

THE IMPACTS OF ODD-EVEN RESTRICTION POLICY ON TRAVEL BEHAVIOUR

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ABSTRACT

In order to reduce traffic congestion, the Government of DKI Jakarta has imposed vehicle restrictions by implementing an odd-even system policy. This study aims to identify travel behaviour of private car users and their perceptions of the odd-even policy. The target respondents were people who live in Jabodetabek and travel in or to the Jakarta area using private cars. Questionnaires were distributed online to the appropriate target respondents. The analysis is descriptive statistics. The result shows that the majority of car users will shift to using public transportation or using motorbikes to travel in or to Jakarta if the road sections affected by the odd-even policy are expanded. But some of them who do not want to shift modes, they prefer to avoid the applied roads. Meanwhile, for some of the users whose economic level is more than adequate will tend to buy a new car, with a different car number plate. For private care users, socialization of odd-even system policy and supervision of violators was considered effective, then the implementation of odd-even system policy on several roads is deemed effective in smoothing traffic flow than before.

Keywords: *Odd-Even Restriction Policy, Travel Behaviour, Private Car User Perception*

BACKGROUND

The capital city of DKI Jakarta has the highest activities especially as central areas of government and economy of Indonesia. In addition, Bodetabek (Bogor, Depok, Tangerang and Bekasi) which supports Jakarta, has made Jakarta experience a very rapid urban economic development. Along with the increasing population and economic growth in Jabodetabek, various urban problems are risen up such as traffic congestion especially occurs on the main roads that connecting residential areas to the others (social, economic and government areas).

The increase in the number of vehicles is not proportional to the increase in road length. It can be one of the factors that drives the bad congestion in Jakarta. Badan Pusat Statistik (BPS), the percentage growth in the number of vehicles each year reached 6.38% from 2016 to 2018. Meanwhile, the average increase in road length over the same time frame is only 0.26% per year. In the DKI Jakarta, the average growth in the number of vehicles reached 5.04% per year, while road length decreased by 5.1% in 2016-2017 and there were no additional roads (excluding toll roads) (BPS, 2019).

Judging from the facts above, the government needs to implement comprehensive solutions for reducing congestion, considering that the losses caused by congestion are quite large. Several studies that have been conducted have identified several losses caused by congestion, including waste of fuel, loss of time, environmental damage due to air pollution, increased vehicle operating costs and the incidence of respiratory disease due to deteriorating air quality (Syaukat, Sarma, Falatehan, & Bahtiar, 2019; Tamara & Sasana, 2017). Several approaches have been taken to reduce the level of congestion, one of which is by developing a long-term strategy for the public transportation system in the city, like operating TransJakarta, Mass Rapid Transit (MRT), Light Rapid Transit (LRT) and so on. Another approach to reduce the level of congestion is to improve traffic management by regulating and controlling the number of vehicles, such as implementing the odd-even restriction policy. This policy aims to encourage people to reduce the use of private vehicles. However, this effort will be in vain if it is not harmonized with the concept of public transportation development, where congestion only moves to the other location at certain hours. It means that there are conditions that must be provided by the Government in line with the odd-even policy, such as the availability of public transportation, comfortable, safe and integrated public transportation. Finally, people are not only encouraged to reduce private vehicles but also they will shift to use urban public transportation

as targeted by the government, which is 60% by 2029 (Peraturan Presiden Nomor 55 Tahun 2018 tentang Rencana Induk Transportasi Jabodetabek Tahun 2018-2029).

In practical, this odd-even system still creates several problems. Congestion seems to occur along the road corridors where this system is implemented. In addition, there is a movement of congestion on several alternative roads around the road corridors. The government has evaluated this policy, and it results in expanding the scope areas of implementation of the policy. So that, it is interesting to study regarding public acceptance of this policy. This study aims to identify travel behaviour as well as to assess people's perceptions regarding the implementation of the odd-even system policy.

The Odd-Even Restriction Policy

Transportation Demand Management (TDM) is a strategy to maximize the efficiency of the urban transportation system by limiting the unnecessary use of private vehicles and encouraging more effective, healthy and environmentally friendly modes of transportation such as public transportation and non-motorized vehicles (Broaddus, Litman, & Menon, 2009). TDM is suitable to be applied in cities in developing countries because of its low cost and many benefits (Litman, 2003). Several forms of TDM are applied in Indonesia include the 3 in 1 system and the odd-even system. In 2016 the odd-even system began to be implemented on 9 main roads in the Jakarta area, replacing the 3 in 1 system which previously applied to 6 main roads. Furthermore, in 2019 the DKI Jakarta Government has expanded it to 26 roads in the Jakarta area (Peraturan Gubernur DKI Jakarta Nomor 88 Tahun 2019).

The odd-even restriction policy is implemented by only allowing vehicles with an even number plate to run and vice versa for odd ones. In some cases, the application of vehicle plate restrictions is based on the type of vehicles, specific areas, and particular time. The policy applies specifically to 4 (four) wheeled vehicles. On the affected roads, private car users can use public transportation to access the destination. The implementation of the odd-even system is a form of transition before the implementation of the Electronic Road Pricing (ERP) system.

The odd-even system has advantages and disadvantages (Litman, 2003). This odd-even system is often easily accepted by people as the government's commitment to reduce congestion and air pollution. In addition, this policy can temporarily reduce congestion while public transportation is being improved by government.

Also, it increases the average travel speed on the road. On the other hand, the policy tends to encourage people to buy new car, prone to forgery of vehicle plate numbers, increase taxi trips if taxi car are not included in this policy, as has happened in Mexico City and Bogota. So this policy is not a long-term solution because of the increase in car ownership will occur from time to time and it only excludes for certain vehicles.

Several similar policies have been implemented in various countries, such as Lagos (Nigeria), Mexico City (Mexico) (Davis, 2008; Gallego, Montero, & Salas, 2013), Bogota and Medellin (Colombia) (Ramos, Cantillo, Arellana, & Sarmiento, 2017), Santiago (Chile), Sao Paulo (Brazil), Manila (Philippines), Beijing (China) (Cai & Xie, 2011; Li & Guo, 2016), Delhi (India) (Kreindler, 2017), Quito (Ecuador) (Litman, 2003; Yudhistira, Muhammad Halley; Kusumaatmadja, Regi; Hidayat, 2019). Many researchers then evaluated the success of implementing the Odd-Even policies in these countries. The implementing of the Odd-Even policy during the 2008 Olympic Games in Beijing showed 20-40 percent reduction in traffic volume and 10-20 percent increase in travel time (Li & Guo, 2016), a 20 percent increase in travel speed in (Litman, 2003) and also this policy is effective in reducing air pollution and improving air quality (Cai & Xie, 2011).

METHODS

The research was conducted in the DKI Jakarta area who private car users were the research object. The study focuses on impact on travel behaviour of people regarding implementation of odd-even policy. It also evaluates the extent of public acceptance of this policy. The data consist of primary and secondary data. The primary data was public perceptions obtained by distributing online questionnaires for 2 weeks. The secondary data were demographic data and travel population data in/to Jakarta obtained from related institutions.

The target respondents were private car users who live in the Jabodetabek area. They were at least traveling in or to Jakarta more than 1 (one) round trip within 1 (one) week. In determining the minimum sample size, the Slovin formula (Sugiyono, 2013) is used with an error rate of 10%. The population in this research were public who travelling in/to Jakarta area. The population in this study were people who traveled in / to the Jakarta area. According to data from Badan Pengelola Transportasi Jabodetabek (2018), there are 4,500,000 trips in/to Jakarta area per day. Assuming this number of trips is made by the population, so the minimum number of respondents is 100 respondents.

The analysis used descriptive statistics based on online survey of 108 respondents. It related to trip characteristics and perceptions of the odd-even policies. The questionnaire questions were divided into 4 (four) sections containing information below:

- 1) Screening questions (to get the target respondent)
 - a. Domicile of respondent
 - b. Whether the candidate respondent uses private car when traveling in / to Jakarta
 - c. Whether the candidate respondent travels in / to Jakarta more than once (round trip)
- 2) Travel characteristics
 - a. Trip origins
 - b. Trip destinations
 - c. Number of trips within 1 (one) week
 - d. Trip purposes
 - e. Followed route
- 3) Perceptions regarding odd-even policy
 - a. Respondents' approval of the odd-even policy implementation in Jakarta
 - b. Mode choice
 - c. The perceived Odd-Even impact of the policy
 - d. Selection of alternative modes of travel
 - e. How effective is the odd-even policy socialization carried out by the government
 - f. How effective is the monitoring of odd-even policy violations
 - g. How effective has the Odd-Even policy been in reducing congestion
- 4) Profile of respondents
 - a. Gender
 - b. Occupation
 - c. Education
 - d. Car ownership
 - e. Motorcycle ownership
 - f. Monthly expenses
 - g. Monthly expenses for transportation costs

In the perception section with a Likert scale, the validity and reliability of the data were tested to measure whether the questionnaire prepared was good at measuring symptoms and producing valid data. These questions include respondents' approval of the odd-even policy implementation in Jakarta (Q19); how effective is the odd-even policy socialization carried out by the government (Q20); How effective is the monitoring of odd-even policy violations (Q21); how effective has the Odd-Even policy been in reducing congestion (Q22). The result of both tests with level of significance 5% indicates that these questions are valid and reliable ($r > r$ product moment). The conclusion of both test results are presented in the following table.

Tabel 1. Result of validity and reliability test

Question	Validity test r	Reliability test r	r product moment
Q19	0.7985		
Q20	0.8721		
Q21	0.8372	0.7880	0.1891
Q22	0.7857		

RESULTS AND DISCUSSION

Profile of Respondents

The profiles of respondents in this study are presented in Table 1.

Tabel 2. Profile of respondents

Characteristic of respondents	%
1. Gender	
Male	60%
Female	40%
2. Age	
< 20 years	0%
20-30 years	43%
31-40 years	35%
41-50 years	15%
> 50 years	7%
3. Educational background	
High School	18%
Diploma	15%
D4/S1	48%
S2/S3	19%
4. Occupation	
Students	6%
Employees	48%
Entrepreneurs	19%
Others	26%
5. Monthly expenditure	
< IDR 3.500.000	13%
IDR 3.500.000-IDR 5.000.000	36%
IDR 5.000.000-IDR 6.500.000	20%
IDR 6.500.000-IDR 8.000.000	12%
> IDR 8.000.000	18%
6. Average monthly expenditure for transportation	
< IDR 500.000	8%
IDR 500.000-IDR 1.000.000	27%
IDR 1.000.000-IDR 2.000.000	35%
IDR 2.000.000-IDR 3.000.000	19%
IDR 3.000.000-IDR 4.000.000	3%
> IDR 4.000.000	8%

The majority of respondents in this study were men (60%), who in productive age (20-40 years) (78%), having Bachelor degree (48%), employees (48%), the average monthly expenditure is relatively middle to upper class, and the average monthly expenditure for transportation is relatively medium. Furthermore, to confirm whether the respondent is in accordance with the target can be on the characteristics of the trip.

Travel Characteristic

1. Trip Origin

The areas of trip origin were grouped into 5 regions, namely DKI Jakarta, Bogor, Depok, Tangerang, and Bekasi. The following figure shows domiciles of respondents are scattered in the Jabodetabek area. The majority of respondents live in Jakarta by 34%, it followed by respondents from the Bogor area by 19%, then followed by respondents from the Depok area by 18%, and respondents from Tangerang and Bekasi area by 15%. Trips from outside Jakarta (67%) are bigger than trips within Jakarta (34%).

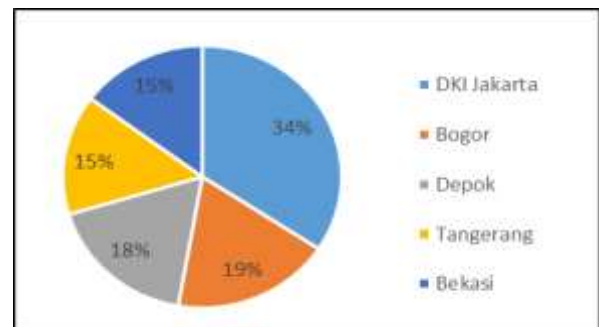


Figure 1. Trip origins of respondents

2. Trip Destination

Figure 2 shows that the dominant respondents travelled to Jakarta (88%). There were only 13% of respondents travelled outside Jakarta. Related to trip origin data above, most of respondents have activities in Jakarta area with various purposes.

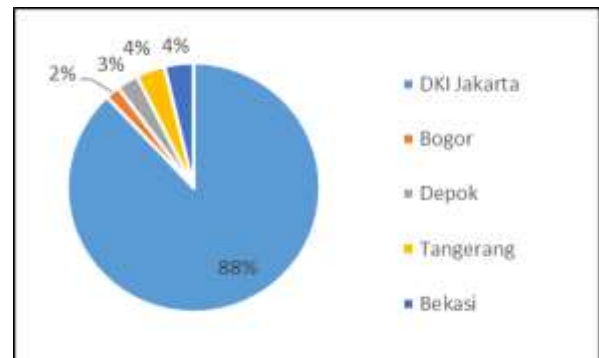


Figure 2. Trip destinations of respondents

3. Trip Frequency

Figure 3 presents the majority of respondents were commuters in Jabodetabek area. It indicates that they have already known about the Odd-Even policy in Jakarta.

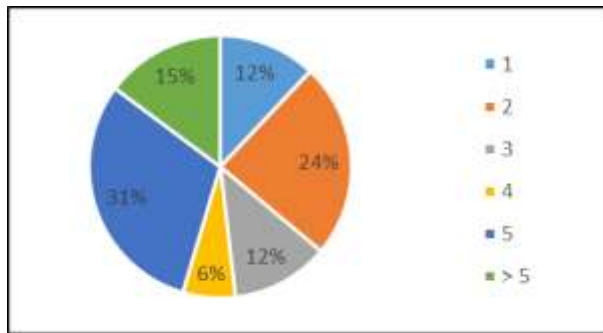


Figure 3. Trip Frequency of respondents in a week

4. Trip purpose

Trip purposes of respondents were divided into 4 purposes, namely working, studying, recreation, and others. The survey results show that the majority of respondents travel for work. This is accordance with what is shown in Figure 3 above.

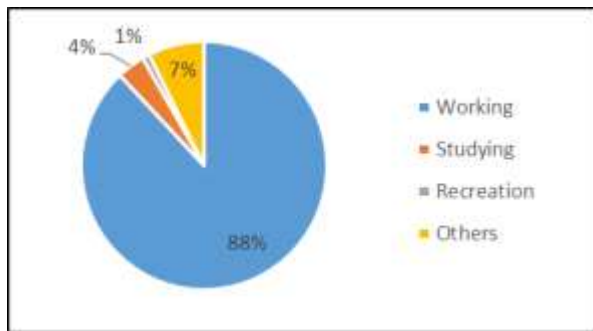


Figure 4. Trip purposes

5. The followed route

Based on the questions regarding the route taken, it can be seen that 74% of respondents who answered the questions in this questionnaire already knew which roads were affected by the Odd-Even policy.

Perceptions of Odd-Even Policy

The perception regarding the implementation of the Odd-Even policy is carried out to assess the effectiveness of the Odd-Even policy in achieving the stated goals. The results of the perception data regarding the Odd-Even policy as follows:

1. Perception regarding the implementation of the Odd-Even policy in Jakarta

The survey result shows there were 67% of respondents agree with the implementation of the policy, although there were 21% of respondents who quite agree with that. The public seemed to welcome this policy as well.

Related to the 67% of respondents who agreed, the majority of them are males, aged 20-40 years old, have bachelor's degree, own 1 car and 1 motorcycle, have medium expenses between IDR 3,500,000 to IDR 6,500,000 per month, and have transportation expenses IDR 1-2 million per month. It can be seen that the users are in the

middle economy with productive age who feel the benefit of this policy.

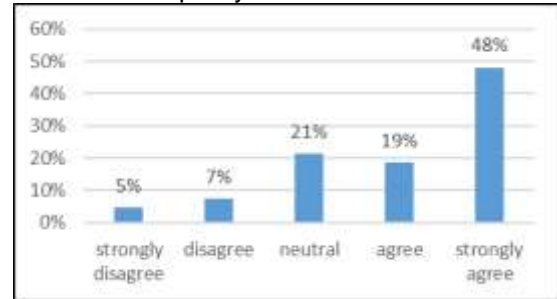


Figure 5. Perception regarding the implementation of the policy

2.Travel behavior due to Odd-Even policy

Then, respondents were asked about their travel behaviour if the car number plates did not match the date. Based on the survey results, there were 43% of respondents who stated that they would continue to use their own car and try to find the other routes which were not affected by the policy. Furthermore, 21% of respondents would choose to use another car with the appropriate number plates. Twenty-nine percent of other respondents would choose to use public transportation, while 4% of respondents would ride their relatives' car, and the other 4% of respondents would cancel their trip.

The reason why some respondents would not shift to public transportation was they had more than one car/vehicle with different plate number, so they continued to use private vehicles for their trip. It can be said that some of the respondents have more than adequate welfare.

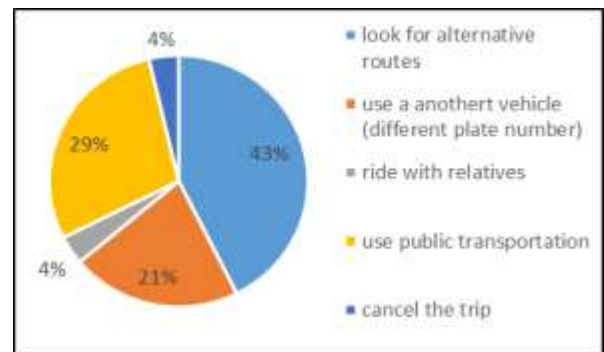


Figure 6. Travel behavior due to Odd-Even policy

3. The Impacts due to the implementation of Odd-Even policy

Mostly, the impact felt by public due to the implementation of this policy was the congestion is reduced and travel time is faster (54%). However, there were also respondents who argued the opposite, that the congestion still occurs, especially during on peak hours in some alternative roads (29%). In addition, there were also several respondents who complained because they felt it was difficult to travel for business, deliver goods, or travel for sudden necessity (11%). Also, there were respondents

who felt it was not a problem because they could use other car (1.8%), and other comments. But overall, to reduce congestion on several roads, the odd-even policy is considered very helpful.

4. The alternative modes

Asking for this question aims to determine the type of mode used daily to travel if the policy is expanded and the monitoring is tightened. From this information, it can then be studied regarding the availability of transportation facilities in order to improve accessibility and ease of getting public transportation services from origin to destination of the trip.

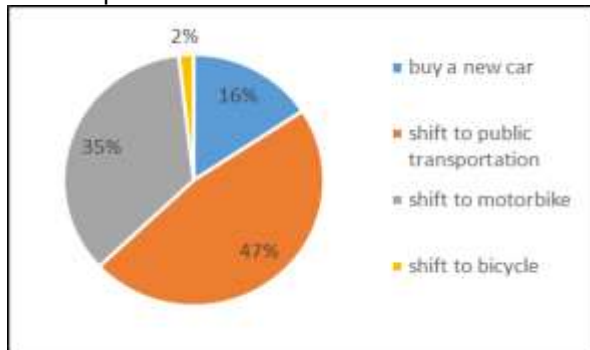


Figure 7. Shifting of alternative modes

Based on the survey results, there were 47% of respondents said they would shift to use public transportation, then 35% of respondents would switch to use a motorbike, 16% of respondents said they would buy a new vehicle and the other 2% of the respondents chose to use a bicycle. From these results, it can be seen that most respondents are committed to shifting to using public transportation, it means that public transport services must be further improved. Then the success of the odd-even policy implementation will be significant.

5. Perception regarding the Odd-Even policy socialization

Regarding the socialization of the policy by the government, there were 61% of respondents stated that the socialization was effective. This is mostly stated by men of productive age who commute every day. The other 29% of respondents stated that the socialization was quite effective. Only a few of the respondents stated that government socialization was ineffective. It indicates most of respondents have already known about the implementation of this policy in Jakarta.

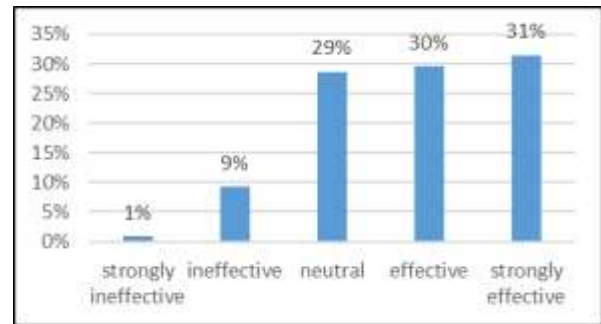


Figure 8. Perception regarding the socialization of the policy

6. Perceptions regarding the supervision of the policy

According to the survey result, most of respondents stated that the field monitoring has already effective. However, it is better if the monitoring is supported by electronic system such as *e-tilang*. Currently the E-TLE (*Electronic Taffic Law Enforcement*) only applies to vehicles that violate road signs, markings, traffic lights, and so on. Manual supervision by officers in the field requires a lot of personnel. So it is necessary to think about the more effective and efficient method if this policy will continue in the future.

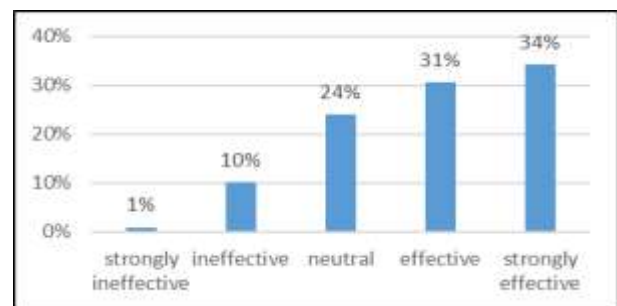


Figure 9. Perception regarding the supervision of the policy

7. Perception regarding the effect of the policy in reducing congestion

Forty-seven percent of respondents felt the congestion had decreased since the implementation of this policy. This finding is in line with the result in point 3 above. Then there were 37% of respondents stated it was quite effective and the other 16% of respondents stated that the Odd-Even policy was not yet effective in reducing congestion. To validate this, it is necessary to do before-after study for simulating the traffic in next research. Finally, the significance of improving the performance of road sections in Jakarta can be clearly seen.

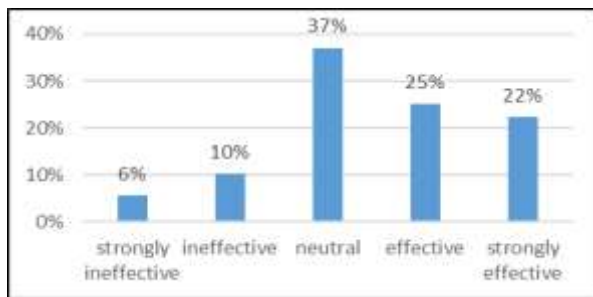


Figure 10. The implementation of the policy in reducing congestion.

CONCLUSION

The high daily commuter trips from the Bodetabek area to Jakarta and vice versa are targets that the government must pay attention to in order to reduce congestion in the capital. Implementation of the odd-even policy by reducing the volume of vehicles, especially on main roads, can be effective if it is carried out consistently, effectively and efficiently. Overall, most people are aware of the implementation of the policy, and the applied roads are generally passed by the people every day.

On certain roads, there are only vehicles with a certain number plate (odd-even following the date) can pass the roads. The interesting thing is the policy has led to new travel behaviour such as private car users who do not want to shift modes and they prefer to avoid the applied roads. In addition, the other negative effects can also be predicted, especially for some of them whose economic level is more than adequate will tend to buy a new car, of course, with a different car number plate. Moreover, it supported by the Low Cost Green Car (LCGC) which is widely produced today. In the future, it is necessary to apply the other TDM policies that can support this policy, such as increasing progressive tax on vehicle ownership and stricter terms for users. However, if this policy is extended to other roads, many people will shift to using public transportation. Then improving the performance and integration of public transport will be very important to do. Ownership of motorbikes will also increase if the government does not prepare a solution.

In addition to socialization of the policy that are considered good enough by the public, the government also needs to make efforts to increase supervision in the field, then it consistently implemented. Technology development in supervision is also an important thing to do. Although some people think that this policy has been effective, it needs to do more research that can simulate the traffic to see the measurable changes in road performance. Furthermore, implementing ERP as a TDM policy

plan requires careful preparation by the government in order to reduce congestion in the Jakarta area.

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