Eco-driving behavior tendency among Indonesian people: a preliminary study

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Abstract. Eco-driving behavior can be triggered by many aspects such as economic and environmental awareness. In Indonesia this issue received less attention from citizen, whereas it has significant roles in reducing greenhouse gas emission. This paper initiated a study about eco-driving tendency behavior among Indonesian people, the objective is to see whether current behavior support or not, and does the differences between gender and age exist. Adopted on-line study method using an online form questionnaire, 27 questions developed consist of 8 items related to individual data, 19 items related to perception and driving behavior. The respond measures using 5 scale option answers (i.e. strongly disagree, disagree, quite agree, agree, and strongly agree). Based on average respondents’ answers, can be concluded that the tendency of behavior somewhat supports to in line with eco-driving behavior. After Q15 and Q18 omitted based on Pearson-product moment correlation, further analysis results showed that most of respondents categorized into mild tendency behavior (109 respondents). However, a mild tendency among female respondents are higher than male, and the strong tendency of males is higher than female respondents. Based on gender, there are no significant tendency behavior differences between male and female (p-value =0.320), and also among age groups (30y, 31-40y, 41-50y, and >50y), even though age >50 have a lower tendency to the behavior compare to other groups.

1. Introduction
Eco-driving behavior can be defined as a behavior during driving that considers fuel usage to be much more efficient and economic [1]. The behavior relatively difficult to adopt [2], and most people kept back to their usual driving style which cannot be categorized into an economically and ecologically driving style. Other factors also contribute to the situation such as traffic, car condition, environment and others [2]. The behavior is called as green driving, currently becomes one of the most important issues considering the fossil resources are kept decreasing and the behavior can be a solution to save the resources. Besides that, green driving behavior also contributes to improve people’s health through creating a cleaner environment [3][4].

Green community Canada suggests that 10-15% fuel efficiency can be made by eco-driving behavior [5] and if the behavior adopted worldwide, the significant effect of fuel usage reduction is possible. Particularly nowadays, transportation sector are the third largest greenhouse gas producer [6] and primarily comes from burning fossil fuel and cars as one of the contributors; producing 15% of the greenhouse gas emission. The gas generated by vehicles in Indonesia is estimated to continue increasing as the number of vehicles continues to grow. A figure below shows vehicle number in
Indonesia between year 2000-2015 [7], and fuel consumption in the transportation sector also provided below (Figure 2.).

Indonesian government formulated policies to reduce greenhouse gas emissions in many sectors, and in transportation it is including mass/public transportation and Intelligent Transport System development, bus replacement program, Bus Rapid Transpot (BRT) system implementation, congestion charging & road pricing, and smart eco-driving training. The target is to reduce 4,542 million tons CO\textsubscript{2} in 2020 [8].

![Figure 1. Vehicles growth in Indonesia](image1)

The reductions in greenhouse gas emissions are expected to be derived from the decrease in private vehicle usage. Figure 1 showed passenger vehicle has higher growth percentage compare to bus and freight cars. Most of the car currently uses a lower octane fuel (RON88) that may contribute to higher CO2. A fuel consumption graphic 2014-2016* in Indonesia can be seen on Figure 2 [9].

![Figure 2. National Fuel Consumption 2014-2016](image2)

Even though there are almost 56.81% passenger cars available in Indonesian market offered Eco driving features [10], a decrease number of vehicles on the road will have a higher effect to environment. Next figure gives information related to 13 popular car brands in Indonesia based on type cars available in the market and how many types are support eco-driving feature.
Eco-driving behavior concept estimated as unfamiliar to some Indonesian people, although a fuel consumption reduction becomes a concern among them. It was motivated by the price after Indonesian Government starts reducing fuel subsidies in 2009. However the price is still cheaper compared to other country [11] and its compromise with the quality which means the emission is higher. The increasing of fuel price may not quite induces a lifestyle change to become more efficient in transportation aspect such as driving behavior.

This paper initiated a study about eco-driving tendency behavior among Indonesian people with driver as a main focus. In the eco-driving, there are many research topics, and can be categorized into: a) factors contribute to fuel consumption [12][13], b) fuel consumption models [14][15], c) eco-driving behavior [16][17][18][19], d) method for motivation driver related to eco-driving behavior [20][21], e) user interface effectively [22] and others. Study about driving behavior were discussed about risky behavior and accidents [16], driving violation behaviours [17], driver behavior while interacting with eco-driving systems[18], and effect eco-feedback to driving style [19]. Focusing research on the people tendency behavior is still rare, although the results should able to exploited in various policies to increase eco-driving awareness among citizen.

A study on this topic is quite wide with many aspects are still open for discussion, and discussion about tendency behavior of Indonesia people are still limited. This paper tried to explore and find out whether the current driving behavior of driver in Indonesia are aligned or not with green driving style, without interfering the respondent with the concept itself. The study also explored whether the differences between demographic aspect, such as gender and age were exist. The result hopefully can give useful information about the position related to tendency eco-driving behavior in Indonesian and have little contribution to any government program in increasing understanding and awareness to eco-driving behavior. The results also hopefully can provide basis for other research related to driving behavior and can proceed to the wider direction by considering other factors.

2. Method

The study adopted on-line data collection method. A questionnaire with 27 items: 8 items related to individual data, 19 items (Q4-Q22) related to perception and driving behavior; distributed to target respondents. The questionnaire is developed with 5 scale answer (i.e. strongly disagree, disagree, quite agree, agree, strongly agree) with 13 items are positive thought/activities that support eco-driving behavior (Q4-Q14, Q16, Q22) and 5 items are negative thought/activities that against the eco-driving behavior (Q15, Q17-Q21). Three questions (Q4-Q6) measured how often the respondent intends to reduce fuel consumption, Q7-Q9 are related to machine maintenance condition behavior, Q10-Q12, Q21-Q22 are trying to capture the participant’s driving style, Q14-Q16 are related to checking car condition behavior before the trip, and Q17-Q20 are collecting information about air conditioning usage during driving.
The respondents are invited by email and online communication media to express their opinion. It stated that respondents who eligible are the one who regularly driving a vehicle and have a license. An online form is utilized in filling questionnaire process during June-July 2017.

There are about 165 people who respond to the questionnaire, and only 109 responses used in this study, the other are omitted by reason of inconsistency. Among 109 data, 64.5% are female and the rest are male. The respondent’s consist of 67.92% under 30 years old, 19.81% between 31-40 years old, and about 12.26% are older than 40 years old. Most of them, usually drive in the city (54.2%), 23.4% drive out of town, 10.3% drive cross province and the rest has local route driving.

3. Result & Discussion

The questionaires as a tool to measures eco-driving tendency behavior first checked of internal consistency, or how closely related a set of items are as a group that consider as scale reliability using Alpha cronbach, and the value is 0.7363 after Q15 (checking tire before a long trip) and Q18 (turn off the engine while waiting in the parking area) removed. Both item tests are not included in the analysis, based on Pearson’s Product-Moment correlation result as tools for validity test. Both test is conducted using Minitab 16.0 statistic software. Questionnaire result (mean of each question) can be seen below:

As can be seen above, most of answer fell into "somewhat in line with eco-driving behavior" category, and only 8 questions has value > 3 (meaning: inline with eco-driving behavior). The first three questions (Q4-Q6) about fuel consumption, respondents showed a bit lower support eco-driving behavior than expected. For air conditioner usage (Q20) respondents preferred to keep it on, and that will contribute to increase fuel consumption. Other questions about driving style showed that respondents’ driving style in line with eco-driving behavior, and also questions related to maintenance behaviors (Q7-Q9) respondents claimed they regularly check the machine condition and categorized to supported behavior of eco-driving. Further analyzed conducted to find whether respondent has weak, mild or strong eco-driving behavior tendency based on total value answer of repondent. The result summarized in Figure 5 below:
As shown above in Figure 5 most of respondents fall into mild eco-driving behavior tendency category for both male and female respondents, in all age segments. A responds is classified to a weak tendency when respondents stated disagree-strongly disagree for positive activities that support eco-driving behavior, or stated agree-strongly agree for any activities against it. A responds put into the mild category when the respondent stated quite agree for any positive activities related to eco-driving behavior. This result is a bit surprising because only 51.9% respondents who stated that they know about eco-driving behavior, 15% of them are not really sure and the rest (34.9%) claimed never heard of it.

Male and female has no significant differences in eco-driving behavior (p-value = 0.320), it means the tendency both of gender is similar. However, the percentage of male respondents who fall into the mild category is less than female, but percentage of strong tendency relatively higher than female. This result may not really aligned with the other type study about driving behavior that showed male drivers involved in risky driving behavior and violating traffic regulations more often compared to female [23], which is closest to non-eco-driving behavior.

Based on age, percentage under week tendency category of > 50 years old group respondents is higher compared to other age group, follow by 31-40 year group and 30 years old. Group age with strong tendency is 31-40 years old follow from 41-50 years old. It’s also a bit surprising, to assume that 30 years old has more time to access media and expose with many information and knowledge, the eco-driving behavior of this age group is relatively similar to another group. A study between groups also showed that there is no significant differences behavior between them. It can be concluded that gender and age may not the key aspect of encouraging eco-driving behavior, another aspect should be explored such as campaign, or policy related vehicle’s feedback support to create eco-driving.

From the result, it is shown that Indonesian people’s knowledge about eco-driving and their willingness to do eco-driving is still at the average level, even though the automobile industries have provided their cars with the eco-mode or eco-lamp (indicator). Eco-mode is a mode that basically changes the settings in the vehicles to improve fuel efficiency. While the eco-lamp is a basic indicator to show that the driving behavior is eco-friendly. In fact, these new technologies about eco-driving significantly affect the driving performances which improve the fuel economy values [24]. Based on 13 companies, cars in Indonesia support eco-driving behavior. These 13 companies are chosen because the amount of its cars in Indonesia is quite a lot compared to other brands, data shown in Figure 2. It is shown that most company’s vehicles support eco-driving. Only 3 from 13 companies
where the level of contribution are below 50%. The level of contribution is calculated based on the total type of vehicles in Indonesia. The percentage might be low because of some company, they still have a lot of vehicles that still not renewed. So basically, the cars which used already supports the eco-driving behavior.

The other consideration which may affect the eco-driving behavior might be a traffic. The traffic in Indonesia is probably also the biggest factor against eco-driving, especially in the capital city, Jakarta. The amount of start-stop cars/year in Jakarta is the 5th highest in the world after Istanbul, Mexico City, Moscow and Beijing, it’s about 28,080 [25]. This amount is equal to 55 hours in the traffic per year [26]. Other big cities in Indonesia also have high number start-stop/year (36,7 to – 42,7 hours) [26]. This amount can greatly affect Indonesian people’ behavior in eco-driving.

The number of respondents in this study doesn't very large compare to similar research [16] [17] but still it give new perspective about the tendency among gender and age. The tendency that measured in this study is based on respondents’ own perspective, and the next study equipped with monitoring tools to measure the behavior, may correct or confirm this result. In other studies, which focusing on adoption to the behavior [27] [28], some difficulties may appear when it's applied in daily life. The same condition may exist in Indonesia, even though the tendency of behavior is quite high as shown above. Further research that investigates contributory factors, and the constraints to create the habit among Indonesian people, is an interesting area to explore.

4. Conclusion

This study exploring the position of eco-driving tendency among Indonesian people and the result showed that the tendency categorized into somewhat support. Tendency differences among gender and group age are not proved statistically, but it can said that older group person much less tendency behavior than younger one. People with age over 50 years may keep old driving habits or their opinion, which may not really align with eco-driving concepts.

The Eco-driving tendency among Indonesian people might not as high as expected, but it the concepts is fairly known among them. To increase an understanding and awareness, a program to support it should plan carefully and consider many aspects that contribute to the behavior. Based on this study result, government programs in increasing eco-driver awareness should cover gender and age differences. Emphasized to men may need, because their driving hours and driving distance traveled is higher than women [16, 30].

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