Passenger preference characteristics of transport mode to Soekarno Hatta International Airport

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Abstract. Soekarno Hatta International Airport is one of Indonesia's largest airports located in the Jakarta area. In 2017 the airport served 63 thousand passengers. With many such passengers, the airport's traffic and around the airport must be massive. Accessibility to the airport is one of the essential factors that can support airport operations properly. Many factors influence passengers in choosing the mode of transportation. There are environmental preferences and social preferences. This study aims to determine passenger preferences in choosing transport mode to Soekarno Hatta International Airport related to environmental preferences and social preferences. The passenger preferences for transport mode are divided into a bus, airport railway, and private cars. This study used a quantitative method. An online questionnaire was shared with the passenger who had traveled to the airport. The result shows that passengers know about environmental preferences, but social preferences are more influential in choosing the airport's transport mode.

1. Introduction
Activities in urban areas are among the highest activities contributing to carbon emissions in the environment [1]. Transportation is the most significant contributor to urban areas because transportation in urban areas is dominated by land transportation. The majority are motorized vehicles that use fossil fuels [2, 3]. Besides land transportation, other transportation that contributes to carbon emissions is air transportation. Air transport activities’ development caused this industry to contribute much carbon emissions to the environment [4, 5]. Therefore the airport is an integration place of carbon emissions between land transportation and air transportation.

As an integration place of carbon emissions between land transportation and air transportation, the airport is one of the places that have a high uncertainty factor. On the other hand, the airport has an essential role in the country's economic growth and as a driving factor of area development, especially the area around the airport [6, 7]. The functions of the airport will be appropriately fulfilled if supported by adequate infrastructure. One of the infrastructures that must be fulfilled is access to and from the airport must be adequate. Access to the airport must be able to support the continuation of activities at the airport.

One of the airports currently in the infrastructure development is Soekarno Hatta International Airport. Soekarno Hatta International Airport is one of the largest airports operating in the Jakarta area and is one of Indonesia's main entrances [8]. Based on 2017 data, Soekarno Hatta International Airport serves 63,015,620 passengers, with 45,064,449 domestic passengers and 13,131,035 international passengers. To serve the passenger's movement, Soekarno Hatta International Airport also serves
447,390 aircraft movements. Based on Airport Council International data, Soekarno Hatta International Airport also entered the top 20 busiest airports in the world in 2018, ranked 18th [9]. That caused passenger traffic to and from Soekarno Hatta International Airport is quite dense. However, on the other hand, the number of transportation services that serve to and from Soekarno Hatta International Airport is not sufficient.

![Figure 1. Map of Soekarno Hatta International Airport [10].](image)

Accessibility to Soekarno Hatta International Airport can be reached by road and airport railway. The highway built around Soekarno Hatta International Airport is Prof. Dr. Sedyatmo [11]. To enhanced the option of transport mode to Soekarno Hatta International Airport, the authority of Soekarno Hatta International Airport and Indonesian Railway Company formed a subsidiary to apply airport railway in Soekarno Hatta International Airport. The airport train application, which began operating on December 26th, 2017, departs from Manggarai Station through Pluit and ends at Soekarno Hatta International Airport. The following table is the comparison between motorcycles, private cars, buses, and trains [12, 13].

| Transportation modes | Transport Volume | Pollutants | CO | HC | Nox  | CO2   |
|----------------------|-----------------|------------|----|----|------|-------|
| Motorcycles          | 2               | 749,76     | 135,3 | 8,98 | 3300  |
| Private Cars         | 5               | 659,13     | 150,51 | 150,51 | 37679,4 |
| Buses                | 40              | 10317,9    | 569,7 | 10761   | 922914 |
| Trains               | 1500            | 763,3      | 325  | 3846,67 | 225568,33 |

Passenger preference of transport mode is influenced by (a) travel time, (b) travel costs, (c) service levels, (d) accessibility, and (e) reliability of public transportation in terms of time [14, 15]. This research will examine passenger preference categories of transport mode to Soekarno Hatta International Airport, divided into the bus, airport railway, and private cars. To achieve sustainable transportation, transportation must qualify environmental, social, and economic aspects [16]. Previous research on
environmental, social, and economic aspects of transportation has been widely carried out. Such as research on sustainable indicators on airport railway [17]. However, there is still little research on the sustainable aspects of transportation in terms of passengers. Therefore, this research aims to present activities that passengers have carried out at the airport and why they influence them in choosing transport mode to Soekarno Hatta International Airport, related to environmental and social preferences. Economic preferences are not discussed in this study because it can be concluded from the costs that must be paid by passengers.

2. Method
The research used quantitative methods. The research method includes an explanation about research location, data collection, and data analysis.

2.1. Study area
The research was carried out in Jakarta. As the capital city of Indonesia, Jakarta is a city that is the center of all government, business, education, and cultural activities. Therefore Soekarno Hatta International Airport, which is located in the Jakarta area, is also one of the entrances to Indonesia's capital city. So that it causes heavy passenger traffic activities. Airport development continues, especially in the aspect of accessibility to the airport. Currently, accessibility to the airport from the Jakarta area can be reached via bus, airport train, and private cars. Therefore it is fascinating to research Passenger Preference Characteristics of Transport Mode to Soekarno Hatta International Airport.

![Research location map](image)

**Figure. 2** Research location map [18].

2.2. Data collection and analysis
Preliminary data were collected using an online questionnaire via a google form. An online questionnaire was distributed to the passenger who had traveled to Soekarno Hatta International Airport at least twice in the last two years. One hundred forty-nine questionnaires were filled from August 12th, 2020, to September 6th, 2020. The questionnaire contains questions regarding the distance from where they live to where they ride the vehicle to Soekarno Hatta International Airport, preferred transport mode, environmental preferences, and social preferences that influence them in choosing the type of
transport mode to the airport. Data analysis was performed using the Microsoft Excel application to determine the number and amount of proportions.

2.3. Environmental preferences
Environmental preferences influence preferences based on aspects related to the environment, divided into two aspects, namely carbon emissions and energy consumption. These two aspects are considered to be fundamental aspects if a person chooses a mode of transportation.

Table 2. Aspects of environmental preferences.

| Aspect                  | Description                                                                 |
|-------------------------|-----------------------------------------------------------------------------|
| Carbon emissions        | The carbon emissions taken into consideration here are the carbon emissions generated as long as passengers use individual transport mode to Soekarno Hatta International Airport. The carbon emissions generated during the construction of this transport are not being noticed. |
| Energy consumption      | The transport mode to Soekarno Hatta International Airport is still dominated by transportation using fossil fuels. The use of energy in question is the fuel used and the source of energy used for electricity in that transportation mode. |

2.4. Social preferences
Environmental preferences influence preferences based on aspects related to the social, divided into five aspects, namely accessibility, convenience, punctuality, facility, and cancellation. These five aspects are considered to be fundamental aspects if a person chooses a mode of transportation.

Table 3. Aspects of social preferences.

| Aspect     | Description                                                                 |
|------------|-----------------------------------------------------------------------------|
| Accessibility | Accessibility is how passengers can reach a transport mode when using it to go to Soekarno Hatta International Airport. Comfort is one aspect that makes passengers feel pleased when using the transport mode to Soekarno Hatta International Airport, related to the facilities and atmosphere in transportation. |
| Convenience  | Punctuality is one of the vital aspects in determining the preferred transport mode to the airport. The passenger must choose the right mode of transportation to save time. This facility is related to the comfort felt by passengers. These facilities can be in passenger seats, luggage storage, room lighting, and air circulation in the vehicle. |
| Punctuality  | Cancellation is also an essential social preference. Because if a passenger wants to cancel or reschedule but it is troublesome or even unable to do it, then the passenger will switch to another mode of transportation that is easy to cancel and reschedule |
| Facility     | Cancellation is also an essential social preference. Because if a passenger wants to cancel or reschedule but it is troublesome or even unable to do it, then the passenger will switch to another mode of transportation that is easy to cancel and reschedule |

3. Results and discussion

3.1. Passenger preferences for transport mode
Based on the three categories of transport modes that have been made, the questionnaire results define that most passengers who have traveled to Soekarno Hatta International Airport use private cars.
Table 4. The results of passenger preferences of transport mode.

| Distance               | Number | Percentage |
|------------------------|--------|------------|
| 0 – 10 km              | 134    | 90%        |
| 10 – 20 km             | 8      | 5%         |
| > 20 km                | 7      | 5%         |
| Bus                    | 34     | 23%        |

| Preferred Transport Mode | Number | Percentage |
|--------------------------|--------|------------|
| Airport railway          | 32     | 21%        |
| Private cars             | 83     | 56%        |
| Traveled with planes     | 140    | 94%        |
| Traveled with relatives  | 4      | 3%         |
| Others                   | 5      | 3%         |

Through the questionnaire questions, it can be seen that passengers who have a distance of up to 10 km are 134 passengers, passengers with a distance of 11-20 km are eight passengers, and those of more than 20 km are seven passengers. From the data, 83 passengers choosing a private car as a transport mode to the airport is related to social preferences. Social preferences relate to accessibility, convenience, punctuality, facility, and cancellation. Private cars are perceived to be superior in terms of social preference over buses and airport railway. In terms of accessibility and convenience, private cars are easy to access and more convenient than the bus and airport railway. This is because passengers can get on from their homes and get off right at the drop point or vehicle park close to their departure terminal. While in the vehicle, passengers also feel comfortable because they usually go with their family or relatives, so they do not mingle with other people like other transport modes.

From the facility aspect, private cars, buses, and airport railway also have a good facility. In terms of punctuality, it is clear that the use of a private car is superior because it can leave at any time, and there is no need to wait for passengers, as is often the case on buses. In terms of tariffs that must be paid, this depends on the number of passengers. However, according to most respondents, private cars’ use is quite affordable because it only costs money to buy petrol and pay for parking at the airport. Furthermore, private cars are more comfortable to cancel; passengers do not need confirmation for cancellations. In contrast to bus or airport railway passengers have to confirm to officers for cancellations or reschedule.

Despite environmental preferences, private cars’ use is not as fair as the use of buses and airport railway. Because private cars generate more significant carbon emissions and energy use than buses or trains. The carrying capacity of private cars is less than buses or trains. It can be concluded that passenger preferences in choosing the mode of transportation to Soekarno Hatta International Airport are seen from environmental and social preferences dominated by the use of private cars, and the rest use buses and airport railway.

Surprisingly, based on processed data, 140 passengers answered they went to Soekarno Hatta International Airport to travel by planes. Moreover, the rest of the passengers were traveled with relatives and did another activity. As a result, it will be possible to know the need for suitable transport mode for traveled passengers because passengers who travel will usually carry quite a lot of luggage. Therefore it will be known what facilities must be provided by transportation authority and airport authority. As is well known, Soekarno Hatta International Airport is the biggest and most crowded airport in Indonesia, so this data of characteristic passengers is essential to make an acceptable policy.

3.2. Environmental and social preferences
Environmental preferences are divided into carbon emissions and energy consumption. Based on processed data, most passengers choose energy consumption to affect their preferences in choosing the transport mode to Soekarno Hatta International Airport. Moreover, social preferences are divided into
accessibility, convenience, punctuality, facility, and cancellation. Based on processed data, most passengers answered more than one aspect that affects their preferences in choosing the transport mode to Soekarno Hatta International Airport.

Table 5. The results of Passenger Preferences of Transport Mode.

|                          | Number | Percentage |
|--------------------------|--------|------------|
| Environmental Preferences|        |            |
| Carbon emission          | 34     | 23%        |
| Energy consumption       | 32     | 21%        |
| Answer both aspects      | 83     | 56%        |
| Accessibility            | 34     | 23%        |
| Punctuality              | 5      | 3%         |
| Social Preferences       |        |            |
| Cancellation             | 3      | 2%         |
| Convenience              | 12     | 8%         |
| Facility                 | 3      | 2%         |
| Answer more than one aspect | 92 | 62%        |

Based on data, 58 respondents answered carbon emissions as an aspect that influences the choice of transport mode, then 21 others answered these two aspects that affect environmental preferences for transport modes. The carbon emission calculated in this study is the carbon emission produced by passengers when using the transportation, from they get on to the vehicle until they get off. Meanwhile, the energy consumption in question is the fuel required by the selected transport mode and the fuel used for other facilities in that transportation.

This means that respondents already understand the carbon emissions generated by the transport mode they choose to get to Soekarno Hatta International Airport and the energy consumption required by the preferred mode of transportation. Relatively many respondents are aware of the two environmental impacts generated by transportation. However, suppose it is related to the previous transportation mode preference, which was still dominated by private cars. In that case, this environmental preference cannot be a priority aspect chosen by passengers.

Afterward, 93 passengers answered more than one aspect of the social preferences that influenced them in choosing the mode of transportation to the airport. This means that these aspects are interrelated and influence passengers to choose the transport mode to the airport. About 35 passengers choose accessibility as an influential aspect. This is since transportation modes in the Jakarta area, and surrounding cities have begun to be integrated. Therefore, many passengers have also chosen to use public transportation to the airport. This is important to the buses and airport railway authority to consider these aspects to create public transportation that appropriates the community's social preferences.

4. Conclusion
As an entry point from other countries, Soekarno Hatta International Airport is unique and challenging to be researched. This study managed to collect data from 149 passengers. The aspect of being researched is the preference of transport mode used to the airport, related to environmental and social preferences, and what activities they do at the airport. Based on the data previously described, the majority of activities carried out by passengers at the airport are they will travel by plane. Referring to the theory previously mentioned, an airport is a meeting place for land transportation and air transportation. Land transportation produces carbon emissions that are met with air transportation, which is always being developed, thus creating carbon emissions. Although these passengers know their preferences about the environment, most passengers still use private cars to go to the airport. Social preferences can influence this because private cars are more comfortable to use than buses or airport railway. There is still a need for further research on the passenger's purpose that traveled by plane.
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