Stakeholder perspective on urban transport system service quality

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Different transport stakeholders have different needs for transport infrastructure and services. Achieving stakeholder satisfaction implies a total quality management (TQM) that continuously improves service quality. However, few studies have discussed service quality in relation to urban transport systems. This study proposes an instrument based on SERVQUAL for measuring urban transport service quality from a stakeholder perspective. The proposed instrument is developed and tested through exploratory and confirmatory factor analyses. The gaps between stakeholder expectations and actual received and the gaps associated with stakeholders' expectations and the perceptions of these expectations by professionals are examined. Importance-performance analysis is used to construct a service attribute evaluation map for determining resource allocation to improve service quality. The application is illustrated through an empirical study to discuss the managerial implications in the Taipei metropolitan area. The analytical results reveal the existence of gaps and that stakeholders are more concerned with reliability and safety dimensions.

Keywords: instrument; service quality; gap analysis; importance-performance analysis

Introduction

Transport systems consist of infrastructure, modes and stakeholders. Needs for transport infrastructure and services differ between transport stakeholders. Although most transport services are provided by the public sector, the service levels of transport systems have increased substantially around the world over the last 20 years, particularly in metropolitan areas of developed countries, due to a shift towards a culture of requiring that the performance of government should be as efficient as that of the private businesses. This raises concerns regarding maintaining transport quality in the face of changing social and lifestyle patterns that are generating increasingly diverse travel needs. Policy-makers cannot simply create services, provide them, and hope for the best. To decide how to improve the service quality of transport systems, policy-makers must first understand how stakeholders view their services via valid measuring instruments to effectively measure user reactions to those services (Carr, 2007). Currently, SERVQUAL, developed by Parasuraman, Zeithaml, and Berry (1988), is the dominant instrument for measuring stakeholder reactions in the service domain and a useful tool for making overall assessments of service quality (Saravanan & Rao, 2007).

Numerous studies have discussed service quality in transport industries. Nathanail (2008) addressed service quality for railway passengers, qualitative studies of bus users were presented to improve the understanding of traveller attitudes regarding public

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transport and to explore perceptions of bus service quality (Hensher, Stopher, & Bullock, 2003; Wall & McDonald, 2007). Moreover, many studies assessed service quality for airline and air cargo services through various constructs and measures to analyse the relationships between performance, competition, critical factors, and customer satisfaction (Chen & Chang, 2005; Gilbert & Wong, 2003; Gursoy, Chen, & Kim, 2005; Liou & Tzeng, 2007; Pakdil & Aydm, 2007; Park, 2007; Rhoades & Waguespack Jr, 2000; Tsaur, Chang, & Yen, 2002; Wang, 2007). Additionally, Beirao and Cabral (2007) conducted in-depth interviews to obtain the main influences on modal choice of travellers and attitudes towards public transport and private cars. However, few studies have discussed TQM as a method of improving urban transport system service quality to satisfy stakeholder needs. Furthermore, most transport planners allocate resources to improving transport system performance without clearly understanding the importance of stakeholder needs and related expectations.

This study proposes a model for service quality of transport system based on the revised SERVQUAL scale and gap framework suggested by Parasuraman, Zeithaml, and Berry (1985). The model can help planners decide how to invest appropriately in transport infrastructure to improve urban transport system service quality and equitably achieve stakeholder needs. The application of the model is illustrated through an empirical study to enhance the managerial implications of applying the model in the Taipei metropolitan area. The remainder of this paper is organised as follows: First, service quality is briefly outlined. Second, the study hypotheses and methodology are presented. Third, items based on SERVQUAL for evaluating the service quality of transport system are developed through exploratory factor analysis (EFA). Fourth, the analytical results are then discussed. Finally, conclusions and recommendations are drawn.

Service quality

Service quality is more difficult to describe and assess than product quality owing to the intangibility, heterogeneity, inseparability, and perishability of the service industry. Gronroos (1984) argued that customer perceptions of service quality comprise technical quality, namely the assessment of the core services that the buyer receives from the seller, and functional quality, namely the evaluation of the service delivery process reflecting customer experiences of service quality. Parasuraman et al. (1985) proposed a gap framework that identifies overall service quality using five gaps, where the first gap occurs when customer expectations regarding service differ from managerial perceptions of those expectations. The fifth gap, service quality, refers to the degree and direction of difference between customer perceptions and expectations. For service providers, precisely identifying customer expectations is the most critical step in defining service quality (Zeithaml, Parasuraman, & Berry, 1990). Besides, Parasuraman et al. (1988) suggested the SERVQUAL scale based on factor analytic psychometric research in which service quality was assessed using five constructs, including tangibles, responsiveness, assurance, empathy, and reliability.

SERVQUAL has clearly contributed substantially to understanding service quality as well as highlighting the importance of stakeholder reactions to service (Carr, 2007). The original SERVQUAL involves 22 items arranged into five dimensions, and provides a basis for the following labels and concise definitions (Parasuraman et al. 1988).

- Tangibles: physical facilities, equipment, and personnel appearance.
- Responsiveness: willingness to assist stakeholders and provide prompt service.
- Assurance: service provider knowledge and ability to inspire trust and confidence.

- Empathy: provision of individualised care and attention for stakeholders.
- Reliability: ability to perform the promised service dependably and accurately.

However, the fact that numerous studies utilise SERVQUAL and the conceptual model to measure service quality results in inconsistency in attributes among different industries (Jiang, Klein, & Crampton, 2000; Kettinger & Lee, 2005; Triplett, Yau, & Neal, 1994). Furthermore, Carman (1990) suggested that the items and dimensions should be redesigned based on the procedures proposed by Parasuraman et al. (1988) according to industry charac- teristics since SERVQUAL has been developed to provide a basic skeleton for measuring service quality. Additionally, Hinkin (1998) provided a process for developing survey questionnaire scales. The items for assessing the service quality of the transport system are thus based on the five dimensions and scale development process mentioned previously.

Methodology

Hypotheses formulation

We have developed a research framework representing the study hypotheses and associ- ated guidance based on the literature (Figure 1). Previous research indicates that service quality results from comparing customer expectations and perceptions (Parasuraman et al., 1985). Perceived service quality is viewed as the degree and direction of the discrepancy between stakeholder expectations and perceptions. The first hypothesis thus is developed (Gap 1):

H₁: Stakeholder expectations and perceptions of transportation service attributes differ significantly.

In most organisations management are responsible for establishing service quality standards and specifications, therefore, it is important for management to understand stakeholder expectations to ensure they are met or exceeded (Saleh & Ryan, 1991). Any discrepancy between stakeholder expectations and professional understanding of
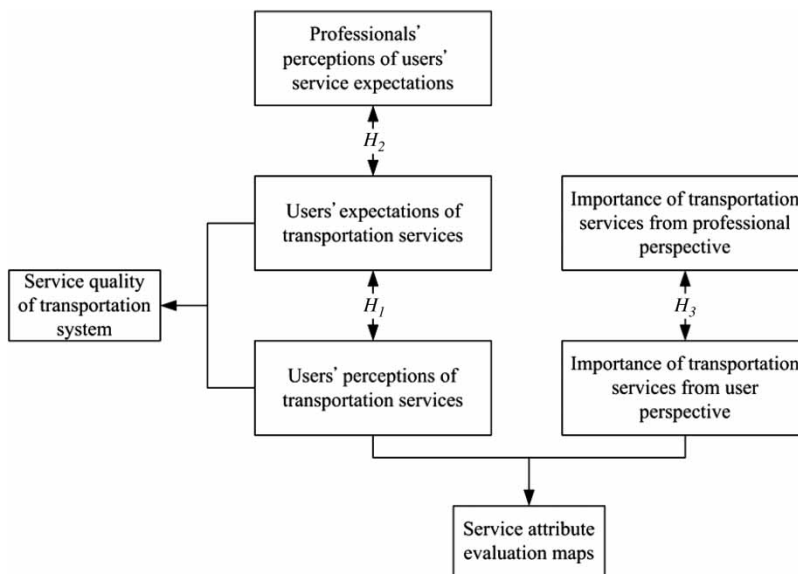

Figure 1. Research framework.

those expectations will ultimately negatively impact the service performance of transport systems (Chen & Chang, 2005). Previous research findings confirmed the existence of such a gap (Brown & Swartz, 1989) leading to the second hypothesis (Gap 2):

> *H2*: Stakeholder expectations of transport service attributes differ significantly from professional perceptions of those expectations.

Studies of service quality demonstrate that expected satisfaction can substitute for level of importance priority (Chen & Chang, 2005; Deng, 2007) in situations where needs are treated as one-dimensional quality elements. Similarly, the differences between stakeholder and professional recognition of importance create considerable policy confusion. The third hypothesis (Gap 3) is:

> *H3*: Stakeholder and professional recognitions of the importance of transport service attributes differ significantly.

Importance-performance analysis (IPA)

For service industry practitioners, it is essential to measure both the satisfaction and importance of service attributes to users. Service attribute evaluation maps thus applied the importance-performance analysis (IPA) technique of Martilla and James (1977) to simultaneously identify the relative importance and performance levels of service attributes. Hansen and Bush (1999) argued that IPA is a simple and effective technique for assisting managers in identifying improvement priorities for customer attributes and direct quality-based marketing strategies. In fact, numerous researchers have applied IPA to determine the key performance factors in customer satisfaction survey data for products and services (Deng, 2007; Enright & Newton, 2004; O'Neill & Palmer, 2004; Tikkanen, Alajoutsijarvic, & Tahtinen, 2000).

A two-dimensional matrix was created by depicting attribute importance along the x-axis and attribute performance along the y-axis. The means of performance and importance, which are commonly utilised in practice, divided the matrix into four quadrants (Figure 2). Attributes located in Quadrant I (good performance and high importance) are areas where the company should aim to maintain its existing competitive advantage, the management scheme for attributes in this quadrant is 'keep up the good work'. Attributes located in Quadrant II (poor performance and high importance) require immediate attention for improvement, the associated management scheme is 'concentrate here'. Attributes in Quadrant III (poor performance and low importance) do not require additional effort because of their 'low priority'. Attributes located in Quadrant IV (good
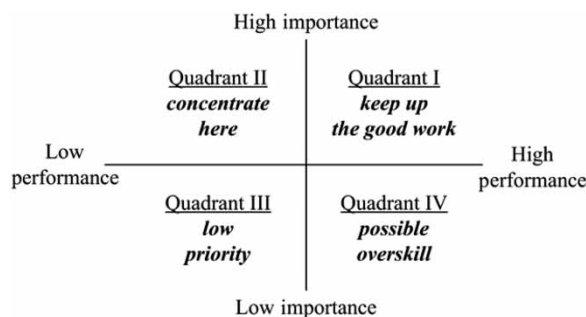

Figure 2. Importance-performance analysis matrix.

performance and low importance) indicate that excessive resources are being devoted to areas and that those resources could be better used elsewhere. The management scheme for this quadrant is 'possible overkill'.

Sample and survey

An anonymous questionnaire was sent to 600 commuters in the Taipei metropolitan area and 510 effective responses were obtained, yielding an 85% response rate. One hundred and three expert questionnaires were collected from scholars and professional practitioners – including engineers, designers and planners studying in the urban and transport fields. The scale development process followed the six steps described by Hinkin (1998). The questions were designed after a literature review, and were based on the instrument SERVQUAL with modifications to match the requirements of urban transport systems. A pilot study was conducted and revised based on the suggestions of 18 Ph.D. students and 26 stakeholders. Item wording was further refined following the pilot testing. Exploratory factor analysis was performed using 150 random samples. The remaining 360 samples were utilised in a validation study using confirmatory factor analysis (CFA).

Part one of the stakeholder questionnaire dealt with the importance of transport services. Respondents were asked to indicate the importance of each attribute via a five-point Likert scale anchored by 'Minimally Important' and 'Extremely Important'. Part two of the questionnaire involved rating the expectation and perception for each attribute using a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Part three of the questionnaire gathered demographic information such as sex, age, education, occupation, and the chosen vehicle. Meanwhile, the service provider questionnaire asked transport professionals to indicate the importance of each attribute and their perceptions of stakeholder expectations regarding transport service attributes.

Scale development

Along with four items measuring the quality of pedestrian transport services, the Appendix contains a survey instrument consisting of 32 items developed to empirically validate the transport service quality based on the five dimensions proposed by Parasuraman et al. (1988). The survey items are established based on the operational definitions of the dimensions. In the pre-test, items belonging to the construct 'responsiveness', such as 'The transport infrastructure/service provider informs users if services are unavailable,' 'The transport infrastructure/service provider is willing to help users,' and 'The transport infrastructure/service provider responds to user requests promptly', are excluded because most stakeholders are insufficiently willing and experienced to encounter transport infrastructure/service providers.

Table 1 shows the results of the reliability analysis clarifying the relationship between modified items and the five dimensions. In the dimension 'responsiveness' in which only one item was left, the Cronbach's alpha values for four dimensions are above 0.70, indicating a strong scale reliability (Cronbach, 1951). EFA is employed to investigate the item factor structure for identifying urban transport system characteristics. Figure 3 shows the resulting scree plot. Following the oblique rotation, the components with eigenvalues exceeding 1 (Kaiser, 1960) are adopted. Table 2 lists the eight components of the exploratory factor analysis.

The first principal component explains 35.56% of the total variance, with five items having positive loadings ranging from 0.76 to 0.86. Since all items express the

Table 1. Results of reliability analysis for the original dimensions.

Dimensions	Tangibles	Reliability	Responsiveness	Assurance	Empathy
Cronbach's alpha	0.877	0.848	–	0.908	0.821
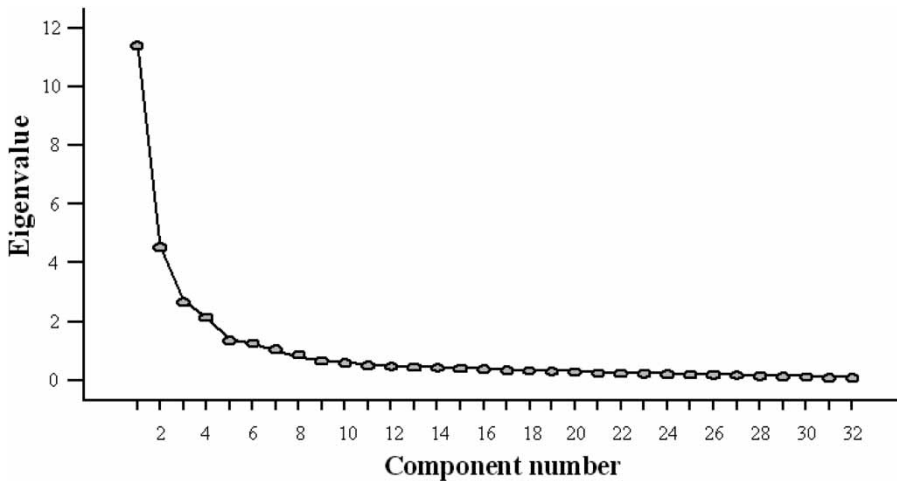
Figure 3. Scree plot of the 32 items.

Table 2. Results of exploratory factor analysis.

Component	Eigenvalue	% of variance	Cumulative %	Items (factor loading)
1	11.378	35.56	35.56	Y4 (0.862), Y5 (0.812), Y6 (0.855), Y7 (0.855), Y8 (0.763)
2	4.529	14.15	49.71	Y13 (0.589), Y14 (0.721), Y15 (0.826), Y16 (0.853), Y17 (0.845)
3	2.654	8.30	58.01	Y25 (0.765), Y26 (0.860), Y27 (0.852), Y28 (0.779)
4	2.129	6.65	64.66	Y29 (0.798), Y30 (0.835), Y31 (0.737), Y32 (0.850)
5	1.435	4.20	68.86	Y21 (0.734), Y22 (0.736), Y23 (0.813), Y24 (0.773)
6	1.348	3.90	72.76	Y9 (0.749), Y10 (0.739), Y11 (0.713), Y12 (0.751)
7	1.187	3.08	75.84	Y18 (0.713), Y19(0.774), Y20 (0.786)
8	1.065	2.39	78.23	Y1 (0.771), Y2 (0.838), Y3 (0.687)

consumption of natural resources and negative environmental externalities, the construct is named *Environmental Impact*. The second component, consisting of five items, explains 14.15% of the total variance, and has factor loadings ranging from 0.59 to 0.85. This construct is termed *Safety* because of its strong loading of items expressing accidents and a safe transport infrastructure/service. The third component explains 8.30% of the total variance, with four items whose loadings range from 0.76 to 0.86. Since all items express the level of barrier-free infrastructure/service, the construct is labelled *Universal Design*. The fourth component, comprising four items, explains 6.65% of the total

variance, has factor loadings ranging from 0.73 to 0.85, and is labelled *Affordability*. The remaining components are termed *Accessibility*, *Reliability*, *Mobility*, and *Physical Facilities*, respectively, according to the features of stronger loading items.

Results

Confirmatory factor analysis (CFA)

The 32 items used to measure eight latent constructs are subjected to CFA to verify the construct validity and the structural model. The maximum likelihood estimation method is utilised because of its robustness without respect to normality (Chou & Bentler, 1995). Every construct in the final measurement model is measured using at least three indicator variables as listed in Table 3.

Construct validity is evaluated based on the content validity, reliability, convergent validity and discriminant validity of each latent variable in the model. Furthermore,

Table 3. Construct validation.

Construct	Measure	Mean	S.D.	Standardised loading	t-value	Cronbach's alpha	Composite reliability
Environmental impact	Y4	2.64	1.17	0.88	21.08	0.93	0.94
	Y5	2.71	1.06	0.82	18.83		
	Y6	2.86	1.25	0.89	21.14		
	Y7	2.65	1.15	0.88	20.74		
	Y8	2.56	1.06	0.80	18.15		
Safety	Y13	2.91	1.17	0.61	12.34	0.90	0.91
	Y14	3.36	1.13	0.83	19.06		
	Y15	3.27	1.06	0.87	20.47		
	Y16	3.34	1.04	0.89	21.36		
	Y17	3.24	1.01	0.86	19.99		
Universal design	Y25	2.91	1.08	0.81	18.20	0.92	0.93
	Y26	2.78	1.09	0.91	21.80		
	Y27	2.76	1.10	0.89	21.27		
	Y28	2.76	1.03	0.84	19.14		
Affordability	Y29	3.31	0.98	0.84	19.15	0.90	0.91
	Y30	3.35	1.01	0.87	20.08		
	Y31	3.09	1.07	0.76	16.47		
	Y32	3.61	0.96	0.85	19.51		
Accessibility	Y21	3.24	1.01	0.79	17.37	0.89	0.90
	Y22	3.12	0.96	0.77	16.59		
	Y23	3.37	1.07	0.85	19.48		
	Y24	3.44	1.02	0.87	19.97		
Reliability	Y9	3.69	0.80	0.76	16.06	0.84	0.85
	Y10	3.60	0.85	0.79	16.96		
	Y11	3.75	0.85	0.72	14.76		
	Y12	3.66	0.85	0.76	15.87		
Mobility	Y18	3.11	1.17	0.84	18.67	0.85	0.86
	Y19	3.48	0.94	0.78	16.65		
	Y20	3.07	1.19	0.82	17.93		
Physical facilities	Y1	3.39	0.94	0.78	16.47	0.82	0.82
	Y2	3.23	1.07	0.83	17.90		
	Y3	3.07	1.08	0.72	14.85		

content validity is measured by considering the relationship between the semantic meaning of the measures and the constitutive definitions of the constructs (Bagozzi, Yi, & Phillips, 1991). The items validated by previous EFA can be used to infer content validity. Furthermore, reliability can reflect the internal consistency of the indicators used to measure given factors. Internal consistency is assessed using Cronbach's alpha and composite reliability (CR), as shown in Table 3. Rivard and Huff (1988) argued that the factor loading of each item must exceed 0.5 and the Cronbach's alpha should exceed 0.6. In this study, all standardised factor loadings exceed the 0.5 threshold, the factor loadings of 31 of the 32 items exceed 0.7. Moreover, the Cronbach's alpha and composite reliability of each construct significantly exceeds the 0.7 minimum values suggested by Nunnally (1978). This study thus infers that eight constructs are internally consistent and testify strong scale reliability.

Convergent validity is achieved if strongly correlated scores are obtained when using various indicators to measure the same construct. The structural equation model (SEM) can assess convergent validity by reviewing the *t*-tests for the factor loadings (Hatcher, 1994). The *t*-values in Table 3 reveal statistical significance for all factor loadings for indicators measuring the same construct, clearly indicating that all indicators effectively measure their corresponding constructs and exhibit good convergent validity.

Typically, the most rigorous method for examining discriminant validity estimates the average variance extracted for each latent construct and compares it with the square of the correlations among the latent constructs. However, this method is deficient in statistical tests. Discriminant validity is tested by setting the correlation between each pair of constructs in the model to 1. Because it is necessary to test the discriminant validity for every pair of eight constructs in this study, the experimental error rate (the overall significance level) should be controlled. By using the Bonferroni method under 0.05 and 0.01 overall levels of significance, the critical values of the chi-square test are, respectively, $\chi^2(1,\ 0.05/28) = 9.76$ and $\chi^2(1,\ 0.01/28) = 12.74$. Since the chi-square difference statistics listed in Table 4 exceed 12.74 for every pair of constructs, all the constructs are empirically distinct. Additionally, the values of the model fit indices, such as NFI (0.902), NNFI (0.944), CFI (0.951), RMSEA (0.050) and RMR (0.045), indicate excellent model fit to the data.

Gap analysis

Stakeholder expectations of transport services were investigated using the target levels of provided services. Perceived service was expressed in terms of the degree of respondent satisfaction with each attribute. Service quality, indicated by Gap 1 in Table 5, denotes the difference between stakeholder expectation and perception regarding service. Paired sample *t*-tests were used to test for the existence of a gap.

Respondent perceptions of levels of satisfaction with transport services are lower than their expectations on all attributes. All of these gaps are statistically significant at the 0.001 level. The results supporting H_1 reveal that stakeholders did not receive what they expected. Therefore, infrastructure/service providers should stress the improvement of urban transport system service quality. The largest gaps exist in the constructs pedestrian service, environmental impact, and universal design. In contrast, the smallest gaps are those associated with construct reliability and physical facilities.

Gap 2 is the difference between stakeholder expectations of services and professional perceptions of those expectations. Independent sample *t*-tests were carried out to test whether gap 2 existed. In Table 5, professionals underestimated stakeholder expectations

Table 4. Chi-square difference tests for examining the discriminant validity.

Construct pair	Unconstrained chi-square (436)	Constrained chi-square (437)	Chi-square difference
Environmental impact, Safety		1576.28	744.35**
Environmental impact, Universal design		1676.20	844.27**
Environmental impact, Affordability		1598.17	766.24**
Environmental impact, Accessibility		1703.80	871.87**
Environmental impact, Reliability		1350.32	518.39**
Environmental impact, Mobility		1197.59	365.66**
Environmental impact, Physical facilities		1148.31	316.38**
Safety, Universal design		1540.57	708.64**
Safety, Affordability		1603.54	771.61**
Safety, Accessibility		2581.75	1749.82**
Safety, Reliability		1244.87	412.94**
Safety, Mobility		1110.89	278.96**
Safety, Physical facilities		1027.64	195.71**
Universal design, Affordability	831.93	1652.54	820.61**
Universal design, Accessibility		1656.40	824.47**
Universal design, Reliability		1307.84	475.91**
Universal design, Mobility		1212.41	380.48**
Universal design, Physical facilities		1102.57	270.64**
Affordability, Accessibility		1680.51	848.58**
Affordability, Reliability		1301.95	470.02**
Affordability, Mobility		1227.65	395.72**
Affordability, Physical facilities		1159.67	327.74**
Accessibility, Reliability		1655.78	823.85**
Accessibility, Mobility		1311.00	479.07**
Accessibility, Physical facilities		1216.75	384.82**
Reliability, Mobility		1061.73	229.80**
Reliability, Physical facilities		1037.91	205.98**
Mobility, Physical facilities		1058.13	226.20**

Note: The numbers in parentheses after chi-square refer to the degree of freedom.
**Significant at the 0.01 overall significance level by Bonferroni method.

on all transport service attributes exhibiting statistically significant difference at the 0.001 level. These results support H_2 and indicate that professionals, including engineers, designers and planners involved in urban and transport planning, have a poor understanding of stakeholder expectations. The largest gaps exist in pedestrian service.

Table 5 shows that stakeholders perceived all transport service attributes as important (4.081–4.494) with the mean value being 4.299. It is considered to be the most important for trips that ensure stakeholders arrive at a destination on schedule using a safe infrastructure/service during which providers ensure that services are provided at the promised time. This clearly demonstrates the significance of urban transport systems in stakeholder transport service evaluation. Conversely, stakeholders consider the accessibility of remote areas, provision of a channel for complaints, and dense provision of infrastructure/services as the least important attributes.

The importance of professional recognition of transport service attributes has a mean of 4.357, with a range from 3.971 to 4.660. Only three of these attributes have importance ratings below 4, including stakeholders feeling free to walk around, the accessibility of remote areas, and dense provision of infrastructure/services. A safe pavement is

Table 5. Gap analysis for transport service attributes.

Construct & item	Service importance		Perception of stakeholder [C]	Expectation of		Gap 1 [D]-[C]	Gap 2 [D]-[E]	Gap 3 [A]-[B]
	Stakeholder [A]	Expert [B]		stakeholder [D]	Experts' perception [E]			
Pedestrian service								
Safe pavement	4.361 (9)	4.660 (1)	2.486	3.964	2.816	1.478***	1.148***	−0.299***
Free to walk around	4.158 (33)	3.971 (36)	2.792	3.961	2.864	1.169***	1.097***	0.187
Comfortable	4.253 (28)	4.029 (33)	2.875	4.003	3.039	1.128***	0.964***	0.224**
Pedestrian friendly	4.261 (26)	4.282 (15)	2.747	4.005	2.922	1.258***	1.083***	−0.021
Environmental impact								
Emission	4.302 (22)	4.282 (16)	2.642	3.592	3.068	0.950***	0.524***	0.020
Noise	4.211 (30)	4.184 (27)	2.706	3.528	2.941	0.822***	0.587***	0.027
Mitigate impact	4.314 (18)	4.272 (18)	2.858	3.700	3.042	0.842***	0.658***	0.042
Resource consumption	4.225 (29)	4.175 (28)	2.653	3.559	3.054	0.906***	0.505***	0.050
Resilience	4.197 (31)	4.126 (32)	2.564	3.495	3.060	0.931***	0.435***	0.071
Safety								
Complaint channel	4.106 (35)	4.136 (29)	2.908	3.564	3.163	0.656***	0.401***	−0.030
Rare accidents	4.408 (2)	4.515 (4)	3.358	3.897	3.336	0.539***	0.561***	−0.107
Attach importance	4.356 (11)	4.553 (3)	3.267	3.800	3.344	0.533***	0.456***	−0.197**
Users feel safe	4.394 (6)	4.417 (6)	3.344	3.838	3.400	0.494***	0.438***	−0.023
Trustable safety plan	4.306 (20)	4.359 (10)	3.244	3.722	3.254	0.478***	0.468***	−0.053
Universal design								
Without barrier	4.253 (27)	4.204 (26)	2.911	3.617	3.118	0.706***	0.499***	0.049
Disable users	4.306 (21)	4.398 (8)	2.778	3.631	3.141	0.853***	0.490***	−0.092
Specific vs. general	4.181 (32)	4.136 (31)	2.758	3.519	3.007	0.761***	0.512***	0.045
Satisfying barrier-free	4.311 (19)	4.223 (22)	2.775	3.584	3.095	0.806***	0.489***	0.088

Affordability								
Low ratio to income	4.319 (15)	4.252 (21)	3.308	3.769	3.157	0.461***	0.612***	0.067
No impact on life	4.267 (25)	4.214 (24)	3.350	3.789	3.310	0.439***	0.479***	0.053
Low-income users	4.300 (23)	4.223 (23)	3.094	3.677	3.193	0.583***	0.484***	0.077
Necessary trip needs	4.353 (12)	4.320 (13)	3.611	3.919	3.306	0.308***	0.613***	0.135
Accessibility								
Dense spread	4.144 (34)	3.990 (34)	3.244	3.702	3.299	0.458***	0.403***	0.154
No remote area	4.081 (36)	3.990 (35)	3.119	3.558	3.208	0.439***	0.350***	0.091
Access easily	4.319 (14)	4.214 (25)	3.367	3.811	3.312	0.444***	0.499***	0.105
Easily arrive anywhere	4.397 (5)	4.262 (19)	3.436	3.842	3.286	0.406***	0.556***	0.135
Reliability								
On schedule	4.494 (1)	4.515 (5)	3.689	3.961	3.531	0.272***	0.430***	−0.051
Dependable	4.394 (4)	4.398 (7)	3.603	3.931	3.430	0.328***	0.501***	−0.004
Ensured service time	4.406 (3)	4.563 (2)	3.750	3.989	3.461	0.239***	0.528***	−0.157*
Time meets demands	4.356 (10)	4.272 (17)	3.661	3.936	3.403	0.275***	0.533***	0.084
Mobility								
Short waiting time	4.394 (7)	4.398 (9)	3.106	3.787	3.314	0.681***	0.473***	−0.004
Arrive rapidly	4.394 (8)	4.282 (14)	3.475	3.858	3.401	0.383***	0.457***	0.112
Rare congestion	4.350 (13)	4.320 (12)	3.069	3.741	3.238	0.672***	0.503***	0.030
Physical facilities								
Equipment maintenance	4.317 (17)	4.262 (20)	3.394	3.783	3.420	0.389***	0.363***	0.055
Traveler information	4.319 (16)	4.330 (11)	3.225	3.783	3.200	0.558***	0.587***	−0.011
Spacious facilities	4.269 (24)	4.136 (30)	3.069	3.688	3.168	0.619***	0.520***	0.133

Note: The numbers in parentheses refer to the rankings of service attributes.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

considered the most important attribute, followed by providers ensuring that services are provided at the promised times and attach importance to stakeholder safety. Professional recognition of importance rankings for service attributes is distinct from that of stakeholders. However, both professionals and stakeholders consider reliability, mobility, and safety the most important constructs owing to them having the highest factor scores as calculated by respondent recognition of service importance weighted by the factor loading of each item. Conversely, environmental impact and pedestrian service are considered the least important constructs.

Gap 3 denotes the difference between stakeholder and professional recognition of the importance of transport service attributes. Independent sample *t*-tests were performed to test the existence of such a gap. As shown in Table 5, the four items display statistically significant difference at the 5% level. These results do not support hypothesis H_3. The largest gaps exist in the items safe pavement, comfortable walking environment, attaching importance to stakeholder safety, and the promised services times. Only one significant item gap among the four significant attributes is positive, indicating that stakeholders attach more importance than professionals do to a comfortable walking environment.

Transport service attribute evaluation map

The IPA technique is utilised to draw up the service attribute evaluation map. The location of the grid dividing the map into four quadrants is critical to the interpretation of the results. The means of importance and performance are employed to establish the matrices (Chen & Chang, 2005; Martilla & James, 1977) to avoid discarding useful information.

In the transport service attribute evaluation map displayed in Figure 4, eight attributes are identified in the 'concentrate here' quadrant – perceived as important yet also as performing poorly. In this quadrant, stakeholders perceive the least satisfaction from safe pavements (X1), followed by emissions (Y4), creating a barrier-free transport system (Y28), ease of travel for disabled users (Y26), mitigation of environmental impact (Y6), rare congestion (Y20), affordability to low-income users (Y31), and short waiting time (Y18). Moreover, the attributes expressing stakeholder needs, i.e. constructs, namely pedestrian service, environmental impact, and universal design are dissatisfactory, although some items are classified into the quadrant 'low priority'. This implies that the government should pay more attention to improving pavements, and particularly to creating safe pavements that are free of conflicts between pedestrians and motor vehicles, promoting the use of public transit to reduce the negative environmental impacts of car use, and to constructing a barrier-free environment in which those with disabilities can easily meet their basic transport needs.

Additionally, service attributes belonging to mobility receive a higher performance rating in this quadrant because of the car-oriented development of the Taipei metropolitan area during recent decades. However, regulators should reallocate road space to shorten waiting times, reduce road congestion, and improve the bus mobility. The government should provide subsidies to low-income users to make essential trips affordable to this group.

Fifteen attributes occupy the 'keep up the good work' quadrant, and are rated as both important and well performed. These attributes include on schedule arrival (Y9), dependable system (Y10), ensured service time (Y11) meeting stakeholder needs (Y12), few accidents (Y14), providers focusing on user safety (Y15), feeling safe in trips (Y16), trustable safety plan (Y17), equipment maintenance (Y1), traveler information (Y2), easily
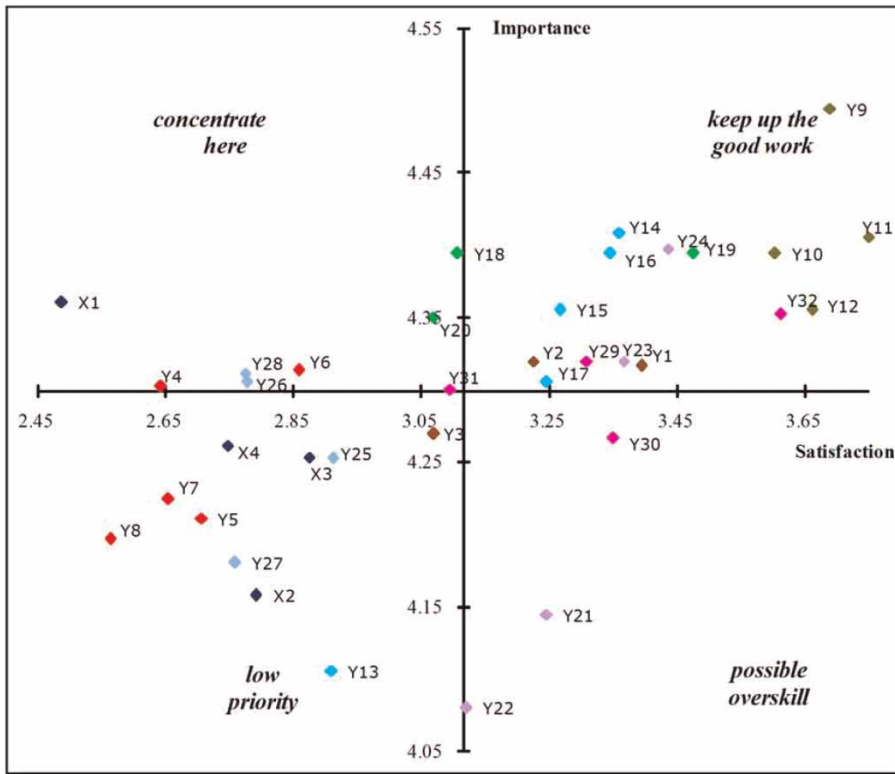
Figure 4. Transport service attribute evaluation map.
Note: Series numbers represent the id of items that refer to service attributes in the appendix.

accessible service (Y23) and ability to provide service anywhere (Y24), fast service (Y19), low ratio of travel costs to disposable income (Y29), and ability to economically take necessary trips (Y32). The analytical results show that the respondents are satisfied with the reliability, safety, and physical facilities of urban transport services, and thus resources should be directed to maintaining the service quality in these areas. Generally, stakeholder needs, specifically accessibility and affordability, are considered relatively unimportant to respondents.

Conclusion

After an extensive literature review, this study develops a survey instrument for measuring urban transport system service quality. Eight components representing content similarities to stakeholder needs are extracted from the 32 items using EFA. The instrument is validated by using CFA to demonstrate goodness of fit. The service quality scores of needs can be computed with respect to stakeholder scores weighted by the factor loading of each item. This study explores the different recognition of service importance between stakeholders and professionals, as well as the gaps in relation to stakeholder service expectations, actual service received, and the perceptions of transport professionals from the Taipei metropolitan area of stakeholder service expectations. The results indicate that significant differences exist between stakeholder expectations and actual service received. Although no gaps exist in the recognition of service importance between stakeholders

and professionals, gaps between stakeholder service expectations and professional perceptions of those expectations are significantly positive. This study finds that the service level provided by professionals based on their perceptions of user expectations cannot achieve stakeholder expectations of targets. This highlights the importance of collaborative planning, specifically through consensus building, for incorporating stakeholder information into the process of decision-making so that public sector organisations can provide appropriate levels of service in response to stakeholder needs.

According to the transport service attribute evaluation map, decision-makers should maintain the reliability, safety, and physical facilities of urban transport systems. Respondents are also concerned regarding strategies for improving pedestrian service, eliminating barriers to access, and minimising environmental impacts. The findings can assist decision-makers in improving the performance of urban transport systems and the satisfaction of stakeholders. Due to the limitations of IPA, some attributes belong to a higher satisfaction level. However, the perceived satisfaction of stakeholders with transport service attributes has a relatively low mean of 3.118, with a range from 2.486 to 3.750. The findings should be taken into account by the public sector when making resource allocation policies.

This study proposes a survey instrument to measure the service quality of urban transport systems based on stakeholder needs and a general framework for advancing the knowledge of stakeholder expectations and identifying areas for service improvement and resource allocation. The development of such an instrument can help policy makers understand real stakeholder needs and improve the service offering of transport systems in ways that are important to stakeholders. The scope of the present research excludes bicycle users, residents, and bus operators. It is recommended that further research should replicate the survey developed in this study using different collaborative groups, as well as in diverse spatial scopes to validate the involved constructs and items.

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References

Bagozzi, R.P., Yi, Y., & Phillips, L.W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, *36*(3), 421–458.

Beirao, G., & Cabral, J.A.S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy*, *14*(6), 478–489.

Brown, S.W., & Swartz, T.A. (1989). A gap analysis of professional service quality. *Journal of Marketing*, *53*(2), 92–98.

Carman, J.M. (1990). Consumer perceptions of service quality: An assessment of the SERVQUAL dimensions. *Journal of Retailing*, *66*(1), 33–35.

Carr, C.L. (2007). The FAIRSERV model: Consumer reactions to services based on a multidimensional evaluation if service fairness. *Decision Sciences*, *38*(1), 107–130.

Chen, F.Y., & Chang, Y.H. (2005). Examining airline service quality from a process perspective. *Journal of Air Transport Management*, *11*(2), 79–87.

Chou, C.P., & Bentler, P.M. (1995). Estimates and tests in structural equation modeling. In R.H. Hoyle (Ed.), *Structural equation modeling. Concepts, issues and applications* (pp. 37–55). California: Sage Publications Inc.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334.

Deng, W. (2007). Using a revised importance–performance analysis approach: The case of Taiwanese hot springs tourism. *Tourism Management*, 28(5), 1274–1284.

Enright, M.J., & Newton, J. (2004). Tourism destination competitiveness: A quantitative approach. *Tourism Management*, 25(6), 777–788.

Gilbert, D., & Wong, K.C. (2003). Passenger expectations and airline services: A Hong Kong based study. *Tourism Management*, 24(5), 519–532.

Gronroos, C. (1984). A service quality model and its marketing implications. *European Journal of Marketing*, 18(4), 36–44.

Gursoy, D., Chen, M.H., & Kim, H.J. (2005). The US airlines relative positioning based on attributes of service quality. *Tourism Management*, 26(1), 57–67.

Hansen, E., & Bush, R.J. (1999). Understanding customer quality requirements: Model and application. *Industrial Marketing Management*, 28(2), 119–130.

Hatcher, L. (1994). *A step–by–step approach to using the SAS system for factor analysis and structural equation modeling*. Cary: SAS Institute Inc.

Hensher, D.A., Stopher, P., & Bullock, P. (2003). Service quality – developing a service quality index in the provision of commercial bus contracts. *Transportation Research Part A: Policy and Practice*, 37(6), 499–517.

Hinkin, T.R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, 1(1), 104–121.

Jiang, J.J., Klein, G., & Crampton, S.M. (2000). A note on SERVQUAL reliability and validity in information system service quality measurement. *Decision Sciences*, 31(3), 725–744.

Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1), 141–151.

Kettinger, W.J., & Lee, C.C. (2005). Zones of tolerance: Alternative scales for measuring information systems service quality. *MIS Quarterly*, 29(4), 607–621.

Liou, J.H., & Tzeng, G.H. (2007). A non–additive model for evaluating airlines service quality. *Journal of Air Transport Management*, 13(3), 131–138.

Martilla, J.A., & James, J.C. (1977). Importance–performance analysis. *Journal of Marketing*, 41(1), 77–79.

Nathanail, E. (2008). Measuring the quality of service for passengers on the hellenic railways. *Transportation Research Part A: Policy and Practice*, 42(1), 48–66.

Nunnally, J.C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw Hill.

O'Neill, M.A., & Palmer, A. (2004). Importance–performance analysis: A useful tool for directing continuous quality improvement in higher education. *Quality Assurance in Education*, 12(1), 39–52.

Pakdil, F., & Aydm, O. (2007). Expectations and perceptions in airline service: An analysis using weighted SERVQUAL scores. *Journal of Air Transport Management*, 13(4), 229–237.

Parasuraman, A., Zeithaml, V.A., & Berry, L.L. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, 49(4), 41–50.

Parasuraman, A., Zeithaml, V.A., & Berry, L.L. (1988). SERVQUAL: A multiple–item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.

Park, J.W. (2007). Passenger perceptions of service quality: Korean and Australian case studies. *Journal of Air Transport Management*, 13(4), 238–242.

Rhoades, D.L., & Waguespack Jr, B. (2000). Judging a book by it's cover: The relationship between service and safety quality in US national and regional airlines. *Journal of Air Transport Management*, 6(2), 87–94.

Rivard, S., & Huff, S.L. (1988). Factors of success for end–user computing. *Communications of the ACM*, 31(5), 552–561.

Saleh, F., & Ryan, C. (1991). Analysing service quality in the hospitality industry using the SERVQUAL model. *The Service Industries Journal*, 11(3), 324–345.

Saravanan, R., & Rao, K.S.P. (2007). Measurement of service quality from the customer's perspective – an empirical study. *Total Quality Management & Business Excellence*, 18(4), 435–449.

Tikkanen, H., Alajoutsijarvi, K., & Tahtinen, J. (2000). The concept of satisfaction in industrial markets: A contextual perspective and a case study from the software industry. *Industrial Marketing Management*, 29(4), 373–386.

Triplett, J.L., Yau, O.H.M., & Neal, C. (1994). Assessing the reliability and validity of SERVQUAL in a longitudinal study: The experience of an Australian organization. *Asia Pacific Journal of Marketing and Logistics*, 6(1/2), 41–62.

Tsaur, S.H., Chang, T.Y., & Yen, C.H. (2002). The evaluation of airline service quality by Fuzzy MCDM. *Tourism Management*, *23*(2), 107–115.
Wall, G., & McDonald, M. (2007). Improving bus service quality and information in Winchester. *Transport Policy*, *14*(2), 165–179.
Wang, R.T. (2007). Improving service quality using quality function deployment: The air cargo sector of China airlines. *Journal of Air Transport Management*, *13*(4), 221–228.
Zeithaml, V.A., Parasuraman, A., & Berry, L.L. (1990). *Developing Quality Service: Balancing Customer Perceptions and Expectations*. New York: The Free Press.

Appendix

Instrument for measuring transport system service quality

Pedestrian Service

X1. You feel safe while using the pavements and there is little conflict between pedestrians and vehicles.
X2. You feel free to walk around without affecting or being affected by other pedestrians.
X3. You feel comfortable when brushing past other pedestrians.
X4. Infrastructure provider attaches importance to a pedestrian friendly environment.

Tangibles

Y1. Infrastructure/service provider regularly maintains equipment.
Y2. Infrastructure/service provider supplies adequate traveler information.
Y3. The physical facilities are spacious and do not make users feel pressured.
Y4. The total emissions caused by your vehicle do not damage the community health.
Y5. The vehicle you use if not noisy.
Y6. You use an environmentally friendly vehicle.
Y7. Making an increasing number of trips in your vehicle does not increase natural resource consumption.
Y8. The earth is sufficiently resilient to deal with the natural resource consumption of your vehicle.

Reliability

Y9. The infrastructure/service gets you to your destinations on schedule.
Y10. The infrastructure/service is dependable.
Y11. The infrastructure/service provider ensures the services at the time it promises to do so.
Y12. The services provided meet your demands.

Responsiveness

Y13. It is easy to find the channel of infrastructure/service provider for making complaints.

Assurance

Y14. It is rare to have accidents in the infrastructure/service.
Y15. The infrastructure/service provider attaches importance to the safety of users.
Y16. You feel safe while taking trips via the infrastructure/service.
Y17. You can trust the safety plan created by the infrastructure/service provider.

Empathy

Y18. The waiting time for using the infrastructure/service is short.
Y19. You can quickly arrive at your destinations via the infrastructure/service.

Y20. The infrastructure/service is usually congestion free
Y21. The infrastructure/service densely spreads over the metropolitan area.
Y22. The adequate infrastructure/service means that there are no hard-to-reach areas within Taipei metropolis
Y23. You can easily access the infrastructure/service.
Y24. The infrastructure/service allows you to easily reach anywhere you need to go.
Y25. All individuals can utilise the infrastructure/service without barrier.
Y26. It is easy for users with special needs, including the elderly, the disabled, or pregnant women, to use the infrastructure/service.
Y27. No significant difference exists between the utilisation of specific and general users in the infrastructure/service.
Y28. Infrastructure/service providers create a satisfyingly barrier-free environment.
Y29. The ratio of monthly travel costs to disposable income is low.
Y30. Your total monthly travel expenses are not so high that they impact other activities in your daily life.
Y31. The infrastructure/service is affordable for low-income users.
Y32. You can afford to take the trips you need through the infrastructure/service.