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A Preliminary Feasibility Study of Electric Taxi Promotion in Hong Kong—Behavior Modelling of Driving Patterns and Preferences

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Abstract: In 2013, the first electric taxis were launched in Hong Kong. In 2021, the HKSAR government announced that no new registration of fuel-propelled private cars, including hybrid vehicles, will be granted by the year 2035. Local public policies have shown a breakthrough milestone in the passenger transport sector and fostered the development of a smart city in Hong Kong as an international metropolis. This paper aims to study the feasibility of gradually introducing electric vehicles (EVs) in the Hong Kong taxi industry in the next decade. In particular, taxi license owners' intentions of purchasing electric vehicles for operational use and the driving behavior of taxi drivers in Hong Kong are investigated. Multiagent modelling with an integrated behavioral model is then adopted to analyze the survey data collected from 250 taxi drivers in Hong Kong, followed by interviews with industrial experts. The implications for future public policies are then discussed. To achieve emission reduction, the paper suggests a gradual, step-by-step promotion and transfer from conventional taxis to electric taxis in Hong Kong, with consideration of various factors and the interests of different stakeholders in the community.

Keywords: electric vehicle; taxi industry; multiagent modelling; behavior analysis; smart city

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1. Introduction

Taxis are typically employed in urban areas. In recent years, the usage of electric vehicles has become more popular [1]. Taxis, one of the major public transport service providers in Hong Kong, are changing to electric taxis to achieve sustainable development [2]. In 2022, there were a total of 18163 taxis in Hong Kong, including 15250 urban taxis (red), 2838 New Territories taxis (green), and 75 Lantau taxis (blue). Almost all the taxis are owned by various independent taxi companies and rented out to self-employed drivers on a shift basis. Only a few taxis are independently owned by the drivers [3]. Because taxis are very common in Hong Kong, and they provide a point-to-point service for passengers, the average daily taxi patronage is approximately 15 million [4]. Due to almost all taxis in Hong Kong employing internal combustion engines (ICE), they produce huge carbon footprint emissions. Because of their particularly high mileage, one taxi produces as much pollution and exhausts as much energy as ten private cars. Moreover, the high level of particulate pollution, notably PM 2.5, is presently a severe health situation in Hong Kong. Additionally, the world is encountering a COVID-19 pandemic [2]. In response, [5] identified that higher PM 2.5 pollution would exacerbate the seriousness of the epidemic. In doing so, the existing ICE taxi service providers are obliged to promote electric taxis to decrease PM 2.5 and air pollution, in order to move toward smart and sustainable city development in Hong Kong.

One of the largest obstacles in the transformation from ICE to electric taxis is determining how to design the establishment of charging stations to meet the dynamic travel patterns of electric taxis [6,7] conducted past studies relevant to the distribution of NGV, LPG, and gasoline stations to determine optimal sites on the road networks. However, such research models are inappropriate for electric taxi charging locations, due to refueling ICE taxis spending much less charging time than electric taxis; this can lead to extended queues in the case of electric vehicles. Basically, such models of optimal location choices are mostly derived from origin-to-destination input data. Therefore, real travel data for taxis are difficult to acquire.

Currently, carbon neutralization has become the 'hot' topic of the taxi industry due to climate change. To prevent the production of carbon dioxide, the taxi industry has made significant changes. Some taxis will be replaced by electric vehicles, improving traffic safety and environmental protection. The electric taxi consists of energy storage devices such as various types of batteries, fuel cells, and ultra-capacitors along with electric propulsion, and the body of the vehicle and energy management system use diversified technologies of electrical, electronic, mechanical, automotive and chemical engineering [8].

This paper investigates the feasibility of gradually introducing electric vehicles (EVs) into the Hong Kong taxi industry in the next few years. Taxi service license owners' intentions of purchasing electric vehicles for operational use are analyzed, following a quantitative analysis of the driving behavior of local taxi drivers. Multiagent modelling with an integrated behavioral model is then adopted to analyze the survey data collected from 250 taxi drivers in Hong Kong, followed by interviews with industrial experts. Active support from the local transport association was obtained to enhance the research application of this project. In the discussion and conclusion section, the implications for future public policies are discussed, with consideration of various factors and the interests of different stakeholders in the community.

2. Overview of Electric Vehicles and Electric Taxis in Hong Kong

2.1. The Evolution of Taxi

In the 1800s, taxis already existed in Hong Kong. However, the taxi at that time was a two-wheeled or three-wheeled cart pulled by humans. In other words, pulled rickshaws were used as 'taxis' in the late 1800s. Around 7000 pulled rickshaws were imported from Japan, and the speed of the rickshaws depended on the driver and the terrain. Taxis were introduced prior to the Second World War, and the usage of rickshaws dropped gradually after the war [9]. Although taxi services were shut down during the Second World War, taxis then become a standard method of transport for locals, and rickshaws were treated as a tourist activity [10,11].

There were four major taxi companies in the past, including Central Taxicab Company, New Taxicab, Star Taxicab Ltd., and Goldside Taxi. Mr. Wu Chung, the father of taxis, is also the founder of Central Taxicab Company and has contributed a great deal of effort to the taxi industry. He implemented the usage of roof lights, and the little light-up box on the top of the taxi to identify whether the taxi is already in use [9]. This design was originally used to identify Central Taxicab Company Cars and in-use taxis. However, the light box is now installed on every Hong Kong taxi. Other taxi companies, New Taxicab and Goldside Taxi, were established in the Kowloon Peninsula in the 1950s, but during the Second World War, Goldside Taxi was temporarily taken over by the Japanese [12].

After the Second World War, the government started to record the number of registered taxis. In 1947, there were 329 officially recorded taxis. Taxi services covered the New Territories by 1960, and the number of cars had increased to more than 1000 [13]. At that time, taxis were mainly imported from Europe, and BMC B-series engines were used, with petrol and diesel versions [14]. However, in the 1970s, taxi companies imported taxis from Japan, and 2164 cc four-cylinder diesel engines were used. In the mid-1990s, the typical engine capacity increased from 2164 cc to 2700 cc, which enabled longer driving time and a larger driving range [15,16].

2.2. On the Move: Encouraging Diesel Taxi to LPG Taxi

In the past, Hong Kong taxis mainly ran on diesel fuel, while four-passenger taxis ran on petrol. In the 1920s, a few taxis were already running on Hong Kong Island. Taxis then began to provide services in Kowloon from 1926 onwards. Although taxis and other public transport provide excellent transport services to Hong Kong citizens, they have become the main source of roadside pollution in Hong Kong [4]. According to the Legislative Council, the emitted respirable suspended particulates and nitrogen oxides were extremely serious, and 95% of these were emitted by public transport and lorries. As the government wants to protect the environment and reduce air pollution, they have launched three stages to gradually promote electronic vehicles to the public. The purpose of the first stage is to encourage the development of electric vehicle technologies [17]. Additionally, in July 1992, emission standards for passenger cars (Euro 1, Diesel, and Petrol) were established by the European Union. The purpose of setting the European emission standards is to control the level of pollutants emitted and to reduce air pollution as much as possible. All vehicles, including private cars, commercial cars, and public transport providers, need to comply with the standard. According to the standard, light commercial vehicles could only emit 2.72 g of carbon oxide per km (both diesel and petrol) [18]. In January 1996, Euro 2 was introduced with a higher standard for carbon oxide emission; cars could only emit 1.0 g (diesel) and 2.2 g (petrol) of carbon oxide per km. Meanwhile, the Hong Kong government launched a test project for the use of liquefied petroleum gas (LPG), which is a cleaner alternative fuel. The government promoted LPG because the combustion of propane results in lower CO_2 emissions. Although LPG is more expensive when compared with petrol or diesel, it is more environmentally friendly [19].

According to the Hong Kong Legislative Council, LPG is cleaner than petrol and diesel, as its composition is simple hydrocarbon compounds. LPG is also lead-free, and most of the additives contain only a little sulphur. LPG-driven vehicles contain lower levels of hydrocarbon compounds, sulphur oxides, nitrogen oxides, air toxics, particulates, etc. Moreover, according to TNO Road Research Institute (the United States Environmental Protection Agency), for almost all the listed exhaust components, including regulated (e.g., CO, HC, NO_x) and unregulated (e.g., NO_2, SO_2, Benzene, 1, 3-Butadiene, Formaldehyde, etc.), the performances of petrol and diesel were worse than that of LPG. Furthermore, many countries started to use LPG in 1994, including Italy, the Netherlands, Mexico, and so on [20]. Taxis became one of the major types of LPG vehicles in several countries, including Australia, Japan, Canada, Greece, Spain, and South Korea, since the 1950s.

The Hong Kong government tried to follow the worldwide trend and plan for the implementation of LPG. In the late 1990s, some of the taxis started running on LPG under this test project, and the project was successfully implemented in 1999. At that time, LPG was built into all new Hong Kong taxis to replace diesel taxis. In January 2000, the EU launched the Euro 3 standard, in which carbon oxide emission was cut down to 0.64 g/km for diesel, and 2.3 g/km for petrol. The EU also set the standard for nitrogen oxide emission at 0.5 g/km for diesel and 0.15 g/km for petrol, respectively. From 2000 to 2003, the government provided a cash grant to taxi owners who purchased a new LPG taxi, to accelerate the replacement of diesel taxis. To boost the development of LPG taxis, the Hong Kong government prohibited the import of diesel taxis from 1 August 2001. Additionally, from 1 January 2006, it is illegal to drive a diesel taxi in Hong Kong. Apart from LPG taxis, in January 2005, Euro 3 was replaced by Euro 4, tightening the emission standards. For carbon oxide emission, only 0.5 g/km was allowed for diesel, and 1.0 g/km for petrol. For nitrogen oxide, only 0.25 g/km was allowed for diesel, and 0.08 g/km for petrol. Furthermore, Euro 5a was introduced in 2009. The standard of carbon oxide emission remained unchanged for both diesel and petrol, while the standard for nitrogen oxide has been lowered from 0.25 g/km to 0.180 g/km for diesel, and from 0.08 g/km to 0.06 g/km for petrol. In the meantime, in order to obey the European emission standards, the number of seats has been reduced from five to four seats.

2.3. Initiation of Electric Taxis in Hong Kong

To become environmentally friendly, the government and automobile companies tried to manufacture more sustainable vehicles, such as hybrid vehicles and electric vehicles [21,22]. The government launched Stage Two of the project in the late 2000s to early 2010s, with the mass supply of production of electric vehicles. The government also set up a steering committee in 2009 in order to coordinate EV promotion strategies and study the feasibility of installing charging facilities in the Hong Kong government multistory car parks [17]. In 2011, the government offered a Gross Floor Area (GFA) concession for car parks in new developments, to require and encourage the provision of charging facilities. At the same time, the government also set up the Pilot Green Transport Fund, in order to encourage the public transport sector to try out green innovative transport technologies and also to promote the technological development of electric vehicles, especially for electric commercial vehicles, for instance, taxis [23].

At the end of 2012, some automobile companies introduced hybrid vehicles, but they failed to access the Hong Kong market because of the high purchasing price. In 2013, BYD Automobile Co. Ltd. introduced 45 electric taxis through the Pilot Green Transport Fund. However, because the charging time of electric taxis is extremely long, there were insufficient charging facilities. In addition, many users thought that electric vehicles were unlikely to replace conventional petrol cars, as the available driving range of petrol cars was much larger. However, the government has waived the First Registration Tax (FRT) on purchasing electric vehicles, which could attract users to change from petrol to electric vehicles. The plan eventually failed, and BYD Automobile retreated from Hong Kong in 2014. Despite this, it tried to re-enter the Hong Kong market in 2021. BYD introduced the second generation of the E6 model for both private cars and Hong Kong taxis, and trials will be started in 2022 [24].

Because people have not been eager to purchase electric vehicles in the past few years, the government launched Stage Three in 2014, with a longer driving range of electric vehicles. The price of electric vehicles, after being adjusted, is more comparable to conventional petrol cars. Additionally, the FRT policy was extended, and the government even revised the FRT concession with a “One-for-One Replacement” scheme to make sure that the policy would not be affected by high-priced electric cars [17]. As a result of these effective policy incentives, the penetration of EVs has been developed in-depth in Hong Kong in the past five years, as shown in Figure 1.

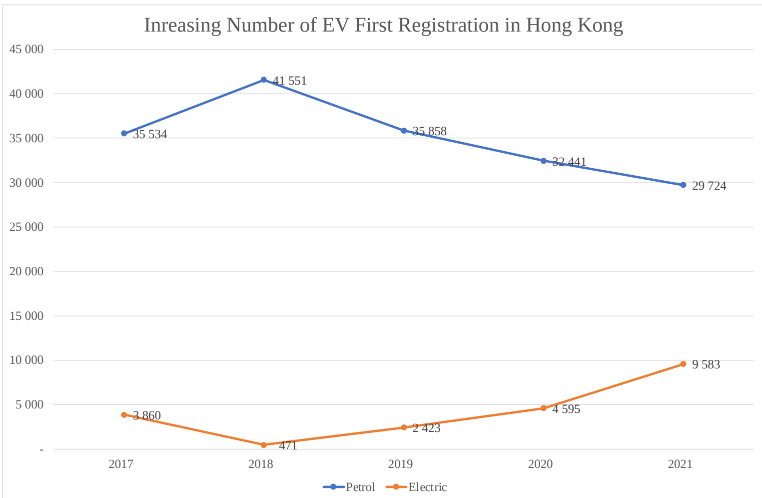

Figure 1. First registrations of EVs increasing in Hong Kong.

3. Research Methodology

Compared with conventional vehicles, the changes that EVs bring to taxi drivers mainly relate to anxiety about the cruise range and the inconvenience of finding charging facilities. Therefore, a series of survey questions are designed to extract vital information related to taxi drivers' operational behavior and license owners' preferences about how they would like to purchase and drive electric taxis. Essential factors that affect taxi drivers' use of EVs, such as the anxiety of cruise range, are represented by daily driving distance, driving range per full-charging, and charging time. Charging convenience is represented by detour time to charging facilities like charging stations or charging pillars. Other incentives like financial subsidies are also included. These variables are categorized into three groups as shown in Table 1. The designed questionnaire collecting information on taxi drivers' driving behavior and operational preferences is further supported by the local industrial association. Numerical analyses via sampling and simulation are then provided in the following section.

Table 1. Variables affecting driving behavior and operational preferences of taxi drivers.

Group	Variables	Notation	Related Questions in the Survey
The anxiety of cruise range	Charging frequency	a	How many times would you accept to charge your car for a full-day operation?
	Daily driving mileage	b	How many kilometers does the taxi driver usually travel per day?
	Preferred cruise range	c	What is the preferred cruise range for electric taxi drivers?
The convenience of charging facilities	Cruise time to arrive at closest charging stations	d	What is the acceptable driving time to the closest charging stations?
	Locations of charging stations	e	Where should new charging facilities be installed?
Incentives	Subsidy	f	What is the acceptable financial subsidy for electric taxi purchases and for transport operation?

4. Numerical Analysis and Simulation Results

4.1. Sampling

In-street interviews were conducted with taxi drivers in Hong Kong. There are around 40,000 taxi drivers in Hong Kong, and we randomly selected 250 taxi drivers. Among the 250 respondents, 97.6% (244 out of 250) are male, and 2.4% (6 out of 250) are female. Regarding age and experience, 46.4% (116 out of 250) are between 51 and 60 years old, 44.8% (112 out of 250) are more than 60 years old; 84% (210 out 250) of interviewees have more than 10 years of experience in driving taxis, which means 84% of them are familiar with this industry, and their opinions are significant to the implementation and development of electric taxis.

For the daily travel distance of a taxi driver, 25.6% (64 out of 250) stated that their travel distance is around 200 km, 18.4% (46 out of 250) stated that it is around 250 km, and 13.6% (34 out of 250) stated that it is around 180 km. Based on the survey results, we can assume that the average daily travel distance of a taxi driver would be from 180 to 250 km.

As to the suggestion for the ideal travel distance of electric taxis, 26.1% (65 out of 250) suggested around 300 km, 23.3% (58 out of 250) suggested 400 km, and 15.7% (39 out of 250) suggested 350 km as the ideal travel distance of electric taxis. As a result, more than 65% agreed that the ideal travel distance of an electric taxi would be at least 300 km.

As to the number of times of charging, 99.2% (247 out of 250) would accept charging only one time in their shift. Regarding the duration of charging electric taxis, 39% (97 out of 250) would only accept 5 min as the charging duration, 25.3% (63 out of 250) would accept 10 min, and 17.7% (44 out of 250) would accept 15 min as the charging duration. The above results revealed that most of the interviewees are not willing to waste too much time charging electric taxis, and the ideal charging plan for taxi drivers is to charge only one time during their shift, for a maximum of 15 min each time.

For the incentives of using electric taxis, some of them mentioned that they are not able to purchase a taxi, and they would rather choose to receive an operating subsidy. Among 250 responses, 82.8% would like to receive an operating subsidy, while only 17.2% would like to receive subsidies upon purchase of an electric taxi.

As to the venues for installing charging stations, 87.2% (218 out of 250) agreed that it would be appropriate to install charging stations in the streets, 51.6% (129 out of 250) agreed that they should be installed in public car parks, and 42% (105 out of 250) agreed that they should be installed in shopping malls. These results show that most of the interviewees would like to choose some public venues, such as street parking and public car parks, for charging, as this is the most convenient way for taxi drivers.

As to attitudes towards the obstacles of electric taxi development, 91.6% (229 out of 250) strongly agreed that the time of queuing (waiting to charge) and the time of charging are the main concerns when they consider whether to change from diesel to electric taxis, while 65.2% (163 out of 250) strongly agreed that the distance between taxi waiting and charging stations is quite far, and they were not willing to travel a long distance in order to find a charging station. Additionally, 62.4% (156 out of 250) agreed that lack of incentives is one of the major obstacles of electric taxi development. Therefore, some of them do not consider changing from diesel to electric taxis.

4.2. Modelling and Simulation

Although each question in the questionnaire is aimed at different influencing factors, one answer sheet contains a respondent's psychological threshold preference for multiple influencing factors. Therefore, when this paper adopts the method of generating computer multiagents to describe the behavior preferences of taxi drivers using EVs, an accurate description of their preferences needs to rely on the joint probability information of the psychological threshold of multiple factors in the questionnaire. The extraction process of the joint probability information of the questionnaire is shown as follows in Figure 2.

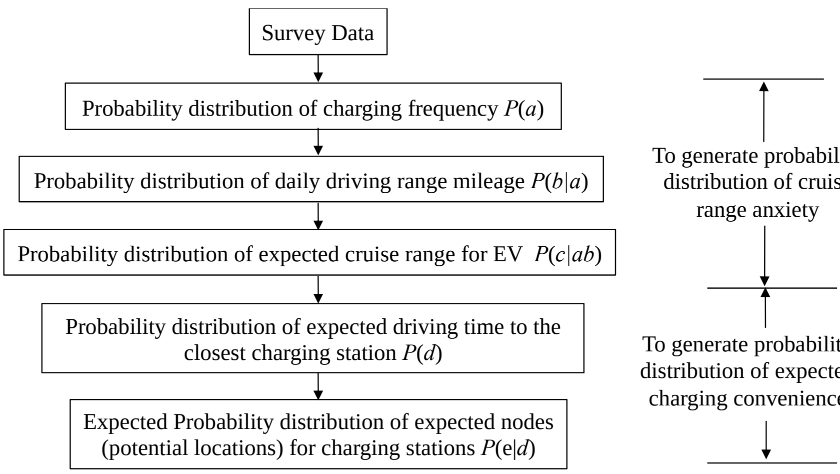

Figure 2. Logic flow and modelling of the joint probability distribution from the survey data.

The formal expression of range anxiety is shown in the below Equation (1), where A is the range anxiety value ($A \in [0, 1]$); the higher the value of A, the higher the range anxiety about EV; T_a is the daily threshold of charging times; T_b is the threshold of daily driving mileage; T_c is the threshold of expected driving mileage.

$$A = \frac{T_a \cdot T_c - T_b}{T_a \cdot T_c} \times 100\% \tag{1}$$

Following in-depth information extraction via the modelling and logic flow as shown in Figure 2, based on the conditional probability distribution P(c | ab) of the driving mileage and the conditional probability distribution P(e | d) of the expected nodes in the street network, i.e., potential locations for charging stations, multiagent modelling and simulation was undergone using random samples generated by Monte Carlo algorithm. The statistical distribution of the multiagent population for influencing factors is consistent with the statistical distribution of questionnaire samples in general, and each agent reflects the threshold preference for influencing factors. As a result, the probability distribution of daily mileage is a generated distribution of all agents under different cruise range anxiety conditions, as shown in Figure 3. Different colors in Figure 3 represent a different number of agents. A deeper color indicates a greater number of agents. The simulation results reveal that drivers with low daily driving mileage have more anxiety about the EV cruise range than drivers with high daily driving mileage.

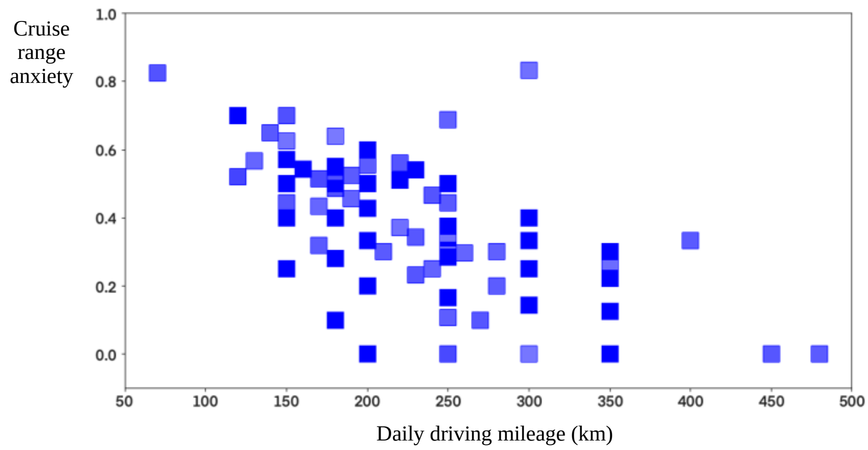

Figure 3. Daily driving mileage distribution of multiagents under different cruise range anxiety.

Furthermore, different agents' preference for expected cruise time to arrive at the closest charging stations is illustrated in Figure 4, when the cruise range anxiety parameter varies. The results indicate that taxi drivers prefer to arrive at the closest charging stations within 15 min of driving time.

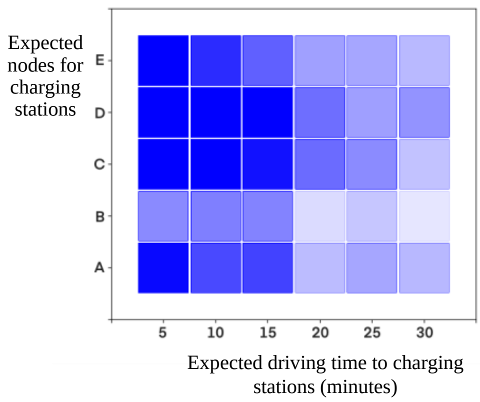

Figure 4. Preference distribution between expected driving time and nodes of closest charging stations considering cruise range anxiety.

5. Discussion

In order to reduce emissions, public transport should be first changed to electric vehicles, which are emission-free, to support the government's goal. To promote electric vehicles and enhance environmental awareness, the Hong Kong Government has established some policies to support the development of electric vehicles, such as providing subsidies for electric vehicle purchases and charging infrastructure. The government has set a target that all new cars in Hong Kong could be electric by 2035. In October 2021, there were nearly 25,000 electric passenger cars, and the government would like to introduce more and more electric vehicles [25]. The government would offer FRT concessions for electric commercial vehicles, including buses, goods vehicles, taxis, etc. The Hong Kong Government has also allocated approximately HKD 300 million for electric buses and taxis, and trials of electric taxis and minibuses will commence in 2023 [22–26]. According to the *South China Morning Post*, electric vehicle buyers will be entitled to as much as HKD 97,500 off their FRT. Additionally, subsidies of HKD 2 billion are included in the Hong Kong government's policy to support the installation of 110,000 electric vehicle charging facilities on private housing estates [27]. Furthermore, the government imposed lower vehicle license fees and supports electric vehicle development through several trials and funds.

To successfully promote electric vehicles and taxis, the government may face some challenges regarding the electricity supply and installation costs of charging infrastructure. Because Hong Kong contains many high-rise buildings, finding places to construct new parking spaces would be a big challenge for the government. Apart from the parking spaces, the electricity supply would also be a major concern. As the weather in Hong Kong is always hot and the humidity is always high, air-conditioning is essential for electric vehicles. Moreover, electric taxis in Hong Kong may need a greater battery capacity in order to support their operation during shifts. To a certain extent, this poses key barriers to carrying out a large-scale introduction of electric taxis in Hong Kong. If we can successfully promote electric taxis, it is possible to protect the environment, for instance, limiting the effects of climate change, such as heat waves, rising sea levels, melting glaciers, warming oceans, etc. We can also reduce air pollutant emissions like carbon dioxide and nitrogen oxide in order to slow down global warming. To this end, electric taxis may potentially have a positive effect on the well-being of the environment and local economies [22].

6. Conclusions

This research study strives to examine taxi drivers' behavior toward electric taxis in Hong Kong and discusses how to boost the number of taxi drivers participating in electric taxi use. In this regard, driving behavior should also be investigated. This study shows that daily driving distance, driving range per full charge, and charging time determine taxi drivers' use of electric taxis. As expected, the research can create fundamental work toward future research directions (e.g., transportation in the direction of sustainable road transport, operation behavior of taxi drivers). By completing the study, the local community will be benefited by having clarity about the extent to which EV will penetrate taxi services and how the promotion of EVs for taxi services will contribute to carbon neutralization. In the long term, we may achieve the Sustainable Development Goals (SDGs) 2030 agenda and develop a sustainable city in Hong Kong.

In this study, we only collected 250 surveys from Hong Kong taxi drivers. Such a preliminary study may reduce a lack of generalization in the study. Sample selection will continue to be developed in further research. In the future, we may carry out a large-scale interview with Hong Kong taxi drivers along with an in-depth, semi-structured interview with the relevant stakeholders, including policymakers, associations, government bodies, and industrial practitioners, to generate a comprehensive study. In addition, we may carry out a comparative case study between Hong Kong and the Greater Bay Area cities. Such a comparative study may provide a useful guideline and valuable insights into how to create a smart city in the future. Based on this fundamental research work, we could potentially construct an optimized charging station map for the adoption of electric taxis in Hong

Kong. As such, our work may support the penetration of electric taxi operations to achieve carbon neutralization in the near future.

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References

1. Scorrano, M.; Danielis, R.; Giansoldati, M. Mandating the use of the electric taxis: The case of Florence. *Transp. Res. Part A Policy Pr.* **2020**, *132*, 402–414. [CrossRef]
2. Keawthong, P.; Muangsin, V.; Gowanit, C. Location Selection of Charging Stations for Electric Taxis: A Bangkok Case. *Sustainability* **2022**, *14*, 11033. [CrossRef]
3. Yang, W.; Wong, R.; Szeto, W. Modeling the acceptance of taxi owners and drivers to operate premium electric taxis: Policy insights into improving taxi service quality and reducing air pollution. *Transp. Res. Part A Policy Pr.* **2018**, *118*, 581–593. [CrossRef]
4. Transport Department HKSAR. 2022. Available online: https://www.td.gov.hk/en/transport_in_hong_kong/public_transport/taxi/index.html (accessed on 7 September 2022).
5. Razzaq, A.; Cui, Y.; Irfan, M.; Maneengam, A. Asymmetric effects of fine particulate matter and stringency policy on COVID-19 intensity. *Int. J. Environ. Health Res.* **2022**, *32*, 1–10. [CrossRef] [PubMed]
6. Kaya, O.; Alemdar, K.D.; Çodur, M.Y. A novel two stage approach for electric taxis charging station site selection. *Sustain. Cities Soc.* **2020**, *62*, 102396. [CrossRef]
7. Lin, C.; Lin, C. The p-center flow-refueling facility location problem. *Transp. Res. Part B* **2018**, *118*, 124–142. [CrossRef]
8. Wu, Y.; Lau, Y.-Y.; Wu, J.-A. Integration of Electric Vehicles into Microgrids: Policy Implication for the Industrial Application of Carbon Neutralisation in China. *World Electr. Veh. J.* **2022**, *13*, 96. [CrossRef]
9. Chong, G. Hidden Hong Kong: A history of the Iconic Hong Kong Taxi. 2021. Available online: https://www.localiiz.com/post/culture-history-taxi-local-public-transportation-hong-kong (accessed on 25 September 2021).
10. Yang, H.; Wong, S.C. A network model of urban taxi services. *Transp. Res. Part B Methodol.* **1998**, *32*, 235–246. [CrossRef]
11. Xu, J.; Yan, L.; Mak, C.K. Service encounter failure, negative destination emotion and behavioral intention: An experimental study of taxi service. *Tour. Manag. Perspect.* **2021**, *40*, 100886. [CrossRef]
12. Newcombe, K.; Kalma, J.; Aston, A.R. The metabolism of a city: The case of Hong Kong. *Ambio* **1978**, *7*, 3–15.
13. Transport Department HKSAR. 2007. Available online: https://www.info.gov.hk/gia/general/200703/28/P200703260091.htm (accessed on 8 August 2021).
14. Adhikari, A.; Mukherjee, S. The New Amby: The Second Debut. *Asian Case Res. J.* **2019**, *23*, 39–63. [CrossRef]
15. Patunru, A.A.; Minato, K.; Hori, M.; Hirota, K. *ERIA Research Project 2008 No. 7, Sustainable Automobile Society in East Asia*; Economic Research Institute for ASEAN and East Asia: Jakarta, Indonesia, 2009.
16. Frost, S.L.; Frost, A.K. Taxi Shanghai: Entrepreneurship and semi-colonial context. *Bus. Hist.* **2021**, 1–30. [CrossRef]
17. Legislative Council of the HKSAR. Promoting the Use of Electric Vehicles. 2020. Available online: https://www.legco.gov.hk/yr19-20/english/panels/ea/ea_ev/papers/ea_ev20200511cb1-589-1-e.pdf (accessed on 7 September 2022).
18. DieselNet. 2022. Available online: https://dieselnet.com/standards/eu/ld.php (accessed on 1 August 2022).
19. Sustainable Business Toolkit. 2022. Benefits of LPG vs Petrol Vehicles. Available online: https://www.sustainablebusinesstoolkit.com/lpg-vs-petrol-vehicles/ (accessed on 10 July 2022).
20. Legislative Council of the HKSAR. A Study on LPG as a Fuel for Vehicles. 1997. Available online: https://www.legco.gov.hk/yr97-98/english/sec/library/967rp05.pdf (accessed on 6 June 2022).
21. Zheng, X.; Lin, H.; Liu, Z.; Li, D.; Llopis-Albert, C.; Zeng, S. Manufacturing Decisions and Government Subsidies for Electric Vehicles in China: A Maximal Social Welfare Perspective. *Sustainability* **2018**, *10*, 672. [CrossRef]

22. Lau, Y.Y.; Wu, A.Y.; Mak, W.Y. A way forward for electric vehicle in Greater Bay Area: Challenges and opportunities for the 21st century. *Vehicles* **2022**, *4*, 420–432. [CrossRef]
23. Wu, Y.A.; Ng, A.W.; Yu, Z.; Huang, J.; Meng, K.; Dong, Z. A review of evolutionary policy incentives for sustainable development of electric vehicles in China: Strategic implications. *Energy Policy* **2021**, *148*, 111983. [CrossRef]
24. Singtao. Electric New Taxi BYD e6 Taxi Ready for Trial Early Next Year. 2021. Available online: https://std.stheadline.com/supplement/article/2422583 (accessed on 8 August 2021).
25. Ng, E. All New Cars in Hong Kong Could Be Electric by 2030, Five Years Ahead of Schedule. 2022. Available online: https://www.scmp.com/business/article/3157974/all-new-cars-hong-kong-could-be-electric-2030-five-years-ahead-schedule#:~{}:text=park%20by%20itself-,Chinese%20XPeng%20electric%20car%20can%20drive%20and%20park%20by%20itself,lower%20than%20for%20petrol%20cars (accessed on 8 September 2022).
26. Lau, Y.Y.; Wu, A.Y.; Mak, W.Y. Electric vehicle charging infrastructures in the Greater Bay Area of China: Progress, challenges and efforts. *Front. Future Transp.* **2022**, *3*, 893583. [CrossRef]
27. Lau, Y.-Y.; Yip, T.-L.; Dulebenets, M.A.; Tang, Y.-M.; Kawasaki, T. A Review of Historical Changes of Tropical and Extra-Tropical Cyclones: A Comparative Analysis of the United States, Europe, and Asia. *Int. J. Environ. Res. Public Health* **2022**, *19*, 4499. [CrossRef] [PubMed]