Chapter 7

Sustainable Mobility in Viet Nam: A Study on the Willingness to Pay for Electric Motorbikes

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Chapter 7

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1. Introduction

This chapter explores the consumers' perspectives on the use of electric versus internal combustion motorbikes in Ho Chi Minh City. In that regard, this chapter complements the previous work on the households' perceptions towards the use of renewable energy for electricity generation. Indeed, whilst there is widespread recognition for the need to promote decarbonisation of the power systems, transportation is also one of the main sources of greenhouse gases emissions. On a global scale, transportation accounts for 24% of all the emissions and, out of these, three quarters are due to road transportation (IEA, 2020). As the climate emergency becomes more pressing (IPCC, 2021) (IPCC, 2021), there is also an increasing need to accelerate the shift from internal combustion engine vehicles to other technologies, such as hydrogen and electricity. Particularly, electrification of road transportation is currently one of the mains strategies to increase its sustainability (Weiss et al., 2015). However, policy support is still needed to make the purchase economically reasonable from the consumer's point of view. For that, several governments (both national and sub-national) have adopted is to set a timeline for phasing out the sales of the internal combustion engine passenger cars. So far, this option is still limited to several European countries (European Union [EU] and non-EU members), North America (Canada and California), and few other countries (Costa Rica, Cape Verde, and Singapore) (Wappelhorst, 2021). Other countries are following, even though without official commitments for full phasing out. China has announced that from 2035, the only new cars for sale will be 'new-energy' (electric, fuel cell, or plug-in hybrid). Similarly, Japan is planning to allow only the sale of electric and hybrid vehicles by 2035 (Davis, 2020). Nevertheless, electrification of transportation alone cannot reduce the overall emissions, and need to be combined with a decarbonisation of the power mix (Zhang and Fujimori, 2020).

In ASEAN, transportation is considered as one of the key elements of the *6th Energy Outlook* for the period 2017–2040 (AO6) (ACE, 2020a). The AO6 outlines two key approaches to realise greener transport: the adoption of electric vehicles and the

replacement of oil products with biofuels. Electric vehicles are still in their infancy in ASEAN, although several countries are setting targets. In contrast, there is more experience with biofuels, but to secure their sustainability, more efforts are needed to develop second-generation biofuels that use waste and other non-food feedstock. Furthermore, Improvements in fuel economy are also essential. These are also included in the ASEAN Transport Strategic Plan 2016–2025 (also known as the Kuala Lumpur Transport Strategic Plan), approved in 2015, as a successor of the Brunei Action Plan (ASEAN, 2015). The Kuala Lumpur Transport Strategic Plan outline several strategic goals for air, land, maritime, and sustainable transport and transport facilitation. The need for a fuel economy roadmap for the transport sector was then incorporated as one of the key steps towards a more sustainable transportation system.

- Goal 1: Average fuel consumption per 100 kilometres of new light-duty vehicles sold in ASEAN is reduced by 26% between 2015 and 2025.
- Goal 2: Common indicators and methodologies, as well as baseline data for fuel economy, are defined.
- Goal 3: Regional cooperation, national action, and fuel economy policy leadership are established.
- Goal 4: Fuel economy label information is regionally aligned.
- Goal 5: Introduction or enhancement of fuel consumption or CO_2 emissions-based fiscal policies.
- Goal 6: Adoption of national fuel consumption standards for light-duty vehicles in all markets, striving towards a regional standard in the long term.

In terms of fuel efficiency, ASEAN countries follow the EU classification for emissions standards (Table 7.1). Currently, there is a six reference level, and stricter emissions standards are expected to be adopted by the EU Commission during the fourth quarter of 2021.[9] The implementation of these standards is still at very different levels in each country but has been improved gradually. (Tongsopit et al., 2016) notes that Euro IV standards have been implemented only in Malaysia and Thailand, and in Singapore only for diesel vehicles; Malaysia, Indonesia, and Viet Nam have Euro II; whilst, there are no emissions standards in Brunei Darussalam, Cambodia, Lao People's Democratic Republic, and Myanmar. (Li and Chang, 2019) point out that Singapore has already implemented Euro 5 for all cars, which Thailand is also introducing gradually, and Malaysia and Indonesia have plans to introduce Euro 4. In Viet Nam, Euro 4 standards apply for vehicles,

[9] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12313-European-vehicle-emissions-standards-Euro-7-for-cars-vans-lorries-and-buses_en

whilst two and three-wheelers must follow Euro 3.[10] ASEAN has adopted a regional approach to ensure a harmonised improvement of the fuel economy standards building upon the agreements outlined in the ASEAN Transport Strategic Plan 2016–2025, and further extended in the ASEAN Fuel Economy Roadmap for Transport Sector 2018–2025 with the goals previously mentioned. In this effort, several initiatives for sustainable transport are being implemented in the region. In 2019, the International Transport Forum and the ASEAN Secretariat established the International Transport Forum–ASEAN Transport Research Proposal to support the development of the roadmap and supported by the Global Fuel Economy Initiative (2021a).

Table 7.1: European Emissions Standards

		Unit	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6
Implementation	New approvals	Date	1 July 1992	1 Jan 1996	1 Jan 2000	1 Jan 2005	1 Sep 2009	1 Sep 2014
	All new registrations	Date	31 Dec 1992	1 Jan 1997	1 Jan 2001	1 Jan 2006	1 Jan 2011	1 Sep 2015
Petrol standards	CO	g/km	2.72	2.2	2.3	1.0	1.0	1.0
	HC + NOx	g/km	0.97	0.5	-	-	-	-
	THC	g/km	-	-	0.20	0.10	0.10	0.10
	NMHC	g/km	-	-	-	-	0.068	0.068
	NOx	g/km	-	-	0.15	0.08	0.06	0.06
	PM	g/km	-	-	-	-	0.005	0.005
	PN	#/km	-	-	-	-	-	6.0 x10^11
Diesel standards	CO	g/km	2.72	1.0	0.66	0.50	0.50	0.50
	HC + NOx	g/km	0.97	0.7	0.56	0.30	0.23	0.17
	NOx	g/km	-	-	0.50	0.25	0.18	0.08
	PM	g/km	0.14	0.08	0.05	0.025	0.005	0.005
	PN	g/km	-	-	-	-	6.0x10^11	6.0x10^11

CO = carbon monoxide, g/km = gram per kilometre, HC = hydrocarbons, NOx = nitrogen oxides, THC = total hydro carbon, NMHC = non-methane hydrocarbons, PM = particulate matter, PN = particle number.

Source: Euro 1 to Euro 6 Guide – Find out your Vehicle's Emissions Standard.

https://www.rac.co.uk/drive/advice/emissions/euro-emissions-standards/

[10] https://www.transportpolicy.net/standard/vietnam-motorcycles-emissions/

Electric motorbikes can play an important role in developing countries, particularly in those with already high penetration. Electric motorbikes can become even more important if they can shift some users from private cars to electric mobility. As electric cars still remain too expensive for the average person, this can become critical in avoiding a continuous increase in private cars, and the pollution, congestion, and traffic accidents associated. Gasoline motorbikes already play a vital role in mobility in many ASEAN cities, occupying less space in the road than cars. Motorbikes are also important for equity to access. With a broader range of available options in the market, it is easier for all economic classes to access the purchase of a motorbike. However, the rapid increase of existing motorbikes in cities have brought other problems, such as air pollution, congestion, and traffic accidents (Van, 2009). A shift to electric motorbikes would reduce these impacts, particularly in air pollution, and the possibility of traffic accidents (due to lower average speed). However, the impact on congestion is difficult to assess. Electric motorbikes are in general simpler in their maintenance, and lighter and cleaner in the operation, reducing the barriers for new entrants. This could lead to a worsening of congestion due to an increase in the number of motorists).

Furthermore, electric motorbikes represent an alternative that fits current consumer preferences (i.e. private mobility), and urban mobility goals (i.e. reduced air and noise pollution). In any case, a shift towards electric motorbikes should be accompanied by the promotion and improvement of a city's public transportation system, such as more sustainable bus technologies (Büyüközkan, Feyzioğlu, and Göçer, 2018), and to look at the potential introduction of newer urban mobility systems, which could be public, private, or a combination of both. These include micro-mobility devices such as e-scooters and electric bicycles (Abduljabbar, Liyanage, and Dia, 2021), both in private ownership or shared business models (Christoforou et al., 2021). In addition, there is an increase in the adoption of shared-economy models for motorbikes and cars, well established in Southeast Asia through companies such as Singapore-based Grab and Indonesia-based GoJek (Lauria, 2020). Even more, it is needed to consider the integration of all the different urban mobility systems (Oeschger, Carroll, and Caulfield, 2020).

However, studies on the adoption of electric motorbikes are still lacking, particularly when comparing with those on private cars (electric and hybrid) (Jones et al., 2013). (Eccarius and Lu, 2020) reviewed studies on the adoption of electric motorbikes. In total, the authors analysed 11 studies finding that most of them considered similar attributes, such as purchase price, operating cost, and performance levels. Cultural differences are considered to play a role in certain inconsistencies between the studies, such as whether gender has any effect on the adoption of electric motorbikes. The symbolic meaning that

motorbikes can have for many owners also play an important role. In that sense, the image of a specific model will have a notable effect on the decision, either positively or negatively. (Eccarius and Lu, 2020) also point out the necessity for futures studies on consumers' attitudes towards electric two-wheelers and how related infrastructure could influence consumers. Nonetheless, there is nascent literature on willingness to pay for electric two and three wheelers, including motorbikes but others such as auto rickshaws. Table 7.2 presents previous related studies.

Table 7.2: Overview of Studies on Willingness to Pay for Electric Motorbikes

Author(s) (Year)	Country	Method	Main Findings
Jones et al. (2013)	Viet Nam	Mixed logit model	Technological improvements and economic incentives (i.e. sales taxes) can have significant effects on adoption
Patil et al. (2021)	India	Multinomial logit, random parameter logit	Speed is most important, followed by acceleration and charging duration
Chiu and Tzeng (1999)	Taiwan	Multinomial logit	Sales taxes, technological improvements, and increases in gasoline prices could expand market share
Sung (2010)	Taiwan (28)	Four-stage stated preference experiment	Respondents have a higher quality perception of the electric motorbike than the gasoline motorbike
Zhu et al. (2019)	Macau	Double-boundary dichotomous contingent valuation method + binary logistic regression analysis	Actual cost (i.e. sale price, charging fee, repair fee, and tax incentives) are the main points of interest for respondents Product features (i.e. driving speed and load capacity) got very little attention
Guerra (2019)	Solo (Indonesia)	Mixed logit model	Charge time is particularly important

Scorrano and Danielis (2020)	Italy	Multinomial logit model + Random parameter logit model	Electric scooters adoption is Limited by non-monetary factors and still inadequate supply
Sun and Zhang (2013)	Lao PDR	Dogit model	Cruising range, charge distance operation cost, and diffusion rate are major influential factors
Patil et al. (2021)	India (Hyderabad)	Multinomial and Random parameter logit	Top speed is the most important attribute, followed by acceleration and charging duration
ADB (2009)	India (Ahmedabad) and Viet Nam (Ha Noi)	Conditional logit	A poor reputation for quality is a significant factor

Source: Collated by authors.

This chapter aims to contribute to this emerging literature with a survey and choice experiment for electric motorbikes in Viet Nam. The ownership ratio of motorbikes in Vietnam is one of the largest in the world. Indeed, currently, personal motorbikes are the default and preferred urban transportation mode (Le and Trinh, 2016). However, this has also created severe problems such as traffic congestion and air pollution. Indeed, Vietnamese large urban areas (Ha Noi and Ho Chi Minh City) are amongst those with lower air quality in the region. The transformation into sustainable transportation systems is therefore one of the priority areas for policymakers in the country. Indeed, in 2021, Viet Nam has adopted its 10-year climate-resilient urban development plan until 2030 (Vietnam+, 2021). A shift from gasoline to electric motorbikes has been pointed out as one of the suitable alternatives in this process (Huu and Ngoc, 2021). And as such, some pilot projects have been implemented in the country. The United Nations Environmental Programme (UNEP) under the eMob Programme is supporting developing countries, including Viet Nam, in their transition to electric mobility in a programme under the Global Environment Facility (Global Fuel Economy Initiative, 2021b; Fabian, 2020). The programme partnered with the Viet Nam University of Transport Technology under the project 'Mainstreaming Electric Mobility in Vietnam', which concluded at the end of 2020. The focus of these studies has been mostly on the potential for electric motorbikes to contribute to a transition towards sustainable transportation, as well as the possible

limitation and shortcomings of such an approach. Nevertheless, it is also important to also consider the perceptions and preferences of residents (current owners or not of gasoline motorbikes) to better design policies to promote a shift from gasoline to electric motorbikes in the country.

The remainder of the chapter provides further details for each of the cities and the sampling approaches from the research teams. The next section provides an overview of willingness to pay studies on electric motorbikes. This feeds into the design of the choice experiment described in the following section. After that, the results are presented including socio-demographics, an analysis of the current mobility patterns and insights into respondents' view on electric mobility, and the estimation of the willingness to pay for electric motorbikes. The final section provides a summary of the main findings and a discussion on policy implications and further research.

2. Survey Design

The survey was divided into five parts: (i) personal mobility, (ii) knowledge on electric motorbikes, (iii) choice experiment, (iv) attitude towards environmental problems, and (v) household respondents' information. The overall questionnaire was prepared in collaboration between the teams at the University of Tokyo and the Ho Chi Minh University of Economics based on the review of the literature and a pre-test conducted in the first trimester of 2021.

The choice experiment was designed so respondents are presented a hypothetical scenario to purchase a motorbike between three alternatives: (i) electric motorbike, (ii) gasoline motorbike, (iii) none of them. Figure 7.1 shows one of the actual choice sets employed (CSID 001) in Vietnamese. The choice sets were prepared with a D-optimal design (NIST/SEMATECH, 2012) combining the different levels for each of the attributes selected. Visual representations were prepared as an aid for the respondents. In total 110 different choice sets were prepared, and 486 interviews were conducted. Each of the respondents was expected to complete five-choice tasks, although the final registered responses were 2,406).

Figure 7.1: Sample Choice Set

	Option A [Phương án A] Electric Motorbike [XE MÁY ĐIỆN]	Option B [Phương án B] Gasoline Motorbike [XE MÁY XĂNG]
Fuel [Loại nhiên liệu]	 Electricity	 Gasoline
Maximum speed (km/h) [Tốc độ tối đa (km/h)]		
Range in single charge (km) [Quãng đường đi được sau 1 lần sạc đầy (km)]	 150 km	 100 km
Fuel/electricity cost (VND/100 km) [Tiền xăng/điện (đồng/100km)]	 5.000 đồng/100km	 50.000 đồng/100km
Maintenance cost (VND/month) [Chi phí bảo trì (đồng/tháng)]	 90.000 đồng/tháng	 100.000 đồng/tháng
Time for full charge (hour) [Thời gian sạc đầy pin (giờ)]	 4 giờ	 0 giờ

Country of origin [Xuất xứ thương hiệu]	 Châu Âu	 Việt Nam
Price (VND million) [Giá bán đã bao gồm thuế và phí (triệu đồng)]	 20 triệu đồng	 40 triệu đồng
He/she chooses [Ông/Bà chọn...]	☐ Electric motorbike [Xe máy điện]	☐ Gasoline motorbike [Xe máy xăng]
	☐ Not buy any [Không mua chiếc nào]	

Source: Authors.

The attributes for the choice sets were prepared including those that were found to be relevant for Vietnamese residents in their decision to purchase their motorbike but that would allow for the estimation of the willingness to pay for each of them. The levels were prepared after consultation of available resources to make them realistic in the present or a reasonable future. The sources included reports from industry such as (Terra Motor and Quantum Leaps, 2013) and (Mirai Asset Daewoo, 2020). The initial design was modified after the pre-test. In particular, the appearance of the motorbike was one attribute that was discarded after that; for others, the levels were adjusted when needed (maximum price was increased to fit an appreciation by some respondents of more expensive models). The final list of attributes and values are presented in Table 7.3.

Table 7.3: Attributes and Levels for the Choice Experiment

Attribute	Unit	Levels
Top speed	km/hour	40 – 60 – 80 – 100
Range	km	100 – 150 – 200 – 250 – 300
Fuel / electricity cost	VND/100 km	Electric: 3,000 – 4,000 – 5,000 Gasoline: 30,000 – 40,000 – 50,000
Maintenance cost	VND/month (over a period of 6 years)	Electric: 50,000 – 70,000 – 90,000 – 110,000 Gasoline: 100,000 – 150,000 –200,000 – 250,000 For electric need to replace the battery after 6 years For gasoline monthly maintenance For electric swap battery monthly service
Time to charge	Hours	Electric: 0 (swappable) – 1 – 4 – 7 Gasoline: 0
Country of origin	-	Viet Nam – China – Japan – Europe
Price	VND million	20 – 40 – 60 – 80 – 100

km = kilometre.

Source: Authors.

Top speed and range are common features of great importance for motorists. Electric motorbikes have traditionally counted with limited maximum speed to optimise the use of batteries. This has led them to be more focused on short travels within the boundaries of cities rather than for long-distance travel or use on roads with high-speed limits, such as highways. Nevertheless, new models are being brought to market with speed limits analogous to those of gasoline motorbikes. However, these faster models were out of scope for this study. The exploratory survey and the pre-test revealed that the main use for motorbikes in Ho Chi Minh City is still for travel within city boundaries. For these, the speed is limited due to the regulation, and by the common traffic jams. For that, the highest maximum speed was set at 100 kilometres per hour (km/h), and the minimum at 50 km/h, which is more adequate for the cheapest models. A range between 100 to 300 km was adopted for both electric and gasoline motorbikes. These are relatively high values for electric motorbikes, but it considered adequate for the development of hypothetical alternatives.

For the repetitive costs, only charging (fuel or electricity) and maintenance were included. Other costs such as taxes and parking fees were discarded. In general, drivers also count in the initial tax as part of the total cost of the motorbike and there are free of charge parking is commonly available. The charging cost for the gasoline motorbikes was estimated based on the responses during the pre-test. For the electric motorbikes, the value was estimated including the cost of electricity in Viet Nam (per kWh) and the range of benchmarking models (such as those from VinFast). This was also contrasted with those values considered by the industry (Mirai Asset Daewoo, 2020). For the maintenance cost, similarly, the value for gasoline was based on experience from motorists in Viet Nam and for electric motorbikes based on external sources. In general, electric motorbikes required less maintenance than conventional motorbikes (Publimotos, 2020). However, battery check-ups are required at 1,000 km and 5,000 km (Silence Valencia, 2020). Furthermore, batteries need to be replaced after 6 years, adding a large cost that was distributed across their period of service. Although not equal, this was assumed to be similar to the total expenses for contracting a swapping battery service during that time.[11]

Battery anxiety is a common concern for consumers to purchase electric vehicles. This is usually lower for electric motorbikes than for cars due to the possibility to charge them without installing additional infrastructure. In many cases, the batteries can be charged connected to electric home power outlets. Moreover, many companies already offer subscription models that allow swapping of batteries (Sholichah and Sutopo, 2020). In this case, the time required to charge the battery is virtually reduced to zero due to the availability of battery charging stations through the city from which to replace the used battery for one fully charged .

Country of origin is another important feature that is considered by drivers. Japanese manufactures have traditionally dominated the motorbike market in Viet Nam. Honda is consistently the most widespread brand, followed by Yamaha, and, in a minor position Suzuki. European brands have only been introduced with models such as Piaggio Vespa. American brands are less popular. Nevertheless, this market structure does not apply to electric motorbikes. The first models were introduced by Chinese manufacturers. However, bad experiences from customers at that time limited their initial expansion. Large Japanese manufacturers, such as Honda, have not introduced their electric models until recently. Although some other smaller companies have looked at this as a niche market with sufficient potential (Terra Motor and Quantum Leaps, 2013). The market for

[11] As a reference VinFast's battery rental service is available at https://shop.vinfastauto.com/vn_vi/vinfast-bike.html

electric motorbikes in Viet Nam has started to see an increase in newer models with higher quality and that is capturing attention from consumers. In 2018, VinFast, a Vietnamese brand, started to sell only electric motorbikes with a rapid increase in their sales (Bloomberg, 2020). In 2019, Yadea, a Chinese brand and one of the major global brands in electric motorbikes opened a factory in Viet Nam to supply the market with local manufactured products.[12]

There is a wide range of prices for the motorbike models available in Viet Nam.[13] In general, electric motorbikes have specialised in lower price models, with some of them below VND20 million. Nevertheless, there is a trend for relatively higher-end models, with the popularity of the VinFast Klara. For gasoline motorbikes, Honda is the leading brand, and the Wave and SH are the most popular models in Viet Nam. However, consumers tend to automatically include the purchase and registration taxes as part of the purchase cost. Furthermore, the pre-test revealed that respondents also consider higher price models.

3. Results

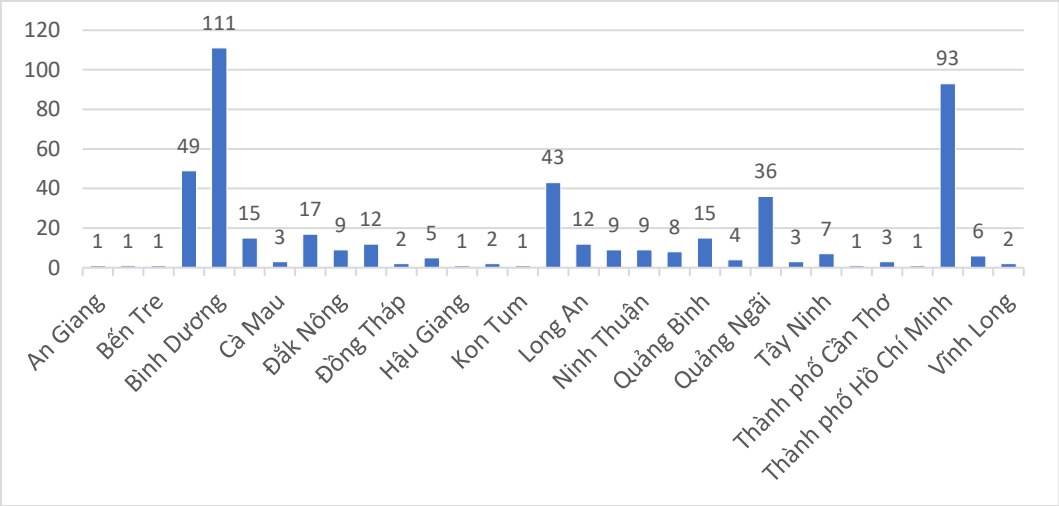
3.1. Socio-demographics

Initially, the target surveyed area was Ho Chi Minh City, but this needed to be modified due to the mobility restrictions put in place by the government to prevent the spread of COVID-19 in the city. To overcome such limitations, the surveyors' team was expanded to include economics students from the University of Economics of Ho Chi Minh City, Binh Duong University, and Quy Nhon University. Furthermore, some of the interviews were conducted via video conferences. As a result, the respondents were scattered across the country (Figure 7.2 and Figure 7.3), but most of them were located in the provinces of the three universities. In total, 486 interviews were conducted, nearly half split by gender (Figure 7.4) and distributed between unskilled labour, office workers, and self-employed (Figure 7.5) with a monthly income between VND6 to VND40 million (Figure 7.6).

[12] http://www.globalyadea.com/newsdetails-68.html

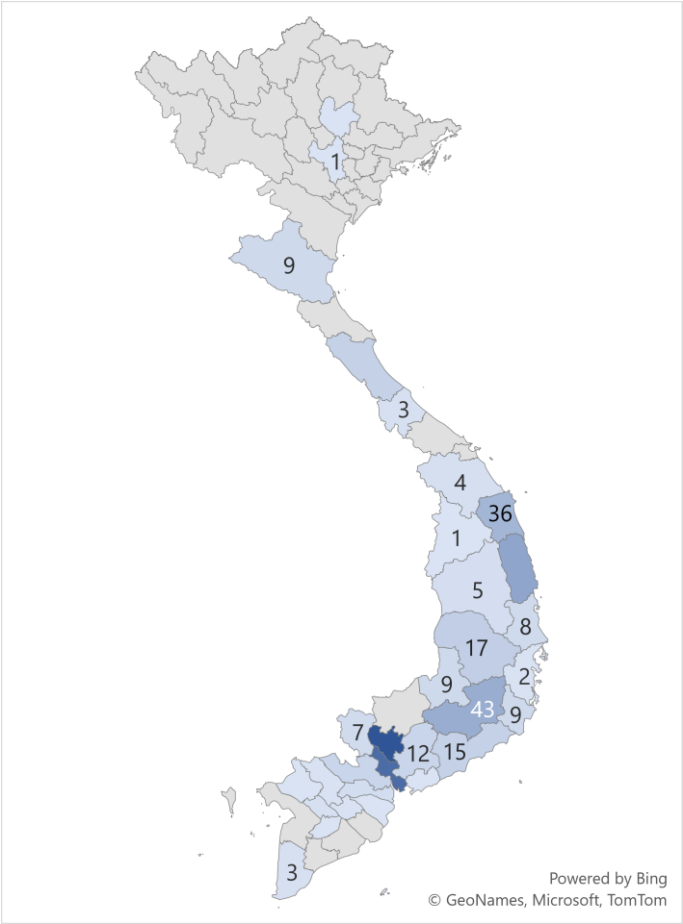
[13] Reference models from Honda (market leader in motorbikes in Viet Nam) and VinFast (emerging manufacturer specialised on electric motorbikes) were used for benchmarking. https://www.honda.com.vn/xe-may/san-pham and https://shop.vinfastauto.com/vn_vi/vinfast-bike.html

Figure 7.2: Respondents per Province



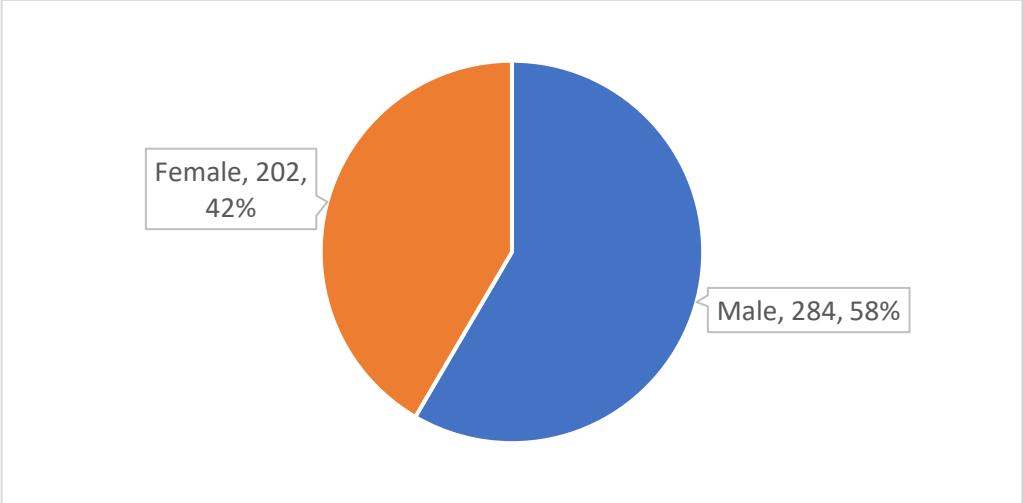
Source: Authors' calculation.

Figure 7.3: Map with the Distribution of Respondents by Province



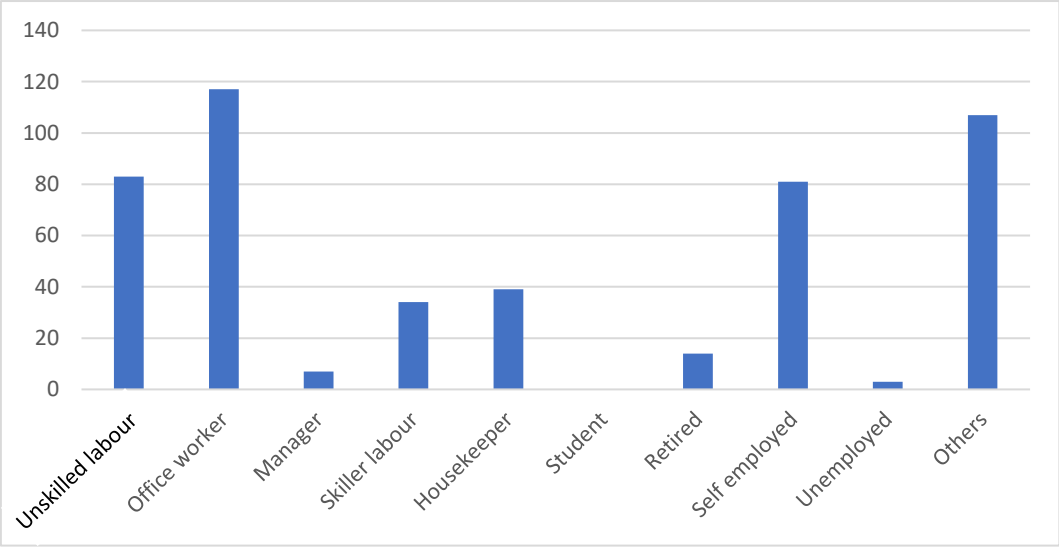
Source: Authors' calculation.

Figure 7.4: Respondents' Gender



Source: Authors' calculation.

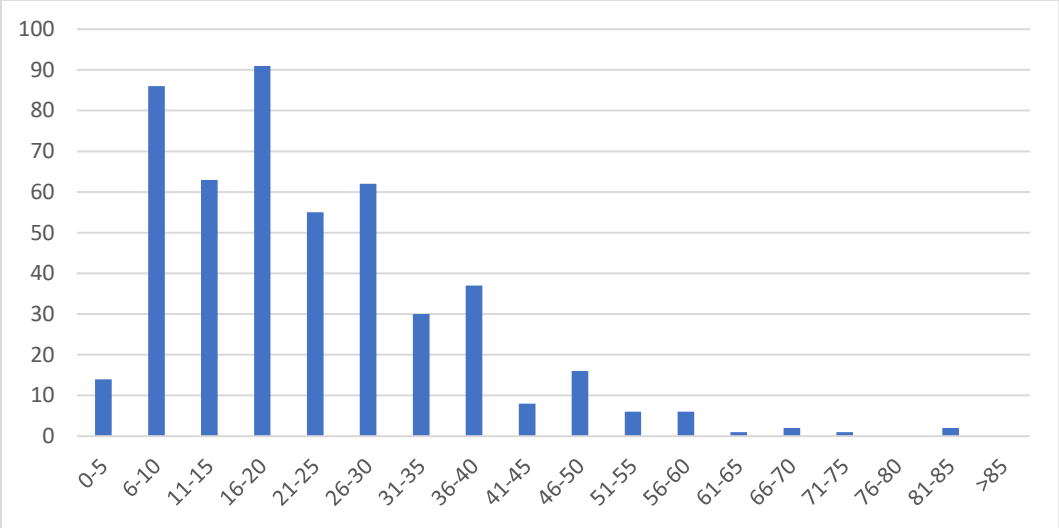
Figure 7.5: Respondents' Occupation



Source: Authors' calculation.

Figure 7.6: Respondents' Monthly Income

(VND)

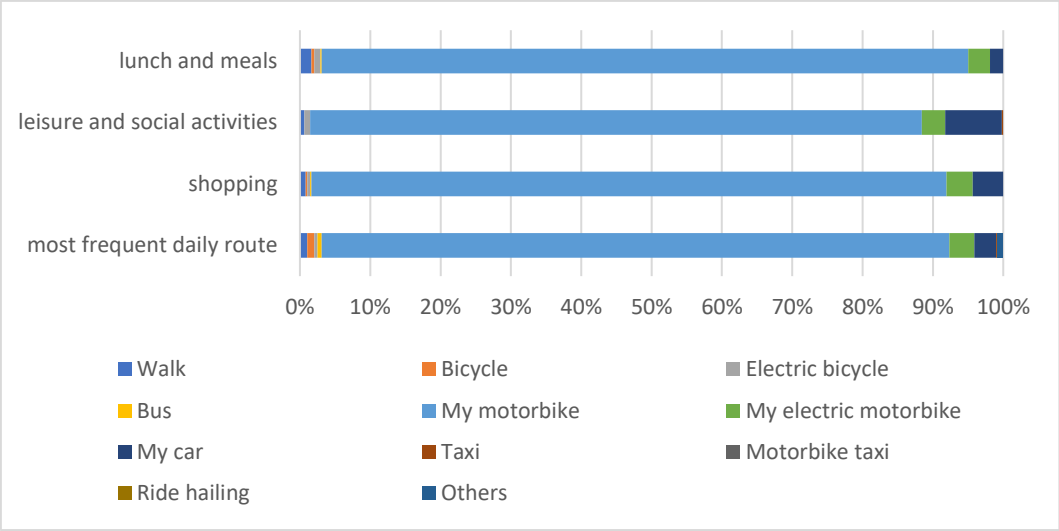


Source: Authors' calculation.

3.2. Personal Mobility

Personal motorbikes are the de-facto choice for urban mobility for the responses for each of the activities considered (Figure 7.7). During the pre-test, ride-hailing was one of the transportation modes for respondents. However, during the full survey, no respondent mentioned it for any of the activities. This was probably because of the lower popularity of ride-hailing services outside of big cities and the stopping of these services in major cities due to the COVID-19. This can also explain the low number of respondents that walk or use a bus for their trips.

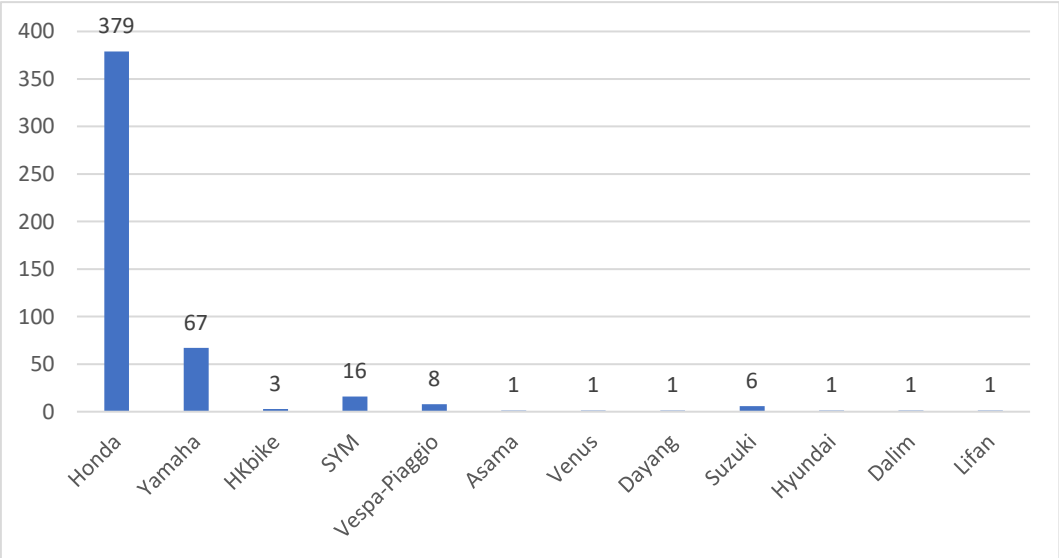
Figure 7.7: Main Transportation Mode by Activity



Source: Authors' calculation.

Most of these motorbikes (480) are gasoline, with only six respondents owning an electric motorbike (HKbike, Asama, Venus, or Hyundai). Also, most respondents own one of the models offered by Honda, followed by Yamaha (Figure 7.8). This is in line with the current market trends in Viet Nam.

Figure 7.8: Respondents' Motorbikes by Brand

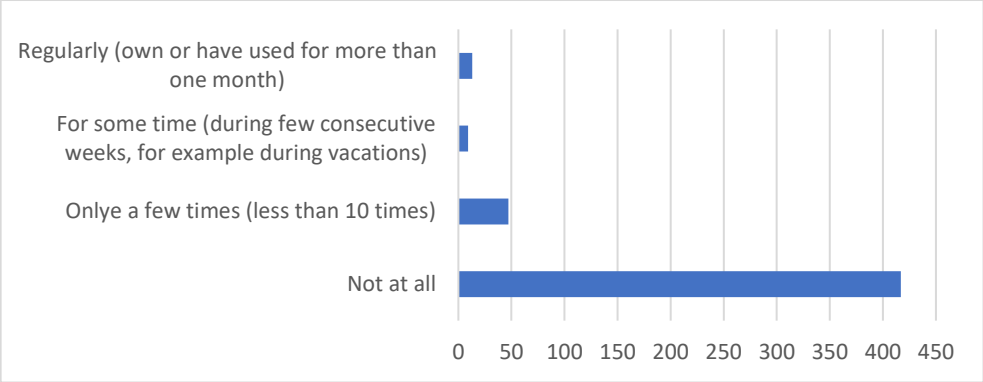


Source: Authors' calculation.

3.3. Knowledge of Electric Motorbikes

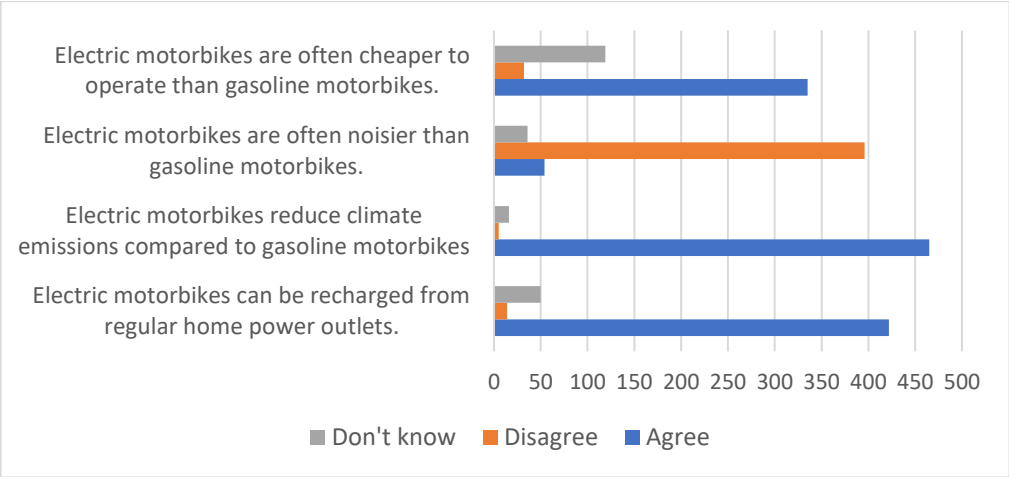
In addition to the lower ownership of electric motorbikes, very few respondents have ever experience riding one (Figure 7.9). Only 13 respondents use an electric motorbike regularly, nine sometimes, and 47 for a few times. In contrast, 417 reported having never ridden one. However, respondents appeared to be aware of electric motorbikes. The questionnaire survey included a short quiz on basic knowledge including four questions on comparing electric and gasoline motorbikes (Figure 7.10). The majority could correctly answer these. Only the question of the cost of operation of the electric motorbike got several 'do not know' responses. This might be due to the lack of ownership or experience for a long period.

Figure 7.9: Experience in Riding an Electric Motorbike



Source: Authors' calculation.

Figure 7.10: Quiz on Basic Knowledge on Electric Motorbikes



Source: Authors' calculation.

3.4. Estimation of the Willingness to Pay

The regression analysis (Table 7.4) shows that all the attributes, except the charging time, are significant. As it would be expected, those related to cost (price, fuel, and maintenance cost) are negatively correlated, whilst those on performance (speed and range) are positive. The charging time was not significant, indicating a possible lower relevance in the purchasing behaviour for the battery capacity or easiness to charge (in contrast to the situation with electric cars). The country of origin was also significant, with the highest preference for electric motorbikes from Japan and Viet Nam. It is important to note that Japanese brands (particularly Honda and, at a lower rate, Yamaha) are the current dominant manufacturers in the country. The emergence of Vietnamese brands and the good reputation they are gaining amongst residents shows the potential of a shift to electric motorbikes also as an industrial policy. Table 7.5 includes the calculation of the marginal willingness to pay for each of the attributes. From, this, the WTP for each of the attributes is estimated. The results are that a WTP of VND400,000 for improving 1 km/h in top speed, VND620,000 to improve a range in 10 km, VND50,000 to reduce VND1,000/km in fuel cost, and VND170,000 to reduce VND1,000 /month in maintenance cost.

Table 7.4: Attributes and Levels for the Choice Experiment

	Model 1
Price	–0.0204***
	(0.0011)
Speed	0.00818***
	(0.0014)
Range	0.00127***
	(0.0004)
Fuel cost	–0.0000119***
	(0.00000265)
Maintenance cost	–0.00000353***
	(0.00000075)
Charging time	–0.0230
	(0.0161)
Country/region of origin	
China	1.248***
European Union	2.152***
Japan	2.169***
Viet Nam	2.163***
R2	0.11
Observations	7218
Log-likelihood	-3418

Note: Robust standard errors are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10% respectively.
Source: Authors' calculation.

Table 0.1: Marginal Willingness to Pay for Each of the Attributes

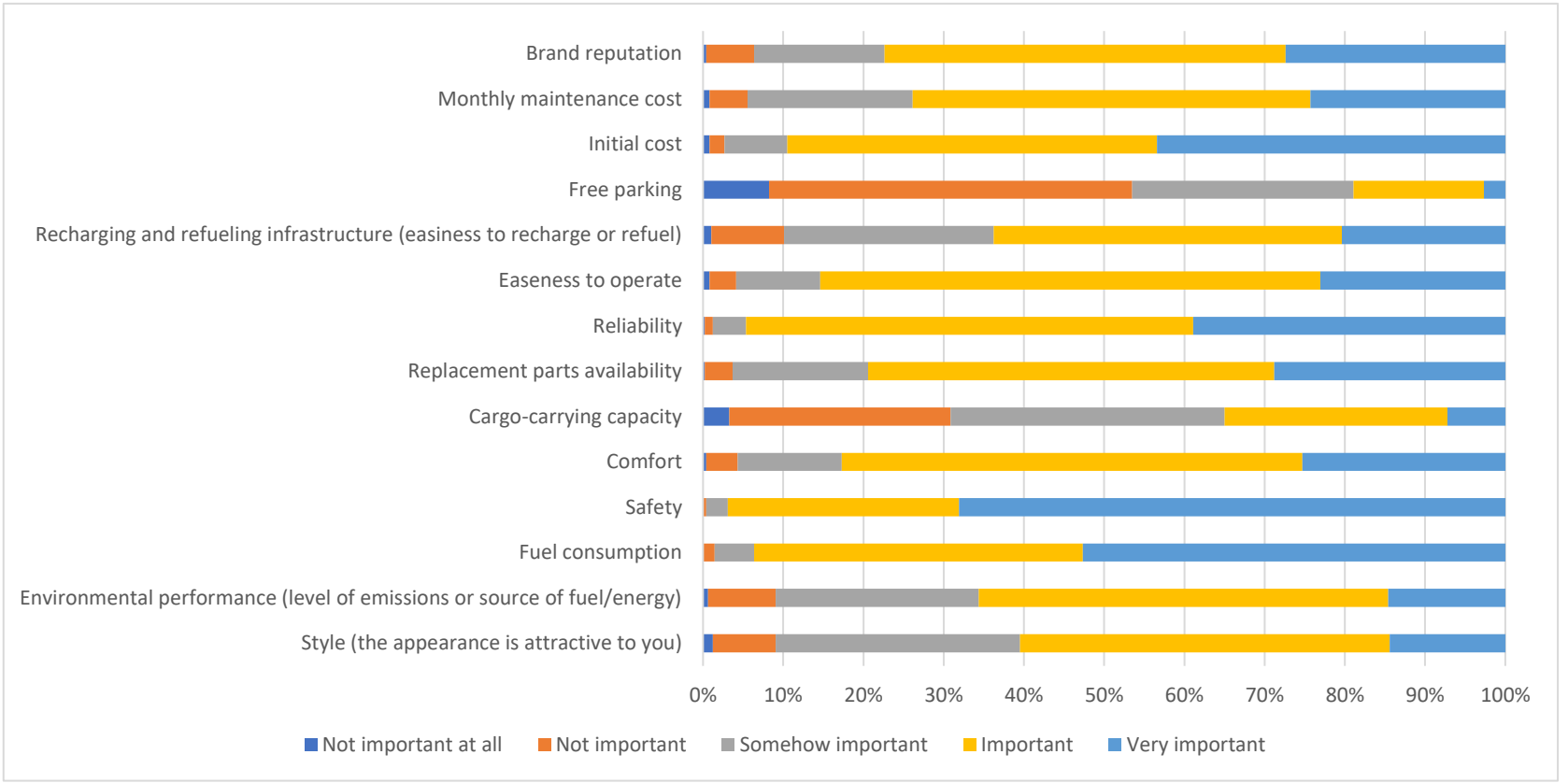
Variable	Marginal Willingness to Pay (95% CI)	Willingness to Pay
Speed	0.4 (0.26~0.54)	Improve 1 km/hour speed: VND400,000 (USD17.6)
Range	0.062 (0.021~0.11)	Improve 10 km range: VND620,000 (USD27.3)
Fuel cost	–0.00058 (–0.00084~-0.00032)	Reduce VND1,000/km (4.4 cents/km) fuel cost: VND580,000 (USD25.5)
Maintenance cost	–0.00017 (–0.00025~-0.0001)	Reduce VND1,000/month (4.4 cents/month) maintenance cost: VND170,000 (USD7.5)
Charging time (Insignificant)	–1.12 (–2.65~0.45)	Reduce charge time –

CI = confidence interval, km = kilometre.

Source: Authors' calculation.

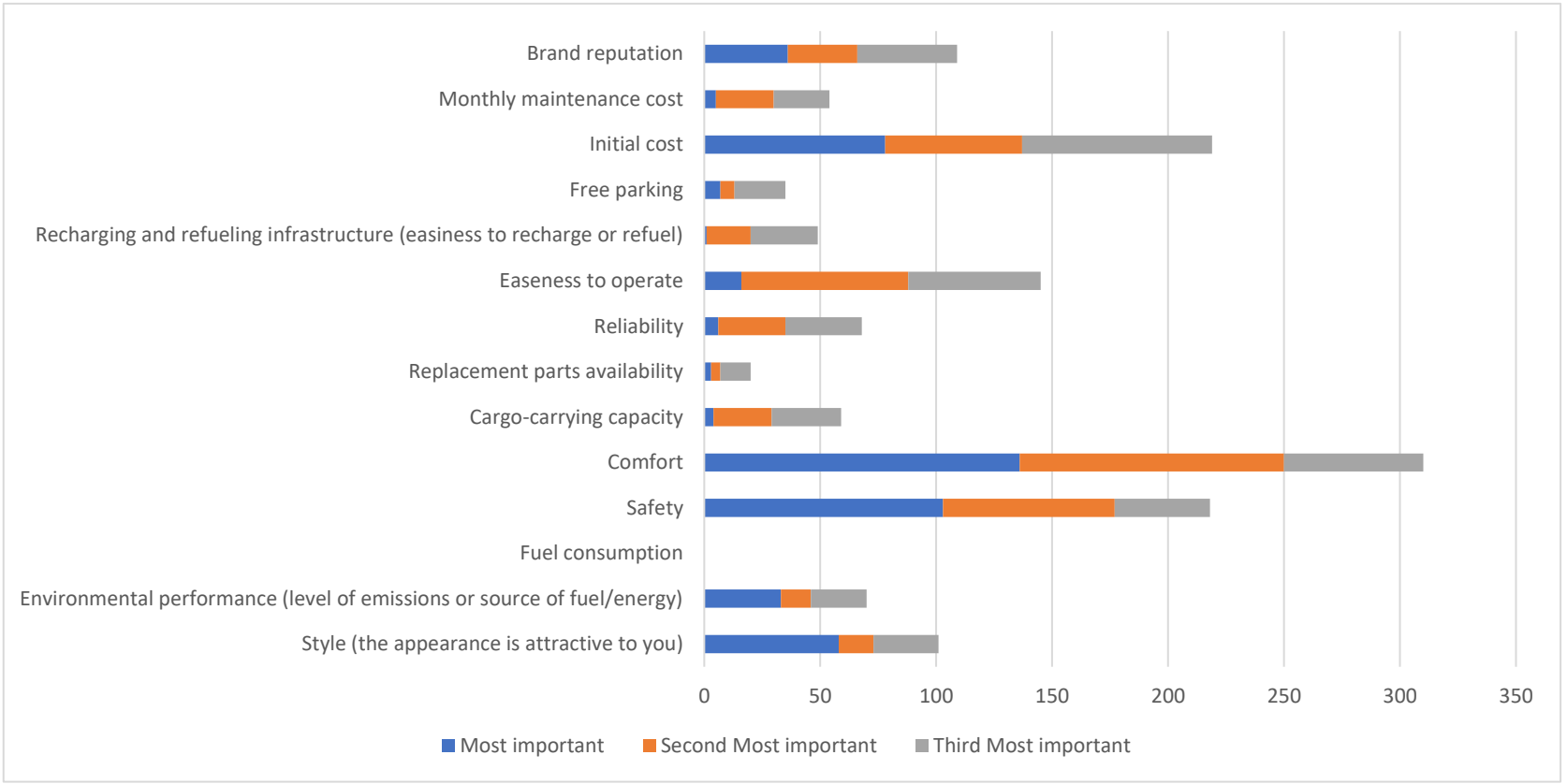
In addition to the choice experiment, the questionnaire survey included follow up questions to further investigate the factors that respondents consider at the time of purchasing a new motorbike (Figure 7.11). Safety is the overall most important factor, followed by the fuel consumption and the initial cost. However, comfort is the most commonly cited factor when respondents are questioned only for the three most important factors (Figure 7.12). Ease of operation is also highlighted as one of the three commonly mentioned important decision criteria. In contrast, availability of replacement parts and free parking are two of the least important factors (Figure 7.13). Style and brand reputation are two of the most divisive elements, these are very relevant for many, but also some of the least important for other respondents. Environmental performance is also in a similar situation, in which it highlights both in the list of three most and the three least considered factors. However, there is consensus amongst respondents on a negative perception of air quality and traffic congestion (Figure 7.14).

Figure 7.11: Factors to Consider When Purchasing a New Motorbike



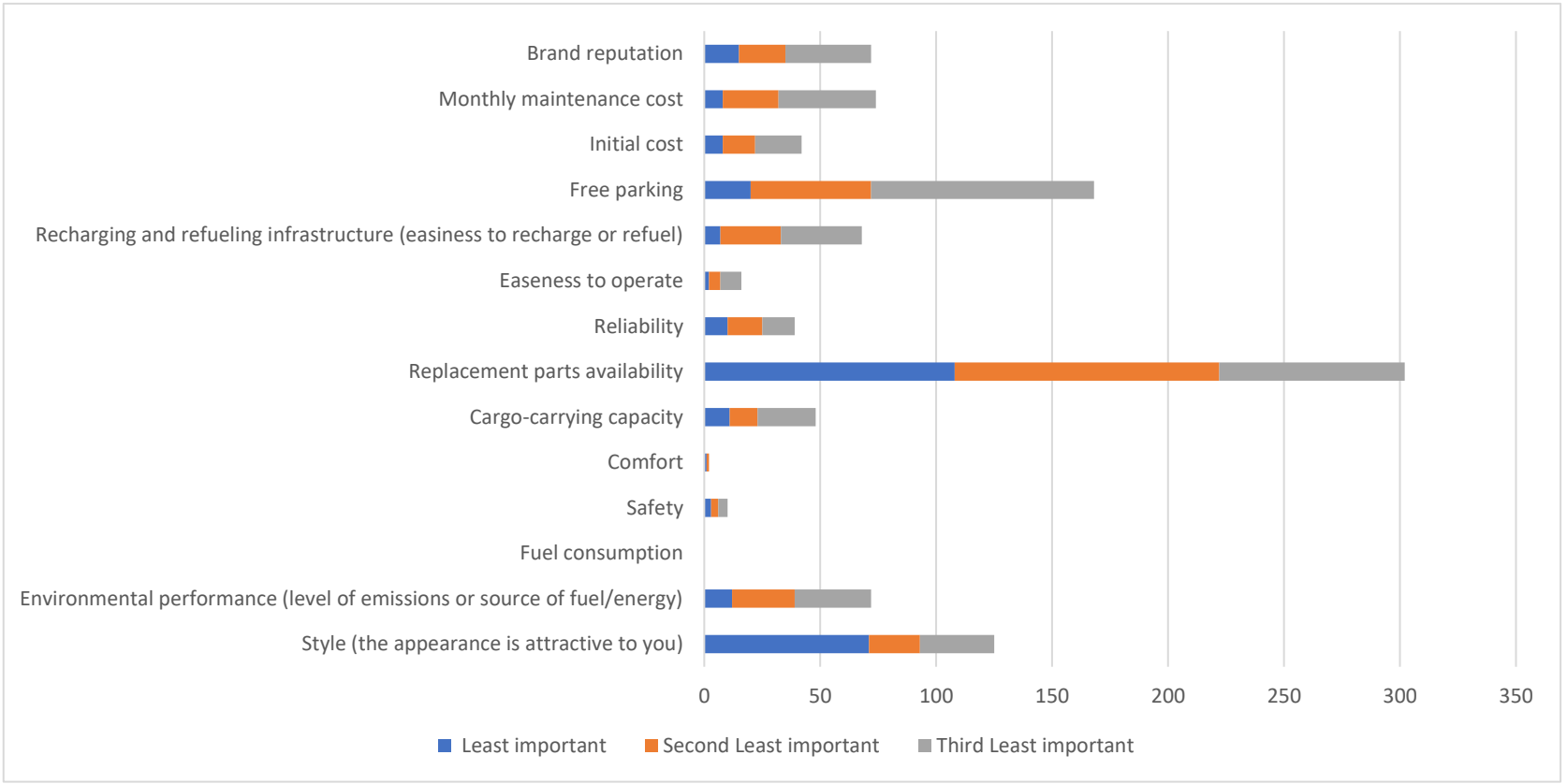
Source: Authors' calculation.

Figure 7.12: Three Most Important Factors to Consider when Purchasing a New Motorbike



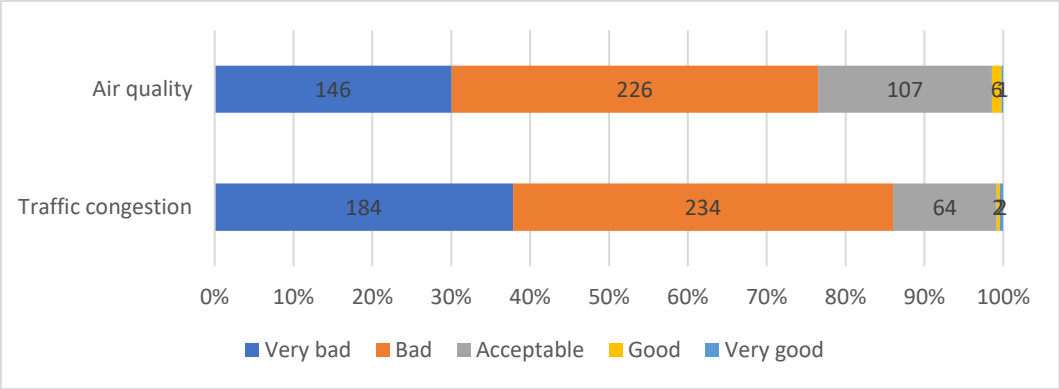
Source: Authors' calculation.

Figure 0.1: Three Least Important Factors to Consider when Purchasing a New Motorbike



Source: Authors' calculation.

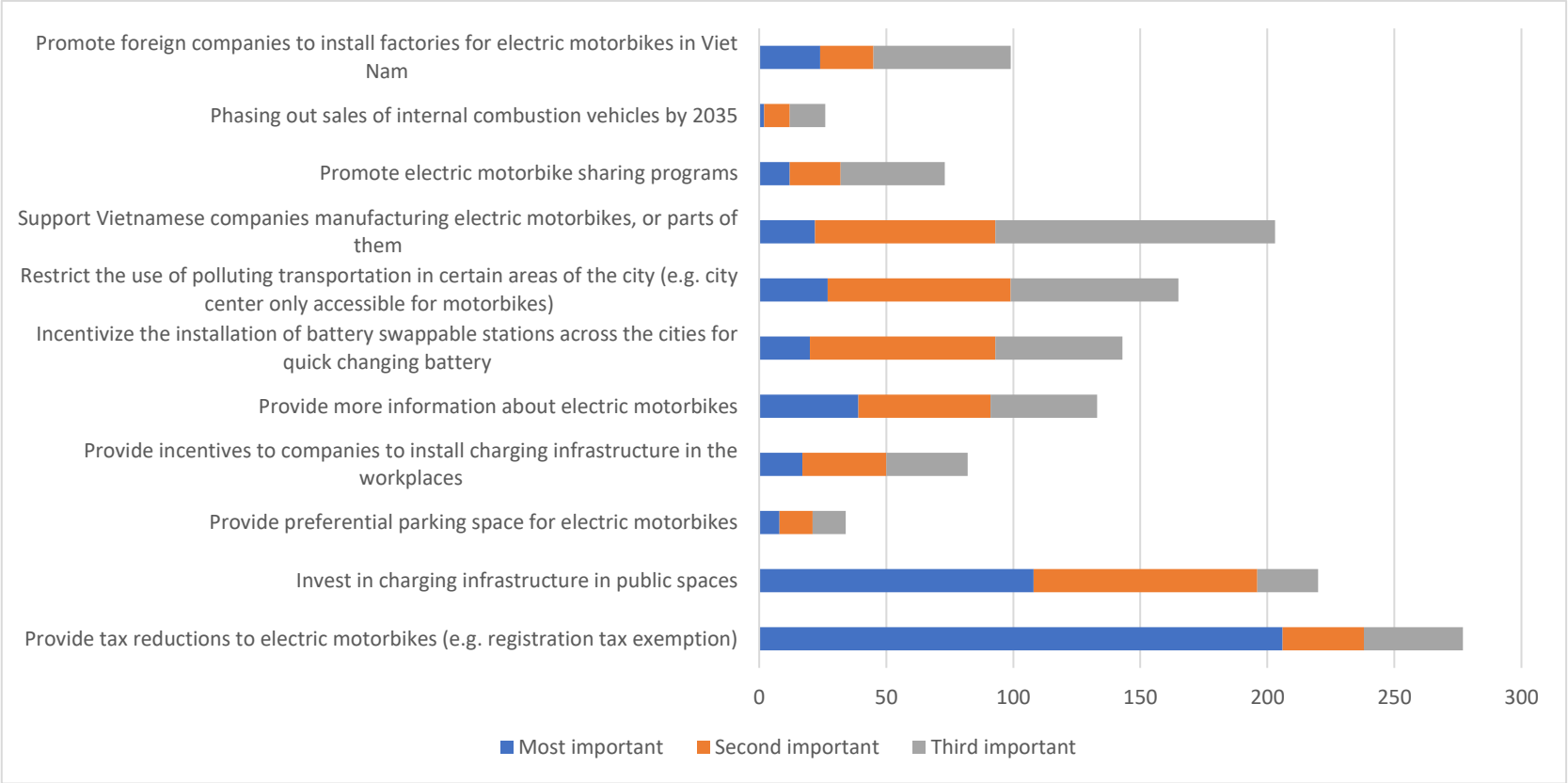
Figure 0.2: Respondents' Perception of the Air Quality and Traffic Congestion



Source: Authors' calculation.

For the promotion of the use of electric motorbikes, respondents favoured policy measures such as tax reductions and investments in charging infrastructure in public spaces (Figure 7.15). The support to Vietnamese companies to involve in the manufacturing of motorbikes was also a commonly expressed action that the government could take, notably more than the support for installation of manufacturing centres from foreign companies. Other restrictive measures such as phasing out the sale of internal combustion engine motorbikes or the creation of preferential areas parking space for electric motorbikes were the least preferred. Nevertheless, a great number of respondents expressed their support for the restriction of access to the city centres to the most polluting transportation modes. Other measures to support the installation of charging points and stations for swapping batteries are broadly supported, as well as increasing the diffusion of information about electric motorbikes.

Figure 7.15: Top Three Actions the Government Could Take to Promote Electric Motorbikes



Source: Authors' calculation.

3.5. Conclusion

A sustainable transportation model in Viet Nam must consider the decarbonisation of the current mobility patterns compatible with the needs of residents. Currently, motorbikes are the preferred transportation mode for any purpose. The COVID-19 pandemic has exacerbated this pattern. The number of motorbikes is already at unsustainable levels leading to high congestion and air and noise pollution. As residents increase their available income, drivers may shift from motorbikes to private cars, which would worsen the conditions. In contrast, a replacement of the gasoline motorbikes by electric would help to reduce the negative environmental impacts with an acceptable solution. To understand the attributes that could trigger or hinder this shift, this chapter presents the results of a survey and choice experiment in Viet Nam.

Most of the respondents to the survey use their motorbikes for their trips. This result is probably biased due to the mobility restrictions imposed due to COVID-19. However, it shows the importance that motorbikes play in the country. Most of them are gasoline motorbikes from large manufacturers, particularly Honda and Yamaha. Respondents also had very little experience with riding electric motorbikes, with most of them not having any experience at all. Nevertheless, respondents showed good knowledge of the characteristics of electric motorbikes and the available models in the market.

All the attributes considered are significant except for charging time, which may indicate that batteries for electric motorbikes are not a major barrier, such as for electric cars. This can be due also to the ease of charging, the lower range of usual trips, and the possibility of contracting battery-swapping services. The estimation of the WTP for each of the attributes is USD25.5 for improving 1 km/h in top speed, USD27.3 to improve range in 10 km, USD25.5 to reduce 4.4 cents/km in fuel cost, and USD7.5 to reduce 4.4 cents/month in maintenance cost. The country of origin is also significant and shows a lower preference for motorbikes manufactured in China. This may be due to bad experiences with early models. However, since China is the largest market for electric motorbikes, these companies might be able to bring models that fit the needs and expectations of consumers. Also, brands from Viet Nam are regarded similarly to those from Japan (the main country of origin of available gasoline motorbikes) and Europe (which are regarded as high cost and performance).

The survey also allowed the respondents to express their preferences amongst a set of policy incentives. Amongst those, tax reductions and investments in charging infrastructure in public spaces were the most preferred. Indeed, the provision of incentives for the installation of charging points and stations for swappable batteries are

in general supported by the respondents. In contrast, other measures more restrictive with gasoline motorbikes, such as banning their sale or restricting parking spaces are least preferred. However, there seems to be an understanding that certain restrictions would be required, and, for example, limiting the access to the city centre to the most polluting vehicles is broadly supported.

To sum up, there seems to be an interest in electric motorbikes despite not being widely available yet. Respondents have a good knowledge and a positive attitude towards them. As companies, national and foreign, are bringing to the market new models with a wider range of prices and characteristics, local and national governments have the opportunity to put in place policies to support a gradual replacement of polluting motorbikes for other more environmentally friendly. Nevertheless, this should not minimise the importance and need of improvements in other alternatives, such as public transportation. Widespread adoption of electric motorbikes would help to significantly reduce the air and noise pollution impacts from the traffic congestion, but this would continue with the transit travel time and total travel cost. For example, a study around the delayed metro line project Ho Chi Minh City, (Nguyen et al., 2019) found that a resident switching from a motorbike would obtain a monetary welfare increase of VND56,000.