Multivariate Analysis of Customer Satisfaction: A Case Study of Bangkok's Mass Rapid Transit (MRT) Passengers

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Abstract: One of the service quality indicators for urban rail transit system is the service evaluation from a passenger's viewpoint. The key objective of service quality analysis is to improve services such that user expectations and needs can be met. This study aims to analyze customer satisfaction of Bangkok's mass rapid transit (MRT) system. Data was collected from 661 respondents by means of questionnaire survey. Based on 31 service quality attributes, relationships between the overall customer satisfaction and service quality attributes are analyzed using factor analysis and structural equation modeling. Results indicate that travel convenience is the most significant factor affecting the overall satisfaction. Other factors include transit fare, service and information, cleanliness and safety, transit facilities, and access/egress to stations. Furthermore, market segmentation analysis reveals distinct findings across four categories of MRT users. It is expected that results can be used to enhance the overall performance of urban rail system.

Keywords: Customer Satisfaction, Bangkok's MRT, Factor Analysis, Structural Equation Modeling

1. INTRODUCTION

Transit quality of service is regarded as one of the important tools to evaluate transit performance. The key objective of quality of service analysis is to improve services such that user expectations and needs can be met. While transit operators and practitioners traditionally strive to maintain their own service performances, such services provided may not necessarily be in line with passenger's viewpoint. Thus, it is essential to take into account how passengers assess and perceive dimensions of transit services, qualities, and system. Understanding them would help transit operators derive relevant determinants of service quality from their customers and better manage transit services.

According to the second edition of the Transit Capacity and Quality of Service Manual, the quality of service is defined as "*the overall measured or perceived performance of transit service from the passenger's point of view*" (TRB, 2003). Transit quality measures primarily focus on two major aspects of transit services, namely, the availability of transit service and the service's comfort and convenience. Since the quality of service is measured from passenger's point of view, it is important to determine proper determinants of service quality and their potential relationships towards overall satisfaction.

Various benefits can be observed when improving customer satisfaction. First existing customers can be secured. Secondly, the frequency of system usage can be increased. Thirdly, transit agencies could attract new passengers with a more positive public image (TRB, 1999). In addition, customer satisfaction evaluation can be used as a benchmark or can be used to track customers over time via longitudinal surveys.

Several techniques can be used to measure customer satisfaction. The *Handbook for Measuring Customer Satisfaction and Service Quality* (TRB, 1999) suggested two categories: those involving stated importance measures and those involving derived important measures. The stated importance measures explicitly ask respondents for their perceptions about the importance of each transit attribute. The so-called quadrant analysis or SERVQUAL is customarily applied and relevant statistical test of significance is conducted. On the other hand, the derived important measures focus primarily on statistical association between individual ratings and overall customer satisfaction. Many techniques can be classified under this category, ranging from a simple bivariate correlation, regression analysis, to the factor analysis (TRB, 1999).

Past studies attempted to construct indices and relevant framework for transit service quality analysis for public buses (see, for examples, Weinstein, 1998; Eboli and Mazzulla, 2007; Eboli and Mazzulla, 2009; Choocharukul, 2004) and urban rail transit (see, for examples, Bron *et al.*, 2009; Stuart *et al.*, 2000; Nathanail, 2007). In measuring transit quality of service, not only the line-haul service attributes should be considered, but the total trip from passenger's origin to destination should be taken into account as well. Such dimensions include, but is not limited to, access facility, ticketing service, waiting time on platforms, comfort and safety inside stations and trains, etc.

Transit customer satisfaction has been studied in several aspects. For instance, in California, Weinstein (1998) collected survey data from San Francisco Bay Area Rapid Transit District (BART). Bivariate correlation and factor analysis of over 5000 respondents in terms of 43 service characteristics revealed 7 key service factors, namely, train cleanliness and comfort, station cleanliness, service and information timeliness, station entry and exit, police presence, parking, and policy enforcement.

Nathanail (2007) analyzed 22 quality of service indicators based on multicriteria evaluation. These indicators were grouped into 6 categories, i.e. itinerary accuracy, system safety, cleanness, passenger comfort, servicing, and passenger information. Empirical analysis on passengers using Hellenic Railways through different time horizons indicated that the itinerary accuracy and system safety were attributed the highest grades among all categories. Brons *et al.* (2009) utilized the Dutch Railways customer satisfaction survey to evaluate the importance of access to railway stations on the overall satisfaction. Using a principal component analysis, it was found that passenger's overall satisfaction partly depends on satisfaction with access facilities, especially for infrequent passengers. Other elements of rail journeys leading to passenger satisfaction included travel comfort, travel time reliability, station organization and information, service schedule, dynamic information, price-quality ratio, accessibility, ticket service, personal safety, and personnel.

In addition to derive important measures like factor analysis, some past studies explored the application of structural equation modeling to further investigate potential relationships among latent variables. For example, Stuart *et al.* (2000) applied structural equation modeling for New York City subway to explain casual factors affecting customer satisfaction. Based on the analysis of 11 variables, results showed that the impact of predictability of service on perceived speed of the trip on the overall satisfaction is as important as or even more important than the frequency of service. Likewise, Eboli and Mazzulla (2007) formulated a structural equation model to examine the causal linkage between global customer satisfaction and service quality attributes. A dataset collected from 763 University of Calabria students in Italy was analyzed by an exploratory factor analysis (EFA). Three latent variables, namely, service planning and reliability, comfort and other factors, and network design, were found to be of statistical significance for customer satisfaction in structural equation modeling.

While the above studies attempted to group service attributes into a smaller group of service variables or factors, some past studies proposed an alternative approach to analyze customer satisfaction. Grigoroudis and Siskos (2002), for instance, proposed multicriteria satisfaction analysis (MUSA) to measure and analyze customer satisfaction. The analysis aggregated individual's judgements into a collective value function and can be formulated as a linear programming modeling. However, the proposed method requires a complete and correctly-answered questionnaire as input data. Fu and Xin (2007) proposed Transit Service Indicator (TSI) as an alternative measure for the service quality of a transit system. This indicator incorporated spatial and temporal variations in travel demand and integrated various measures such as service headway, service hours, route coverage, and travel time components. Eboli and Mazzulla (2009) suggested Heterogeneous Customer Satisfaction Index (HCSI) for evaluating transit service quality. Such an index considered heterogeneity among the user judgments about different service aspects.

From extant literature, it can be seen that although a number of techniques can be used to analyze customer service and satisfaction, there are both advantages and disadvantages associated with each analytical tool. As such, there is no definite conclusion on the most appropriate method since several circumstances have to be considered and justified, including the nature of transit service, passenger's behavior, and availability of data. This study aims to analyze customer satisfaction for passengers who use Bangkok's mass rapid transit (MRT) system. Relationships are sought between overall customer satisfaction and individual service quality attributes. Factor analysis and structural equation modeling are analyzed in the present study. It is expected that the results could shed more light on transit customer satisfaction research and can be used to enhance the overall performance of urban rail system.

The remaining sections are outlined as follows. The second section presents study methods, including discussion of study location, samples, measurements and survey questionnaire. Findings are presented in the third section, where summary statistics are summarized, followed by factor analysis and structural equation modeling results. Afterwards, market segmentation analysis is conducted and results are discussed. The last section of the paper concludes key findings and provides suggestion for future research.

2. METHODS

2.1 Study Location and Sample

The Bangkok MRT is considered in the present study. This subway line consists of 18 stations from Bang Sue station to Hua Lamphong station for a total distance of 21 kilometers, as shown in Figure 1. Passengers can transfer to BTS Sky Train at Sala Daeng, Sukhumwit, Chatuchak Park stations. Nowadays, the average MRT ridership is over 250,000 trips in a working day and the ridership has been increasing since the opening in 2003 (BMCL, 2012). Thus, it is regarded as one of the key public transportation modes in Bangkok.

A questionnaire survey is taken as a means for data collection. The data collection was conducted during February and March 2012 along MRT stations during both off-peak and peak periods covering weekdays and weekends. A stratified sampling technique is utilized such that the proportion of respondents in each MRT stations is consistent with the proportion of the MRT population. In total, 661 samples were interviewed.

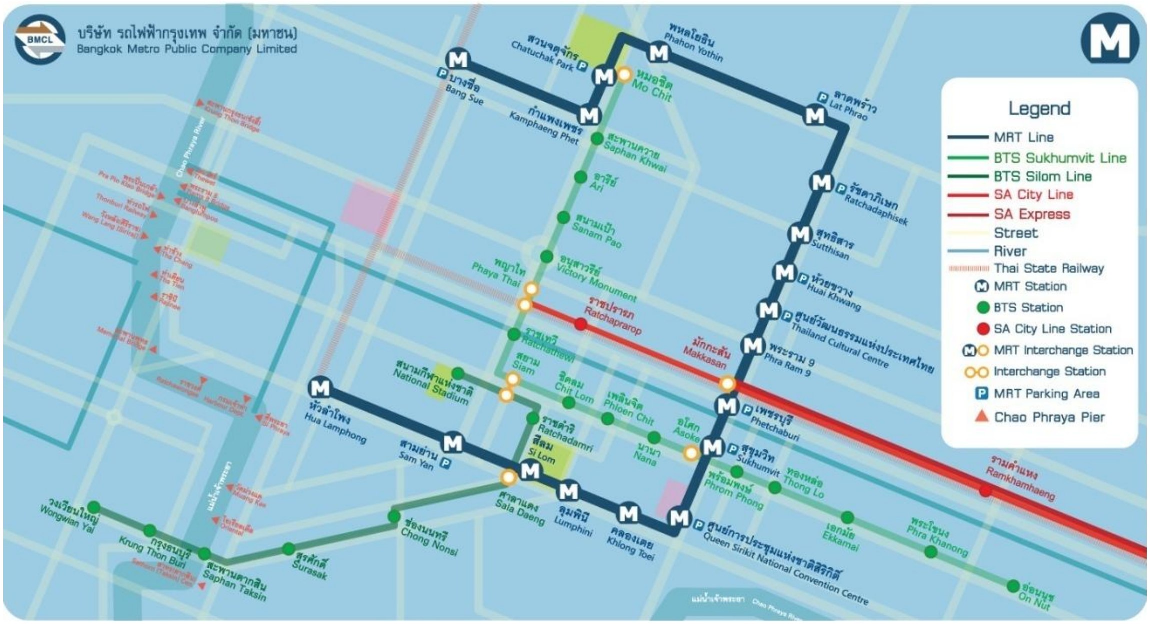


Figure 1. Study location

2.2 Measurements and Questionnaire

Survey questionnaire used in the present study contains four sections. The first section solicits travel characteristics of the respondents. The second section measures various attitudes towards travel by MRT, while the third section asks customer satisfaction. The socioeconomic data is requested in last section of the questionnaire. This paper primarily focuses on customer satisfaction measures, in which a total of 31 service quality attributes are asked and compared with the overall satisfaction of MRT service.

The service attribute questions are designed using seven-point Likert scale. These attributes are constructed based on service locations, covering outside stations, inside stations/platforms, and on trains. Furthermore, another set of attributes are designed to capture dimensions on transit fare and types of payment. More details of the items in the survey questionnaire can be referred to Sriroongvikrai (2012).

2.3 Statistical Analysis

Factor analysis is used to describe the covariance relationships among variables. A set of latent variables representing key factors affecting customer satisfaction is determined. The data is further examined by structural equation modeling. We utilize statistical software packages SPSS and AMOS from IBM for the analysis in the present study (Field, 2005; Byrne, 2001).

Several goodness-of-fit indices can be used to judge the reliability and validity of the model. Cronbach's alpha coefficient is taken as a measure for homogeneity of the extracted factors in factor analysis. In structural equation models, measures such as chi-square statistics, degree of freedom, goodness of fit index (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) are investigated. An acceptable model would have GFI and CFI values higher than 0.9. The RMSEA value less than 0.10 is regarded as an acceptable model, although a good fit of the models can be observed when such a value is below 0.08 (Hair *et al.*, 2006).

3. FINDINGS

3.1 Sample Characteristics

Table 1 presents summary statistics of 661 respondents. More than half of the respondents are between 20 and 30 years old, with an average age of 25 years. The average monthly income is found to be about 18,000 Baht (approximately US$600) per month. A majority of respondents stay at apartments and condominium, reflecting the preferred household type in an urban area. It should be noted that although 45.7 percent of the samples have their car available for travel, they decided to take rail transit. This might be due to the fact that traveling by train is more convenient and could save their travel time, especially during the peak periods when severe traffic congestion is typically observed in the city center.

Table 1. Respondent's socioeconomic data

Attribute	**Level**	**Percent**	**Attribute**	**Level**	**Percent**
Age (years)	≤ 20	26.1	Education	< Bachelor's	35.0
	20-30	58.4		Bachelor's	55.5
	30-40	11.8		> Bachelor's	9.5
	40-50	3.2	Monthly Income	≤ 5,000	7.2
	> 50	0.5	(Thai Baht)	5,000-10,000	24.6
Gender	Male	42.7		10,000-15,000	25.3
	Female	57.3		15,000-20,000	20.0
Marital Status	Single	93.9		20,000-25,000	4.8
	Married	6.1		25,000-30,000	7.4
Household	1	2.3		> 30,000	10.7
Members	2	10.4	Car Availability	Available	45.7
	> 2	87.3		Not available	54.3
Occupation	Company employee	40.2	Household Type	Single Housing	32.5
	Government employee	5.0		Townhouse / Row House	26.6
	Student	47.0		Apartment/Condominium	39.2
	Owned business	5.7		Others	1.7
	Others	2.0			

Respondent's travel characteristics are shown in Table 2. Many respondents do not use MRT on a daily basis. In fact, more than 40 percent use the rail transit less than once a week, presumably only when there is a need to travel for special events or occasions. Nearly 80 percent of respondents travel alone and more than half prefer single journey token. It is interesting to note that the percentage of respondents using period pass is quite small, even though more than half of the respondents use MRT on a regular basis. In terms of access mode to MRT stations, walking and bus are among the most popular modes, attributing up to more than 80 percent of the total responses.

Table 2. Respondent's travel characteristics

Attribute	Level	Percent	Attribute	Level	Percent
MRT Usage	< once a week	42.8	Travel Alone	Yes	79.8
Frequency	1-5	28.0		No	20.2
(times/week)	6-10	23.3	Payment Type	Single Journey Token	55.4
	11-15	5.9		Stored Value Card	36.6
Trip Purpose	Work	31.2		Period Pass	8.0
	Study	32.0	Access Mode	Walk	46.3
	Others	36.8		Car	6.7
Usage Time	Morning Peak	40.3		Bus	35.5
	Evening Peak	38.2		BTS Sky Train	7.0
	Off Peak	20.2		Others	4.5
	Uncertain	32.4			

3.2 Factor Analysis of MRT Customer Satisfaction Variables

Factor analysis is used to detect underlining structure of service attribute variables. A principal component analysis with orthogonal (varimax) rotation is performed. Table 3 presents the factor loadings and reliability. Essentially, six factors are extracted and accounted for 66.44% of the total variance. To measure the homogeneity of the extracted factors, Cronbach's alpha coefficient is computed. The values of 0.6 to 0.7 can be considered as lower limit of acceptability (Hair *et al.*, 2006). It can be observed that all factors can be used for further analysis with acceptable reliability.

From factor analysis results, the six extracted factors are named according to associated variables with high loadings. They are *travel convenience* (SAT1), *service and information* (SAT2), *access and egress* (SAT3), *transit fare* (SAT4), *cleanliness and safety* (SAT5), and *transit facility* (SAT6).

3.3 Structural Equation Modeling Results

Structural equation modeling is utilized to investigate underlying relationships between derived satisfaction factors and the overall customer satisfaction score. Figure 2 and Table 4 show the model estimation results. The maximum likelihood estimation of the model gives a chi-square value of 688.055 with 252 degrees of freedom. The goodness-of-fit statistics indicate that the data fits the model reasonably well. The CMIN/DF is lower than 3 and the GFI, CFI values are above the cutoff value of 0.90. Furthermore, the RMSEA value of 0.060 is below the upper limit of 0.10, indicating the acceptable fit of the model.

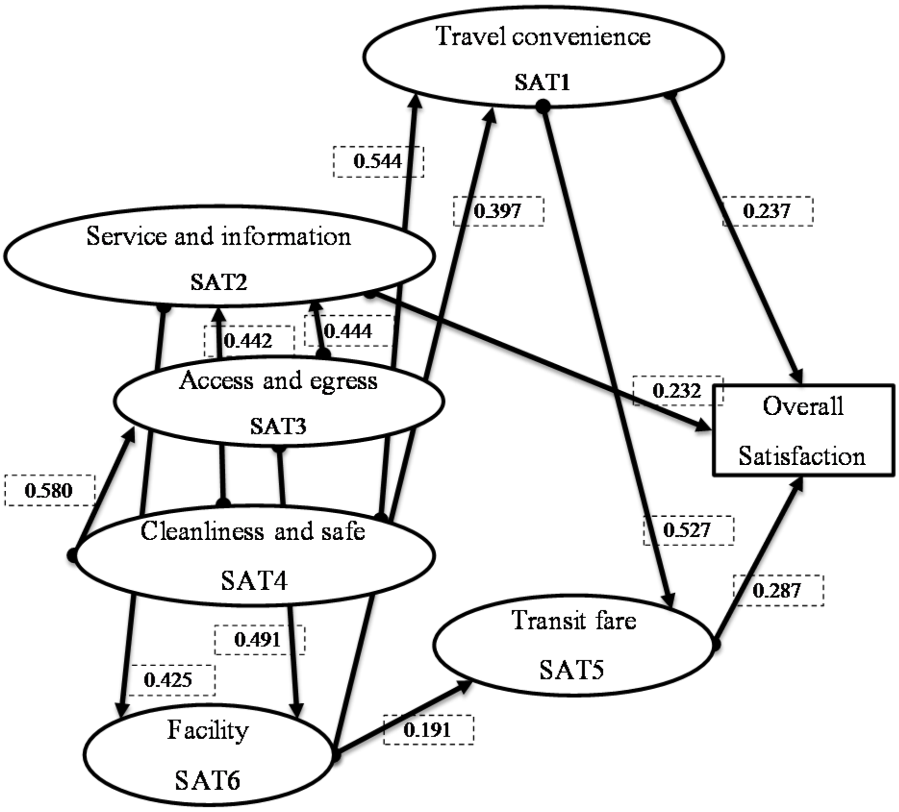
The direct and indirect effects are summarized in Table 5. From the results, the direct effects towards overall satisfaction (OVSA) can be observed from three factors, including *travel convenience* (SAT1), s*ervice and information* (SAT2), and *transit fare* (SAT5). The other three factors, namely, *access and egress* (SAT3), *transit fare* (SAT4), and *transit facility* (SAT6) do not directly affect the overall satisfaction, yet to some extent they have influence on the overall satisfaction through intermediary factors.

Table 3. Factor Loadings and Reliability of MRT Customer Satisfaction Variables

Items	Extracted Factor					
	SAT1	SAT2	SAT3	SAT4	SAT5	SAT6
Train waiting time	.777	.032	.221	.139	.112	.150
Comfort and convenience at platform	.697	.219	.207	.064	.204	.185
Seat comfort on train	.666	.139	.143	.295	.132	.031
Availability of hand rails	.632	.165	.089	.304	.280	.094
Easiness to pass entrance gates to platforms	.539	.358	.065	.126	.184	.255
Train line-haul time	.498	.072	.178	.284	.337	.086
Display of transit fare information	.134	.790	.073	.094	.180	.170
Display of access/exit maps	.191	.752	.184	.155	.097	.189
Ease of purchasing tickets/tokens	.188	.663	.212	.168	.230	.085
Availability of personnel at platforms/stations	.088	.599	.377	.088	.315	.025
Convenience from trip origin	.165	.096	.794	.147	-.012	.000
Convenience to trip destination	.273	.165	.791	.074	.027	-.035
Safety and security inside platforms/stations	.169	.228	.671	.051	.135	.154
Pedestrian facility around stations	.029	.153	.581	.110	.335	.362
Special fare for children/elderly	.198	.130	.128	.892	.103	.100
Value of train fare with respect to time/distance	.249	.102	.138	.817	.114	.154
Variety of ticket types	.276	.208	.087	.750	.202	.160
Cleanliness of train interior	.262	.054	.080	.131	.799	.044
Service announcement system on trains	.278	.277	.049	.169	.660	.047
Cleanliness of platforms/stations	.080	.388	.127	.037	.645	.063
Safety from crimes on trains	.423	.238	.120	.183	.564	.134
Availability of shops at stations	.261	.135	.049	.203	-.014	.742
Availability of facilities for disables	.294	.367	-.030	.078	.058	.669
Park and ride facility	-.022	.040	.466	.153	.225	.650
% Variance Explained	14.01	11.84	11.37	10.78	10.63	7.80
Cronbach's Alpha	0.84	0.82	0.79	0.80	0.89	0.68

Among the factors that directly affect the overall satisfaction, transit fare appears to be the most prominent factor with standardized regression coefficient of 0.287. However, when indirect effects are taken into account, travel convenience seems to be the most important factor affecting the overall satisfaction, with a total effect of 0.388. This factor includes certain aspects such as comfort and convenience at platforms, seat comfort, line-haul time and waiting time.

From the total effect computation, derived factors affecting overall satisfaction, from the most important to the least important, are *travel convenience* (SAT1), *transit fare* (SAT5) *service and information* (SAT2), *transit fare* (SAT4), *transit facility* (SAT6), and *access and egress* (SAT3) with the effect values of 0.388, 0.287, 0.232, 0.231, 0.149 and 0.103, respectively.



GFI = 0.902 CMIN/DF = 2.730 CFI = 0.927 RMSEA = 0.060

Figure 2. Path diagram of estimated standardized structural equation model

Table 4. Estimated casual effects among variables

Path			Estimated Parameters	t-Statistics	p-value
SAT6	<---	SAT3	0.491	4.70	≤0.01
SAT6	<---	SAT2	0.425	4.45	≤0.01
SAT1	<---	SAT6	0.397	5.71	≤0.01
SAT1	<---	SAT4	0.544	8.33	≤0.01
SAT5	<---	SAT6	0.191	2.64	≤0.01
SAT5	<---	SAT1	0.527	7.28	≤0.01
SAT3	<---	SAT4	0.580	0.06	≤0.01
SAT2	<---	SAT3	0.444	0.09	≤0.01
SAT2	<---	SAT4	0.442	0.07	≤0.01
OVSA	<---	SAT1	0.237	0.22	≤0.01
OVSA	<---	SAT5	0.287	0.24	≤0.01
OVSA	<---	SAT2	0.232	0.25	≤0.01

Table 5. Direct and indirect effects

Path	Direct Effect	Indirect Effect
OVSA <--- SAT1	0.237	
OVSA <--- SAT5 <--- SAT1		0.287*0.527 = 0.151
OVSA <--- SAT2	0.232	
OVSA <--- SAT2 <--- SAT3		0.232*0.444 = 0.103
OVSA <--- SAT1 <--- SAT4		0.237*0.554 = 0.128
OVSA <--- SAT2 <--- SAT4		0.232*0.442 = 0.103
OVSA <--- SAT5	0.287	
OVSA <--- SAT1 <--- SAT6		0.237*0.397 = 0.094
OVSA <--- SAT5 <--- SAT6		0.287*0.191 = 0.055

3.4 Market Segmentation Analysis

To further understand the factors influencing the overall satisfaction, we analyze the above SEM model by different market segments. A past study attempted to categorize MRT passengers based on travel characteristics and attitudes toward rail transit using K-means cluster analysis (Sriroongvikrai, 2012). Four distinct market segments were identified, namely, *Routine Riders*, *Car Shift Users*, *MRT Favorites*, and *Deliberate Users*. The cluster analysis was examined based on seven derived factors: time sensitivity, advantage of MRT, relaxation in travel, willingness to use MRT, responsibility for environment and traffic, penalty for driving alone, and carriage's condition. Since these four customer segments were derived from the same dataset, it is reasonable to consider such groups for market segmentation analysis in the present study.

Among the four customer segments, the routine riders represent passengers who usually take MRT for their commuting trips during peak hours. They would value high on their travel time and did not concern much on train crowdedness and train condition. The car shift group has a higher tendency to access to MRT stations by car. Similar to the first customer group, car shift users value more on their travel time. The MRT-favorites category characterizes passengers who take MRT mainly in some special occasions. This customer segment cares about travel comfort and is more environmental conscious. They would be willing to patronize MRT whenever it is possible. The last group, deliberate users, represents another market segment of MRT passengers whose travel comfort and convenience are preferred. When compared with other feasible alternatives, the MRT will be chosen as their mode of travel only if it is easy to access to train stations or their destination is located near the train stations.

Table 6 summarizes estimated SEM standardized coefficients classified by four market segments. It is apparent that different segments of MRT passengers possess distinctive preferences. It should be noted that, unlike the full model in the previous section, certain variables are not statistically significant in some market segment models. Table 7 presents the effects of latent variables classified by market segments. From the results, travel convenience (SAT1) is regarded as the most important factor for car shift users (with a total effect of 0.484+0.127 = 0.611), while service and information (SAT2) are critical for deliberate user group (with a total effect of 0.384). The transit fare (SAT4) is considered to be the most significant for both routine riders and MRT favorites with a total effect of 0.422 and 0.341, respectively.

Table 6. Estimated casual effects classified by market segments

Path	Market Segment			
	Routine Riders	**Car Shift Users**	**MRT Favorites**	**Deliberate Users**
SAT3 <--- SAT4	0.507 (<.001)	0.644 (<.001)	0.576 (<.001)	0.541 (<.001)
SAT2 <--- SAT3	0.637 (<.001)	0.272 (.09)	0.377 (.005)	0.343 (.003)
SAT2 <--- SAT4	0.280 (.016)	0.517 (<.001)	0.513 (<.001)	0.641 (<.001)
SAT6 <--- SAT2	0.207 n.s. (.438)	0.812 (<.001)	0.255 n.s. (.114)	0.624 (<.001)
SAT6 <--- SAT3	0.522 (.091)	0.113 n.s. (.476)	0.734 (<.001)	0.357 (.010)
SAT1 <--- SAT6	0.303(.032)	0.315 (.020)	0.252 (.067)	0.533 (<.001)
SAT1 <--- SAT4	0.663 (<.001)	0.631 (<.001)	0.567 (<.001)	0.428 (<.001)
SAT5 <--- SAT6	0.095 n.s. (.463)	0.122 n.s. (.347)	0.254 (.032)	0.337 (.067)
SAT5 <--- SAT1	0.643 (<.001)	0.592 (<.001)	0.378 (.001)	0.41 (.025)
OVSA <--- SAT1	0.118 n.s. (.429)	0.484 (.001)	0.173 n.s. (.115)	0.042 n.s. (.832)
OVSA <--- SAT2	0.208 (.069)	0.038 n.s. (.762)	0.334 (.002)	0.384 (.044)
OVSA <--- SAT5	0.422 (<.001)	0.215 (.028)	0.341 (<.001)	0.307 (.004)

Note: n.s. = not significant at 90% confidence. p-values are shown in parentheses.

Table 7. Effects of latent variables classified by market segments

Path	Market Segment			
	Routine Riders	**Car Shift Users**	**MRT Favorites**	**Deliberate Users**
OVSA <--- SAT1	n.s.	0.484	n.s.	n.s.
OVSA <--- SAT5 <--- SAT1	0.271	0.127	0.129	0.126
OVSA <--- SAT2	0.208	n.s.	0.334	0.384
OVSA <--- SAT2 <--- SAT3	0.132	0.010	0.126	0.132
OVSA <--- SAT1 <--- SAT4	0.078	0.305	0.098	0.018
OVSA <--- SAT2 <--- SAT4	0.058	0.020	0.171	0.246
OVSA <--- SAT5	0.422	0.215	0.341	0.307
OVSA <--- SAT1 <--- SAT6	0.036	0.152	0.044	0.022
OVSA <--- SAT5 <--- SAT6	n.s.	n.s.	0.087	0.103

4. DISCUSSION AND CONCLUSIONS

This study demonstrates the application of multivariate analysis for customer satisfaction. The MRT passengers in Bangkok are taken as a case study. Data was collected from 661 respondents based on 31 service quality attributes. Relationships between the overall customer satisfaction and service quality attributes are analyzed using factor analysis and structural equation modeling. From the structural modeling results, travel convenience is found to be the most important factor affecting the overall satisfaction. This factor consists of 6 variables, namely, train waiting time, comfort and convenience at platform, seat comfort on train, availability of hand rails, easiness to pass entrance gates to platforms, and train line-haul time. Consistent with past studies (Stuart *et al.,* 1999; Eboli and Mazzulla, 2007), certain service quality factors in the present study are found to indirectly influence the overall customer satisfaction, while others have a direct impact on the overall satisfaction.

When different market segments are considered for MRT passengers, structural equation models yield different findings. Specifically, those who regularly use MRT (*Routine Riders*) and those who patronize mainly in some special occasions (*MRT Favorites*) would be satisfied with the overall service quality when transit fare, among all other factors, is acceptable. Passengers who use their cars as an access mode to MRT stations (*Car Shift* segment) would judge convenience as a major determinant towards overall satisfaction of transit service. The *Deliberate Users* segment who rationally decides travel mode choices among other feasible alternatives would regard service and information as the most important factor determining the overall satisfaction.

In terms of managerial implication, transit operators and planners need to formulate relevant strategies in order to maintain customer's satisfaction level. From the present findings, impacts of service quality improvements, classifying by four market segments, can be summarized in Table 8. Such impacts could be used as a guideline for transit service improvement depending on targeted customers.

Table 8. Potential impacts of service quality improvements on customer satisfaction

Factors	**Potential Impacts on Customers**			
	Routine Riders	**Car Shift Users**	**MRT Favorites**	**Deliberate Users**
Travel convenience	↑	↑↑↑	↑	↑
Service and information	↑		↑↑	↑↑
Access and egress	↑		↑	↑
Cleanliness and safe		↑↑	↑	↑
Transit Fare	↑↑	↑	↑↑	↑↑
Facility		↑	↑	↑

Notes: ↑Slightly affect customer satisfaction (Estimated coefficients between 0.1-0.3); ↑↑ Moderately affect customer satisfaction (Estimated coefficients between 0.3-0.5); ↑↑↑ Highly affect customer satisfaction (Estimated coefficients between 0.5-1.0)

Although the multivariate analysis technique used to analyze customer satisfaction is not completely new, we demonstrate that such a method can be applied for a transit system in developing cities with limited information. This issue should be promptly addressed, especially for those Asian cities that focus on urban rail infrastructure development in planning horizons. Bangkok, as an example, plans to have a total of 10 mass transit lines in the near future. Knowledge about current service attributes of passenger satisfaction can be regarded as a sound reference for a better transit service planning. Nevertheless, it is suggested that the service improvement plans should be developed in line with performance measures routinely collected by transit agency. In addition, such improvement plans should follow desired public images that the transit agency wishes to convey.

This study is still far from definite. Some issues could be investigated for future research. First, to complete the overall picture of transit quality of service, it is necessary to additionally focus on potential users, those who currently use other modes of transportation but have a tendency to switch to transit services. Secondly, attitudes and perceptions of transit services from passenger's perspective can be further analyzed in order to better enhance the dimensions towards customer satisfaction and quality of service. The second section of the present survey questionnaire provides a decent ground for such an analysis. Lastly, each market segment should be refined in terms of market share identification. Knowing and understanding customers in distinct markets well would certainly help improving transit performances.

ACKNOWLEDGEMENT

The authors are grateful to the Infrastructure Management Research Unit of Chulalongkorn University for support of the research.

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