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ANALYSIS OF PEDESTRIANS' SIDEWALK SERVICE

   Summary. The presence of sidewalks is very important to support the safety, comfortability, and activities of pedestrians in CBD (Central Business District). Therefore, this study was conducted to analyze the service quality of the pedestrian lanes in two CBDs of Banda Aceh City using the Importance-Performance Analysis (IPA) method. The results showed most of the service quality variables of the sidewalks are in quadrant A (concentrate here), followed by C (low priority), D (possible over-skill), and B (keep up the good work). This means the qualities of the sidewalk services need to be improved to ensure their performances are in line with pedestrians' expectations. This is necessary because most of the width and height of these sidewalks were found through field investigation not to meet government standards, whereas several obstacles were also discovered such as the presence of traders, merchandises, and parked vehicles, as well as the lack of seating facilities and disability lanes. These violations are part of the problems in many cities of Indonesia and other developing countries and are due to the lack of public awareness and supervision by the authorities. Therefore, further improvement is recommended to realize the expected pedestrian path.

1. INTRODUCTION

   The Central Business District (CBD) is one of the favourite destinations for travellers, and most of the movements are usually through walking, which has been reported to be an environmental-friendly transportation mode suitable for short-distance trips [1]. Moreover, recent transport policies are focused on energy-saving and pollution-reducing activities, and this requires making use of public and non-motorized transportation modes such as cycling and walking [2, 3]. According to Rajat et al [4], walking is a complete and at the same time a supplementary mode as observed with individuals accessing their vehicles or public transportation and in reaching final destination through the use of a sidewalk or a pedestrian lane. Most city centers have sidewalks with different facilities, but the number is still quite low in developing countries such as Indonesia owing to poor quality of the transportation system, with pedestrians and cyclists categorized mainly as the unprotected or vulnerable group [3]. In Russia, the concept of transport development involves providing safety for pedestrians and cyclists and differentiating transport flows [5], whereas those in Indonesia are observed not to be safe nor comfortable, thereby causing their abandonment. Some of the obstacles hampering pedestrian movement on these paths include merchandising and parking of vehicles as well as narrowness, improper connection, unevenness, and damaged parts. These, therefore, make pedestrians prefer to walk on motor vehicle highways lane, and this is considered dangerous and disruptive.

   Banda Aceh is the capital of the Aceh province located in the western end of Indonesia. It has two CBDs which are the old, Pasar Peunayong, and the new, Pasar Aceh. The sidewalks in the two CBDs have different qualities, but they are both not often used by several pedestrians despite their importance to the activities conducted in the city. They were also used as the route for emergency

evacuation during the 2004 tsunami disaster, being one of the least affected infrastructures. Therefore, there is a need to evaluate the satisfaction of pedestrians in the sidewalk facilities. This led to the conduct of this study to assess the service quality of the pedestrian lane at Pasar Aceh and the Pasar Peunayong shopping areas in Banda Aceh using the IPA (Important-Performance Analysis) method. The results of this study are expected to be used as a reference to improve the sidewalk in the future and consequently increase pedestrians' satisfaction. According to Said et al and Wang et al [6, 7], being satisfied with walking does not solely depend on the physical attributes of the environment but also the emotional perception. A study by Bellizzi, M. G. L. Forcinity, C [8] also suggested the pedestrian path should be made delightful and serviceable for users to ensure they are more pleasant with its use.

Satisfaction is the ability of the feature or the whole of a product or service to provide a pleasurable level of consumption-related fulfilment [9]. The concept was considered by Choi, T. Y. and Chu, R [10] to be a customer's evaluation of the food or service received to be at least as good as expected. According to Hansemark, O. C. and Albinson, M [11], "satisfaction is an overall customer attitude toward a service provider, or an emotional reaction to the difference between what customers anticipate and what they receive, regarding the fulfilment of some needs, goals or desire." The evaluation of service quality and customer satisfaction is, therefore, one of the strategies to resolve several problems in transportation as well as the development of appropriate techniques to identify the critical aspects of the supplied services toward increasing customer satisfaction [12]. Service quality is, however, closely related to user satisfaction and is usually applied as a specific assessment of services provided [13, 14].

Importance-Performance Analysis (IPA) is one of several marketing research techniques that involve the analysis of customers' attitudes toward product or service attributes and direct quality-based perceptions for marketing strategies [15, 16]. It was first proposed and introduced by Martilla and J. James [17] as a means to measure the satisfaction of clients in a product or service through the comparison of three factors, including the level of expectations, the importance of perception, and performance, such that when the expected service (ES) > perceived service (PS), the perceived quality is less than satisfactory and tends toward totally unacceptable quality with an increased discrepancy between ES and PS. Meanwhile, in a case ES = PS, the perceived quality is satisfactory, whereas ES < PS shows the perceived quality is more than satisfactory and tends toward ideal quality with an increased discrepancy between ES and PS [18].

2. CASE STUDY

2.1. Location

The physical area of research was in Baiturrahman and Kuta Alam sub-districts of Banda Aceh, both of which are directly adjacent to the river in the north part of the city. They are also reported to be located in the red zone of the tsunami and experienced severe effects during the 2004 disaster [19]. The map of the research location is shown in Fig. 1.

2.2. Research Samples

Primary data were collected through the distribution of questionnaires to respondents which are pedestrians in the two CBDs, Pasar Aceh and Pasar Peunayong. The number of samples in each route is shown in Table 1.

Table 1

The Number of Samples

CBD	Number of Samples (n)
1. Old CBD of Banda Aceh – Peunayong	79
2. New CBD of Banda Aceh - Pasar Aceh	72
Total samples	151

Fig. 1. Research Location

2.3. Variables and scale of measurement

The 19 variables utilized in this study are presented in Table 2.

The sidewalk service was assessed as either important or not based on the expectations of the pedestrians, with the results projected to be evaluated by the institution. The pedestrians' expectations and observed performance were measured using a 5-point Likert scale [20]. The levels of pedestrians' expectations for the sidewalk service are as follows [21]:

    a. The answer indicating "very important" has a score of 5.
    b. The answer indicating "important" has a score of 4.
    c. The answer indicating "neutral" has a score of 3.
    d. The answer indicating "unimportant" has a score of 2.
    e. The answer indicating "very unimportant" has a score of 1.

The level of pedestrians' satisfaction in the sidewalk service was assessed using the following indicators:

    a. The answer indicating "very satisfied" has a score of 5.
    b. The answer indicating "satisfied" has a score of 4.
    c. The answer indicating "neither satisfied" has a score of 3.
    d. The answer indicating "dissatisfied" has a score of 2.
    e. The answer indicating "very dissatisfied" has a score of 1.

3. METHOD

Data were collected through questionnaires distributed to the pedestrians in the buses at each route from 7:00 AM to 6:00 PM. The data obtained were processed through the following stages [21, 22]:

1. The average value for the service levels and pedestrians' expectations for each variable was calculated using the following equations:

$$\bar{X} = \frac{\Sigma xi}{n} \tag{1}$$

$$\bar{Y} = \frac{\Sigma yi}{n} \tag{2}$$

Note: $\bar{X}$ = Average score for the level of observed performance/satisfaction; $\bar{Y}$ = Average score for the level of expectation/importance; n = Number of respondents

The satisfaction level scores were plotted on the horizontal axis (x), whereas the expectation level scores were on the vertical axis (y).

Table 2
Variables of Research

Code	Variables
V1	The width of the sidewalk
V2	Lighting facilities along the sidewalk
V3	Bollard facilities (posts preventing vehicles from entering the pedestrian lane area)
V4	The facility which is the boundary between road and sidewalk
V5	The height of the sidewalk
V6	The sign facilities
V7	Pedestrian crosswalk facility
V8	Pelican cross facilities
V9	Special lane facilities for disabilities
V10	Seating facilities along the sidewalk
V11	Cleanliness
V12	Garbage bin facilities adjacent the sidewalk
V13	Air pollution conditions
V14	Sound pollution conditions
V15	Roadblocks, such as for street vendors, parking, and shops.
V16	Surface condition of pedestrian paths (no potholes, damage, and so on)
V17	Shelter for public transportation
V18	Facility to protect against weather
V19	Connectivity between sidewalks

2. The average values for the level of observed performance score (x) and the level of expectation/importance for all factors affecting satisfaction (y) were calculated by utilizing the following equations:

The values of $\bar{X}$ and $\bar{Y}$ are the perpendicular cross lines and the truncated dots $(\bar{\bar{X}}, \bar{\bar{Y}})$

$$\bar{\bar{X}} = \frac{\sum_{i=1}^{N} \bar{x}_1}{K} \tag{3}$$

$$\bar{\bar{Y}} = \frac{\sum_{i=1}^{N} \bar{y}_1}{K} \tag{4}$$

Note: K = The number of attributes/facts influencing pedestrians' satisfaction.

3. A Cartesian diagram was produced and divided into four parts/quadrants of A, B, C and D, as shown in Fig. 2.
4. The four quadrants were analyzed as follows:
   a. Quadrant A indicates the variable is a top priority and considered important with influence on customer satisfaction. Meanwhile, it has not been implemented according to the expectation of pedestrians; therefore, it is disappointing/dissatisfied.
   b. Quadrant B indicates the variable needs to be maintained in the future due to its successful implementation in accordance with pedestrians' expectations.
   c. Quadrant C is a low priority. The variables in this quadrant show several factors that are considered less important for pedestrians or ordinary, and the results are less satisfactory or of low priority.
   d. Quadrant D is excessive. This means the variables are less important but the implementation is excessive such that the pedestrians' consideration does not prioritize them but their results are satisfactory.
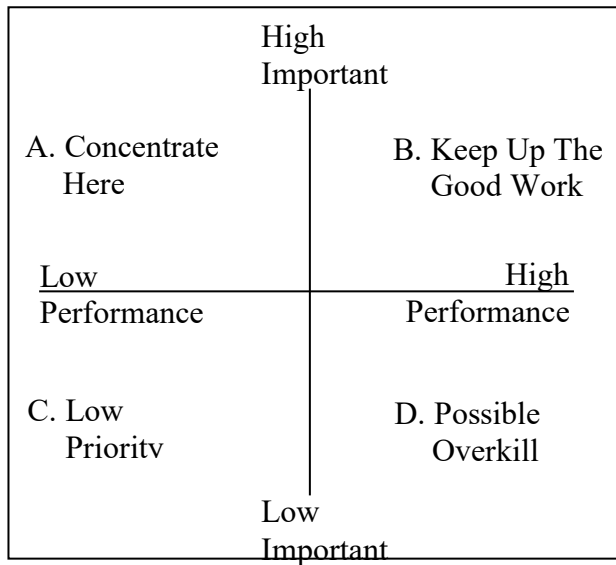
Fig. 2. Cartesian Diagram of IPA

4. RESULTS AND DISCUSSION

4.1. The existing condition of the sidewalks

Pasar Aceh and Pasar Peunayong are two CBDs in the city of Banda Aceh, and the observations of width and lane height showed most of the sidewalks do not meet pedestrian path standards in Indonesia. They were found to be constructed with an average width less than 2 m instead of a minimum of 2 m and the ideal value of 4 m required by standard, whereas lane height was averagely more than 15 cm, which is the maximum required by the standard. The sidewalks for the two CBDs were observed to have different standards and quality, in terms of safety and comfort owing to the differences in the application time, planners and contractors, widely used for other activities such as selling of goods and parking of motorized vehicles, and lack of facilities for disabled persons. The variations in the conditions in the sidewalk in each of these roads due to inappropriate designation have caused diverse problems. Moreover, public transportation routes are on K.H. Ahmad Dahlan, Diponegoro, and W.R. Supratman streets, whereas bus stops are located only on Diponegoro street, and this has led to the use of other transportation modes such as pedicabs and motorcycle taxis by the residents. It was also discovered that most of the sidewalks have lights, bins, marks, and signs, but there is a need to improve their conditions. The condition of the sidewalk is presented in Fig. 3.

Fig. 3. The photos of the sidewalks in the research location: a) Diponegoro Street; b) R.A. Kartini Street; c) Tgk. Chik Pante Kulu Street; d) K.H.A Dahlan Street; e. W.R. Supratman Street

Fig. 3 shows the effective width of the sidewalk has been reduced due to obstacles such as merchandise and parked vehicles, with the traders observed to be selling both on the sidewalk and the road, which also leads to a decrease in the width of the road. This is associated with the lack of control and sanctions from the government for violations, thereby making some pedestrians prefer walking on the road, as observed in the 0% to 94% found to be walking on the sidewalk compared with 6% to 100% outside as shown in Figure 4. A sidewalk on R. A. Kartini street, specifically the northbound segment, was observed to have been abandoned by pedestrian and found to be used for selling.
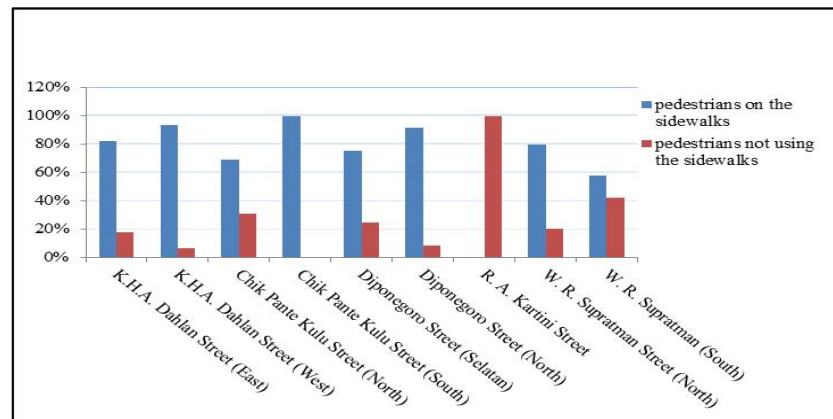
Fig. 4. Composition of pedestrians using and those not using the Sidewalks

4.2. Pedestrians Characteristics

Female respondents were found to be more than males in the two study locations, namely 53% in Pasar Aceh and 63% in Pasar Peunayong. This is associated with the closeness of the areas to the market. Women usually shop in the market. Meanwhile, those between the ages of 15 and 25 years old were discovered to be higher, with 43.06%, than 25 to 35 years old, with 18.06%, in Pasar Aceh, whereas the groups were 38.27% and 37.04%, respectively, in Pasar Peunayong. This variation in the composition of age groups is likely owing to the differences in the characteristics of the markets, as observed in the fact that Pasar Aceh is for sale of clothes and equipment, whereas Pasar Peunayong is for fish, fruits, vegetables, and other spices for household needs. Moreover, both markets were observed to be dominated by students and entrepreneurs at 33% and 23% in Pasar Aceh area and 27% and 25% in Pasar Peunayong area, respectively, as illustrated in Figs. 5 and 6.
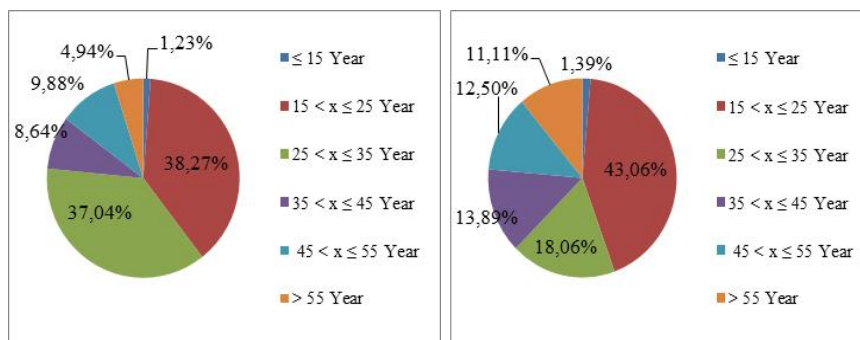

Fig. 5. Age of Respondents

The movement charateristics were classified into four categories including the origin of the trip, the mode of transportation to the location, travel destination, and mode used to return home, and the composition of each category is presented in Figs. 7, 8, and 9.
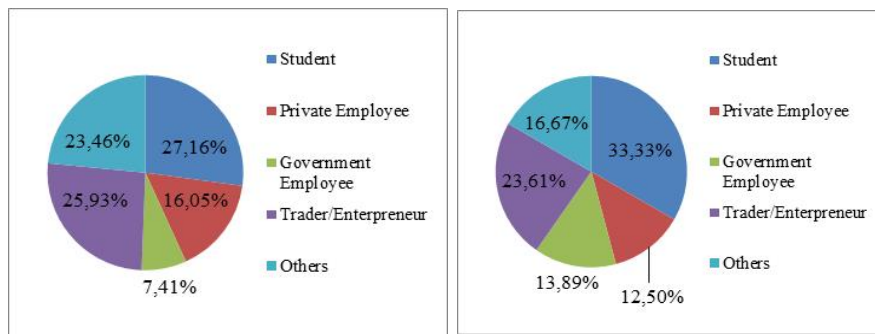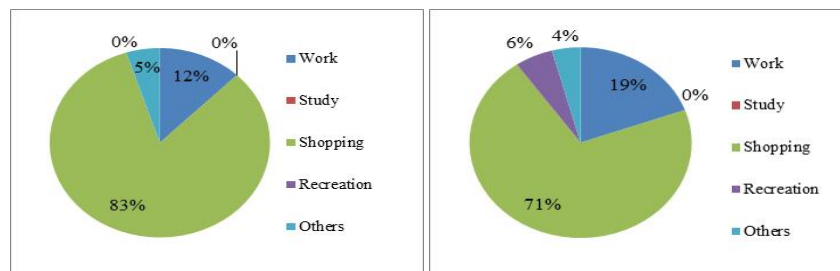
Fig. 6. Education of Respondents
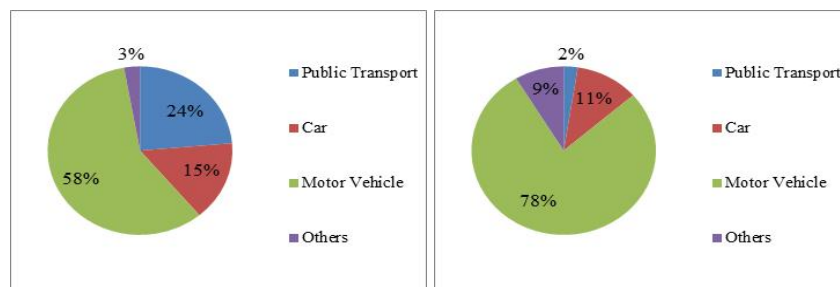

Fig. 7. Purposes of Respondents' Travel

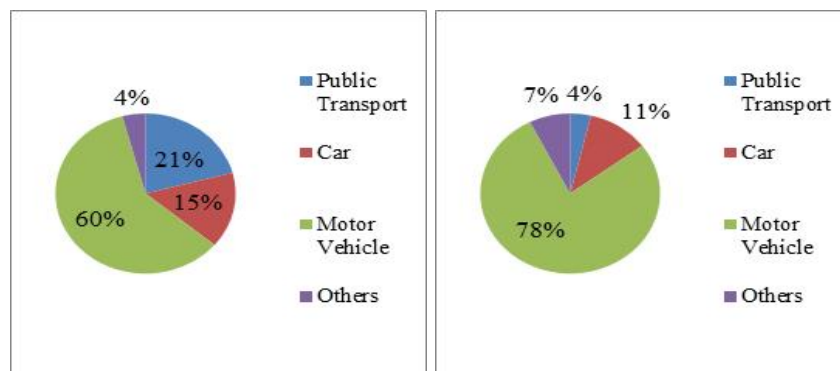Fig. 8. Modes Used by Respondents to Depart

Fig. 9. Modes Used by Respondents to return home

Motorcycles were found to be the dominant modes used by respondents to transport to both research sites with 58% recorded to have used this mode to depart and 60% to return home at Pasar Aceh, whereas it was 78% and 78%, respectively, for respondents in Pasar Peunayong. The difference in the percentage recorded in Pasar Aceh is possibly owing to the fact that some of the respondents are driven by other persons to the location, whereas they return home using other modes of transportation. Meanwhile, most of those in Pasar Peunayong possibly use their private vehicles while going to the market and also to return home.

4.3. Performance of the Pedestrian Lane

The pedestrian path performance was analyzed using the IPA method, and the results are presented in a Cartesian diagram consisting of four quadrants as shown in Figs. 10 to 14. The location of service variables affecting pedestrian satisfaction is in four quadrants, as shown in Fig. 10, and each part is interpreted as follows:

(1) TGK. CHIK PANTE KULU STREET

The variables located in quadrant A are lighting facilities along the pedestrian path (V2); special lane facilities for disability (V9); sign facilities (V6); seating conditions along the pedestrian path (V10); the pedestrian path width (V1); facilities to protect pedestrians from the weather such as trees, canopies, and others (V18); availability of trash bins on the pedestrian path (V12); sound pollution conditions (V14); air pollution conditions (V13); and cleanliness (V11). Some of these facilities were observed not to be available on Tgk. Chik Pante Kulu Street, and the pedestrians expect their implementation are prioritized. This means they presently do not meet expectations.

Some of these variables were also mentioned in Aghaabbasi, M et al [20], which was conducted on the pedestrian path in Johor Bahru District, Malaysia, with some of those needed to be improved including seating area, effective sidewalk width, and lighting. Moreover, another study on the city of Thiruvananthapuram, India, showed the need to improve street light as part of the requirements to increase pedestrian satisfaction [23], whereas shades are reported to be important to protect pedestrians in tropical countries from hot weather [24].

The variables placed in quadrant B include V4, V19, V5, and V16, with their performances considered fit for the pedestrians' expectations and expected to be maintained in the future. Meanwhile, those located in quadrant C include V15 and V8, and their performance is considered non-satisfactory because they are believed to be less important by the pedestrians and are expected not to be prioritized by the government. The variables in quadrant D include V3, V7, and V17, which are considered less important by the pedestrians but have better performance than expected.
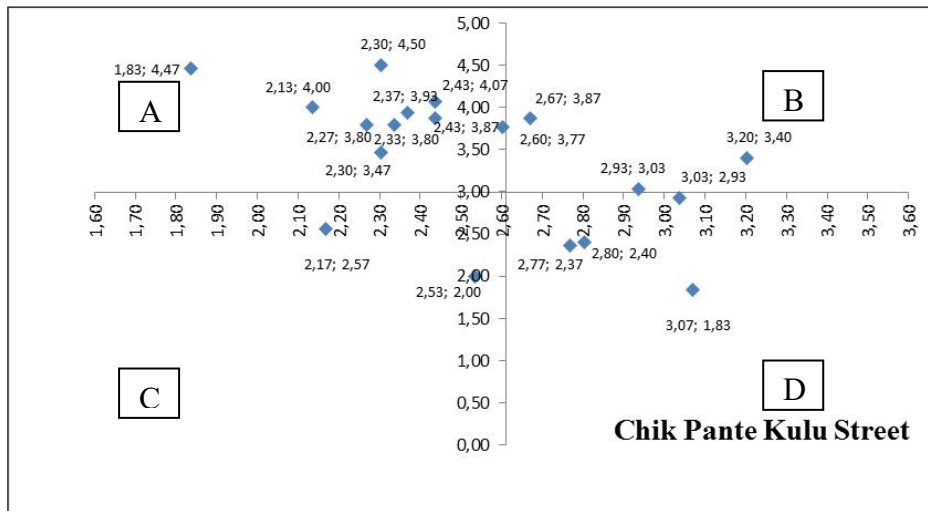

Fig. 10. Pedestrians Perspectives Performance Chart for Tgk. Chik Pante Kulu Street

(2) K.H. AHMAD DAHLAN STREET

The variables found in quadrant A include special lane facilities for disability (V9); surface conditions such as no potholes and damage (V16); sign facilities (V6); seating facilities along the

pedestrian path (V10); pedestrian crossing facilities (V7); facilities for protection from the environment such as trees and canopies (V18); trash bin facilities in the pedestrian path (V12); sound pollution conditions (V14); air pollution conditions (V13); and cleanliness (V11), which are expected by the pedestrians to be prioritized. Their performance was, however, observed not to be in line with pedestrians' expectations.

The variables in quadrant B are V1 and V5 with their performances considered fit for the pedestrians' expectations and expected to be maintained in the future. Meanwhile, those located in quadrant C include V15, V17, and V8, and their performance is considered non-satisfactory because they are believed to be less important by the pedestrians and are expected not to be prioritized by the government. The variables in quadrant D are V18 and V19, which are considered less important by the pedestrians but have better performance than expected.
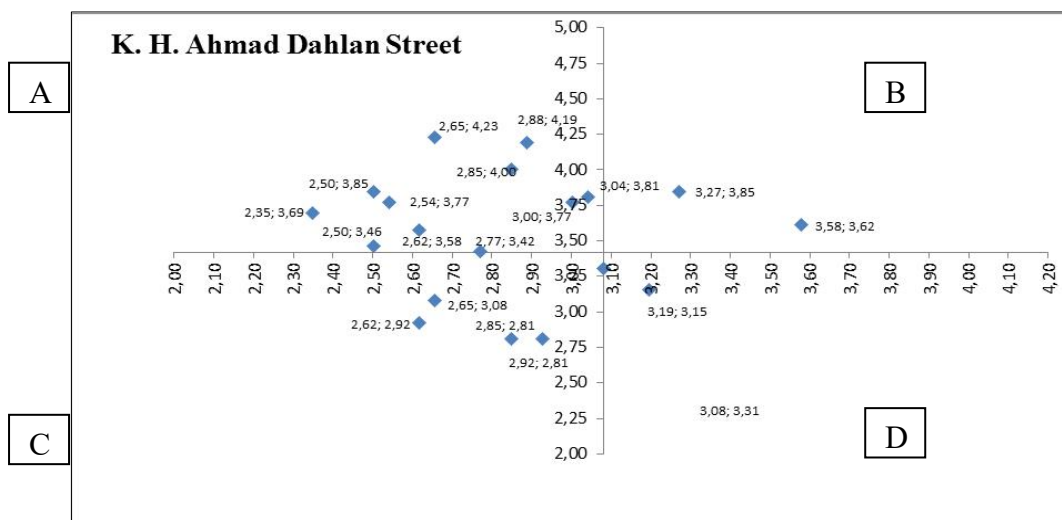

Fig. 11. Pedestrians Perspectives Performance Chart for K.H. Ahmad Dahlan Street

(3) DIPONEGORO STREET

The variables in quadrant A are special lane facilities for disability (V9); the surface, such as no potholes and damage (V16); seating facilities along the pedestrian path (V10); pedestrian crossing facilities (V7); garbage bin facilities in the pedestrian path (V12); sound pollution conditions (V14); and cleanliness (V11), which are expected by the pedestrians to be prioritized. Their performance was, however, observed not to be in line with pedestrians' expectations.

The variables in quadrant B are V5 and V17 with their performances considered fit for the pedestrians' expectations and expected to be maintained in the future. Meanwhile, the variables located in quadrant C are V15, V6, V8, and V13 and their performance are considered non-satisfactory because they are believed to be less important by the pedestrians and are expected not to be prioritized by the government. The variables placed in quadrant D include V4 and V19, which are considered less important by the pedestrians but have better performance than expected.

(4) R. A. KARTINI STREET

The variables located in quadrant A are special lane conditions for disability (V9); surface conditions, such as no potholes and damage (V16); signpost conditions (V6); the pedestrian path width (V1); availability of trash bins on the pedestrian path (V12); no air pollution (V13); and cleanliness (V11), which are expected by the pedestrians to be prioritized. Their performance was, however, observed not to be in line with their expectations.

The variables located in quadrant B are V2, V5, V18, and V14, and their performances are considered fit for the pedestrians' expectations and expected to be maintained in the future. The variables in quadrant C include V15 and V10, and their performance is considered non-satisfactory because they are believed to be less important by the pedestrians and are expected not to be prioritized by the government. Meanwhile, those in quadrant D include V3, V4, V19, V7, V17, and V8, which are considered by the pedestrians to be less important but have performances above their expectations.
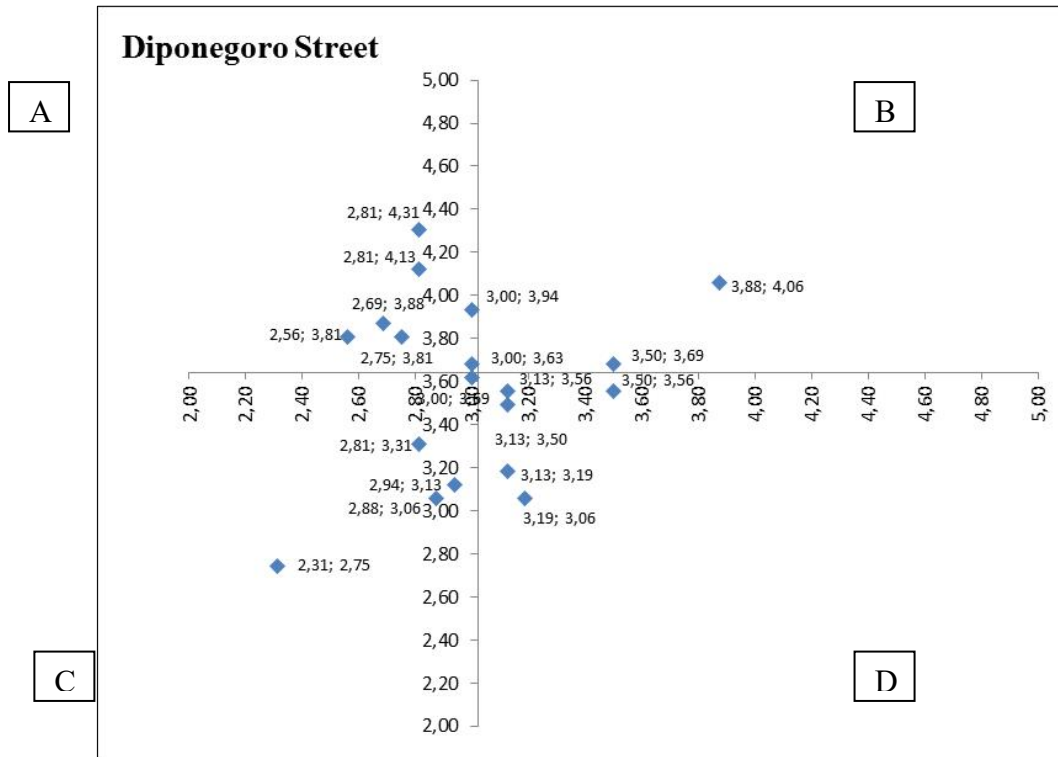

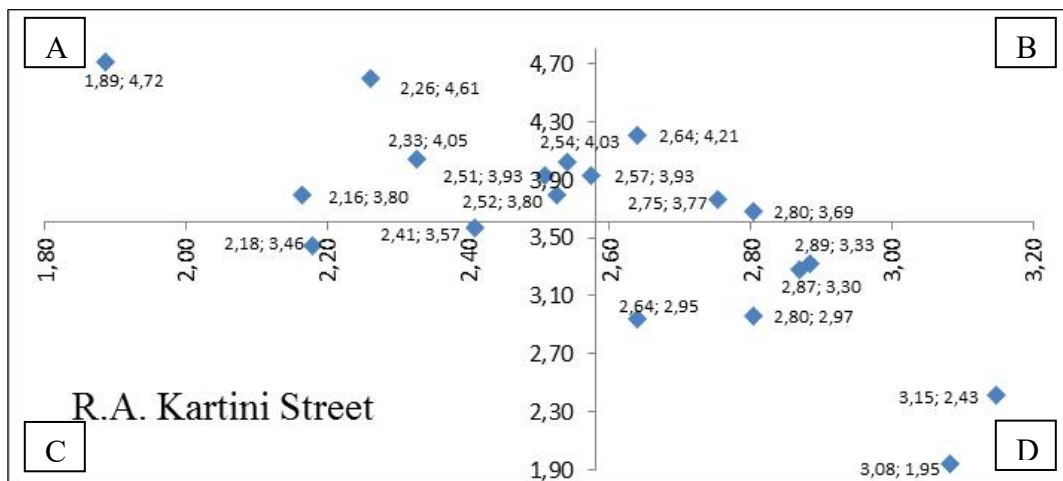Fig. 12. Pedestrians Perspectives Performance Chart for Diponegoro Street

Fig. 13. Pedestrians Perspectives Performance Chart Diagram for R. A. Kartini Street

(5) W. R. SUPRATMAN STREET

The variable items located in quadrant A include seating facilities along the pedestrian path (V10), pedestrian path width (V1), garbage bin facilities in the pedestrian path (V12), and air pollution conditions (V13) and expected to be prioritized by the pedestrians but their performances are found to be lesser than their expectations.

The variables found in quadrant B are V2, V16, V6, and V11, with their performances considered fit for the pedestrians' expectations and expected to be maintained in the future. Meanwhile, the variables in quadrant C include V15, V9, V8, and V14 and their performance is considered non-satisfactory because they are believed to be less important by the pedestrians and are expected not to be prioritized by the government. Those in quadrant D include V3, V4, V19, V5, V7, V18, and V17, which are considered less important by the pedestrians but have better performance than expected.
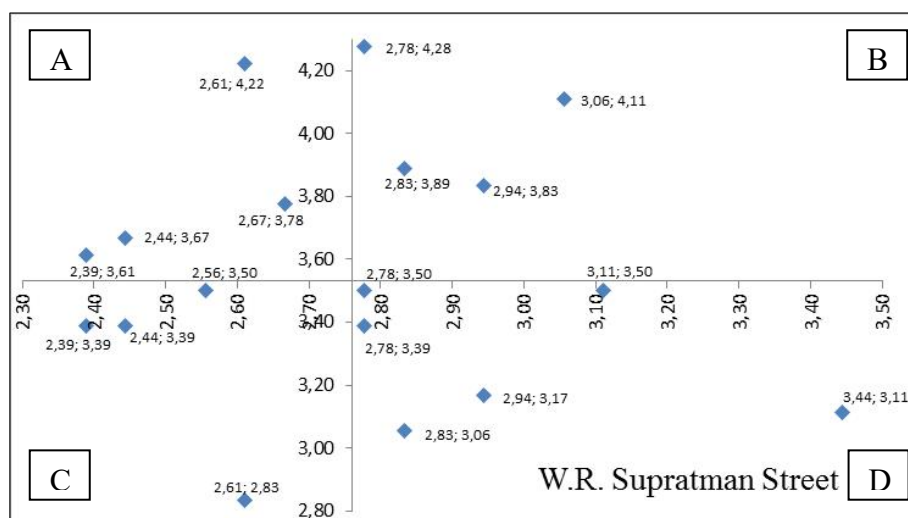

Fig. 14. Pedestrians Perspectives Performance Chart for W. R. Supratman Street

Figs. 10 to 14 show there is a need to improve the state of facilities along the footpath, especially the seating and facilities for disabled people. This is necessary considering the fact that all the research sites are markets and people need to rest after shopping. Moreover, cleanliness is also considered essential for improvement owing to its imperfect implementation in the areas and the need for convenience.

According to pedestrians, bus stop, bollard, zebra passage, pelican movement, and the presence of hazards on sidewalks such as the sale of goods and parking of motorized vehicles are not essential. The bus stop facilities are considered irrelevant probably owing to the minimal use of pedestrian transport to both locations, as estimated with 2% to 24%. Moreover, the bollard zebra crossing and pelican crossing services in the area are not being accessed by the pedestrians, and this is possibly associated with their lack of understanding regarding the importance of these facilities.

The barriers such as the presence of street vendors and vehicles parked on the sidewalks are considered by the pedestrians not to be removed, and this is probably owing to the ease with which they can walk along the motorized lane without feeling threatened by the barriers on the road. This makes the two regions to become chaotic and disturbing by being a hard-to-fix culture. Therefore, all the support facilities for the pedestrians' sidewalk need to be improved in the future to enhance order and comfort in both regions. Moreover, regulations such as a ban on selling or parking on the pathways need to be simply and consistently implemented to ensure the safety and comfort of the pedestrian trail. The two regions are also vulnerable to earthquakes and tsunami, and this makes the provision of safe sidewalks necessary to ensure an effective evacuation process.

Another solution directly related to the RA Kartini Street (Peunayong Market) and Tgk Chik Pante Kulu (Aceh Market) is to expand the pedestrian lanes and remove the vehicle lanes. Vehicles on Tgk Chik Pante Kulu street are recommended to be redirected to Diponegoro street. Alternatively, it is possible for the vehicles on Peunayong Market's RA Kartini street to make use of the Ahmad Yani Street. This is important owing to the fact that RA Kartini Street is currently a busy market area for fruit and vegetables from morning-to-night, with most pedestrians' sidewalk along this road found not to be working, whereas Tgk Chik Pante Street is a clothing shopping center and also one of the access roads to the landmark of Banda Aceh City, the Baiturrahman Grand Mosque, which is one of the most significant places of worship and a tourist destination. The two roads are also ideal for conversion into a pedestrian lane owing to their characteristics.

The transportation problems observed in the location of this study also occur in other cities of Indonesia, including the city of Jakarta, which is the capital of the country. The plan of these cities does not accommodate pedestrians, with the sidewalk designed in Jakarta observed not to be humanist, thereby forcing commuters to ride cars. The paths are designed to be next to the road and have insufficient width to accommodate pedestrians' volume, thereby creating an unsafe and very uncomfortable condition for the pedestrians [24].

European cities have pedestrian paths completed with streetscape and humanist order and considered to be in a very good condition, more comfortable, and enjoyable and can be used as a reference in pedestrian path planning. It is, however, important to note the importance of climate factors in adopting this method in tropical cities by designing pedestrian paths with shade to protect pedestrians [24].

Sub-standard pedestrian paths have also been reported in several developing countries where most of the people move within the Central Business District by walking. However, most pedestrians avoid sidewalks owing to their inadequate conditions such as reduced width, pedestrian flow rates, presence of obstacles, and unavailability of handrails [1]. They mostly use the road in walking, and this is considered dangerous owing to the possibilities of being involved in accidents with motorized vehicles. Asian cities are traditionally pedestrian cities but have been experiencing increased use of motorized vehicles, thereby limiting the focus on pedestrian facilities and public transport, but there is a need to change focus to allow people, not vehicles, reclaim the urban environment [25].

A study conducted on pedestrian walkways in the urban area of Cosenza, Italy, showed the level of comfort is influenced by the presence of street vendors, noise and pollution, temperature, lighting, odor, cleanliness, environment, and landscape with the pedestrian-oriented paths preferred to non-pedestrian-oriented paths. Moreover, the pedestrians were observed to prefer walking instead of using motorized transportation modes, and this means segregated pedestrian-oriented paths should be implemented [8].

5. CONCLUSION AND RECOMMENDATIONS

The sidewalk width and lane height in the researched area were observed to be below the required standard owing to the existence of several obstacles such as the presence of traders, merchandises, and parked vehicles. These violations are part of the problems in many cities of Indonesia and other developing countries and are due to the lack of public awareness and supervision by the authorities.

The width was found to be averagely less than 2 m instead of a minimum of 2 m and the ideal value of 4 m required by standard, whereas lane height was averagely more than 15 cm, which is the maximum required by the standard. Facilities for disabled persons were also observed to be lacking with the public transportation routes found only on K.H. Ahmad Dahlan, Diponegoro, W.R. Supratman, and T. P. Polem streets, whereas bus stops are only on Diponegoro street, and this makes people switch from the use of public transportation to other transportations, such as pedicabs and motorcycle taxis. Moreover, lights, bins, marks, and signs were found on the sidewalks but their conditions need to be improved.

The pedestrians' perceptions showed most of the service quality variables of the sidewalks are in quadrant A (concentrate here) followed by C (low priority), D (possible over-skill), and B (keep up the good work) in that order. This means the variables in quadrant A are the major weaknesses and require immediate attention for improvement, those in quadrant C are minor weaknesses and do not require additional effort, the resources in D need to be deployed elsewhere, whereas the variables in quadrant B show the opportunities to achieve or maintain a competitive advantage and observed to have the major strengths.

It is, therefore, recommended the following:

- The width of the pedestrian paths be increased while the supporting facilities are evaluated to ensure the safety and comfortability of the pedestrians.
- Regulations on pedestrian paths need to be enforced strictly to minimize violations.
- The city planning has to accommodate pedestrians.
- Pedestrian paths need to be designed with shade to protect pedestrians from the climate.
- R. A. Kartini Street and Tgk. Chik Pante Kulu Street should be converted into pedestrian paths owing to their small length and width and crowdedness with street vendors.

Acknowledgements

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