BPLN0039_SJQR9

by Ian Tze-Rong Teo

Submission date: 26-Aug-2022 10:15PM (UTC+0100)
Submission ID: 185274969
File name: BPLN0039_SJQR9_3828312_319479540.pdf (2.94M)
Word count: 20615
Character count: 118662

LONDON'S GLOBAL UNIVERSITY

UCL

University College London

Faculty of the Built Environment

The Bartlett School of Planning

A sustainable rEVolution? Examining the political framing of Battery Electric Vehicles (BEVs) and how BEVs affect Generation Y's attitudes towards transport in Singapore

Candidate Number: SJQR9

Date: 5 September 2022

	Word count
Main body of dissertation	10,951 words
Appendices	1,076 words

Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of ***MSc Transport and City Planning*** at University College London:

I declare that this dissertation is entirely my own work and that ideas, data, and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

1. Abstract

Battery electric vehicles (BEVs) have been heralded by some as key to reducing carbon emissions from the transport sector. Yet, there has been little critical research into their sustainability from a transport planning perspective. This study critically analyses the sustainability of BEVs in Singapore by examining the changing political framing of BEVs and how BEVs affect attitudes towards transport among Generation Y.

The government's pragmatic ideology led to BEVs being initially framed as an 'unnecessary' and expensive risk without clear national benefits. The subsequent policy reversal to embrace BEVs was due to falling costs, image issues, and a green growth opportunity. Encouraging BEV adoption was arguably never *just* about responding to the climate emergency.

Among Generation Y, car ownership was associated with strong symbolic motivations. BEVs will likely strengthen them given BEVs are seen to signal progressiveness, innovativeness and prestige. Consequently, the promotion of BEVs involves a fine balancing act to avoid accentuating the car's symbolism. BEVs were seen to connote eco-friendliness, but many doubted environmental reasons were a significant motivator driving BEV adoption. BEVs were found to strongly symbolise that one is in the privileged 5% of people staying in single-unit landed properties, where accessibility of charging points is not an issue. This is a concerning inequity that needs to be addressed given the government's target to cease the registration of new ICE vehicles by 2040.

Table of Contents

List of Figures & Tables

2. Introduction

There is a pressing need for transformative change towards a more environmentally sustainable transport sector. 16% of global CO_2 emissions come from road transport and transport is the most rapidly growing emissions sector (Hickman *et al*., 2017; IPCC, 2021). The Intergovernmental Panel on Climate Change has declared that electric vehicles (EVs) charged using low carbon sources represent the biggest potential to mitigate emissions from land transport (IPCC, 2022). Many countries and cities in the Global North are forging ahead with this mitigation pathway with incentives, subsidies, and infrastructure targeted at EVs. Most ambitiously, 14 countries have stated targets when registrations of internal combustion engine (ICE) cars will be disallowed (Wappelhorst, 2021).

However, many experts assert that EVs are no silver bullet because they reinforce the "system of automobility" (Urry, 2016) that plagues many cities, perpetuating many of the same problems as ICE cars such as traffic fatalities, congestion, and car-dominated built environment (Henderson, 2020; Kester *et al*., 2020; Schwanen, 2021a). Consequently, Moriarty (2022) cautions that fervently promoting EVs risks distracting society from more environmentally sustainable pathways such as active mobility, public transport (PT), and car-free developments.

2.1 Motivations for the study

In assessing the sustainability of EVs, it is also pertinent that, in line with the three-pillar approach of sustainable development, 'sustainability' is not just about the environment, but encompasses social and economic pillars too (Bina, 2013). For mobility transitions, this entails ensuring that they do not perpetuate transport disadvantage in a relative or absolute sense (Delbosc and Currie, 2011).

There is widespread recognition that the car serves much more than as a mode of transport but also, as a symbolic marker (Steg, 2005). Such is the strength of symbolic aspects that they can hold more sway over car use than instrumental factors (ibid.). Given that studies find EVs confer new symbolic meanings such as environmental awareness, and innovation compared to their ICE-powered counterparts (Noppers *et al*., 2014), could this have unintended consequences for more sustainable modes like PT by drawing people away from them and into private EVs? Despite these concerns, there is a dearth of studies on the unintended consequences of EVs, attitudes towards them, and how more just transitions towards electric mobility can be achieved (Lis *et al*., 2018; Schwanen, 2021b).

More broadly, there is also a need for more theory-driven research into attitudes that drives travel satisfaction and mode choice (Beirão and Sarsfield Cabral, 2007). For example, testing theories of affective and symbolic drivers of car use (Gatersleben, 2007; Steg, 2005). As aptly put by Dyson & Sutherland (2021) "people are not cargo" (p.3). Transport systems need to be attractive, and this means going beyond a narrow focus on the utilitarian efficiency of positivist transport models (Mladenovic and Trifunovic, 2014) and instead, better account for behavioural elements and enhance the journey experience (Dyson and Sutherland, 2021).

Understanding them better enhances the effectiveness of and enables more targeted interventions towards sustainable travel.

3. Research Aims

This study adds to the nascent literature on these topics in the context of Singapore, a dense and compact city-state of 5.7 million in Southeast Asia. There is a pressing need for more research into EVs in Singapore. Following years of policy neglect toward EVs, Singapore is on the cusp of an EV revolution (Park, 2021). This study will first examine the Singapore government's changing position towards Battery Electric Vehicles (BEVs) and why it has until recently lagged the leading adopters of BEVs despite possessing the characteristics of high income and shorter travelling distances which facilitate BEV use (Shah, 2021). This will add to the understanding of geographical and temporal variations in policy approaches towards BEVs.

While other low-carbon forms of vehicles exist, this study looks at BEVs, defined as vehicles that do not have an internal combustion engine (ICE) and are recharged through a wired connection when parked (Mahmoudzadeh Andwari *et al*., 2017). This is because firstly, compared to hybrids, BEVs provide far greater reductions in emissions by doing away with an ICE. Secondly, their need for charging points (CPs) means substantial changes to transport infrastructure are required, creating many challenges. Thirdly, compared to other alternative fuels like natural gas and hydrogen, BEVs are the most common in Singapore and globally (Ghadikolaei *et al*., 2021; LTA, 2022a).

Subsequently, this study will look at attitudes towards various transport modes in Singapore; particularly, whether and how they could be affected by the increasing prevalence of BEVs, and the symbolism of BEVs. Singapore's unique characteristics arguably limit the applicability of studies conducted elsewhere. Firstly, cars are the most expensive in the world due to strict controls on ownership, increasing their symbolism (Barter, 2019; Julius Baer, 2022). Secondly, the sheer proportion (95%) of people staying in apartment-style multi-unit residential buildings (MURB) (fig.1) accentuates the challenge of CP provision (CNA, 2021; SingStat, 2021).

Fig.1: Typical apartment-style MURBs in Singapore (Housing Development Board public housing), and communal carparks (Jnzl's Photos, 2020; Ong, 2006; ProjectManhattan, 2014)

This study also answers calls for more research on EVs in non-European and non-American settings which presently comprise most of the literature on EVs (Wicki *et al*., 2022). Studies have found that perceptions of EVs are extremely context-dependent (Kumar and Alok, 2020; Wang *et al*., 2016; Wicki *et al*., 2022). Thus, generalising findings across could prove problematic (Kester *et al*., 2020). More broadly, there is a lack of studies looking at psychological factors behind transport use (for all modes) in Asia (Van et al.,2014). There is a pertinent need to fill this gap given the huge rise in car ownership in Asia (Hickman *et al*., 2017).

This study purposefully targets individuals who are non-car owners but possess demographic characteristics that make them more likely to purchase cars and BEVs in the medium term. Based on a review of the literature, this encompasses individuals who are younger, male, and have higher incomes and university education (Blackbox, 2021; Hackbarth and Madlener, 2013; Mukherjee and Ryan, 2020; Sang and Bekhet, 2015). Age is an important discerning characteristic. Studies have found that 'Generation Y', defined as individuals between 20 to 30 years old are more open to adopting BEVs due to a greater tendency to be savvy toward

technology and possess pro-environmental attitudes (Naderi and van Steenburg, 2018; Singh *et al*., 2020; Vafaei-Zadeh *et al*., 2022). Concentrating on non-users of BEVs also better elicits inequalities and barriers to BEV adoption given that as an emerging technology, BEV usage is still exclusive (Tschiesner *et al*., 2020).

3.1 Research questions

The research questions (RQs) are as follows:

1. How has the Singapore government's position towards BEVs evolved?

Among the more highly educated Generation Y in Singapore:

2. What are attitudes towards private car usage and other means of travel?
3. What is the symbolism of BEVs?

4. Outline

The format of the paper is as follows. Section 5 is a literature review covering: (1) political framings of BEVs, (2) attitudes towards transport modes, and (3) symbolic attitudes towards BEVs. Section 6 provides an overview of the study area. Section 7 covers methodology. Section 8 presents the results. Section 9 discusses the findings, policy implications and limitations, followed by the conclusion.

5. Literature Review

5.1 Political framings of BEVs

Governments often have an important part to perform in the roll-out of revolutionary technologies, especially those that possess long-term social benefits (Brown, 2001). BEVs are one such example. Government intervention to spearhead the adoption of BEVs is widely regarded as necessary to lower purchase costs, roll out CPs, support BEV manufacturers, and deter the adoption of ICE vehicles (IEA, 2022; Sandalkhan *et al*., 2021). The approach taken by governments around the world and even between regions in the same country differs tremendously, evidenced by highly unequal rates of BEV adoption globally even between regions with similar socio-economic conditions (Foster *et al*., 2021).

Examining how the framing of BEVs has evolved is a useful way to document changing policy positions (Brown, 2001). Framing is defined as a means of "selecting, organizing, interpreting, and making sense of a complex reality to provide guideposts for knowing, analysing, persuading, and acting" (Rein & Schon, 1991 p.263). Only a handful of studies, none in Singapore, have attempted to analyse the political framings of BEVs. This is surprising given the sheer importance of governments in accelerating their adoption. One study was by Aubertin (2021) who scrutinises why regional approaches to plug-in electric vehicles (which include BEVs) differed across Canadian provinces. Aubertin finds that variations can be explained in terms of different framings: to spur Green Growth, to prop up the car industry, or to achieve economic independence. In another study looking at

California's changing position towards zero-emission vehicles in the late 1990s, Brown (2001) documents how it evolved from one focused on promoting the wider social environmental interest, to merely satisfying consumer demand for such vehicles.

Lastly, the political position toward BEVs can also serve much more than just to reduce ownership costs and barriers, but also act as a strong signal of their merits (or lack thereof), providing "symbolic certification" (Ingeborgrud and Ryghaug, 2019 p.507). A better understanding of political positions towards BEVs can thus offer crucial insights into its symbolism in society.

5.2 Attitudes towards transport modes: theory

Attitudes are defined as "the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question" (Ajzen, 1991 p.188). Many authors highlight that behavioural change is fundamental to fostering sustainable transport and relying on technology alone to achieve this is insufficient (Dyson and Sutherland, 2021; Kitamura *et al*., 1997; Schwanen *et al*., 2012). A better understanding of attitudes is necessary not only for more effective interventions, but also to ensure democratic accountability (Goodwin and Lyons, 2009).

Several models have been developed to better understand the relationship between attitudes and travel behaviour. Ajzen's (1991) theory of planned behaviour posits that behaviour is based on attitudes which remain stable over time, the subjective norm, and a perceived behavioural control (De Vos and Singleton, 2020). Another is the theory of cognitive dissonance which postulates that attitudes towards travel modes and/or mode choice tend to change to reduce dissonance when there is a mismatch between them (ibid.). Identifying and addressing mismatches can help encourage the use of active modes and PT. By making these modes more satisfying, attitudes towards them can be improved, stimulating their use (ibid.).

5.3 Attitudes towards private car usage

The high degree and quality of personal mobility afforded by cars, combined with their pervasiveness have shaped the very notion of what we come to expect of 'transport' (Sheller and Urry, 2000). The conveniences cars offer serve as a mental yardstick for people against which other modes such as PT struggle to match (Urry, 2016). So entrenched is the car in modern civilisation that Urry (2016) describes a "system of automobility" (p.25) where the material object that is the car is intertwined with cultural and symbolic notions. Attitudes are essentially co-constitutive.

As an emblem of materialism and often the most expensive personal purchase after the home, it seems fitting to apply Dittmar's (1992) typology of attitudes in the "Social Psychology of Material Possessions" to understand attitudes towards car use and ownership, as Steg (2005) did in her seminal work. This encompasses four categories constituting motivations: instrumental, symbolic, independence, and affective.

The instrumental aspect is defined as the "convenience or inconvenience" (ibid. p.149) of car use. Positive attributes include flexibility, speed, cost, seamlessness, loading capacity, and ability to serve as a comfortable private cocoon (Beirão & Sarsfield Cabral, 2007; Gardner & Abraham, 2007). That said, decisions over car use and ownership are however rarely based on instrumental factors alone but are shaped by symbolic and affective motives as well (Hickman *et al*., 2017). People choose to use cars not because "they *need* to do so, but also because they love driving" (Steg, 2003 p.34).

Symbolism refers to how individual beliefs, self-concept, and social position are portrayed in terms of ownership decisions and the type and brand of car (Hermans and Hermans-Jansen, 2001; Steg, 2005). Symbolism transpires through "denotations and connotations" (Ashmore et al., 2020 p.608). Denotations are more superficial and tend not to change between social groups (Chandler, 2007). For example, how BEVs symbolise eco-friendliness. Connotations, on the other hand, relate to what value individuals derive from denotations. For example, the desirability of being seen to be eco-friendly may vary between people due to education, social status, and desires to stand out from the crowd. Several studies have looked at the symbolism of cars and find that they tend to symbolise power, prestige, economic success, and masculinity which are constructed through advertising, popular culture and the arts (Flink, 1975; Graves-Brown, 1997; Marsh and Collett, 1987; Mokhtarian *et al*., 2010). Symbolism also varies geographically. Ashmore et al. (2020) find that the perceived need for a transport mode to symbolise social standing is much stronger in South Asia compared to Northern Europe, with coding densities for such traits being at least ten times higher in the former. The theory of social comparison underpins this which posits that individuals continuously seek to compare themselves against others to determine their self-worth (Festinger, 1954).

In Singapore, the symbolism of the car as a marker of social status is extremely strong, fuelled by their high price (Barter, 2019; Basu and Ferreira, 2020; Chng *et al*., 2019). Car ownership is seen as one of the defining symbols of economic success. This is encapsulated in the local term '5Cs', which represent five items one must obtain to realise the Singaporean dream: "Cash, Car, Credit card, Condominium and Country club membership" (Lai, 2021). Many households simply purchase cars when it becomes 'affordable' (Chng *et al*., 2019) and consequently, car ownership has a strong positive relationship with income (Basu and Ferreira, 2020). Concerning Generation Y, although some studies in the West find that younger people have a weaker disposition towards car ownership and use (Kuhnimhof *et al*., 2012), there is little sign of this in Singapore with Tan (2017) finding that two-thirds of under-35s still aspiring towards car ownership.

Car ownership and use are also motivated by affective factors which refer to feelings towards cars, and feelings conjured up by using and being in the presence of cars (Sheller, 2004). Many studies have examined negative feelings in the context of peak hour commutes and most commonly point to stress and aggression as emotional consequences of cars (Evans *et al*., 2016; Koslowsky and Krausz, 2016; Parkinson, 2001). There has been comparatively less research into positive aspects (Gatersleben, 2007). Sheller (2004) outlines a few such as the "thrill of driving", "joy of the road", and "passion of the collector" (ibid. p.224). So deep-

seated and pervasive are such emotive notions that McLuhan (2002) describes the car as akin to a “mechanical bride”.

Lastly, cars confer a feeling of autonomy. In an analysis of the literature, Gatersleben (2007) find that the strongest positive emotion was the feeling of control. That is, the independence, freedom and autonomy accorded by driving cars, something which cannot be replicated at the same scale as other transport modes (Jensen, 1999).

While it has been suggested that symbolic and affective factors are more powerful predictors of car use and ownership (Stokes and Hallett, 1992), few studies have assessed them quantitatively. The seminal work on this is undoubtedly by Steg (2005) who, using questionnaires and factor analysis confirm that the typology is easily distinguished and found that firstly, car use for commuting is greater among individuals who rate the symbolic and affective attributes of cars more positively. Secondly, commuter car use is not related to instrumental motives. And thirdly, being younger and male is associated with stronger affective and symbolic motives respectively.

5.4 Attitudes towards public transport

Compared to cars, symbolic and affective factors are generally much weaker for PT and overall, attitudes are less positive. In a study in Denmark, Jensen (1999) finds that the strong attraction and rating of car use are not shared with PT. Assessments do however differ between frequent and infrequent car users. In the Netherlands, Steg (2003) finds that the more frequently someone used a car, the more influential they would report the car to be towards their identity and the community compared to PT. Conversely, infrequent car users express a less negative attitude towards PT.

Looking at attitudes towards PT in Porto, Beirão and Sarsfield Cabral (2007) find that for buses, great importance is placed on journey time, comfort, reliability, and direct and frequent services. Light rail was preferred over buses not just because of their superiority in many of the former attributes, but also because of intangible factors like status and novelty.

Attitudes towards PT in Singapore can be gleaned from the national Public Transport Council’s customer satisfaction survey (PTC, 2022). Because most people attempt to maximise satisfaction, satisfaction can plausibly be used as an indicator of attitudes (De Vos et al., 2017). The 2021 survey found that satisfaction with PT was high with the top performing categories being safety/security and station/bus stop accessibility while waiting time had the biggest room for improvement (PTC, 2022). Satisfaction with the metro (MRT) was also higher compared to buses. Comparing attitudes towards cars versus PT for shopping trips in Singapore, Ibrahim (2005) finds that people had overall positive attitudes towards both modes. The car edged out PT, performing best in suitability, practicality, and comfort.

5.5 Attitudes towards cycling

Stark global variations in infrastructure provision, social norms, and geography make generalisations on attitudes toward cycling challenging with many conflicting findings

(Heinen *et al*., 2009). It is also uncertain if attitudes are a consequence of cycling or whether cycling decisions are the consequence of such attitudes (ibid.). That said, looking at satisfaction, studies tend to find that active modes such as cycling are associated with higher travel satisfaction than the car or PT (Mouratidis et al., 2019; De Vos et al., 2017; Ye and Titheridge, 2017).

In Singapore, cycling is considered more favourably as a leisure activity than as a mode of transport (Tee, 2021). Although its tropical climate does act as a deterrent by making cycling more uncomfortable, the top reason for not cycling is the lack of safe infrastructure (Kupferschmid *et al*., n.d.; Lee and Pojani, 2019; Rojas López and Wong, 2017). This is unsurprising given that cycling infrastructure is oriented towards leisure cycling (Barter, 2019). The cycling network aptly named the 'Park Connector' focuses on linking green spaces rather than serving commuter routes.

5.6 Symbolism of BEVs

Many studies have examined the drivers of BEV adoption. In a meta-analysis, Wicki et al. (2022) find that key factors include the presence of CPs, higher incomes and education, being male and younger, neighbourhood effects, and social interactions. Besides these more tangible reasons, however, Noppers et al. (2014) stress the importance of symbolic motives, an area which is often underemphasised and unresearched (Schuitema *et al*., 2013); surprising given Steg's (2005) finding of the strong relationship between symbolism and car use. In the context of BEVs, symbolism is "the (positive or negative) outcomes of the ownership and use of the sustainable innovation for one's (self-)identity and social status" (ibid. p.14). The two most common symbolic associations of BEVs are their environmental friendliness and innovativeness (Moons and de Pelsmacker, 2015; Schuitema *et al*., 2013). Symbolism affects purchase intentions because people who regard an item's image to be in line with their self-beliefs tend to hold more favourable attitudes towards it, and consequently, are more likely to adopt it (Sirgy and Danes, 1982).

Noppers et al. (2014) make an important distinction between the role of BEVs as a mere signal of pro-environmental virtues versus representing actual intentions. Purchasing an BEV might be motivated more by a superficial desire to advertise oneself as eco-friendly rather than the actual intention to help the environment. One reason could be the association of the higher cost of a more environmentally friendly product with social status since it signals that one can make a financial sacrifice for the social 'good' (Griskevicius *et al*., 2010). Strong government incentives and policies toward BEVs can also influence their symbolism, acting as a highly visible political endorsement, and positively influencing people's attitudes towards them (Ingeborgrud and Ryghaug, 2019).

As a novel technology, BEVs also symbolise innovativeness (Vandecasteele and Geuens, 2010). For example, concerning one of the most recognisable BEV brands, Tesla, Ingeborgrud & Ryghaug (2017) find that owners were mainly attracted by it being a "computer on wheels" (p.898) while Warren (2017) describes it as "the ultimate statement car of the moment", symbolising that "I am forward thinking… get outta my way".

BEVs could also precipitate transport injustice because of their high cost and/or uneven access to CPs. In Norway, which has the world's highest BEV adoption rate, Tvinnereim & Ferguson-Cradler (2020) find considerable animosity towards BEV users, with many non-owners seeing BEV users as "free-loaders" and symbolising "a transition for the rich" (p.3). Such injustices are rendered more visible by concessions like easier parking, subsidies, waivers from road pricing and the use of bus lanes (Tvinnereim and Ferguson-Cradler, 2020). Similarly, Li et al. (2020) find that subsidies for BEVs in China are very contentious as they overwhelmingly benefit the rich.

6. Research Setting

> *"(Singapore is) as far away from automobile dependence as one can get among wealthier cities"* (Newman & Kenworthy, 2015 p.74)
>
> *"Singapore has essentially become a city for cars rather than people"* (Wildermuth, 2016 p.105)

The city-state of Singapore which is on the cusp of an BEV revolution represents an interesting case study. As the preceding two quotes allude to, sustainable transport in Singapore represents a tale of two halves. On one hand, it has been praised for its integrated land use and transport planning (Lew and Choi, 2016), high density and compact size (5.7 million people living in an area half the size of Greater London), and world-leading PT network (McKinsey & Company, 2021). A dense network of metro lines known as Mass Rapid Transit (MRT) serves the city (fig.2) and fares are relatively affordable.

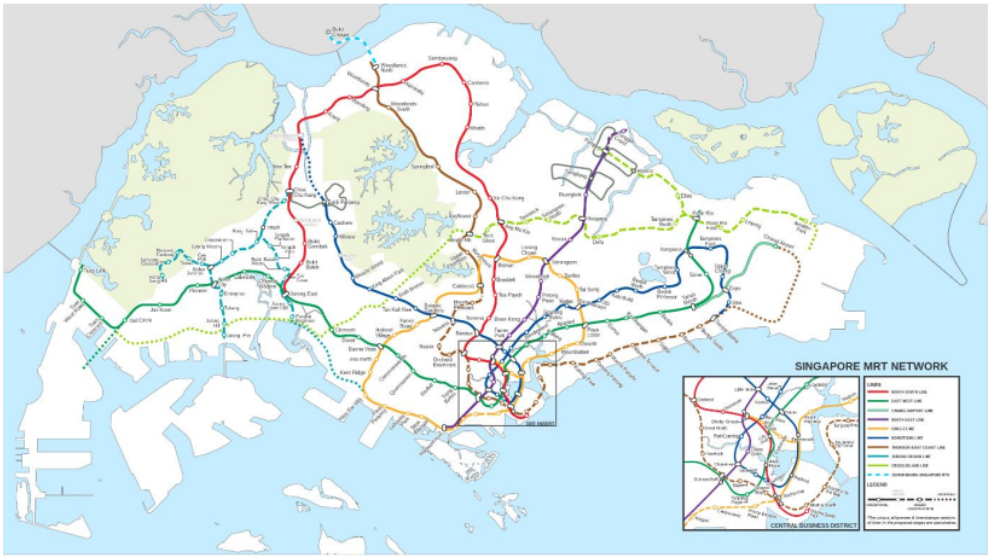


Fig.2: Singapore's Mass Rapid Transit (MRT) network. Dashed lines denote lines under construction or planned for. (Wikimedia Commons, 2021)

On the other hand, the "system of automobility" (Urry, 2016 p.25) is deeply ingrained in Singapore society evidenced by firstly, car ownership being regarded as a defining symbol of hard work and success (Yao, 1996). And secondly, a road planning philosophy that has more in common with car-dependent US cities than more progressive European ones due to its focus on maximising vehicle speeds resulting in an extensive network of wide roads even in downtown areas (Barter, 2019).

This dualism is reflected in Singapore's transport mode share for commutes. Although the mode share by PT is relatively high by global standards at 53% and is low for cars at 33%, car use is still considerably higher in Singapore compared to the similarly dense and developed Hong Kong and Tokyo (fig.3).

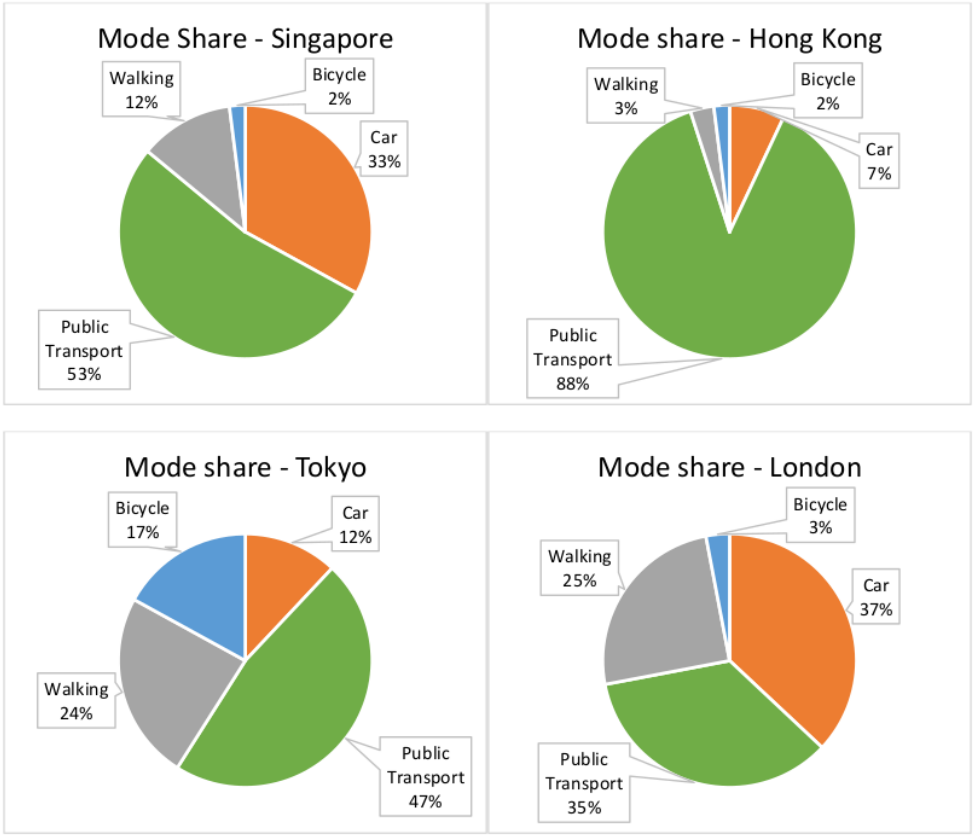


Fig.3:Mode share for commutes (Deloitte, 2020)

The strong symbolism of cars in Singapore is an unintended consequence of a cornerstone of Singapore's heavy-handed approach to controlling its vehicle population, its one-of-a-kind Vehicle Quota System (VQS) (Barter, 2013). The VQS restricts the number of vehicles on the roads by requiring prospective owners to bid for a Certificate of Entitlement (COE) which allows a vehicle to be registered for 10 years (Poon, 2016). The supply of COEs is fixed and is determined by the number of vehicles deregistered in a preceding period plus a growth

factor which is currently zero for private cars (LTA, 2020). The VQS however shares many of the same unintended consequences of trying to ration fine art through auctions. Chiefly, that high prices (the cost of car ownership in Singapore is the highest in the world (Julius Baer, 2022)) cement the car's role as a marker of social status thereby inducing demand (Barter, 2019). How might the arrival of BEVs change this relationship?

6.1 BEVs in Singapore

At first glance, Singapore appears ideal for BEVs given its small size and short trip distances reduce range anxiety, a key stumbling block for BEV adoption (Shah, 2021). Although 95% of Singapore's electricity is produced using natural gas (EMA, 2021), electrification of the light vehicle fleet would still deliver a 4% reduction in national carbon emissions (LTA, 2022b). This stands to be even greater under plans to import 30% of its electricity needs from low-carbon sources by 2035 (Tan, 2021).

Yet, despite being frequently touted as one of the world's greenest cities (Igini, 2021), BEV adoption has until last year, paled in comparison to the global average (fig.4). In 2020, BEVs only accounted for 0.8% of new car registrations compared to 2.9% globally and 5.4% in the EU.

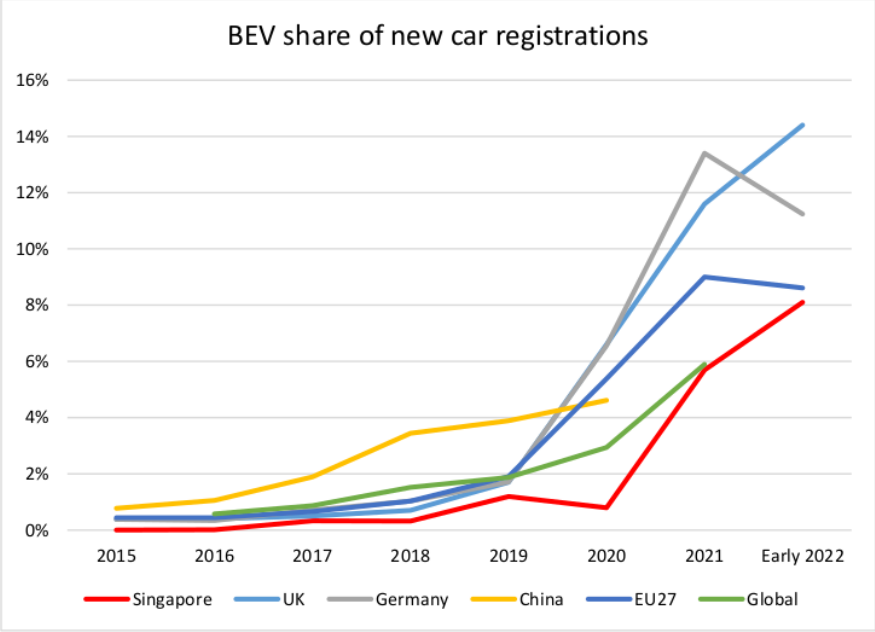


Fig.4: BEV share of new car registrations (EAFO, 2022a, 2022b, 2022c; EV Volumes, 2022; LTA, 2022a, 2022c; MOT, 2022; Statista, 2020, 2021a; Zap Map, 2022)

Two leading reasons behind the slow rate of BEV adoption in Singapore are the lack of CPs and cost (EVAS, 2022).

Singapore may have a relatively low BEV to public CP ratio at 4 BEVs per charger (LTA, 2021a, 2022d) compared to other cities with much higher rates of BEV adoption such as London which has 6 BEVs per CP (London Assembly, 2022). However, statistics mask firstly, the small number of public CPs in Singapore, 796 compared to around 5,000 in London (London Assembly, 2022; LTA, 2021a). Secondly, the much greater reliance on public CPs compared to private CPs in Singapore because 95% live in MURBs (of which 82% is public housing), where installing private CPs is not possible (Singstat, 2021a). And thirdly, the uneven distribution of CPs.

Figs.5-8 show all publicly accessible BEV CPs in Singapore and illustrates their uneven distribution[1]. Boundaries correspond to local planning areas. From fig.5, a disproportionate number of CPs are located close to the downtown core, far from most public housing which is on the periphery. There are also some planning areas, particularly in the north and northwest with >30,000 households in public housing, but with only a handful of CPs. The dearth of CPs in peripheral locations is further confirmed by fig.6 which shows that much of the periphery contains less than 6 CPs per 10,000 households in public housing. Having CPs close to home is critical as studies in other countries show that 80-90% of people charge their BEVs at home (Tzventarny, 2014).

Uneven distribution of CPs occurs in other countries such as the UK where richer areas contain more CPs (Ofgem, 2018). This is unsurprising given that early BEV adopters tend to have higher incomes (Henderson, 2020). However, looking at the relationship between socioeconomic advantage[2] and CPs in Singapore (fig.8) presents a mixed picture. Although the least advantaged areas contain very few public CPs, the most advantaged areas contain few points too. The latter is attributable to the fact that the most advantaged areas contain the greatest proportion of people living in landed properties[3], where they rely on privately installed CPs.

[1] Data on CPs obtained from LTA (2022d) (correct as of Jul 2022); on mode share and population from Singstat (2021b)

[2] As data on mean income by planning area was not publicly available, the socioeconomic advantage index from Earnest et al. (2015) is used instead.

[3] Landed properties refer to private single unit dwellings like terraced houses and bungalows.

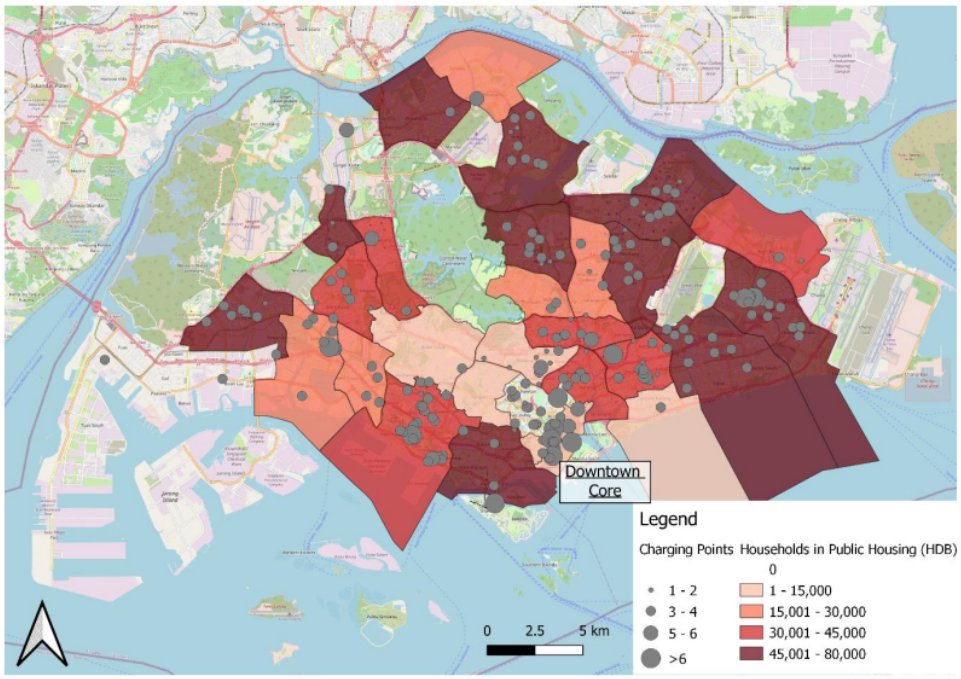


Fig.5: Households in public housing (HDB) & BEV CPs.

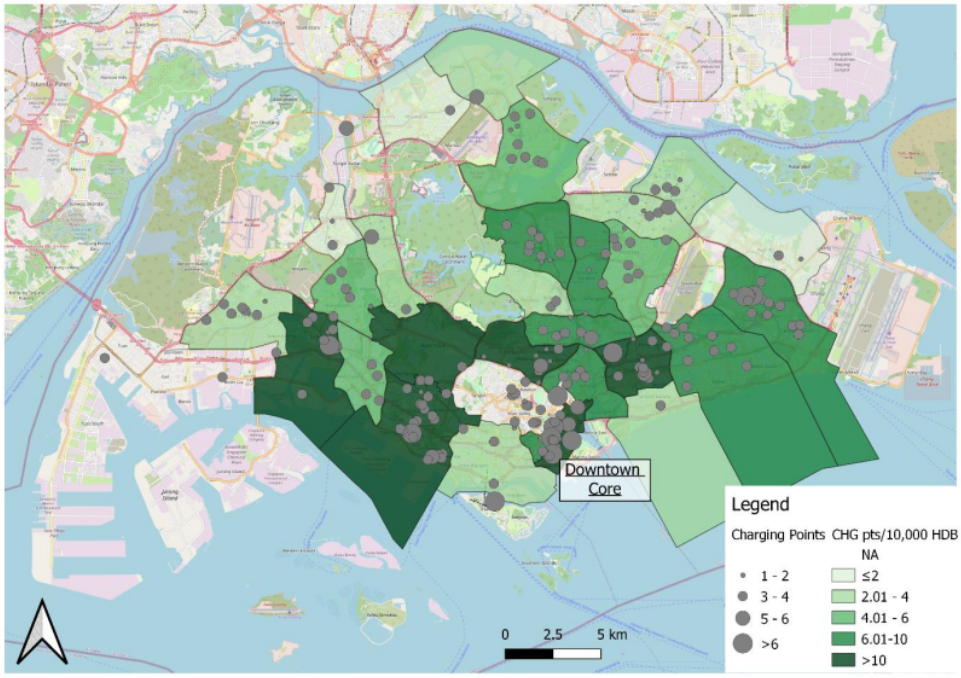


Fig.6: BEV CPs per 10,000 households in public housing (HDB)

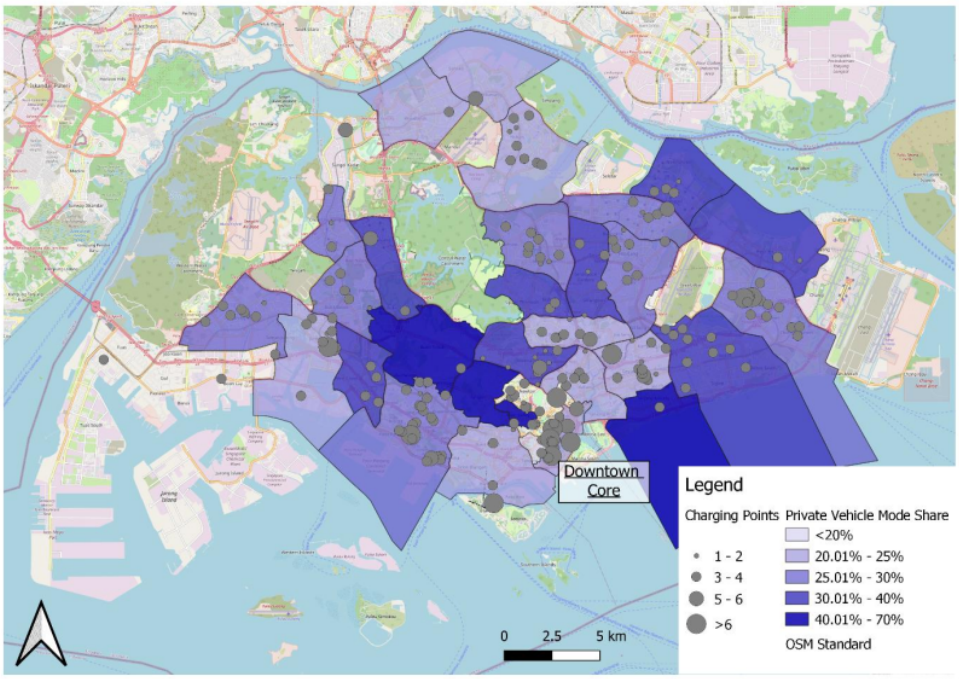


Fig.7: Private vehicle mode share for commuting (by place of residence) & BEV CPs

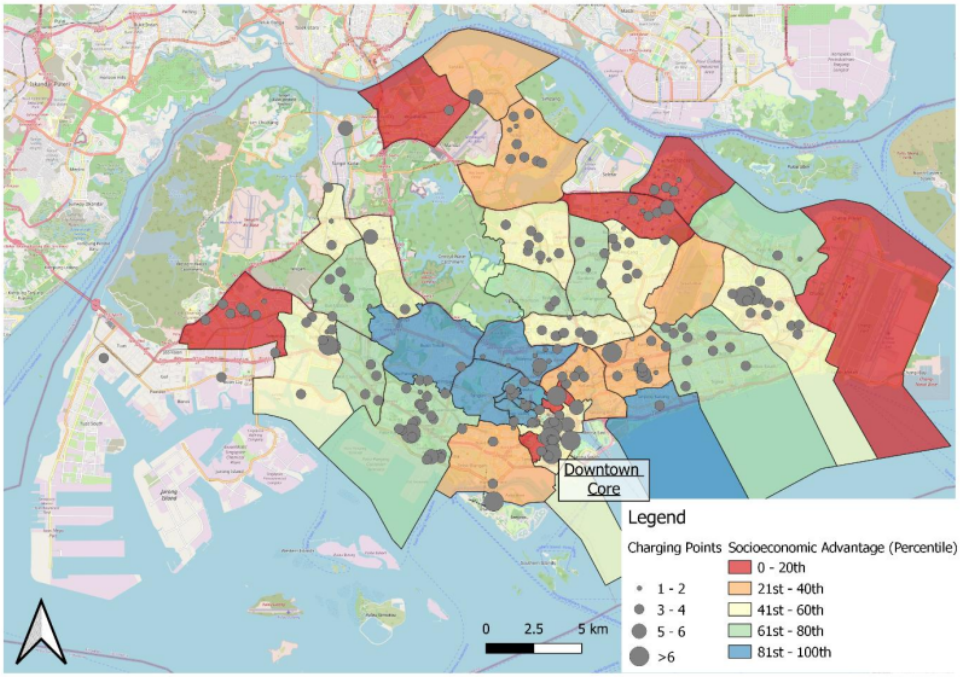


Fig.8: Socioeconomic advantage (100^{th}=most advantaged) & BEV CPs

The main reason behind the lack of public CPs is arguably the chicken-and-egg issue of there being insufficient demand due to the low BEV adoption rate, whilst the dearth of CPs dissuades their take up (Ha, 2020). Fortunately, the government has recently stepped in, announcing in 2021 that it aims to increase Singapore's public CPs 50-fold, and install 40,000 public CPs by 2030 (LTA, 2021b). That said, given that many of these CPs will only offer slow overnight charging (ibid.) and a rationing framework has yet to be established, questions remain over how many CPs will be sufficient (CNA, 2022). The only other cities with strong BEV adoption and similarly high densities to Singapore are in China, where access to CPs is a significant challenge, even with the world's largest BEV charging network (Hyperdrive, 2021).

Concerning cost, until recently, BEVs were 50% more expensive to purchase compared to an equivalent ICE car (Yuen, 2018). Running costs were also comparable to ICE cars due to the necessity of relying on more expensive public charging and higher road taxes for BEVs (CarBuyer Singapore, 2021; Yuen, 2018). New measures introduced in 2021 and 2022 lessened the high premiums commanded by BEVs, though they have yet to reach parity with ICE cars (LTA, 2021c).

7. Methodology

7.1 Procedure

To answer RQ1, content analysis was undertaken. Content analysis involves "examining the content or information and symbols contained in written documents or other communication media" (Neuman, 2013 p.49). Content analysed for this research covered mainstream media articles, government publications, and Hansard transcripts of parliament based on the keywords 'electric cars' and 'electric vehicles'. Particular attention was paid to how BEVs were framed by the government over time. Due to limited government sources on BEVs, a semi-structured interview (Appendix 1) was conducted online with a transport consultant in Singapore who works closely with the government on BEV issues, to support the content analysis.

To address the remaining RQs, semi-structured interviews (Appendix 2) were performed. The interviews covered three sections: (1) attitudes towards various transport modes (private cars, private-hire vehicles, taxis, PT and cycling), (2) attitudes towards BEVs, and (3) suggestions on how Singapore's transport system can be improved. Questions for the first section were drawn from a qualitative study by Chng et al. (2019) comparing transport experiences between Singapore and London. BEVs were not explicitly mentioned until the second section, so attitudes towards car use elicited in the first pertained to car ownership and use in general. At the start of the second section, respondents were asked about their familiarity with BEVs, including whether they had read about them and seen BEVs on the road.

A qualitative method was selected as it is better suited for more novel areas of inquiry and to elicit 'why?' responses, which is a central part of this study (Clifton and Handy, 2001;

Jensen, 1999). Interviews also facilitate the tailoring of successive questions based on preceding answers and provide room for clarification and discussion of responses (Clifton and Handy, 2001).

The interviews took place online via MS Teams and were followed by a short questionnaire to obtain sociodemographic information. A pilot interview was conducted to refine the survey questions before the main set of interviews. Interviews were recorded with the interviewees' consent and transcribed. Subsequently, coding was conducted using the Nvivo software.

Coding is the process of picking out statements which represent thematic concepts (Gibbs, 2007). For RQ2, for attitudes towards cars, a deductive approach was taken whereby themes were coded based on existing theories and research (Azungah, 2018). Steg's (2005) typology of instrumental, symbolic, independence and affective motivations was used. Attitudes towards other modes were coded along positive and negative themes. For RQ3, an inductive approach was taken instead whereby frequent themes were identified directly from the data. This was selected as BEVs represent a more exploratory area of research.

7.2 Participants

The interviews for RQ2&3 involved 14 young adults who reside in Singapore. Interviews were conducted until data saturation, whereby no new significant new issues were raised, was attained. Snowball sampling was employed, and each interview lasted between 15 and 35 minutes. Sampling was purposive, focusing on individuals who are non-car owners but possess demographic characteristics that make them more likely to purchase BEVs in the medium term. Participants' demographic characteristics are given in table 1.

Participant ID	Age	Gender	Education	Work status	Cars in household	Possessing a driver's license?	Main mode used for commuting to work/school	Property type
M01	26	M	Masters	Studying full-time	0	Yes	PT	High-rise public housing
F02	24	F	Masters	Studying full-time	1	Yes	PT	Landed
M03	25	M	Bachelors	Studying full-time	1	No	PT	High-rise private housing
F04	23	F	Bachelors	Working full-time	0	No	PT	High-rise public housing
M05	26	M	Bachelors	Working full-time	3	Yes	Bicycle	High-rise private housing
M06	25	M	Masters	Studying full-time	2	Yes	PT	Landed
M07	25	M	Bachelors	Working full-time	1	Yes	PT	Landed
F08	23	F	Bachelors	Working full-time	1	No	PT	High-rise public housing
M09	26	M	Bachelors	Working full-time	1	Yes	PT	High-rise private housing
M10	26	M	Masters	Working full-time	1	Yes	PT	High-rise private housing
M11	25	M	Bachelors	Working full-time	4	Yes	Ride-hailing	Landed
M12	28	M	Bachelors	Working full-time	1	Yes	PT	High-rise private housing
M13	25	M	Bachelors	Working full-time	1	Yes	PT	High-rise public housing
M14	29	M	Diploma	Working full-time	0	No	PT	High-rise public housing

Table 1: Demographics of participants

7.3 Ethical considerations

The research was of low ethical risk to participants. Participants were reminded that interviews were voluntary, and an information sheet (Appendix 3) was presented to them beforehand. As the interviews were conducted over a video call, acknowledgement was sought verbally. All electronic data was stored securely on a password-protected device. Participants were also informed that their names would be anonymised.

8. Results

8.1 RQ1: How has the Singapore government's position towards BEVs evolved?

The Singapore government's position towards BEVs can be split into two time periods: before 2020, when intervention was minimal, and from 2020 when this was reversed with a slew of new subsidies targeted at BEVs and the announcement of plans to increase public CPs 50-fold (Doshi and Zahur, 2020). The next section elaborates on each period, offers explanations for the initial reluctance to commit to BEVs, and suggests reasons which sparked the policy reversal in 2020.

8.1.1 2013-2019: Wait-and-see

Fig.9 illustrates how concerns over BEVs have evolved by analysing the number of times they were mentioned in parliament, categorised into key themes. Looking at pre-2020, calls to lower ownership and running costs were the predominant concerns in earlier years. This was later overtaken by demands for more public CPs, which were raised seven times in 2019. This coincides with a marked increase in the BEV population, although BEV's share of new car registrations in 2019 was still minuscule, at 1.19%. Setting a deadline to ban the registration of ICE cars was also suggested once in 2018, and again in 2019.

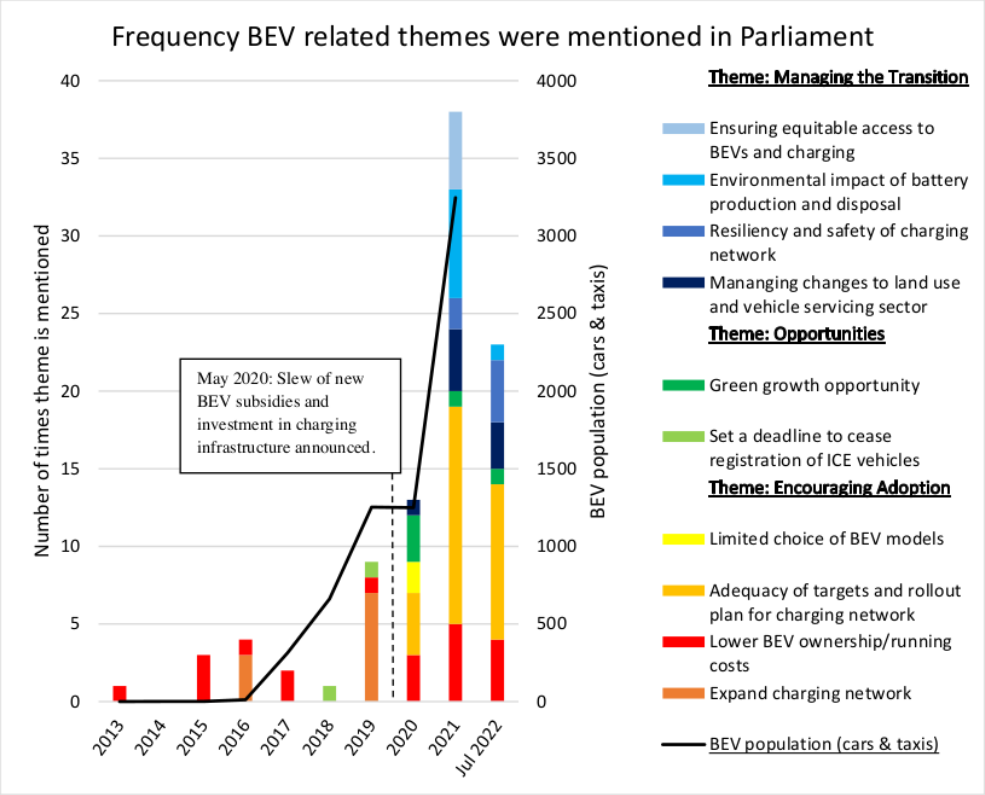


Fig.9: Frequency of BEV-related themes mentioned in parliament

Early concerns over the uncompetitive costs of BEVs are unsurprising given that a government trial involving a five-vehicle testbed between 2009-2013 concluded that they did not make financial sense even when accounting for external benefits to well-being and the environment (LTA, 2014). A later study by Yuen (2018) in Singapore calculated that the social cost of carbon (SCC) would have to be as much as S$9,700 (£6,000)[4] per/tonne for BEVs to trump ICE cars based on social cost-benefit analysis.

[4] While a definitive SCC does not exist, Wang et al. (2019) provides an estimate of £94 based on a meta-analysis of studies

Consequently, unlike in many European countries, BEVs were not promoted in Singapore through generous tax breaks or subsidising charging infrastructure. The government did not want to 'pick' technological winners, especially when they were not cost competitive from a societal standpoint. Environment Minister Masagos Zulkifli summed up Sinagpore's ambivalent stance towards BEVs in the following statement, made when eschewing calls for more pro-BEV policies:

> *"Singapore's vehicular emission policies are* ***technology-neutral****, and we seek to ensure that our air quality targets can be met in* ***cost-effective*** *ways"* (Singapore Parl Written Answers, 2018)

Technological neutrality was also reflected by the common defence that the government was already promoting 'cleaner' or 'low-carbon' vehicles. These vague terms were used to refer to all manner of 'cleaner' technologies, from hybrids, to even Euro VI diesel vehicles.

Singapore's lacklustre approach to BEVs even caught the attention of Tesla founder Elon Musk who stated in 2019, in response to a question over why Tesla was absent from the Singapore market[5], that the government had been "*unwelcome*" (Musk, 2019). In response, Minister Zulkifli retorted that:

> *"What Elon Musk wants to produce is a lifestyle…* ***We are not interested in a lifestyle****. We are interested in* ***proper solutions that will address climate problems****."* (Murtaugh et al. 2019)

Two 'proper' solutions were alluded to by Minister Zulkifli: PT and hydrogen cars. While relying on PT is all well, it does not address emissions from the sizable vehicle fleet that will inevitably remain. Concerning hydrogen, the joke that it is always 10 years away holds very true given that Singapore's roads have still never seen a hydrogen car.

On CPs, fear of locking in the wrong infrastructure was cited by Deputy Prime Minister Heng Swee Keat as a reason for the initial wait-and-see approach to BEVs:

> *"The nature of adoption (of new technologies) is that if you start to do it in a big way, and something else turns out to be a lot better, then you have a lot of* ***stranded costs****, so I think this (wait-and-see approach) was a* ***rational way*** *for us to proceed."* (Bloomberg, 2021)

On the contrary, a World Bank analysis of EV adoption concluded that subsidies for CPs were the most cost-effective policy and "if you build it, they will come" (Foster *et al*., 2021). Indeed, the surge in mention of the theme of CPs in parliamentary debates in 2019 (fig.9) suggests cost was a key obstacle.

The government was also likely scarred by the flop of cleaner compressed natural gas (CNG) vehicles, which it strongly supported in the 2000s, only for it to disappear completely after

[5] Tesla only formally entered the Singapore market in 2021.

2018 when costs spiralled after subsidies were withdrawn (Mokhtar, 2018). This was reflected by MP Ang Wei Neng:

> *"We do not want Singapore to **bet on the wrong "green" car** like the experience we have had of CNG cars."* (Singapore Parl Debates, 2020a)

A deeper reason behind the ambivalence towards BEVs is arguably the dogma of pragmatism which pervades the ruling People's Action Party (PAP) government. Pragmatism is operationalised through the adoption of "natural, necessary and realistic" policies, "consistent with a technically efficient approach to using scarce resources optimally and unencumbered by wasteful ideological demands" (Tan, 2012 p.72). For example, while progressives deploy backcasting (Hickman and Banister, 2014) to determine the aggressive policies needed to limit warming to 1.5°C, pragmatists would reject such imaginative exercises as impractical, unrealistic and utopian (Tan, 2012).

In Singapore, economic growth is prioritised, and pragmatism strongly shapes discourse around the environment (Weida, 2009). For example, global effects of climate change are rarely ever framed as the principal reason behind environmental policies (ibid.). Translated to BEVs, this meant the government was not going to take the risk and foot the bill for a more expensive, unproven novel technology whose main benefit, lower carbon emissions are dispersed globally when more proven cost-effective pathways (i.e. 'cleaner' hybrid/ICE vehicles and PT) existed.

8.1.2 2020-present:

Pragmatists are also adaptable and willing to change should conditions evolve (Tan, 2012). This happened with BEVs in 2020 when a slew of new measures was announced: registration of ICE vehicles would cease after 2040, subsidies for BEVs were dramatically increased and taxes slashed, and public CPs would be increased 50-fold (Doshi and Zahur, 2020). Looking at fig.9, the themes mentioned in parliament also changed with a lot more concern over how the transition would be managed and the adequacy and equitability of investments into charging infrastructure.

Relying on politicians' comments and an interview with a transport consultant (TC) in Singapore, the next section suggests reasons for the government's change in heart towards BEVs.

<u>Falling production costs</u>

Although still commanding a premium over their ICE-powered counterparts, the prices of BEVs have plummeted globally in the last decade with price parity expected in 2026 (McKerracher, 2021). In particular, China provided a strong case study on how electrification can be achieved with a reasonable amount of subsidies and was in itself responsible for bringing down production costs thanks to the sheer volume of BEVs produced domestically (TC).

Economic opportunities

As a tiny city-state without any natural resources, Singapore has always been on the lookout for new growth areas to attract and grow through clustering (Schein, 1996). With the trend towards green growth and surge in BEV sales globally (IEA, 2022), making Singapore the region's BEV hub and attracting part of its value chain was framed as an area of opportunity. This was reflected in parliament:

> *"The adoption of EVs can turn us into the **bellwether state** in ASEAN (Southeast Asia) for EV adoption." [MP Dennis Tan]* (Singapore Parl Debates, 2020a)

> *"Singapore needs to **ride on this green wave** to **seize the economic opportunities** and **not be left out**…we need to identify the key strategic growth areas for Singapore." [MP Liang Eng Hwa]* (Singapore Parl Motions, 2022)

Indeed, the TC goes as far as suggesting that economic opportunities alone justify the government's about-turn on BEV policies.

> *"Even if hypothetically, it (BEVs) is not beneficial to environment, there is still some room for looking into BEVs because it's being seen as a **growth trend**." [TC]*

Furthermore, just as many users adopt BEVs because they symbolise innovativeness, the TC suggests that Singapore could be warming up to BEVs to portray itself as a regional trendsetter and strengthen its international standing.

> *"At least in ASEAN, or compared against South Korea and Japan, we want to be seen as a regional leader, like **leading the trend instead of following the trend**." [TC]*

To date, Singapore has successfully attracted Hyundai to produce BEVs locally, quite an achievement given that car manufacturing has not taken place in Singapore since the 1980s (Lim, 2020).

Increased awareness of climate change

Traditionally a laggard for climate issues compared to Western countries, there has been a growth in recent years of environmental awareness, especially among the younger generation (Kok, 2019; Tan, 2019). This encompasses not just climate change but issues about the loss of local biodiversity and forests. Electrifying the vehicle fleet – a very visible move is thus a key component of the political response to this green awakening.

8.2 RQ2: What are attitudes towards private car usage and other means of travel?

8.2.1 Private car

Instrumental

Among the four themes identified by Steg (2005), instrumental benefits of car usage were most frequently mentioned by interviewees. The word 'convenient/convenience' with regards

to car usage came up frequently, 24 times among 11 interviewees, sometimes enthusiastically.

> *"I love it! I love commuting by car because it is convenient." [F02]*

The following sub-themes were identified.

Door-to-door connectivity

A key benefit of the car compared to PT was its ability to largely eliminate first/last-mile connectivity issues.

> *"It gets you from literally doorstep to doorstep." [M12]*

Singapore's tropical climate was seen to exacerbate the discomfort of walking to bridge last-mile gaps, especially among those living in landed properties where the nearest transit stop is a considerable distance away.

> *"A car would help you bridge that last mile very well instead of having to walk in the heat." [M07]*

Speed

Several interviewees highlighted that they valued the time savings from faster journeys by car, or that it allowed them to accomplish more things.

> *"(The car) kind of opens the doors to many places that I want to go to that…. if I take public transport, it takes a significantly longer time than if I take my private vehicle." [M09]*

The considerable speed advantage of cars over PT, even during peak hours was also raised.

> *"Traffic is actually generally quite OK compared to most other cities that I've been in. So (the car) actually does get you to places faster." [M12]*

Singapore is a peculiarity in that even with its excellent PT, the car still commands a huge speed advantage even along transit corridors as an extensive road network and high cost of car ownership keep congestion at bay (Barter, 2013). Comparing the mean duration by PT versus the car for randomly selected trips in 38 global cities, Singapore only ranks 25th (Urban Mobility Index, 2021).

Haulage ability

The car's ability to transport large amounts of cargo easily was repeatedly mentioned, almost always in comparison to PT.

> *"If I have to buy heavy-duty goods and stuff, I can't exactly carry them on public transport and private hire might be a bit of a chore." [M12]*

The inability to transport pets using PT was also mentioned.

"Dogs aren't allowed on public transport. So it means that wherever I want to go in Singapore and if I want to bring my dog along, then he will join us in the car." [M09]

For interviewees with access to a family car, several said that the car would always be used when travelling as a family due to lower cost, and older members being more sensitive to discomfort from walking.

"As a family, it is always car, we've never gone on public transport as a family." [M10]

Comfort

Lastly, the comfortable private cocoon afforded by the car was prized.

"You can play the music you want. You have the aux cord." [F04]

"You can have your own personal space." [M13]

Despite being most frequently mentioned, instrumental aspects alone can hardly explain motivations towards car ownership in Singapore given that most instrumental aspects can be realised through private hire vehicles, as one interviewee admitted.

"*Owning a car in Singapore is a privilege because basically, it's cheaper to take private hire or taxi everywhere than to actually own a car.*" *[M10]*

Non-instrumental aspects are hence crucial motivators of car ownership.

Symbolic

Cars were regarded as a symbol of economic success.

"There's the whole saying of the '5Cs'... people in Singapore tend to want to have cars because it signifies that they have managed to become economically independent... There is a level of prestige when it comes to buying, owning and driving a car." [M01]

Cars' strong symbolism could also entice people without adequate financial means to buy a car just to 'show off', as one interviewee described her friend's recent purchase of a car.

"I know your family is not rich. They're taking out loans to get cars and I'm just like... what?... The high price isn't stopping people from necessarily getting the car." [F08]

The high price of cars hardly quelled aspirations towards car ownership and in fact, may even be fuelling it given it reaffirms their exclusivity.

Independence

The car was frequently described as unleashing a sense of autonomy.

"Having driven my family car, it's very liberating." [M06]

"It gives you ultimate freedom." [M11]

"You have a lot more agency." [M13]

However, one interviewee who did not possess a driving license described the car passenger experience negatively in this respect.

"I just don't like the idea of being sent from place to place." [M03]

Affective

Interviewees valued cars for the affective experiences they conferred which stemmed from various sources. First, from the pleasure of driving. This tended to be described in relation to experiences of road trips through the countryside of foreign countries. Singapore's fully urban setting and stop-start traffic evidently dampened the enjoyment of driving.

"I like driving in the countryside areas in UK. You can see the horizon as you drive, and that's a nice drive." [M06]

Affective motivations also informed car choice for interviewees who expressed interest in car ownership.

"Which brand or which model can capture my imagination more." [M07]

"It's got to sound good, and it's got to be fun to drive." [M11]

Overall, cars were seen as more than just transportation tools, but a source of pleasure and are cherished as such.

"You buy your dream car and design it the way you want, do whatever you want in the car, apart from just like, travelling like from A to B." [F04]

8.2.2 Public transport

Interviewees were largely satisfied with PT. They praised its accessibility and connectivity, with some conceding that this meant car ownership was not necessary. However, cars were still strongly valued for their non-instrumental benefits.

"The public transport system is good enough that a car is not necessary. But this does not mean that people should not have a car. To me, apart from the convenience, the car is a form of enjoyment. I think that every Singaporean deserves to enjoy this form of enjoyment in their lives." [F02]

The government's investment in new MRT lines was acknowledged. The positive journey experience particularly in terms of air conditioning, good wayfinding and cleanliness, as well as affordable fares, were frequently cited.

Interviewees however did highlight aspects which could be improved such as crowding during peak hours, first/last mile connectivity, and journey times for those living in peripheral locations.

8.2.3 Cycling

While many interviewees cycled for leisure, only one commuted by cycling, doing so because of the short distance. The lack of safe cycling infrastructure was most frequently mentioned for not commuting by bicycle along with the lack of post-trip facilities like showers in workplaces which are especially necessary due to Singapore's tropical climate.

> *"You read it almost every day in the news, collisions between cyclists and pedestrians. You know, our roads and pathways…they're just not designed for cycling." [M12]*

8.3 RQ3: What is the symbolism towards BEVs?

Awareness

All interviewees had basic knowledge of BEVs. While none had an BEV in their household, a few have experienced them through car sharing services, or test drives. Interviewees also noted the significant uptick of BEVs on the road recently and local press coverage on the government's policy turn towards BEVs.

There was a 'Tesla effect' with half of the interviewees mentioning the brand when talking about BEVs. This stemmed from the recent formal entrance and rapid growth of Tesla into Singapore (Lin, 2021), and a large amount of global press coverage the company and its charismatic founder get.

> *"I think Tesla right? Elon Musk." (When asked about the first thing that comes to mind when he reads about BEVs.) [M05]*

> "*You see more Teslas around nowadays." [M12]*

Innovativeness & progressiveness

BEVs were seen to be novel and futuristic. This was interpreted by some to confer superiority.

> *"People who buy BEVs may buy into the idea that my car is more futuristic, a bit better than yours." [M01]*

The exceptional challenges and higher cost of BEV ownership pre-2020 (before the government's policy turn) were interpreted by two interviewees to symbolise risk-taking.

> *"This person is more experimental, willing to take risk. Willing to brave that initial winter." [M10]*

One interviewee also imagined that BEV owners would be progressive on other fronts as well.

> "*If you want me to lean into their stereotype, I'm just like, oh maybe I can start discussing things with them, maybe on the social front as well [laughs].*" *[M12]*

Eco-friendliness

Interviewees associated BEVs with some degree of eco-friendliness. However, opinions on whether they constituted an environmentally sustainable form of transport in Singapore were mixed. While interviewees pointed out how most of Singapore's electricity came from non-renewable sources, only some (rightly) said that electrification would still reduce the carbon footprint.

Others qualified that PT and active mobility were more environmentally sustainable than BEVs, so should be prioritised instead. Overall, however, interviewees placed little importance on the environmental impact of their transport choices, with no mention of it when asked what influences their decision behind mode choice.

> *"The image of cars as being pollutive, noisy and just overall environmentally not very good is not quite there in Singapore." [M01]*

Several interviewees contested the eco-friendly 'image' of BEVs in Singapore, reasoning that electricity comes from non-renewable sources and pointing to problems of battery disposal and life-cycle emissions.

> *"I wonder if they've (BEV owners) done their research…. or they just assumed that getting an electric vehicle would be the more environmentally friendly option." [F04]*

Some doubted that BEV owners really cared for the environment more and simply got an BEV to appear virtuous.

> *"The sceptic in me has this impression that it's more of a status symbol than a true reflection of one's commitment towards sustainability." [M09]*

Luxury

A few interviewees associated BEVs with being luxury cars. While car ownership was already regarded as being upper middle class, BEVs were seen to symbolise being upper class. Teslas, in particular, were cited as being "*very premium*" [F02] and "*fancy*" [M05]; misnomers given the most common Model 3 costs similar to an entry-level ICE-powered Volkswagen Golf (Harper, 2022). The lack of BEVs from more household mass-market brands in Singapore is a possible explanation.

Landed properties

12 out of 14 interviewees highlighted the lack of accessibility to CPs in MURBs as problematic. BEVs were associated with landed properties, where one could easily install a private CP.

> *"The first thing that comes to mind is where are they going to charge it?... They probably stay in a landed property." [M13]*

> *"If you get an EV, it almost always means the word 'landed' to me." [M07]*

When asked if BEVs were sustainable in Singapore, several interviewees immediately cited social issues namely, the inequitable access to CPs. Given that environmental issues tend to dominate discussions surrounding the 'sustainability' of BEVs globally, the frequency and importance given by interviewees to social aspects of sustainability in Singapore point to the perceived gravity of inequities. Only 5% of households reside in landed properties (Singstat, 2021a) and the average price of a terraced house is S$3.2 million (£1.9 million) (Evlanova, 2022). Interviewees reiterated the need for the government to step in to increase public CPs.

> *"If you just like, sell the cars without providing any extra infrastructure for it, I don't think that's very sustainable." [F08]*

> *"Government support in the rolling out of charging stations... is a prerequisite for it (BEVs) being kind of democratized across Singapore." [M07]*

> *"Sustainable in the sense that everyone who owns an EV would actually get adequate charging infrastructure and enjoy that, you know, experience of having no anxiety with having an EV." [M10]*

> *"I come to this question with the angle of sustainability from the part that...the wider population will use it; the current infrastructure does not support this at this moment." [M12]*

9. Discussion

> *"Car ownership is an issue close to the heart of many Singaporeans and I hope those who are planning for policies on car ownership would think deeper and assess the implications before rolling out." [MP Lim Wee Kiak]* (Singapore Parl Debates, 2021a)

9.1 Is Singapore's BEV revolution sustainable? The environmental angle

Is Singapore's BEV revolution sustainable? From an environmental angle, it depends on the lens one dons.

By reinforcing the symbolism of the car and perpetuating the "system of automobility", BEVs serve as a distraction from car-free futures that Singapore is well-suited to, given its high density, compactness, and extensive high-quality PT network. A paradigm shift in

infrastructure and lifestyles is required to realise the visions of the most progressive advocates of sustainable transport who say that private car ownership (no matter the fuel type) has no future in cities (Hickman *et al.*, 2017; Monbiot, 2020). Singapore's low car ownership rate and mode share, and high-quality PT may be laudable when compared to most cities. But getting from low to zero private car ownership represents a much bigger hurdle, one that requires that policymakers adopt an 'all-change' mindset to transform car-centric infrastructure and change strong pro-car attitudes which persist even among Generation Y as this study has shown. This may be a tall order given that "pernicious pragmatism" (Sarkki et al., 2017 p.549) restrains the government from taking a risk by pursuing more exploratory and transformative pathways in the absence of a compelling alignment with its policy objectives (economic growth), or threats to its regional standing (image issues), as the initial ambivalence towards BEVs is indicative of. Consequently, accepting that Singapore will be 'car-lite', not 'car-free' has been the modus operandi with BEVs serving to 'green' the strategy (LTA, n.d.). BEVs are seen as an easy way out, a technical solution that avoids tackling nagging issues of excessive mobility while also unlocking a new area of green growth, satisfying the rat race for economic growth (Moriarty, 2022).

Turning to the issue of BEVs conferring new symbolic meanings towards the car, what implications might this have for environmental sustainability?

This study confirms the applicability of Steg's (2005) typology of instrumental, symbolic, independence and affective motivations for car use in Singapore. Like similar studies (Chng *et al*., 2019; Goletz *et al*., 2016), cars were found to be strong symbolic markers of economic status. Their high price does little to quell this motivation and is likely fuelling it, in line with Dittmar's (1992) theory of material possessions. The symbolism of the car could be strengthened because BEVs are regarded to signal progressiveness, innovativeness and prestige, generally desirable traits. Interestingly, while there was consensus that BEVs connote eco-friendliness, many doubt that it denotes the owner *actually* cares for the environment given the consensus that PT is a greener and viable alternative for many journeys, and most of Singapore's electricity comes from non-renewable sources. Combined with a general lack of concern over the environmental impact of one's transport choices, in line with Beirão and Sarsfield Cabral's (2007) study, it suggests that attitudes towards car travel are unlikely to be impacted on the environmental front simply because ICE cars have been replaced by BEVs. Changes in attitudes are more likely to be driven by the symbolic values that BEVs connotate rather than actual care for the environment.

How might BEVs impact PT? PT, although not perfect, was generally held in high regard among interviewees for its quality and good connectivity. This high satisfaction and positive attitudes may attenuate mode substitution from PT to BEVs since travel mode dissonance among PT users is arguably low. The few shortcomings of PT were mostly expressed in comparison to the car, particularly longer journey times. This reflects the Achilles heel of Singapore's transport system; that an extensive road network and tight controls on car ownership (which keeps congestion at bay) mean the car is almost always much faster even with excellent PT connectivity, making PT seem relatively less attractive.

Concerning cycling, in line with other studies in Singapore, commuting by bicycle was despised due to a lack of safe infrastructure, end-of-trip facilities, and tropical climate. Given cycling's tiny mode share, it is unlikely that BEVs will have any notable impact on cycling.

9.2 Is Singapore's BEV revolution sustainable? The social angle

Ensuring that transitions to electric mobility are just is necessary to uphold the social equity pillar of sustainable development. While one could posit that car ownership in Singapore is inherently unjust, given cars are the most expensive in the world, it is still pertinent to ensure that the transition to BEVs does not sow new divisions, especially among groups in society where the case for car ownership is justifiably stronger, like the mobility impaired, elderly and certain essential workers. This study has found that the introduction of BEVs en masse in Singapore risks further entrenching the chasm between the 5% of people who can easily install CPs in their landed properties, and the 95% who stay in MURBs and must ration potentially far-flung communal CPs among themselves. This also discourages BEV adoption (Patt *et al*., 2019). The government may have an aggressive plan to roll out more CPs, but by their calculations, it will still be vastly insufficient in the long term given the looming 2040 target for all new ICE registrations to cease (Singapore Parl Debates, 2020b). There is also a lack of solutions to address anti-social behaviour like the hogging of CPs and the higher tariff rates using public CPs (twice as much as charging privately) (Sgcarmart, 2021; Statista, 2021b), and devise a CP allocation system.

9.3 Policy Implications

Three key policy implications for sustainable transport in Singapore can be derived.

Firstly, ensuring more equitable access to CPs for those staying in MURBs should be prioritised to avoid sowing a divide whereby BEVs symbolise that one resides in a landed property. This is critical to ensure the transition to electric mobility is more just. The call in parliament, for "the principle of equitable access to chargers should be enshrined in law" (Singapore Parl Debates, 2021b) should be followed through. Equitable access entails more than just the number of CPs, but also, allocation systems and prices.

Secondly, promoting BEVs in Singapore involves a fine balancing act. Their environmental benefit over ICE cars should be promoted, along with greater environmental awareness of one's impact from transport. Yet, care must be taken to avoid reinforcing symbolic motivations of private car usage and ensure that BEVs are generally promoted as a second-best mode in comparison to PT and active modes. PT should be the default option. In practice, this could mean that BEVs should not be promoted in a silo. Instead, the lower environmental impact of PT and active modes compared to BEVs should be continually stressed.

Thirdly, while providing high-quality PT is essential to dampen aspirations of car ownership among Generation Y, it may be worthwhile implementing more 'sticks' to deter car usage beyond just increasing their price (which fuels their symbolism). This could entail making car usage more inconvenient by introducing car-free zones, reclaiming road space to prioritise

transit and build safer cycling infrastructure, and street calming, to reduce journey time differences between PT and car journeys.

Beyond Singapore, this study underscores the importance of studying changing political framings of BEVs to understand global variations in BEV adoption; moving beyond studies of socio-demographic characteristics which dominate the literature on BEVs. And also, the importance of residential location type in the transition to electric mobility which is highly applicable to the many dense growing cities in Asia, where MURBs are the dominant housing type.

9.4 Limitations

Concerning the content analysis methodology, a key limitation is potential researcher bias introduced when selecting sources (Jacobs, 1999). The opaque nature of decision-making in Singapore also limits the amount of content and hence insights that can be gleaned (Rodan, 2004).

Although the focus on non-BEV users yielded perspectives such as perceived inequities that are often absent from the many studies that focus only on BEV users; ideally, the same set of interview questions should be replicated among BEV owners to establish between-group differences.

Additionally, given the sample of interviewees is highly educated, between 20-30 years old and skewed towards male respondents, it is not representative, and caution should be taken in generalising its findings to the wider population. Future studies should garner the views of a larger subset of the population and apply quantitative methods such as surveys to triangulate this study's findings.

10. Conclusion

The central aim of this study was to analyse if Singapore's BEV revolution is sustainable. Examining the changing political framing of BEVs, it was found that the initial reluctance to accord them the same preferential treatment as many western countries was largely driven by a pragmatic dogma which saw supporting BEVs as an 'unnecessary' and expensive risk without clear national benefits. Technology neutrality was stressed, and no form of 'cleaner' vehicle was favoured over another. A policy reversal followed as falling costs, image issues, economic opportunities, and greater awareness of climate change tipped the scales. BEVs were never framed as *just* about a response to the climate emergency.

By strengthening the symbolism of the car, electrification could increase aspirations toward car ownership. However, this is likely to be attenuated by the high degree of satisfaction with PT and can be discouraged further with more non-price 'sticks' to make the car less favourable in comparison to PT. An arguably stronger impediment to the sustainability of the revolution is presently the inequitable access to charging points (CPs), a significant issue in Singapore given that 95% of the population lives in multi-unit residential buildings where one must rely on public CPs which are few and far between. BEV ownership has come to be

strongly associated with the 5% of the population living in single-unit landed properties. This is a concerning inequity that needs to be addressed given the government's target to cease the registrations of new ICE vehicles by 2040.

While not the most environmentally sustainable pathway, facilitating an equitable shift from ICE cars to BEVs in Singapore may be the most politically palatable pathway to reduce road transport emissions today and could act as a stepping stone to even more progressive transport futures.

11. Bibliography

Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Academic Press, Vol. 50 No. 2, pp. 179–211.

Ashmore, D.P., Thoreau, R., Kwami, C., Christie, N. and Tyler, N.A. (2020), "Using thematic analysis to explore symbolism in transport choice across national cultures", *Transportation*, Springer, Vol. 47 No. 2, pp. 607–640.

Aubertin, A. (2021), *Why Implement Plug-in Electric Policies? Comparing Policy Discourse in Newspapers across Three Canadian Provinces (2008-2018)*, available at: http://summit.sfu.ca/item/21744 (accessed 23 June 2022).

Azungah, T. (2018), "Qualitative research: deductive and inductive approaches to data analysis", *Qualitative Research Journal*, Emerald Group Holdings Ltd., Vol. 18 No. 4, pp. 383–400.

Barter, P. (2013), "Singapore's Mobility Model: Time for an Update?", in Meyer, G. (Ed.), *Megacity Mobility Culture*, Springer, Berlin, Heidelberg, pp. 225–242.

Barter, P. (2019), "Singapore's Changing Relationship with Cars", in Yuen, B. and Hamnett, S. (Eds.), *Planning Singapore: The Experimental City*, Routledge, pp. 170–196.

Basu, R. and Ferreira, J. (2020), "Understanding household vehicle ownership in Singapore through a comparison of econometric and machine learning models", *Transportation Research Procedia*, Elsevier, Vol. 48, pp. 1674–1693.

Beirão, G. and Sarsfield Cabral, J.A. (2007), "Understanding attitudes towards public transport and private car: A qualitative study", *Transport Policy*, Pergamon, Vol. 14 No. 6, pp. 478–489.

Bina, O. (2013), "The green economy and sustainable development: an uneasy balance?", *Environment and Planning C: Government and Policy*, Vol. 31, pp. 1023–1047.

Blackbox. (2021), "Transportation: The electric vehicle revolution is nigh", *Blackbox Corp*, available at: https://blackbox.com.sg/everyone/transportation-the-electric-vehicle-revolution-is-nigh (accessed 21 June 2022).

Bloomberg. (2021), "Singapore Finance Minister Heng on EVs", *Bloomberg UK*, available at: https://www.bloomberg.com/news/videos/2021-02-17/singapore-finance-minister-heng-on-evs-property-market-video (accessed 21 July 2022).

Brown, M.B. (2001), "The Civic Shaping of Technology: California's Electric Vehicle Program", *Science, Technology, & Human Values*, Vol. 26 No. 1, pp. 56–81.

CarBuyer Singapore. (2021), “A Dummies’ Guide To Electric Vehicle Ownership”, *CarBuyer Singapore*, available at: https://carbuyer.com.sg/a-dummies-guide-to-owning-an-electric-vehicle-in-singapore/3/ (accessed 11 July 2022).

Chan, C.Bock. (2011), *Heart Work 2 : EDB & Partners : New Frontiers for the Singapore Economy*, Straits Times Press, Singapore, available at: (accessed 22 July 2022).

Chandler, D. (2007), *Semiotics: The Basics*, 2nd ed., Routledge, available at: http://books.google.com/books?id=WV6Si29I010C&pgis=1 (accessed 22 June 2022).

Chng, S., Abraham, C., White, M.P. and Skippon, S. (2019), “To drive or not to drive? A qualitative comparison of car ownership and transport experiences in London and Singapore”, *Transportation Research Interdisciplinary Perspectives*, Elsevier, Vol. 2, p. 100030.

Clifton, K.J. and Handy, S.L. (2001), *Qualitative Methods in Travel Behaviour Research*, available at: (accessed 26 March 2022).

CNA. (2021), “Amid push for electric vehicles, getting charging points installed in condominiums remains a challenge”, *CNA*, available at: https://www.channelnewsasia.com/singapore/electric-vehicles-ev-charging-points-condominiums-singapore-357416 (accessed 21 June 2022).

CNA. (2022), “LTA launching tender for deployment of 12,000 EV charging points across HDB carparks”, *CNA*, available at: https://www.channelnewsasia.com/singapore/electric-vehicle-ev-charging-points-hdb-carparks-lta-tender-deployment-2593181 (accessed 17 July 2022).

Delbosc, A. and Currie, G. (2011), “The spatial context of transport disadvantage, social exclusion and well-being”, *Journal of Transport Geography*, Pergamon, Vol. 19 No. 6, pp. 1130–1137.

Deloitte. (2020), *Deloitte City Mobility Index 2020 Tokyo*, available at: http://www.deloitte.com/insights/future-of-mobility (accessed 11 January 2022).

De Vos, J., Schwanen, T., van Acker, V. and Witlox, F. (2017), “Do satisfying walking and cycling trips result in more future trips with active travel modes? An exploratory study”, *International Journal of Sustainable Transportation*, Taylor & Francis, Vol. 13 No. 3, pp. 180–196.

De Vos, J. and Singleton, P.A. (2020), “Travel and cognitive dissonance”, *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 138, pp. 525–536.

Dittmar, Helga. (1992), “The social psychology of material possessions : to have is to be”, Harvester Wheatsheaf, p. 250.

Doshi, T.K. and Zahur, N.B. (2020), “Assessing Singapore’s Electric Vehicle Policies”, *IAEE Energy Forum*, No. Fourth Quarter 2020, pp. 21–24.

Dyson, Pete. and Sutherland, Rory. (2021), *Transport for Humans Are We Nearly There Yet?*, London Publishing Partnership, available at: (accessed 20 June 2022).

EAFO. (2022a), "Vehicles and fleet EU27", *European Alternative Fuels Observatory*, available at: https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/european-union-eu27/vehicles-and-fleet (accessed 10 May 2022).

EAFO. (2022b), "Vehicles and fleet Norway", *European Alternative Fuels Observatory*, available at: https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/norway/vehicles-and-fleet (accessed 10 May 2022).

EAFO. (2022c), "Vehicles and fleet Germany", *European Alternative Fuels Observatory*, available at: https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/germany/vehicles-and-fleet (accessed 10 May 2022).

Earnest, A., Ong, M.E.H., Shahidah, N., Chan, A., Wah, W. and Thumboo, J. (2015), "Derivation of indices of socioeconomic status for health services research in Asia", *Preventive Medicine Reports*, Elsevier, Vol. 2, pp. 326–332.

EMA. (2021), "EMA: Singapore Energy Statistics | Energy Transformation", *Energy Transformation*, available at: https://www.ema.gov.sg/singapore-energy-statistics/Ch02/index2 (accessed 11 July 2022).

EV Volumes. (2022), "EV-Volumes - The Electric Vehicle World Sales Database", *EV Volumes*, available at: https://www.ev-volumes.com/ (accessed 10 May 2022).

Evans, G.W., Wener, R.E. and Phillips, D. (2016), "The Morning Rush Hour: Predictability and Commuter Stress", *Environment and Behavior*, Sage PublicationsSage CA: Thousand Oaks, CA, Vol. 34 No. 4, pp. 521–530.

EVAS. (2022), "Singapore study reveals strong interest in EV adoption despite challenges and misconceptions", *Electric Vehicle Association of Singapore*.

Evlanova, A. (2022), "Average Cost of Housing in Singapore 2022", *ValueChampion Singapore*, available at: https://www.valuechampion.sg/average-cost-housing-singapore (accessed 25 July 2022).

Festinger, L. (1954), "A Theory of Social Comparison Processes", *Human Relations*, Sage PublicationsSage CA: Thousand Oaks, CA, Vol. 7 No. 2, pp. 117–140.

Flink, J.J. (1975), *The Car Culture*, MIT Press, available at: (accessed 22 June 2022).

Foster, V., Li, S., Wang, B., Yang, M. and Zhang, F. (2021), "If you build it, they will come: Lessons from the first decade of electric vehicles", *World Bank Blogs*, available at: https://blogs.worldbank.org/transport/if-you-build-it-they-will-come-lessons-first-decade-electric-vehicles (accessed 23 June 2022).

Gatersleben, B. (2007), “Affective and Symbolic Aspects of Car Use”, *Threats from Car Traffic to the Quality of Urban Life*, Emerald Group Publishing Limited, pp. 219–233.

Ghadikolaei, M.A., Wong, P.K., Cheung, C.S., Zhao, J., Ning, Z., Yung, K.F., Wong, H.C., *et al*. (2021), “Why is the world not yet ready to use alternative fuel vehicles?”, *Heliyon*, Elsevier, Vol. 7 No. 7, p. e07527.

Gibbs, G. (2007), *Analyzing Qualitative Data*, SAGE Publications, Ltd, available at:https://doi.org/10.4135/9781849208574.

Goletz, M., Feige, I. and Heinrichs, D. (2016), “What Drives Mobility Trends: Results from Case Studies in Paris, Santiago de Chile, Singapore and Vienna”, *Transportation Research Procedia*, Elsevier, Vol. 13, pp. 49–60.

Goodwin, P. and Lyons, G. (2009), “Public attitudes to transport: interpreting the evidence”, *Transportation Planning and Technology*, Taylor & Francis Group , Vol. 33 No. 1, pp. 3–17.

Graves-Brown, P. (1997), “FROM HIGHWAY TO SUPERHIGHWAY: The Sustainability, Symbolism and Situated Practices of Car Culture”, *Social Analysis: The International Journal of Anthropology*, Vol. 41 No. 1, pp. 64–75.

Griskevicius, V., Tybur, J.M. and van den Bergh, B. (2010), “Going Green to Be Seen: Status, Reputation, and Conspicuous Conservation”, *Journal of Personality and Social Psychology*, Vol. 98 No. 3, pp. 392–404.

Ha, T. (2020), “5 trends this decade that will shape Singapore’s switch to electric mobility”, *Eco Business*, available at: https://www.eco-business.com/news/5-trends-this-decade-that-will-shape-singapores-switch-to-electric-mobility/ (accessed 15 July 2022).

Hackbarth, A. and Madlener, R. (2013), “Consumer preferences for alternative fuel vehicles: A discrete choice analysis”, *Transportation Research Part D: Transport and Environment*, Pergamon, Vol. 25, pp. 5–17.

Harper, J. (2022), “Tesla Owners Singapore car club president Joe Nguyen: Tesla is the future of transport”, *CNA Luxury*, available at: https://cnaluxury.channelnewsasia.com/obsessions/tesla-owners-singapore-car-club-president-joe-nguyen-198071 (accessed 26 July 2022).

Heinen, E., van Wee, B. and Maat, K. (2009), “Commuting by Bicycle: An Overview of the Literature”, *Http://Dx.Doi.Org/10.1080/01441640903187001*, Routledge , Vol. 30 No. 1, pp. 59–96.

Henderson, J. (2020), “EVs Are Not the Answer: A Mobility Justice Critique of Electric Vehicle Transitions”, *Annals of the American Association of Geographers*, Routledge, Vol. 110 No. 6, pp. 1993–2010.

Hermans, H.J.M. and Hermans-Jansen, Els. (2001), *Self-Narratives : The Construction of Meaning in Psychotherapy*, 1st ed., Guilford Press, available at: (accessed 22 June 2022).

Hickman, R. and Banister, D. (2014), *Transport, Climate Change and the City*, *Transport, Climate Change and the City*, Taylor and Francis, available at:https://doi.org/10.4324/9780203074435.

Hickman, R., Smith, D., Moser, D., Schaufler, C. and Vecia, G. (2017), *Why the Automobile Has No Future - A Global Impact Analysis*, available at: www.greenpeace.de (accessed 25 October 2021).

Hyperdrive. (2021), "Buying an EV in China Is Easy. Charging It Is a Different Story", *Hyperdrive - Bloomberg*, available at: https://www.bloomberg.com/news/newsletters/2021-10-18/buying-an-ev-in-china-is-easy-charging-it-is-a-different-story (accessed 17 July 2022).

Ibrahim, M.F. (2005), "Attitudes to transport modes for shopping purposes in Singapore", *Transport Reviews*, Taylor and Francis Ltd , Vol. 25 No. 2, pp. 221–243.

IEA. (2022), "Global EV Outlook 2022", *IEA*, available at: https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf (accessed 23 June 2022).

Igini, M. (2021), "How Sustainable Cities like Singapore Succeed in Green Urban Development", *Earth.Org*, available at: https://earth.org/how-sustainable-cities-like-singapore-succeed-in-green-urban-development/ (accessed 9 July 2022).

Ingeborgrud, L. and Ryghaug, M. (2017), "User perceptions of EVs and the role of EVs in the transition towards low-carbon mobility", *European Council for an Energy Efficient Economy*, available at: https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/4-mobility-transport-and-smart-and-sustainable-cities/user-perceptions-of-evs-and-the-role-of-evs-in-the-transition-towards-low-carbon-mobility/ (accessed 20 May 2022).

Ingeborgrud, L. and Ryghaug, M. (2019), "The role of practical, cognitive and symbolic factors in the successful implementation of battery electric vehicles in Norway", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 130, pp. 507–516.

IPCC. (2021), "WG III contribution to the Sixth Assessment Report Chapter 10: Transport", *WG III Contribution to the Sixth Assessment Report*, available at: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter10.pdf (accessed 14 May 2022).

IPCC. (2022), “WGII Summary for Policymakers Headline Statements”, *IPCC Sixth Assessment Report*, available at: https://www.ipcc.ch/report/ar6/wg3/resources/spm-headline-statements/ (accessed 14 May 2022).

Jacobs, K. (1999), “Key Themes and Future Prospects: Conclusion to the Special Issue”:, *Urban Studies*, Sage PublicationsSage UK: London, England, Vol. 36 No. 1, pp. 203–213.

Jensen, M. (1999), “Passion and heart in transport — a sociological analysis on transport behaviour”, *Transport Policy*, Pergamon, Vol. 6 No. 1, pp. 19–33.

Jnzl’s Photos. (2020), “Lor 8 Toa Payoh HDB facing Braddell Road”, *Flickr*, available at: https://www.flickr.com/photos/surveying/49637084128 (accessed 12 August 2022).

Julius Baer. (2022), “Global Wealth and Lifestyle Report 2022”, *Global Wealth and Lifestyle Report 2022*, available at: https://www.juliusbaer.com/en/spotlight/global-wealth-and-lifestyle-report-2022/ (accessed 17 June 2022).

Kester, J., Sovacool, B.K., Zarazua de Rubens, G. and Noel, L. (2020), “Novel or normal? Electric vehicles and the dialectic transition of Nordic automobility”, *Energy Research & Social Science*, Elsevier, Vol. 69, p. 101642.

Kitamura, R., Mokhtarian, P.L. and Laidet, L. (1997), “A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area”, *Transportation 1997 24:2*, Springer, Vol. 24 No. 2, pp. 125–158.

Kok, X. (2019), “From the PAP to the Workers’ Party, why are Singapore’s political parties increasingly concerned with climate change?”, *South China Morning Post*, available at: https://www.scmp.com/week-asia/politics/article/3035998/pap-workers-party-why-are-singapores-political-parties (accessed 22 July 2022).

Koslowsky, M. and Krausz, M. (2016), “On the Relationship between Commuting, Stress Symptoms, and Attitudinal Measures: A LISREL Application”:, *The Journal of Applied Behavioral Science*, Sage PublicationsSage CA: Thousand Oaks, CA, Vol. 29 No. 4, pp. 485–492.

Kuhnimhof, T., Armoogum, J., Buehler, R., Dargay, J., Denstadli, J.M. and Yamamoto, T. (2012), “Men Shape a Downward Trend in Car Use among Young Adults—Evidence from Six Industrialized Countries”, *Transport Reviews*, Routledge , Vol. 32 No. 6, pp. 761–779.

Kumar, R.R. and Alok, K. (2020), “Adoption of electric vehicle: A literature review and prospects for sustainability”, *Journal of Cleaner Production*, Elsevier, Vol. 253, p. 119911.

Kupferschmid, J.;, Erath, A.; and van Eggermond, M.A.B. (n.d.). “Making cycling a choice mode in Singapore – findings of expert interviews”, available at:https://doi.org/10.3929/ethz-b-000210342.

Lai, L. (2021), “5Cs? It’s 3 new Cs such as caring for environment that resonate with young S’poreans: Heng Swee Keat”, *The Straits Times*, available at: https://www.straitstimes.com/singapore/5cs-its-3-new-cs-like-charting-the-way-forward-that-resonate-with-young-sporeans-today (accessed 22 June 2022).

Lam, P.E. (2014), “The Politics of Confucianism and Asian Values in Singapore”, *Confucian Culture and Democracy*, World Scientific, pp. 111–130.

Lee, Q.Y. and Pojani, D. (2019), “Making cycling irresistible in tropical climates? Views from Singapore”, *Policy Design and Practice*, Routledge, Vol. 2 No. 4, pp. 359–369.

Lew, Y. der and Choi, C.C. (2016), “Overview of Singapore’s land transport development 1965-2015”, in Fwa, T.F. (Ed.), *50 Years of Transportation in Singapore: Achievements and Challenges*, World Scientific, pp. 1–65.

Li, L., Wang, Z., Chen, L. and Wang, Z. (2020), “Consumer preferences for battery electric vehicles: A choice experimental survey in China”, *Transportation Research Part D: Transport and Environment*, Pergamon, Vol. 78, p. 102185.

Lim, J. (2020), “Construction of Hyundai’s electric car manufacturing plant in Singapore begins”, *Today*, available at: https://www.todayonline.com/singapore/construction-hyundais-electric-car-manufacturing-plant-singapore-begins (accessed 7 August 2022).

Lin, C. (2021), “Tesla EV sales boom in Singapore, pushing rivals’ models off the streets | Reuters”, *Reuters*, available at: https://www.reuters.com/business/autos-transportation/tesla-ev-sales-boom-singapore-pushing-rivals-models-off-streets-2021-10-28/ (accessed 24 July 2022).

Lis, A., Wagner, A., Ruzzenenti, F. and Walnum, H.J. (2018), “Section B: ‘Stability and Change’ in Energy Systems”, *Shape Energy*, available at: https://core.ac.uk/download/pdf/161840595.pdf (accessed 14 May 2022).

London Assembly. (2022), “Electric Vehicle Infrastructure”, *Electric Vehicle Infrastructure*, available at: https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/electric-vehicle-infrastructure (accessed 16 July 2022).

LTA. (2014), “Annex B-Key findings from EV Phase 1 Test-bed Key Findings of Market Perception Surveys”, *Land Transport Authority* , available at: (accessed 10 May 2022).

LTA. (2020), “Current Vehicle Growth Rate to Continue until 31 January 2022”, *Land Transport Authority*, available at: https://www.lta.gov.sg/content/ltagov/en/newsroom/2020/8/news-releases/current-vehicle-growth-rate-to-continue-until-31-january-2022.html (accessed 20 November 2021).

LTA. (2021a), “Motor Vehicle Population by Type of Fuel Used”, *Motor Vehicle Population by Type of Fuel Used*, available at:

https://www.lta.gov.sg/content/dam/ltagov/who_we_are/statistics_and_publications/statistics/pdf/MVP01-4_MVP_by_fuel.pdf (accessed 16 July 2022).

LTA. (2021b), "Factsheet: Accelerating Nationwide Deployment of Electric Vehicle Charging Points", *Land Transport Authority*, available at: https://www.lta.gov.sg/content/ltagov/en/newsroom/2021/3/news-release/Accelerating_nationwide_deployment_of_electric_vehicle_charging_points.html (accessed 17 July 2022).

LTA. (2021c), "Factsheet: Encouraging the Adoption of Electric Cars for a More Sustainable Land Transport Sector", *Factsheet: Encouraging the Adoption of Electric Cars for a More Sustainable Land Transport Sector*, available at: https://www.lta.gov.sg/content/ltagov/en/newsroom/2021/3/news-release/Encouraging_the_adoption_of_electric_cars.html (accessed 11 July 2022).

LTA. (2022a), "Annual Motor Vehicle Population by Type of Fuel Used", *Land Transport Authority*, available at: https://datamall.lta.gov.sg/content/dam/datamall/TempXLS/MVP01-4_MVP_by_fuel.xls (accessed 10 May 2022).

LTA. (2022b), "Our EV Vision", *Our EV Vision*, available at: https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/electric_vehicles/our_ev_vision.html (accessed 11 July 2022).

LTA. (2022c), "Annual New Registration of Cars by Make", *Land Transport Authority*, available at: https://datamall.lta.gov.sg/content/dam/datamall/TempXLS/MVP02-2_New_Cars_by_make.xls (accessed 10 May 2022).

LTA. (2022d), "MyTransport.SG application (Android)", *Land Transport Authority*, Land Transport Authority.

LTA. (n.d.). "Public Transport System", *Land Transport Authority*, available at: https://www.lta.gov.sg/content/ltagov/en/who_we_are/our_work/public_transport_system.html (accessed 9 August 2022).

Mahmoudzadeh Andwari, A., Pesiridis, A., Rajoo, S., Martinez-Botas, R. and Esfahanian, V. (2017), "A review of Battery Electric Vehicle technology and readiness levels", *Renewable and Sustainable Energy Reviews*, Pergamon, Vol. 78, pp. 414–430.

Marsh, P. and Collett, P. (1987), *Driving Passion : The Psychology of the Car*, Faber and Faber, available at: (accessed 22 June 2022).

McKerracher, C. (2021), "Hyperdrive Daily: The EV Price Gap Narrows", *Bloomberg UK*, available at: https://www.bloomberg.com/news/newsletters/2021-05-25/hyperdrive-daily-the-ev-price-gap-narrows (accessed 22 July 2022).

McKinsey & Company. (2021), *Urban Transportation Systems of 25 Global Cities Elements of Success*, available at: (accessed 16 May 2022).

McLuhan, M. (2002), *The Mechanical Bride: Folklore of Industrial Man*, New edition., Gingko Press, available at: (accessed 22 June 2022).

Mladenovic, M. and Trifunovic, A. (2014), "The Shortcomings of the Conventional Four Step Travel Demand Forecasting Process", *Journal of Road and Traffic Engineering*, Vol. 60 No. 1, pp. 5–12.

Mokhtar, F. (2018), "Once touted as the next big green thing, CNG vehicles have had a bumpy ride", *TODAY*, available at: https://www.todayonline.com/singapore/once-touted-next-big-green-thing-cng-vehicles-have-had-bumpy-ride-spore (accessed 22 July 2022).

Mokhtarian, P.L., Salomon, I. and Redmond, L.S. (2010), "Understanding the Demand for Travel: It's Not Purely 'Derived'", *Innovation: The European Journal of Social Science Research*, Taylor & Francis Group , Vol. 14 No. 4, pp. 355–380.

Monbiot, G. (2020), "Electric cars won't solve our pollution problems – Britain needs a total transport rethink", *The Guardian*, available at: https://www.theguardian.com/commentisfree/2020/sep/23/electric-cars-transport-train-companies (accessed 27 July 2022).

Moons, I. and de Pelsmacker, P. (2015), "Self-Brand Personality Differences and Attitudes towards Electric Cars", *Sustainability 2015, Vol. 7, Pages 12322-12339*, Multidisciplinary Digital Publishing Institute, Vol. 7 No. 9, pp. 12322–12339.

Moriarty, P. (2022), "Electric vehicles can have only a minor role in reducing transport's energy and environmental challenges", *AIMS Energy 2022 1:131*, American Institute of Mathematical Sciences (AIMS), Vol. 10 No. 1, pp. 131–148.

MOT. (2022), "Opening Remarks by Senior Minister of State for Transport, Amy Khor at the Singapore Green Plan Conversation on Energy Reset", *Ministry of Transport Singapore*, available at: https://www.mot.gov.sg/news/details/opening-remarks-by-senior-minister-of-state-for-transport-amy-khor-at-the-singapore-green-plan-conversation-on-energy-reset (accessed 10 May 2022).

Mouratidis, K., Ettema, D. and Næss, P. (2019), "Urban form, travel behavior, and travel satisfaction", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 129, pp. 306–320.

Mukherjee, S.C. and Ryan, L. (2020), "Factors influencing early battery electric vehicle adoption in Ireland", *Renewable and Sustainable Energy Reviews*, Pergamon, Vol. 118, p. 109504.

Murtaugh, D., Chin, Y. and Amin, H. (2019), "Elon Musk Promoting 'Lifestyle' Not Climate Help, Says Singapore", *Bloomberg*, available at: https://www.bloomberg.com/news/articles/2019-08-21/singapore-says-musk-s-vision-promotes-lifestyle-not-climate#xj4y7vzkg (accessed 11 August 2022).

Musk, E. (2019), "Elon Musk on Twitter: '@KroegerOve Govt has been unwelcome'", *Twitter*, available at: https://twitter.com/elonmusk/status/1080829741056159744?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1080829741056159744%7Ctwgr%5Ea858072f514eb5632bd14c042f979a5362af1901%7Ctwcon%5Es1_&ref_url=https%3A%2F%2Ffuturism.com%2Fthe-byte%2Felon-musk-singapore-unwelcome-tesla (accessed 11 August 2022).

Naderi, I. and van Steenburg, E. (2018), "Me first, then the environment: young Millennials as green consumers", *Young Consumers*, Emerald Group Holdings Ltd., Vol. 19 No. 3, pp. 280–295.

Neuman, L.W. (2013), *Social Research Methods: Pearson New International Edition: Qualitative and Quantitative Approaches*, 7th ed., Pearson.

Newman, P. and Kenworthy, J. (2015), *The End of Automobile Dependence: How Cities Are Moving beyond Car-Based Planning*, *The End of Automobile Dependence: How Cities Are Moving Beyond Car-Based Planning*, Island Press-Center for Resource Economics, available at:https://doi.org/10.5822/978-1-61091-613-4.

Noppers, E.H., Keizer, K., Bolderdijk, J.W. and Steg, L. (2014), "The adoption of sustainable innovations: Driven by symbolic and environmental motives", *Global Environmental Change*, Pergamon, Vol. 25 No. 1, pp. 52–62.

Ofgem. (2018), "Implications of the transition to Electric Vehicles", *Ofgem's Future Insights Series*, available at: (accessed 17 July 2022).

Ong, T. (2006), "Rivervale MSCP.JPG", *Wikimedia Commons*, available at: https://commons.wikimedia.org/wiki/File:Rivervale_MSCP.JPG (accessed 12 August 2022).

Park, K. (2021), "Singapore Warms to Electric Cars Two Years After Tesla's Rebuke", *Bloomberg*, available at: https://finance.yahoo.com/news/singapore-warms-electric-cars-two-210000924.html (accessed 21 June 2022).

Parkinson, B. (2001), "Anger on and off the road", *British Journal of Psychology*, John Wiley & Sons, Ltd, Vol. 92 No. 3, pp. 507–526.

Patt, A., Aplyn, D., Weyrich, P. and van Vliet, O. (2019), "Availability of private charging infrastructure influences readiness to buy electric cars", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 125, pp. 1–7.

Poon, J.F. (2016), "Travel demand management", in Fwa, T.F. (Ed.), *50 Years of Transportation in Singapore: Achievements and Challenges*, World Scientific, pp. 145–199.

ProjectManhattan. (2014), "File:Urban Redevelopment Authority car park in a Housing and Development Board estate, Singapore - 20140816.jpg", *Wikimedia Commons*, available

at:
https://commons.wikimedia.org/wiki/File:Urban_Redevelopment_Authority_car_park_in_a_Housing_and_Development_Board_estate,_Singapore_-_20140816.jpg (accessed 12 August 2022).

PTC. (2022), "Annex A: Public Transport Customer Satisfaction Survey 2021", *Public Transport Council*, available at: https://www.ptc.gov.sg/docs/default-source/news/annex-a---public-transport-customer-satisfaction-survey-2021.pdf (accessed 23 June 2022).

Rein, M. and Schon, D. (1991), "Frame-reflective policy discourse", *Social Sciences and Modern States*, Cambridge University Press, pp. 262–289.

Rodan, G. (2004), *Transparency and Authoritarian Rule in Southeast Asia: Singapore and Malaysia*, *Transparency and Authoritarian Rule in Southeast Asia: Singapore and Malaysia*, Routledge, available at:https://doi.org/10.4324/9780203421017/TRANSPARENCY-AUTHORITARIAN-RULE-SOUTHEAST-ASIA-GARRY-RODAN.

Rojas López, M.C. and Wong, Y.D. (2017), "Attitudes towards active mobility in Singapore: A qualitative study", *Case Studies on Transport Policy*, Elsevier Ltd, Vol. 5 No. 4, pp. 662–670.

Sandalkhan, B., Carrasco, J., Gokbulut, A. and Tasli, Y. (2021), "How Governments Can Solve the EV Charging Dilemma | BCG", *BCG*, available at: https://www.bcg.com/publications/2021/electric-vehicle-charging-station-infrastructure-plan-for-governments (accessed 23 June 2022).

Sang, Y.N. and Bekhet, H.A. (2015), "Modelling electric vehicle usage intentions: an empirical study in Malaysia", *Journal of Cleaner Production*, Elsevier, Vol. 92, pp. 75–83.

Sarkki, S., Ficko, A., Grunewald, K., Kyriazopoulos, A.P. and Nijnik, M. (2017), "How pragmatism in environmental science and policy can undermine sustainability transformations: the case of marginalized mountain areas under climate and land-use change", *Sustainability Science*, Springer Tokyo, Vol. 12 No. 4, pp. 549–561.

Schein, E.H. (1996), *Strategic Pragmatism : The Culture of Singapore's Economic Development Board*, MIT Press, available at: (accessed 22 July 2022).

Schuitema, G., Anable, J., Skippon, S. and Kinnear, N. (2013), "The role of instrumental, hedonic and symbolic attributes in the intention to adopt electric vehicles", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 48, pp. 39–49.

Schwanen, T. (2021a), "Is the future of Transport Electric?", *University of Oxford*, available at: https://www.ox.ac.uk/news/2021-10-07-future-transport-electric (accessed 14 May 2022).

Schwanen, T. (2021b), "Achieving just transitions to low-carbon urban mobility", *Nature Energy 2021 6:7*, Nature Publishing Group, Vol. 6 No. 7, pp. 685–687.

Schwanen, T., Banister, D. and Anable, J. (2012), "Rethinking habits and their role in behaviour change: the case of low-carbon mobility", *Journal of Transport Geography*, Pergamon, Vol. 24, pp. 522–532.

Sgcarmart. (2021), "EV ownership costs in Singapore - can you afford an electric car?", *Sgcarmart*, available at: https://www.sgcarmart.com/news/writeup.php?AID=635&CT=a (accessed 26 July 2022).

Shah, K. (2021), "Can Electric Vehicles Drive the Transport Revolution in Small Island States?", *SSRN Electronic Journal*, Elsevier BV, available at:https://doi.org/10.2139/SSRN.3951032.

Sheller, M. (2004), "Automotive Emotions: Feeling the Car", *Theory, Culture & Society*, SAGELondon, Thousand Oaks and New Delhi, Vol. 21 No. 5, pp. 221–242.

Sheller, M. and Urry, J. (2000), "The City and the Car", *International Journal of Urban and Regional Research*, John Wiley & Sons, Ltd, Vol. 24 No. 4, pp. 737–757.

Singapore Parl Debates. (2020a), "Debate on Annual Budget Statement", *Singapore Parliament; Vol 94, Sitting No 120; [27 Feb 2020]*, available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=budget-1291 (accessed 15 August 2022).

Singapore Parl Debates. (2020b), "Debate on Annual Budget Statement", *Singapore Parliament; Vol 94, Sitting No 121; [28 Feb 2020]*, available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=budget-1294 (accessed 15 August 2022).

Singapore Parl Debates. (2021a), "Debate on Annual Budget Statement", *Singapore Parliament; Vol 95, Sitting No 19; [24 Feb 2021]*, available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=budget-1574 (accessed 15 August 2022).

Singapore Parl Debates. (2021b), "Land Transport Authority of Singapore (Amendment) Bill", *Singapore Parliament; Vol 95, Sitting No 30; [11 May 2021]*, available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=bill-508 (accessed 15 August 2022).

Singapore Parl Motions. (2022), "Towards a Low-carbon Society", *Singapore Parliament; Vol 95, Sitting No 46; [12 Jun 2022]*, available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=motion-1790 (accessed 15 August 2022).

Singapore Parl Written Answers. (2018), "Written Answers to Questions for Oral Answer Not Answered by End of Question Time", *Singapore Parliament; Vol 94, Sitting No 55;*

[8 Jun 2018], available at: https://sprs.parl.gov.sg/search/sprs3topic?reportid=written-answer-na-4040 (accessed 15 August 2022).

Singh, V., Singh, V. and Vaibhav, S. (2020), "A review and simple meta-analysis of factors influencing adoption of electric vehicles", *Transportation Research Part D: Transport and Environment*, Pergamon, Vol. 86, p. 102436.

SingStat. (2021), "Singapore Population", *Department of Statistics Singapore*, available at: https://www.singstat.gov.sg/modules/infographics/population (accessed 21 June 2022).

Singstat. (2021a), "Households", *Department of Statistics Singapore*, available at: https://www.singstat.gov.sg/find-data/search-by-theme/households/households/latest-data (accessed 15 July 2022).

Singstat. (2021b), "Geographic Distribution - Publications and Methodology", *Department of Statistics Singapore*, available at: https://www.singstat.gov.sg/find-data/search-by-theme/population/geographic-distribution/publications-and-methodology (accessed 12 August 2022).

Sirgy, J. and Danes, J.E. (1982), "Self-Image/Product-Image Congruence Models: Testing Selected Models", *Advances in Consumer Research*, Vol. 9, pp. 556–561.

Statista. (2020), "China: battery electric vehicle sales 2020", *Statista*, available at: https://www-statista-com.libproxy.ucl.ac.uk/statistics/1050097/japan-battery-electric-car-sales/ (accessed 10 May 2022).

Statista. (2021a), "China: passenger car sales by model 2021", *Statista*, available at: https://www-statista-com.libproxy.ucl.ac.uk/statistics/281169/china-passenger-car-sales-by-model/ (accessed 10 May 2022).

Statista. (2021b), "Singapore: electricity tariffs 2021", *Statista*, available at: https://www.statista.com/statistics/985342/singapore-electricity-tariffs/ (accessed 26 July 2022).

Steg, L. (2003), "Can Public Transport Compete with the Private Car", *IATSS Research*, Elsevier, Vol. 27 No. 2, pp. 27–35.

Steg, L. (2005), "Car use: lust and must. Instrumental, symbolic and affective motives for car use", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 39 No. 2–3, pp. 147–162.

Stokes, G. and Hallett, S. (1992), "The role of advertising and the car", *Transport Reviews*, Taylor & Francis Group , Vol. 12 No. 2, pp. 171–183.

Tan, A. (2019), "More in Singapore aware of climate change, and willing to bear costs and inconvenience to safeguard planet", *The Straits Times*, available at: https://www.straitstimes.com/singapore/environment/more-in-singapore-aware-of-climate-change-and-are-willing-to-bear-costs-and (accessed 22 July 2022).

Tan, A. (2021), "Singapore plans to import 30% of energy from low-carbon sources by 2035", *The Straits Times*, available at: https://www.straitstimes.com/singapore/environment/singapore-plans-to-import-30-of-energy-from-low-carbon-sources-by-2035 (accessed 11 July 2022).

Tan, C. (2017), "Young Singaporeans still aspire to own a car", *Torque*, available at: https://www.torque.com.sg/features/young-singaporeans-still-aspire-car/ (accessed 26 November 2021).

Tan, K.P. (2012), "The Ideology of Pragmatism: Neo-liberal Globalisation and Political Authoritarianism in Singapore", *Article in Journal of Contemporary Asia*, available at:https://doi.org/10.1080/00472336.2012.634644.

Tee, K. (2021), "Commentary: Cycling great for going green but is still a pain in urban Singapore", *CNA*, available at: https://www.channelnewsasia.com/commentary/cycling-singapore-park-connector-routes-path-road-rules-635311 (accessed 23 June 2022).

Tschiesner, A., Heuss, R., Hensley, R., Wu, T., Schaufuss, P., Hertzke, P., Knupfer, S.M., *et al*. (2020), "The road ahead for e-mobility", *McKinsey & Company*, available at: https://www.mckinsey.com/~/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/the%20road%20ahead%20for%20e%20mobility/the-road-ahead-for-e-mobility-vf.pdf (accessed 21 June 2022).

Tvinnereim, E. and Ferguson-Cradler, G. (2020), "Electric vehicles from novelty to controversy: Analyzing environmental and fairness claims in open-ended survey questions", *Comparative Politics*, 28 September, available at:https://doi.org/10.33774/APSA-2020-6S44W.

Tzventarny, J. (2014), "Enabling Electric Vehicle charging in condominiums", *Plug'n Drive & Canadian Condominium Institute-Toronto*, available at: (accessed 27 July 2022).

Urban Mobility Index. (2021), "Urban Mobility Index - Singapore", *Urban Mobility Index*, available at: https://urbanmobilityindex.here.com/city/singapore (accessed 20 November 2021).

Urry, J. (2016), "The 'System' of Automobility:", *Theory, Culture & Society*, SAGELondon, Thousand Oaks and New Delhi, Vol. 21 No. 5, pp. 25–39.

Vafaei-Zadeh, A., Wong, T.K., Hanifah, H., Teoh, A.P. and Nawaser, K. (2022), "Modelling electric vehicle purchase intention among generation Y consumers in Malaysia", *Research in Transportation Business & Management*, Elsevier, p. 100784.

Van, H.T., Choocharukul, K. and Fujii, S. (2014), "The effect of attitudes toward cars and public transportation on behavioral intention in commuting mode choice—A comparison across six Asian countries", *Transportation Research Part A: Policy and Practice*, Pergamon, Vol. 69, pp. 36–44.

Vandecasteele, B. and Geuens, M. (2010), "Motivated Consumer Innovativeness: Concept, measurement, and validation", *International Journal of Research in Marketing*, North-Holland, Vol. 27 No. 4, pp. 308–318.

Wang, P., Deng, X., Zhou, H. and Yu, S. (2019), "Estimates of the social cost of carbon: A review based on meta-analysis", *Journal of Cleaner Production*, Elsevier, Vol. 209, pp. 1494–1507.

Wang, S., Fan, J., Zhao, D., Yang, S. and Fu, Y. (2016), "Predicting consumers' intention to adopt hybrid electric vehicles: using an extended version of the theory of planned behavior model", *Transportation*, Springer New York LLC, Vol. 43 No. 1, pp. 123–143.

Wappelhorst, S. (2021), "Update on government targets for phasing out new sales of internal combustion engine passenger cars", *International Council on Clean Transportation*, available at: https://theicct.org/sites/default/files/publications/update-govt-targets-ice-phaseouts-jun2021_0.pdf (accessed 14 May 2022).

Warren, T. (2017), "Tesla Model S P100D review: the ultimate status symbol of California cool", *The Verge*, available at: https://www.theverge.com/2017/9/8/16235524/tesla-model-s-review-p100d-2017-electric-car (accessed 11 May 2022).

Weida, L. (2009), "Climate Change Policies in Singapore: Whose 'Environments' Are We Talking About?", *Environmental Justice*, Mary Ann Liebert, Inc. 140 Huguenot Street, 3rd Floor New Rochelle, NY 10801 USA , Vol. 2 No. 2, pp. 79–83.

Wicki, M., Brückmann, G., Quoss, F. and Bernauer, T. (2022), "What do we really know about the acceptance of battery electric vehicles?–Turns out, not much", *Transport Reviews*, Routledge, available at:https://doi.org/10.1080/01441647.2021.2023693/SUPPL_FILE/TTRV_A_2023693_SM7751.ZIP.

Wikimedia Commons. (2021), "File:Singapore MRT Network.svg - Wikipedia", *Wikimedia Commons*, available at: https://en.m.wikipedia.org/wiki/File:Singapore_MRT_Network.svg (accessed 25 June 2022).

Wildermuth, B. (2016), "Land Transport Policy: Urban Infrastructure in Singapore and Switzerland", in Guo, Y. and Woo, J.J. (Eds.), *Singapore and Switzerland*, World Scientific, pp. 97–111.

Yao, S. (1996), "Consumption and Social Aspirations of the Middle Class in Singapore", *Southeast Asian Affairs*, Vol. 1996, pp. 337–354.

Ye, R. and Titheridge, H. (2017), "Satisfaction with the commute: The role of travel mode choice, built environment and attitudes", *Transportation Research Part D: Transport and Environment*, Elsevier Ltd, Vol. 52, pp. 535–547.

Yuen, K.H. (2018), “Cost-effectiveness analysis of electric vehicles in Singapore”, *The Singapore Economic Review*, World Scientific Publishing Company , Vol. 63 No. 2, pp. 313–338.

Zap Map. (2022), “How many electric cars are there in the UK 2022 - Zap-Map”, *Zap Map*, available at: https://www.zap-map.com/ev-market-statistics/ (accessed 10 May 2022).

12. Appendix 1: Question guide used for the interview with the transport consultant (RQ1)

i. Why do you think the government's attitude towards EVs has changed so radically in the last 2 years, where there is now a big push towards adoption?
    a. Especially since studies and trials of EVs in Singapore from the early 2010s showed that EVs were not cost effective compared to conventional cars.
    b. Do you think this was influenced by the realisation that the mass adoption of EVs were inevitable given global trends, so the government better do something about it?
    c. Do you think EVs are being promoted by the government for reasons other than their environmental benefit?

ii. How strong do you think the symbolism of EVs are in Singapore? Do you observe whether this is due primarily for social status, to signal environmental awareness, or other reasons like to signal innovativeness of the user?

iii. Do you think the greater prevalence of EVs on our roads will lead to more Singaporeans aspiring to be car owners? For example, acting as the decisive factor which converts public transport users into car owners.

iv. Do you think the issue of insufficient charging points in high rise residential buildings can ever be satisfactorily solved, and if not, does this risk creating a chasm between transport options for those that stay in landed properties versus high rise apartments?

v. Do you think the government's commitment to phase out ICE by 2040 is realistic given the current trajectory of developments? Or does it seem more like a symbolic target?

vi. Do you think the current approach towards car ownership, both for conventional cars and EVs needs tweaking?

13. Appendix 2: Question guide used for the interview (RQ2&3)

Introductory message: Thank you for consenting to be part of this interview. The interview explores your experiences and thoughts about transport in Singapore. There are no right or wrong answers as the study is interested in your opinions on this topic. Lastly, the session will be audio recorded and used for the purpose of this study only and all data used will be anonymised. If you do not have any questions we can begin.

Part 1: Attitudes towards various modes

i. What is your most frequent mode of transport used for commuting to work/school?
    a. What do you like and not like about it?
    b. How about for non-work trips, do you regularly use a different mode of transport?
ii. What about a mode that you do not use often like public transport/the car
    a. What do you like and not like about it?
iii. When choosing which mode of transport to use, what factors influence your decision? Why are they important to you?

Part 2: Attitudes towards BEVs

i. Have you been in a fully electric car before or seen fully electric cars on the road in Singapore?
ii. What is the first thing that comes to mind when you see a fully electric car on the road or read about it?
iii. Do you think car ownership in Singapore, whether conventional or electric is affordable, and do you think it should be made more or less affordable?
iv. What would you consider as affordable?
v. Do you plan to purchase a car in the future? Why or why not?
    a. If so, what would be some key considerations over what car to purchase?
vi. *[If the respondent plans to purchase a car]* Assuming you can afford a car, do you think there is an expectation among people close to you that you will get an electric car? Why?
vii. *[If the respondent does not plan to purchase a car]* If someone close to you, say a family member or close friend planned to buy a car, do you expect that they purchase an electric car?
viii. What do you think and electric car says about its user?
ix. Do you think the government should be doing more to promote electric cars?
x. Do you think electric cars are a sustainable way to travel in Singapore?

Part 3: Additional questions about transport in Singapore

i. Do you think the current system for car ownership needs tweaking?
    a. In your opinion what should be tweaked and how?
ii. If it were up to you, what would you do different to the existing transportation system? Why would you propose these?

14. Appendix 3: Information sheet provided to participants

Bartlett School of Planning, University College London

Information for participants

Thank you for considering participating in this interview. This information sheet outlines the purpose of the study and provides a description of your involvement and rights as a participant, if you agree to take part.

1. What is the research about?
The research investigates people's attitudes towards various transport modes in Singapore including public transport, conventional cars, and electric vehicles.

2. Do I have to take part?
It is up to you to decide whether or not to take part. You do not have to take part if you do not want to. By continuing with the interview, your agreement is assumed to have been obtained.

3. What will my involvement be?
You will be asked questions concerning various transport modes in Singapore and socio demographic details.

4. How do I withdraw from the study?
You can withdraw at any point of the study, without having to give a reason. If any questions during the interview make you feel uncomfortable, you do not have to answer them. Withdrawing from the study will have no effect on you. If you withdraw from the study, we will not retain the information you have given thus far, unless you are happy for us to do so.

5. What will my information be used for?
I will use the collected information for my master's dissertation.

6. Will my taking part and my data be kept confidential? Will it be anonymised?
The records from this study will be kept as confidential as possible. Only myself and my supervisor will have access to the files and any audio recordings. Your data will be anonymised – your name will not be used in any reports or publications resulting from the study. All digital files, transcripts and summaries will be given codes and stored separately from any names or other direct identification of participants.

7. What if I have a question or complaint?
If you have any questions regarding this study please contact the researcher [REDACTED] at [REDACTED]@ucl.ac.uk

15. Approved Risk Assessment Form

RISK ASSESSMENT FORM

FIELD / LOCATION WORK

DEPARTMENT/SECTION: BARTLETT SCHOOL OF PLANNING

LOCATION(S): LONDON, UNITED KINGDOM

PERSONS COVERED BY THE RISK ASSESSMENT: [REDACTED]

BRIEF DESCRIPTION OF FIELDWORK (including geographic location):

1. SEMI-STRUCTURED INTERVIEWS ON ATTITUDES TOWARDS TRANSPORT MODES IN SINGAPORE FOLLOWED BY A QUESTIONNAIRE TO RECORD DEMOGRAPHIC DATA (BOTH CONDUCTED REMOTELY VIA ZOOM).

2. CONTENT ANALYSIS OF GOVERNMENT DOCUMENTS, SPEECHES, AND POLITICIANS' STATEMENTS.

COVID-19 RELATED GENERIC RISK ASSESSMENT STATEMENT:

Coronavirus disease (COVID-19) is an infectious disease caused by coronavirus SARS-CoV-2. The virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Droplets fall on people in the vicinity and can be directly inhaled or picked up on the hands and transferred when someone touches their face. This risk assessment documents key risks associated fieldwork during a pandemic, but it is not exhaustive and will not be able to cover all known risks, globally. This assessment outlines principles adopted by UCL at an institutional level and it is necessarily general. Please use the open text box 'Other' to indicate any contingent risk factors and control measures you might encounter during the course of your dissertation research and writing.

Please refer to the Dissertation in Planning Guidance Document (available on Moodle) to help you complete this form.

Hazard 1: Risk of Covid -19 infection during research related travel and research related interactions with others (when face-to-face is possible and/or unavoidable)

Risk Level - NONE

Existing Advisable Control Measures: Do not travel if you are unwell, particularly if you have COVID-19 symptoms. Self-isolate in line with NHS (or country-specific) guidance.

Avoid travelling and face-to-face interactions; if you need to travel and meet with others:

- If possible, avoid using public transport and cycle or walk instead.

- If you need to use public transport travel in off-peak times and follow transport provider's and governmental guidelines.
- Maintain (2 metre) social distancing where possible and where 2 metre social distancing is not achievable, wear face covering.
- Wear face covering at all times in enclosed or indoor spaces.
- Use hand sanitiser prior to and after journey.
- Avoid consuming food or drinks, if possible, during journey.
- Avoid, if possible, interchanges when travelling - choose direct route.
- Face away from other persons. If you have to face a person ensure
that the duration is as short as possible.
- Do not share any items i.e. stationary, tablets, laptops etc. If items need to be shared use disinfectant wipes to disinfect items prior to and after sharing.
- If meeting in a group for research purposes ensure you are following current country specific guidance on face-to-face meetings (i.e rule of 6 etc.)
- If and when possible meet outside and when not possible meet in venues with good ventilation (e.g. open a window)
- If you feel unwell during or after a meeting with others, inform others you have interacted with, self-isolate and get tested for Covid-19
- Avoid high noise areas as this mean the need to shout which increases risk of aerosol transmission
of the virus.
- Follow one way circulation systems, if in place. Make sure to check before you visit a building.
- Always read and follow the visitors policy for the organisation you will be visiting.
- Flush toilets with toilet lid closed.
-'Other' Control Measures you will take (specify):

NOTE: The hazards and existing control measures above pertain to Covid-19 infection risks only. More generalised health and safety risk may exist due to remote field work activities and these are outlined in your Dissertation in Planning Guidance document. Please consider these as possible 'risk' factors in completing the remainder of this standard form. For more information also see: Guidance Framework for Fieldwork in Taught and MRes Programmes, 2021-22

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? LOW

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	work abroad incorporates Foreign Office advice
	only accredited centres are used for rural field work
X	participants will wear appropriate clothing and footwear for the specified environment
X	refuge is available
	work in outside organisations is subject to their having satisfactory H&S procedures in place
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Interviews will be conducted remotely via Zoom, so participants are likely to be in a familiar environment.

EMERGENCIES	Where emergencies may arise use space below to identify and assess any risks
e.g. fire, accidents	Examples of risk: loss of property, loss of life

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
X	contact numbers for emergency services are known to all participants
X	participants have means of contacting emergency services
	a plan for rescue has been formulated, all parties understand the procedure
	the plan for rescue /emergency has a reciprocal element
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Interviews will be conducted remotely via Zoom, so participants are likely to be in a familiar environment.

FIELDWORK	**1**	May 2010

EQUIPMENT	Is equipment used?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	the departmental written Arrangement for equipment is followed
	participants have been provided with any necessary equipment appropriate for the work
	all equipment has been inspected, before issue, by a competent person
	all users have been advised of correct use
	special equipment is only issued to persons trained in its use by a competent person
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	YES	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation *lone interviews.*	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	the departmental written Arrangement for lone/out of hours working for field work is followed
	lone or isolated working is not allowed
	location, route and expected time of return of lone workers is logged daily before work commences
X	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
	all workers are fully familiar with emergency procedures
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Interviews will be conducted remotely via Zoom, so participants are likely to be in a familiar environment.

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, *personal attack, special personal considerations or vulnerabilities.*	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? LOW

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	all participants have had the necessary inoculations/ carry appropriate prophylactics
X	participants have been advised of the physical demands of the research and are deemed to be physically suited
X	participants have been adequate advice on harmful plants, animals and substances they may encounter
	participants who require medication should carry sufficient medication for their needs
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Interviews will be conducted remotely via Zoom, so participants are likely to be in a familiar environment. There will be no physical activity involved.

TRANSPORT	Will transport be required	NO	X	Move to next hazard
		YES		Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low?			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	only public transport will be used
	the vehicle will be hired from a reputable supplier
	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	**Will people be dealing with public**	**YES**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
X	all participants are trained in interviewing techniques
	advice and support from local groups has been sought
X	participants do not wear clothes that might cause offence or attract unwanted attention
X	interviews are conducted at neutral locations or where neither party could be at risk
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Interviews will be conducted remotely via Zoom, so participants are likely to be in a familiar environment.

WORKING ON OR NEAR WATER	Will people work on or near water?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	lone working on or near water will not be allowed
	coastguard information is understood; all work takes place outside those times when tides could prove a threat
	all participants are competent swimmers
	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
	boat is operated by a competent person
	all boats are equipped with an alternative means of propulsion e.g. oars
	participants have received any appropriate inoculations
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	the departmental written Arrangement for MH is followed
	the supervisor has attended a MH risk assessment course
	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
	all persons performing MH tasks are adequately trained
	equipment components will be assembled on site
	any MH task outside the competence of staff will be done by contractors
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	the departmental written Arrangements for dealing with hazardous substances and waste are followed
	all participants are given information, training and protective equipment for hazardous substances they may encounter
	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
	waste is disposed of in a responsible manner
	suitable containers are provided for hazardous waste
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	**Have you identified any other hazards?**	**NO**	**If 'No' move to next section** **If 'Yes' use space below to identify and assess any risks**
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		
CONTROL MEASURES	**Give details of control measures in place to control the identified risks**		
Have you identified any risks that are not adequately controlled?	**NO**	**X**	**Move to Declaration**
	YES		**Use space below to identify the risk and what action was taken**

DECLARATION	The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.	
	Select the appropriate statement:	
X	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk	
	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above	

NAME OF SUPERVISOR

DR JONAS DE VOS

FIELDWORK	**5**	May 2010

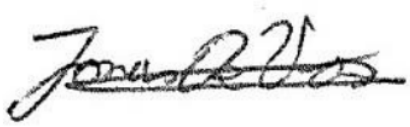
Supervisor sign-off for Ethical Clearance Forms and Risk Assessment Forms

Are you satisfied with the **ethical clearance form** (*yes*/*no*)?

Please provide any additional comments about the form that may help the student. ***(If the form is missing, the proposal must be given a mark of 0, and the student will have 48hours to resubmit the complete proposal. If the form is unsatisfactory, the student must amend their ethical questionnaire to your satisfaction before they can proceed with their research)*** ***Yes***

Are you satisfied with the **risk assessment form** (*yes*/*no*)?

Please provide any additional comments about the form that may help the student. ***(If the form is missing, the proposal must be given a mark of 0, and the student will have 48hours to resubmit the complete proposal. If the form is unsatisfactory, the student must amend their ethical questionnaire to your satisfaction before they can proceed with their research)*** ***Yes***



16. Ethical Clearance Questionnaire

Ethical Clearance Pro Forma

It is important for you to include all relevant information about your research in this form, so that your supervisor can give you the best advice on how to proceed with your research.

You are advised to read though the relevant sections of UCL's Research Integrity guidance to learn more about your ethical obligations.

Please ensure to save a copy of your completed questionnaire BEFORE hitting 'submit' (you will not be able to access it later).

Submission Details

1 * Please select your programme of study.

Transport and City Planning : Transport and City Planning

2 * Please indicate the type of research work you are doing.

- [x] Dissertation in Planning (MSc)
- [ ] Dissertation in City Planning (MPlan)
- [ ] Major Research Project

3 * Please provide the current working title of your research.

A sustainable rEVolution? Examining the political framing of Battery Electric Vehicles (BEVs) and how BEVs affect Generation Y's attitudes towards transport in Singapore

4 * Please select your supervisor from the drop-down list.

De Vos, Jonas : De Vos, Jonas

Research Details

5 * Please indicate here which data collection methods you expect to use. Tick all that apply.

- [x] Interviews
- [ ] Focus Groups
- [x] Questionnaires (including oral questions)
- [ ] Action research
- [ ] Observation / participant observation
- [ ] Documentary analysis (including use of personal records)
- [ ] Audio-visual recordings (including photographs)
- [ ] Collection/use of sensor or locational data
- [ ] Controlled trial
- [ ] Intervention study (including changing environments)
- [ ] Systematic review
- [x] Secondary data analysis
- [ ] Advisory/consultation groups

6 * Please indicate where your research will take place.

Overseas only : Overseas only

7 * Does your project involve the recruitment of participants?

'Participants' means human participants and their data (including sensor/locational data and observational notes/images.)

(•) Yes ( ) No

Appropriate Safeguard, Data Storage and Security

8 * Will your research involve the collection and/or use of personal data?

Personal data is data which relates to a living individual who can be identified from that data or from the data and other information that is either currently held, or will be held by the data controller (you, as the researcher).

This includes:

- Any expression of opinion about the individual and any intentions of the data controller or any other person toward the individual.
- Sensor, location or visual data which may reveal information that enables the identification of a face, address etc. (some postcodes cover only one property).
- Combinations of data which may reveal identifiable data, such as names, email/postal addresses, date of birth, ethnicity, descriptions of health diagnosis or conditions, computer IP address (of relating to a device with a single user).

○ Yes ◉ No

9 * Is your research using or collecting:

- special category data as defined by the General Data Protection Regulation*, and/or
- data which might be considered sensitive in some countries, cultures or contexts?

*Examples of special category data are data:

- which reveals racial or ethnic origin, political opinions, religious or philosophical beliefs, trade union membership;
- concerning health (the physical or mental health of a person, including the provision of health care services);
- concerning sex life or sexual orientation;
- genetic or biometric data processed to uniquely identify a natural person.

○ Yes ◉ No

10 * Do you confirm that all personal data will be stored and processed in compliance with the General Data Protection Regulation (GDPR 2018)?

◉ Yes
○ No
○ I will not be working with any personal data

11 * I confirm that:

☑ The information in this form is accurate to the best of my knowledge.
☑ I will continue to reflect on, and update these ethical considerations in consultation with my supervisor.

You **MUST** download a copy of your responses to submit with your proposal, and for your own reference.

To do this, use the print screen function of your web browser, and print to PDF in order to save.

BPLN0039_SJQR9

GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

PAGE 38

PAGE 39

PAGE 40

PAGE 41

PAGE 42

PAGE 43

PAGE 44

PAGE 45

PAGE 46

PAGE 47

PAGE 48

PAGE 49

PAGE 50

PAGE 51

PAGE 52

PAGE 53

PAGE 54

PAGE 55

PAGE 56

PAGE 57

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

PAGE 63

PAGE 64

PAGE 65

PAGE 66

PAGE 67

PAGE 68

PAGE 69

PAGE 70

PAGE 71

PAGE 72