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A user's perception survey of quality and reliability of urban public transport services in Asian cities

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Abstract

Asia has urbanized and growing urban population demands for better urban mobility services. There are concerted efforts by authorities to improve public transport in Asian cities. However, the mode share of public transport is still low in many cities and use of personal vehicles is dominant. This is leading to an increase in congestion, consumption of fossil fuels, road accidents, emissions, and air pollution. The quality and reliability of public transport services play an important role in attracting more commuters. Stakeholders' participation is an important aspect of urban transport planning according to their needs. The paper presents the findings of a survey of public transport users in five Asian cities. The user satisfaction surveys along key public transport routes indicate mixed results. While the users are satisfied with services in Bandung, Thimphu and Tehran, majority of survey respondents in Dhaka and Ho Chi Minh city are not satisfied with the public transport services. The results provide useful insights for transport planners and public transport regulators and operators to improve accessibility, safety, quality and reliability of public transport systems. The improvement of services would help to attract more commuters to the system and increase the mode share of public transport thereby enhancing the overall sustainability of public transport systems.

Keywords Public transport, Asia, user's perception, quality, reliability, safety

1. Introduction

More than 50% of the Asian population are living in urban areas. By 2030, 2.7 billion people will be living in urban areas in Asia [1]. This rapid urbanization and the growth and concentration of private motor vehicles in urban areas is putting pressure on already congested urban public transport systems. Bengaluru, Manila, New Delhi, Mumbai, Jakarta and Bangkok are Asian cities with high level of congestion [2].

The one of the accepted narratives to improve sustainability of passenger transport is to increase the use of public transport and discourage private modes [3]. Asian countries and cities are working to extend the reach of and improve public transport systems. For example, construction and expansion of mass transit systems is progressing in many Asian cities Jakarta, Dhaka, Bangkok, Hanoi, Ho Chi Minh city and many other Asian cities including Chinese, Indian and Iranian cities. Bus rapid transit (BRT) systems operate in 46 Asian cities with 1772 km of routes carrying 8 million passengers per day [4].

Despite the efforts to improve of physical infrastructure, network, and services of urban public transport, it is often seen that in many Asian cities the public transport is not able to attract enough passengers. The mode share of public transport is still low in many cities and the use of personal vehicles is dominant.

In addition to formal public transport, different types of paratransit complement public transport systems and provide services to inner city areas. However, there is always an issue of safety, comfort, and behaviors of operators. On demand transport is getting poplar their use is strongly correlated with age and lifecycle stage, and it has potential to grow and increase use of public transport and get new users in Australia [5]. Given the existence of many forms of paratransit in Asia, some put blame on informal transport and their operators for low service quality in public transport [6].

There is an aspiration for Asian cities to be seen as a metro city and some cities are planning to develop at least a line of metro. Cities with large and dense transit networks developed based on the concept of transit-oriented development (TOD) with affordable fare structure can attract and serve more commuters and become green [7]. There have been efforts to look at engagement of community and people in improving public transit use and TOD [8] and public private

partnership can be used to develop rail transit in Asia [9].

For efficient mobility solution, a network of public transport providing accessibility to maximum number of urban residents is essential. The public transport network could include a combination of different forms and modes of transport with integration that allows users for seamless intermodal transfer among modes. Physical, service, operational and fare integration of public transit can be enhanced with use of digital technologies with combined ticketing [10]. A trip usually needs to use a combination of different transport modes. Providing real-time information and digital payment for public transport makes it more efficient, attractive as well as convenient for users for smooth transfer. Strategies to improve comfort, punctuality, travel time, and safety of bus services can attract more commuters to buses in Delhi [11].

An assessment of 25 Asian cities revealed that the quality and reliability of public transport services varied from 30% to 89% satisfied users. The investment in public transport was low as a share of total transport investment in many cities. It is usually observed that cities have preference for high end transit systems rather than improving the services in existing systems. Usually, the operation of public transport is subsidized by the city, state, or national government. But the low fare level was not able to attract many commuters to public transport owing to poor quality, reliability and safety of the systems. Therefore, assessing and evaluating user's perception on the quality and reliability of public transport is important to plan public transport system considering the users need as well as to improve the services. Davis [12] argues for the transparency of policy formulation and implementation process and continuous engagement of multiple-stakeholders and innovations can support enhancement of governance capacity.

Identification of policy gaps to improve reliability of bus and BRT operations can be helpful for the public transit planning and operations [13]. Commuter satisfaction survey is a useful tool for transport planners [14]. There has been practices of obtaining users' perception in Asian cities. But it is important to use the results to improve public transport planning, operation and quality of services and reliability. However, it is usually observed that there is much focus of planning and lack of implementation [15]. The frequency of survey and implementation is much affected by resource constraints in Asian context. Even in Europe (Spain) the public consultation is considered more theoretical rather than practical [16].

Operational arrangements, whether the system is operated under public transport operator, state enterprises or by the private sector play an important role in service quality [17]. Public perception about the quality and reliability of urban public transport services plays an important role in attracting more commuters to use public transport. Stakeholder engagement and interaction contribute to loyalty, service quality perceptions and satisfaction [18].

In this context, the paper evaluates the user perception of quality and reliability of public transport systems in five Asian cities. Commuters' perception survey is conducted using eight attributes of quality and reliability [19].

The proposed study is one of the first to cover several cities in Asia to analyze users' perception on eight attributes of operation of public transport system using one approach and methodology. In-depth survey and interaction with users, operators and decision makers in the process supported in to draw conclusions and develop strategies to identify barriers and improve public transport operations. Earlier studies that covered Asian cities took different approaches and methods, some of those are: Bandung [20]; Delhi [11]; Dhaka [21]; Jakarta [22]; Jogjakarta [23]; Manila [24]; Moscow [25]; Multan [26], and Tehran [27].

The paper contributes to the body of literature on urban mobility and practices to support the narrative to increase the use of public transport and improve overall sustainability. The findings of the research would be useful for the cities and countries to: (i) improve planning, operation and service of public transport against compliance of the process and requirement; (ii) reflect on the survey process using eight attributes and rating methods; (iii) monitor the achievement of Sustainable Development Goal (SDG) 11 "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all" and SDG target 9.1 "Develop quality, reliable, sustainable and resilient infrastructure" [28].

2. Literature review

Relationships among customer preferences, customer satisfaction, and customer segments in public transport have been the interest of many researchers [29-35]. Some studies look at the specific issues of public transport services in developing countries and developed criteria to improve design of quality standards for public transport [36]. Canitez [37] used the concept of socio-technical perspective to study the role institutional settings, governance structures, and urban mobility challenges taking a case of Istanbul city.

Some explored three main perspectives of place sustainability that included the perception of residents, the physical reality, and the investment of the local government [38]. There are different quality factors that could be included in public transport user satisfactions surveys [39]. The World Business Council for Sustainable Development (WBCSD) adopts an indicator approach to assess transport quality. The WBCSD study for the city of Indore [33] focused on measuring satisfaction with the city's BRT system only. A study in Tehran stresses that on-board surveys provide useful reflection of user's perceptions [27].

There has been a growth of publications covering public transport reliability [40] however they use different approaches. There are concepts of evaluating the whole journey approach when commuting by using more than one mode of public transport. Dixit et al. [41]

developed a methodology using smart cards to study reliability of multiple transfers and factors influencing the variability of travel time [42].

High quality and reliable urban public transport services are crucial to attracting passengers and reduce personal motorized transport in the long term. The user's positive experience of the service is critical for people's desire to choose public transport. Periodic evaluation of user satisfaction is therefore becoming a common approach among urban public transport operators using satisfaction surveys [43]. There are both objective and subjective indicators approaches used to measure quality and reliability of public transport services, but the subjective approach is usually preferred. Also, stakeholder consultation and engagement are critical parts in the process of development of policy and planning to improve mobility [12]. The quality and reliability of public transport services is one of the indicators of the sustainable urban transport index (SUTI) developed and applied in more than 35 Asian cities [44, 45].

These studies indicate that while assessing quality and reliability, there is no agreed standard for it. There are two approaches taken, the subjective assessment through the satisfaction survey, and objective assessment evaluating functional aspects of public transport quality such as punctuality or connectivity. The Gesellschaft für Internationale Zusammenarbeit (GIZ) provides a condensed summary of various approaches on 'Measuring Public Transport Performance' [32].

Objective assessments are often used by major, technically advanced systems such as Metros. Three of the most used attributes are on-time performance, headway regularity, and the adherence to running time [30]. Many other possible objective indicators for reliability have been applied but according to van Ort [46] and others there is still limited consistency in their usage and interpretation as an indicator of public transport quality. Therefore, subjective measurement through satisfaction surveys is commonly used.

For customer satisfaction survey reliability, safety, customer services and comfort are important attributes, and these have been used in BRT in Latin America [47] and Iran [48], bus transit in Scotland [49] and Addis Ababa [50], intercity rail service in Thailand [51] and bus in Phnom Penh [52]. While others stressed the importance of convenience [53]. Many argue that the service quality has a significant and direct relationship with accessibility [54] and user's perception on integration of services that includes fares and physical and service [55]. Punctuality and comfort were the two most important attributes used in Belgrade [56]. In Indonesia more efforts are required to improve consumer satisfaction [23].

The survey and review of public transport have been used to inform and improve planning process. A review of Istanbul public transport systems shows that the quality of life there has improved [57]. A survey in a Japanese city indicate that generally older people show higher travel satisfaction in using public transit [58]. Standards for level of service vary among cities and largely depends on user's expectation and local context [59]. Relationship between transport users' perceptions and travel behaviours as well as locational, socio-demographic, psychological and cultural factors affect commuters' mode choice [60]. TRB's Transit Capacity and Quality of Service Manual identifies four types of stakeholders: passengers, transit agency, motorists and community and set out quality of service standards [61].

Satisfaction survey of six European cities revealed that travel satisfaction is positively related to accessibility (network coverage, travel speed and service frequency), costs and perceived societal and environmental importance of public transport [62]. There is however difference in opinion of users, planners, and policymakers on how to make mobility sustainable [63].

Improvement of public transport is linked to sustainability and quality of life and reliability of public transport is an important issue [64]. A study of Multan identified service planning, infrastructure of stations, access, and integration as critical elements for success of BRT [26]. It is important to evaluate the quality of service at bus stations and BRT platforms [65] and BRT operators work to improve quality standard of services along all corridors [22]. There has been evaluation of direct and indirect incentive mechanisms for increasing public transit ridership through partnerships with the private sector [66].

In some cities the car dependency is hampering the use of public transport due to limited accessibility and survey was conducted to understand the public opinion and to shift behavior to use metro in Qatar [67]. The COVID-19 pandemic forced authorities to rethink transport and urban planning [68]. Public transport authorities in Manila utilized the opportunity to initiate public transport reforms [24].

The quality and reliability of public transport services is defined as the degree to which passengers of the public transport system are satisfied with various attributes of the quality and reliability of service while using the different modes of public transport [44]. The result is expressed as the overall share of satisfied customers as percentage (%) of all public transport users based on a survey. The guideline recommends a minimum of 30% satisfaction and 95% satisfaction [19]. Thus, cities should aim to have a high level of satisfaction with public transport commuters. A score of more than 50% on each attribute is considered satisfactory.

3. Method and data collection

3.1 Selection of cities

The cities were selected in consultation with countries and cities following the proposal received from the candidate cities expressing interest for assessment of urban mobility using the sustainable urban transport index (SUTI) framework. Three criteria were used for city selection, The first criterion was that proposed cities must have some forms of public transport and policies and plans for improvement. A second criterion was

familiarity with city context and availability of information on public transport. The third criterion was having good local contacts that make the planning for the survey, collection of data and additional interviews possible. The five Asian cities, three capital cities and two secondary cities, were selected for the study. These cities are part of the border group of cities where the sustainability assessment of urban mobility was conducted. The study was designed to include cities from different subregions of Asia having different public transport systems, economy, and urban context. Tehran city is from South-West Asia, Dhaka and Thimphu are from South Asia, and Bandung and Ho Chi Minh city are from South-East Asia. The cities are of different sizes, represent different national, spatial and economic characteristics and have different forms of public transport systems and services. The similarities as well as differences in characteristics offer to draw some policy insights. Table 1 shows basic characteristics of five cities selected for the study.

Table 1 Basic characteristics of the five cities selected for study.

Characteristics City	Size (sq Km)	Population	Average density (pop/sq Km)	Form of public transport
Bandung	167.7	2.48 mil.	14,795	BRT, Bus, *Angkok* (Expansion of BRT planned)
Dhaka	303	17.00 mil.	56,105	Bus, water taxi, metro, paratransit, (BRT and Metro extension planned)
Ho Chi Minh	2,095	8.99 mil.	4,291	Bus, water taxi (Metro and BRT planned)
Tehran	730	9.10 mil.	12,465	Metro, BRT, Bus (Expansion of BRT and Metro planned)
Thimphu	26.13	114,551	4,384	Bus, (Improvement Bus, light BRT and LRT planned)

(Source: compiled from various sources)

3.2 Attributes and rating scale

Based on the review of literature, it is important to identify key attributes of urban public transport services to seek feedback from the users on quality and reliability of services. The results then can be used to improve the overall service quality of public transport. Public transport regulators can use the results to seek improved services from operators where the result values are low or less satisfactory.

The following eight attributes of quality and reliability recommended in Economic and Social Commission for Asia and the Pacific (ESCAP) guideline [19] were used for the survey. These eight attributes are similar to the recommended attributes in the study by de Oña and de Oña [35]. The commuters were asked the question "How satisfied are you with the following aspect of public transport service:

i. Frequency of the service
ii. Punctuality (delay)
iii. Comfort and cleanliness of vehicles
iv. Safety of vehicles
v. Convenience of stops/stations
vi. Availability of information
vii. Personnel courtesy
viii. Fare level.

During the survey, the commuters were asked to rate their satisfaction with the above eight attributes on a 7, 5- or 3-point scale. The suggestion is to use a seven-point scale, five point or three-point scale, for the survey. The following are the rating scales:

i. Very dissatisfied
ii. Dissatisfied
iii. Partly dissatisfied
iv. Neither satisfied nor dissatisfied
v. Partly satisfied
vi. Satisfied
vii. Very satisfied.

ESCAP data collection guideline provides detail information on the collection of data and analysis [19].

3.3 Commuters survey

The surveys were conducted in Dhaka, Tehran and Thimphu during 2017 and 2019 [69-71]. Ho Chi Minh City and Bandung the results of the customer satisfaction survey of public transport conducted by the research institute and transport agency are used [72, 73]. Table 2 shows the sample size, survey time and approach taken for the user's perception survey. The data collection and analysis were part of the overall sustainable mobility assessment of these cities [19, 44, 45, 74].

Table 2 Survey method and sample size in cities.

S. No.	City	Sample size	Survey time	Survey method
1	Dhaka	280	2018	Survey of commuters at bus stops and on board along 5 major public transport corridors. Used seven-point scale.
2	Tehran	300	2019	Three surveys of passengers on the bus, BRT and Metro conducted. Results presented in two categories as satisfied and unsatisfied.
3	Thimphu	125	October 2019	Survey of commuters along major public transport routes. Results presented in two categories as satisfied and unsatisfied.
4	Ho Chi Minh	400	2017	Commuters survey along major bus routes. Used five-point scale.
5	Bandung	250	April-June 2017	Survey of commuters of the Trans Metro Bandung. Results presented in two categories as satisfied and unsatisfied.

Even though it was recommended to use a unified approach for the survey, cities used different sampling methods and approaches. The questionnaire used in Tehran was slightly different but covered all the attributes outlined in the methodology [71]. The survey in Ho Chi Minh city included more attributes than suggested in the methodology and used a 5-point scale [72].

The implication of the research and findings was to inspire city authorities to use the findings to improve the public transport services and attract more commuters to use public transport. However, the implementation and use of results depends on local authorities and availability of resources (limited) in Asian context and on the structure of how public transport is managed. For example, in some cities it seems the lack of implementation of regulation, regular maintenance of vehicles and maintaining quality standards.

4. Result

Table 3 shows key four sustainability indicators related to public transport in five Asian cities. As the cities size and urban transport context is different, we should be cautious in comparing the findings among five cities. In these cities, the mode share of public and active transport ranges from 19% in Bandung to 87% in Dhaka, accessibility ranges from 38% in Bandung to maximum 93% in Tehran, satisfaction level of quality and reliability was low with 38% in Dhaka and high 88% in Bandung (only BRT). The fatality data for Dhaka is 1.64 fatality per 100,000 population is too good compared with national average of 15.3 [75]. This could represent underreporting and result of dense population in Dhaka. Also, the mode share includes share of active transport (17%) and fixed service paratransit (14%). The commuter's dissatisfaction in the survey do not go along with high mode share of public transport indicating the captive users of forced to use irregular public transport systems in Dhaka. Among these five cities Tehran has high accessibility covering 93% of urban residents with bus, metro and BRT network followed by Ho Chi Minh city with 76% coverage. The completion of ongoing BRT and metro system in Dhaka is expected to increase the accessibility of public transport.

4.1 Overall findings

This section presents overall finding of the survey in five Asian cities. Figure 1 shows the radar plot of satisfaction survey of five Asian cities. It can be observed that the commuters in Bandung, Thimphu and Tehran are more satisfied with the quality and reliability of public transport service. Most commuters in Dhaka and Ho Chi Minh city were not satisfied with the quality and reliability of public transport in those two cities. In the case of Dhaka, the users poorly rated punctuality, safety, comfort, and provision of information to the users. In Dhaka commuters only rate the fare level as satisfactory. While in Tehran all public transport modes (BRT, Bus and Metro) the provision of information was rated poorly, and the operations were not punctual. The case was similar in terms of provision of information to users in Thimphu bus service and where users also rated location of bus stops and comfort and cleanliness in buses poorly than other attributes. Ho Chi Minh city was only city among five where the respondents rated all attributes on quality and reliability poorly, except for fare level. While Bandung BRT was rated highly by respondents and only punctuality scored lowest among other attributes. The results of individual cities are discussed in the following section.

Table 3 Key public transport indicators of sustainability in Asian Cities.

	Cities Sustainability indicators	Bandung	Dhaka	Ho Chi Minh	Tehran	Thimphu
1	Modal share of active and public transport in commuting	19.34%	87.11%	28.58%	37.40%	36.80%
2	Convenient access to public transport service (% of population covered by public transport)	38.00%	56.50%	75.77%	93.23%	52.76%
3	Public transport quality and reliability (% satisfied)	88.00%	37.90%	41.77%	62.01%	63.52%
4	Traffic fatalities per 100,000 inhabitants	4.36	1.64	8.00	7.39	6.11

(Sources: [69-73])

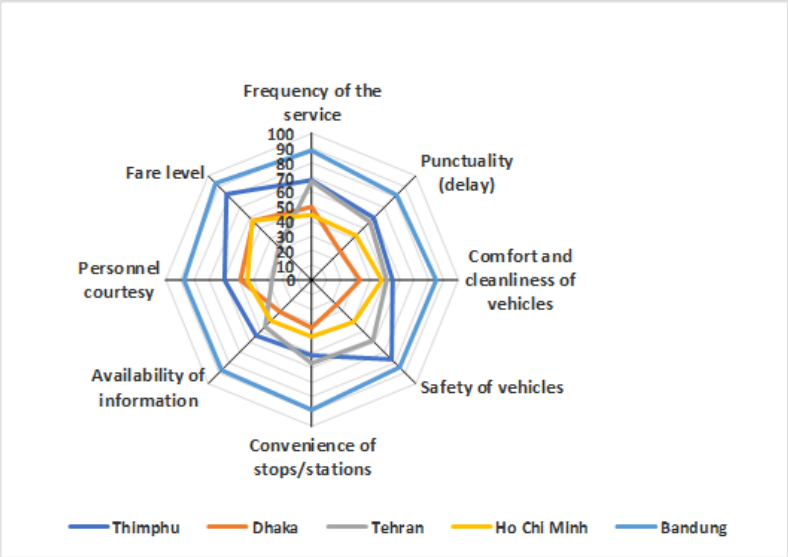

Figure 1 Radar plot of perception survey of Asian cities.

4.1.1 Frequency of the services

The results of the surveys show that the commuters are satisfied with the frequency of public transport services in Bandung and Tehran. However, they are not satisfied with the frequency of services in Dhaka, Ho Chi Minh city and Thimphu. The commuters in Dhaka can be considered marginally satisfied with the frequency.

4.1.2 Punctuality

The results of the surveys show that the commuters are satisfied with the punctuality of public transport services in Bandung, Tehran and Thimphu. However, they are not satisfied with the punctuality of services in Dhaka and Ho Chi Minh city.

4.1.3 Comfort and cleanliness of vehicles

The results of the surveys show that the commuters are satisfied with the comfort and cleanliness of vehicles in Bandung, Tehran and Thimphu. However, they are not satisfied with the comfort and cleanliness of vehicles in Dhaka and Ho Chi Minh city.

4.1.4 Safety of vehicles

The results of the surveys show that the commuters are satisfied with the safety of vehicles in Bandung, Tehran and Thimphu. However, they are not satisfied with the safety of vehicles in Dhaka and Ho Chi Minh city.

4.1.5 Convenience of stops or stations

The results of the surveys show that the commuters are satisfied with the location of public transport stops in Bandung, Tehran and Thimphu. However, they are not satisfied with the location of bus stops in Dhaka and Ho Chi Minh city.

4.1.6 Availability of information

The results of the surveys show that commuters are satisfied with the availability of information on public transport in Bandung and Thimphu. However, they are not satisfied with the availability of information on public transport in Dhaka, Ho Chi Minh city and Tehran.

4.1.7 Personnel courtesy

The results of the surveys show that the commuters are satisfied with the courtesy and etiquette of drivers and staff of public transport in Bandung, Tehran and Thimphu. However, they are not satisfied with the courtesy and etiquette of driver and staff in Dhaka and Ho Chi Minh city.

4.1.8 Fare level

The results of the surveys show that the commuters are satisfied with the fare level of public transport in all

cities: Bandung, Dhaka, Ho Chi Minh city, Tehran and Thimphu. The surveys find the fare level in Asian cities affordable, usually local and federal governments provides subsidies to the public transport operation.

4.2 Individual city

This section presents detailed findings of the survey in each city.

4.2.1 Bandung

Public bus, Trans Bandung Metro (TBM), paratransit (minibuses) and taxis provide public transport service to commuters. There are 15 bus routes operated by Djawatan Angkoetan Motor Repoeblik Indonesia (DAMRI), four BRT corridors, 39 *Angkot* (paratransit) routes which are very popular and convenient modes of public transport in Bandung. In addition, a fleet of free yellow school buses for school students is operated by the city. The mode share of bus and scheduled minibus is very low with *Angkot* taking significant share of public transport because of affordability, frequency, and convenience.

Figure 2 shows the results of the customer satisfaction survey conducted in Bandung. The result shows that the commuters are satisfied (88%) with the service of BRT system in Bandung [73]. In addition to the eight attributes suggested in the methodology, the survey included one additional attribute. Bandung also has bus and semi-organized paratransit (*Angkot*) services which are not included in the survey. Punctuality and quality of services are two attributes that received the low rating of 82% and 84% respectively. Some of the bus stops of the TBM are not actually used as they are raised from the road.

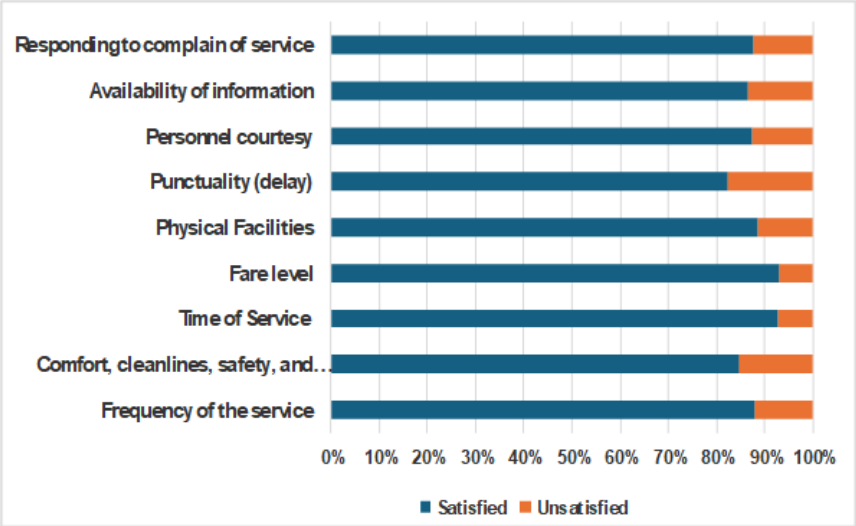

Figure 2 Result of commuter satisfaction survey in Bandung. (Source: [73]).

4.2.2 Dhaka

Dhaka, one of the most populous and dense emerging megacities in the world, suffers from lack of efficient public transport systems. Bus, minibus, various paratransit, and rickshaw are main constituent of public transport systems in Dhaka. There are 152 bus routes with 237 bus stops in Dhaka. Water transport, Hatirjheel Water Taxi service is also getting popular in providing a cost effective and quick transportation system inside Dhaka city. Circular bus service (Dhaka-Chaka) in Hatirjheel area is also popular and helps to ease the movement in and around Gulshan and Banani area [69]. In order to improve public transport construction of BRT and expansion of metro is progressing in Dhaka.

Table 4 shows the results of the satisfaction survey in Dhaka. It can be observed from the result that overall, 38% of respondents are satisfied with the quality and reliability of public transport in Dhaka. This is similar to the findings of Munira and Santoso [21] that indicated a high level of user dissatisfaction on the use of public transport in Dhaka. Only the fare level received a score of 56% and personal courtesy and frequency of service is satisfactory. But people are highly dissatisfied with the safety issues (24%). The old vehicle fleet, lack of proper bus stops and bus bays for boarding and alighting passengers are adding to safety concerns [69]. Punctuality received a very poor score (27%) due to frequent undesignated stops and sudden boarding and alighting of passengers. Due to heavy traffic congestion in Dhaka, maintaining the schedule is difficult. Comfort and cleanliness also received poor scores. Though enough buses from different companies are available on the road, still there is a huge lack of well-defined bus stops.

4.2.3 Ho Chi Minh City

Public bus is main mode of transport in Ho Chi Minh city and the city operates total 144 bus routes (including 105 subsidized bus routes and 39 non-subsidized bus routes). The bus based public transport services with 4,405 bus stops/stations cover about 27% of city area and 67% of population [72]. However, the mode share of scheduled bus and minibus is very low as the accessibility is not even across different parts of the city. Water bus along the Saigon River has started service in

recent years with limited stations. To enhance sustainability the city operates 299 buses using clean fuel CNG. Construction of subway is ongoing with planned completion in 2022.

Table 5 shows the result of the overall satisfaction level was low with 44.77%. Among attributes cleanliness at bus and bus stops received low score, followed by safety and security and bus route.

Table 4 Results of survey of public transport quality and reliability in Dhaka.

Attributes	Dissatisfied			Neutral	Satisfied			Responses	Average Score	% Satisfied
	Very		Partly		Partly		Very			
	1	2	3	4	5	6	7			
Frequency of Service	52	44	32	12	108	26	5	279	3.64	49.82
Punctuality	18	85	77	23	56	17	4	280	3.29	27.50
Comfort and Cleanliness	23	28	84	53	67	23	2	280	3.68	32.86
Safety of Vehicles	25	35	78	71	48	16	2	275	3.50	24.00
Convenience of Bus Stops or Stations	25	28	74	58	76	11	2	274	3.63	32.48
Availability of Information	21	22	72	78	64	23	0	280	3.75	31.07
Personal courtesy	17	23	49	54	119	14	3	279	4.04	48.75
Fare Level	8	20	45	46	83	51	22	275	4.52	56.73
Total	189	285	511	395	621	181	40	2222	3.75	**37.90**

(Source: [69])

Table 5 Result of commuter's satisfaction survey in Ho Chi Minh City.

Attributes	Dissatisfied		Neutral	Satisfied		*Response*	*Satisfied (%)*
	Very	**Partly**		**Partly**	**Very**		
Driver's attitude	2	41	178	166	13	400	**44.75**
Bus conductor's attitude	1	35	188	162	14	400	**44.00**
On-bus facilities (air conditioner, seats)	3	25	182	174	16	400	**47.50**
Bus route	1	16	214	155	14	400	**42.25**
Running time (open/close of line)	2	24	198	162	14	400	**44.00**
Ticket price	1	4	166	202	27	400	**57.25**
Safety, security	3	58	176	141	22	400	**40.75**
Cleanliness of bus	3	37	212	135	13	400	**37.00**
Cleanliness at bus station	6	45	216	122	11	400	**33.25**
Operation information of bus	1	20	220	148	11	400	**39.75**
Station distance	2	22	220	145	11	400	**39.00**
Feedback on questions	2	7	246	135	10	400	**36.25**
General evaluation	11	30	210	148	1	400	**37.25**
Responses	**38**	**364**	**2626**	**1995**	**177**	**5200**	**41.77**

(Source: [72])

4.2.4 Tehran

Tehran's public transport system includes variety of public transport modes like bus, BRT, metro, taxi, fixed-route taxi, private taxi, and internet taxi. Taxi is the most popular public transport modes in Tehran. There are about 4785 bus stations and 347 BRT stations in Tehran. Tehran BRT system now has expanded to 12 corridors and 214 km in length carries 850, 000 passengers per day [4]. Tehran metro consists of six lines, with a total 215 km length and 114 stations and total of 723 million trips were made by metro in 2017 [71]. A new bike service named "Bidood" is in operation in 3 districts of Tehran. Tehran Municipality is implementing "Safe and Smooth Transportation and Traffic" policy to improve public transport in Tehran. The weighted average of the users' satisfaction level of these three main public transport modes, was 60% (Table 6).

For bus, metro and BRT transport availability of information was poorly rated with only16%, 27% and 17% satisfied respectively, punctuality of BRT was also

poorly rated by users at 33%, for metro fare level was rated poorly with 32% satisfied. The result of surveys is shown in Table 7.

Table 6 Public transport users' satisfaction survey in Tehran.

Mode	Satisfied (%)	Mode Share (%)	Weightage Satisfied
Bus	60.10	46	**27.64**
BRT	64.2	39	**25.04**
Metro	49.15	15	**7.37**
Total satisfied			**60.05%**

4.2.5 Thimphu

Thimphu with population of 114,551 is stretched along narrow Wangchu river valley running 17 km north south direction, and three km east west direction. Total 270 km of road network and pedestrian walkways provide public transport infrastructure. A fleet of 56 city buses, 3024 taxis, 36567 private cars, 1591 government cars and 3334 two wheelers support the transport needs of the city. Public bus service along 15 routes with a fleet of 49 buses is operated by Bhutan Postal Corporation, a public sector entity. Use of private cars for commuting dominates mode share with 49%. Only 15% of the commuters use city bus services followed by use of taxi by 9.7% commuters. Walking remains the second most popular mode with 22% share [70]. Studies to develop a light rail transit to connect Paro (airport) and Thimphu and development of light BRT to improve public transport were conducted and discussed.

Figure 3 shows the result of survey on quality and reliability of the public transport in Thimphu. Overall score on quality and reliability of public transport is 63.5%. Riders rated the fare of city buses as very reasonable and the total score on the fare is 82.9%. This is quite expected as the government has subsidized the city bus services operated by the Bhutan Postal Corporation. The commuters have rated the convenience of bus stops, availability of information and comfort and cleanliness the lowest. The high satisfaction level seems to have not translated to more share of public transport in Thimphu with 36.8%. The fact that personal vehicles are the preferred mode for commuters due to the complex behavioural aspect that make using a personal vehicle a prestige.

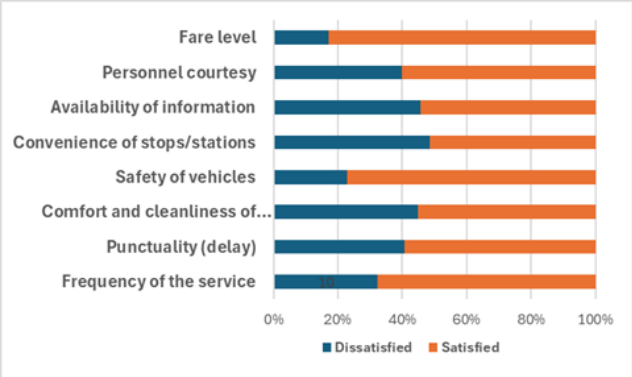

Figure 3 Result of user's survey in Thimphu. Source ([70]).

Table 7 Result of user's perception survey of the public transport in Tehran.

Survey attributes	Bus		Metro		BRT	
	Dissatisfied	Satisfied	Dissatisfied	Satisfied	Dissatisfied	Satisfied
Frequency of the service	25	75	33	67	18	82
Condition of air & temperature inside vehicles	38	62	-	-	24	76
Cleanliness of inside vehicles	27	73	44	56	15	85
Cleanliness of outside vehicles	28	72	-	-	18	82
Personnel courtesy	21	79	49	51	32	68
Satisfaction/safety of vehicles driving	23	77	41	59	20	80
Punctuality (delay)	50	50	43	57	67	33
Convenience of stops/stations	50	50	55	45	42	58
Availability of information	84	16	73	27	83	17
Fare level	53	47	68	32	39	61
Total Responses (%)	**399 (39.9%)**	**601 (60.1%)**	**407 (50.85%)**	**393 (49.15%)**	**358 (35.8%)**	**642 (64.2%)**

Source ([71])

5. Conclusions

The paper has analyzed the perception of commuters towards the quality and reliability of public transport systems and services in five Asian cities. Eight key dimensions are used for a user's satisfaction survey and rating on a 7 or 5- point scale. We could observe the different perception of commuters with respect to eight dimensions that relate to quality and reliability of service of public transport. The results indicate that commuters in Bandung, Tehran and Thimphu are satisfied with the services and the commuters in Dhaka and Ho Chi Minh city were not satisfied with public transport services.

The commuters were satisfied with the frequency of public transport services in Bandung and Tehran. However, they are not satisfied with the frequency of services in Dhaka, Ho Chi Minh city and Thimphu. The commuters in Bandung, Tehran and Thimphu were satisfied with most of the surveyed attributes such as the punctuality of services, the comfort and cleanliness and safety of vehicles, the courtesy and etiquette of drivers and staff and location of public transport stops but they were not satisfied with these five attributes in Dhaka and Ho Chi Minh city.

The commuters are satisfied with the availability of information on public transport in Bandung and Thimphu. However, they are not satisfied with the availability of information on public transport in Dhaka, Ho Chi Minh city and Tehran. Lack of transfer stations and provision of information on public transport stops and stations can help commuters in planning their trips. Cities have developed and used public transport mobile applications in order to improve accessibility of information on public transport cities. These applications provide real-time information on operation. Availability of information on public transport services influences travel choice behavior of users [76].

The commuters are satisfied with the fare level of public transport in all five cities. The surveys find the fare level in Asian cities affordable, usually local or national governments provides subsidies to the public transport operation.

The survey results provide useful insights to the public transport regulator to improve public transport services from the operators. In the case of Dhaka, many efforts are required to improve punctuality, safety, comfort and provide information to users. While in Tehran all public transport modes (BRT, Bus and Metro) need to provide more information to the users, improve punctuality and improve accessibility by designing appropriate location of public transport stops. Additional efforts are required to provide information to users, designate proper bus stops and improve comfort and cleanliness in bus service in Thimphu. Ho Chi Minh city bus operation needs to improve all aspects of service quality and reliability. While the survey indicated good satisfaction with the services of Bandung BRT and punctuality scored lowest among others. It is usually overserved that private operators provide better public transport operators, but it was not true for Dhaka.

There is growing use of different form of paratransit in Asian cities with mode share of passenger using paratransit is significant such as *Angkot* in Bandung. They should also be included while evaluating and assessing existing public transport systems in cities. Even though there are plans to expand public transport systems in these five cities, it is important that the city authorities, regulators or operators use the survey results to improve safety, comfort, and courtesy, and to provide adequate information on public transport to the public and plan bus stops at convenient locations. Similarly, more Asian cities could utilize the survey and assessment methodology and [19] to receive feedback of commuters and utilize the results to improve quality standards of public transport services [61] and attract more commuter to use the public transport.

It is important to increase accessibility by extending service and improve quality and reliability of services based on feedback received from the commuters. All these cities operated combination transport systems. In Dhaka one line of metro has just started operation and the construction of BRT is still progressing. The construction of metro in Ho Chi Minh city is ongoing. Thimphu is planning for a light BRT and light rail transit (LRT); expansion of metro and BRT is ongoing in Tehran and expansion of BRT is planned in Bandung. There is much work to be done to improve the quality and reliability of public transport in Asian cities. Some of measures that can be taken to attract more commuters to public transport could be: (i) designation of bus bays and stops with information on public transport; (ii) at grade boarding and alighting and provision for special need people at stations and inside buses; (iii) regular maintenance of buses and phasing out old bus fleets from the city; (iv) improvement of traffic management system; (v) improve punctuality and reliability of services; and (vi) provide regular training for drivers and bus crew.

Concerns of differently abled and gender need to be considered in planning processes to improve the quality of public transport and living in urban areas [77]. Looking the gender issues of public transport in Azerbaijan, Georgia and Pakistan, it was observed that the public transport is failing in providing required service to women and girls in terms of safety and security and there were cases of harassment while using public transport [78].

There is practice of conducting periodic user's satisfaction surveys by transport authorities- that need to include all important attributes of quality and reliability of public transport services. But the question is how effectively the results are used to improve service and further planning of public transport systems in the city. It would largely depend on the management of regulators and operators of public transport in each city.

It is a very well-established fact that accessibility, quality of services, frequency and punctuality affect the operation of public transport and ridership. The study

confirms the above facts, but the question is why the operators are not able to reflect on the findings of earlier surveys and improve service and increase ridership. Frequency of service is related to demand on a particular route. In some case it may be necessary to look at and review the public transport routes and initiate new service routes.

Further research focusing on users' perspectives and operators' needs including gender and social dimensions would provide deeper insights into improving public transport services and attract more commenters to the public transit systems in Asia.

6. Limitations

The sample size and response varied among cities. The commuters were asked to rate their preference on a 7, 5- or 3-point scale. But in the case of Tehran and Thimphu - the results are presented only in two categories-satisfied and unsatisfied even though the survey included these ratings. The survey of Bandung considered BRT users only. It does not include the perception on other modes such as bus and paratransit (*Angkot*) which is a very popular mode in Bandung. The survey in Bandung was conducted by the transport operator and shows a high level of satisfaction, it could possibly be a positive bias. The surveys in Tehran and Ho Chi Minh city used more attributes of quality and reliability. The gender and social dimensions are important aspects for planning and provision of public transport services; however, the survey did not include specific questions related to these dimensions. The urban mobility context, number of responses and level of detail for each city is different, therefore the findings are more applicable to each city to improve quality and reliability of public transport service. We should be cautious in generalizing and comparing the findings among the cities.

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Author Contributions

The author did all the research work for this study.

Competing Interests

No conflicts of interest exist.

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