SINERGI Vol. 27, No. 1, February 2023: 73-80
http://publikasi.mercubuana.ac.id/index.php/sinergi
http://doi.org/10.22441/sinergi.2023.1.009

Determinant factors in increasing the livability of the city of Padang from the perspective of transportation

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Abstract
Padang has been determined to be a livable city in 2024, according to the Mission of the City Major 2019-2024. Some improvements have been made, such as more BRT corridors, widening the sidewalk, and adding benches along the sidewalks. However, achieving a livable city is far more than just those thingies; we also need to know what people need and what the government is willing to do. This study explores the determinant factors in achieving the livable city criterion for Padang, especially regarding transportation-related variables in the expert views along and public and government interests. The quadrant analysis of Expectation-Performance and Effort-Effect Analysis was used to identify the determinant and priority factors in improving the livability of Padang. The results show that improving some essential elements has satisfied public expectations. Still, more things need to do, such as an integrated transportation system, comfortable public transportation, transportation for disabled persons, and a more environmentally friendly transportation mode. With less effort and high effect, the most priority factors are comfortable and secure pedestrian facilities, improving traffic to reduce travel time, and improving public transport facilities.

Keywords:
Livable City;
SDGs;
Sustainable Transportation System;

Article History:
Received: May 24, 2022
Revised: August 15, 2022
Accepted: August 26, 2022
Published: February 2, 2023

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INTRODUCTION

Sustainable Development Goals (SDGs) have been a global commitment to improving society's welfare, including seventeen objectives. As cities have been home to more than half of the world's population, making cities inclusive, safe, resilient and sustainable and thus livable for all communities is one of the goals of the SDGs. Sustainable transportation policy manifests sustainable development in the transportation sector to suppress the most significant contributor to environmental problems [1]. Furthermore, there is no sustainable development without implementing sustainable transportation because transportation is the primary support of the product [2]. Therefore the 11th goal of SDGs is by 2030; it is expected that there will be access to a sustainable transportation system that is safe and affordable, improved road safety, and development of public transportation with an emphasis on women, children, and the elderly and individuals with disabilities.

In terms of sustainability and city development, many city concepts have been introduced, such as smart cities, livable cities, ideal cities, resilient cities and many other city concepts and brandings. This paper focuses on the livable city. Livable City is a city planning concept where the city as a public space is the center of social life and the focus of the whole

community [3]. Based on this understanding, a livable city is a concept that aims to accommodate all community activities to improve their quality of life. The Association of Planning Experts (IAP) released cities in Indonesia considered livable through the Most Livable City Index in 2017. It was explained that many city residents felt uncomfortable living in their cities. As a result, the average national index decreased compared to the previous survey in 2014. Cities included in the Top Tier Cities are Solo, Palembang, Balikpapan, Denpasar, Semarang, South Tangerang and Banjarmasin [4].

The city of Padang has not been included in the city that the IAP has assessed, so it is not known the condition of achieving the livable city criteria by the Padang City Government. Understanding the critical factors considered by the city population influencing their city's livability would help the government prepare and improve the city. Therefore, this study investigated the determinant factors influencing people's perception of Padang City's livability. As the concept of livable cities was initially introduced in developed countries, the indicators used were mainly based on the experience and expectations of the population in those countries. However, it is expected that different cities would need various hands for the citizen perceived livability. So, this study contributed to identifying essential indicators of livability for Padang City based on the perception of an expert in city development in Padang.

MATERIAL AND METHODS

This study was based on a pen and paper questionnaire survey, which was distributed to some experts in the study area, including staff of the Department of Transportation of Padang, the Department of Public Works and Housing of Padang, Academician, and the Association of Public Transport Providers.

State of the Art

A livable city is a concept in city planning where the city preserves and satisfies current inhabitants' needs without reducing the capability to meet the needs of future generations [3]. In a Livable City, the inhabitants easily find a job, satisfy their basic needs, including clean water and sanitation, access to a good education and health services, and live in a secure and clean environment. The livable city concept accommodates community activities to improve the quality of life and cover all of the community, including accessibility, housing provision, public transport, public services, and easiness of participation. In addition, a livable city is considered capable of improving the quality of people's lives, creating economic value, healthy urban life, and supporting environmental sustainability [2]. Neighborhood dissatisfaction was found to be related to environmental quality, noise, lack of community involvement, traffic and lack of services facilities [5].

The concept of the livable city has multidimensionality [6][7], such as environment, for example, air quality, green open space, and gas emissions; Economy, for instance, economic revitalization and development; Land use, for example, compact and mixed-use development; Transportation, for example, pedestrians, accessibility, and choice of transportation modes; Equity, for instance, the affordability of housing needs, income; and Community development, for example, security and comfort, health services [8]. The priority was given to public space, and safe cycling and walking infrastructure [9]. A safe system is aligned with the livability criteria [10].

The basic principles of a livable city [11][12] are the availability of various basic needs of urban communities (proper housing, clean water, electricity); availability of various public facilities and social facilities (public transportation, city parks, worship/health/worship facilities); availability of public spaces and places to socialize and interact; security, free from fear; economic support, social and cultural functions and; environmental sanitation and beauty of the physical environment. In addition, the livable neighborhood would encourage health-supportive behaviors such as walking and cycling [13].

Sustainable Transportation System

Sustainable transportation is defined as a transportation system that enables the fulfilment of the basic needs of individuals and communities to be met in a manner consistent with human health and the environment from generation to generation. The system must be affordable, operate efficiently, provide a choice of modes according to needs and be capable of driving the economy. In addition, this system must limit emissions and waste to environmental limits that can absorb and eliminate them, minimize consumption of fossil energy sources and limit consumption of renewable energy to ensure sustainability, reuse or recycle components and minimize land use and noise [14].

A sustainable transportation policy is one of the manifestations of sustainable development in the transportation sector. Transportation is also the most significant contributor to environmental

problems [1]. As no sustainable development without implementing sustainable transportation [3], transportation plays a role in realizing 2 SDGs goals, namely the 9th goal (Industry, Innovation and Infrastructure) and the 11th goal (Sustainable Cities and Communities). In goal 9th, policies should provide access to basic urban needs such as housing, water, sanitation, low-carbon energy, transportation, and communication. It is hoped that there will be access to a sustainable transportation system that is safe and affordable, improved road safety, and development of public transportation with an emphasis on women, children, the elderly and individuals with disabilities.

Sustainable Transportation System as Part of Achieving Livable City

The criteria for achieving a livable city related to the transportation sector include public transportation services, pedestrian paths, road network pavement conditions and increased traffic safety [15]. These criteria are seen as the criterion for a sustainable transportation system. The main principle of a sustainable transportation system is to increase the use of mass transportation fueled by environmentally friendly energy sources and increase active transportation (bicycles and walking). A study found that natural beauty spots and the most attractive area, such as the commercial activities along the seafront, positively influence individual's intention to cycle [16]. The creation of some green streets and squares could improve the satisfaction of those who are living nearby. However, those who are living on the remaining street would feel discriminated against as the car traffic on the road will not be reduced [17].

Importance Performance Analysis (IPA) Method

The Importance Performance Analysis (IPA) method was first introduced to measure the relationship between consumer perceptions and priorities for improving product/service quality [18]. The Importance Performance Analysis (IPA) method has been generally accepted and used in various fields of study because of its ease of measurement. The IPA consists of four quadrants, as shown in Figure 1.

Interpretation of the quadrants in IPA are as follow:

a. Shows factors or attributes that affect customers, including service elements that are considered very important, but the product does not match the customer's wishes, so they are not satisfied.

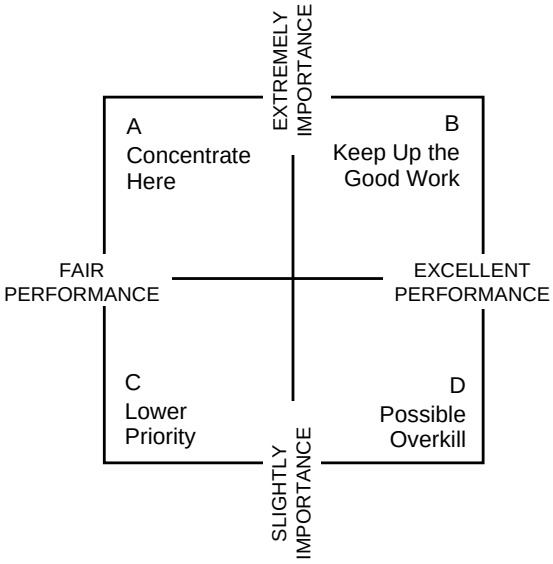


Figure 1. Typical Quadrant in IPA [18]

b. It shows the essential elements that already exist in the product so that it must be maintained and is considered very important and satisfying.
c. It shows less critical factors for customers; their existence is mediocre and considered less necessary and less satisfying.
d. The factors that affect customers are less important, but the implementation is excessive, considered less necessary, and very satisfying.

The IPA method has been used in various fields of study including transportation such as [19][20][21][22][23][24][25][26]. However, recent studies suggested using Satisfaction instead of Performance as the performance evaluates providers' output and satisfaction examines persons' outcomes [27]. Therefore, in this study, ISA will be used instead of IPA.

Research Method

The study was conducted by following the procedure shown in Figure 2. This research starts from a literature study to see the state of the topic being reviewed and looks for criteria to achieve a livable city. Limited interviews were conducted with officials at the Department of Transportation and Public Works and Housing Department to compromise the criteria in the literature and those perceived by the government. Next will be the preparation of questionnaires and data collection.

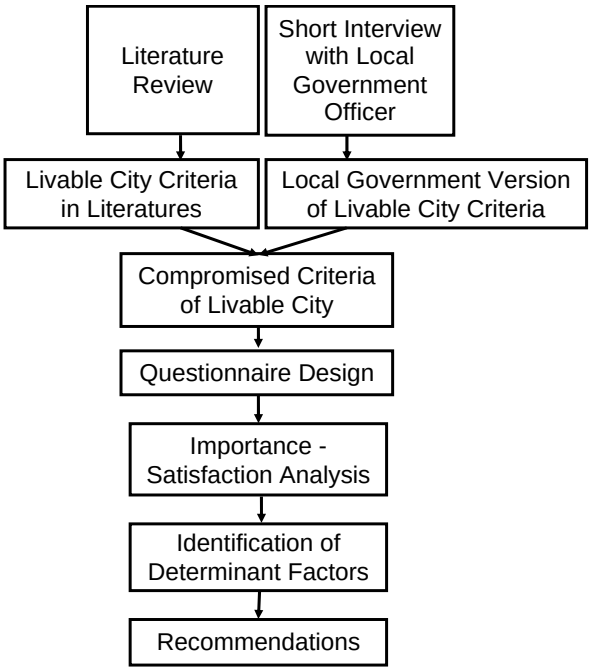


Figure 2. Research Flowchart

The data were analyzed using the Importance-Satisfaction Analysis method. As a result, the perceived achievement of livable city criteria and the most determinant factors influencing the fulfilment of the livable city criterion will be obtained. According to the community, the priority factors to improve the level of satisfaction of the livable city criteria will be known. It will be known which elements need to be corrected immediately to accelerate achievement.

RESULTS AND DISCUSSION

Determining Relevant Variables for the Padang City

In order to obtain the most relevant transportation aspects for the livable city in Padang City, rigorous literature studies have been conducted along with some interviews with the Secretary of Padang City Department of Transportation and transportation experts. The literature studies can be learned from [28]. Five transportation aspects were chosen to be evaluated from all factors considered in the literature. The elements include bicycle lanes, pedestrian pathways, transit points, public transportation routes, and modes.

The variables were offered to twenty-five transportation experts in Padang, academically and practically and policymakers. They were asked to express their views on a 5-point Likert scale.

Characteristics of Respondents

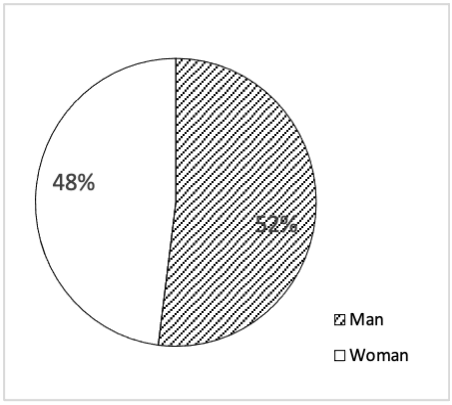
The characteristics of respondents are shown in Figure 3. The respondents are relatively similar in terms of age, men and women. In terms of age range, the respondents are mainly 30- to 49-year-olds, while in terms of educational background, 32% hold an undergraduate degree, 52% hold a master's degree, and 16% hold a doctoral degree. The professional respondents is 40% Lecturer, 52% Staff at the Department of Transportation, Padang City; 4% Staff at the Department of Transportation, West Sumatera Province; and 4% representative of the Association of Public Transport Providers. The characteristics of respondents may influence their responses to the questions. However, as the respondents are experts and the sample size was small. Then the influence of respondent's characteristics could not be used to identify the effect of characteristics on their judgment of the importance or satisfaction of the items in the questionnaire. Characteristics of the respondent were explored in this study just to let the reader know the distribution of respondents by gender, age, education and profession.

Importance Satisfaction Analysis (ISA) Results

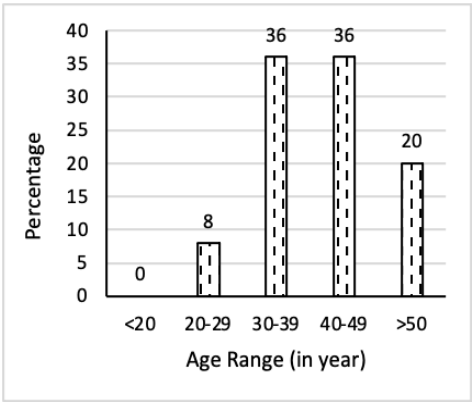
The ISA was conducted by calculating the average value of each Importance and Satisfaction for the item. The mean value of the average importance and average Satisfaction value was calculated and used as the hairline for the quadrant analysis, as shown in Table 1.

Based on Table 1, the Importance Satisfaction Analysis (ISA) was carried out. The results of the four quadrants are shown in Figure 4. Figure 4 shows that attributes were distributed into four quadrants and described in Table 2. Based on the Effort and Impact of the variables, a quadrant analysis has been conducted, and the result is shown in Figure 5.

Similar to the ISA quadrant, the Effort-Impact Quadrant in Figure 5 shows the variables are distributed into four quadrants, as described in Table 3. By definition, we need to prioritise the elements that need a light effort (less budget and less required time for implementation) but have a big impact (quadrant D), and the performance according to the IPA, is low. The second priority is those in quadrant B, which have a significant impact but need an arduous effort, and from the IPA, the Performance is low. Therefore, the elements in the category priority I and II are sown in Table 4.



(a)



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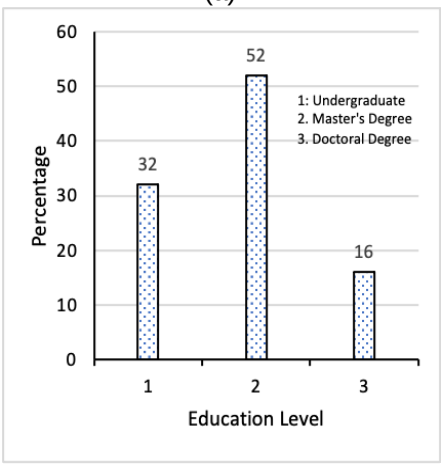

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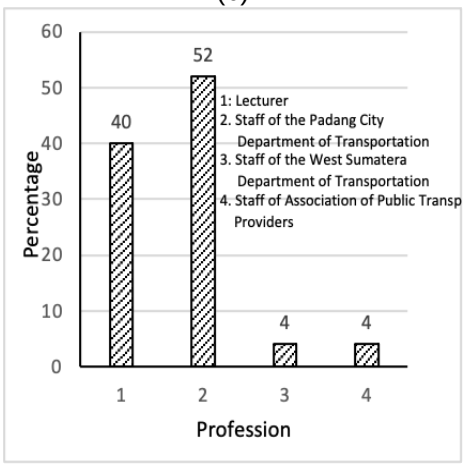

(d)

Figure 3. Characteristics of respondents (a) by gender; (b) by age range; (c) by educational level; and (d) by profession.

Table 1. Average values of Importance and Performance

No	Aspects	Element	Code	Importance	Satisfaction	Different
1	Bicycle lane	The availability of a comfort bicycle lane.	A1	4,3	2,0	2,3
		The availability of a safe bicycle lane.	A2	4,3	2,0	2,3
2	Pedestrian pathway	The availability of a comfort pedestrian pathway.	B1	4,7	3,2	1,5
		The availability of a safe pedestrian pathway.	B2	4,7	2,9	1,8
		The availability of pedestrian pathway for disabled individual.	B3	4,4	2,4	2,0
3	Transit point	The availability of stations at an affordable distance from public service areas.	C1	4,6	2,8	1,8
		The existence of dense land use around the transit point.	C2	4,2	2,8	1,4
4	Public Transport lines	Travel time relatively short.	D1	4,3	3,0	1,3
		The availability of a safe public transport lines.	D2	4,6	3,0	1,7
		The availability of public transport hub.	D3	4,5	3,0	1,5
5	Transportation mode	Reliable public transport schedule.	E1	4,5	3,0	1,5
		Integrated transportation mode.	E2	4,5	2,7	1,8
		The availability of a comfort transportation mode.	E3	4,5	2,7	1,8
		The availability of a safe transportation mode.	E4	4,6	3,0	1,6
		The availability of a friendly transportation mode for disabled person.	E5	4,6	2,2	2,4
		The availability of environmentally friendly transportation.	E6	4,5	2,4	2,2
		An affordable travel cost.	E7	4,5	3,2	1,3
		Average		4.48	2.72	2.8

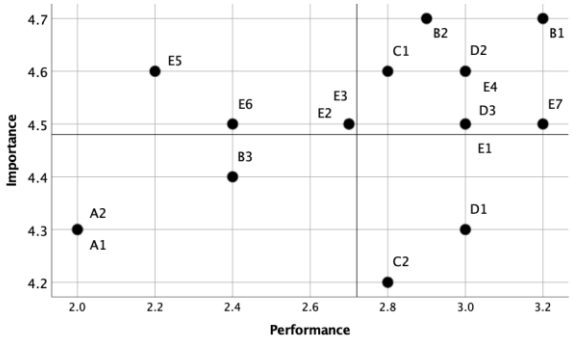

Figure 4. Quadrant Analysis of ISA

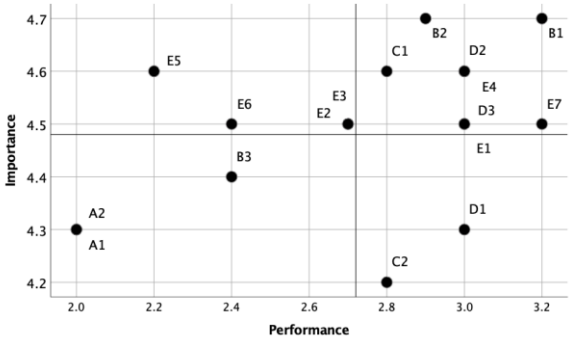

Figure 5. Effort-Impact Quadrant

Table 2. Distribution of Variables in the Quadrants

Quadrant	Element	Code	Interpretation
A	Integrated transportation mode.	E2	Integrated transportation modes, comfort of transportation mode, disabled and environmentally friendly transportation mode are considered very important, but the element does not match the costumer's wishes so that they are not satisfied.
	The availability of a comfort transportation mode.	E3	
	The availability of a friendly transportation mode for disabled person.	E5	
	The availability of environmentally friendly transportation.	E6	
B	The availability of a comfort pedestrian pathway.	B1	The basic elements already exist so that it must be maintained and is considered very important and satisfying.
	The availability of a safe pedestrian pathway.	B2	
	The availability of stations at an affordable distance from public service areas.	C1	
	The availability of a safe public transport lines.	D2	
	The availability of public transport hub.	D3	
	Reliable public transport schedule.	E1	
	The availability of a safe transportation mode.	E4	
	An affordable travel cost.	E7	
C	The availability of a comfort bicycle lane.	A1	These variables are less important for customers, their existence is mediocre and considered less important and less satisfying.
	The availability of a safe bicycle lane.	A2	
	The availability of pedestrian pathway for disabled individual.	B3	
D	The existence of dense land use around the transit point.	C2	These factors are less important but the implementation is excessive, considered less important but very satisfying.
	Travel time relatively short.	D1	

Table 3. Effort-Impact Quadrant

Quadrant	Element	Code	Interpretation
A	The availability of a safe public transport lines.	D2	This element needs a hard effort but less impact.
B	The availability of a comfort pedestrian pathway.	B1	These elements need hard effort but has a big impact.
	The availability of a safe pedestrian pathway.	B2	
	The availability of public transport hub.	D3	
	The availability of a safe transportation mode.	E4	
	An affordable travel cost.	E7	
	Travel time relatively short.	D1	
	The availability of a comfort transportation mode.	E3	
C	Reliable public transport schedule.	E1	These elements need a light effort and have a small impact.
	The availability of a friendly transportation mode for disabled person.	E5	
	The availability of pedestrian pathway for disabled individual.	B3	
	The availability of a comfort bicycle lane.	A1	
	The availability of a safe bicycle lane.	A2	
D	Integrated transportation mode.	E2	These elements need a light effort but have a big impact.
	The availability of an environmentally friendly transportation.	E6	
	The availability of stations at an affordable distance from public service areas.	C1	
	The existence of dense land use around the transit point.	C2	

Table 4. Priority element for improvement

Code	Element	Priority	Note
E2	Integrated transportation mode	I	Route integration was perceived as required lighter effort compared to other criteria.
E6	The availability of an environmentally friendly transportation.	I	Light efforts are needed to established an environmentally friendly transportation such as to do routinely check the exhaust gas.
E3	The availability of a comfortable transportation mode.	II	To make transportation mode more comfortable is perceived to be a hard effort.

The results differed slightly from another research [29], which found environmental regulation, industrial structure optimization, income level and institutional quality.

CONCLUSION

An analysis of the determinant factors in improving the livability of Padang City has been conducted using quadrant analysis of IPA and Effort-Impact Analysis. The result indicated that three elements that have a significant impact in achieving the livability score and are currently perceived as having a low performance are the availability of integrated transportation mode, availability of environmentally friendly transportation and availability of a comfortable transportation mode. However, the last-mentioned factor needs a strenuous effort to make it a reality, thus making it the second priority.

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