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Full Length Research Paper

Robust models for the utilization of public bus transport services in Malaysia

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Unless public transportation is efficient, affordable, clean, comfortable and convenient, people would otherwise resort to drive to their destinations. The increased in the number of private vehicles on the road in Malaysia testifies to the preference of driving to work or places of leisure for many reasons. It could also quite easily point to the ailing public transport industry save for a few developed countries that are endowed with an enviable public transport system. The overall improvement of public transportation augmented with selective restrictions of private vehicle use would invariably improve the utilization of public transportation. This article proposes a conceptual model to assess perceived Bus transport utilization. It uses a categorical survey method to identify the preferences of Bus commuters to assess utilization. This conceptual model also allows managers to identify cost effective strategies within the model that are readily implementable within a relatively short duration to improve the utilization. In addition, the model is flexible enough to allow customization by management to improve the utilization within its own set of constraints.

Key words: Public bus transport, utilization, reliability of schedule, safety and comfort, information service, season ticket, ticket pricing.

INTRODUCTION

In general, the public is concerned with the mode of transportation to reach desired destination on scheduled time with minimum cost and maximum flexibility. Automobile usage has increased multifold during the last few decades in Malaysia mainly attributed to the mobility and flexibility provided by private vehicles. This is in contrast with public transport (PT) travel in Malaysia which is not reliable and often known as “bad” which also necessitates the sharing of the service with other strangers. Evidence shows that the high dependency on private vehicles in Malaysia is attributed to the economic growth, rising household income, establishment of the Malaysia national car project, fuel subsidies, deficiencies and the poor management of PT system (Kamba et al., 2007; Kasipillai and Chan, 2008; Mohamad and Kiggundu, 2007). Excessive private vehicles on major roads in Malaysia have created problems in traffic Congestion which further induce accidents, air and noise pollution (Mohamad and Kiggundu, 2007). Public bus transport (PBT) authorities in Malaysia are therefore, facing tremendous challenges to deal with the poor utilization rate and the resistance of the public to utilize PBT in order to solve the problems associated with the excessive usage of private transportation. They are concurrently subjected to pressure and scrutiny from various parties to provide high quality and robust PBT services to fulfill the needs and expectations of the public. PBT has no doubt become the key policy to achieve an integrated and sustainable transport system in Malaysia. The announcement of the 6th NKRA to increase the utilization of PT users is one of the initiatives by the Malaysian government (The Star, 2009) to promote PT usage among the public. It is believed that the effective and robust PBT service provision is crucial and necessary in realizing the objective of the 6th NKRA which is aimed to increase the utilization rate and to sustain the Malaysia transport system. In fact, the government’s initiatives in promoting PT utilization can

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be seen way back to 2006 where RM 31.8 billion was allocated for the PT sector under 9th Malaysia Plan (2006 - 2010) to improve the service performance (Government of Malaysia, 2006). An additional RM 35 billion was further allocated under Budget 2009 (2009 - 2014) to enhance the PT services in Malaysia, for the allocation of new buses and provision of better infrastructure facilities (Bernama, 2008). Despite nation's initiatives, the great effort and support in improving PT services can be seen in the local state government's planning. For instance, the Kuala Lumpur Structure Plan 2020 aims to reverse the decline rate in PT utilization to achieve a PT to private transport ratio of 60:40 by year 2020 by providing comprehensive and integrated transportation network of high quality, convenience, user-friendly and easily accessible PT service (Kuala Lumpur City Hall, 2004). Whereas in Penang, the aim is to increase the road efficiency, expand and upgrade PT capacity with more efficient PBT system through the execution of Penang Structure Plan (JPBD, 2010). The most current initiative of the Malaysian government to promote PBT usage is found in the 2010 Budget Speech by the Malaysian Prime Minister Datuk Seri Mohd Najib Tun Razak on October 23, 2009 (Government of Malaysia, 2009). These initiatives include the expansion of specific bus lanes and putting more buses on the roads in Kuala Lumpur, the construction of four new hubs to cater for new bus routes in Penang, and the allocation of dedicated special bus lane also on expressways with Touch 'NGo facilities at tall booths.

Sustainability of PBT service has hence raised the necessity of this study in order to understand the real needs and expectations of the commuters to encourage the ridership of the PBT. Research with the aim to increase the utilization rate is therefore much needed. At present, the research on PBT from the commuters' point of view is very limited and no research has been done on the utilization of PBT service in Malaysia. Therefore this study is undertaken to conceptualize the commuters' utilization of PBT to identify the best combination of factors which is highly preferable by the commuters.

Research objectives

The main purpose of this study is to conceptualize the utilization of PBT service by using a strategic analysis approach with the aim to create a robust PBT system of optimum utilization rate. The study will justify the modification and enhancement of the current PBT system with respect to system inefficiencies and commuters' dissatisfaction based on the valuable input of the public inclusive both commuters and non-commuters. The public involvement is a strategic approach that will result in a more precise reflection of the real needs and expectations of the PBT services and consequently more likely to increase the utilization rate consistent with the objective of the 6th NKRA. In a nutshell, the study attempts to accomplish the following three main objectives:

1. To determine the best preferred combination(s) of public bus transport (PBT) service rated by the commuters and non-commuters in Malaysia.
2. To investigate the PBT service drivers influencing the utilization of commuters and non-commuters.
3. To study the influence of socio-demographic factors on the utilization of PBT service.

Motivation of the study

Over the decade, PT companies experience balance sheets which are lack luster. The socio-political system of a country has a bearing upon this performance. The expectations of PBT commuters are very high such as buses keeping to their schedules, bus safety and security. The operating and administrative costs of PBT companies are also rapidly increasing in spite of lower fuel prices. The growing maintenance cost to repair damages due to anti-social elements make profits more elusive. The Malaysian Prime Minster has recently reported that the utilization of PBT service is a mere 16% for the entire country and he has suggested that one of the key areas of his government is to increase the utilization to 25% within six months. The same situation prevails in most of the developed and developing countries as people prefer to use their own transportation rather than PT. The primary motive of this paper is to conceptualize a PBT model using the management utilization theory. The transport companies may test this model to improve the transportation system and to increase the bus utilization.

LITERATURE REVIEW

Private vehicle usage has increased over the last few decades in most of the urban areas especially in developed and developing countries attributed possibly to the poor management of PT services (Kamba et al., 2007; Kasipillai and Chan, 2008; Nurdden et al., 2007; Steg, 2003). PT is often perceived to be poor alternative compared to private vehicles (Steg, 2003). The total vehicle ownership in the world had increased from 122 million in the 1960s to 812 million in 2002 implied an average annual growth rate of 4.6% based on a research conducted by Dargay et al (2007) by using a sample of 45 countries. The study also projected that the world's total vehicles in year 2030 would increase to 2.5 times higher than the total number in 2002 (Dargay et al., 2007). The rapidly increase in the number of automobile usage especially in urban areas has caused tremendous problems to the countries such as massive traffic

congestion, air and noise pollution, and climbing rate of road accidents and casualties (Mohamad and Kiggundu, 2007; Steg and Gifford, 2005). These have consequently raised the concern on the sustainability of current transport system (Goldman and Gorham, 2006; Gudmundsson and Höjer, 1996) associated with the quality of life (Steg and Gifford, 2005).

Due to the increasing importance of PT services to the sustainability of transport system, numerous researches have been conducted on the measures and factors to increase the demand and satisfaction of the commuters. Nevertheless, evaluation of commuters' satisfaction level is a very subjective matter as different commuter might have different needs and expectations toward the rendered services. Among abundant factors, one of the most significant factors directly influencing the satisfaction level of the commuters is the service quality (Ang et al., 2006). Paulley et al. (2006) shared the same opinion about the service quality and argued that other than quality, effect of fares, the commuters' income and the car ownership of the residents are other important factors which can influence the demand for PT. In the context of PBT services, research done by Andaleeb et al. (2007) argued that the main factors to increase the satisfaction level of the regular bus users are the comfort level of the bus, the staff behavior, the number of bus transit point to reach the destination, supervision and waiting facilities provided. In Malaysia, a few researches have been conducted to examine different characteristics of Malaysian citizens who are favoring private transportation as well as factors influencing the individual selection of the mode of transportation (Kamba et al., 2007; Kasipillai and Chan, 2008; Mohamad and Kiggundu, 2007; Sheikh et al., 2006). Some studies showed that an efficient PT system with reduced bus travel time and cost is essential to encourage especially motorists or car drivers to utilize the PBT services (Nurdden et al., 2007; Sheikh et al., 2006). Another research conducted in Putrajaya, Malaysia recently however argued that although service quality positively influencing the ridership, improvement in service alone may not be enough to sufficiently encourage the modal shift (Nor et al., 2006). Demand-restraining measures on private transportation such as increase parking charges, and policy enforcement appeared to be essential to achieve the desired 70:30 modal split between private transportation and PT service (Nor et al., 2006). Although, different author shared different opinion on the factors and measures influencing the demand or satisfaction of PT services, a few important factors have been chosen to be covered in this study as service drivers in order to investigate their influence on the utilization of PBT service in Malaysia.

Reliability of schedule

A study by Palma and Lindsey (2001) showed the importance of optimal timetable to reduce schedule delay cost by considering the preferred travel time by the commuters. For that purpose the researchers developed two location models namely the "line" model and "circle" model. Yan, Chi and Tang (2006) supported the importance of timetable setting and scheduling to enhance inter-city bus carriers' services using the "Stochastic-Demand Scheduling Model" (SDSM). According to Liu et al. (2007), minimizing travel time of the commuters is one of the main reasons for the study of bus scheduling. In this conceptual model, two options are highlighted namely (1) Exact Time of Arrival (ET) within ± 10 min and (2) Approximate Time of Arrival (AT) about 11 to 30 min behind schedule. In Malaysia, reliability is one of the major issues complained by the commuters according to Miss Jaslinna Mohamed Yusoff (personal communication, October 12, 2009). Most of the commuters complain about the unreliable bus schedule and delay as well as the immediate subsequent services where more than two buses stop at the same bus stop at the same time. They also often complain about the delay of the bus and that the drivers do not operate precisely according to the time interval promised by the PBT authority. Some of them also demand more buses during peak hours and wider coverage area to include places like factory, school and residential areas. Malaysian former Prime Minister Datuk Seri Abdullah Ahmad Badawi while tabling Budget 2009 also mentioned that "a more efficient, reliable and integrated public transportation, which provides seamless travel and greater frequency of services, is required" based on his own experience on PT services in Malaysia (Bernama, 2008). Due to the importance of reliability of schedule to the Malaysian citizens, the study therefore hypothesizes that:

H_1: Reliability of schedule (ROS) is positively influencing the utilization of PBT service.

Safety and comfort

Safety and comfort issues are major concerns of the commuters in the decision making on PT services. Although, many empirical findings suggested that PT service is an effective way to reduce congestion and accidents on road (Mohamad and Kiggundu, 2007; Steg and Gifford, 2005), however, current increase numbers of accidents involving bus driver has raised the concern of the public and researchers on the safety issues of the PT services especially in the context of PBT. This has led to the research to identify and characterize the taxonomy of the accidents involving buses (Wåhlberg, 2002, 2004) as well as the indirect involvement of buses in the traffic accidents (Brenac and Clabaux, 2005). Identification of the patterns and characteristics of PBT accident is the first step in solution finding in order to solve the problem.

In addition, red light violation is one of the major factors contributing in the crash risk and accidents which has shown drastic increase in current years. In an attempt to address this issue, Wong et al. (2008) have conducted a research to investigate the acceptance of Public Light Bus (PLB) drivers in Hong Kong on the fine and driver demerit penalty for red light violations and the result showed significant change on the effect. In addition to safety, comfort issue is another major concern of the commuters of PT services especially for long-journey and daily travelling commuters. The range of the comfort of the PT could be very wide, covers from the seat and floor condition to the extent of availability of toilet and extra facilities for the disabled people. Among all, air conditioned is the basic need. Striking a balance between thermal comfort and air quality can increase the satisfaction of the commuters instead of merely complying with the minimum requirements or to the prescribed standard stated by the authorities (Shek and Chan, 2008). The proposed conceptual model hence solicits inputs such as Utmost Priority (UP) or Moderate Priority (MP) from commuters in relation to safety and comfort. This study also hypothesizes that:

H_2: Safety and comfort (SAC) is positively influencing the utilization of PBT service.

Information service

Tremendous researches have been conducted on the imperative of information service to the travelers and their willingness to pay for such information. Most of the literature showed pessimistic result with low willingness to pay for travel information (Khattak et al., 2003; Polydoropoulou et al., 1997; Wolinetz et al., 2001) and PT information (Neuherz et al., 2000; Vance and Balcombe, 1997) specifically as the commuters believe that the information should be provided with no extra charge as a portion already covered in the ticket purchased. Nevertheless, the researchers also clearly indicated that the travelers will be more willing to pay provided if the information is highly customized and significantly satisfied as well as the perceived benefits derived from the information service is great and exceeding the perceived costs of acquiring. Research by Molin and Timmermans (2006) shows PT information plays a major role in increasing the accessibility of PT and commuters sometimes are willing to pay more for the information provided if it is value-added and useful to them. A previous study by Khattak et al. (2003) has similar findings. Dziekan and Kottenhoff (2007) defined a comprehensive framework of the possible effects of “dynamic at-stop real-time information displays” for PT and such displays yield better service quality. This proposal therefore is to assess the commuters’ willingness to pay for more useful bus information services (either Full Information FI or Moderate Information MI). These statements necessitate the construction and testing of H_3 particularly in the context of Malaysia. Therefore, this study hypothesizes that:

H_3: Information service (IFS) is positively influencing the utilization of PBT service.

Season ticket

PBT operators sometimes sell season ticket or bus pass for the convenience of commuters. This reduces waiting time to buy tickets. Season tickets usually come with lower pricing or unlimited number of trips with specified destinations. The season ticket provides great convenience to the bus commuters because they need not carry exact change. FitzRoy and Smith (1999) claimed that the introduction of cheap season ticket is a method to increase the demand of PT as it offers zero marginal trip cost based on the study of four major Swiss cities of Basel, Bern, Geneva and Zűrich. A previous study was also conducted in the German city of Freiburg with similar outcomes (FitzRoy and Smith, 1998). Nevertheless, based on the observation, it is discovered that not many commuters are holding season ticket or any bus pass while travelling with Rapid Penang and therefore it is worthwhile to include this driver in the study in order to identify the real reflection from the commuters about the benefits of purchasing a season ticket as compared to buying ticket every time while travelling (either by Season Ticket ST or Regular Ticket RT). Consequently, this study also hypothesizes that:

H_4: Season ticket (STK) is positively influencing the utilization of PBT service.

Ticket pricing

Consumers are very sensitive to the price of the products they intended to purchase. The buying behaviors of the consumers are much influenced by the small or slight change in the price. Empirical findings from previous researches showed that the public acceptability of transport pricing measures is low (Schade and Schlag, 2003; Schlag and Teubel, 1997). Therefore, cost and pricing is one of the critical drivers in influencing the ridership and utilization of the PT service and hence, a lot of researches have been conducted in this area. There were also researches argued that reduced cost and subsidized fare are important variables to encourage the modal shift especially to the motorist and car driver (Nurdden et al., 2007; Sheikh et al., 2006). Price elasticity on PT service is the major interest among all in the area of pricing researches. A lot of researches have been done in this context to observe the responses of the

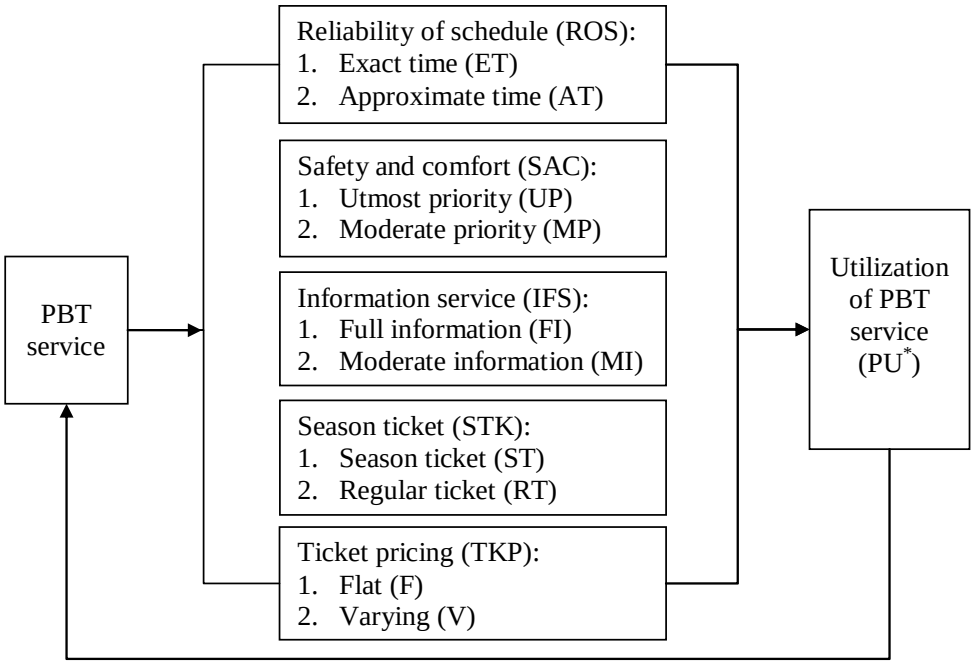

Figure 1. Conceptual Model of Utilization of PBT Service.

commuters towards the price changes in short term and long term period. Research by Paulley et al. (2006) argued that the fare of the PT is one of the major drivers affecting the demand of the utilization of the PT services. The similar research on how price changes affect the ridership of the PT had been done by Litman (2004) with the similar result showed that the price elasticity tends to increase over time. This finding is very useful to the government especially during the decision making process to fix the reasonable price or fare of the PT service. Subsidies on the PT service fare will therefore be a critical consideration of the government in order to sustain the ridership of the PT service to fully utilize the transportation network offered. Therefore tickets pricing may be categorized in this model as either Flat (F) or Varying (V). In Malaysia, the PBT ticket price experiences controlled pricing by the government and varies with fixed rate per distance travelled. In practical, ticket pricing is a complex factor which is a function of service quality, rating of the bus, one-way or return journey, festival seasons, peak hours as well as the competition between private and public bus. Therefore, this study hypothesizes that:

H_5: Ticket pricing (TKP) is positively influencing the utilization of PBT service.

Demographic factors

Previous researches showed that age, gender, car ownership, household size and income were influencing the individual choice of transportation (Nurdden et al., 2007; Paulley et al., 2006; Steg, 2003). In order to understand the effect of social demographic factors on the utilization of PBT service, the following hypotheses were developed to investigate the relationship between gender, age, monthly salary, the possession of private vehicle and the status of commuter/non-commuter with the utilization of PBT service. Accordingly this study hypothesizes that:

H_{6a}-H_{6e}: There is relationship between gender, age, monthly salary, possession of private vehicle, status of commuter/non-commuter and the utilization of PBT service.

Conceptual model

Two research frameworks are proposed in this study to conceptualize the utilization of PBT service among Malaysian citizens. Model-1 (Figure 1) is developed to conceptualize the best combination of service drivers that best suits the needs and preferences of the commuters and non-commuters. In the present study, there are five attributes (F1-F5) of which all attributes are measured at two levels. The conjoint analysis is the most suitable technique to form 32 conjoint profiles. For instance, let *i* and *j* be two levels of attribute F2, and *k* a level of attribute F3 then (Number of responses having $F2_i$ paired with $F3_k$) / (Number of responses with $F2_i$) = (Number of responses having $F2_j$ paired with $F3_k$) / (Number of responses with $F2_j$).

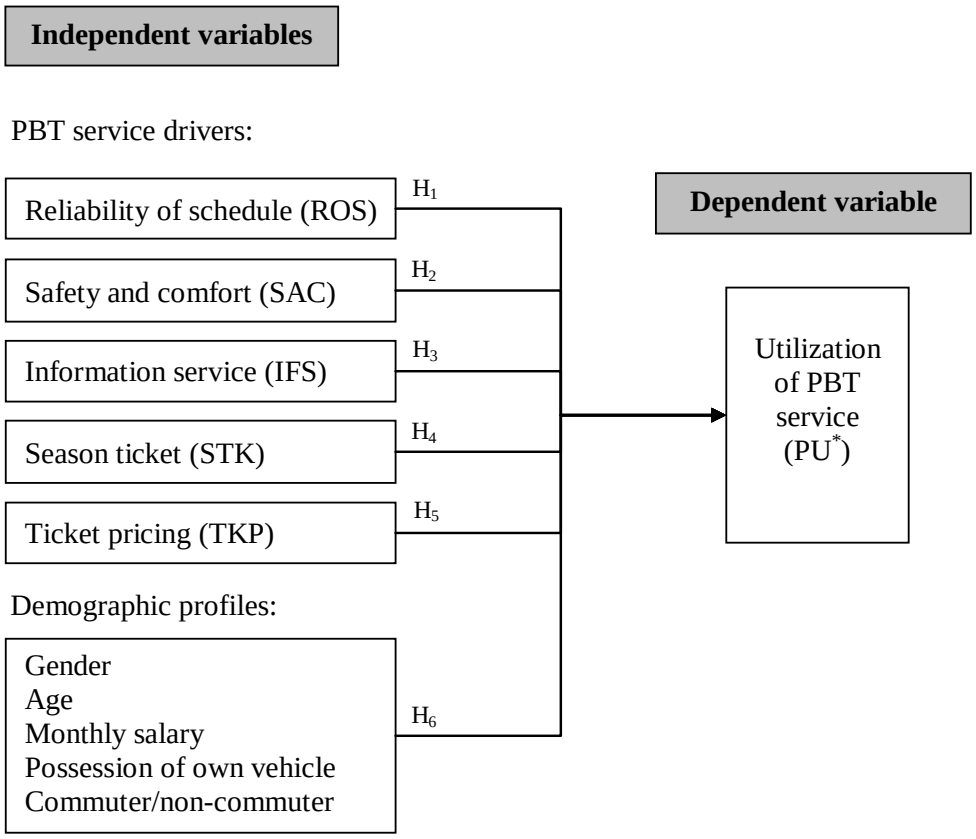

Figure 2. Research framework.

In other words, the chances of finding the response $F3_k$ (Factor F3 at level k =1 or 2) should be the same regardless of the number of levels of attribute F2. Consequently, 32 profiles would be arrayed to obtain all possible combinations.

Alternative model

Model-1 as described in Figure 1 can be redesigned into the following Research Framework as depicted in Figure *2* for hypotheses testing. This study will investigate the effect of five identified PBT service drivers (IVs) to the utilization of PBT service (DV) and how this relationship is affected with the introduction of social demographic factors of the respondents. This model is developed based on the theory of reasoned action (TRA) whereas the chosen service drivers were formulated based on the interview with experts from Rapid Penang, feedback from focus group opinion survey, observations as well as journal literature.

RESEARCH METHODOLOGY

The study solicited respondents' opinion and conceptualized the utilization of PBT service to infer the real needs and expectations of the commuters and non-commuters in Malaysia using quantitative research methodology. The exploratory study was conducted through categorical survey approach and the validity of the model was verified through empirical evidence. This study employed cross-sectional research design with the integration of multi-methods approach in information gathering (literature review, email to government authorities, interview with expert, focus group opinion survey and observation), face validation, pilot study and survey questionnaire as the main methods to gather more accurate and less bias data. The main focus of the study is to investigate the relationship between the IVs (ROS, SAC, IFS, STK and TKP) and DV (PU) as well as to identify the best preferred combination(s) of PBT service drivers rated and chosen by the respondents from the well formed conjoint profiles. The unit of analysis of the study was designed to be an individual who is Malaysian citizen who may or may not have utilized PBT service for the past two years. Opinions from respondents who were commuters and non-commuters were both equally important in order to understand their utilization of PBT service in Malaysia. It can be safely presumed that utilization rates will definitely increase if non-commuters start to utilize the PBT service and the existing commuters are satisfied and continue their utilization of PBT.

Face validation

Since the research topic is new and there is insufficient literature review to support all the questions covered in the survey questionnaire, face validation or content validation is an essential

intuitive process to make sure the measure in each question reflects the correct content of the concept (Bryman and Bell, 2007). Accordingly, Rapid Penang operator was chosen as the judge to establish the face validity of the survey questionnaire in this study. A request was made to Miss Jaslinna Mohamed Yusoff from Rapid Penang to segregate the survey questionnaire to 15 top management officers in Rapid Penang to perform the face validation of the questionnaire. Among the 15 requested questionnaires, eight of them returned the answered questionnaires with valuable input and opinion, yielding a response rate of 53.33%. Based on their feedback, along with additional literature review and observation conducted; appropriate amendment was done on the survey questionnaire in order to strengthen the content of each construct in the research framework.

Pilot study and pre-testing

Pilot study or pre-testing to ensure the survey questionnaire operates well and the research instrument as a whole functions well (Bryman and Bell, 2007) was conducted prior to the empirical survey to establish the item validity and construct validity (by using factor analysis) as well as internal consistency (by using Kappa statistic or Cronbach's Alpha) of the measures. The pilot study was conducted by involving 30 respondents including 15 experts from Rapid Penang (five top management officers, five administrative personnel or general clerks and five bus drivers) and 15 respondents who were non-PBT authorities (eight MBA students and seven private sector employees). All these respondents who were involved in the pilot study were excluded from the sample in full study so that it would not affect the validity and reliability of the final results. The pilot study took place from January 28, 2010 until March 3, 2010 to have all feedback collected. In this pre-testing, together with the questionnaire, a feedback form was attached to understand if respondents faced any difficulty or encountered any unclear or bias question while answering the questionnaire.

Measurement of variables

Five service drivers were considered in this study namely reliability of schedule (ROS), safety and comfort (SAC), information service (IFS), season ticket (STK) and ticket pricing (TKP). Each service driver was limited to two levels of selection. By employing full factorial design, all 32 possible combinations of service drivers were formed to conceptualize the utilization of PBT service in Malaysia. The interaction effect between each profile was assumed to be equal to zero. The much detail list of items which further explained each PBT service driver was directly measured in a five-point Likert scales. The DV in this study is the utilization of PBT service (PU) reflecting the real needs and expectations of the commuters and non-commuters in Malaysia in order for them to utilize the PBT service. Each IV contained several service items and the respondents indicated their importance on a five-point Likert scales: (1) Highly not important, (2) Not important, (3) Neutral, (4) Important, and (5) Highly important. Other than PBT service drivers, there were other five social demographic factors were considered as demographic IVs in the study: gender, age, monthly salary, the possession of private vehicle and the status of commuter/non-commuter to identify whether it further influences the utilization of PBT service (DV) in Malaysia.

Population and sampling design

The target population of the study was determined to be Malaysian local citizens. According to Hair et al. (2010), the minimum acceptable ratio of observations to variables is 5:1 however to obtain better results, it is preferred to be 15:1 (15 respondents to one variable) or more in the study. In this study, the proposed Model-1 (Figure 1) consisted of six variables and Model-2 (Figure 2) consisted of 11 variables. Accordingly, a minimum of 165 respondents (11 * 15 = 165) was required for the study based on the sampling formula recommended by Hair et al. (2010) and Sekaran (2006) for better results and inference. Due to the time and cost constraint, non-probability sampling method was employed in the study. Although it may not confidently generalize the research findings to the population, it provides preliminary useful information in a quick, convenient and less expensive way (Sekaran, 2006).

Exclusion criteria

1. Children below 15 years are excluded from this study as they may not be able to reveal accurate information. They are usually accompanied by their parents who will be the respondents.
2. Those commuters who have not utilized PBT service for the last two years are excluded from the study since the study is focused in finding the current bus conditions and services.
3. Physically challenged people are also excluded. They usually travel free in public buses and their responses may be bias.

Data collection

The final version of the questionnaire was prepared in two languages (English and Malay) in both Microsoft Word format and online survey form. The data collection was conducted for 17 days from March 9 until March 25, 2010. The online survey was the main method of data collection of this study. In order to obtain sufficient data for analysis, a total of 500 email messages with a link to the online survey URL were sent to the targeted respondents (friends, collogues, MBA course mates) who are the residents in Penang with an expected response rate of at least 39% to obtain minimum sample size of 195. More encouragingly, the respondents were offered a summary report after completing the online survey. In addition to the online survey, personal structured interviews were conducted for three consecutive days from March 20 to March 22, 2010 at Rapid Penang Weld Quay bus terminal. In order to reduce the above error, a pre-testing or pilot study was conducted prior to the field interview. Although, rich and more accurate data could be obtained through the personal structured interview, the research favored online survey due to the time constraint and difficulty in getting respondents to answer the questionnaire at the bus station. Out of these data collection methods, 319 respondents had participated in the survey (299 respondents from online survey and 20 respondents from the personal structured interview) yielding a response rate of 61.35%. After discarding 17 incomplete questionnaires, the remaining 302 valid and usable questionnaire data yielded a total response rate of 58.08%.

Validity and reliability of data

Exploratory factor analysis as recommended for larger sample size (Costello and Osborne, 2005; Tucker and MacCallum, 1997) was performed on all 33 items of PBT service drivers collectively to test the validity of the measures. The factor analysis employed the default "principal component" extraction method and "varimax" rotation with Kaiser Normalization. The Bartlett's Test of Sphericity was significant (Chi-square = 2977.69, p = 0.000) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.897 above the recommended 60% (Garson, 2010b) indicated sufficient intercorrelations and these data were "meritorious" and almost "marvelous" for factor analysis (George and Mallery, 2006; Hair et al., 2010). The measurement of sampling adequacy (MSA) at

Table 1. Results of factor analysis and reliability analysis.

PBT Service driver	Component					Mean	SD	Communality
	1	2	3	4	5			
SAC4	0.785	0.029	0.123	0.275	0.061	4.62	0.686	0.712
SAC1	0.765	0.182	0.096	0.150	0.057	4.54	0.709	0.653
SAC2	0.746	0.080	0.173	0.139	0.130	4.59	0.689	0.629
SAC7	0.705	0.017	0.326	0.056	-0.030	4.60	0.716	0.608
SAC3	0.688	0.182	0.052	0.133	0.164	4.39	0.831	0.554
SAC5	0.656	0.136	0.224	0.341	0.053	4.67	0.669	0.618
SAC6	0.576	0.136	0.379	-0.012	0.061	4.42	0.802	0.498
STK2	0.199	0.826	0.126	0.129	0.038	4.13	0.924	0.756
STK1	0.178	0.770	0.088	0.140	0.106	3.97	0.962	0.664
STK4	0.066	0.737	0.222	0.208	0.060	4.11	0.935	0.645
STK5	0.071	0.632	0.248	-0.116	0.213	3.70	1.216	0.524
STK3	0.065	0.543	0.038	-0.098	0.323	3.29	1.217	0.414
IFS3	0.235	0.164	0.712	0.187	-0.044	4.44	0.766	0.626
IFS2	0.221	0.299	0.706	0.092	0.003	4.31	0.875	0.645
IFS6	0.219	0.222	0.592	-0.018	0.135	4.08	0.956	0.467
ROS6	0.056	-0.087	0.577	0.127	0.189	4.39	0.815	0.395
IFS1	0.315	0.289	0.563	0.340	-0.106	4.56	0.744	0.627
IFS4	0.204	0.229	0.557	0.285	0.058	4.43	0.798	0.489
ROS2	0.215	0.042	-0.003	0.696	0.014	4.57	0.790	0.533
ROS7	0.055	0.113	0.108	0.578	-0.008	4.47	0.754	0.362
ROS1	0.228	-0.022	0.325	0.552	-0.033	4.65	0.753	0.463
ROS4	0.214	0.009	0.186	0.489	0.114	4.14	0.800	0.332
TKP2	0.163	0.170	0.105	-0.044	0.792	3.52	1.114	0.696
TKP4	0.021	0.134	-0.115	-0.061	0.707	2.92	1.288	0.535
TKP3	0.122	0.062	0.259	0.137	0.586	4.01	0.915	0.448
TKP1	0.030	0.338	0.071	0.331	0.473	3.94	1.044	0.453
Eigenvalue	7.649	2.513	1.676	1.277	1.229	-	-	-
%Variance (55.17%)	29.421	9.666	6.447	4.910	4.727	-	-	-
Cronbach's alpha	0.875	0.796	0.800	0.561	0.643	-	-	-

N = 302; KMO = 0.897; p = 0.000; Extraction method: Principal component analysis; Rotation method: Varimax with Kaiser normalization.

diagonal of the anti-image correlation matrix was checked and the majority of the items were found > 0.82, far above the acceptance level of 50% (Hair et al., 2010; Table 1). In this study, a value of 0.40 was selected as it brought the significant factor loading and convergent validity for a sample size larger than 200 (Hair et al., 2010). A total of seven items were eliminated during several steps of factor analysis because the item did not contribute to a simple factor structure; or failed to meet a minimum criteria of having a primary factor loading of 0.40 or above and no cross-loading greater than 0.40. Reliability analysis was performed in this study subsequent to factor analysis to ensure the internal consistency of the measures. The reliability of each sub-scale was examined by using Cronbach's alpha coefficients. According to Sekaran (2006), the minimum acceptable Cronbach's alpha value is 0.50. Therefore all measures in the study were considered reliable with the lowest measuring of 0.561 for ROS, followed by TKP (0.643), STK (0.796), IFS (0.800) and SAC (0.875). Three out of five IVs were ranged around or above 0.80 suggested that the internal consistency reliability of the measures were good and promising (Sekaran, 2006). There was no substantial increase in Cronbach's alpha value for any IV by eliminating more items and therefore no item was further deleted from the reliability test. Thus it could be concluded that all measures had an acceptable level of reliability and psychometric properties of data.

RESULTS

The mean value for each service driver was between 3.60 and 4.55 indicating that all five service drivers were ranged between Neutral (3) and Highly important (5). The

Table 2. Correlation coefficients of IVs and DVs.

Variables	Mean	SD	ROS	SAC	IFS	STK	TKP	PU
ROS	4.46	0.51	1					
SAC	4.55	0.55	0.493**	1				
IFS	4.37	0.59	0.486**	0.580**	1			
STK	3.84	0.79	0.215**	0.353**	0.467**	1		
TKP	3.60	0.76	0.163**	0.278**	0.260**	0.437**	1	
PU	-	-	0.067	0.025	0.101*	0.169**	0.115*	1

N = 302; ** p < 0.01 (1-tailed); * p < 0.05 (1-tailed).

Table 3. Best Preferred Combinations of PBT service drivers.

Ranking of combination	PBT service drivers					No. of respondent	Percent
	ROS	SAC	IFS	STK	TKP		
Combination 1 (C1)	ET	UP	FI	ST	F	120	39.7
Combination 3 (C3)	ET	UP	FI	RT	V	101	33.4
Combination 7 (C7)	ET	UP	FI	RT	F	93	30.8
Combination 6 (C6)	ET	UP	FI	ST	V	66	21.9
Combination 2 (C2)	ET	UP	MI	RT	F	59	19.5
Combination 9 (C9)	ET	UP	MI	RT	V	43	14.2
Combination 10 (C10)	AT	UP	FI	ST	F	33	10.9
Combination 5 (C5)	ET	MP	FI	ST	F	33	10.9
Combination 4 (C4)	ET	UP	MI	ST	F	31	10.3
Combination 11 (C11)	ET	UP	MI	ST	V	27	8.9
Combination 8 (C8)	ET	MP	FI	ST	V	23	7.6

N = 302; combinations used a binary code with (1 = Preferred and 0 = Not Preferred); ET = exact time; AT = approximate time, UP = utmost priority; MP = moderate priority; FI = full information; MI = moderate information; ST = season ticket; RT = regular ticket; F = flat; V = varying.

results revealed that the respondents had a very high sense of needs and importance on SAC (mean = 4.55, SD = 0.55). The result also reflected that the respondents agreed that ROS (mean = 4.46, SD = 0.51) and IFS (mean = 4.37, SD = 0.59) were highly important drivers in relation to the rendered PBT services in Malaysia. Similarly, the respondents on average that STK (mean = 3.84, SD = 0.79) and TKP (mean = 3.60, SD = 0.76) were relatively important though the mean values of both drivers were slightly lower than four and the variation of respondents' opinion were spread over a larger range of value. Out of 10 correlations, all correlation coefficients were larger than 0.16 with the highest correlation (0.58) between IFS and SAC; and the lowest correlation (0.16) between TKP and ROS (Table 2). All these correlations were found to be statistically significant at 1% level. There was no high correlation of 0.70 and above (Hair et al., 2010) suggested that multicollinearity problem did not present among IVs in this study.

Best preferred drivers of PBT service

Out of 302 respondents, the best preferred combination selected by 120 respondents (39.7%) was combination 1, followed by combination 3 (33.4%), combination 7 (30.8%), combination 6 (21.9%) and combination 2 (19.5%) as the top five best preferred combinations (Table 3).

The conjoint analysis was employed on socio-demographic factors and the results reveal that the most significant preferred combinations to be recommended to PBT authorities were C1, C3 and C7. The reasons are (1) these three combinations were the top three best preferred combinations selected by 302 respondents and (2) the selection of combinations was significant for social demographic factors proven by the MDS analysis using Euclidean distance model.

Two-group discriminant analysis on PU

Discriminant analysis was selected against binary logistic and viewed as the best method in this study because it met the assumptions required to ensure the validity of its significance test. The DVs in the study were true dichotomy and categorical dependent (Garson, 2010a;

Hair et al., 2010). The sample size of 302 was adequate and exiting the minimum requirement of five observations per IV (Hair et al., 2010). In fact, there is statistical prove that discriminant analysis has more power than logistic regression with less probability of type-II error (Garson, 2010a). Further justification on selecting discriminant analysis was based on the calculation of Youden's index, likelihoods and discriminant power recommended by Sokolova et al. (2006).

The 1st stage of analysis (model-1) was performed between the five identified PBT service drivers and PU. A few assumptions were checked to assure the model fitness. The Wilks' Lambda of PU was significant (λ= 0.963, χ^2 = 11.215, p = 0.047) implied that two priori groups of PU did not have the same mean discriminant function scores and the model was significantly discriminating. Box's M test on the other hand (F = 19.053, p = 0.251) was not significant, demonstrated that the covariance matrix between two groups of PUD were the same. In the 1st stage of analysis, Wilk's lambda was significant by the F test for STK (F = 8.80, p = 0.003), TKP (F = 4.05, p = 0.045) and IFS (F = 3.11, p = 0.079). Discriminant loadings on the other hand were used to interpret the discriminating power of each IV. It was found that discriminant loadings were corresponding closely with the F ratios, indicating that the most influencing variables discriminating the PUD was STK (0.87), followed by TKP (0.59), IFS (0.52), ROS (0.34) and SAC (0.13) with only STK, TKP and IFS had substantial influence on PUD. It was also observed that the discriminant loadings of all three significant service drivers were carrying positive values, indicated that the influence were more on direct utilization than non-utilization.

For the 2nd stage of analysis (model-2), the Wilk's lambda and F ratio values of five identified PBT service drivers remained the same. Additional significant Wilk's lamba was found on social demographic factors of the status of commuter/non-commuter (F = 6.95, p = 0.009), the possession of private vehicle (F = 6.63, p = 0.010), age2 (F = 4.39, p = 0.037) and monthly salary1 (F = 3.83, p = 0.051). Discriminant loading values revealed the similar results by indicating that the most influencing factors discriminating the PU was the status of commuter/non-commuter (0.48), the possession of private vehicle (-0.47), age2 (-0.38) and monthly salary1 (0.35). It was observed that the status of commuter/non-commuter and monthly salary1 were carrying positive values, indicated that these demographic variables influenced more on the direct utilization of PBT service than non-utilization. On the contrary, the negative values carried by the possession of private vehicle and age2 indicated the other way round.

The results of the discriminant analysis reveal that:

i. The respondents were willingly to utilize the PBT service directly if the required service drivers namely STK, TKP and IFS were provided.

ii. The respondents who were non-commuter, did not possess own private vehicle, aged less than 26 and greater than 40 and earning monthly salary greater than or equal to US$ 1000 were the potential commuters who will utilize the PBT service directly.

The aforementioned results support the hypotheses of H_3, H_4 and H_5 whereby IFS, STK and TKP are positively influencing the PU. H_1 and H_2 are not supported indicated that ROS and SAC did not play any significant role in influencing the PU. The results also supported the hypotheses of H_{6b} (partially), H_{6c} (partially), H6d and H6e indicated that there was relationship between PU and social demographic factors of age (partially), monthly salary (partially), the possession of private vehicle and the status of commuter/non-commuter. Finally, classification results showed that 63.6% of total original groups was correctly classified in the Model-1 and it was increased to 66.9% in the Model-2 indicates that the addition of social demographic factors in the analysis further enhance the classification results (Tables 4 and 5). The probability of misclassification of 33.1% could be explained with reference to other significant factors that were not considered for the study or other random fluctuations.

DISCUSSION

The results showed that the top three best preferred combinations of service drivers were C1, C3 and C7, which were proven to be highly influential by the socio-demographic factors of the respondents. It was noticed that all top three best preferred combinations had a very high sense of importance on ROS, SAC and IFS. The results were consistent with the descriptive statistics with high mean importance value of more than 4.37 on a 5-point scale for ROS, SAC and IFS. Most of the respondents perceived and demanded the PBT services to contain the following characteristics: exact time (ET) of arrival within ± 5 min, utmost priority (UP) of SAC measures on board and full information (FI) services as their most preferred choice of PBT services. Reliability and punctuality of the schedule are the major complaint of the PBT commuters in Penang according to Miss Jaslinna Mohamed Yusoff from Rapid Penang (personal communication, October 12, 2009). The importance of frequency and reliability of bus service is further supported by Vance and Balcombe (1997). The respondents on the other hand highly demanded full information service to be provided including but not only limited to the timetable and schedule, bus operation hours and route information. PBT information in Malaysia has always known as "bad" and it is observed that there is no proper information notice board installed at each bus stop in Malaysia. This has caused difficulty to the commuters especially the non-frequent travelers and

Table 4. Summary of discriminant analysis on PUD.

IV	Model-1			Model-2		
	Loading	Wilk's λ	F Ratio	Loading	Wilk's λ	F Ratio
Season ticket (STK)	0.87	0.97	8.80 ***	0.54	0.97	8.80 ***
Ticket pricing (TKP)	0.59	0.99	4.05 **	0.36	0.99	4.05 **
Information service (IFS)	0.52	0.99	3.11 *	0.32	0.99	3.11 *
Reliability of schedule (ROS)	0.34	1.00	1.36	0.21	1.00	1.36
Safety and comfort (SAC)	0.13	1.00	0.18	0.08	1.00	0.18
Commuter/non-commuter				0.48	0.98	6.95 ***
Possession of private vehicle				-0.47	0.98	6.63 **
Age2 (26 - 40 years old)				-0.38	0.99	4.39 **
Monthly salary1 (≥ RM3,000)				0.35	0.99	3.83 *
Age1				0.28	0.99	2.39
Monthly salary2				0.06	1.00	0.10
Gender				0.00	1.00	0.00
Wilk's Lambda		0.963 **			0.907 ***	
Box's M Test (F)		19.053			-	

N = 302; *** p < 0.01; ** p < 0.05; * p < 0.10.

Table 5. Hit ratio of original groups classification for PUD.

Direct Utilization (PUD)		Model-1			Model-2		
		Predicted group membership		Total	Predicted group membership		Total
		Yes	No		Yes	No	
Actual group	Yes	165	93	258	173	85	258
		64.0	*36.0*		*67.1*	*32.9*	
	No	17	27	44	15	29	44
		38.6	*61.4*		*34.1*	*65.9*	
Total correct classification		63.6%			66.9%		

N = 302; numbers in italics indicate the row percentages.

hence raised the necessity to improve the quality of information. The findings from Molin and Timmermans (2006) and Grotenhuis et al. (2007) further emphasized the importance of information to promote the ridership of PT. Out of three best preferred combinations, the implementation of season ticket (STK) with flat ticket pricing was highly perceived and preferred by the respondents. The zero marginal trip cost offered by the season tickets (FitzRoy and Smith, 1998, 1999) would be the main attraction for the commuters. Since season ticket normally comes with discounted rate compared to the regular purchased ticket, therefore with the implementation of season ticket, the commuters were expecting flat ticket pricing for other regular purchases. On the other hand, based on the observation conducted in Penang state, it was noticed that most of the commuters did not use any season ticket or buss pass while travelling. Most of them practiced regular ticket purchase with cash. The unpopularity of season ticket might be attributed to the low utilization rate of PBT services in Malaysia, and hence cash purchase appeared to be the easiest way for them rather than getting a season ticket for one time travel. These scenarios explained the preferences of respondents for selecting regular ticket (RT) as their preferred choice for C3 and C7. Among these two combinations, varying ticket pricing was more preferable than flat ticket pricing according to the feedback from the respondents. Most of them opted for varying ticket pricing based on the distance travelled and the availability of extra facilities and features on board. On the contrary, they did not prefer varying ticket pricing during peak hours or peak seasons, which explained the selection of flat ticket pricing in C7 as one of the most preferred combinations of PBT service drivers.

In fact, pricing has always been a complex function which demands proper planning and strategic formulation by the government and PBT authorities due to the disfavor acceptability of the public on pricing measures (Schade and Schlag, 2003; Schlag and Teubel, 1997). These top three best preferred and statistically significant combinations of PBT service drivers will be proposed to the PBT authorities to help them to understand the real needs and expectation of the commuters and non-commuters in Malaysia. Such fundamental understanding will allow the PBT authorities to react accordingly by identifying cost effective managerial strategies within a relatively shorter duration of time to improve the overall PBT system's robustness and consequently increase the utilization of PBT services.

Moving next, the major empirical findings on PU revealed that STK was the most influential service driver, followed by TKP and IFS. STK plays an important role to increase the direct utilization of PBT service. According to the respondents, the perceived importance of season ticket was very high in saving the time and cost of travelling. Most of the respondents demanded for weekly or monthly season tickets with printed identity to ease the process of travelling. Some of them also perceived that it was important to embed the season ticket in smart card for automatic ticketing system. Discounted rate on season ticket has no doubt is an important criteria to encourage the utilization especially for younger generation to avoid the debt load and cost associated on financing a private vehicle. The importance of season ticket is supported by the study of FitzRoy and Smith (1998, 1999) which emphasized that the zero marginal trip cost of season ticket is the main attraction of the ridership as the commuters are always happy to travel "free" and unlimited with a single pass. The importance of season ticket in stimulating utilization can also be seen from the government's initiative in promoting "1 ticket 1 seamless journey" (FitzRoy and Smith, 1998,1999) by introducing affordable pass and a good ticketing system (The Star, 2010). Nonetheless, although season ticket has been introduced by Rapid Penang, it did not sufficiently increase the utilization rate mainly due to the limited choice of season ticket and the inflexibility of purchase. There is only one type of season ticket offered by Rapid Penang which is 30 days unlimited travel with US$ 22. The monthly season ticket only is not sufficient enough to cater the needs of everyone as some of the respondents demanded shorter duration such as weekly season ticket. Furthermore, the purchase of the season ticket only from the main office of Rapid Penang or Weld Quay bus terminal has caused limited flexibility for the public to get the ticket. A few improvements are therefore inevitable to effectively promote the season ticket to the public. For instance, increase the choices of season ticket by adding weekly pass, easy purchase by adding distributor sale counters at shopping mall or through Internet online purchase, as well as embed the season ticket in smart card for auto ticketing system. The introduced season ticket should be different from the current Touch 'NGo cashless system which acts as prepaid card only without saving any money. The discounted rate should be emphasized to promote the season ticket. Income tax redemption could be also introduced for those who purchase monthly or quarterly season tickets to stimulate the utilization of PBT services.

Followed by STK, the second important service driver is TKP. It is believed that consumers are normally very sensitive to the price of the products or services they intended to purchase. The public normally expect a reasonable better wise cheap ticket price because they perceive that the service is provided by the government and it should be lower than the cost of using private transportations. This is consistent with the previous researches demonstrating the low public acceptability of transport pricing measures (Schade and Schlag, 2003; Schlag and Teubel, 1997). Litman (2004) and Paulley et al. (2006) further supported by arguing that the fare is one of the major drivers affecting the demand of the utilization of PT services and that the fare elasticity of the services tends to increase over years since the fare changes. The perceived importance of subsidized and government supervised ticket pricing was high in the study and therefore it is very important to get support from the authority to promote fare-saving options or fare-discounts to stimulate the utilization rate. Varying ticket pricing based on the distance travelled as well as the availability of extra features on board need to be imposed as per respondents' feedback. In order to promote and increase the utilization rate, the government could consider launching the PBT promotion campaign by giving early bird incentive or free trial ride to the public especially on the new established routes.

The third influencing service driver is IFS. Information of PBT system in Malaysia has always known as "bad" and appeared as one of the main reasons causing the under-utilization of PBT service. The commuters especially the non-frequent travelers face a lot of difficulties to identify the bus number and the departure time because of the insufficient information at the bus stop. The lack of information has made the utilization of PBT service complicated and hence, further discouraging the ridership. The importance of information in increasing the accessibility of PT service and determination of the quality service were proven by the previous researches (Grotenhuis et al., 2007; Molin and Timmermans, 2006; Vance and Balcombe, 1997). Accurate information especially the bus number, timetable including the departure time, arrival time and bus frequency, as well as the bus operating hours including the first and the last bus were highly perceived and demanded by the respondents to be displayed at each bus stop. In fact, the respondents expected a lot of enhancement of current information service not only to ensure reliability, but also to avoid inaccurate information which could lead to the

missing of the last bus and having left alone in a vulnerable situation. Other information highly perceived by the respondents included ticket price and methods to get the ticket, route coverage or route map, delay in schedule as well as the availability of information kiosk at the main bus station. With little or no comprehensive information available to the commuters, their willingness to utilize the PBT service to maximize their ringgit is severe limited. Consequently, it is very important for the PBT service authorities to deliver the information needed by the commuters through notice board at the bus stops, free paper timetable guide and route maps as well as to the extent of employing the Internet technology for online information and downloading which were widely practiced in the developed countries like Japan and UK.

ROS and SAC on the other hand were not significant in influencing the direct utilization of PBT service in Malaysia though the perceived importance of the service drivers was high from both commuters and non-commuters. The perception of direct utilization has no bearing on the reliability mainly because sufficient number of buses already provided in Malaysia and the focus should be on the better organization of the schedule so that the services do not focus only on the profitable routes as well as do not spend too much time waiting for the commuters. Most of the respondents also perceived that it should be the responsibility of the PBT authorities to assure the reliability of the rendered services. Similarly to ROS, the respondents believed that safety and comfort should be provided and guaranteed by the PBT authorities. In fact, Malaysia provides good and safe PBT services among Asian countries next to Japan and Singapore. From the observation, it is also noticed that most of the Rapid Penang buses were equipped with high level of comfort and safety measures, including the priority seats and low floor features for the disabled. Evidence also showed that the bus accident rate in Malaysia is much lower compared to other private motor vehicles. ROS and SAC are important perceived by the commuters and non-commuters in Malaysia however empirical evidence showed that the influence on utilization is not significant. This reflects that most of the commuters already expect that the PBT authorities to provide reliable service and sufficient comfort and safety as their responsibility as PT service providers.

On socio-demographic factors, the empirical findings revealed that the respondents who were non-commuters and did not possess own private vehicles tended to utilize PBT service in the future. The influence of vehicle ownership is also proven by Nurdden et al. (2007), Paulley et al. (2006) and Steg (2003). According to Steg (2003), the car users normally dislike PT not only Because of car outperforms PT, but also the representation of a symbol of freedom and pleasurable of driving. car users, policies should be aimed in reducing functional and culture value of private cars as well as increasing the Hence, in order to encourage the modal shift of fervent performance of PT services. Consequently, government's effort in enforcing rules and regulations to discourage private vehicles usage is much needed. Some recommended initiatives included the reduction of fuel subsidy, the increase in road tax renewal fee as well as the establishment of congestion charging or area licensing scheme which were once proposed but rejected by the Cabinet (Mohamad and Kiggundu, 2007).

The empirical findings also showed that the respondents earning monthly salary of ≥ US$ 1,000 tended to utilize PBT service. This finding is supported by Nurdden et al. (2007), Paulley et al. (2006) and Steg (2003) who claimed that the commuters' income and the car ownership of the residents are important factors influencing the demand for PT usage. The respondents of age less than 26 and more than 40 on the other hand were the most potential commuters to increase the utilization rate. The respondents of age less than 26 opted to utilize PBT service to avoid the high cost associated on financing a private vehicle whereas respondents age more than 40 may choose to utilize the PBT service for convenience and to avoid hectic travel and the risk of caught in the massive traffic jam. On the contrary, the respondents aged 26 to 40 years old chose not to travel by PT services mainly due to the high income and the affordability to own their own private transportations. Finally, empirical data presented that there was no significant relationship between gender and utilization of PBT service. Although recently UNECE discovered that transport could differentiate gender due to the lifestyles, access to transport and employment pattern (UNECE Transport, 2000-2008), the similar situation does not emerge in Malaysia. Nevertheless, "Gender and Transport" is still a very new professional field to be explored according to UNECE though a few countries like Japan already noticed the importance of this aspect and start implementing designated cars and spaces for women in PT system.

Conclusions

The primary objective of the study is to conceptualize the utilization of PBT service to reveal the real needs and expectations of Malaysian citizens. The empirical findings showed that the most significant service driver in influencing the utilization is season ticket, followed by ticket pricing and information service. Reliability of schedule and safety and comfort were found to be not significant. The study also identified that the best three significant preferred combinations of PBT service drivers rated by the respondents were C1, C3 and C7. In addition, the study revealed that the respondents aged less than 26 and more than 40 were the most potential commuters whereas monthly salary, the possession of private vehicle and the status of commuter/non-commuter were partially influencing the utilization. Gender on the other hand was not found to be significant on overall

utilization of PBT service. The findings of this exploratory study provide a valuable insight to the PBT authorities in an effort to design and promote a more robust PBT service. By discovering and understanding the needs and expectations of Malaysian citizens, appropriate operations and managerial strategies can be planned and implemented to increase the utilization rate especially from the non-commuters group. The improved services based on the self-perceived utilization of Malaysian citizens will further enhance their satisfaction, increase the utilization rate and ultimately sustain the transportation system with more profit in PBT sector, stimulate economic growth and improve the environment. This study will serve as an pioneering attempt and further research on utilization in order to develop a more comprehensive conceptual model to continue identify the dynamic needs and expectations of Malaysian population. The more important implications is that the conceptual model in this study is customizable for specific use in accordance to the existing service features offered by the different PBT operators. The customization of the model further accentuates the implication of Theory of Reasoned Action (TRA) in PBT service sector. Finally, the study shows its significant value and impact as a valuable study to the society of Malaysia by the distinctive online questionnaire developed which has caught even the attention of Ministry of Transport Malaysia who expresses a desire to adopt the questionnaire as part of its research on PBT services. A similar and encouraging feedback was also received from the Rapid Penang authority confirming that the study is valuable as an attempt to promote the PBT utilization among Malaysian citizens.

Scope for future study

Due to the novel nature of the research on utilization of PBT service, there is a great opportunity or suggested areas for future research. Since the research model accounted for around 55.17% of the variation in the utilization of PBT service, there are some other service drivers which could be introduced to further explain the unaccounted variations in this study. Future studies can replicate this study by adding more service drivers such as the allocation of specific bus lanes, convenience interlink between different modes of PT services, bus conductors and commuters' ethical behavior and variety of service types for instance regular service, exclusive service, express service, town intruder or matrix route. These service drivers were not covered in this study due to the time constraint and to avoid information overwhelming especially in the construction of conjoint profiles. The main purpose of this study is to conceptualize the preliminary utilization and as an initial attempt to reveal the needs and expectations of Malaysian citizens. In addition, the study can also be replicated by using larger sample size, and more representative demographic profiles by employing stratified random sampling method based on age, gender or state proportion in order to extend the generalization of the study to Malaysian population. In order to get more accurate and error-free data, personal structured interview could be employed as the only survey method for future studies. Furthermore, future studies may also utilize the longitudinal design in order to study the effectiveness and efficiency of the proposed conceptual model over a longer period of time. Finally, this study can also be extended to different contexts such as different PT services or broader areas to different service applications.

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