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Driver Profile and Travel Distance among e-Hailing Drivers: An Exploratory Study

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ABSTRACT

The Land Public Transport Act 2010 and Commercial Vehicle Act 1987 have been used in the enforcement of E-hailing services in Malaysia. E-hailing is a process of ordering transportation to ride from one origin to a particular destination. As the demand for this service has escalated and the number of registered drivers has subsequently increased, the exposure on the road of e-hailing drivers is an area that commands investigation. This study aims to analyse the distance travelled by e-hailing drivers and to identify their profile. The daily trip of an e-hailing driver was explored. A questionnaire was developed and administered via face-to-face interview to one hundred (100) e-hailing drivers in the Klang Valley area of Malaysia. The questionnaire contained two parts: i) driver profile and ii) trip diary. The results showed that most of the drivers were males, with an average age of 37 years. Almost half of the participants (42.9%) had studied up to secondary education, and 32% were part-time e-hailing drivers. The spatial distribution of origin and destination location was concentrated in the city area. The distance travelled during weekdays and weekends was almost the same, but the trips were different. The average number of weekday trips was six, while during the weekend it was four. In both categories (weekdays and weekends), almost half of the trips were of a distance less than 5 km. The distance travelled per day for part-time drivers was between 50 km to 60 km, and for full-time drivers between 70 km to 90 km. This study can be used as a pilot investigation for future wider e-hailing research projects.

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1. Introduction

Nowadays, the number of passengers using e-hailing to commute from one place to another place in the urban area is becoming popular in Malaysia. On 12 July 2018, e-hailing service was enforced as a public transport service under the Land Public Transport Act 2010 and Commercial Vehicle Act 1987. The convenience and flexibility of using e- hailing not only entice individual adults, but many parents use it as a means to transport their children to and from school or college (Acheampong et al., 2020; Balachandran & Hamzah, 2017; Lesteven & Samadzad, 2021). Furthermore, easily accessible trip data such as time, location, and trajectory makes travel more secure (Yang et al., 2018).

The rise of this means of travel has an undeniable impact on the public transportation sector. Rayle et al. (2016) found that ride-sharing replaces the usage of a conventional taxi, public transport and privately owned vehicles. In contrast, ride-hailing contributes to an increase in vehicle mile travelled (VMT) (Clewlow & Gouri, 2017; Jeff et al., 2019; Mao et al., 2021). Ride-sharing and ride-hailing are two different travel operations (Ecolane, 2021). Ride-sharing enables multiple passengers to travel in the same direction. In contrast, in ride-hailing, the vehicle is not shared with any other passenger. Nevertheless, the impact on total VMT for this mode is still unknown because of mixed travel patterns.

At present, in Malaysia, e-hailing is one of the public transports available in the city area (Tu et al., 2019). Usually, the trips begin somewhere other than the place of residence (Rayle et al., 2016). Besides, it is used for a short journey in a city from one point to another (Harding et al., 2016). The 38 e-hailing operators in Malaysia, such as GRAB, EZCAB, and MyCAR (Abu Bakar, 2020), have progressively increased the number of e-hailing drivers and improved their service. According to GRAB, in 2018, there were 2.7 million drivers across the network, and over 90 million mobile users downloaded their application. The increasing number of drivers gives an impression about the growth of the e-hailing industry. Furthermore, this industry has provided jobs and reduced the unemployment rate in the country. Therefore, the welfare of e-hailing drivers should be a concern.

Since e-hailing drivers work on the road, the impact of e-hailing on exposure data is vital. Exposure is defined as any event, limited in time and space, that has the potential of becoming an accident, and

places demand on road user cognition (Elvik, 2014). Distance travelled is considered a relevant exposure measure Hakkert and Braimaister (2002) and Al Haji (2005). Moreover, the number of driver trips might be a factor in increasing the chance of road accidents because they may be driving in a sleepy state during odd hours and may rush in crowded areas. Previous research regarding e-hailing services has mainly focused on passenger satisfaction (Ackaradejruangsri, 2015; Balachandran et al., 2017; Paronda et al., 2017). There is limited information about e-hailing travel distance.

The objectives of this study were to investigate travel distance and identify the profile of drivers in the e-hailing industry. Understanding driver profiles and travel distance is vital for policymakers such as the Ministry of Transport, the Vehicle Inspection Agency, the Occupational Safety and Health Department, and insurance agencies. The findings can contribute to rules and regulations developed for the welfare of e-hailing drivers and could be valuable for future studies on safety, health, and the environment. Besides, travel distance in this study captures the threshold value of km/ day among e-hailing drivers for the National Vehicle Kilometre Travelled (VKT).

2. Method

2.1. Data Collection Location

A structured questionnaire was administered via face-to-face interview to participants across the Klang Valley. Seven e-hailing popular locations were identified, and three of them were selected by random sampling. The selected locations were Kuala Lumpur International Airport (KLIA), Bandar Sunway (Sunway Pyramid Mall), and Kajang (MRT Kajang Station). The investigator booked a one-way e-hailing ride to the destination and interviewed the driver as marked as the first respondent. At the destination, the investigator booked another one-way e-haling ride back to the origin. The driver was interviewed during the journey and marked as the second respondent.

Based on MOT data on e-hailing services in Malaysia, about 115,714 private vehicles were registered under e-hailing (Abu Bakar, 2020). Since there were cost limitations in this study, a sample of 100 drivers was selected at 95% confidence level and 10% reliability.

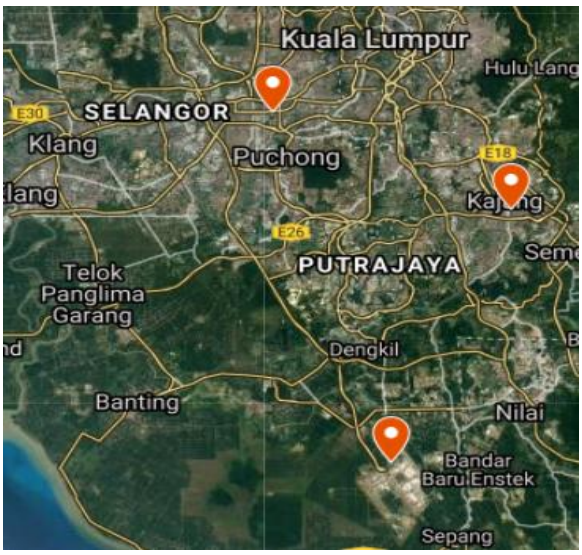

Figure 1: Face-to-face interview location area

2.2. Questionnaire and Analysis

The questionnaire was developed as a tool to obtain data related to e-hailing drivers' background and weekly trip. It comprised of two parts: A) driver profile and B) travel diary. The purpose of this questionnaire was stated at the top of it in order to gain participants' trust and encourage them to share the information needed. Part A was about the demographic data of the participant, and it included the driver's name, telephone number, age, gender, education level (as categorised by the National Education System of the Ministry of Education (MoE) (Clark, 2014)), and employment status. Part B consisted of a travel diary requiring the participant to provide information about the date, the number of trips, time, origin, destination, fares, and distance, individually for weekdays, Fridays, and weekends. Friday was included separately because previous studies have found that it is the peak day and accommodates the highest number of bookings Rayle et al. (2016) and Paronda et al. (2017). The questionnaire was in the Malay language. Figure 2 is a scanned copy of a filled questionnaire.

Results of demographic characteristics and travel distance were represented using bar charts and tables. The trip obtained from the travel diary for each participant was mapped using Quantum Geographic Information System (QGIS) technique. QGIS can make various colourful thematic maps (Fang, Jiang, Xu, & Wang, 2020).

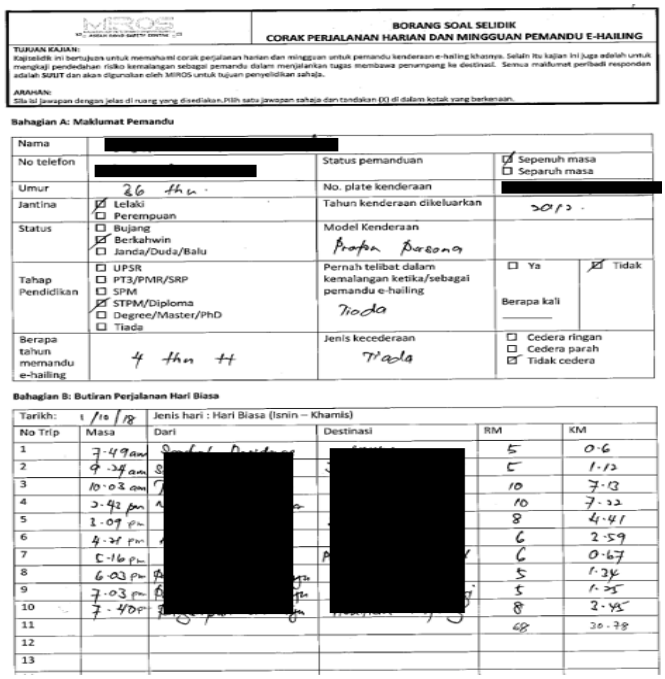

Figure 2: Scanned copy of a filled questionnaire

3. Results

3.1. Participants' Characteristics

In this study, the age of the participants ranged from 22 to 68 years. The average age was 37 years, with a median of 35 years. The most frequent age of the participants was 35 years old, as shown in Figure 3.

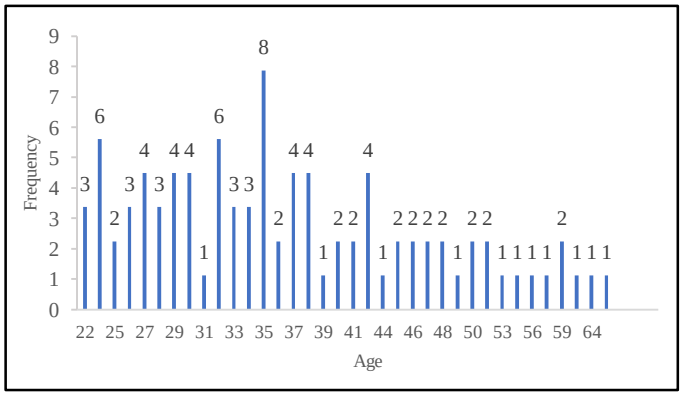

Figure 3: Age of participants

The finding of this study regarding the age of the drivers is supported by the one obtained by Paronda et al. (2017). Their study reported an age range of 20 to 60 years with a mean of 35.8 years among their participants.

The analysis in this study on the age range indicates that e-hailing drivers are jobs that participate with the labour force in Malaysia. Department of Statistic Malaysia (2020) use 15 to 64 years old as the standard age range on the Malaysian labour survey. By participating with the labour force, the unemployment rate can be reduced. Additionally, this study showed that most e-haling drivers are less than 40 years old. National youth development policy defines the age range of 15 to 30 years old as the young group, which constitutes a useful resource and contributes significantly to the development of the nation (Ministry of Youth and Sports Malaysia, 2019).

Table 1 shows the participants' demographic characteristics by age group, gender, education level, and employment status. Most of them were males (91%), with only 9% females. The difference is likely due to the fact the male group were overrepresented in the sample of drivers selected. However, according to Uber, the number of male Uber drivers in the United States was six times higher than that of female drivers (Uber,2019).

Table 1: Characteristics of participants

Characteristics	Variable	Percentage (%)
Age Group	<30	31.5
	30-39	36.0
	40-49	20.2
	50-59	10.1
	>60	2.2
Gender	Male	90.9
	Female	9.1
Education Level	No school	2.0
	Primary	4.1
	Secondary	42.9
	Post-Secondary	33.7
	Tertiary	17.3
Employment status	Full time	68.4
	Part-time	32.6

Table 1 also demonstrates that a high proportion of the participants had studied up to secondary level (42.9%), followed by post-secondary level (33.7%). Only 17.3% of them had a University degree. This study shows that 98 % can read and communicate well as an e-hailing driver. Also, most were working as full-time e-hailing driver (68%), and only 32% were doing it as a part-time job (Table 1).

3.2. Origin Destination Trip

The travel diary explored the daily trips per participant from across Klang Valley. Figures 4 and 5 demonstrate the spatial distribution of trip origins and destinations (OD) within Klang Valley during weekdays and weekends, respectively. As predicted, the e-hailing OD was heavily concentrated in the city area.

An interesting pattern emerged when examining the spatial distribution results during weekdays and weekends OD using QGIS. Graduated colours were used to classify OD density based on participant frequency at each district. From Figures 4 and 5, the white colour area shows less than five participants having OD from this location. The colour changes from light (5 to 10 drivers), dark (30 to 60 drivers) to darker (more than 60 drivers) as the frequency of participants doing OD at the common district increases.

The spatial distribution of the weekday's trips OD was concentrated more at the inner area (dark colour) of Klang Valley. Figure 4 illustrated that Shah Alam/ Kuala Lumpur and Kajang had the highest frequency, followed by Gombak, Sepang and Klang (light colour). However, on weekends, the spatial distribution shows that only Shah Alam/ Kuala Lumpur and Kajang (dark colour) had the highest concentration of trips (Figure 5).

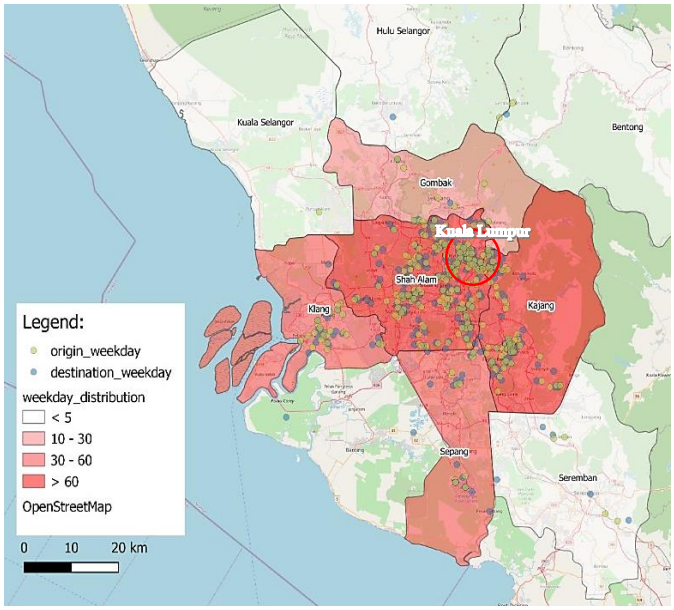

Figure 4: E-hailing origin and destination extract from the travel diary for weekday's trip

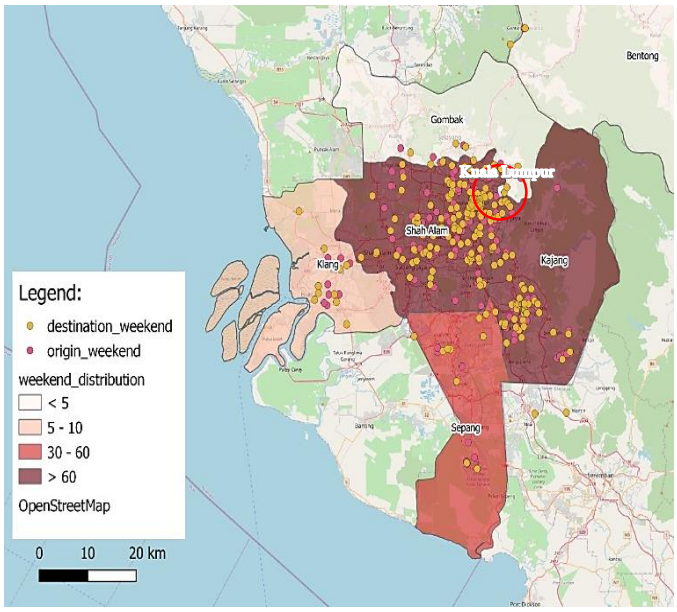

Figure 5: E-hailing origin and destination extract from the travel diary for the weekend's trip

Kuala Lumpur International airport (KLIA) is located in Sepang. The frequency of the OD was relatively high there because e-hailing and taxi are the most popular public transport for air travellers. Contrary, Gombak and Klang hold mostly industrial areas. Since weekends are usually for rest, passenger demand was subsequently lesser than on weekdays in Gombak and Klang. Kajang is a township area that is only half an hour drive to Kuala Lumpur, Malaysia's central business district. Therefore, it is unsurprising to find that Kuala Lumpur is one of the hotspot locations for drivers to drop off and pick up passengers.

The result of OD might have been influenced by the starting location of the interview. It explains why Kajang have a high concentration during weekdays and weekends than Bandar Sunway (Sunway Pyramid Mall). Weekends are usually spent in leisure activities and is a break from travel to and from work/school. This study reveals that the highest usage of e-hailing was in urban city

areas, which might be due to traffic congestion and scarce availability of parking facilities.

3.3. Travel Distance

The distance travelled during weekdays and weekends by each participant was analysed, and the results are shown in Figure 6. In both categories (weekdays and weekends), almost half of the trips were of a distance less than 5 km. However, the frequency of trips of more than 5 km was higher during weekends than on weekdays.

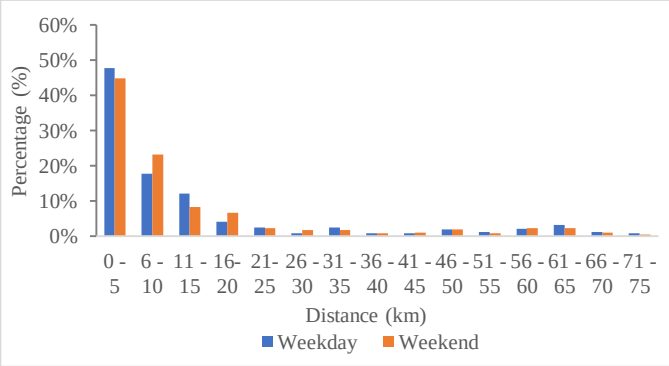

Figure 6: Percentage travel distance per trip during weekdays and weekends

The reported maximum distance per trip from weekdays was 116 km. The longest weekend trip was of a distance of 72 km, both of which were airport pick-up trips. The minimum distance per trip from weekdays was 340 m and from weekends was 640 m.

The average travel distance per trip for weekdays and weekends was calculated. Both had almost the same average value, which was 13.5 km and 12.6 km, respectively. However, the average number of trips was different. During weekdays it was six trips with a median travel distance of 5.4 km. In contrast, during weekends, it was four trips with a median travel distance of 5.7 km. It can be interpreted that during weekends, drivers were more willing to make long-distance trips but reduce the trip distance by 2/3 during weekdays.

3.4. Influence of Participant Characteristics on Daily Travel Distance

This section summarises and discusses the findings on the total travel distance of the participant with respect to their characteristics. However, the factors of gender and level of education were too low and not representative, and only the factors of age and employment status could be analysed.

Figure 7 illustrates the average daily travel distance by participants' age. It could be seen that participants who were less than 30 years old had the highest average daily travel distance, which was 100.4 km. Surprisingly, the second-highest travel distance (82.7 km) was in the age group of 50 to 59 years, which was followed by the age group of 30 to 39 years (60.6 km) and 40 to 49 years (58 km). The participant with the lowest average daily travel distance was aged above 60 years. Daniel et al. (2013) described that in France, people aged 30 to 49 years preferred to drive cars, and this preference starts to decrease at the age of 50 years.

This study found that young drivers were more willing to travel long distances per day. Nonetheless, the effect of age on travel distance might have been influenced by employment status. Full-time drivers would be willing to drive longer distances because they have more time than part-time drivers.

The daily average travel distance on weekdays, Fridays, and weekends can be seen in Figure 8, which outlines both for full-time and part-time drivers. The highest average travel distance was 88.8 km (on weekdays) and 59.6 km (on Fridays), for full-time and part-time drivers, respectively. However, previous studies Rayle et al., (2016) and Paronda et al., (2017) found that Friday is the peak day. Nevertheless, this study found that Friday accommodated the lowest travel distance for full-time drivers and highest for part-time drivers. This finding was as expected because the previous studies stated that customers reason to use ride-sharing during Fridays and weekends was to avoid drinking and driving. It is showing a difference in culture between Malaysia and the other country.

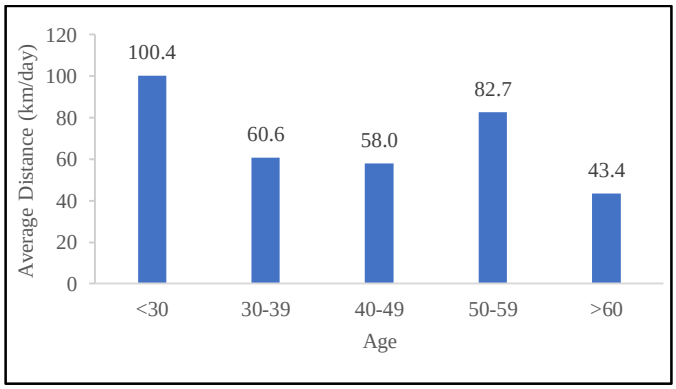

Figure 7: Age vs the daily average travel distance of participants

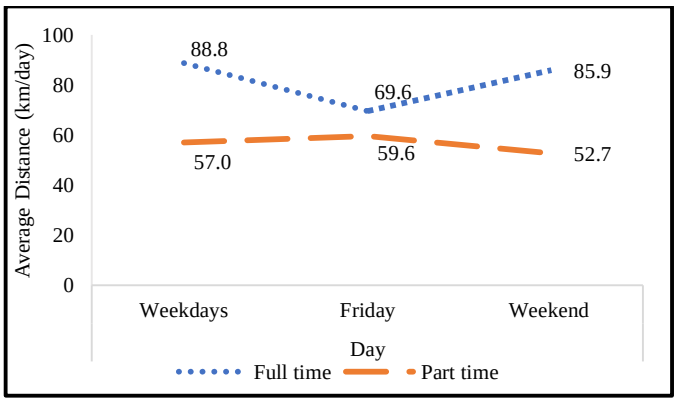

Figure 8: Employment status vs average travel distance based on three different periods (weekdays, Fridays and weekends)

The daily total travel distance by full-time drivers was more (70-90 km/day) than for part-time drivers (50-60 km/day) on either weekdays or the weekends. The annual total average kilometres travelled for motor cars is around 28,000 km, which means that the average total distance travel per day is 78 km (Akmalia et al., 2017). It means that the average travel distance by e-hailing drivers is higher than the average distance travelled in a private vehicle. However, further studies on e-hailing and taxi need to be done to see if the travel distance increases or decreases with e-hailing when traditional taxis are replaced by e-hailing services. Additionally, the travel distance by means of transportation should be carried out to obtain the National Vehicle Kilometre Travelled and hence allowing a comparison of the road safety levels in Malaysia and other countries.

4. Discussion

Currently, the demand for e-hailing services is higher than for taxis—this is increasing the number of e-hailing drivers derived from different community levels. With the development of technologies, passengers, especially generation Y, use their smartphones or other gadgets to reach the service. Registered e-hailing drivers also need to learn and adapt to this new mode of operation. This further explains why the majority of the e-hailing driver participants are young and literate.

Among the participants, there were some with ages more than 55 to 68 years, showing that drivers are still engaged in e-hailing after their retirement. The flexibility of e-hailing allows older drivers to expand the driving network, especially to the seniors in rural areas who are more receptive to vehicle sharing because of the scarcity of

alternative transport in such communities (Payyanadan & Lee, 2018). The reason for older drivers to work at this age is not only for a financial reason but also to keep themselves socially engaged. They get the opportunity to meet and talk with different people in one day, which helps them to feel better morally. However, working on the road also presents a certain risk to this group. But the flexibility of choosing to drive only during the daytime and selecting only familiar roads exposes them to a lesser extent to untoward incidents.

Generally, the participants were holders of at least the Malaysia Education Certificate (SPM), which means that they had completed upper secondary school. The education would enable them to quickly learn and adapt to the structure and rules of this job. Generally, drivers would care about their passengers' safety because driving is their income for livelihood. The Department of Statistic Malaysia (DOSM), 2020 reported that the average monthly salaries and wages of an urban area resident are RM 3,405, and tertiary educational employees have average monthly salaries of RM4,643. Due to the higher cost of living in Klang Valley, e-hailing is one option to generate income, especially for youngsters, whether as a full-time or part-timer driver. E-hailing provides the flexibility of working at one's own time. Levin (2015) estimated that 11% of Uber drivers in the United States were students. They opted for this job as it fits well into their life. Anyone, irrespective of education level or gender, has the opportunity to register as an e-hailing driver and engage in providing this service.

Driver profiling through this study has established an overview of who is operating the e-hailing service on the road. Although the number of younger drivers is higher than older ones, driving a customer is a new experience for all e-hailing drivers. An experienced driver may not necessarily have the upper hand over a young driver. A previous study has shown that the experienced driver shows more complacency and have poor safety culture (Mahudin & Sakiman, 2020). In this case, the competency training or refresher course in safe driving could be advantageous to all e-hailing drivers. It is useful to remind them of their responsibilities towards customers. It helps them in handling road safety risks when driving. Moreover, they are made knowledgeable about their rights as drivers. In particular, in terms of insurance policies in case of accidents.

At present, e-hailing applications require internet access, which has been an issue in rural areas with inadequate internet coverage. It might be one of the main reasons why the acceptance of e-hailing is higher among city dwellers. This service is more manageable by customers to move from origin to destination during weekdays and weekends. Previous studies have found that passengers use e-hailing for various purposes, ranging from work travel to leisure travel (Lesteven & Samadzad, 2021; Rayle et al., 2016). Besides comfort, the customer is satisfied with the tangibility and reliability of e-hailing services (Balachandran & Hamzah, 2017).

This study has found that participants frequently drive short-distance trips within the city centre, which might be due to two main reasons. Firstly, the alternating sunny and rainy weathers discourage people from walking even short distances. Secondly, a lack of pedestrian facilities on the road makes walking and crossing roads very difficult. It has been reported that the long waiting time at signalised crossing creates an unsafe condition (Harun et al., 2017). The impossible access by a walk, the customer used the e-hailing as the first or last mile especially to reach the public transit (Bus, MRT, LRT etc.). To avoid unpredictable weather, unsafe walking, passenger instead use e-hailing and enjoy comfortable and safe journeys.

Vehicle Kilometre Travelled (VKT) is commonly used as an estimator of exposure on the road to rate the level of road safety. The findings of this study could be valuable in developing National VKT. Furthermore, it was found that e-hailing drivers drive more trips and longer distances compared to private vehicle drivers. However, a deeper interpretation of VKT could not be carried out because of the lack of annual data on e-hailing. Data collection is limited around the Klang Valley area. This study, however, could benefit other researchers to have an overview of e-hailing travel pattern with the threshold value of km/day.

E-hailing is a service that can generate income for various age groups, especially those living in the city, as traffic congestion is expected and parking is scarce. It is a useful mode of transport for individuals who do not own any vehicles and hence rely on public transport. E-hailing also helps to decrease the load on other public transport facilities and may become an intermediate to connect passengers to train or bus stations.

5. Conclusion and Recommendations

This study highlighted the profiles of a sample of e-hailing drivers and their travel distance in the Klang Valley area. Being sufficiently educated, e-hailing drivers in Malaysia find it easy to operate the service application on their smartphone. The study also found that most e-hailing drivers were in the mid-30s and worked full-time. Consequently, it is recommended that these full-time e-hailing drivers should plan their future retirement.

Drivers also have the freedom of selecting the timing to do this job. However, there are certain challenges that could be faced, especially by the ageing e-hailing drivers. For instance, they have to learn how to use the service operates, which could be a concern to them. However, e-hailing provides a good opportunity for older individuals to be productive and financially independent. The data of this study could be helpful to develop policies for the welfare of ageing drivers. Older drivers are nevertheless exposed to higher risks when driving from one location to another location, especially for long-distance travels, and therefore need extra insurance protection. In addition, the ergonomic aspect of car seats for aged drivers is an interesting area to be explored as this could encourage older drivers to be part of the e-hailing system. Extensive driving class to refresh their competency and risk-handling capacity is also recommended for aged drivers. They will be helpful to reduce the probability of their involvement in accidents.

Future research should look into the comparison of kilometres travelled by e-hailing, private motorcars, and traditional taxis. This recent and growing mode of transport might impact VKT, especially due to the decrease in the private motorcar and traditional taxi usage. In addition, the VKT by e-hailing can be further investigated.

This study contributes information about e-hailing drivers in Malaysia. It is an exploratory study and could be useful for different countries in Asia. It was carried out for the safety and welfare of road users, including e-hailing drivers.

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References

Abu Bakar, M. K. H. (2020). Malaysia's experience in regulating ride-hailing services. In *Smart Mobility Webinar 1*.

Acheampong, R. A., Siiba, A., Okyere, D. K., & Tuffour, J. P. (2020). Mobility-on-demand: An empirical study of internet-based ride-hailing adoption factors, travel characteristics and mode substitution effects. *Transportation Research Part C: Emerging Technologies*, *115*, 102638. https://doi.org/10.1016/j.trc.2020.102638

Ackaradejruangsri, P. (2015). Insights on GrabTaxi : An alternative ride service in Thailand. *Review of Integrative Business & Economics Research*, *4*(3), 49–61.

Akmalia, S., Rizati, H., Sharifah Allyana, S. M. R., Azzuhana, R., Nur Zarifah, H., Rohayu, S., Siti Zaharah, I., & Wong, S. V. (2017). *Vehicle kilometre travelled validation study*. Kajang, Selangor: Malaysian Institute of Road Safety Research (MIROS).

Al Haji, G. (2005). *Towards a Road Safety Development Index (RSDI): Development of an international index to measure road safety performance*. Linkoping University, Sweden.

Balachandran, I., & Hamzah, I. B. (2017). The influence of customer satisfaction on ride-sharing services in Malaysia. *International Journal of Accounting & Business Management*, *5*(2), 184–196. https://doi.org/10.1098/rstb.2013.0388

Clark, N. (2014). Education in Malaysia. *World Education News & Reviews*. https://doi.org/10.2307/3119815

Clewlow, R. R., & Gouri, S. M. (2017). Distruptive transportation: The adoption, utilisation and impacts of ride-hailing in the United State. In *Institute of Transportation Studies*, University of California, Davis. https://doi.org/10.1139/gen-44-3-401

Daniel, B., Šenk, P., Parkes, A., Stannard, J., & Armoogum, J. (2013). *Mobility patterns in the ageing populations*. Europe: European Commission CONSOL.

Department of Statistic Malaysia. (2020). Jabatan Perangkaan Malaysia. In *Statistics of Graduates in the Labour Force Malaysia*.

Department of Statistic Malaysia (DOSM). (2020). *Salaries & wages survey report, Malaysia 2019*. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=VXRJbkFUNUp5eDl0UFBFRG5CMWlMUT09

Ecolane (2018). Ride-hailing vs. ride sharing: The key difference and why it matters. Retrieved from October 2018 website: https://www.ecolane.com/blog/ride-hailing-vs.-ride-sharing-the-key-difference-and-why-it-matters

Elvik, R. (2014). *Towards a general theory of the relationship between exposure and risk*. Oslo, Norway: Institute of Transport Economics.

Fang, Z., Jiang, G., Xu, C., & Wang, S. (2020). A tectonic geodesy mapping software based on QGIS. *Geodesy and Geodynamics*, *11*(1), 31–39. https://doi.org/10.1016/j.geog.2019.08.001

GRAB (2018). *Grab Corporate Profile*. Retrieved from https://www.grab.com/sg/wp-content/uploads/docs/Grab-CorporateProfile-ENG.pdf?ver=20180212

Hakkert, S., & Braimaister, L. (2002). *The uses of exposure and risk in road safety studies*. Netherlands : Institute for Road Safety Research.

Harding, S., Kandlikar, M., & Gulati, S. (2016). Taxi apps, regulation, and the market for taxi journeys. *Transportation Research Part A: Policy and Practice*, *88*, 15–25. https://doi.org/10.1016/j.tra.2016.03.009

Harun, N. Z., Roslan, A., Hamidun, R., Ishak, S. Z., Shabadin, A., & Voon, W. S. (2017). *The impact of waiting time towards pedestrian crossing behaviour at signalised intersection*. Kajang, Selangor: Malaysian Institute of Road Safety Research (MIROS).

Jeff, X., Dessouky, M., Pang, J., & Fan, R. (2019). A general equilibrium model for transportation systems with e-hailing services and flow congestion. *Transportation Research Part B*, *129*, 273–304. https://doi.org/10.1016/j.trb.2019.08.012

Lesteven, G., & Samadzad, M. (2021). Ride-hailing, a new mode to commute? Evidence from Tehran, Iran. *Travel Behaviour and Society*, *22*, 175–185. https://doi.org/10.1016/j.tbs.2020.09.006

Levin, A. (2015). Uber: The driver roadmap 2.0. In *Benenson Strategy Group*. Retrieved from https://2q72xc49mze8bkcog2f01nlh-wpengine.netdna-ssl.com/wp-content/uploads/2015/12/BSG_Uber-Driver-Roadmap-2.0_12.7.15_FIN2.pdf/

Mahudin, N. D. M., & Sakiman, M. N. (2020). Overworked and unsafe: A comparison of driving behaviour and safety culture according to driver types and working hours. *International Journal of Road Safety*, *1*(2), 42–48. Retrieved from http://ijrs.my/journal/article/view/13

Mao, H., Deng, X., Jiang, H., Shi, L., Li, H., Tuo, L.,…Guo, F. (2021). Driving safety assessment for ride-hailing drivers. *Accident Analysis and Prevention*, *149*, 105574. https://doi.org/10.1016/j.aap.2020.105574

Ministry of Youth and Sports Malaysia (2019). *Malaysian youth policy*. Putrajaya: Ministry of Youth and Sports Malaysia.

Paronda, A. G. A., Gaabucayan-napalang, M. S., & Regidor, J. R. F. (2017). An exploratory study on Uber, GrabCar, and conventional taxis in Metro Manila. *Paper Presented at the Sustainable Built Design 2017*, (September). Retrieved from https://www.researchgate.net/publication/335137528_Drivers'_Tactics_in_Ridesharing_Economy_in_the_Philippines

Payyanadan, R. P., & Lee, J. D. (2018). Understanding the ride-sharing needs of older adults. *Travel Behaviour and Society*, *13*(June), 155–164. https://doi.org/10.1016/j.tbs.2018.08.002

Rayle, L., Dai, D., Chan, N., Cervero, R., & Shaheen, S. (2016). Just a better taxi? A survey-based comparison of taxis, transit, and ridesourcing services in San Francisco. *Transport Policy*, *45*, 168–178. https://doi.org/10.1016/j.tranpol.2015.10.004

Tu, W., Santi, P., Zhao, T., He, X., Li, Q., Dong, L.,…Ratti, C. (2019). Acceptability, energy consumption, and costs of electric vehicle for ride-hailing drivers in Beijing. *Applied Energy*, *250*(May), 147–160. https://doi.org/10.1016/j.apenergy.2019.04.157

Yang, Z., Zhu, S., Franz, M. L., Nasri, A., Zhang, L., & Mahmoudi, J. (2018). Analysis of Washington, DC taxi demand using GPS and land-use data. *Journal of Transport Geography*, *66*(February 2017), 35–44. https://doi.org/10.1016/j.jtrangeo.2017.10.021