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ACCESSIBILITY TO PUBLIC TRANSPORT FROM THE PERSPECTIVE OF THE AGED PEOPLE IN DEVELOPING COUNTRIES: A CASE STUDY IN HANOI, VIETNAM

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Abstract. Providing equal accessibility to social activities and transport to everyone is an important task of the transport authorities, especially in developing countries. However, the transport planners mainly focus on expanding the network coverage but lack attention on the accessibility to the service for the aged people. In this study, we have investigated the preferences of different accessibility indicators from the perspective of the aged people in developing countries using the Analytical Hierarchy Process (AHP) technique. The importance level obtained from the popular rating via the Likert scale will also be compared with the AHP results. The findings presented in this work contributed more insights on the preferences of the aged people on accessibility to public transport, subsequently, better inform transport planners to improve the bus services in these countries. The comparison between self-report surveys via rating and preferences would be a reference for the consideration of survey tools in similar studies.

Keywords: accessibility, public transport, elderly people, motorcycle-based cities.

1. INTRODUCTION

Many Southeast Asia (SEA) countries are facing a growing population of aged people while the economic development level is still low [1]. The underdeveloped public transport in many SEA motorcycle-based cities gives the aged people limited travel choices other than self-driving with motorcycle and/or walking nearby their residential location. The mixed traffic creates a risky travel environment [2], especially for aged people. Studies found that self-driving elderly people are more affected by aggressive traffic than other ages [3]. The risk associated with accidents caused by aged motorcycle drivers is also a public concern [4] in these cities.

To meet the demand of the increasing aged population and their mobility issues, the developing countries should promote an equity transport system. In which, accessibility to public transport is the core aspect to attract the passengers [5], especially the elderly people because most of them have been found facing several obstacles when accessing public transport [6,7]. Evaluating and measuring accessibility with the concentration on the elderly people, therefore, have been extensively investigated in literature [3–12]. Nevertheless, most of them are dedicated to developed countries.

Among various accessibility measurements, individual-based measurements are more appropriate to reveal users' perspectives about the accessibility of public transport. Individual-based measurements are commonly collected from the users' self-report via rating the level of importance or satisfaction on a specific accessibility aspect [13]. The most popular rating form is the ordinal Likert scale. However, the means and standard deviations from such scale only imply the users' knowledge of the items other than their relative ranking [14].

Meanwhile, under constrained budgets in developing countries, various accessibility aspects are needed to be prioritized [12]. The relative importance level among accessibility aspects is a better representation of the users' evaluation than the statistics of the rating scale. The pair-wise comparison approach for the users' preferences, thus, has recently drawn attention from researchers because of its fair comparison between different items [15]. However, applications in evaluating public transport accessibility are limited [12].

This study investigates the preferences of different accessibility indicators from the perspective of aged people in Hanoi, Viet Nam, a developing country in SEA. The accessibility indicators are selected through the review from various case studies in literature. Analytical Hierarchy Process (AHP), a popular pair-wise comparison technique [16] is adopted to derive the importance order. Besides, the result from the popular rating via the Likert scale will also be compared with AHP results.

The findings are expected to contribute more insights on the preferences of the aged people on accessibility to public transport, subsequently, better inform transport planners to improve the bus services in the city as well as other cities with similar context. In addition, the comparison between self-report surveys via rating and preferences would be a reference for the consideration of survey tools in similar studies.

The rest of the paper is structured in five sections. The first section reviews previous studies on the accessibility to public transport so as to obtain the accessibility indices that are appropriate to the aged people in developing countries. The next two sections introduce our approaching method and the case study context, respectively. The fourth section presents the results. The last section concludes the paper.

2. LITERATURE REVIEW

Accessibility to public transport is defined as the ease that all passengers with different characteristics can use public transport [17]. Accessibility could be related to the effort to reach the bus stop, the ease to get on the right vehicle to the right place or be affordable to buy the ticket, etc. More comprehensive review can be found in [13,18].

Table 1: Review of Public Transport Accessibility: Individual-based Indicators.

Indicators	Method/ Target users /Citations
Stops and station facilities, Crossing facilities Information at stops, Vegetation, Bus driver attitude, Access to stops and stations, Quality of footpaths, On-vehicle facilities, Construction works	Quantitative/Pair-wise preferences. Aged people in Australia [12]
Accessibility to stop/stations (access/egress distance and time, condition), Vehicles (safe boarding, vehicle recognization), Service (operating time), Ticketing system, Information system	Quantitative/Rating. General users in Ho Chi Minh City, Vietnam [13]
The comfort, cleanliness and crowding of the bus; Need for transfers; Driver's attitude and helpfulness; Route (network area covered) Access to service: Ease of access to stops and stations; Bus stop location and distance between stops; Handicap access installations; External interface to pedestrians, cyclists, car and taxi; Availability of park and ride schemes; Operation: Waiting and transfer time; Boarding and Alighting time; Total travel time; Reliability of the service ; Operating hours; Frequency Information and facilities: Availability of shelters, benches and waiting areas at stop; Availability of amenities at terminals; Information during travel; Availability of information at station; Pre-trip information; Fare: Bus fare; Availability of multimode tickets; Ease of purchasing tickets; Availability of monthly discount passes; Safety and security Visible monitoring; Lighting, noise, vibration, speed and temperature on bus; Safety during trip ; Absence of offensive; Security against crimes on bus and at stops	Quantitative/Pair-wise preferences. General users in Belfast city, United Kingdom [21]

In general, public transport accessibility measures are categorized as time factors, cost factors, reliability, security/safety, quality, comfort/stress, information and booking [19]. Different from the facility-based or place-based indicators that are objectively obtained by quantitative measures such as the distance to the nearest bus stop, the number of opportunities, individual-based indicators are derived in order to reveal the users' perspective about public transport accessibility. Appropriate indicators should address the problems that the users experience the service.

Studies showed that elderly and disabled people when using public transport, like most other people, faced common difficulties such as the far distance from the residence to the bus station, the long waiting time, the low frequency of route, or whether the fare is supported or not, and even the driver's or assistant's support, etc [12,20]. However, specific accessibility indicators are generally dependent on the specific setting of the transport system, available services, and local behaviour.

In the context of developing countries, Tuan and Son [13] conducted a systematic review on accessibility indicators for the case of Ho Chi Minh City, Vietnam. Indicators representing all three accessibility components (accessibility to the services, accessibility to public transport system and accessibility to the bus stop/station) were developed. However, among investigated indicators, the authors did not consider the role of the on-board drivers and conductors' attitudes. A summary of accessibility indicators from various case studies is presented in Table 1.

It is revealed from the literature review that there are extensive investigations on various aspects of the accessibility to public transport. However, study for the aged people in the developing countries, especially on their perspective about the importance level of various accessibility aspects is rare. This is the gap that this study wants to address.

3. METHOD

The set of accessibility indicators selected for investigation in this study is mainly pertained from the study by Tuan and Son [13] for Ho Chi Minh city. As a free pass has been issued for the aged user in Hanoi since 2019 [22], the perception of the aged users on this policy is also taken into consideration. As we also target at the aged people who have no experience with using public bus, too detail indicators might confuse the non-bus users leading to bias in their answers. A more inclusive list is derived with six accessibility indicators: *1) Accessibility to Stops/Stations (close distance, easy access); 2) Accessibility to Bus Route Information (at the bus station, via smartphone, telephone,); 3) Day fare subsidy / Freeride pass for elder people; 4) Waiting time/Frequency; 5) Utilities at Stops/Stations (Shelter, Seats); 6) Comfort level of passengers on the bus (seat, bus drivers/conductors' attitude, notification sound)*. A self-report survey using both rating and preference forms will be developed and distributed to the aged people in Hanoi, Vietnam, a motorcycle-based city in SEA developing country.

3.1. Rating form

In the rating form, the users are asked to rate the importance level of each indicator using an ordinal Likert scale (Table 2). The weighted rating (WR) of indicator i is obtained using Eq. (1):

$$WR_i = \sum_{b_l=0,1,2,3,4} \frac{b_l * n_{il}}{N_i} \quad (1)$$

Here, n_{il} is the frequency of indicator i evaluated with the importance level l; N_i is the number of users rating indicator i.

Table 2: Importance level in Likert scale

Importance level	**Not important at all**	**Slightly important**	**Important**	**Very important**	**Extremely important**
Value (*b*)	0	1	2	3	4

3.2. Preference form

The selected accessibility indicators will be analyzed to find out the importance rank order from the perspective of the elderly bus users using AHP which is the most popular method among the Multiple criteria decision-making techniques (MCDM). MCDM refers to all methods to support people’s decision-making process according to their preferences [16] is an optimal probable approach [23].

AHP is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology [24]. It represents an accurate approach to quantifying the weights of decision criteria. Individuals' experiences on the problem of interest are utilized to estimate the relative magnitudes of factors through pair-wise comparisons. Each of the respondents compares the relative importance of each pair of items using a specially designed questionnaire.

The AHP questionnaire was created by choosing the importance level between two criteria. The importance of one criterion over another was ranked using a scale between 1 and 9 to represent the intensity of importance, as presented in Table 3.

Table 3: Applicable importance scale in AHP questionaire [24]

Importance scale	**Of equal importance**	**Somewhat important**	**Important**	**Very important**	**Extremely important**
Value	1	3	5	7	9

To calculate the AHP weights, a *k x k* matrix is constructed with *k* is the number of criteria, *k*=6 in our case study. The diagonal elements of the matrix are always 1 (one). If attribute *i* is more important than attribute *j*, the actual judgment value is recorded in the matrix element *(i, j)*. On the contrary, if attribute *j* is more important than attribute *i*, then the reciprocal value is recorded. Following this process, the matrix was populated with the judgment values for every element in the upper triangular matrix. The lower triangular matrix is completed using the reciprocal values of the upper diagonal using Eq. (2)

$$a_{ji} = \frac{1}{a_{ij}} \qquad \textbf{(2)}$$

where a_{ij} = element of row *i* and column *j*.

The relative importance (AHP weight) of the criterion is derived by normalizing the intensity values of each column and averaging the values of each row. The average of all the individual weights provides the overall criterion weight, as shown in Eq. (3)

$$W = \frac{1}{n}\sum_{p=1}^{n} W_p \qquad (3)$$

where W_i is the normalized eigenvector of the chosen criteria for Respondent *p*; and *n* = number of respondents involved in the pairwise comparison.

A *Consystency Ratio* (*CR*) is required to account for the inconsistency in judgement, it is determined by the formula below:

$$CR = \frac{CI}{RI} = \frac{(\frac{\lambda_{max} - k}{k - 1})}{RI} \quad \textbf{(4)}$$

where *CI* is the consistency index; *RI*: random consistency index *RI* = 1.24÷1.26 if *k* = 6 [24]; *λmax* is the principal eigenvalue of the matrix; and *k* is the number of criteria

$$\lambda_{max} = \sum_{i=1}^{k} \left[W_i * \sum_{j=1}^{k} a_{ij} \right] \quad (5)$$

The weights of the criteria represent the importance and the priority given by each of the respondents for chosen criteria.

4. DATA COLLECTION

A survey was conducted in Hanoi from September to October 2021, targeting the people of age over 55, the common retirement age of Vietnam. It should be noted that during this period, the Covid-19 pandemic situation was complicated. This consequently affected the use of public bus due to the adjustment in operating schedule as well as the users avoid using public service. However, this situation does not significantly affect the objective of this study, which mainly focuses on the general accessibility indicators.

Hanoi is a typical motorcycle-dominated city with nearly 80% of daily trips by motorcycle. Public transport infrastructure is underdeveloped. The share of public transport ridership in Hanoi is only 12% which is quite low for an 8 million inhabitant city [22]. The authorities have put efforts into improving network coverage by increasing the number of bus stops, the number of vehicles, providing onboard Wi-Fi, designated seats and free ride passes for the elders in Hanoi from 2019. This effort only increased the rate of elderly users to 16.8% while the main users' age ranged from 13 to 22 [22].

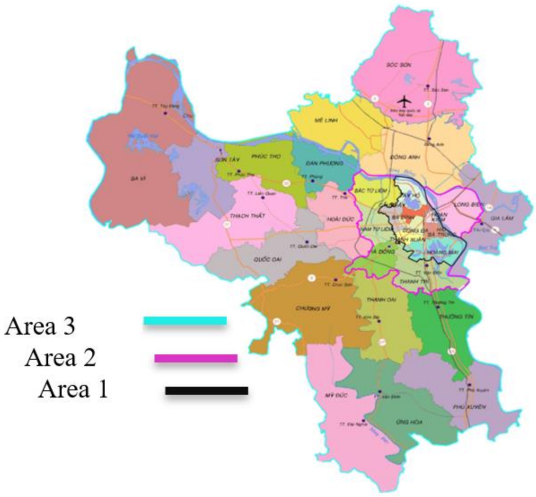

Figure 1: Study area (Edited from [25]).

Due to the Covid-19 pandemic, the planned face-to-face survey was affected by the strictly extended national lockdown. An online survey on Google Forms was considered as an alternative to keep social distancing. After the first pilot test, the survey's link has been shared with people who are in various Hanoi districts (Figure 1) via online social networks. The feedback rate was very low because the format of the questionnaire on a smartphone screen was difficult for the aged volunteers to finish. Besides, studies showed that most elderly people in developing countries have limitations in using smartphones or computers for such tasks [26]. Therefore, young people who are living with the seniors in the household were also invited to support the survey.

Within a scope of this study, the sample size is determined on the basic of the analysis tools. Saaty [27] did not specifically indicate a minimum sample size to apply AHP method. Therefore, we applied the rule of thumb that the number of responses should be at least five times the number of interested indicators [21]. With 6 indicators, the minimum size is 30. However, in 115 feedback answers, 111 valid responses were received.

Indicator (A)	Extremely important	Very important	Important	Somewhat important	Of equal importance	Somewhat important	Important	Very important	Extremely important	Indicator (B) (B)
	(A) than (B)					*(B) than (A)*				
Accessibility to Stops/Stations (close distance, easy access)										Accessibility to Bus Route Information (in bus station, via smartphone, telephone,)
Accessibility to Stops/Stations (close distance, easy access)									/	Day fare subsidy / Free ride pass for elder people
Accessibility to Stops/Stations (close distance, easy access)										Waiting time / Frequency
Accessibility to Stops/Stations (close distance, easy access)										Utilities at Stops/Stations (Shelter, Seats,)
Accessibility to Stops/Stations (close distance, easy access)										Comfort level of passengers on the bus (seat, bus drivers/conductors' attitute, notification

Figure 2: Sample AHP questions.

The survey questionnaire consisted of three main sections namely general information, bus user's experience, and questions for the pair-wise comparison on accessibility indexes. The first general information part refers to the socio-demographics of respondents, which shows characteristics of the study group such as age, gender, education level, self-income, number of household vehicles, etc. The second part consists of questions on the respondents' most frequent bus trip information such as frequency, purposes, ticket type, typical trip duration, distance, etc. In the third part, respondents were asked to complete the rating scale and pair-wise comparisons of six selected accessibility indicators (Figure 2).

5. EMPIRICAL RESULTS

Figure 3 presents the distribution of CR value which reflects the consistency in the respondents' answer on the pair-wise comparison. As recommended by [24], the critical CR value is recommended to be less than 0.1. However, the larger threshold up to 0.3 could also be adopted without affecting overall evaluation due to practical issues [12,28–31], for example involving elderly respondents. Approximate 70% of the 111 valid respondents whose CR value falls within the selected threshold (0.3) are reported hereafter.

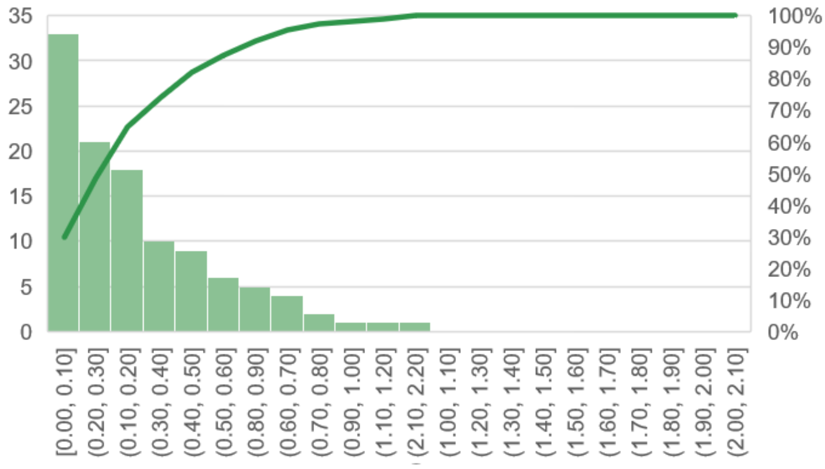

Figure 3: Relative frequency of consistency ratio CR - all respondents.

Table 4 presents some descriptive information on the 73 respondents with CR not larger than 0.3. The share of male and female respondents of 44.44% and 55.56% respectively reflect the share in the population. The monthly income of more than 65% of the respondents is less than 5 million VND which is at a low average level. The most frequent travel mode of the aged people in our sample is ‘Walking’ (76.12%), followed by self-driving motorcycle (36.6%). Regarding the distance to a bus stop, nearly 60% of the respondents’ are living within a radius of 500m from the bus stop.

Table 4: Descriptive information on the selected sample.

	Sociodemographics
Gender	Male (44.44%); Female (55.56%);
Age	55 - 65 (55.56%); 65+ (44.44%);
Living area	Urban Districts (23.61%); New developed Districts (52.78%); Rural Districts (23.61%);
Education Level	High school (76.39%); Undergraduate (20.83%); Postgraduate (2.78%);
Monthly income (mill. VND)	Not stable (15.28%); Less than 2 (6.94%); 2 - 5 (44.44%);5 -10 (30.56%); More than 10 (2.78%);
	Mobility pattern: Frequently used transport mode
Self-driving motorbike	Never (28.17%); Sometimes a year (11.27%); Sometimes a month (23.94%); Sometimes a week (36.62%);
Self-driving car	Never (81.82%); Sometimes a year (3.03%); Sometimes a month (9.09%); Sometimes a week (6.06%);
Bicycle	Never (26.76%); Sometimes a year (11.27%); Sometimes a month (26.76%); Sometimes a week (35.21%);
Public bus	Never (11.27%); Sometimes a year (32.39%); Sometimes a month (38.03%); Sometimes a week (18.31%);
Walk	Never (1.49%); Sometimes a year (5.97%); Sometimes a month (16.42%); Sometimes a week (76.12%);
Grab/Taxi	Never (10.94%); Sometimes a year (54.69%); Sometimes a month (34.38%); Sometimes a week (0%);
Riding with family member	Never (4.48%); Sometimes a year (29.85%); Sometimes a month (49.25%); Sometimes a week (16.42%);
Distance to	Under 250m (13.89%);250m – under 500m (25.00%);500m – under 750m

nearest bus stop	(20.83%);750m – under 1km (33.33%); More than 1km (6.94%);
	Bus trip patterns
Frequency of using bus	Rarely (30.30%); 2-3 times / month (46.97%); 2-3 times/ week (21.21%); Everyday (1.52%);
Purpose	Visiting relatives/Friends (35.90%); Shopping (5.13%); Entertainment (20.51%); Health care (35.04%); To work (3.42%);
Searching for trip information	Ask relatives (31.18%); Online searching (19.35%); At Bus stop (48.39%); Ask random traveller (1.08 %)
Access mode	Bicycle (1.19%); Walk (70.24%); Self-driving motorbike (2.38%); Taxi (4.76%); Riding with family member (21.43%);
Ticket type	Free bus riding pass/Monthly pass (47.76%); Trip-based ticket (52.24%);
Trip start-time	5:00 - 8:00 (35.82%);8:00 - 11:00 (50.75%);14:00 - 17:00 (10.45%);17:00 - 20:00 (2.99%);
Vehicle waiting time (minutes)	Less than 5 (0%);5-15 (86.57%);16-25 (7.46%);26-35 (2.99%); More than 35 (2.99%)
In-vehicle time (minutes)	Less than 15 (1.49%);16-30 (19.40b%);31 - 45 (55.22%); More than 45 (23.88%);
Trip distance (km)	Less than 5 (2.99%);5 - 10 (23.88%);10 - 15 (49.25%); More than 15 (23.88%);

5.1. Importance rank: AHP weights vs Weighted Rating

The weighted ratings of the six accessibility indicators derived from Equation (1) are presented in Figure 4. In general, the weighted ratings of all indicators are larger than 2.0 which indicated that the users considered all aspects important. However, 'Comfort level of passengers on the bus' is the most important indicator while small different ratings among the others.

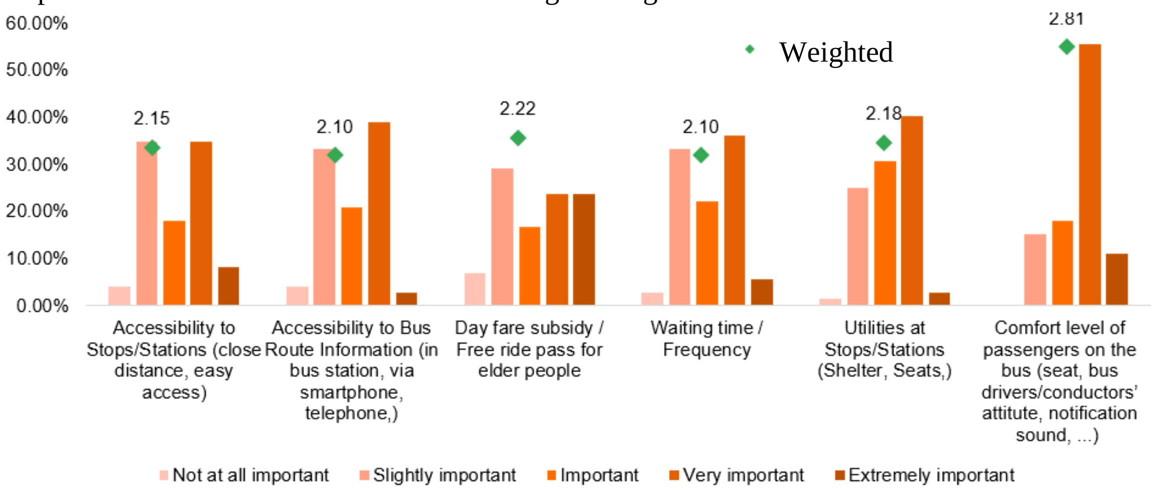

Figure 4: Weighted Importance level of All Indicators.

From aggregated results (Figure 5), '*Day fare subsidy/free ride pass for elder people*' is considered the most important indicator (AHP weight of 0.217); followed by '*Comfort level of passengers on the bus*' which is just slightly lower (0.216); '*Accessibility to Stops/Stations*' is the third important indicators. '*Utilities at Stops/Stations*' and '*Waiting time/frequency*' are rated equally important (0.144 and 0.145); the least is '*Accessibility to bus route information*'.

This result suggests that inconsistent conclusions could be made from the two approaches in our case study. As pointed out in [14,15], the rating via ordinal scale approach is not capable of capturing the order of items they evaluate. Major studies applied this self-report form due to its simplicity. In contrast, the pair-wise comparison approach based on the AHP technique has its internal consistency check procedure. Therefore, its result reflects the nature of the ordering from the users' perspective. However, to obtain higher consistency feedback, this AHP pair-wise comparison approach requires more effort on the survey than its counterpart.

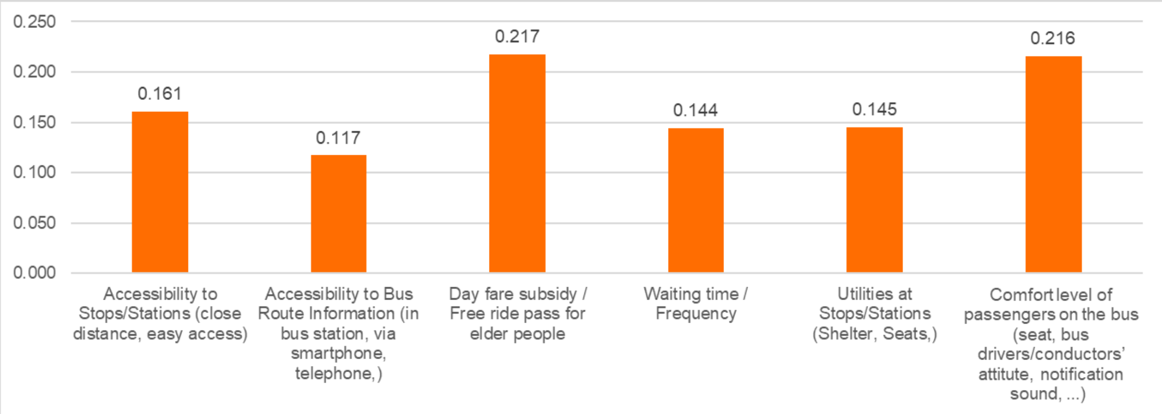

Figure 5: AHP Weights of All Indicators.

5.2. Perceived preferences of the aged people on Accessibility to public transport

The perception of the aged people on accessibility to public transport is dependent on the socio-demographic variables such as age, gender, and travel pattern such as bus use frequency, service quality at residential areas [32]. We considered two age groups using the threshold of 65. Two groups of '*Ticket type'* were defined with the assumption that the respondents who are using monthly passes (both free and paid passes) are the frequent users and the others are occasional users. The t-test for the differences between groups defined by those variables is presented in Table 5. Figure 8 to Figure 7 illustrate the difference/indifferences among accessibility indicators by different groups.

In general, there is almost no different perception between male and female aged people in Hanoi. '*Accessibility to Stops/Stations*' indicator significantly affects people whose age is more than 65 years old. As the holders of the monthly pass are considered frequent bus users, they are more concerned about the '*Utilities at Stops/Stations*' and '*Comfort level of passengers on the bus*' than the counterpart. However, this difference is rather weak with a 90% confidence level.

The most differences are observed across the different geographic areas of the city. Historically, Hanoi is divided into three areas with different development characteristics. Area 1 consists of the central districts. The more recently developed districts are categorized into Area 2 and the rural districts are categorized as Area 3.

The aged people living in Area 2 rank "*Comfort level of passengers on the bus*" as the most important indicator in public transport accessibility while those who live in Area 3 rank '*Day fare subsidy /Freeride pass for elder people*' the most important indicator. The higher the average income, the easier it is to get the free pass in Area 1 and 2 than in Area 3 are the main contributors to these differences.

Table 5: T-test results on the different AHP weight between groups.

Indicators	Area 1/ Area 2	Area 2/ Area 3	Area 1/ Area 3	Gender	Age group	Ticket type
Accessibility to Stops/Stations (close distance, easy access)	-0.536	2.484**	1.348	1.014	-2.150**	-0.623
Accessibility to Bus Route Information (in bus station, via smartphone, telephone)	-0.409	0.245	-0.069	-0.848	-0.618	0.326
Day fare subsidy / Free ride pass for elder people	0.735	-3.001***	-2.007**	1.540	0.762	-1.608
Waiting time / Frequency	2.006**	1.984**	3.131***	-0.739	-0.159	-0.187
Utilities at Stops/Stations (Shelter, Seats)	0.322	-2.000**	-1.681*	-1.513	1.424	1.737*
Comfort level of passengers on the bus (seat, bus drivers/conductors' attitute, notification sound)	-2.370**	2.652***	0.183	-0.947	0.520	1.735*

Significance code: '0.01': ***; '0.05': **; '0.1': *

The importance of '*Waiting time/Frequency'* is perceived differently among three areas with more than 95% confidence level. The highest value is perceived by the aged respondents living in Area 1 while the lowest value is recorded for ones living in Area 3. It should be noted that the density of public transport service is not equally developed with the bus network coverage decreasing from Area 1 to Area 3 [22]. In addition, due to the high population density traffic congestion are much more frequent in Area 1 and Area 2, consequently, the punctuality of public bus is lower in Area 1 and 2 than Area 3.

Besides, the aged people living in Area 3 rank the '*Utilities at Stops/Stations*' higher than the other two areas. Several surveys on the facilities at the bus stop in Hanoi [22,33] also revealed that only 1% of the bus stops in Area 3 are sheltered while this rate is nearly 25% in the other areas of the city.

Figure 6: AHP weights by gender

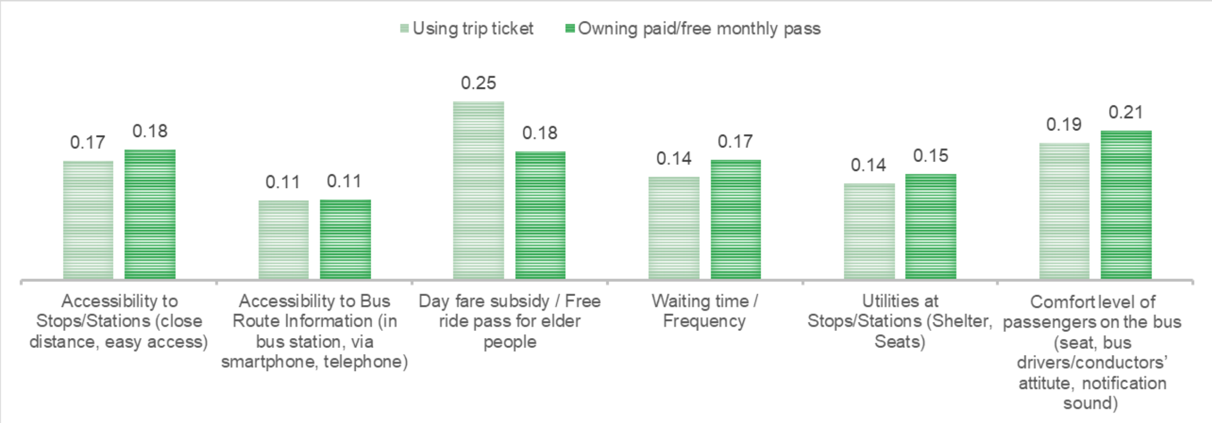

Figure 7: AHP weights by ticket types

Figure 8: AHP weights by respondents' living areas

Figure 9: AHP weights by age groups

4. CONCLUSION

This study investigated the patterns of the elderly people's bus trips and their preferences on the accessibility to public transport. Six representative accessibility indicators were considered, namely '*Accessibility to Stops/Stations'', Accessibility to Bus Route Information', 'Day fare subsidy / Freeride pass for elder people', 'Waiting time / Frequency', 'Utilities at Stops/Stations', 'Comfort level of passengers on the bus*'. An online-form questionnaire survey was sent out to the people from 55s living in Hanoi. The AHP analysis method was adopted to rank the perceived importance level among selected accessibility indicators. The main findings are followed.

The most important accessibility indicators perceived by the aged people in Hanoi are the subsidized ticket/freeride pass and the attitude of the onboard drivers and conductors. However, the different perceptions on the rank of accessibility indicators were also found across the age people of different ages, bus use frequency, and especially the living areas. This result suggested that the subsidy policies on the user side play an important role to encourage the use of public bus. Because it is known that most of the aged bus users in Hanoi have low or unstable income, especially the people residing in the rural area. Our findings contribute more insights for Hanoi transport authorities to improve public bus service, for example: promoting the free-riding pass to the elderly people. The subsidy scheme should also consider the senior people with an age range from 55 to 59. This is because people in these groups reach retirement age but are still younger than the eligible age to get the free pass.

Secondly, compared with the popular rating via ordinal Likert scale, the resulted rating from AHP method was better. However, a higher number of indicators make the AHP technique much more difficult to complete due to a large number of pair-wise combinations.

There are several limitations in our study that needs further researches. Due to the Covid-19 pandemic, the direct interview which is the best survey tool with the elderly people were not able to be conducted as we planned. This led to the high *CR* in our sample given the synthetic accessibility measurements. In addition, as the Covid-19 also affected the bus operation in Hanoi during the conduct of our survey, the respondents' answers were based on the reflection of their most recent experiences with the system. Therefore, updated improvement of the public transport system might not be captured in this study. On the other hand, more detailed accessibility indicators are expected to investigate in future studies.

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