The Feedback Loop between Policy Perceptions and Perceived Individual Capability Sets

Policies Promoting Electric Vehicle use in the context of Utrecht and the Netherlands

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Master Thesis Human Geography

Photo by author in the Keistraat in Utrecht

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1. Abstract

The shift towards electric vehicles (EVs) is an important part of the transition towards sustainable mobility. To ensure everyone has the opportunity to participate in the shift to EVs equality of opportunity is needed. This can be obtained through effective and inclusive transport policies. For policies to be able to provide equality of opportunity a focus on individual perceptions is needed, as these have an important role in determining policy outcomes. These perceptions are influenced by an individual's perception of their personal circumstances – their perceived capability sets. To date, there is a lack of knowledge on the perceptions of individuals regarding equity outcomes of policies promoting EV use and the role of perceived capability sets herein. Within this research, the role of perceived capability sets in individual perceptions of policies promoting EV use and its equity implications is investigated through 25 qualitative semi-structured interviews. The results showed that policies function as a social conversion factor influencing individuals' perceived capability of EV adoption. These policies are perceived to mainly benefit higher socio-economic groups in favourable economic positions and living in affluent neighbourhoods. As the policies do not enhance equality of opportunity for all makes the current policies serve as an in- and exclusion mechanism.

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2. Introduction

In the current day and age, combatting climate change and reducing greenhouse gas (GHG)[1] emissions is seen as a global priority (Tarei et al., 2021). Due to a share of up to one-fifth of road transportation in global GHG emissions and the expected rise in transportation demand of up to 50% in 2030, governments are seeking sustainable alternatives to 'conventional' vehicles with internal combustion engines (ICEVs) (Egbue & Long, 2012; Haider et al., 2019; ITF, 2019; Ritchie, 2022). Sustainable alternatives include a shift towards sustainable private car alternatives (such as public transport, active transport and shared (micro)mobility), shifting towards cleaner vehicles such as electric vehicles (EVs) and moving towards a low mobility society through reducing mobility demands (Griffiths et al., 2021; Holden et al., 2020).

The shift to EVs has been one of the dominant narratives within the sustainable mobility transition and has been accumulating a lot of policy attention (Griffiths et al., 2021). EVs are popular as, besides the reduced GHG emissions, EVs are also seen as a catalyst in reducing fossil fuel dependency and noise pollution compared to ICEVs (Carlton & Sultana, 2022; Goel et al., 2021). Due to the wide array of benefits as well as the presence of advanced technological possibilities for large-scale uptake of EVs, many governments worldwide are promoting the use of this mode (Carlton & Sultana, 2022; Ferloni, 2022; Tarei et al., 2021). This is for example seen in policy proposals of banning the sale of new petrol and diesel cars in the European Union (EU) by 2035 to promote EV uptake (European Parliament, 2022).

To effectively reduce negative environmental impacts through the shift to EVs, it is crucial that everyone has the opportunity to participate in this shift regardless of their socioeconomic status, demographic characteristics, or geographical location (Gallez & Motte-Baumvol, 2017). Public policies have the role to provide this equality of opportunity, which results in the need to implement effective and inclusive transport policies (Gallez & Motte-Baumvol, 2017; Randal et al., 2020).

Focusing on the individual's perceptions of this equality of opportunity provided by policies to participate in the shift to EVs is highly important. This is due to perceptions having an important role in determining policy outcomes (Swinkels, 2020). It is seen that perceptions act as a way of making sense of the world, a 'coloured lens' to evaluate information (Swinkels, 2020). This, in turn, influences individual's decision-making and eventually what they end up being or doing (Vecchio & Martens, 2021). Arguably, these perceptions are influenced by an individual's perception of their personal circumstances – their perceived capability sets- or in other words, what people perceive themselves as able to be or do (Vecchio & Martens, 2021). Understanding how individuals perceive the policies promoting EV use in relation to their capabilities allows shedding light on the role of policies in providing equality of opportunities among several socioeconomic and demographic groups (Randal et al., 2020). Policy-makers can use these insights to improve and design policies that ensure equality of opportunity, in this case for adopting an EV (Randal et al., 2020).

To date, there is a lack of knowledge on the perceptions of individuals regarding equity outcomes of policies promoting EV use and the role of perceived capability sets herein. This is due to various reasons. First, equity implications of the transition towards sustainable mobility have received relatively less attention within academic literature overall as mobility studies have often focused on efficiency, economic- and environmental impacts and social acceptance (Martens, 2016). Furthermore, the studies conducted on the equity implications of transitioning to EV mostly have a top-down, more quantitative, approach (Martens, 2016). These studies are beneficial for identifying groups and

[1] For an overview of all abbreviations within this paper see Appendix A

populations experiencing inequality of opportunity but are not as suitable to fully comprehend the origins of this inequality (Martens, 2016; Vecchio & Martens, 2021). The findings of these top-down studies could be enhanced through a bottom-up and qualitative approach accounting for individuals' experiences and perceptions (Martens, 2016; Vecchio & Martens, 2021). Lastly, there is a lack of (qualitative) focus on assessing the explicit role of policy perceptions and their equity implications in current literature, despite the crucial role of policies in obtaining equitable outcomes (Kester et al., 2018; Randal et al., 2020; Xiong & Wang, 2020).

These gaps will be addressed within this study by aiming to investigate the role of perceived capability sets in individual's perceptions of policies promoting EV use and its equity implications in the following research question:

How are the policies promoting EV adoption perceived by individuals according to their capabilities set and how does this impact their perceived capability of adoption?

The research question will be answered with the help of the following sub-questions:

- What are the key factors influencing individuals' perceptions of policies promoting EV use in relation to their capability set?
- How does the perception of policy relevance differ among different socioeconomic groups based on their capability set?
- How does the perception of policy relevance differ among EV user and non-user groups?

For answering these research questions, a qualitative method is implemented as this study focuses on understanding individual perceptions of policies promoting EV use in relation to individual's perceived capability sets for EV use for daily mobility. Semi-structured interviews will be conducted with individuals in different income groups and containing both users and non-users of EV.

The research takes place within the context of the city of Utrecht – a middle-sized city in the Netherlands. The Dutch context, and Utrecht specifically, provide a valuable research context as the Netherlands is one of the frontrunners in the EV transition and has well-established charging infrastructure and policies promoting EV use in place (Rijksdienst voor Ondernemend Nederland, 2022; Vermeulen et al., 2019). In addition, Utrecht is the national central mobility hub and is actively trying to promote this transition to EVs in an accessible manner, with several policies already in place (Municipality of Utrecht, n.d.).[2]

[2] The policies promoting EV use in both the national and local context of respectively the Netherlands and Utrecht can be found in detail in Appendix D.

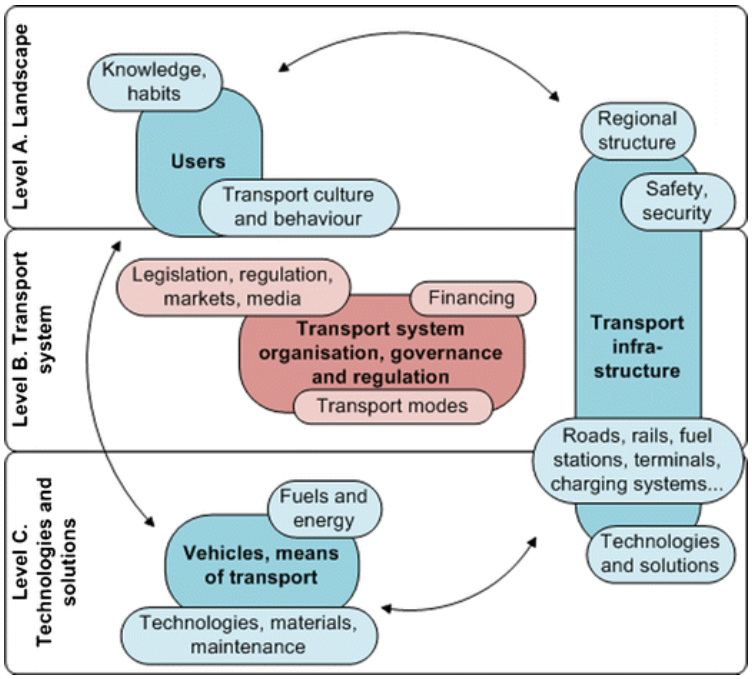
3. Theoretical framework

3.1 Transport as a socio-technical system and equity

Transport has a profound societal impact as it connects people, goods and services. Transport systems allow individuals to participate in society and access opportunities and essential services such as education, employment and healthcare (De Vos et al., 2013).

This societal impact comes out of the functioning of the transport system, which can be seen as a complex socio-technical system where social and technological factors interact in various ways (Dingil et al., 2021). The key factors in this system are the physical transport infrastructure, vehicles, users and transport governance, which all interact and are influenced by technological, social, economic, political, legal and environmental dimensions (Auvinen & Tuominen, 2014). For instance, which transport infrastructures are prioritised is influenced by political dimensions and economic considerations. The socio-technical system of transport can be depicted as follows:

Figure 1: Transport as a socio-technical system depicted by (Auvinen & Tuominen, 2014)



It should be noted that the interactions presented in the figure may not affect all individuals in the same manner. For example, individuals with greater socio-economic status are likely to have a larger selection of vehicle options at their disposal, or transportation infrastructure may be more widespread in urban regions than in rural areas (Knowles, 2006). Thus, both positive and negative impacts of the socio-technical system of transport are not divided equally across the population (Beyazit, 2011; Randal et al., 2020). Only select groups are seen to benefit from the transport system, while the most vulnerable groups have to bear the most extensive burdens (Gössling, 2016; Randal et al., 2020). These differences in benefits are problematic from an equity point of view, as this unequal division of advantages and disadvantages of the transport system leads to unfair access to opportunities and resources (Cao & Hickman, 2019).

The unequal allocation of benefits and burdens within the transportation system emerges as a prominent subject of concern within the discourse on transport justice (Karner et al., 2020). Transport justice can be described as *"a normative condition in which no person or group is disadvantaged by lack of access to the opportunities they need to lead a meaningful and dignified life"* (Karner et al., 2020, p. 440). The normative condition requires obtaining an equitable distribution of the positive and negative impacts of the transport system, implementing fair transport planning processes, and respecting the diversity of needs of the individuals who are affected by the policymaking in the transport planning process (Karner et al., 2020; Sovacool et al., 2019; Verlinghieri & Schwanen, 2020). Obtaining this condition calls for addressing the underlying structures and processes responsible for the inequitable distribution (Karner et al., 2020).

3.2 The Capabilities Approach (CA)

To obtain a more comprehensive understanding of the underlying structures and processes contributing to the inequitable distribution of outcomes within the transport system the Capabilities Approach (CA) of Sen and Nussbaum can be employed (Nussbaum, 2006; Nussbaum & Sen, 1993; Sen, 1985; Verlinghieri & Schwanen, 2020). The CA is a normative justice theory which assesses social justice with an emphasis on individuals' freedoms and opportunities to achieve what they have reason to value. Rather than focusing exclusively on material resources or outcomes, the CA looks at the range of possible beings and doings individuals can achieve (Martinez & Keseru, 2023; Vecchio & Martens, 2021). This approach helps to inform why certain people have certain opportunities available while others do not, even when people have the same resources available (Vecchio & Martens, 2021).

The CA has mainly emerged due to criticism of Sen towards other distributive justice theories, such as utilitarianism and Rawls' egalitarianism (Beyazit, 2011; Nahmias-Biran et al., 2017; Pereira et al., 2017). According to Sen, these other theories are too focused on aggregate well-being and therefore overlook the freedoms and rights of people as well as that they focus too much on resources (*"fetishism"*) as a way to obtain advantage (Beyazit, 2011).

As an alternative Sen developed the CA which tackles many criticisms of previous justice theories by accounting for the heterogenous needs, abilities and preferences of individuals (Beyazit, 2011; Martinez & Keseru, 2023). The CA focuses on capabilities, which are the opportunities or freedoms available to individuals to live their lives in a way that is meaningful to them (Randal et al., 2020; Vecchio & Martens, 2021). These capabilities are also referred to as capability set or opportunity set and could be seen to lie in between resources and welfare (Meijering et al., 2019; Nahmias-Biran et al., 2017).

The capabilities available to individuals are dependent on their resources and the extent to which they can transform these resources into capabilities and ultimately functionings, which are shaped by conversion factors- commonly known as one's personal context (Hvinden & Halvorsen, 2018; Nahmias-Biran & Shiftan, 2020). These conversion factors comprise three distinct types: personal, social and environmental conversion factors. Personal conversion factors are internal to an individual, and for example refer to someone's age, gender, intelligence, physical ability, safety concerns etc. (Meijering et al., 2019; Vecchio & Martens, 2021). Social conversion factors relate to the society an individual is living in and include social norms, policies and power relations (Meijering et al., 2019). Lastly, environmental conversion factors relate to one's built environment, for example, the location where one lives, the climate and the charging infrastructure available (Hvinden & Halvorsen, 2018; Meijering et al., 2019).

Capabilities could be seen as a complex concept composed of resource availability, conversion factors, and individual and social attributes which form the basis of an individual's functionings (Nahmias-Biran & Shiftan, 2020; Vecchio & Martens, 2021). Functionings refer to what individuals ultimately achieve to be or do; they are an individual's actualised capabilities (Vecchio & Martens, 2021). Which capabilities are actualised depends on an individual's agency, which is influenced by personal preferences, social factors and past experiences (Beyazit, 2011). While some argue that functionings are most important in the CA as they represent what people achieve to be and do, capabilities can be considered more important for justice as they reflect an individual's freedom of choice (Jansen & Verharen, 2017).

3.2.1 The Capabilities Approach in Transport

The CA could be employed in several ways to assess transport, such as defining capabilities in the transport context (Randal et al., 2020). There are two general approaches which could currently be considered dominant within the application of the CA within the transportation context: mobility as a capability and accessibility as a capability (Vecchio & Martens, 2021).

Mobility as a capability refers to the ability to physically, socially, and financially move from one place to another and to interact within society, which is a crucial prerequisite to acquiring other capabilities (Luz & Portugal, 2022; Vecchio & Martens, 2021). Having the possibility to be mobile- closely connected to the concept of motility- can for example already contribute to well-being, even when the mobility is not realised by the individual (Flamm & Kaufmann, 2006; Shliselberg & Givoni, 2018; Vecchio & Martens, 2021).

Accessibility as a capability focuses on whether individuals can reach and participate in activities that are valuable to them (Vecchio & Martens, 2021). This approach centres on whether individuals are able to transform resources into meaningful activities (Vecchio & Martens, 2021). Accessibility as a capability is also a prerequisite for other capabilities, such as accessing schools which is important for obtaining an education (Terzi, 2004; Vecchio & Martens, 2021).

3.2.2 Transport policy as a social conversion factor

The aforementioned approaches of mobility as a capability and accessibility as a capability have been frequently employed in current research, but recently these approaches have received criticism from Randal et al. (2020). Randal et al. (2020) view the aforementioned approaches as limited in comprehending the impacts of the transport system on individuals. In their view, these approaches tend to have a too narrow focus on one capability and thus lose attention to other (in)direct impacts of the transport system, such as environmental or well-being impacts (Randal et al., 2020). As an alternative, they present a fairly new approach to transport within the CA: applying the lens of transport policy as a social conversion factor (Randal et al., 2020).

According to Randal et al. (2020), this focus on conversion factors instead on specific capabilities is important, as these include all the structural effects which either enhance or diminish capabilities. The conversion factors could thus be understood as the location of the mechanisms causing social inequalities (Goerne, 2010). Public policy, also a social conversion factor, has the role to address these inequalities by diminishing the impacts of the conversion factors which limit capabilities (Randal et al., 2020). For instance, policies which lower the costs of public transport and thus make the use of this mode more accessible.

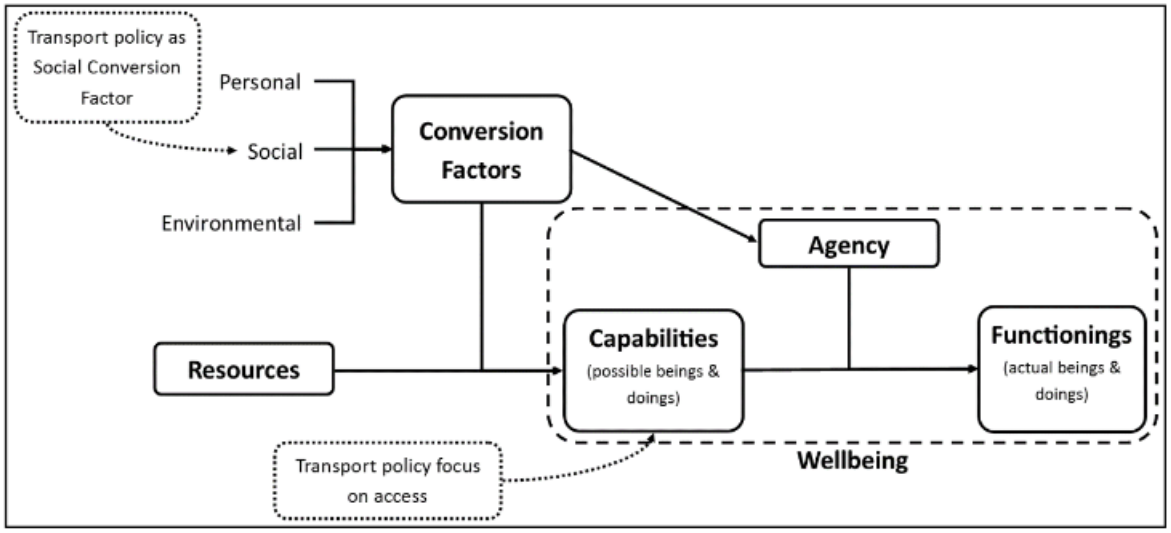
These public policies aim to enhance capabilities indirectly by influencing the effects of conversion factors influencing capabilities (Randal et al., 2020; Vecchio & Martens, 2021). However, these policies also have the potential to directly influence capabilities themselves (Randal et al., 2020; Vecchio & Martens, 2021). It could, for instance, be seen that varying degrees of accessibility to these policies

exist, such as policies applying to certain areas or groups only (e.g. lowered costs of public transport being available only for the elderly and students) (Hvinden & Halvorsen, 2018; Yerkes et al., 2019). Moreover, awareness of policy options and an understanding of the policy process also influence the accessibility of policies (Yerkes et al., 2019). As a result of such a process of inclusion and exclusion, policies themselves can also be seen to be a source of inequality, as they do not provide equal access to capabilities (Yerkes et al., 2019).

In the context of transport, turning attention towards the role of transport policy as a conversion factor allows to see how these policies can either promote or limit capabilities (Randal et al., 2020; Vecchio & Martens, 2021). This allows a broader view of transport, which in turn guides achieving equity and well-being for policymakers (Randal et al., 2020). The focus on transport policy is especially important as transport planning is a political process (Martens, 2016). Transport policies affect different individuals in various ways as a result of inevitable trade-offs, e.g. balancing the environmental, economic and equity impact of policies. However, this political character of transport policy is often overlooked and therefore not recognised (Martens, 2016; Remme et al., 2022).

This approach could be visualised as follows:

Figure 2: Transport policy as a social conversion factor, depicted by (Randal et al., 2020):



Within this approach, it is also recognised that the aim should lie on capabilities rather than functionings, as policies should promote the equality of opportunity rather than the equality of outcomes (Randal et al., 2020).

3.3 Electric Vehicle use and equity

Within transport policy, the transition to EVs has received increased attention due to the need for cleaner transport in the face of climate change (Berkeley et al., 2017). Examples of such policies include financial incentives and subsidies, traffic regulations, the deployment of charging infrastructure, and awareness campaigns (Caulfield et al., 2022; Egbue & Long, 2012; Rietmann & Lieven, 2019).

Despite the available policy measures, EVs are unevenly adopted across populations. This could be due to EVs being a relatively new development and currently being mainly adopted by early adopters who tend to earn higher than average incomes (Dedehayir et al., 2017; Plötz et al., 2014). However, within the United Kingdom, for example, lower socioeconomic groups in particular are seen to face challenges in adopting an EV (Norman, 2021). Several studies conducted in North America, Western

Europe, and China have also found evidence that EV measures tend to promote the usage of EVs within homogeneous groups, which are often characterized by high income, high education, home ownership, middle-agedness, and access to multiple vehicles within their household (Chen et al., 2020; Guo & Kontou, 2021; Hardman et al., 2021; Khan et al., 2022). Households in disadvantaged communities, who often have low income, education, and job stability, as well as limited access to vehicles, are perceived as less likely to adopt an EV, despite its lower total cost of ownership (TCO) relative to ICEV (Sheldon, 2022; Stockkamp et al., 2021).

There are multiple potential reasons for this unequal spread, relating to:

1) The barrier of high purchase costs of EVs (Bauer, 2021; Berkeley et al., 2017)
2) The lack of access to charging infrastructure (Khan et al., 2022)
3) The lack of awareness of the existence of policies (Anastasiadou & Gavanas, 2022; Broadbent et al., 2021)
4) The lack of understanding of how to use policies (Munshi et al., 2022; Xiong & Wang, 2020)

In terms of EV purchase costs, it is seen that they account for a significant proportion of low-income households' income, making them unaffordable for this group (Bauer, 2021; Berkeley et al., 2017). The primary reason is that the majority of EV manufacturers concentrate on luxury models with high-end technological innovations, resulting in a low supply of affordable EVs and thus a substantial gap in purchase price between EVs and ICEVs (Caulfield et al., 2022; Franke & Krems, 2013; Hardman et al., 2021). Additionally, due to the novelty of EV technology, the number of second-hand EVs in circulation remains low (Hardman et al., 2021).

Regarding access to charging infrastructure, an unequal spread across the population in terms of availability and affordability can be observed (Khan et al., 2022). First, it could be seen that home charging, which is deemed the most preferable charging option for (potential) EV users, is less available to low-income households due to high installation costs and the unavailability of designated private parking spots in many multi-family and rental housing units (Caulfield et al., 2022; Hardman et al., 2021; Jochem et al., 2022). An alternative option is charging at the workplace; however, it is less accessible for this group due to the nature of less stable jobs (Hardman et al., 2021). Lower-income households may become reliant on public charging infrastructure, which has a generally low availability (Hardman et al., 2021). In addition, the cost of public charging is typically higher compared to home charging due to the lower costs of residential electricity compared to commercial electricity (Engel et al., 2018; Hardman et al., 2021; Jochem et al., 2022). Home charging also allows for overnight charging when residential electricity costs are even lower due to off-peak hours (Engel et al., 2018). This inaccessibility of charging infrastructure could lead to suppressed potential EV use (Khan et al., 2022).

Furthermore, a lack of awareness of the existence of policies promoting EV use could lead to an unequal spread of EV use across the population as awareness of policies positively correlates with the likelihood of adoption (Anastasiadou & Gavanas, 2022; Broadbent et al., 2021). Broadbent et al. (2021) found that EV adopters had significantly higher policy awareness than ICEV users, as EV users reported thoroughly investigating their options when considering a new car purchase. Nevertheless, it should be mentioned that the impact of policy awareness on EV adoption is still not entirely understood, due to the restricted number of studies on this topic.

Lastly, a lack of understanding of how to use the policies could affect the adoption of EV use. A lack of understanding could be due to the reach of information on these policies being limited (Munshi et al., 2022; Xiong & Wang, 2020). The limited reach of information on these policies can be explained by many potential policy recipients having stereotypes about the policies which hinders policy understanding (Xiong & Wang, 2020). Policy understanding is also hindered by individuals finding

information about these policies, or the policy process, confusing or conflicting (Biresselioglu et al., 2018). This is for instance seen within the study of Hennessy and Syal (2023) in California where an EV promotion programme aimed at low-income groups failed due to a complicated and challenging process of application with insufficient assistance for the applicants. This leads to situations where policies aimed at making EVs more accessible are available, but are not known or usable for everyone.

3.4 Conceptual relationships

Transport policy is crucial in shaping equal capabilities, and consequently, fostering equality of opportunity, which is a key component of transport justice (Karner et al., 2020; Randal et al., 2020). These capabilities include, for example, mobility and accessibility, as well as broader aspects such as health and well-being (Randal et al., 2020).

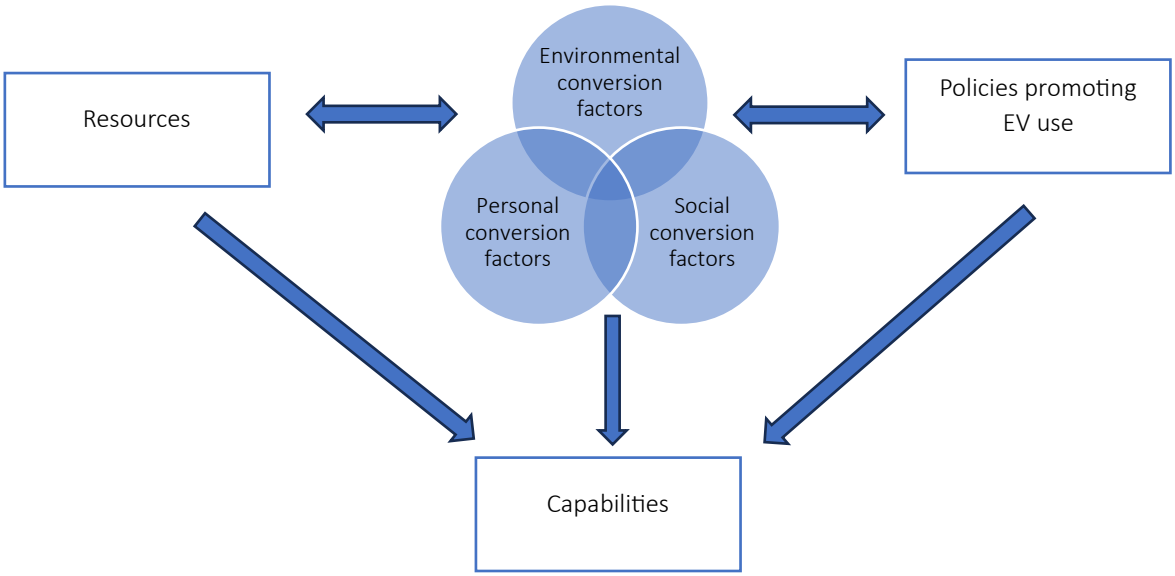
Transport policy can actively contribute to providing equal opportunities by influencing the impact of conversion factors that affect capabilities (Randal et al., 2020). However, it is essential to acknowledge that transport policy itself may result in unequal capabilities, primarily due to unequal accessibility of policies, resulting in disparities among different groups (Yerkes et al., 2019).

Regarding EV adoption, it could be seen that disparities among different groups exist despite the existence of widespread measures. A partial explanation could be an inequality of opportunity, for example, reflected in too high initial purchase prices of EVs or the inaccessibility of charging infrastructure (Berkeley et al., 2017; Hardman et al., 2021; Khan et al., 2022). Therefore, current policies aimed at promoting EV usage could be improved to achieve equality of opportunity. Examples of policy improvements could for instance include subsidies reducing the initial purchase price, or increasing the provision of affordable charging infrastructure.

To improve current policies promoting EV use and subsequentially increase the equality of opportunity, it is crucial to focus on individuals' perceptions of these policies as these influence individuals' perceived capabilities sets, which in turn inform their functionings (Vecchio & Martens, 2021). The understanding of these perceptions can help to tailor policies to increase the relevance and effectiveness of policies promoting EV use.

The conceptual relations central to this theoretical framework are schematically depicted in figure 3. Within this figure, it could be observed that capabilities are influenced by several factors and interactions. First, capabilities are seen to be dependent on resources and the extent these resources are shaped by the interplay between conversion factors (Hvinden & Halvorsen, 2018; Nahmias-Biran & Shiftan, 2020). Within the context of EV adoption, these conversion factors for instance include residential location and associated access to charging infrastructure. Moreover, policies – such as policies promoting EV use – have an important role in shaping capabilities both indirectly and directly (Randal et al., 2020; Yerkes et al., 2019). This happens through the policy influence on other conversion factors and policies shaping accessibility to capabilities through in- and exclusion processes (Yerkes et al., 2019). In addition, policies themselves are also shaped by other conversion factors, for instance, political and legal dimensions (Auvinen & Tuominen, 2014).

Figure 3: Policies promoting EV use as a social conversion factor



4. Methodology

4.1 Research design

This research aimed to get a deeper understanding of how policies promoting EV use are relevant for individuals in providing equality of opportunity, based on their perceived capabilities sets, and how this differs in various socio-economic contexts. Herein, the perceptions of the individuals are central; both their perceptions of these policies and how this relates to their capabilities sets.

A qualitative approach was chosen as the most suitable method to investigate these perceptions. This is due to individual perceptions being subjective in nature and qualitative methods allowing for in-depth answers to explore the underlying reasons for these perceptions (Hay, 2016). Furthermore, a lack of qualitative understanding of perceptions on policies promoting EV use and its effects could be observed in current literature, despite the importance of individual perception on ongoing policies supporting the diffusion of EVs in the sustainable mobility transition (Kester et al., 2018; Xiong & Wang, 2020).

Semi-structured interviews were used to obtain insight into these aforementioned perceptions as these interviews allow to compare participants' answers as well as to allow for structure, flexibility and in-depth understanding (Balushi, 2018). The interviews focus on how policies shape the context for EV adoption according to the participants while considering individuals' perceived capability sets and their implications for transport justice. The interviews formed the basis of the data analysis, and combine a deductive and inductive approach to analyse the data according to the emergent concepts in the context of the conceptual perspectives considered. A combined coding approach allows for a structured approach while simultaneously exploring new conceptual directions (Saldaña, 2013).

The data collection of this research took place within the ITEM project, a research project which centres around inclusivity, equity and fairness of electric mobility in urban communities in Europe, of which Utrecht is one of the case studies (ITEM, n.d.). The research company 'Markteffect' was in charge of the data collection, and recruited participants by using their qualitative research panels and using monetary incentives (Markteffect, n.d.).

4.2 Recruitment of participants

For this research, the target population contained inhabitants of (or close to) the city of Utrecht. In the recruitment of these participants, car ownership, type of ownership, income level, and household composition were taken into account. Additionally, a similar distribution of age and gender was also incorporated to ensure potentially varying perspectives to be heard.

Only current car owners were included in this research, as policies promoting EV use are aimed to let existing ICEV owners transition to EVs to reduce GHG emissions (Leurent & Windisch, 2011). The primary target group of the policies is thus current ICEV owners, and therefore views of individuals who do not use a car fall outside the scope of this study. Regarding the current car owners, both ICEV and EV owners were included to incorporate perceptions of users and non-users of EVs.

In addition, income levels were incorporated within the selection process as various studies show (potential) EV use highly differs based on income levels (Sheldon, 2022; Stockkamp et al., 2021). Including income levels within the research can provide information on how the policies promoting EV use are affecting the decision-making process within low-income participants, thus also providing insights about the equity impacts of the EV transition and diffusion.

Furthermore, household composition (e.g. the presence of children within the household) was considered in the selection of participants to understand how different household compositions with specific travel arrangements affect EV adoption.

Within the recruitment process (potential) participants were informed about the aim of the study, the options for withdrawal of participation, the potential risks and benefits of participation, data storage and protection and contact options for potential questions (see appendix B), and thus ensuring informed consent.

Furthermore, during the recruitment process a monetary incentive of €50,- was used to incentivise participation. Such monetary incentives are highly debated within literature due to their ethical implications, such as undermining decision-making or the risk of oversampling low-income participants (Zutlevics, 2016). Nevertheless, income levels were incorporated into the recruitment to prevent an unwanted oversampling of low-income participants. In addition, the risk of harm due to participation was reviewed and deemed acceptable by the Science–Geo Ethics Review Board UU.

4.3 Data collection

The data was collected through semi-structured interviews, which took place online due to practical considerations for both the researcher and participants. Online interviews are also easier to participate in for participants as they are less time-consuming due to the absence of travel time to the interview location (Balushi, 2018). The downside of online interviewing is however that non-verbal cues can be easily overlooked (Balushi, 2018). To reduce the impact of the latter, follow-up questions were asked by the interviewer when uncertainties arose.

Before the start of the data collection, a series of three to four pre-test interviews were carried out. These interviews aimed to enhance the clarity and understandability of the questions and also assessed the length of the interview. The insights from the pre-test interviews were used to improve the interview questions, which were designed in co-creation with all the ITEM partners (see Appendix D). The interview consists of a pre-interview survey (Appendix C), to collect the participants' characteristics, and the in-depth interview questions (Appendix D). The in-depth interview questions were divided into four themes: introduction, travel profile, experience with the transition to and using EV and EV-transition and social inclusion. The first two themes are used to obtain an overall picture of the participant's travel profile and to get insight into how they experience their current own mobility patterns. Thereafter, the interviews delved into the participants' experiences with the transition to EV to explore their EV adoption consideration and their awareness of various policies promoting EV use. The final theme aims to gain insights into the participants' perceptions of justice concerning the EV transition.

4.4 Participant characteristics

During the data collection period, 25 interviews have been conducted with various car owners. The sample of interviewed participants looks as follows:

1. Low-income ICEV owners (n=10), 3 households with kids
2. Middle- or high-income ICEV (n=5), 4 households with kids
3. EV owners
    a. EV private owners (n=4), 1 household with kids
    b. EV private lease owners (n=4), 1 household with kids
4. ICEV *and* EV owners (n=2), 2 households with kids

The division of gender was almost equal with 13 female and 12 male participants. Regarding age, there was a widespread distribution, with a bigger presence for participants in their forties and a lower presence of participants in their twenties or sixties and seventies. The complete division of characteristics per participant is depicted below:

Table 1: Characteristics per participant

Participant	Type of car ownership within the household	Gender	Age	Income level**	Place of residence***	Household composition
1	Private ownership ICEV	Female	23	Middle income	Utrecht (8)	Single living without children living at home
2	Private ownership ICEV	Male	41	Middle income	Utrecht (8)	Cohabiting/married with children living at home
3	Private ownership ICEV	Male	54	Low income	Utrecht (8)	Single living without children at home
4	Private ownership EV	Male	40	High income	Nijkerk (4)	Cohabiting/married with children living at home
5	Private ownership EV	Female	50	Middle income	Uithoorn (4)	Cohabiting/married without children living at home
6	Private ownership ICEV	Male	46	Middle income	Utrecht (8)	Cohabiting/married with children living at home
7	Private ownership EV	Male	60	Middle income	Uithoorn (4)	Cohabiting/married without children living at home
8	Private ownership ICEV	Female	39	Middle income	Utrecht (8)	Single living with children living at home
9	Private ownership EV & business lease ownership EV	Male	38	High income	Amersfoort (7)	Cohabiting/married without children living at home
10	Private lease EV	Female	32	High income	Gouda (5)	Cohabiting/married with children living at home
11	Private ownership ICEV	Female	76	Low income	Utrecht (8)	Single living without children living at home
12	Private ownership ICEV	Female	58	Low income	Utrecht (8)	Single living without children living at home
13	Private ownership ICEV	Male	61	Low income	Bilthoven (4)	Single living without children at home
14	Private ownership ICEV & EV*	Female	45	High income	Tienhoven (5/1****)	Cohabiting/married with children living at home
15	Private ownership ICEV and private lease EV*	Male	43	High income	IJsselstein (4)	Cohabiting/married with children living at home

16	Private ownership of two ICEVs	Female	40	Middle income	Utrecht (8)	Cohabiting/married with children living at home
17	Private ownership ICEV	Female	49	Low income	Hoevelaken (4/2****)	Single living with children at home
18	Private ownership ICEV	Female	34	Low income	Leersum (5/2****)	Single living with children at home
19	Private ownership ICEV	Female	56	Low income	Culemborg (4)	Single living with children at home
20	Private lease EV	Female	37	Low income	Amersfoort (7)	Single living with children at home
21	Private ownership ICEV	Male	46	Low income	Zeist (5)	Living-apart-together relationship
22	Private lease EV	Male	41	Middle income	Gouda (5)	Living-apart-together relationship
23	Private ownership ICEV	Female	66	Low income	Soest (4)	Single living without children living at home
24	Private ownership of two ICEVs	Male	23	Low income	Scherpenzeel (3)	Living with parents
25	Private lease EV	Male	36	Middle income	Amersfoort (7)	Single living without children living at home

*The EV is used as the second car within the household

** Income levels are based on the gross monthly income of the entire household. This is the amount before payroll tax and national insurance are deducted. The following categories, provided by MarktEffect, were used:

- Low income: Below €3400,-
- Middle income: Between €3400,- and €5700.-
- High income: Above €5700,-

*** Place of residence is mentioned, as well as the municipal size category of this place based on data from the Central Bureau of Statistics (Centraal Bureau voor de Statistiek, 2023). Categories are as follows:

- Fewer than 5000 inhabitants (code 1)
- 5000-10.000 inhabitants (code 2)
- 10.000-20.000 inhabitants (code 3)
- 20.000-50.000 inhabitants (code 4)
- 50.000-100.000 inhabitants (code 5)
- 100.000-150.000 inhabitants (code 6)
- 150.000-250.000 inhabitants (code 7)
- 250.000 inhabitants or more (code 8)

**** Due to a merger, these residential areas have become part of a larger municipality. However, the CBS lacks specific data for the mentioned places of residence, only having information on the level of the overall municipality. This limitation may lead to a distorted perception of the size of these individual places of residence. To address this issue, additional data from other sources is utilized to accurately represent the true size of each place. This results in two categories, the first belonging to the larger municipality based on CBS data, the second based on more specific data from additional sources.

4.5 Data analysis

Once the interviews had been carried out, they were transcribed and anonymized. These transcriptions were then used for data analysis, which involved coding the interviews through content analysis. Both deductive and inductive coding techniques were utilized to identify links with pre-existing theories and to expand on them. A preliminary codebook was created based on emerging concepts within the conceptual perspectives and was modified throughout the process based on the interview findings. The final version of the codebook for this research can be found in Appendix E.

The coding process was conducted in NVivo 12 and executed by two researchers, including the author, who met up frequently to identify themes and to discuss and review the found codes. Coding with multiple researchers is important to ensure interpretative validity and reduce research bias.

5. Results

The results section will be discussed based on the key factors found to influence individual's perceptions of the policies promoting EV use, related to capability sets. These key factors relate to 1) economic position, 2) location of residence and 3) views of policy communication. Within the discussion of these key factors, the differences found between socioeconomic groups and between EV users and non-users are incorporated. Furthermore, interrelations between individual policy perceptions and perceived capability sets are discussed. All quotations shown are translated from Dutch to English by the author.

5.1 Economic position

Within the group of participants, there was a noticeable division in the perception of whether current policies take their economic position into account. This division pertains to their economic position in relation to the initial purchase price of an EV, which is generally perceived as expensive by the participants. The split was observed both at the national and local policy levels.

At the national policy level, various measures have been implemented to promote the adoption of electric vehicles by making them more affordable. Several EV owners confirmed that they perceived the policies taking their economic situation into account, as these measures made it within their financial means to purchase one.

> *I was able to take advantage of the subsidy* [SEPP] *easily. This has partly made it possible for me to drive an EV at all. And even if I could* [financially] *done it* [adopt an EV] *already, I would have just got some extra money.* (Participant 7 – EV owner)

This is not only seen amongst EV adopters, as some participants who own an ICEV with various levels of income also perceive that the policy measures take their economic position into account by making EV adoption more financially attainable. This opens up the possibility for them to contemplate buying an EV as well.

However, numerous participants have also expressed that the current national policy measures do not adequately consider individuals with a low or middle income, particularly those who are single living. They perceive the measures as insufficient for EV adoption to be within their financial reach. This perception of EVs being financially out of reach for these groups mainly stems from their limited financial resources available and limited options to save combined with the scarcity of affordable EV models, either through private ownership or private lease. The participants state that the high cost of EVs can be attributed to their reliance on new technology and their relative novelty in the car market, resulting in costlier models and a shortage of second-hand EVs.

Even when second-hand EVs are available, participants mention that these often come with high initial purchase prices and their purchase is often perceived as high-risk due to the uncertainties regarding battery quality and potential depreciation of this type of EV. The current national policies are perceived to not sufficiently offer affordable models, which is according to the participants particularly evident in the unrealistic minimum purchase price requirements for receiving subsidies (especially SEPP), making it challenging for low and middle-income individuals to benefit from the incentives.

> *By the time second-hand cars are affordable to buy, those cars are already so old that their batteries have to be replaced. The initial low initial purchase price will not matter as much because there will be a very expensive battery replacement on top of that.* (Participant 13 – ICEV owner)

This shortage of affordable (second-hand) EV models also contributes to the perception of low- and middle-income economic positions not sufficiently being considered in policies on the local level, especially regarding the proposed implementation of a zero-emission zone in 2030 within Utrecht. As ICEVs will no longer be allowed in the city centre after 2030 these groups feel obliged to switch to an EV if they wish to access the city centre, but this is financially challenging for them. They emphasize that they currently possess well-functioning ICEVs and are reluctant to dispose of them because it is environmentally unsustainable to do so. Moreover, they state reluctance with replacing well-functioning cars, as the costs would be substantial. This sentiment is especially emphasized by elderly participants who mention not anticipating needing a car for many more years.

> *There are still so many cars that run on fuel. I do not think everyone has one of those* [EVs] *in seven years. There will be so many people thinking about where they are going to get to money to buy such a car* [EV]*, and so will I. And then what do you do? This car can't be driven so you take it to the scrap yard, but then you don't have a car. And what do you do then?* […]. *If they phase out the policy measures and ban ICEVs they* [the government] *should give me one as I can't afford it. But I don't think they will.* (Participant 19 – ICEV owner)

Several participants mention their economic situation combined with the zero-emission zone will likely lead to the inaccessibility of the city centre for them as through the emission zone ICEVs are not allowed, EVs are financially out of reach and other transport modes are seen as insufficient to access the city centre. For some, this is because of mobility problems and therefore being reliant on car use. Others mention needing to carry big items which are difficult to transport with another mode. Furthermore, other transport modes, especially public transport, are often also seen as insufficient due to the high usage costs as well as the time-inflexibility of this mode. These participants thus feel that they need an ICEV for their daily activities.

> *Back in the day, you could buy a ticket* [for public transport] *for a euro in the city. Well, it was pretty crowded. Now you don't see anyone at the bus stops anymore. The key factor is the price. The train is unaffordable. If I need to go anywhere I can travel twice as cheaply by car.* (Participant 12 – ICEV owner)

As a result of this perceived inaccessibility of the city centre by ICEV, some participants mention considering visiting other cities without zero-emission zones.

A small portion of participants also states that relatively seen low-income groups are generally financially worse off compared to middle- and especially high-income groups. Participants primarily attribute this to the fact that higher-income groups tend to adopt new technology – like EVs – earlier, allowing them to benefit from financial support measures (such as the MRB) for an extended duration. Participants state that these financial supportive measures have already diminished and will continue to do so as EVs become more prevalent. This coincides with when lower-income groups may contemplate purchasing EVs and consequently receive reduced financial support.

The main findings regarding the economic position and policy perceptions can be found in Table 2.

Table 2: Participant perception of incorporation of their economic position within the policies

		Participants perceive the policies to incorporate their economic position		**Participants perceive the policies do not incorporate their economic position**
Participant perception of the incorporation of their economic position within the policies	National policies	*Middle- and high-income EV owners* Policies allowed EV adoption to be within their financial means *Participants 5, 7, 9, 10, 15 & 20*	*Middle-income ICEV owners* Policies make EV adoption more financially attainable *Participants 1,2, 6, 11, 16, 17 & 19*	*Low- and middle-income ICEV owners* Policies are too limited for EV adoption to be financially attainable due to the insufficient offer of affordable EV models *Participants 3, 12, 13,17,19, 21, 23 & 24*
	Local policies	*No specific references regarding the participant's economic positions*		*Low- and middle-income ICEV owners* The zero-emission zone policy makes EV adoption feel obliged which is financially challenging. This is especially a concern for those reliant on a car. *Participants 3,12,13,16,18 & 21*

5.2 Place of residence

Among several participants, mentions were made of whether current policies consider their place of residence, especially regarding the availability of charging infrastructure in those areas and the related parking options. Within the city of Utrecht, there are current plans to increase the number of public charging stations, which is pleasantly perceived by the vast majority of the participants. Nevertheless, different views on the current availability of charging infrastructure can be recognised.

One group of participants, predominantly middle- and high-income EV owners, state that they are not significantly affected by the public charging policies of their municipality, as they have the option to charge their EVs at home, often even in a private driveway. They are satisfied with home charging as this provides them with convenience and a sense of security, knowing they always have a reliable charging option without the stress of searching for potentially occupied public charging stations.

> *But that's nice, at least then you know it's* [the EV] *close by, that's just a comfort. And you know you can always charge it when you need it. So then you also don't have the hassle of having to take it away for someone else* [EV at a public charging station]. *That really does make it a lot easier.* (Participant 14 – EV owner)

Furthermore, several of these participants mentioned having solar panels at home, which makes home charging even more appealing as it incurs minimal charging costs. For one participant costs were especially low due to having received a subsidy for the solar panels as well.

For the groups of participants who would be subject to charge at a public charging station, it could be seen that the perception of charging needs being met depends on both the availability of public charging stations as well as their occupancy rate. Some participants, mainly living in medium-sized municipalities of 20.000-50.000 inhabitants, are content with their neighbourhood's charging options due to sufficient supply and low occupancy of public charging spots, which is according to them likely

attributed to higher-income and many EV drivers in the neighbourhood. Participant 21 (ICEV owner) for example states "*There are a lot of charging stations, I do like that. A lot of big earners live here* [...]*, that does contribute, of course. I think most of the people here drive electric cars.*" Nevertheless, these participants mention concerns about charging stations being more occupied in the future as uptake in EVs is starting to increase.

Additionally, there is a dissatisfied group, living in municipalities of various inhabitant sizes, that asserts the current charging options are inadequate for their needs. The limited availability of public charging stations in their neighbourhood and the inability to charge at home serve as discouraging factors for many of them when considering EV adoption. Living in a low-income neighbourhood or a smaller village contributes to this, according to the participants' perceptions, as there are not many EV drivers in these areas. Consequently, due to the lack of charging infrastructure, people do not consider public charging as a viable option, leading them to refrain from adopting an EV. This perception of public charging being unviable is increased when the municipality is uncooperative in the view of the participants, as reflected by participant 6 (ICEV owner):

> *My neighbour, who has had an electric car for almost a year now, has applied to the municipality for a charging station from the start. But they don't want to proceed with it. So now he just has to charge his car from home every time, and then he just sticks a plug through the letterbox. He has to park his car as close to his front yard as possible and then it* [the EV] *stands there all day charging. Again, I think that's something really worthless.* [...] *The municipality is talking about sustainability, about giving space to green ideas. But a charging station doesn't seem like a possibility.*

Furthermore, a different group of participants, living in municipalities of various inhabitant sizes, are dissatisfied with the charging infrastructure in their neighbourhood due to exacerbating parking issues with their ICEVs. These participants perceive their parking options to be reduced due to the installation of more charging stations, as the parking spots at these charging stations are only available for EVs. This makes it harder for them to park their ICEV close to home, which is seen as uncomfortable. One participant (participant 1 – ICEV owner) specifically mentioned that the public charging stations have a supply-demand mismatch. Numerous charging stations are not necessary for the residents but are utilized by people from different neighbourhoods with too few charging options. This results in increased crowdedness in the participant's area, which is a source of irritation for her.

The main findings regarding place of residence and policy perceptions can be found in Table 3.

Table 3: Participant perception of incorporation of their place of residence within the policies

		Participants perceive the policies to take their place of residence into account	**Participants perceive the policies to not take their place of residence into account**	**Policies do not significantly affect them**
Participant perception of incorporation of their place of residence within the policies	Local policies	*Participants living in affluent neighbourhoods* Public charging infrastructure in their neighbourhood offers sufficient supply and low occupancy of public charging spots *Participants 5, 7, 9, 15 & 21*	*Participants living in less affluent neighbourhoods & ICEV owners in general* Limited availability of public charging infrastructure in combination with the inability to charge at home + Public charging infrastructure reduces parking options for ICEV owners *Participants 1,2, 3, 4, 6, 12, 16, 17, 19 & 21*	*Middle- and high-income EV owners* Policies regarding charging infrastructure do not affect them due to the possibility of home charging *Participants 5,7, 10, 15 & 25*

5.3 Policy communication

Regarding the communication of policies, some participants who owned an ICEV expressed that they did not perceive their needs being met in terms of policy awareness, understandability and clarity of the policies and their terms and conditions. Other participants did not specifically refer to any concerns about it.

Regarding policy awareness, some participants were seen to have a lack thereof regarding the policies promoting EV use both on the national and local levels. Most participants explained never having investigated the policies as a reason for their unawareness, but a small number referred to the perception of a lack of information provided by the government about the policies and their implications.

When learning more about the policies during the interview, some participants mentioned that their perceptions of their capabilities changed. For some, this led to a positive change in their perception of their capabilities, especially regarding their economic situation in relation to EV adoption. Participant 8 (ICEV owner) for instance mentioned: "*Well, I didn't know about these policy measures. When I go looking for a lease car I just think, gosh, that's a lot of money. But I didn't know at all what else is involved.*" This participant also mentioned feeling more positive about her options after learning about the policy measures.

However, learning about the policies could also lead to a perceived limitation of capabilities. Participant 16 (ICEV owner) for instance mentioned that she was unaware of the local proposed zero-emission zone in 2030 and learning about it led to the perceived urgency to transition to an EV. This urgency came forward out of otherwise having reduced access to the city centre, which would reduce her perceived capabilities. It could be likely that such unawareness could place current ICEV owners in a position without enough time to adjust to the new measures.

Even when participants were aware of the existence of the policies, some– both ICEV and EV owners – mentioned unclarity regarding the terms and conditions of the national policies. They did not perceive these being communicated understandably to them leading to an incomplete perception of the policies.

> *That you're able to get a subsidy* [SEPP]*, I did see that on television, but I didn't exactly understand what it was. I kept hearing about 2950 euros for purchase, but I had not understood that you just get that amount as a subsidy.* (Participant 11- ICEV owner)

In addition, several participants expressed specific uncertainty about how these policies would evolve and a lack of communication about this, which caused insecurity regarding their ability to meet their future economic needs.

> *Road tax exemption until 2024. That's very limited, I think. So after 2024, what happens then? That is unclear. Some more clarity on that needs to be given* [by the government]*. Also the exemption of the purchase tax from BPM until at least 2024. That is also quite vague. What happens after that?* […]*. You might suddenly start being taxed.* (Participant 6 – ICEV owner)

The main findings regarding policy communication and policy perceptions can be found in Table 4.

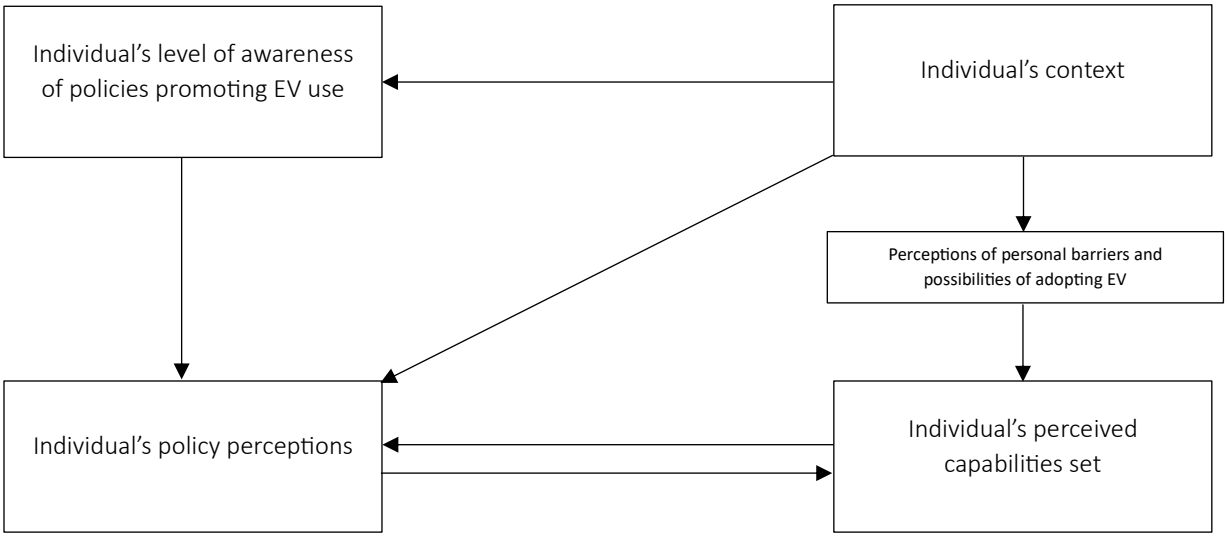
Table 4: Participant perception of incorporation of their policy communication needs within the policies

		Perception of policy communication needs being unmet	
		Policy awareness	Clarity terms and conditions policies
Participant perception of incorporation of their policy communication needs within the policies	Both local and national policies	*ICEV owners* Participants feel there is a lack of communication by the government regarding existing policies *Participants 2, 6, 8, 11, 12, 16, 17 & 18*	*Various socio-economic backgrounds, both EV and ICEV owners* Participants lack information about the terms and conditions of the terms and conditions of the policies, which leads to incomplete views and insecurity regarding individual's economic situations *Participants 2, 6, 7, 8, 10, 12, 13, 20, 21, 24 & 25*

5.4 Interrelation of policy perceptions and capabilities

The interviews with the participants show that policy perceptions are strongly connected with perceived capabilities sets in various ways. This is schematically depicted in figure 4. It must be noted that these processes in the figure are simplified, but are made to get a more comprehensive understanding of the interrelation between an individual's policy perceptions and perceived capabilities set.

Figure 4: The feedback loop of policy perceptions and individual's perceived capabilities set



Within this figure, it could be seen that a 'feedback loop' exist between policy perceptions and perceived capabilities. If an individual's policy perception changes this could lead to a change in their perception of their capabilities and vice versa.

The feedback loop is influenced by the individual's context and the individual's level of awareness and understanding of the policies promoting EV use. Factors such as one's age, mobility level, economic position, place of residence, current car ownership, interest in and knowledge about EVs and views on the mobility transition all contribute to an individual's context. This context shapes one's perceptions

of their personal barriers and possibilities for adopting EVs, thus influencing their perceived capability of EV adoption. For example, some participants cited their personal economic situation or inadequate charging infrastructure in their area as reasons for feeling unable to adopt an EV and therefore regarding the existing policies as insufficient to meet their needs.

In addition, the individual context can also directly affect how individuals perceive the policies promoting EV use. This may include an individual's view on the mobility transition which can influence how one perceives the policies encouraging EV use. However, it's important to note that this individual context doesn't necessarily lead to changes in one's perceived capabilities set, as many factors impact their capabilities simultaneously. For instance, some EV owners mentioned questioning the necessity of the strict measures in the mobility transition given the Netherlands' relatively small contribution to global GHG emissions, but still feel capable of driving an EV for other reasons.

> *Well, I do understand that all of us, but of course everyone around the world, must be looking at what we're leaving behind for our children and grandchildren. But what I'm saying is that we're overdoing it with all the nitrogen and CO2, you name it, measures.* (Participant 15 – EV owner)

Furthermore, one's individual context can impact their knowledge and comprehension of policies encouraging EV use. Individuals who have a greater interest in technology or EVs seem to be more inclined to investigate these policies, resulting in greater awareness and understanding of these. However, it is important to note that other factors, such as the communication from the government about these policies also affect people's level of awareness.

An example of this feedback loop could be observed for participant 3 (ICEV owner). First, due to a lack of accessible public charging and no options for home charging, he did not perceive the policies promoting EV use as relevant to him. However, when the municipality placed a public charging facility nearby his residence, he also felt the policies promoting EVs were more relevant for him and perceived EV adoption to be closer within reach within his own personal circumstances.

6. Discussion

In this research manuscript, it is explored how the policies promoting EV adoption are perceived by individuals according to their capability set, and how this affects their perceived capability of EV adoption through executing qualitative interviews. The research findings indicate notable disparities in how individuals perceive the consideration of their capability sets in policies promoting electric vehicle use. According to the perceptions of the participants, the policies appear to be more relevant for the capability sets of higher-income groups and individuals residing in affluent neighbourhoods, giving these more attention to the adoption acceleration compared to the capability sets of lower-income groups and individuals in less affluent neighbourhoods.

For participants who mentioned not feeling their capability sets being considered well enough in the policies this was due to their economic situation, their location of residence or a lack of policy communication. These perceived reasons for policies not considering capability sets are seen to correspond with the reasons for the current unequal spread of EV observed in the academic literature.

Regarding the economic situation, it was seen that the initial purchase price of EVs was seen as an important reason for unequal EV adoption as these consume a too large proportion of household income for particularly low-income households (Bauer, 2021; Berkeley et al., 2017). ICEV owners with low- and middle incomes within this study also referred to the high initial purchase prices alongside the lack of affordable model options. Specifically, they also highlighted the high costs of replacing their current well-functioning ICEV as negatively impacting their perceived ability of EV adoption. Participants in this study refer to needing a minimum financial situation for the policies to be relevant in light of the perceived capability of EV adoption.

The inaccessibility of charging infrastructure seen in literature due to the lack of home charging or the lack of affordable and available public charging options for low-income groups (Hardman et al., 2021; Jochem et al., 2022) is also reflected by certain groups of participants, particularly ones residing in less affluent areas. These participants feel the policies regarding charging infrastructure prioritise affluent areas with many current EV adopters. As these participants perceive current policies as not attending to their charging needs they perceive themselves as unable to adopt an EV. This issue could potentially be addressed by workplace charging (Caulfield et al., 2022; Hardman et al., 2021; Jochem et al., 2022), however, none of the participants referred to this form of charging. Living in a multi-family residence (Hardman et al., 2021) was also not explicitly mentioned as impacting participants' perceived capability of EV adoption.

Moreover, several participants from various socio-economic backgrounds refer to a lack of communication on the policies. They do feel this lack of communication makes them unaware of the existence of policies or, if they are aware of their existence, a comprised understanding of their contents which could lead to suppressed potential EV use. Both the lack of policy awareness and understanding are known barriers to EV adoption in literature (Broadbent et al., 2021; Munshi et al., 2022; Xiong & Wang, 2020). According to these studies, limited policy understanding is caused by a limited reach of information due to stereotypes of policies or confusing or conflicting policy information (Biresselioglu et al., 2018; Munshi et al., 2022; Xiong & Wang, 2020). However, within this research stereotypes of policies were not as clearly recognised. Moreover, the role of having a general interest in the policy topic, in this case, EVs, surfaced as playing a role in policy understanding in the interviews which was not seen in current academic literature.

Nevertheless, it must be noted that the participants with EV ownership did perceive the policies to be relevant for their capability sets, especially regarding their economic position. The policies made EV adoption more financially attainable for this group as they already possessed minimal levels of financial

means. In addition, these participants often had the ability to charge at home, which led them to be less affected by public charging infrastructure policies. In the literature it is seen that home charging is also mostly available to higher-income groups due to the installation costs of home chargers (Caulfield et al., 2022; Hardman et al., 2021; Jochem et al., 2022).

Based on the perceptions of the participants – according to their capability sets – the current policies seem to predominantly focus on the capability sets of the already better-off populations – individuals with sufficient financial means and residing in affluent neighbourhoods. Despite the role of policies promoting the equality of opportunity (Randal et al., 2020), participants do not perceive equality of opportunity in the capability of EV adoption. Participants without sufficient financial means or living in less affluent neighbourhoods do not perceive the policies to sufficiently consider their position, which limits their perceived capability of EV adoption. According to the participants' perspectives, the situation is exacerbated by the gradual phasing out of policies promoting EV use, which has primarily benefited early adopters, a group who tend to have higher incomes (Dedehayir et al., 2017; Plötz et al., 2014). This leaves lower-income groups with limited access to the benefits offered by these policies.

In this context, policies promoting EV use serve as a social conversion factor and act as a selection mechanism (Yerkes et al., 2019). The current policies only benefit select groups, which makes the policies function as an in- and exclusion mechanism (Yerkes et al., 2019). The feedback loop between policy perceptions and perceived capability sets, described in the results section, is also recognisable herein as for some of the worse-off groups their perceived capability set is not considered to lead to a negative policy perception, while for others the policy perception is incomplete due to a lack of information, which could lead to unrealised potential enhancement of capabilities.

6.1 Policy implications

The above results show that mainly lower income groups and individuals residing in less affluent areas perceive the policies as not considering their position which leads to not perceiving themselves as able of EV adoption. This could lead to disparities in EV adoptions, possibly even disparities in possibilities to participate in the mobility transition.

Participants mention where they perceive the policies to be insufficient for them to use, relating to the initial purchase price of EVs, the high costs of replacing well-functioning ICEVs, the lack of charging infrastructure and the insufficient policy communication. Addressing these issues for these groups can help to design more effective policies to ensure everyone can participate in the mobility transition. Potential policies could be both financial and non-financial, such as reducing costs of EV adoption, increasing accessible public charging infrastructures and increasing information outreach campaigns (Caulfield et al., 2022; Egbue & Long, 2012; Rietmann & Lieven, 2019). In these policies, it must be explicitly considered how these can be relevant for everyone, especially lower socio-economic groups.

A crucial side note for designing and improving these policies is that the societal context in which they are implemented potentially limits what may be accomplished through policies (Auvinen & Tuominen, 2014). The policies promoting EV use might be affected by other developments, such as the development of the current energy grid which is necessary to meet the increased electricity demand when EV adoption increases (Zhang & Fujimori, 2020). Another example is the current lack of second-hand EV models which can only be solved over a longer time period (Hardman et al., 2021). To address these challenges for future policy implementation, further multidisciplinary research is needed to learn how to solve these barriers coming forward out of other societal developments.

6.2 Limitations

For this research, some limitations regarding the data collection and research scope should be kept in mind. Regarding data collection challenges occurred in reaching participants residing within the city of Utrecht and due time-constraint the choice was made to also incorporate participants residing in the vicinity of the city of Utrecht in the recruitment. As not all participants are residents of Utrecht, they are less impacted by several proposed local policies which could affect their policy perceptions.

Furthermore, difficulties arose in recruiting participants who both owned EVs and had low incomes. As a consequence, almost exclusively EV owners with high incomes were included in the participant sample. This leads to difficulty in distinguishing if the perceptions of these EV owners are related to their car ownership or their socioeconomic status. Further research is needed to further elaborate on the role of type of car ownership and socioeconomic status in the context of policy perceptions of EV owners.

In addition, the interviews were carried out by a researcher from an external research company. This researcher was informed about the research aim and the contents of the interview questions, however, this researcher had less conceptual knowledge regarding the contents of this research. When new topics emerge within the interviews, this external researcher could potentially be limited in recognising these and therefore not ask follow-up questions to explore the new topics in comparison to the interviews being carried out by researchers of the ITEM project themselves.

Lastly, this research has a limited scope as only participants who own cars were included. However, it is important to recognize that the policies examined in this research also have an impact on non-car owners and their capability sets. Further research should also investigate to what extent these policies affect this group. In addition, this research focused on policies promoting EV use, neglecting other sustainable transport modes. To provide a more comprehensive understanding of individuals' perspectives on the potential for participation in the mobility transition, future research should include these other modes of transportation.

In addition to the points mentioned above, personal reflections regarding the research project can be found in Appendix F.

7. Conclusion

This research centred around the research question: *How are the policies promoting EV adoption perceived by individuals according to their capabilities set and how does this impact their perceived capability of adoption?* This was explored through 25 qualitative interviews with both ICEV and EV owners from various backgrounds in the areas surrounding the city of Utrecht.

First, it could be seen that key factors of one's capabilities set influence policy perceptions. The key factors that surfaced in the interviews refer to individuals' economic position, their place of residence and policy awareness and understanding. Regarding economic position, it was seen that individuals perceive needing a minimum financial situation for the policies to be relevant in the light of the perceived capability of EV adoption.

In addition, one's place of residence also influenced policy perceptions as participants perceived the policies needing to provide accessible public charging infrastructure, both in terms of availability and occupancy rate, to perceive themselves as capable of EV adoption. Nevertheless, if home charging was an option, policies regarding providing public charging infrastructure became less relevant.

Lastly, policy perceptions were also influenced by individuals' level of policy awareness and understanding, which partially came forward out of participants' personal interest in EV as well as the level of policy communication by the government. If the policies were perceived as relevant for one's capability set thus depends on how well these are understood. Policy awareness and understanding could therefore be seen to indirectly influence an individual's perceived capability of EV adoption.

Based on the aforementioned key factors of one's capability set which influence policy perceptions it could be seen that these are closely interrelated to the perceived capability of EV adoption. A feedback loop exists. Individuals' policy perceptions depend on the extent they view these policies to enhance their capability of EV adoption. This perception is dependent on the current state of their capability set (their economic position, place of residence, policy awareness and understanding).

This feedback loop manifests differently for various groups, as well as for socioeconomic groups as for different types of ownership. For socioeconomic groups, the loop manifests differently dependent on income levels. For individuals with a low income and living in less affluent neighbourhoods it was seen that they felt not being in a position for the policies to be helpful in attaining EV adoption, they do not feel the policies consider their position well enough. Individuals with higher incomes and in more affluent neighbourhoods nevertheless felt able to benefit from the policies regarding EV adoption due to their personal circumstances.

Regarding differences between EV users and non-users, EV users already experience being capable of EV adoption as EV use has become a functioning for them. Their positive assessment of their capability of EV adoption is also reflected in perceiving the policies as relevant. Nevertheless, it must be noted that almost all EV owners in this sample are from higher-income groups For ICEV owners it could be seen that their perception of the policies as relevant depends on their economic situation and place of residence. For both EV and ICEV owners, it could thus be seen that socioeconomic status is highly relevant in their policy perceptions and perceptions of the perceived capability of EV adoption.

It could thus be said that how the policies are perceived highly depends on policy awareness and understanding, which is less dependent on specific characteristics, as well as on an individual's socioeconomic position, which includes their economic position and place of residence. Policies promoting EV use then function as a social conversion factor influencing individuals' perceived capability of EV adoption. For higher socioeconomic groups the policies enhance the capability of EV adoption. For lower socioeconomic groups however the policies do not make the capability of EV

adoption within reach despite the role of policies to enhance equality of opportunity (Randal et al., 2020). This makes the current policies serve as an in- and exclusion mechanism (Yerkes et al., 2019).

These perceptions of policies mainly benefitting better-off groups align with the current observation of inequal EV adoption within the population along socioeconomic lines (Chen et al., 2020; Guo & Kontou, 2021; Hardman et al., 2021; Khan et al., 2022). To achieve equality of opportunity, policies thus need to be redesigned to provide everyone with perceived equality of opportunity regarding EV adoption.

8. References

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