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Customer Satisfaction with Service Quality of the Bangkok Mass Rapid Transit System

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ABSTRACT

With the increasing number of rail lines being developed in Thailand for economic growth, it is imperative that the service provided meet the expectations of its customers. To help public agencies and rail transport operators improve the quality of service of the country's rail transport system, the present study aims to determine the service quality indicators used to effectively measure rail transport passenger satisfaction; identify which aspects of service quality are the passengers most and least satisfied with; and assess how different are the levels of satisfaction of the passengers across their socio-demographic groups using Bangkok's mass rapid transit system as a case study. The Principal Component Analysis (PCA) and cross tabulation analysis with comparison statistical tests are adopted. The PCA results in 7 components which are ticket sales, station facilities, station safety and security, station staff, public relations, rolling stock, and ride comfort. Overall, the average level of satisfaction for the transit system is high with value of 4.25 out of 5.00; but interestingly, passengers are least satisfied with ticket sale factors. The differences in satisfaction of the respondents according to their gender, age, income, and trip purpose are also observed. The results suggest that relatively low satisfaction levels are found from females, young passengers, those earning less than 30,000 Baht/month, and travelers who use the train for shopping-related trips. Considering that these groups represent a large proportion of the respondents, some recommendations are summarized as drawn from the result interpretations such as further in-depth studies on the value of money of ticket prices to be appropriate for travel distance and service quality as well as enhanced information dissemination practices.

Keyword: Customer satisfaction, mass rapid transit system, principal component analysis, service quality.

1. Introduction

The rail transportation industry in Thailand continues to grow in accordance with the National Strategy 2018-2037 [1] and Thai Transport Infrastructure Development Plan 2015 – 2022 [2]. In Bangkok, the mass rapid transit system has been continuously developed from the Bangkok Transport Study in 1972 to the currently ongoing Second Mass Rapid Transit Master Plan [3]. Currently, there are seven operating urban lines while three more are expected to be open for public use in the next couple of years. To ensure this fast-paced growth of the country's rail transport system, it is imperative to provide quality service to its users. One important performance indicator which reflects demand feedback is the level of satisfaction of customers [4]. Customer satisfaction is not just one of the effective means of measuring performance but also serves as an avenue to identify the system's areas of improvement through the viewpoint of its passengers.

The current study aims to evaluate the level of satisfaction of the passengers of Thailand's rail transport system through a case study covering five lines (commuter, airport link transit, and feeder lines) of the mass rapid transit system in the Bangkok Metropolitan Region. Specifically, the goals of this study are as follows:

1. To identify the service quality indicators that can effectively measure rail transport passenger satisfaction;

2. To determine which of the service quality indicators are the passengers most/least satisfied with; and

3. To evaluate the differences among the satisfaction of the passengers across their socio-demographic groups.

This research contributes to the existing knowledge through the identification of service quality indicators of rail transport customer satisfaction in the context of Thailand's fast-growing mass rapid transit system. Through the analysis of the level of satisfaction of the passengers, guidance to the areas of improvement of the mass rapid transit system can be provided to the public agencies and rail transport operators. The indicators identified and methods used in this study may also be applied in other similar transport systems.

2. Review of Literature

2.1 Mass Rapid Transit in Bangkok

The government of Thailand has developed numerous plans for the improvement of the rail transport system in the Bangkok Metropolitan Region. The goal of these plans is to promote the use of public transportation through the mass rapid transit system. The latest of these plans is the Mass Rapid Transit Master Plan (M-Map) prepared by the Office of Transport and Traffic Policy and Planning (OTP) [2] which represents a 20-year development plan for the rail transport system from 2010 to 2029. It consists of 12 lines (two commuters, one airport rail link, five transit lines, and five feeder lines) with a total length of approximately 556 km [5]. Due to the constantly changing conditions as well as

challenges faced during the first ten years of implementation of the M-Map, a second mass rapid transit master plan (M-Map2) which has better integration and connection with other modes of public transportation has been started [5]. The summary of the urban railway lines under these plans which are currently operating and are under construction is presented in Table 1. In the current study, five currently operating heavy rail lines from the mass rapid transit system were evaluated. These are composed of transit lines, commuter lines, airport rail link, and a feeder line.

2.2 Customer Satisfaction

Customer satisfaction has been found to be one of the many effective performance indicators of rail transportation. The Community of Metros, the world's metro benchmarking community, conducts an annual customer satisfaction survey on multiple aspects of service quality with the goal of achieving a better understanding on how the public transit's services meet the expectations of its customers as well as to determine ways to improve the areas where passengers are least satisfied with [6]. Another standard, EN13816, which is the European standard for measuring the service quality of public transport services, also focuses on customer-centered indicators which are composed of eight main criteria (availability, accessibility, information, time, customer care, comfort, safety, and environmental impact) [7]. It defines customer satisfaction to be the measure of how congruent the service quality received by the customer is to the customer's expectations. The International Transport Forum, an intergovernmental organization that organizes global dialogue regarding developments on transport policies, also emphasizes the importance of customer satisfaction in evaluating the performance of rail transport systems [8]. Domestically, the OTP reiterates the need to measure the level of satisfaction of customers as an indicator of the system's service quality [4].

2.3 Service Quality Indicators of Customer Satisfaction

The service quality indicators, factors that significantly affect the level of satisfaction of customers, have been widely studied by researchers. The general factors include those related to on-board experience, service delivery, waiting conditions, customer service, and passenger costs. Table 2 presents the summary of indicators found significant or highly affects the level of satisfaction of public transport commuters.

2.4 Principal Component Analysis

Principal component analysis (PCA) is a non-parametric statistic and dimension reduction process used to examine the interrelationships among a set of variables for the purpose of identifying the underlying structure of those variables [9]. The PCA provides a set of simplified explainable variables, called principal components, which facilitates interpretation without losing too much information from the original data.

In producing such simple structure, rotation is most often than not, necessary. Rotation is the process of performing arithmetic in analyzing further the initial results of the PCA by rotating

the factors so that a simpler structure is obtained [21]. Depending on the nature of the factors in the analysis, rotation methods can be orthogonal or oblique. Orthogonal methods assume that the factors are uncorrelated while oblique assumes the opposite [22].

In this study, PCA was used to group the identified service quality indicators into simpler groups of components. In the data analysis, the indicators were analyzed by these components for clearer and easier interpretation of results.

TABLE I

Current and under construction rail lines in Bangkok

Line	System	Section	Opening Year	Distance (km)
Dark Green	Heavy Rail	Initial Section	1999	6.5
		South Extension 1	2009	7.5
		South Extension 2	2013	
Light Green	Heavy Rail	Initial Section	1999	17
		East Extension 1	2011	5.3
		East Extension 2	2018	13
		North Extension 1	2019	19
		North Extension 2	2020	
Blue	Heavy Rail	Initial Section	2004	20
		Extension to Tao Poon	2017	1.2
		Hua Lamphong to Lak Song	2019	15.9
		Tao Poon to Tha Phra	2020	11
Airport Rail Link	Heavy Rail (commuter)	East Section	2010	28.5
		Phase II	2024-2025	171.9
		Phase III		7.8
Purple	Heavy Rail	North Section	2016	23
		South Section	(2027)	23.6
Dark Red	Heavy Rail	North Section	2021	26
Light Red	Heavy Rail	West Section 1	2021	15
Pink	Monorail	Full Line	(2023)	34.5
Yellow	Monorail	Full Line	(2023)	30.4
Orange	Heavy Rail	East Section	(2025)	21.2

3. Methodology

The methodological framework is presented in Figure 1. A triangulation research strategy was used in this study consisting of literature review, expert validation, and survey questionnaire. The list of service quality indicators was verified for its suitability to the case study through expert consensus. A series of physical and online

meetings with various experts from both the public and private sections in Bangkok were made. Discussions over the list of important indicators were held. The list was edited and refined until a consensus was reached. This list that has been deemed appropriate for the study area, together with the indicators' corresponding detailed descriptions are presented in Appendix 1.

TABLE II

Service quality indicators from literature

		References										
Service Quality Indicators		[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
On-board experience	Cleanliness	x		X	x	x		x		x	X	x
	Comfort		X	X		x	x				X	x
	Seating capacity			x		x				x		
	Accessibility (physical)	x		x		x				x		x
	On-board information	x		x				x		x		x
	Crowding				x						X	x
	Quality of vehicle	x				x					X	
	Safety	x	X	x			x	x		x	X	x
	Temperature				x					x		x
Service delivery	Reliability						x	x		x		x
	Punctuality	x	X	x	x		x	x		x	X	x
	Frequency	x	X			x		x		x	X	x
	Travel time					x				x		x
	Network coverage	x		x	x	x						x
	Stop location		X							x	X	x
	Station parking			x					x	x		x
	Waiting time	x			x	x				x		x
Waiting conditions	Waiting conditions	x	X	x		x					X	x
	Information at stops	x						x		x	X	x
	Safety at stops						x	x	x	x	X	x
	Cleanliness at stops							x	x	x	X	x
Customer service	Staff behavior and attitude	x	X		x		x		x	x	X	x
	Personnel skills						x		x	x	X	x
	Complaint handling						x		x	x	X	x
Costs	Value	x	X		x						X	
	Types of tickets and passes	x	X									
	Ticket selling network			x					x		X	x

Source: Authors

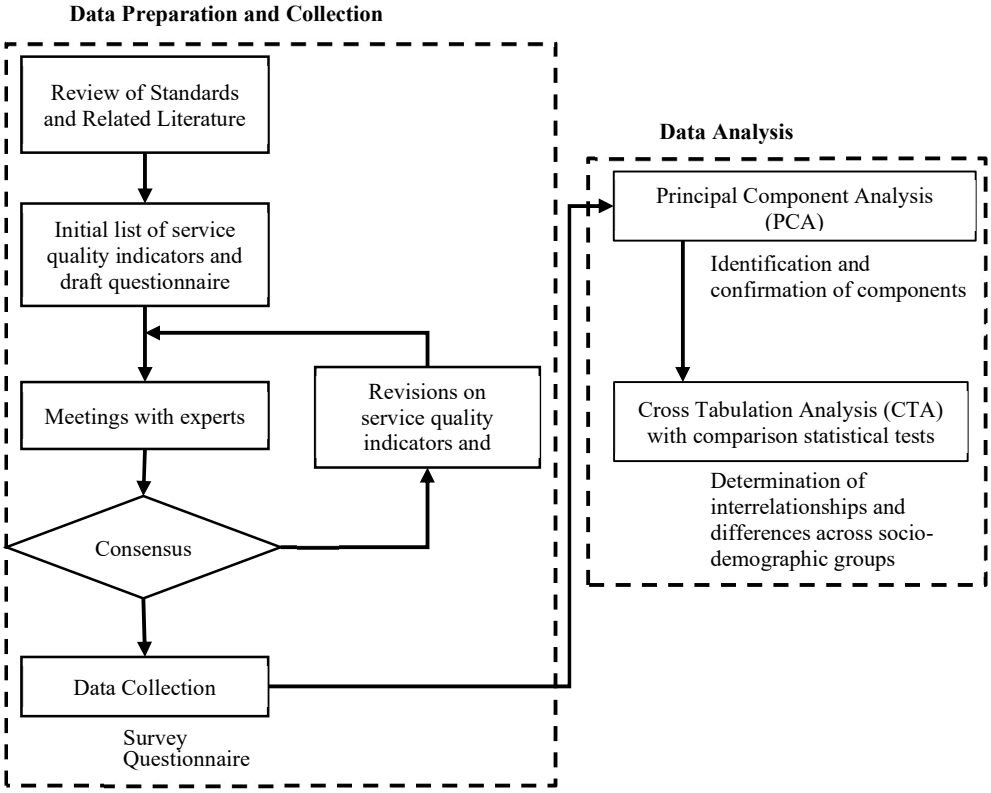
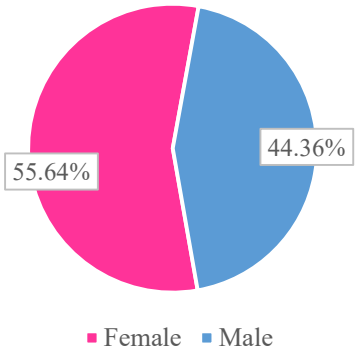


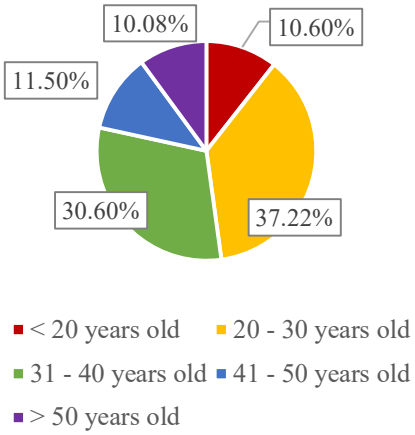
Fig. 1 Methodological framework

The survey questionnaire distributed was composed of two sections. The first section asked about the respondents personal and trip information. In the second section, the respondents were asked to rate their level of satisfaction on the service quality indicators using a 5-point Likert scale with 1 being very dissatisfied and 5 being very satisfied. The survey questionnaires were handed out to passengers of the mass rapid transit system in Bangkok. A total of 1905 usable responses were collected. The socio-demographic characteristics of the respondents are shown in Figure 2.

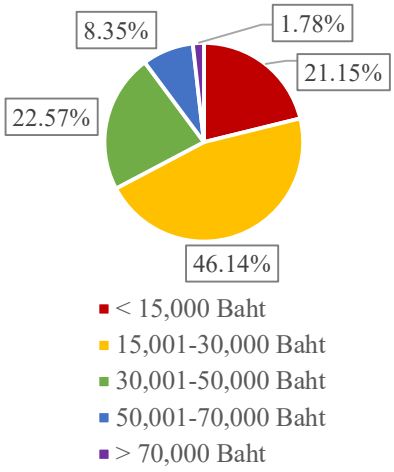
It can be seen that majority of the responses came from young to middle-aged working-class individuals. This can be caused by the restrictions amid the COVID-19 pandemic during the data collection of this study. The age distribution shows that very young people (< 20 years old) and older generations (> 50 years old) use the rail transit systems less, as they are recommended to avoid traveling to public areas for their safety. The small percentages of shopping and study-related trips are also attributed to the pandemic given that schools were operating online and leisure travels were discouraged.



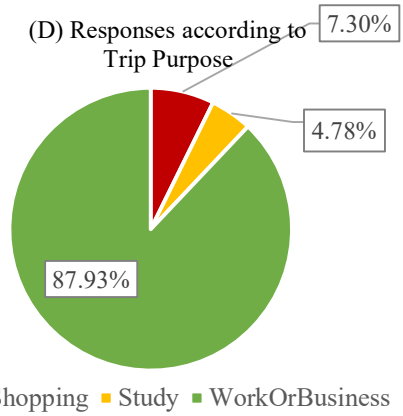
(a) Responses according to gender



(b) Responses according to age.



(c) Responses according to monthly income



(d) Responses according to trip purpose

Fig. 2 Responses by socio-demographic groups

3.1 Principal Component Analysis

PCA was conducted on the 38 questions in the survey questionnaire using IBM SPSS Statistics 26. Variable collinearity was first checked to determine how strongly a single variable is correlated with other variables. To check the sampling adequacy of the data, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used for the overall data set. In addition, Bartlett's test of sphericity was used to assure that the data has adequate correlations among the variables for data reduction. The results of these tests are shown in Table 3.

TABLE III
Results of KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.955
Bartlett's Test of Sphericity	Approx. Chi-Square	58679.550
	Df	703
	Sig.	0.000

The KMO value of 0.955 indicates that there is enough variance in the data, considering that values between 0.8 and 1.0 indicate sampling adequacy and those between 0.9 to 1.0 are considered marvelous. The Bartlett's test of sphericity sig. value of 0.000 suggests that the items have good correlation. Such results show that the data of the study can be partitioned using PCA.

The number of principal components to be extracted was determined using Kaiser's stopping rule which states that the number of factors to be considered in the analysis are only those with eigenvalues greater than 1.00 [23]. Using this criterion, a total of 7 components were extracted from the 38 questions in the survey. The scree plot in Figure 3 shows the graphic representation of the determination of the number of principal components analyzed.

Upon checking the correlation values among the factors, enough variance was observed to warrant oblique rotation [21]. The direct oblimin oblique rotation method was then used in the analysis. Out of the 38 questions analyzed, one question (Q33) was found to be a complex factor, i.e., it loads heavily in two components. It was then excluded and the final results of the reran model produced a simple structure.

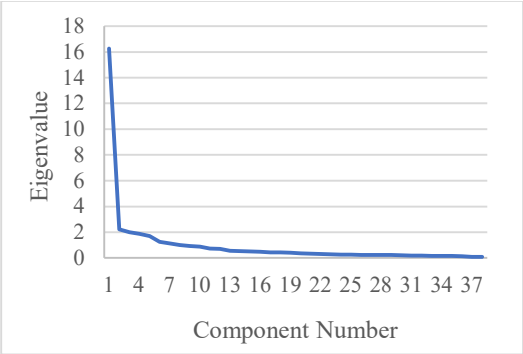


Fig. 3 Scree plot

The rotated factor loadings are shown in Table 4. Loading values that are less than 0.32 [24] are excluded for a simpler demonstration of how the questions load highly on only one component.

Analyzing the nature of the questions that fall on each component, the 7 service indicators are concluded and summarized in Table 5. The reliability of the data was also checked by calculating the Cronbach's alpha of each component to estimate of the data's internal consistency. It is important to note that the Cronbach's alpha coefficient values of 0.6-0.7 are accepted, values of 0.8 or greater are considered very good, and those greater than 0.95 are not necessarily good due to the probable indication of redundancy [25]. The Cronbach's alpha coefficients of the service quality indicators were found to have values between 0.6 and 0.95, indicating acceptable levels of reliability.

TABLE IV

Rotated factor loadings from PCA

	Component						
Indicator	1	2	3	4	5	6	7
Q1	0.691						
Q2	0.721						
Q3	0.421						
Q4	0.363						
Q5	0.548						
Q6	0.735						
Q7		0.488					
Q8		0.583					
Q9		0.653					
Q10		0.695					
Q11		0.773					
Q12		0.833					
Q13		0.788					
Q14		0.801					
Q15		0.739					
Q16		0.615					
Q17			-0.600				
Q18			-0.679				
Q19			-0.672				
Q20			-0.655				
Q21				0.873			
Q22				0.905			
Q23				0.898			
Q24					-0.884		
Q25					-0.919		
Q26					-0.974		
Q27					-0.973		
Q28						-0.655	
Q29						-0.632	
Q30						-0.578	
Q31						-0.591	
Q32						-0.551	
Q34							-0.566
Q35							-0.656
Q36							-0.706
Q37							-0.751
Q38							-0.736
% variance	42.823	5.842	5.243	4.892	4.487	3.284	2.905

TABLE V
Service quality indicators from PCA

Component	Service Quality Indicator		Description	Cronbach's alpha
1	TS	Ticket Sales	TS indicates the satisfaction on the method of sales of tickets as well as the value of money of the ticket prices.	0.680
2	SF	Station Facilities	SF indicates the satisfaction on the accessibility of the station, quality and availability of facilities, information available for users, and inclusivity to people with disabilities.	0.926
3	SSS	Station Safety and Security	SSS pertains to the satisfaction on how safe and secured passengers feel when using the rail transport services.	0.908
4	SS	Station Staff	SS relates to the satisfaction of respondents regarding the personality, politeness, and service offered by staffs at the station.	0.945
5	PR	Public Relations	PR indicates the satisfaction with information dissemination, unusual events notification, and complaints handling.	0.946
6	RS	Rolling Stock	RS pertains to the satisfaction with the operations of the rail transport system and readiness and cleanliness of the trains.	0.915
7	RC	Ride Comfort	RC relates to the inclusivity of train facilities, ambiance, and safety and security inside the trains.	0.902

3.2 Cross Tabulation with Comparison Statistical Tests

The level of satisfaction differs among socio-demographic characteristic groups of passengers [9]. Cross tabulation analysis (CTA) is one method to quantitatively analyze how the variables are related to each other and how they differ across groups of respondents. In this study, CTA was used to examine the relationship of customer satisfaction on the service indicators identified through PCA and the socio-demographic characteristics of the respondents. The results are divided into gender, age group, monthly income, and trip purpose. Since CTA is empirical in nature, comparison statistical tests were also conducted. Upon checking if the data meets the assumptions of parametric and non-parametric tests, it was determined that the comparison tests of t-test and Kruskal-Wallis (KW) tests with pairwise comparisons were to be used to determine if the differences among the groups are statistically significant.

4. Results and Discussion

The respondents are found to be relatively satisfied with the service quality of the mass rapid transit lines with majority of the mean values of level of satisfaction being greater than 4 (Figure

4). It is noteworthy, however, to find that passengers are significantly least satisfied with ticket sales (TS) with a mean of 3.719. This indicates that the method of sales and value of money passengers receive in purchasing the train tickets need improvement. This result is similar to the findings of Petrovic et al. [26] where the authors found that ticket price is amongst the service quality elements that passengers were most dissatisfied with. It is then recommended that the method of sales such as ticket booths, ticket vending machines, applications, and internet banking be maintained well and also enhanced to accommodate the increasing demand. Ibrahim et al. [27] also recommended the improvement of the value of the trip in order to produce higher levels of passenger satisfaction.

Public relations (PR) was found to be the indicator with the second lowest mean level of satisfaction (4.128). This result suggests that improvements be made to the dissemination of information methods, notification of unusual events, and handling of complaints. This can include proper planning in cases of potential schedule disruptions, real-time decisions leading to advanced and updated announcements, enhanced information dissemination quality and delivery methods, and more efficient complaint management [28, 29].

The indicator with the highest level of satisfaction is found to be station staff (SS) with a mean value of 4.540 which indicates that the personality, politeness, and services offered by staffs at the station are commendable.

Overall, the average satisfaction considering equal weights to the service quality indicators was found to be 4.250 out of 5.000. This indicates high level of satisfaction from customers of the Bangkok Mass Rapid Transit System.

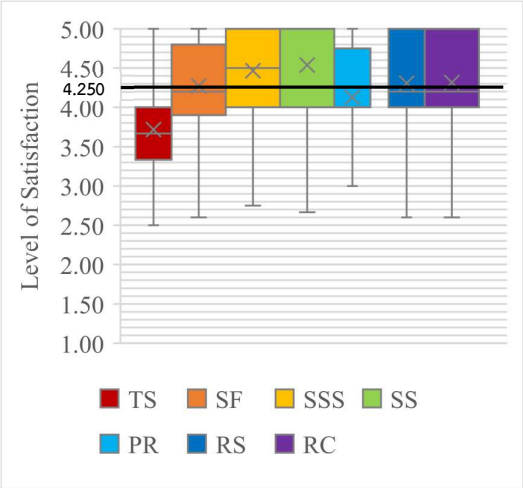


Fig. 4 Overall level of satisfaction on service quality indicators

4.1 Gender

The level of satisfaction was found to be different across gender groups of male and female as shown in Appendix 2A. Independent t-tests showed that there is significant difference among the groups in all service quality indicators except station staff (SS) and public relations (PR). In general, it can be seen that females have lower level of satisfaction. From the results of the indicators SSS and RC, it can be deduced that females are less satisfied with the safety and security of both the trains and train stations. The result suggests that females are less satisfied with their feeling of being safe relating to presence of security guards, safety zones at platforms, and

baggage inspections. For security, this pertains to crime and theft of valuables especially at dimly lit areas and blind spots. This complements the findings in other countries where females were found to feel less safe and more at risk at metro stations and trains compared to males [9]. Ibrahim, et al. [27] recommended the following to enhance the satisfaction of females in terms of safety and security: installation of more security cameras for monitoring, ease of reporting of suspicious activities, increased number of security staff, and designated exclusive coaches for females.

4.2 Age

The results of the CTA with KW tests showed that in all service indicators, the null hypothesis that the level of satisfaction is the same across the categories of age is rejected. As shown in Appendix 2B, the consequent pairwise comparisons reveal that except for ticket sales (TS) and public relations (PR), younger age groups (respondents younger than 30 years old) are significantly less satisfied with the service quality compared to the older generations. Similar to the results of the study of [9], a trend can be found where lower satisfaction levels are observed in the younger age groups.

Considering that the younger generation are a majority of the passengers, that they were found to be the respondents least satisfied with the service quality, and that they are considered the most technologically literate, it is highly recommended that their levels of satisfaction be increased by taking advantage of technological techniques such as provisions of real-time transit information online, mobile application discounts, and social media promotions [30].

4.3 Income

Appendix 2C shows the CTA results across the monthly income of respondents. In majority of the service quality indicators, it can be observed that the respondents who earn 30,001 – 50,000 Baht per month are significantly the most satisfied especially when compared to lesser earning groups. To increase the level of satisfaction of the lesser earning groups, it is recommended that promotions be provided such as cheaper weekly and monthly ticket price bundles [28].

4.4 Trip Purpose

Except for station safety (SS) indicator, the level of satisfaction across trip purpose showed that there is no significant difference among the groups (Appendix 2D). This suggests that regardless of the trip purpose, the respondents have the same level of satisfaction for the ticket sales, station facilities, station safety and security, public relations, rolling stock, and ride comfort.

It is noteworthy to find that in regard to the station staff (SS) indicator, passengers who travel for shopping purposes are significantly the least satisfied. One explanation can be attributed to how these customers communicate with the staff more often considering that those who use the train for study and work trips most likely do so on a regular basis, and thus the latter need not ask for further assistance. This finding is also important especially for tourists who avail of the service for shopping-related trips. It is

recommended that the SS indicator be better improved to cater the needs of shopper travelers.

In summary, across the socio-demographic characteristics of the respondents, it was found that the relatively lowest satisfaction levels were found in females, passengers younger than 30 years old, those who earn less than 30,000 Baht/month, and people who travel for shopping purposes. Considering that these groups represent a majority of the responses, it is highly recommended that the service quality of the mass rapid transit system be improved to raise their levels of satisfaction.

5. Conclusion and Recommendations

The rail transport system in Thailand was evaluated based on a case study on the customer satisfaction of passengers of the mass rapid transit system in the capital. Principal component analysis followed by cross tabulation analysis with comparison statistical tests were conducted to assess the level of satisfaction of the respondents. The results showed that the service quality indicators of satisfaction are ticket sales, station facilities, station safety and security, station staff, public relations, rolling stock, and ride comfort. Among these indicators, passengers are significantly least satisfied with the method of ticket sales and ticket prices followed by the public relations. On the contrary, they are generally most satisfied with the service received from the station staff. The results also suggest that there are significant differences among the socio-demographic groups of respondents. Relatively low satisfaction levels were found from females, young passengers (< 30 years old), those earning less than 30,000 Baht/month, and travelers who avail of the train services for shopping-related trips. Considering that these groups represent a large number of passengers who use the mass rapid transit system, improvements must be made to meet their expected service quality, consequently increasing their levels of satisfaction.

The limitations of this study include the following: transfer between and across other lines and modes were not considered; the importance of each service quality indication was assumed to be of equal weights; more disaggregate levels of income across respondents can be used; and level of educational attainment could have also been asked. It is recommended that further studies incorporate these changes for more in-depth analysis of the customer satisfaction in rail transport.

In summary, the following recommendations to public agencies and rail transport operators are summarized upon assessing the survey results:

• With regard to ticket sales, it is recommended that the method of sales such as ticket booths, ticket vending machines, applications, and internet banking be maintained well and also improved to accommodate the increasing demand. It is also recommended that further in-depth studies be conducted focusing on the value of money of the ticket prices and their appropriateness to passengers' traveling distance and service quality received.

• Considering public relations, it is suggested that improvements be made to the dissemination

of information methods, notification of unusual events, and handling of complaints. This includes proper delay planning, real-time updates on trip schedules, enhanced information dissemination quality and delivery, and more efficient complaint management.

• Complementary to previous research recommendations, it is suggested that safety and security for females be enhanced and encouraging strategies such as online or mobile application promotions, regular rider discounts, and shopping rebates be made to increase the level of satisfaction of the socio-demographic groups found to be relatively least satisfied with the rail transport services.

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Appendix 1

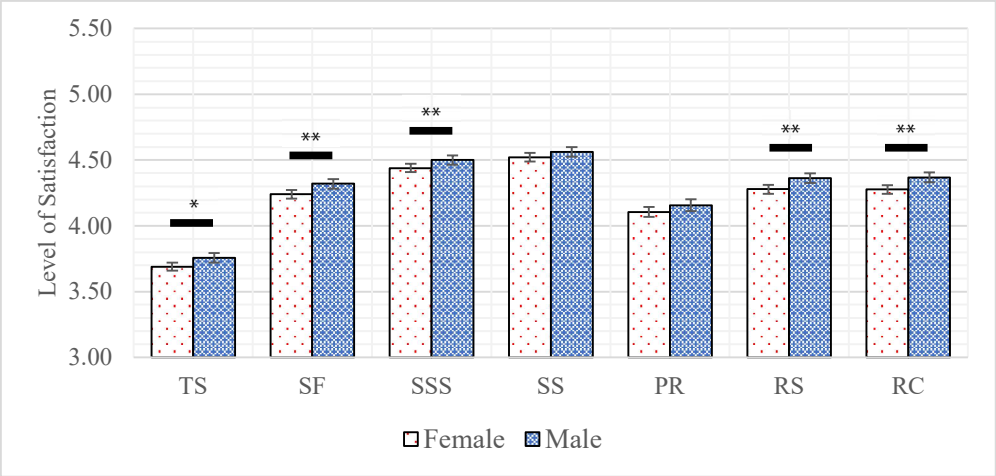
Initial list of service quality indicators

Category	No.	Indicator	Description
Ticket Price and Sales	Q1	Sales equipment	Ticket booths and automatic ticket vending machines are properly serviced and ready to use.
	Q2	Method of sales	The method of selling and paying for ticket is convenient and fast.
	Q3	Top-up options	There are various methods and very convenient for topping-up tickets, such as ticket booths, automatic ticket vending machines, application, and internet banking.
	Q4	Cost/distance	Ticket price is appropriate for traveling distance.
	Q5	Value of comfort	Ticket price is appropriate for comfortable and convenience.
	Q6	Passenger rights	Protection of passengers' rights is fair and appropriate, such as ticket cancellation and ticket refunding.
Facilities at the Station	Q7	Accessibility	Easy and convenient to access a station.
	Q8	Parking	There is a proper Park-and-Ride facilities which are ready to use.
	Q9	Walkways	There is a proper walkway which are available and ready to use.
	Q10	Pick-up/drop-off	There is a convenient and safe passenger pick-up point.
	Q11	Directional information	There is a clear direction sign and map showing the route inside station.
	Q12	Travel information	There is an information display/audio announcing about travel information and necessary travel advices such as the next station, route, warnings and precautions.
	Q13	Ticket gates	There is an automatic ticket gate in service and ready for use.
	Q14	Waiting area	There is sufficient and suitable space for waiting trains on the platform.
	Q15	Vertical transport	There is an escalator/elevator, and wheelchair ramps for handicapped which are available and ready to use.
	Q16	Other facilities	Other facilities are adequate and appropriate, such as ATMs, shops and convenience stores.
Security and Safety at the Station	Q17	Station cleanliness	The station and the area surrounding the station are clean.
	Q18	Air quality	There is a ventilation system/air conditioning system that is efficient, such as does not produce unpleasant odors, and do have the right temperature.
	Q19	Station safety	It is safe to use the service, such as having a security guard, there is a yellow line indicating a safety zone around the platform, and passenger baggage inspection.
	Q20	Station security	Safe from crime and theft. especially in dimly lit areas and blind spots.

Category	No.	Indicator	Description
Staff at the Station	Q21	Staff personality	Staffs have nice personality and dress neatly.
	Q22	Staff attitude	Provide polite and enthusiastic service/assistance.
	Q23	Staff competence	Provide accurate information when asking/can help solve immediate problems quickly.
Public Relations, Information	Q24	Information availability	Accessibility to information/news on services is convenient and has various of channels.
Provision, and Complaint	Q25	Notifications	Notification of delays/disruptions/unusual events is clear and up-to-date.
Handling	Q26	Complaint channels	Complaints are convenient and there are various channels for complaints.
	Q27	Complaint management	Able to resolve complaints with speed and efficiency.
Rolling Stock	Q28	Punctuality	The service is punctual
	Q29	Frequency	The operating frequency is appropriate both during peak hour and off-peak hour
	Q30	Delay management	Management during delay/disruption/unusual incident is appropriate
	Q31	Train cleanliness	Vehicles are clean inside and out
	Q32	Seating	Sufficient seating/handrails are available with clean and ready to use
	Q33	On-board information	There is an information display/audio announcing about travel information and necessary travel advices such as the next station, route, warnings and precautions
	Q34	Service application	There is an application that provides sufficient and complete service information and up to date
	Q35	Universal design	Other facilities are adequate and appropriate, such as seats for the disabled, the elderly and pregnant women, and a lock for a wheelchair for the handicapped
	Q36	On-board air quality	There is an efficient ventilation/air conditioning system, such as. no unpleasant odors, and have the right temperature
	Q37	On-board safety	There is safety in using the service, such as having a security guard on the train, and inspection of suspicious or foreign objects
	Q38	On-board security	Be safe from crime and theft problems such as preventing the loss of valuables, and preventing unrest on convoys

Appendix 2A

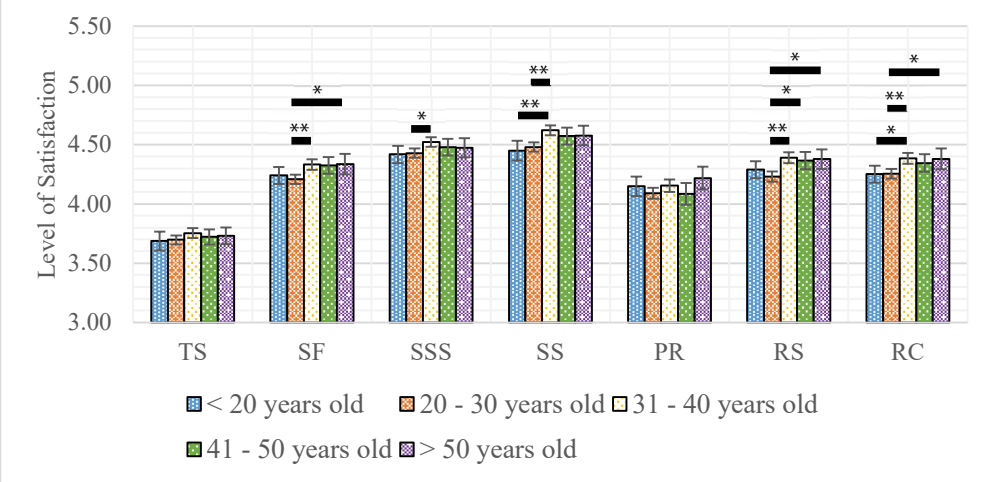
Level of satisfaction across gender



* p < 0.05, ** p < 0.01

Appendix 2B

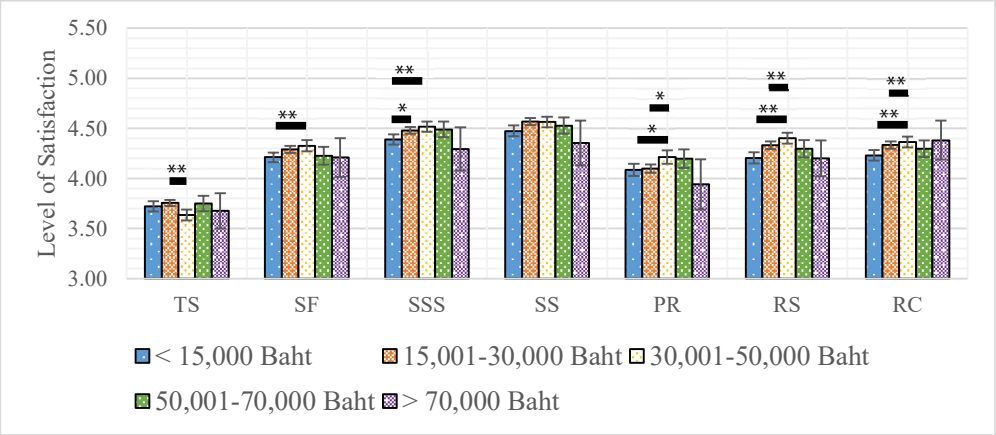
Level of satisfaction across age



* p < 0.05, ** p < 0.01

Appendix 2C

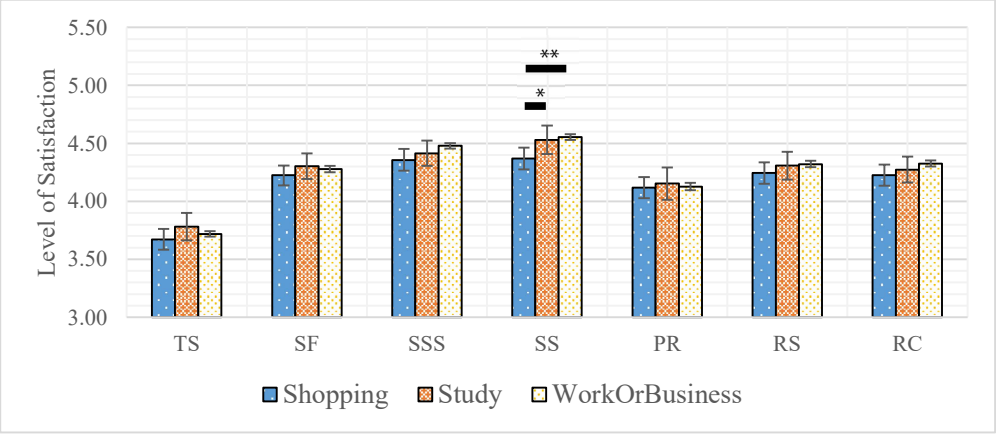
Level of satisfaction across income



* p < 0.05, ** p < 0.01

Appendix 2D

Level of satisfaction across trip purpose



* p < 0.05, ** p < 0.01