. Although the subsidy for low-emission vehicles has an obvious impact on job choices, it cannot promote the use of low-emission vehicles with cheaper operational costs. This argument can be supported by two negative parameters of fuel type for the *ojek* and *bajaj*/*becak* job options. From this point, it can be inferred that the subsidy for low-emission vehicles is insufficient and/or the savings in operational costs from vehicle changes cannot compensate for the enormous cost of purchasing the low-emission vehicles (*ojek* is electrically powered, and *bajaj* is CNG powered). Another possible reason is that *bajaj* drivers underestimate the performance of such vehicles because of their unfamiliarity. If this is true, the advantages of low-emission vehicles should be properly publicized.

   Looking at the influence of individual characteristics, married *bajaj* drivers have an obvious tendency to choose "new *bajaj* driver" jobs. The higher the education level, the lower the desire to choose a "new *bajaj* driver" job. *Bajaj* drivers with lower household income (less than 1 million Rp and between 1 and 2 million Rp) prefer a "new *bajaj* driver" job. *Bajaj* drivers from East Jakarta are more likely to choose the *bajaj*/*becak* option. The statistically significant captivity parameter (*Theta*) clearly indicates that current *bajaj* drivers would like to have their own *bajaj* and to do this job in the future; that is, they would be captive to new *bajaj* jobs.
4. Angkot Drivers
   In the SP survey, 51.2 % of *angkot* drivers preferred the same job with better conditions, and only 4.1 % expressed a wish to continue their current job without changes. It is interesting that 44.7 % of current *angkot* drivers preferred a "new *ojek* driver" job in future.

   The job salary parameter is statistically significant and negative. This suggests that *angkot* drivers prefer a "new *ojek* driver" job, even though the salary level is lower. A possible explanation is that current *angkot* drivers without their own vehicle would like their own *ojek* first so that they can enjoy the more flexible work style of an *ojek* job at the expense of some of their wage. Meanwhile, the statistically significant job-specific captivity parameter (*Theta*) for *ojek* also suggests that 44.7 % of current *angkot* drivers would prefer "new *ojek* driver" jobs in the future. The employment opportunity positively influences job choice. The insignificant influence of fuel type can be partially explained by the negative parameter of subsidy for a low-emission vehicle.

   With respect to individual characteristics, the only statistically significant dummy variable (living in DKI Jakarta) shows clearly that *angkot* drivers from DKI Jakarta are reluctant to take *ojek* driving as a future job option.

5. Summary
   Recognizing the important roles played by paratransit systems in providing valuable job opportunities to low-income people and quite seamless transport services to residents in developing cities, this study has attempted a comprehensive investigation of the employment issues of paratransit drivers in developing cities by taking the JMA as an example. Drivers of four typical paratransit vehicles (*becak*, *ojek*, *bajaj*, and *angkot*) were targeted. Aiming to create more competitive, attractive and sustainable paratransit systems in future, this study examined whether current paratransit drivers would prefer new and different paratransit driver jobs in vehicles equipped with low-emission vehicles under altered competitive employment circumstances as well as various policy interventions. "Captive jobs" are identified, especially for jobs as *ojek* and *bajaj* drivers. It is also revealed that employment opportunities reflecting the social perspective of policy interventions, and government subsidies for low-emission vehicles reflecting the environmental perspective, have strongly contrasting influences on the job choices of four typical types of paratransit drivers. For policy-related variables, only subsidies for new vehicles exert a significant influence on *becak* and *bajaj* drivers' job choices. Given the current energy subsidies in Indonesia, it seems that fuel type has almost no impact on the job choice behavior of paratransit drivers. This suggests that financial incentives are the most important tool for encouraging paratransit drivers to shift to sustainable driver jobs. In contrast, savings from the operational costs of vehicles with much cleaner power seem to have no influence on drivers' job choices. To the best of the authors' knowledge, this is the first comprehensive study in the transportation literature to examine factors affecting the job choices of various types of paratransit drivers under social and environmental policy interventions. These analysis results offering deep insight into job choices of paratransit drivers could be useful for decisions on policies to transform the current ineffective paratransit systems in developing cities to make transportation more sustainable, competitive and attractive.

6.8 Conclusions and Future Challenges

6.8.1 Policy Design for Paratransit-Adaptive Transportation Systems

The popularity of paratransit in developing countries is undoubtedly supported by local people's various mobility needs. Many existing case studies in various parts of the developing world, including ours, have confirmed this popularity. Paratransit in developing countries is currently an essential travel mode because of inadequate official public transportation systems. Until such needs can be satisfied by official public transport services, paratransit will continue to be an indispensable part of transportation systems in developing countries. The case studies in this chapter revealed unique policy directions for redesigning the paratransit systems in

developing countries according to their users' travel behavior, drivers' job choices and QOL considerations of both users and drivers.

First, paratransit issues concern not only transportation but also society. We reconfirmed this point with a series of systematic and consistent questionnaire surveys. It is suggested that paratransit policies should be decided by systematically evaluating the influence of policies on people's QOL. Unfortunately, in reality, discussions about sustainable transport policies in developing countries have ignored, or at least attached less importance to, the social equity issues related to paratransit. According to a speech by the mayor of Surabaya City,[1] it is planned that angkot drivers' in Surabaya City will have their wages paid, and will be provided with new types of vehicles, by the government. Many development aid programs by international agencies have mainly focused on strategic planning of transportation systems in developing countries without sufficient attention to issues in the transitional process. Surabaya's practices should be evaluated carefully if the plan is realized. To make such policies possible, strong leadership is definitely required, because various governmental sectors, including the transportation sector, need to collaborate. In reality, such cross-sector collaboration is very important but is always the most difficult aspect of implementing policies. To demonstrate leadership, effective cross-sector collaboration frameworks should be established.

Second, this study emphasizes the importance of behavioral studies in transport policy decisions. Recently, in recognition of the limitations of supply-oriented policies in resolving transportation issues, a new approach, called the A–S–I (A: Avoid/Reduce, S: Shift/Maintain, I: Improve) approach, was proposed to achieve reductions in GHG emissions, energy consumption and congestion, with the final objective of creating more livable cities.[2] The avoid–shift–improve (ASI) approach aims to *mitigate* the impacts of transportation activities. However, this is insufficient to address environmental issues involving paratransit. Insufficient official transportation services have pushed increasing numbers of people in developing countries to rely heavily on it. Simply eliminating it from transportation systems in developing countries may resolve environmental issues but at the same time will surely result in more social issues caused by unemployment among paratransit drivers and may erect barriers to the transportation poor, whose only available (and/or affordable) means of travel may be paratransit. Therefore, measures adapted to paratransit should be taken jointly with these mitigation measures.

The above observations suggest that for transition to sustainability during the current economic development in developing countries, a considerable period of regulating and incorporating paratransit into official public transportation systems rather than simply banning it is a wise method for realizing sustainable urban transportation.

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[1] An invited speech given by Ms Tri Risnaharini, the Mayor of Surabaya City, in the GELs Special Seminar on Urban and Regional Development in Climate Change Regime, organized by the Hiroshima Center for International Environmental Cooperation (HICEC), Hiroshima University, November 19, 2012.

[2] www.sutp.org

6.8.2 Recommendations for Future Research

This study comprehensively examines issues of paratransit systems in developing countries from the perspectives of supply and demand as well as QOL of paratransit drivers and users. Various new findings and potential policies for transition to sustainability have been proposed. However, there are still many issues that need to be addressed to put our findings into practice.

First, to generalize our findings, more case studies should be conducted on large-scale questionnaire surveys in various parts of the developing world. Second, regarding choice behavior in terms of paratransit drivers' job choices and users' travel mode choices, heterogeneous responses to policies should be combined to promote paratransit-adaptive transportation policies in developing countries effectively. To quantify the effects of transportation policies on QOL, travel behavior requires investigation together with other aspects of citizen's life behavior, and a comprehensive QOL evaluation model system should be developed linking policy to behavior decisions, and behavior decisions with QOL evaluations (Zhang et al. 2012).

Second, the above behavioral studies should be incorporated into a framework of transportation network analysis covering both demand and supply sides of paratransit as well as official transportation systems. It is relevant to this transportation network analysis that Anwar et al. (2011) and Weningtyas et al. (2012b) confirmed that the reduction of travel speed resulting from traffic congestion in Dhaka, Bangladesh and Bandung, Indonesia can be observed at much lower ratios of traffic volume to capacity than in developed countries. Such remarkable reductions in travel time are largely because of mixed paratransit and official transportation vehicle traffic, on-street parking and shops. Such travel time performance has not been reflected well in transportation network analyses of developing countries. Furthermore, redesign of paratransit systems in developing countries requires clear policy goals, which should be incorporated into the process of transportation network design (Weningtyas et al. 2012c). For this purpose, it is worth developing a hybrid network analysis framework with both top-down and bottom-up decision-making mechanisms, in which various sustainable urban and transportation policy scenarios can be systematically and consistently examined (e.g., Feng et al. 2010; Feng and Zhang 2012).

Third, to resolve the traffic issues caused by paratransit in developing countries, mitigation measures are definitely required. However, considering the special situations in developing countries, transportation policy decision makers need to pay attention to paratransit and its popularity. Paratransit-adaptive measures must be taken to enhance the public acceptance of policies. There is no doubt that in reality, both mitigation and adaptation measures are required, but the success of mitigation measures relies heavily on whether appropriate alternative travel options can be provided. It is important to clarify how best to package the mitigation- and adaptation-oriented measures under the constraints of financial budgets and limited human resources. Because the social impacts of paratransit policies seem remarkable, the transportation sector should collaborate well with other relevant governmental sectors under a better governance scheme.

Finally, international agencies and other donors should exert their best efforts to assist recipients' endogenous development based not only on easily applied but old-fashioned and less scientific methods but also on up-to-date scientific methods by adapting them to local contexts. In the paratransit context, the above scientific approaches should be developed based on cutting edge international knowledge and local expertise.

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