The Commuting Pattern Analysis Of Commuters From Depok City West Java

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A B S T R A C T

This research aims to analyze the commuting pattern of commuters from Depok City. Quantitative descriptive method was used and survey was conducted in this research. The population of this research are 395.093 commuters from Depok and 100 commuters were selected as the sample. The result of this research are the characteristic of commuters based on its status can be classified into workers and students. Spatial commuting pattern that found on this research is headed to Jakarta as 97 percent while the rest go to South Tangerang. Based on the region characteristic, commuters come from suburb to CBD and suburb to suburb. There are 40 percent of respondents commute to Central Business Distict (CBD) of Jakarta, especially workers. The average distances of commuters are 26 kilometers and the commuting duration is 86 minutes. Non-spatial commuting pattern was related to the main mode of transport that use, there are Motorbike (43%) and Train (37%). The farther the distance is, the number of public transport users increase, especially for women. The typical of public transport users is 'transit choice user', which is related to the availability of public transport facility nearby their origin. Those who have high accessibility toward public transport live less than 5 kilometers from nodal interchanges (train station and bus stops).

Kata kunciL

Kota Depok
Penglaju
Pola Pergerakan

A B S T R A K

Penelitian ini bertujuan untuk menganalisis pola pergerakan penglaju asal Kota Depok. Populasi pada penelitian adalah 395.093 penglaju asal Kota Depok dan sampel pada penelitian sejumlah 100 orang. Metode yang digunakan dalam penelitian ini adalah kuantitatif deskriptif dengan pengumpulan data survei. Hasil penelitian ini menunjukkan penglaju asal Kota Depok berdasarkan statusnya terdiri dari penglaju bekerja (pekerja dan pedagang) dan penglaju sekolah (siswa dan mahasiswa). Pola pergerakan spasial penglaju yang ditemui pada pada penelitian ini mayoritas menuju DKI Jakarta sebanyak 97 persen sedangkan sisanya menuju Tangerang Selatan. Berdasarkan karakteristik wilayahnya, pola pergerakan spasial berasal dari wilayah suburban menuju ke pusat kota dan dari suburban menuju suburban. Sebanyak 40 persen penglaju memiliki wilayah tujuan ke arah *Central Business Distict* (CBD) Jakarta terutama penglaju bekerja. Rata – rata jarak pergerakan adalah 26 kilometer. Kemudian pola pergerakan non spasial berkaitan dengan moda transportasi yang utama digunakan yaitu Sepeda Motor (43%) dan KRL *Commuter Line* (37%). Rata – rata durasi perjalanan adalah 86 menit. Seiring meningkatnya jarak pengguna kendaraan umum meningkat khususnya penglaju wanita. Responden yang menggunakan kendaraan umum ialah *transit choice user* berkaitan dengan dekatnya lokasi tempat tinggal dengan fasilitas transportasi, yakni mereka yang bertempat tinggal <5 km dari fasilitas transportasi.

Introduction

Jakarta as a mega city has become the economic attraction not only for its citizens but also for those who live in suburbs. Jakarta is surrounded by suburbs regionalization called Bodetabek, it consists of four cities: Bogor, Depok, Tangerang and Bekasi. The daily mobility pattern from suburbs to Jakarta and vise versa is called commuting.

People who commute are commuters. There are 1,38 million commuters from Bodetabek who have daily activities in Jakarta. Commuters from Depok is the highest percentage among them with 19,6 percent (BPS, 2019). Administratively, Depok is a city located in southern Jakarta. Functionally, Depok has become Jakarta's hinterland area.

There are three main factors which contribute to commuting. The economic activities are the major factor. There is an impact of the city's spatial structure on commuting patterns (Modarres, 2011). One third of all worker commute to the city center which has a commercial function (Acheampong, 2020). Based on Jabodetabek Commuters Statistic Data, the percentage of commuters are 73,4 percent workers and 36,1 percent are students (BPS, 2019).

Second, the existence of well-built urban transportation service to accomodate commuters and overcome long distances from their origin to destination (Suryadi, 2014). For example, the train (KRL Commuter Line) has become the top choice for commuters who use public transport with low cost. KRL Commuter Line users from Bodetabek have below average income, even those who own four-wheeled vehicles may still use the KRL Commuter Line because it is more economical (Munandar, 2015).

Third, settlements are dispersed as urban sprawl in suburbs (Motte, 2016). In 2045, 82.37 percent of Indonesia's population is projected to live in urban areas (Director of Settlements Development, 2017). Depok has built-in land cover with a high urban sprawl rate. The land use change from agricultural land to settlements has occurred significantly in the last 10 years, from 36.71 percent in 2006 to 54.55 percent in 2016 (Ristianingrum, 2018). The development pattern of Depok City leads to the south and west with a longitudinal pattern following the road network or known as the ribbon development pattern. The population of Depok City is distributed close to activity centers (Rizqihandari, et al., 2017).

The massive urban mobility causes various problems, especially those related to commuters. The main characteristic of commuters is the movement that recur every day (Mantra, 2000). These recurring events can cause significant problems in various dimension. First, spatial dimension, high level of mobility causes congestion and delays (Todd, 2013). Second, the environmental dimension, high mobility contributes to air pollution, especially non public transportation. There are 58 percent of Bodetabek commuters use motorbike modes of transport (BPS, 2019). Motorbikes contribute 72 grams of CO2 carbon emissions per passenger kilometer (Rikkinen & Burns, 2018). Finally, in social dimension, the length of time on the trip can lead to decreased life satisfaction (Chatterjee, et al., 2017). Furthermore, commuting with a longer trip duration enhance the level of stress (Vale, et al., 2018).

An understanding of how the commuting pattern is needed to figure out the factual problems of commuting. The commuting pattern is a dimension of how was the direction, distance, duration, types of transit, and transport costs (Dickinson, 1967 and Mondal, 2015). These variables are interrelated and mutually dependent (Setyodhono, 2017). Therefore, researchers are interested in researching "The Commuting Pattern Analysis of Commuters From Depok City West Java".

Method

Quantitative methodology is used and a survey was conducted as data collection techniques. The population in this study is commuters from Depok City, according to BPS data, there are 395,093 people (BPS, 2019). Based on a calculation using the Slovin formula with an error rate of 10 percent, the number of samples are 100 commuters,.

Multistage random sampling was used. This sampling technique is the combination of two or more different sampling techniques. In this study, cluster sampling (area sampling) and random sampling were applied. First, Depok City was selected as the sampling area. Then because the number of commuters in each sub-district in Depok is not stratified, the sampling needs to use simple random sampling (Sugiyono, 2016).

The study was conducted in May 2020. Due to COVID-19, the questionnaire was obtained using Google Form. The questionnaire was distributed through several social media such as the WhatsApp, Instagram and Twitter. The timing of this research was taken when the COVID-19 case was high and large-scale social gathering restrictions (PSBB) were applied. Therefore, at that time, the mobility rate was decreased. Respondents were asked to fill in answers with assumptions before the implementation of the PSBB, so commuting pattern can be obtained. However, as a comparison, some questions about their commuting status during PSBB were asked. The data were analyzed using descriptive statistics to describe the characteristics of commuters and spatial analysis of the direction of commuting.

Result and Discussion

Respondents' Background

Based on its gender, respondents divided equally, 50 : 50 for male and female. The age range are varied from 16 years to 51 years old. Respondents composed by young age, the majority are 16 – 28 y.o which covers 89 percent. Based on their educational status, most of the respondents had the latest high school level of education. Based on their income level, 42 of them earn less than IDR 3,000,000 per month. However, those who have an income range of IDR 3,000,000 - 7,000,000 per month are quite a lot as many as 40 people. Only 4 who have an income higher than IDR 7,000,000 per month are only 4 people. Meanwhile, the rest claimed that they hadn't had a stable income.

Respondents are spread across 11 sub-districts in Depok. The largest composition came from Sukmajaya sub-district (17 respondents), followed by Cimanggis and Beji with 15 and Pancoran Mas sub-distrct with 12 respondents. These four sub-districts are the most densely populated sub-districts in Depok. Meanwhile, the sub-district with the smallest percentage of respondents was Bojongsari sub-district which is morelikely rural area with only 2 commuters.

Spatial Commuting Pattern

Spatial commuting patterns indicators are the direction, distance, and route of travel (Roberts, 1974; Tolley & Turton, 1995; Chapin, 1995; Tamin, 1997; Berroir, 2011 and Pebrian & Ratnasari, 2013). The commuters' direction in this study mostly goes to Jakarta. As many as 97 people

headed to Jakarta and only 3 people headed to South Tangerang. The majority of respondents headed to East Jakarta, with 52 people and South Jakarta with 33 people.

Based on the travel distance, the majority of respondents covered a moving distance of 24-30 kilometers. The closest distance traveled by the respondent is 4 kilometers, while the farthest is 50 kilometers. To strengthen the validity of the data, we also check the respondent's origin-destination with Google Maps if there is only a slightly difference it is said to be valid. The most frequency is at a distance of 30 km as many as 22 respondents. The average travel distance was 26 kilometers. Respondents who have a relatively shorter distance live in the sub-districts that are directly adjacent to DKI Jakarta or their destination. Based on gender, there is a difference between the average distance traveled by male and female respondents. The average distance traveled by female respondents is farther than that of men. Female respondents covered an average distance of 25.55 kilometers while male respondents traveled 24.59 kilometers.

Non-spatial commuting pattern

The non-spatial movement pattern consists of a description of the reasons for commuting, mode of transport, transportation costs and commuting duration (Tamin, 1997; Mantra, 2000; Vale et., al, 2018). There are 48 commuters who commute to work while 52 commuters are students. The majority as 51 commuters are university students and only one who is high school student. Most of the modes of transportation used by respondents were public transportation, as many as 53 people and private vehicles as many as 47 people. Most of the respondents who are public transportation users, they used train (KRL Commuter Line) as 71,7 percent, Transjakarta bus as 22,6 percent, then remaining 5,7 percent used motorcycle taxis. Meanwhile, the majority of private vehicles used were motorbikes as 93,6 percent and the remaining 6,4 percent using cars.

In terms of changing the mode of transportation in one-way trip, the number of mode changes are varied. There are 46 respondents only used one mode of transport. Then, there are 32 respondents who need to change the mode of transport two times (mostly motorbikes + train or bus). Meanwhile, respondents who experienced 3 modal changes were as many as 22 people (mostly motorbikes + train + bus).

In general, the respondents' transport costs for one round trip varied from IDR 7,000 to 100,000. Transport costs can be categorized into 3 namely cheap, medium and expensive. The largest number of respondents based on transport costs incurred was in the range of 7,000 - 39,000 IDR as many as 82 people or Meanwhile, the average cost of transport was IDR 15,000.

Most of the respondents commute on weekdays as many as 46 people. This is related to the main reasons the respondents travel to work, study and go to school. The majority of respondents who only travel on certain days work with a flexible time. The rush hour concentrated before 07.00 WIB. The highest percentage

is at 5.00 to 6.00 am with 57 respondents. The time the respondents arrived at destination varied but were concentrated before 08.00 WIB. The average trip duration was 84 minutes. Most respondents come back home from 16.01 - 17.00, as 33 respondents. On average, respondents arrived home at 18.22 (GMT +7). The average duration of the return trip is longer than the time of leaving, which is 98 minutes. The assumption regarding this finding is that during the return trip they are not in a hurry because there is no compensation whatsoever if he arrives late at home so that they don't need more efforts on the mode of transportation or routes that prioritize speed.

Data Analysis

In this study, we only found commuters headed to Jakarta and South Tangerang. Meanwhile, based on data from the Jabodetabek Commuter Statistics Agency (2019), there are others destinations such as heading to Bogor Regency (10.46 percent), Bogor City (2.82 percent), Tangerang Regency (0.62 percent), Tangerang City (1.15 percent), Bekasi Regency (0.78 percent), Bekasi City (1.65 percent) and Outside Jabodetabek (0.32 percent). Therefore, this study has limitations, which only describes the pattern of commuting towards Jakarta and South Tangerang City.

The commuting direction that is concentrated to Jakarta compared to other areas is called "biased direction", which is the tendency of commuting towards areas that have more attraction compared to other areas (Cox 1972 in Dianawati, 2016). Respondents commute due to obligatory activities (Rodrigue, 2006).

Analysis of spatial commuting patterns also considering the function of a city. According to Yunus (2002), a city based on its function in an organic area has a functional relationship between various sectors of activity in a large area and mutually forms a node of activity. Functionally, Yunus (2002) also categorized a city into suburb and the Central Business District.

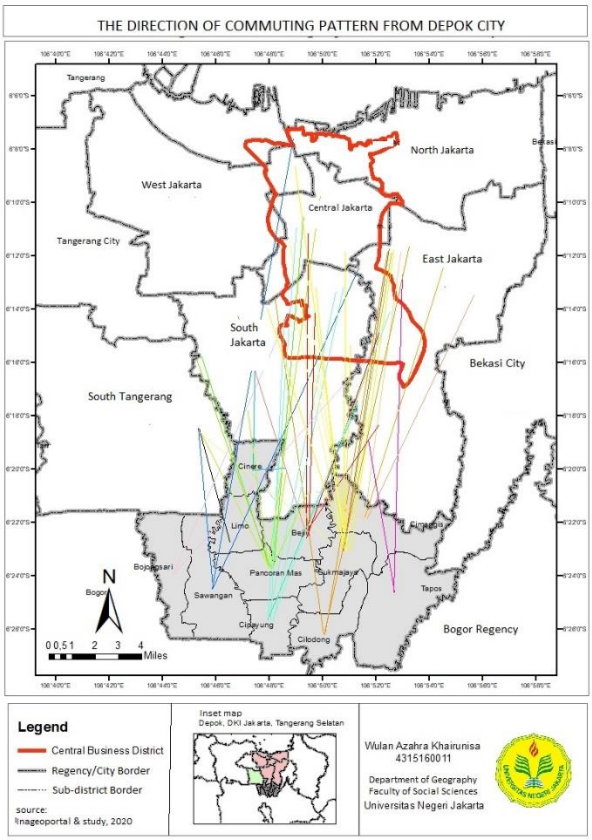

Figure 1 The Direction of Commuting Pattern
Source: Data Analysis, 2020

Therefore, functionally, the commuting pattern is from suburbs to suburbs (South Tangerang and Jakarta's fringe area) and from suburbs to CBD.

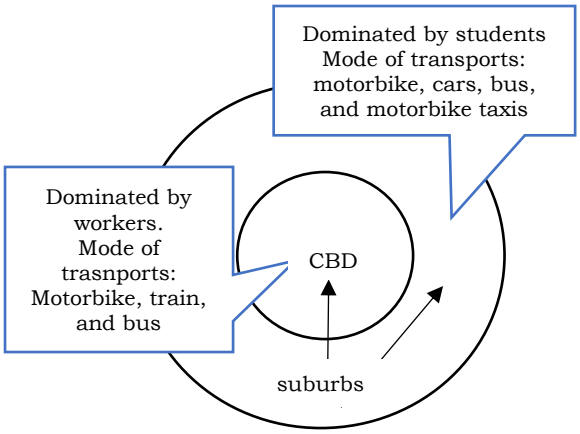

Figure 2 The Commuting Pattern

Source: Data Analysis, 2020

Further analysis regarding the choice of transport mode can be explained by the types of users, there are "choice user" and "captive user". Most of the female respondents (as 60 percent) are transit choice users, which means those who choose to use public transportation even though they have the choice of using private vehicles. Meanwhile, only 16 percent of male respondents are transit choice users. On the other hand, 62 percent of male respondents are auto choice users and only 20 percent of female respondents are auto-choice users.

The origin of the sub-district is an important unit of analysis for a city scope. Each sub-district in Depok has its own characteristics, especially those related to the accessibility of transportation modes. Train (Commuter Line KRL) users live close to train stations are especially concentrated on a radius of 3 kilometers. The farthest radius for the train users is 5 kilometers. Therefore, it is reasonable for them to choose the train compared to other transports. The same thing happened to Transjakarta bus users, only 3 respondents or 16.66 percent who live more than 5 kilometers from the bus stop but still choose to use this transportation.

In general, private vehicles and motorcycle taxis users travel patterns follow the pattern of the city's road network. The pattern is in the form of a grid with the majority of North - South road network services while East - West movement services are still very limited (Bappeda Depok, 2013). Therefore, nothing has connected the growth of Depok on the east side. The road route from Depok City to the north is the primary collector and secondary collector roads. Meruyung - Cinere Raya road is a secondary collector road based on the Depok Bappeda (2013). In the middle, Margonda Raya road, is the primary collector road (Bappeda, 2013). Then, in the eastern part there is Bogor road which is a primary arterial road. In addition, Sawangan road is the main road section for west-east movements, both those that want to pass Meruyung - Cinere Raya, Grogol - Gandul Raya, and Kartini - Margonda Raya road. Based on Bappeda (2013) Sawangan road is a Primary Koletor Road, so that it often becomes a congestion point.

As previously mentioned, most private vehicle users are auto-choice users (not choosing to use public transportation even though transportation facilities are available). Therefore, respondents who use private vehicles over public transportation have certain reasons. First, we asked them about "do they want to switch to public transportation" and the results were 72.88 percent said they did not want to, only 27.12 percent said they may switch.

The main reasons of their unwilliness to switch to public transportation are varied. There are 7 main reasons: longer travel

duration, remote access to public transportation, takes time for waiting, higher costs, impracticality, insecurity and inconvenience. The majority of the answers were longer travel duration, as much as 21.35 percent, then the other main reasons were impractical and long waiting times were 17.71 and 17.20 percent. Respondents who explained the reason for being unsafe were prone to be infected of COVID-19.

The Impact of COVID-19 on Commuting

At the time of data collection, namely in May 2020, Large-Scale of Social Gathering Restrictions (PSBB) were being implemented due to the COVID 19. This research ask the respondents to assumes the mobility under normal conditions or before the implementation of the PSBB because the number of commuting activities forced to reduce during PSBB. However, to assure how's the exact condition, at the end of the questionnaire they were asked about "how is their commuting activities during PSBB". As many as 80 percent of respondents answered that their condition was "working and studying from home", then 13 percent answered "being temporarily sent home until the PSBB ends". Furthermore, 5 percent answered "working at home and at the office combined", and 2 percent answered "still working full-time in the office". Although the mobility during the pandemic is reduced, policies related to mobility can change rapidly as the PSBB policy loosen and returns to normal conditions so that the data in this study is still relevant**.**

Conclusion

The conclusions in this study can be divided into three parts. First, based on their characteristics, commuters from Depok consist of workers and students. Consists of male and female predominantly under 30 years. The majority of respondents earn less than IDR 3,000,000 per month. Second, the spatial commuting pattern, in this study, the majority movement direction headed to Jakarta and only a small portion towards South Tangerang. Based on the functional region, the commuting pattern originates from suburbs to suburbs and suburban to CBD. Third, non-spatial commuting patterns based on the main mode of transport used by commuters from Depok are train and motorbike. The farther the distance, public transportation users increase, especially for female commuters, while motorbikes tend to be chosen for shorther travel distance.

The location of origin and destination has an impact on the choice of mode of transport and travel route. Respondents who use public transportation (train called KRL Commuter Line and Transjakarta bus), are related to the proximity of their residence to transportation facilities, they live less than 5 km from the transit hub (train station/bus stop). Meanwhile, for private vehicle users, the primary routes to the destination are Meruyung - Cinere Raya road on the west, Margonda Raya road on the middle and Bogor on the east. In addition, Sawangan road is the main road section for the west to east movement.

There are two implications of this research. First, it can be used as a consideration for the development of transportation system planning, especially in several sub-districts in Depok which have low accessibility due to the lack of public transportation facilities. Therefore, in the

near future, auto-choice users have willingness to switch to public transportation and the accumulation of passengers in some transit can be reduced. Second, this data also could be a consideration for mobility strategies during the COVID-19 pandemic as the majority of commuters from Depok use the the train (KRL Commuter Line) they are prone to be infected by COVID-19.

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