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"Green is the new black": the motives and barriers of adopting electric cars in an alpine European city

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Abstract

The ever-growing environmental concerns linked to transport sectors demand a wider market share of electric vehicles (EVs). Although Australia is considered a slow adopter of EVs (3.4%) compared to the global rate (8.6%), the recent changes in federal policies to exempt EVs from fringe benefits tax may increase the EVs ownerships in the coming years. However, the effectiveness of these initiatives is largely unknown and subject to study from users' point of view. Additionally, the existing charging infrastructures are already challenged to cope with the rate of EV sales, and new infrastructure should facilitate users an easier transition from combustion cars to EVs. Innsbruck, the fifth-largest city in Austria has similar EV ownership trends and government incentive changes to Australia's current EV adoption rate. The aim of this paper is to share the lessons from one of Europe's emerging EV-adopting cities, and the insights gained from this study can be customised into the Australian context to obtain a thorough understating of the challenges and prospects of EV adoption in Australia. This study has used qualitative approach to understand the challenges related to future electric vehicle adoption from both the existing EV owners' and potential EV owners' perspectives. The reasons for buying EVs, perceived barriers of EVs, charging habits, and improvement aspects (e.g., the location of EV chargers and charging kinds) are explored with 18 semi-structured interviews. The thematic analysis shows that functional barriers of EVs (e.g., lengthier charging time, range anxiety, inadequate charging infrastructures) are the main perceived barriers. Whereas social norm is one of the main motivators to purchase EVs. Furthermore, public charging stations with additional facilities (e.g., supermarkets, restrooms, wi-fi hotspots, co-working spaces) and transparent, standardized charging costs can encourage a larger market adoption of EVs.

1. Introduction

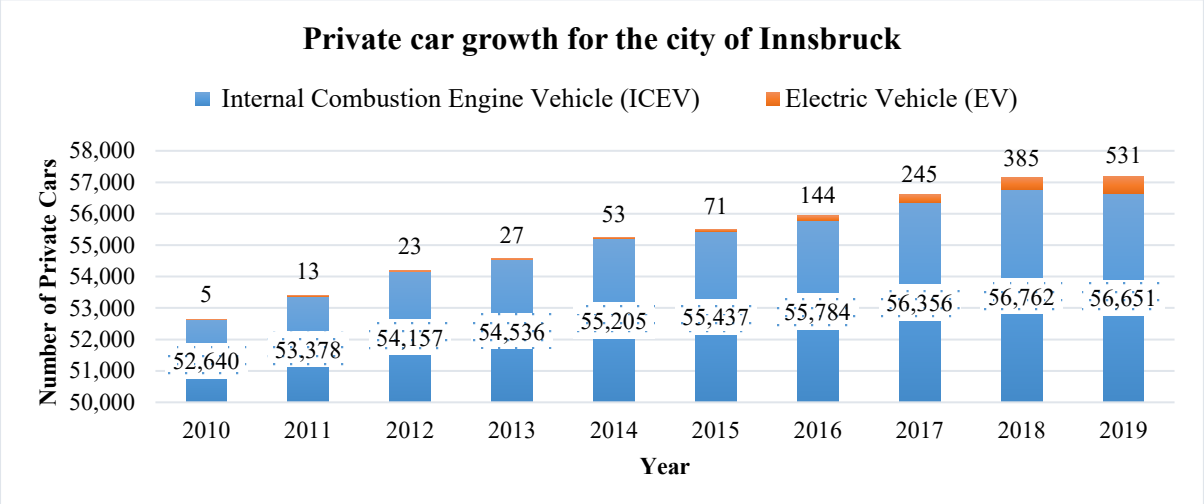
Over the last decade, Electric Vehicles (EVs) have considerably improved in terms of price, efficiency, and availability, but market share and diffusion rate have hardly increased in Europe except for Norway (Sperling, 2018). In Austria, the demand is rising slowly and 125,000 EVs have been registered till June 2022 (Austriatech, 2021), which is 2.47% of the total personal vehicle fleet. Innsbruck, the capital of Tyrol, and the fifth largest city in Austria with

approximately 311,000 inhabitants depicts similar trends regarding EV adoption. The total number of registered EVs in Innsbruck before the changes in monetary incentives was 531, which was less than 1% of registered private cars, (Figure 1). Although over the last three years this number has increased and currently there are total 1,276 registered EVs; which is still low compared to the conventional vehicles with combustion engine.

Similar to the EV adoption rate in Innsbruck, Australia is also considered a slow adopter of EVs (3.4%), however, the recent changes in federal policies to exempt EVs from fringe benefits tax may increase the EVs ownerships in the coming years. At the same time, the latest promotional initiatives in Austria to promote EVs (e.g., increased subsidies, incentives for establishing "at home" charging facilities) are also anticipated to boost the EV ownerships in Innsbruck (BMK, 2020). Moreover, due to global warming, the federal state of Tyrol aims to achieve energy autonomy by 2050 in response to global warming, and the capital Innsbruck is an integral part of this initiative (Tyrol, 2019). Additionally, Innsbruck Municipal Corporation (IKB), the energy provider of the Innsbruck city aims to explore the potentials of the "Smart City" concept for Innsbruck, which is promoted as "alpine - urban - smart". One of the aspects of IKB's smart city concept is cleaner and more environmental-friendly vehicles. Therefore, to promote EV, it is crucial to investigate users' perceptions of their preferred charging location (i.e., private vs. public infrastructure) and the payment options that are available in Innsbruck for both short-term (occasional/fast) and long-term (regular/everyday) charging facilities.

Previous studies have shown that higher acquisition costs, limited battery ranges, and inadequate charging facilities are the commonly cited barriers to EV user's acceptance (Axsen and Sovacool, 2019). Moreover, a common argument from the demand-side users of EV concerns battery capacity and driving range. Primarily, users with limited hands-on experience with EVs perceived that EVs are not suitable for long-distance travel—namely anxiety associated with driving range. Notably, the daily average car trip in Innsbruck is approximately 34 kilometres. According to the IKB, there are total 70 publicly accessible charging stations with different tariff structures and various charging speeds: slow (11- 22 KW power supply), moderate (22-75 KW power supply), and fast (over 75 KW power supply). The charging stations are concentrated mostly in the central business district areas.

Figure 1: Private car growth in Innsbruck (source: own illustration based on Statistic Austria, 2021)



Despite the relatively shorter trips suitable for EV driving coverage, adequate charging infrastructure, and revised monetary incentives the EV uptake is relatively low in Innsbruck.

Therefore, this study aims to explore the opportunities and challenges related to EV adoption from both the existing EV owners' and potential EV owners' perspectives, using qualitative method. This research aims to investigate the following research questions:

- What are the main challenges related to EV adoption in terms of charging infrastructure and payments perceived by the existing and potential EV owners?
- What are the implications for developing a reliable EV charging infrastructure and promote wider shares of EVs in a medium-sized city like Innsbruck?

The paper is structured as follows; the following section provides a context for the research, reviewing research literature on EV adoptions, focusing mainly on qualitative studies. This is followed by an outline of the methodology adopted for the study. Results are then described followed by a discussion and conclusion outlining key findings and implications for policy.

2. Research context

2.1 Literature review on qualitative studies relating to EV adoption

The stream of qualitative research on EV adoption are mainly based on two themes: trial -based non-EV users' experience and regular EV users' experience. Bühler et al. (2014) studied the driving experience of EVs in the 6-months field trial, which pertains the first theme. 78 participants without any prior experience with EVs were recruited. The semi-structured interviews identified driving pleasure (e.g., low noise) and low maintenance cost as the motivators to purchase EV. Although the study measured the real-life experience of EVs for an extended period, it pointed out the necessity to conduct studies in countries that have moved beyond the early-adopter stage, with better access to public transport infrastructure and government subsidies. Another 7-day trial in UK with 40 conventional car drivers shows that, innovative production and marketing, supportive government policies, and infrastructural investment can alleviate the perceived discrepancies between conventional cars and EVs regarding value for money, performance, range, convenience, aesthetics and symbolic value (Graham-Rowe et al., 2012).

Regarding the second theme which comprises regular EV users' experience, (Ottesen and Banna, 2020) conducted an in-depth interview with five EV owners in Iceland following the Vancouver School Approach. The 15-open ended questionnaire explored the experience of owning an EV, advantages and limitations and repurchasing intention. Safety related to burning EV batteries was the major concerns of the participants in the study. Also, temperature seems to be a contributing factor to range anxiety in colder region, where drivers are expected up to 30% lower range, as heating drains the battery much faster. As power supply is a major concern for EVs, van Heuveln et al. (2021) interviewed 20 regular EV drivers concerning vehicle-to-grid charging facilities, which propose to use the vast storage capacity of combined fleets of electric vehicles to provide grid services in exchange for which EV owners get compensated. Hardman et al. (2017) also identified refuelling time and range anxiety as consumer barriers by interviewing 39 Tesla owners in Northern California. While Noel et al. (2020) conducted 227 semi-structured interviews with transportation and electricity experts from 201 institutions across seventeen cities in Denmark, Finland, Iceland, Norway, and Sweden, confirming that range, price and charging infrastructure continue to persist as the main barriers, despite technological advancements over the recent years.

Notably, these trials and interviews are conducted either with experienced EV drivers or inexperienced EV adopters, but not in their combination. It is evident that there are significant differences between these two groups in terms of perceived environmental benefits of EVs,

energy-efficiency, driving range and financial benefits (Egbue and Long, 2012, Jabeen et al., 2012). Hence, a pre-post comparison of experience with EVs, combining both actual EV users and non-users can provide better insights into policy implications for wider EV adoption. Therefore, using the in-depth face-to-face qualitative approach, this study investigates the potential and current users' perception on the reason to purchase EVs, perceived barriers and concerns relating charging infrastructure, charging habits, and aspects for improvement.

4. Methodology

4.1 Data collection

Semi-structured interviews via video conference served to grasp user needs and underlying thoughts, beliefs, motives, and values (Castleberry & Nolen, 2018; Vaughn & Turner, 2016). The invitation to participate in the interview was distributed with the official newsletter of the city of Innsbruck, 'Innsbruck Informiert' to reach wider group of participants, with the possibility of reaching 79,000 households in Innsbruck city. To collect a diverse sample of EV owners, the invitation to participate was also distributed in the inner-city areas and western part of Innsbruck, where there are more dedicated EV charging stations. For easier identification, the EV number plates are green in Innsbruck. So, invitation brochures were also distributed around the long-term parking spaces near the University of Innsbruck and surroundings, targeting only EVs with green plates. There was no incentive to take part in the interview and a total of 18 participants living in Innsbruck, Austria, volunteered to take part in the interview process from August to December 2021.

The duration of the interview was on average 39 minutes for EV-owners, and 33 minutes for non-EV owners. Notably, there was a difference between the length of the questionnaire within these two groups. Both the EV owners and non-owners were asked about the policy (e.g., subsidies, funding for private charging installation), reasons for and against EV purchase intention, the purpose of trips with EVs, potential aspects to improve the current charging infrastructure, and location choice for new infrastructure. Additionally, EV-owners were asked about their current charging habits and their satisfaction and dissatisfaction with their EVs.

4.2 Data analysis

The interview guidelines and questionnaire for the two groups: EV owners vs. non-EV owners, were slightly different to specifically identify the individual perceptions, behaviors, and evaluations between these groups. The recorded interview was transcribed using the software NVivo. Subsequently, the document was coded with MAXQDA applying the thematic analysis, which is an established method for qualitative study designs (Castleberry & Nolen, 2018). A thematic analysis was conducted to the identification of patterns or themes in qualitative data, and thus allows in-depth data exploration (Braun and Clarke, 2006, Castleberry and Nolen, 2018).

4. Results

Table 1 offers a summary of the interviewees' characteristics. Majority of the respondents are full-time workers (14 out of 18) and have experience driving an EV (17 out of 18). There are 11 EV owners and 7 non-EV owners, divided into three age groups: below 25 years, 25 to 50 years, and above 50 years old. More than half of the respondents own multiple cars in their household and have dedicated parking at home. Most of the respondents are home owners (Table 2).

Table 1: sample characteristics and experience with EV

Category	Age Group	Respondent id	Gender	Age	Occupation	EV Experience
Non-EV Owners	<25	R01	female	24	student & casual worker	Hybrid
		R02	male	23	student & casual worker	yes
	25 - 50	R03	male	42	working full-time	yes
		R04	female	29	working full-time	Hybrid
		R05	male	25	student & casual worker	yes
	>50	R06	male	59	working full-time	no
		R07	male	61	working full-time	yes
EV owners	<25	R08	female	24	working full-time	yes
	25 - 50	R09	male	37	working full-time	yes
		R10	female	40	working full-time	yes
		R11	male	34	working full-time	yes
	>50	R12	male	60	working full-time	yes
		R13	male	54	working full-time	yes
		R14	male	53	working full-time	yes
		R15	male	69	Retired	yes
		R16	male	62	Self-employed, full-time	yes
		R17	female	51	working full-time	yes
		R18	male	52	working full-time	yes

Table 2: Car ownership and parking situation

Category	Age Group	Respondent id	Household Size	Tenant or owner	Cars per household	Parking at home	Parking at work
Non-EV Owners	<25	R01	6	Tenant	3	No	Yes
		R02	1	Tenant	1	Yes	No
	25 - 50	R03	2	Owner	2	Yes	Yes
		R04	4	Tenant	1	Yes	Paid
		R05	2	Tenant	0	Paid	Yes
	>50	R06	2	Owner	1	Yes	No
		R07	3	Owner	3	Yes	Yes
EV owners	<25	R08	2	Tenant	1	Yes	Yes
	25 - 50	R09	4	Tenant	2	Yes	Yes
		R10	3	Owner	2	Yes	Yes
		R11	3	Tenant	1	Yes	Yes
	>50	R12	4	Owner	3	Yes	No
		R13	2	Owner	1	Yes	Yes
		R14	2	Owner	3	Yes	Yes
		R15	3	Owner	2	Yes	Yes
		R16	4	Owner	3	Yes	No
		R17	2	Owner	1	Yes	Yes
		R18	4	Owner	2	Yes	Yes

4.1 Reasons to purchase an EV

Non-EV owners and EV owners mentioned overlapping criteria as relevant in the decision-making of whether to purchase an electric vehicle or not. Categories for the theme “reasons for an EV purchase” comprise sustainability, cost aspects, and brand. Related to the reasons for purchase, another category addresses the willingness to recommend electric vehicles to others.

4.1.1 Sustainability

Both non-EV and EV owners mention sustainability as a main driver in their considerations regarding an EV purchase.

Non-EV Owners:

"So, the main criteria for why I would [purchase an EV] would be… probably environmental aspects, for sure." (R01)

EV owners:

"In my younger days, I would say I had an affinity to "greenness", […], and it's an aspiration of mine that I contribute something [to sustainability]." (R13)

4.1.2 Cost

Both groups mention cost-savings as a reason for an EV purchase, stemming from political subsidies but also lower maintenance costs in the long run.

Non-EV owners:

"Well, costs are still very high, but also the subsidies are very high. And now we have reached a point in time where… a well-equipped electric vehicle is similar in price to a well-equipped internal combustion engine car. And then there is no maintenance… in my opinion, maintenance is largely gone […]" (R07)

EV owners:

"Maintenance is a big plus. Also, that there will not be that many repair or maintenance costs to pay. The engine is kind of like a program and that's exactly what is a positive aspect of electric vehicles" (R08)

4.1.3 Brand affinity

The vehicle's brand was not relevant or played a minor role in the purchase decision for non-EV drivers. However, for EV-owners company's strategy behind the brand or design was a contributing factor for purchasing a particular brand.

EV owners:

"Well… my husband appreciates a nice car. That is, I would have been completely indifferent whether we take any car. But my husband said the other cars are so ugly… so, in this price category, the brand played a major role for him" (R10, EV owner)

"Well, in general, I think that Elon Musk's strategic direction convinces him" (R08, EV owner)

4.1.4 Recommendation to purchase

All EV owners would recommend using an electric vehicle instead of an internal combustion engine car.

EV owners:

"Yes, in any case [I would recommend an EV]. I think the signs of our time are clear. And if you can't live without individual transport, you should at least go for a medium that is actually affordable already." (R09)

"[I would] absolutely [recommend an EV]! I am very patient in discussions around this topic. But when I feel that the discussion is pointless, so to say… I share my enthusiasm and I try to

counter the others' fears or arguments, but I am realistic about it and know that if someone really drives 500km or more a day, then [electric mobility] will lead to time constraints." (R14)

4.2 Perceived barriers and concerns

Apart from positive evaluations regarding EVs, both groups also point out critical aspects they worry about and consider a barrier to a seamless experience.

4.2.1 Range

A recurring topic in this theme is the electric vehicle's range. Non-EV owners describe the limited range as one of the main barriers stopping them from adopting an electric vehicle.

Non-EV owners:
"My main concern is the range […] as I don't use [a car] so much in the city but more to go on vacation. So, I am worried I won't make it to my destination." (R02)

Therefore, some Non-EV owners consider an electric vehicle only as a secondary car. On the other hand, most of the EV owners describe the limited range of electric vehicles as a minor adjustment compared to conventional cars. While they admit that the EV's range requires thorough route planning and development of new habits, they do not perceive it as a major barrier.

EV owners:
"I think I would still recommend it. Especially for people that don't drive large distances with their cars, I don't see why not. Of course, this longer range might be a point, but I actually don't see many disadvantages except maybe that it bothers you." (R08)

4.2.2 Purchase price

Especially young non-EV drivers mention the high purchase price as a barrier for EV adoption.

Non-EV owners:
"[…] you'd have to take a better model, the ID3 or ID4 by Volkswagen. Those can do 500 km best-case, so let's say 400km. If you drive very efficiently you would also achieve that in winter. The problem is, those models are not in the price class of what we would spend for a car right now." (R05)

However, some EV drivers state that there are affordable used electric vehicles on the market.

EV owners:
"You can get an electric vehicle at a very good price. I can get a Zoe for 10,000 Euros, a used one that has traveled few kilometers and is a good car. In my eyes, [high purchase price] is always a bit of an excuse. […] A Tesla is a really expensive and exciting and great vehicle, but it costs accordingly. But a combustion car like a Mercedes costs the same." (R16)

4.2.3 EV battery production

Especially young non-EV Drivers voiced concerns regarding the environmental and social sustainability of electric vehicles:

Non-EV owners:
„I think I'd have to inform myself in more detail regarding how good electric cars actually are because their production and the batteries are also… I think they are not much better off compared to combustion vehicles considering the carbon footprint." (R04)
However, EV drivers emphasized the importance of looking at e-Mobility as a whole instead of only focusing on the EV purchase.

EV owners:
"Actually, we know that it's all possible, it's all already developed in technology. I really expect it to be implemented. That just has to be part of it because throwing away a battery in the end, we can't tolerate that! Circularity, be it energy […], that the source is sustainable, that the complete cycle is in place, also the recycling. That is at least as important as that people choose to drive an electric vehicle. Because rushing the purchase and neglecting everything else, that's not the way it should be!" (R13)

4.2.4 Resale value

Due to the dynamic developments of EVs and battery technology, both groups mentioned concerns regarding EV's low resale value, fast depreciation, and limited battery durability.

Non-EV owners:
"There's really happening something in the market and I believe that in the next 2, 3 years there will happen much more. The question is whether to buy [an EV] right now if in 2 or 3 years there's the same model or a much better one for less money." (R05)

EV owners:
"A problem is, of course, the battery technology, that the batteries are quickly overhauled and then the repurchase value is no longer the same because the technology is a different one […]" (R09)

4.3 Charging habits

Another theme often mentioned by the respondents comprise the charging habits. Non-EV owners referred to their charging habits based on their previous driving experience with EV, while EV owners reported on their actual charging habits and activities.

4.3.1 Charging at home

Non-EV owners:
"[the public charging infrastructure in Innsbruck is] hopefully not relevant for me because I will mostly charge at home. So that I start with a fully charged battery at home and therefore won't need any charging infrastructure in Innsbruck. I hope." (R03)

EV owners:
"I have never charged somewhere else [other than home]" (R10)

4.3.2 Charging at work

Non-EV owners:
"[I would charge while] working, or studying…" (R02)

EV owners:
"I charge my car 95% [of times] at home or work." (R13)

4.3.3 Additional amenities at the EV charging station

Non-EV owners:
"Well, giving some entertainment options, you could offer Wi-fi hotspots at the charging stations…" (R02)

EV owners:
"If I go shopping for one hour, which is what actually happens, and I charge 8 kw in that hours, that would be about 11 or 15 cents…" (R14)

4.4 Aspects to improve

The various factors that are mentioned by both the groups in terms of improving the experience of driving an EV for the wider market implementation are as follows:

4.4.1 Location of charging spots

As for the infrastructure, respondents emphasized the importance of distributing chargers across residential areas and close to workplaces.

a. Private charger - residential areas

Non-EV owners:
"There are many old buildings, where… in the city center, there are many buildings that don't have a private parking lot but have to park on the side of the road. And someplace I have to charge my electric vehicle or otherwise, I can't buy an EV." (R06)

EV owners:
"We are tenants of our apartment and in order to install a charging station in a multi-party building, every owner must give consent, because it's a change of the house itself. You must drill holes to place a cable line. So up to now, it's almost impossible… and for me, that's not in line with the climate goals of the Austrian government. Because it's just too cumbersome and we've actually already spent about one year trying to get permission to build a private charging station in the house." (R11)

b. Private charger - workplaces

Non-EV owners:
"I either park the car at home or work […]. So [it would be great] that everywhere the car is parked, I could charge it." (R03)

EV owners:
"[…] If I don't have the benefit to charge at home, but then have the option to park my car at work and maybe leave it there for one day, then it's easily fully charged again… or maybe a half-day." (R11)

c. Public chargers

Non-EV owners:
"I think that maybe charging stations should be at parking lots of skiing stations and hotels, because Innsbruck profits a lot from skiing tourism, or also during the summer from tourism in the mountains in general. So, where you drive to start your trip into the mountains, there should be charging infrastructure." (R02)

EV owners:
"I saw that supermarkets don't offer that many [chargers]… there is lots of potential for sure […] it all depends on how easily you can charge your car privately." (R11)

4.4.2 Charging duration

Non EV owners have more concerns about the longer charging duration compared to their counterparts. Both the groups, however, are less likely to tolerate longer waiting time for getting a charging spot.

Non-EV owners:
"[…] So that there are enough chargers, and you don't have to wait because charging takes so long – you shouldn't have to wait for half an hour until somebody else has finished charging and then wait another half an hour to charge your own car." (R01)

EV owners:
"I would just emphasize… of course, when I travel larger distances with my EV that I don't have to wait at those charging stations. At gas stations, I don't have to wait. I mean, if I have to wait for two cars or one car, that doesn't matter. But I wouldn't want to wait in line. For me and my EV that would resonate very, very negatively."

4.4.3 Charging prices

Both groups report on differing schemes and prices in the public charging infrastructure.

Non-EV owners:
"[…] especially at the fast-charging stations, they charge per minute. That's good for someone who has a car that can charge very fast and therefore needs little time to charge. But still, I think that's unfair because especially smaller cars usually cannot charge that fast and so they are actually being punished with such a fee. And it should be standard like with gasoline, you don't pay the time it takes to fuel but you pay per liter. So, the amount you fuel. And that's how it should be when charging, so paying per kwh." (R03)

EV owners:
"Some charge per minute, others charge per kw. And per minute, that's really just a rip-off because one provides you with 11kw per minute, and the other with 40kw per minute. So, nobody can calculate anymore. […] so, for a clear and simple payment I'd prefer to pay per kw" (R12)

4.4.4 Payment system and charging process

Both groups perceived the existing payment system and charging process complicated and less user-friendly.

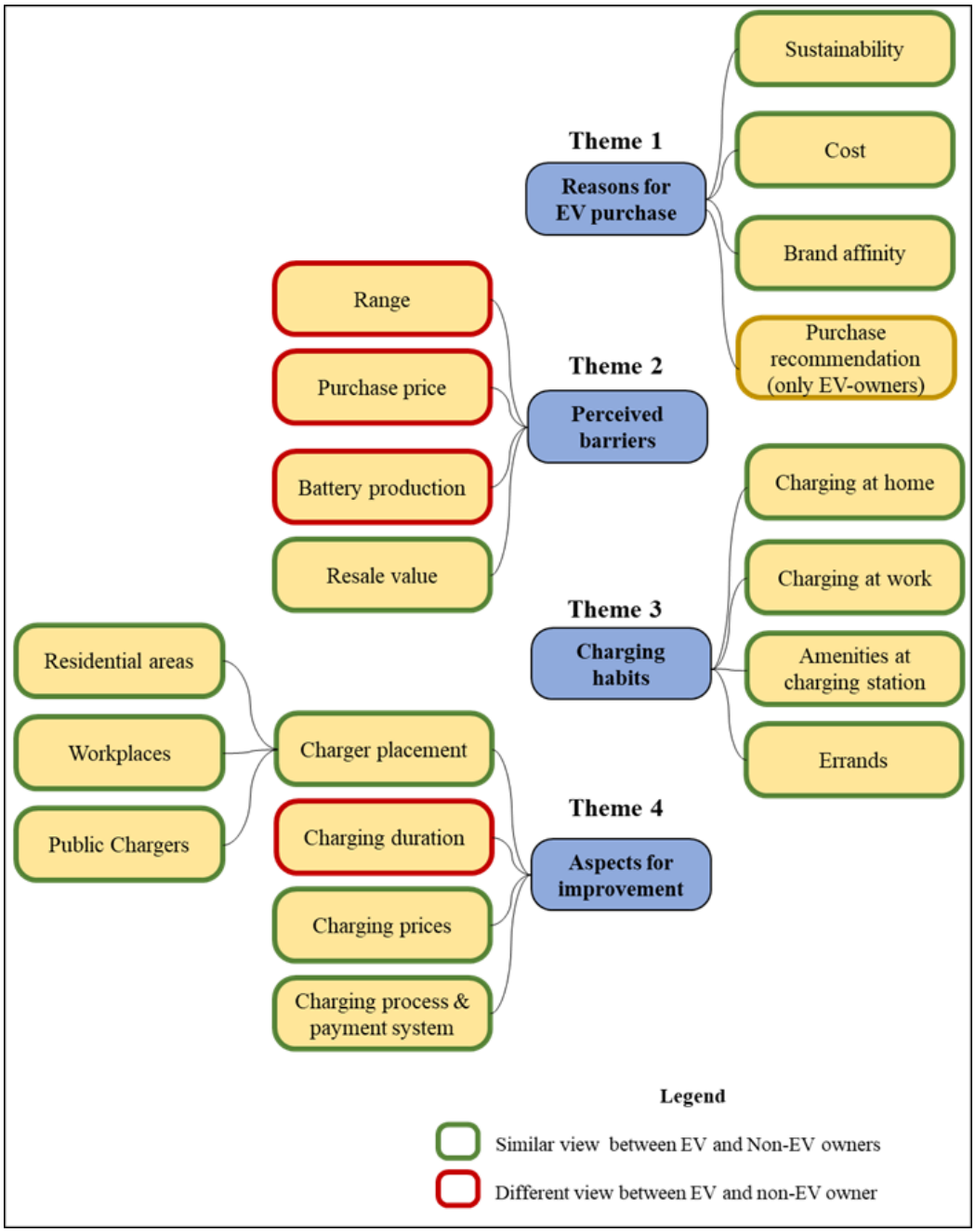
Non-EV owners:
"I'd prefer [to pay] with an app. Or credit card. Anyways, with one integrated system that works for all the charging stations." (R03)

EV owners:
"… there are different cards, apps, and stuff everywhere. The best way would be to just pay with a credit card, something everybody has and that is just… easy." (R18)

5. Discussion of the findings

The thematic analysis yielded 4 distinct themes with their respective categories: 1. reasons for a (potential) EV purchase, 2. perceived barriers and concerns, 3. (expected) charging habits, and 4. aspects for improvement. Figure 2 provides an overview of the four themes and their respective categories.

Figure 2: Thematic analysis results



The results for *theme 1* show that sustainability plays a major role in purchase decisions of EVs for both the EV owners and non-EV owners. Egbue and Long (2012) confirm this finding by suggesting that sustainability and environmental aspects exhibit greater influence on the adoption of EVs. However, they observed that cost and performance play a more significant role. The respondents in the current study also frequently referred to the financial aspect of

purchasing an EV. While non-EV owners emphasized the benefits of government subsidies, EV owners mostly referred to the reduced maintenance cost. Although it is assumed that consumers consider the purchase price rather than fuel and operational savings (Hidrue et al., 2011), possibly today more people are aware of the distinct cost efficiency that comes with EVs with promotion and word of mouth. The findings on subsidies are confirmed in prior literature where it is found to be an effective instrument to overcome consumers' perceived barrier of higher EV purchase costs (Kester, 2019). Regarding the brand affinity, the literature states that brand and style play a larger role for high-income individuals in their purchase decisions (Habich-Sobiegalla et al., 2019) which is in agreement with the findings of the current study. All the EV owners in this sample unequivocally recommended purchasing an EV.

Overall, several positive aspects are mentioned by the interviewees for purchasing an EV. However, despite technological progress and much promotion, EVs still make up only a minor part of the global car fleet, accounting for about 1% of the global car stock in 2019 (Noel et al., 2020, Bibra et al., 2021). *Theme 2* adds to the literature by exploring barriers and concerns hindering a faster EV adoption. Existing literature pinpoints purchase cost and driving range of EVs as the two main barriers responsible for the slow EV adoption (Chen et al., 2020, Franke et al., 2016, Hidrue et al., 2011, Mandys, 2021, Nilsson, 2014, Noel et al., 2019, Pevec et al., 2020, Xu et al., 2020). Particularly, driving range is a primary concern for non-EV drivers. This study is also in agreement with the previous studies and most Non-EV owners mentioned "range anxiety" as one of the major barriers in purchasing an EV. Whereas, EV owners in this study are less concerned about range and stressed the importance of effective route planning. Regarding the purchase price, younger individuals are more concerned with the purchase price and the current study includes only one EV owners younger than 25 years, showing that EVs are still overly priced for the low-income young adults. Another notion to forgo using EVs are the battery production of the EVs. Predominantly, younger interviewees questioned whether EVs are as environmentally beneficial as it is advertised. Regarding the resale value, both the EV owner and non-EV owners stated rapid developments in battery technology, depreciation, and limited battery durability as a general concern regarding purchase decisions, which is also in line with prior research (Baltas and Saridakis, 2009).

Theme 3 reveals the existing and prospective charging habits of the EV owners and non-EV owners. There is a divergence between expectation and reality of these two groups. Based on previous experience with EVs, non-EV owners perceive that they will often use public infrastructure to charge their EVs, while existing EV owners will mainly rely on home charging and some have never used public charging facilities. Non-EV owners acknowledge the convenience of charging while staying home or at work, however, they also intend on charging during other activities such as leisure or running errands. For non-EV owners potential charging habits also depend on the access to private charging facilities at home or work at the moment. For EV owners, their current habit shows that they prefer charging at home and feel that there is more infrastructure needed on highways for long-distance trips. In addition, both the groups would value a Wi-Fi hotspot at charging station for utilizing the time while EVs are charging.

Location of the EV charging station is a crucial research area to further promote the full transition to electromobility. *Theme 4* represents three locations for installing EV chargers identified by the interviewees: residential areas, workplaces, and public chargers. Interviewees mentioned the need for political support in installing a private charger at home, particularly tenants who are living in apartments and have shared parking. For old buildings where no

designated parking lots are available, public charging stations in surrounding residential areas should be provided. Workplaces are another important location for installing EV charging stations. Especially long-distance commuters will value this option (Liao et al., 2017). Karolemeas et al. (2021) also observed that chargers should be available in places with a high density of commercial workplaces. Additional locations for charging stations mentioned by both the groups includes, ski resorts, hotels, supermarkets, fitness centers—namely incorporating leisure with EV charging. Heterogeneous views are demonstrated in terms of charging duration. While non-EV owners are sensitive to the charging speed of EVs and expect it to be improved at the public charging stations, EV owners are more accepting of longer charging time and perceive it as a break from driving, especially for long-distance travel. This conflicting view between owners and non-owners can be explained by the status quo bias, namely individuals' behavior to favor the current state over change. The finding is also in line with other research on bias and resistance in EV adoption (Shankar and Kumari, 2019, Stryja et al., 2017). Nevertheless, both groups expressed their concerns over waiting times as a result of other drivers occupying the charging station, as this would lead to total waiting times beyond their comfort level. Regarding the charging price, both the groups perceive the tariff scheme at the public charging stations as non-transparent. There are several providers in the market for charging facilities with complicated payment procedures. Both the EV-owners and non-owners recommended an integrated payment system, using a credit or debit card rather than carrying multiple cards from different providers. They also highlighted the importance of standardized pricing, preferably energy-based price (kw/h), which may be comparable to the "conventional" fueling with a price per liter.

5. Conclusion and policy recommendation

The qualitative study reveals opportunities and challenges relating to EV adoption. It contributes in identifying the factors important for both the EV manufacturers and policy makers to promote full transition to electromobility. The policy recommendations are as follows:

- Public charging infrastructures are more relevant for commuters or those who cannot reap the benefits of a private charging facility. Most EV drivers identified that more fast charging points are needed on highways, and can alleviate the perceived range anxiety.
- Residential and commercial areas (e.g. work places) and connection to public transport (commuters) are the most crucial locations for installing the charging infrastructure. Moreover, the public charging infrastructure will be less stressed if more private chargers are installed.
- The government's first-time buyer incentives could lead to an increased number of EVs on the road. However, the result shows that this applies mainly to high-income groups, while younger users still think EVs are costly. More opportunities to ride EVs should be offered to encourage the promote EVs and reduce this EV reluctance. The benefits of EVs to these populations can be realised with the use of soft measures, such as driving schools with EV fleets.
- The public charging infrastructure should be installed strategically, such as near supermarket, cafes, ski- resorts.
- As a source of electricity photovoltaic installation should be promoted, particularly for private charging facilities installed by the EV owners.
- To avoid occupying public charging spots when an EV is fully charged, introduction of idling fee and limiting the charging capacity to 80% can be a possible solution.

- Additional facilities such as Wi-fi hotspot can facilitate entertainment and work during charging process, increasing the utility of the EV charging stations.
- EV owners highlight the importance of transparency in charging prices, standardization (large differences exist, up to 200%), clear signage of charging facilities, and flexible charging system (e.g., mode of payment, preferably non-cash options) and the draws policy makers attention to facilitate the installation of private charging facilities at home, particularly for multi-family rental apartments.
- Abolition of roaming fees (follow example of European Union phone roaming fees abolition) can be a crucial factor for wider EV acceptance.
- EV users are willing to pay a premium on EV charging price for faster charging and for the dedicated EV-only parking spots

The findings have important implications for the charging infrastructure roll-out for the emerging EV adopting countries. As Australia's framework to achieve net zero emission by 2030 includes the increased uptake of the EVs (Department of Climate Change, 2023), hence the insights from this study on the objective and subjective perception of the existing and potential EV owners can be tailored in a questionnaire that is relevant to Australian context. Furthermore, future research can draw on the explored themes and conduct a mixed-method research, combing both qualitative and quantitative study. A promising area for a follow-up research in Australia is the topic of range anxiety and varying level of home solar photovoltaic systems penetration. This study has limitation as the sample size is relatively small. However, considering the rate of EV deployment in Innsbruck and the size of the city, the sample served to explore the important arenas of promoting EVs from both the existing and potential EV owners.

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