Marketing mix of used electric vehicles in Ontario, Canada.

by

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Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Electric vehicles (EV) support sustainable transportation by contributing to the reduction of emissions from the light-duty (passenger) vehicles sector. Electric vehicle adoption is a topic that has been studied through a variety of disciplinary lenses, from economics to engineering; however, while many studies have looked at consumer motivations for purchasing new EVs, virtually no research has been conducted on the used (i.e., second-hand) EV market. As the EV market continues to grow, so too will the supply of used EVs. The used EV market is an interesting point of entry for those purchasing an EV for the first time or who cannot afford the cost of a new EV. Previous research has identified the point of sale of new EVs as an influential factor in the adoption of this technology, and it is through this lens that the used EV market was investigated. This study uses an exploratory approach to address the sale of used EVs in Ontario, Canada by analyzing online advertisements of used EVs by dealerships and private sellers. The aim was to determine how/if attributes that are specific to EVs (e.g., battery life and charging range) are being communicated to potential buyers. A secondary aim was to compare this information to advertisements for internal combustion vehicle (ICV) versions of the same cars. To achieve this, data from 480 advertisements for used vehicles on the autoTrader website were collected, including a sample of 408 EVs and 72 ICVs. The dataset included a mixture of quantitative (e.g., model, year, price, mileage, etc.) and qualitative information (e.g., seller's own description of the vehicle attributes). The results from the study showed very little difference between advertisements for EVs and ICVs in terms of what information is being communicated: For all ads, the first few attributes communicated tended to be related to the condition of the vehicle and/or specific non-EV attributes such as 'heated seats'. Findings also revealed that private sellers were more likely to talk about EV-specific features of the vehicle than were dealers. Overall, this research can conclude that the market of used EVs in Ontario lacks focus on attributes that differentiate EVs from ICVs, thus potentially making adoption by

first-time potential purchasers more challenging, since the barriers often found by EV adopters are not being addressed. This presents an interesting opportunity for online platforms, such as autoTrader, to further customize advertising templates to include EV-related attributes. The results of the study also signal that further research should take place from the point of view of potential customers as well as previous purchasers in the used EV market to determine what information would be useful when shopping for vehicles online.

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List of Abbreviations

BEV – Battery Electric Vehicle

ESG – Environmental, Social, and Governance

EV – Electric vehicle

GHG – Greenhouse Gas

HEV – Hybrid Electric Vehicle

HOV – High Occupancy Vehicles

HOT – High Occupancy Toll

ICV – Internal Combustion Vehicle

MSRP – Manufacturer Suggested Retail Price

PHEV – Plug-in Hybrid Electric Vehicle

TCO – Total Cost of Ownership

WTP – Willingness to Pay

ZEV – Zero Emission Vehicle

1. Introduction

Electric vehicles (EVs) have the opportunity to support advancements in sustainability when compared to Internal Combustion Engine Vehicles (ICVs). In particular, EVs contribute to the reduction of air pollution thanks to zero tailpipe emissions, noise pollution, and energy use (IEA, 2020). In addition to these environmental benefits, EVs also offer benefits for owners. EVs allow owners to divest from the oil industry. Likewise, performance features such as the instant torque or acceleration, along with the convenience of charging the car at home, and financial savings over high ICV maintenance costs are also key features preferred by EV owners (Shahan, 2015).

For society, the most important potential benefit of EVs is their emissions reduction potential. Canada's commitment to the 2016 Paris Agreement includes plans to reduce emissions by 30% compared to 2005 levels by 2030 (Environment and Climate Change Canada, 2021). Transportation currently contributes about one-quarter of greenhouse gas (GHG) emissions in Canada, with light-duty vehicles accounting for almost 50% of these transportation-related emissions (Natural Resources Canada, 2019a). Significant reductions in the use of gasoline-powered vehicles and the increase of alternative-fuel vehicles in the transportation sector will be needed as Canada works towards meeting its emissions reduction goals. Canada's recently introduced *Zero Emission Vehicle Infrastructure Program* aims for 10% of light-duty vehicles sales in Canada to be zero emission vehicles by 2025 (Natural Resources Canada, 2019a). To encourage EV adoption as a way to meet the 10% sales target, the Government of Canada has implemented a policy framework that includes financial incentives and encourages charging infrastructure provisions (Transport Canada, 2020)

In parallel, car manufacturers are also setting ambitious targets to move towards EVs as their primary light-duty vehicle offering in their sales line-up. Examples include General Motors's

commitment to the sale of only EVs by 2035 (Abuelsamid, 2021), Honda committing to phase out gasoline cars and go all electric by 2040 (Lyon, 2021), and Ford committing to go all electric in Europe by 2030 (Taylor, 2021). The motivations for these ambitious targets are likely complex, involving consumer pressures, marketing, and even access to investment in a climate of increasing focus on company environmental, social, and governance (ESG) performance. However, car manufacturers illustrate a potential transformation of the light-duty passenger vehicle market.

To fulfill the potential sustainability benefits of EVs (including Canada's GHG emissions targets), it is important to consider the environmental impact of manufacturing EVs. From a life-cycle perspective, current batteries use rare earth minerals, the electricity mix of the local electrical grid influences actual emissions reduction, and EVs must remain on the road for a number of years (varies by geographic location) to overcome the increased embodied energy in their construction to result in improved emission performance over ICVs (Archsmith et al., 2015; Hawkins et al., 2013). Ahmadi et al (2014) state that the manufacturing of an EV contributes up to half of the GHGs it produces over the lifetime of the vehicle, meaning that the longer an EV stays on the road, the better it performs from a life-cycle perspective. While the need to keep EVs on the road longer is justification alone for the development of a strong second-hand vehicle market for EVs, there are other compelling reasons.

Once a consumer has made a first purchase of an EV, they are likely to continue purchasing EVs in the future. Research has shown that over 80% of EV owners continue to purchase EVs (Hardman & Tal, 2021). This, coupled with rapid development in EV range, charge times, and additional features such as driver assist technology, mean that as EV owners seek to upgrade to newer models, used EVs that have not reached the end of their life cycle become available on the second-hand market. The range of EVs (vehicle types and price points) are growing

rapidly. As of March 2021, there were 938 different light-duty vehicle models available in the new-car market in Canada, 2.9% (27) of which were available Battery Electric Vehicles (BEV) models, and 3.8% (36) were Plug-in Hybrid Electric Vehicles (PHEV) models (Natural Resources Canada, 2021). With the introduction of models like the Ford Mustang Mach-E or the Polestar 2, it would be natural transition for some current EV owners who desire to match the latest trends to trade their current EV for the latest innovation in EV technology. While the market share for EVs is still low, it is expected to grow in the next years (IEA, 2019). As the number of new EVs on the road continues to grow, so will the market for used EVs (which up until recently has been quite small but is steadily growing).

In addition, the higher initial cost of EVs compared to ICVs means that these second-hand vehicles present an opportunity for entry into the EV market for individuals that may not view a new EV as a cost-effective option. Used EVs present an option for a consumer to get the proverbial 'foot in the door.' When considered alongside Hardman & Tal's (2021) findings, with an 80% conversion rate to EVs on their next vehicle purchase, getting consumers into a used EV is a way to 'lock' in a transition to this vehicle type. By making EVs more accessible, a strong market for used EVs can increase the general uptake of EVs. Hence the need to analyze the retail component of EVs to better understand the opportunity that the used market could bring to the expansion of EV adoption.

EV adoption is a topic commonly studied by multiple disciplines, from economics to engineering. While many studies have looked at consumer motivations for purchasing an EV (Abotalebi et al., 2019; Bailey et al., 2015; Bjerkan et al., 2016; Chandra et al., 2010; Higgins et al., 2017; Li et al., 2020; Zarazua de Rubens, 2019; Zhang et al., 2016), infrastructure challenges (Bailey et al., 2015; Barisa et al., 2016; Gnann & Plötz, 2015; Wang et al., 2019), as well as challenges at

point of sale (e.g. Matthews et al, 2017; Zarazua de Rubens et al, 2018), virtually no research has been conducted on the used EV market.

Following previous studies which have identified the point of sale as an influential factor in the sale of new EVs, this thesis takes an exploratory approach to this topic by looking at the way in which used EVs are advertised by dealerships and private sellers. Investigating the current way in which information about used EVs is communicated to potential sellers provides insights into the relatively new market for used EVs and explores opportunities for improvement. Further, it contributes to the extant literature on the marketing of 'green' products. Exploring the attributes of used EVs includes the characteristics of the vehicles, the promotion given by the sellers, and the place where they are being sold. All of those elements will provide a clearer view of the barriers and opportunities that exist in the used EV market.

1.1 The definition and development of EVs

Currently, there are different types of EVs for passengers on the market, the most common ones being BEVs, PHEVs, Hybrid Electric Vehicles (HEVs), and Fuel Cell Electric Vehicles (FCEVs). While all the previously mentioned types of EVs could be considered 'electric vehicles' that have clear purposes related to environmental concerns, such as reducing greenhouse gas emissions and fuel costs, their functioning differs. For instance, BEVs are capable of drawing electricity from batteries onboard to then power an electric motor and propel the vehicle, however, the batteries from BEVs are only rechargeable from an external source. PHEVs are vehicles that combine the use of a conventional gasoline engine with an electric motor and high-capacity batteries to propel the vehicle. The gasoline engine and electric motor can operate simultaneously or separately, however, when driving only with the electric motor engaged, the tailpipe emissions are less. PHEVs batteries can be also charged externally and because of

their smaller size compared to BEVs, PHEVs have a shorter range when operating using electricity. HEVs are quite similar to PHEVs with the main differences being the size of the batteries (bigger for PHEVs), and the capability to be charged from an external source (PHEVs). Fuel Cell Electric Vehicles (FCEVs) use hydrogen with oxygen in a fuel cell to power an electric motor. Regardless of all of them being electric vehicles, FCEVs are often left out of the picture for being in a very early stage in sales, production and charging infrastructure. BEVs, PHEVs and HEVs share one main feature in common that is often the object of research around it; this feature is the battery.

Batteries have evolved since the first EVs rolled out into the market, with continuous improvement over time in terms of capacity, weight and optimized materials used to manufacture them. There are various challenges related to the resources used in EV batteries such as nickel, manganese, and cobalt used for the cathode, or lithium-ion (Li-ion) used on the electrode. Some of these materials are harder to get than others or even some of them are sourced from countries with a record of human exploitation, such as the Democratic Republic of Congo, which is known for being a great source of cobalt (Union of Concerned Scientists, 2018a). In addition to these issues, the demand for these materials is expected to grow to levels more than eight times the amount of material used for EV batteries in 2019 (IEA, 2020). This offers another argument for a strong used EV market. Because of the embedded energy and resources used to manufacture batteries, it is important to maximize their lifespan by keeping EVs on the road as long as possible.

1.2 EVs market in Ontario, Canada

In Ontario, the plan is to reduce by 37% of GHG emissions by 2030 by in relation to levels measured in 1990 (Province of Ontario, 2016). Therefore, the use of green transportation in the province needs to be promoted and supported as one tool to achieve this goal. Recent statistics show a total of 54,353 EVs sold in 2020 Canada wide, 1,812 vehicles less than the previous year. Nonetheless, the share of new EV sales increased from 2.91% to 3.5% for 2020, the main reason for this was the sales of ICVs being hit harder by Covid-19 pandemic than those from EVs (Jarratt, 2021). Ontario is among the three provinces with more EVs sales in Canada, its share of new EVs registrations went up to 1.8% in 2020 from 1.2% in 2019. In 2020, 10,515 new EVs were registered which is 753 over the previous year but not close to the 16,365 EV registrations reached in 2018 (Jarratt, 2021).

Currently in Canada, there is an estimate of 168,000 EVs on the roads, accounting for less than 1% of the total light-duty vehicle registrations (Rabson, 2020). Of the 23.4 million light-duty vehicles registered in Canada, 8.5 million units are registered in Ontario (Government of Canada, 2020). As Ontario has the largest population in Canada (14.7 million) it likewise has the highest number of EV registrations in the country (Government of Canada, 2021). Therefore, by focussing efforts on EV adoption in the province and succeeding on the EVs uptake, the rest of the provinces could follow steps followed to increase EVs shares in the entire country.

Canada has developed some ambitious goals for future EV adoption, which will be challenging to achieve given the current rate of growth in EV sales (Rabson, 2020). Currently, there are two federal incentives directed at EVs buyers, the first one is a rebate on the purchase of new EVs that ranges between $2,500 and $5,000 for BEVs and PHEVs. The second incentive is a tax

write-off for vehicles purchased for business. Several provinces offer additional incentives including British Columbia, Nova Scotia, Quebec and Prince Edward Island (CAA National, 2021; Plug ‘N Drive, 2021; Solomon, 2021). Among the three Canadian territories, only the Yukon provides a financial incentive for EV purchases (Bettencourt, 2021).

Up until recently, Ontario had one of the largest incentive programs for EV purchases. This incentive program included a rebate of up to $14,000 for the purchase of an eligible EV. This incentive was removed in 2018. Subsequently, EV sales declined in 2019 in Ontario by 55% over 2018 sales (Jones, 2019). Presently there are only two incentives to the residents of Ontario looking to purchase an EV; both incentives are offered through Plug ‘N Drive, a non-profit organization looking to accelerate EV adoption in Ontario. The Plug ‘N Drive incentives focus on the used EV market by providing $1000 towards a purchase of a used BEV (or $500 towards a used PHEV) after attending a one-hour free seminar on EVs. The second incentive is $1,000 toward the purchase of a used BEV or PHEV when an ICV is scrapped (CAA National, 2021; Plug’n Drive, 2021). This is the only incentive in Canada that is geared specifically towards the used EV market. The fact that more focus is being placed on the used EV market in Ontario makes it an interesting case study to consider in terms of how the attributes of EVs are being communicated to potential owners of these vehicles.

Even when incentives are available country-wide, one of the main hurdles for EV adoption is the availability of EVs on different places of sale, most commonly for brand-new cars offered in dealerships. Previous research has been done on the lack of availability of EVs models at dealerships, decreasing then the number of customers interested on purchasing an EV since not too many customers would buy a product sight-unseen (Matthews et al., 2017). One of the reasons for this EV-shortage in Ontario is due to the fact of most of EVs stock is being sent to provinces with stronger incentives available such as British Columbia or Quebec (Bettencourt,

2020). This is when the used market for EVs comes into play to provide vehicles to new adopters, often with limited availability but without long waiting lists as is usually common when purchasing a brand-new EV. However, to maximize resources available in the used market for EVs there is one issue that must be solved and has been identified in previous research as well, and that is the accuracy of the information provided to customers looking for an EV, this is a crucial point to engage customers into a fruitful purchase process (Matthews et al., 2017).

1.3 Thesis purpose and research objectives.

This research explores the market of used EVs in Ontario, Canada. Specifically, this research examines how EVs are promoted in the second-hand marketplace with attention to how EVs are described. For a better understanding on how those products are being promoted, an approach exploring their marketing mix is used; this implies exploring the product, its price, place of sale and promotion.

This study sets 2 research questions:

1. How do the attributes of the marketing mix of used electric vehicles in Ontario are expressing the main benefits unique of this sustainable transportation?
2. How are the common barriers for EV adoption being addressed by used EVs promotion and how does that promotion differ from that of used ICVs in Ontario?

When viewed through the lens of the barriers to the adoption of EVs and frameworks for marketing of sustainability, it is possible to identify how the used EV market can be enhanced to increase adoption of EVs and to keep them on the road longer, thus extending the use of the comparative sustainability benefits that EVs hold over ICVs.

For this research, HEVs were not considered due to their stronger dependence on a conventional gasoline engine. Therefore, the term Electric Vehicles (EVs) refers to BEVs and PHEVs only. The term “used vehicle” will also be used to refer to any non-brand-new vehicle in the market. This is the generally accepted industry term for second-hand vehicles (see for example, Plug ‘N Drive, 2021). This study focuses only on the light-duty vehicles in the market, also known as “passenger vehicles.”

The objectives that this study intends to meet are the following:

1) Explore the marketing mix components of used EVs in Ontario.
2) Identify what sustainable attributes are being broadcasted by used EVs sellers to potential new owners.
3) Identify what barriers faced by EV adopters are being addressed in used EVs promotion.
4) Compare used EVs promotion against used ICVs promotion, to find differences or similarities that may influence EV adoption

1.4 Research approach

This research took an exploratory approach by looking at online EVs ads that were posted in autoTrader, a well-known site for advertising cars in Canada. The scope of this research was set to Ontario only, since it has the greatest population in Canada, and the province suffered a decrease on EVs sales in 2018. Thus, there is a potential gap in the adoption of EVs by new customers. A total of 480 advertisements were observed using an e-mystery shopping approach. This allowed gathering the most significant data from the 480 vehicles in the advertisements to later analyze it using a statistical test of Pearson Chi-Square independence-relation to find any possible relation between vehicles with specific features and their description. The final dataset contained a sample of 408 EVs containing BEVs, and PHEVs;

additionally, there were 78 ICVs for comparison purposes with their EV similar model. The methods for gathering the data were strictly reserved to online observation, the features from each vehicle were added to a MS Excel spreadsheet to create a data set and generate the descriptive statistics of it. One of the features added to the dataset was the description written by the seller in the advertisement, this description was later analyzed and coded into 4 different categories that reflect the first three attributes mentioned in the description. Those categories for features mentioned were the following: EV related, non-EV related, owner use, care and/or maintenance, and sale related. The statistical test of Pearson Chi-Square independence-relation allowed to relate the descriptions of the vehicles in the sample with the seller's focus on the unique attributes of EVs.

1.5 Contributions

This research provides insightful data on the current state of the market of used EVs and its characteristics. The data can be used by online sites that are dedicated to the sales of used cars, so they can adjust their marketing strategy to deal with the weaknesses detected and subsequently to strengthen the adoption of new customers, which will reflect as a higher number of sales completed. From an academic perspective, the research in this thesis contributes to the broader discussion on how data on 'green' products such as EVs are communicated to consumers. To date, there has been a dearth of information on 'used' green products, with the exception studies focusing on the second-hand clothing industry.

1.6 Thesis structure

This thesis is structured into 5 different chapters that provide: the background used to discern the gap in the current literature, the methods used to collect the data, the results from the data

gathered and the analysis done to it, and the discussion and conclusions from the results obtained.

Chapter 2 gives detail on the previous research done on EVs adoption, which allowed the highlight of the gap this thesis intends to fill.

Chapter 3 describes the steps followed and criteria used to gather characteristics from all the EVs available on the website autoTrader.com.

Chapter 4 reveals the results obtained from the data gathering and explains the analysis done to find any possible relationship between the description of the EVs in the used market and their different features.

Chapter 5 links the results obtained to existent literature and highlights possible gaps for future research in EVs adoption from a marketing point of view.

Chapter 6 discusses conclusions.

2. Literature review

In this chapter, the literature on electric vehicles adoption is presented with a specific focus on the marketing of EVs and EVs at the point of sale. This review is used to point out the current gap in EV adoption research, highlighting the benefits of EVs, and targeting the used market of vehicles as a potential boost to increase EV adoption; to then develop a framework for this research.

This chapter serves to highlight the complexity of consumer decisions related to EV purchasing. Researching EV adoption identifies the multiple influences that shape decisions to purchase including personal benefits, environmental, economic, and experiential factors. Therefore, EV adoption is a multidimensional topic that allows the participation of a wide range of fields such as economics, psychology, sociology, marketing, and more (Taylor & Fujita, 2018). Kumar and Alok (2020) conducted a structured literature review on the research made over the last decade on EV adoption and highlighted the lack of research done on some areas such as marketing and dealer experience. The literature review presented in this chapter will use some of Kumar's and Alok's (2020) literature review structure to present the research done on EV adoption, allowing then to highlight the current gap that this thesis aims to fill. The chapter systematically explores the influences that shape EV purchasing decisions, which, given the relatively young field of study, are typically viewed in isolation. It then presents a framework to help position and integrate these influences shape consumer purchasing decisions for used EVs.

2.1 EVs benefits

EVs offer a variety of benefits over conventional ICVs. Some can be directly appreciated by EV owners while others are present on a higher scale. When talking about the benefits of EVs some of the most common ideas from consumers is the benefit they present to the environment by having zero tailpipe emissions. Thanks to the reduction of those emissions, EVs are a good solution to decrease air pollution in urban areas, with a high density of people who often are exposed to harmful emissions from vehicles on the road (IEA, 2020).

EVs capacity of reducing tailpipe emissions is directly related to the reduction of GHG emissions. However, the issue goes further into the background of the origin of the electricity used to power those vehicles, meaning that EVs contribution to the reduction of GHG emissions will be more fruitful in those countries where their electricity is obtained via sustainable processes with the use of wind, solar or water power (IEA, 2020; Young, 2020).

Well-to-wheel (WTW) emissions refer to the emissions from the different processes of getting the fuel needed to power a vehicle and all the tailpipe emissions that the vehicle burns when operating. In a WTW context, EVs can have a reduction of about 60% of the emissions from a conventional ICV and 40% of the emissions of an HEV. However, these reductions strongly depend on the carbon intensity of electricity generation to power the vehicles in different countries (IEA, 2020).

EVs also benefit from having a higher energy efficiency from that of ICVs, meaning that EVs can convert over 77% of the electrical energy supplied to power at the wheels while conventional ICVs only convert about 12%–30% of the fuel to power at the wheels, most of that energy is lost in heat form (Natural Resources Canada, 2019b; U.S. Department of Energy, 2021a). This

benefit may not be appreciated easily by EVs owners. Nonetheless, at a bigger scale, it implies less waste of energy in the case of ICVs energy obtained from fossil fuels.

Related to fossil fuels and EVs benefits over ICVs there are two main benefits to be presented. The first one is the cost of powering each type of vehicle. For instance, the cost of electricity per kilometer is lower than that of gasoline, a BEV costs about $0.02 to $0.03 per kilometre km (at $0.13/kWh), compared to a 4-cylinder ICV at $0.07 to $0.08 per kilometre (at $1.00/L) (Natural Resources Canada, 2019b). The second benefit is related to the energy security that EVs bring to the transportation sector since this sector relies highly on fossil fuels which in some countries are imported, making the transportation sector even more dependent. On the other side, electricity can be produced domestically and with a variety of resources (IEA, 2020).

Some other benefits provided by EVs are more noticed by owners. The first one is related to the performance of EVs over conventional ICVs. EVs and specifically BEVs are known to provide instant torque and acceleration from the moment the throttle is pressed, while on ICVs there is a small response time for the car to deliver all its power available (Union of Concerned Scientists, 2018b; U.S. Department of Energy, 2021a). The second one is related to maintenance costs reduction (most significantly for BEVs), the main reason for this being the reduction of moving parts and fluids, (e.g. no engine oil which requires regular maintenance or brake wear reduced considerably because of the regenerative braking) (U.S. Department of Energy, 2021b). Noise reduction is another benefit often perceived by EV owners, by being quieter EVs contribute to the reduction of noise pollution.

Finally, charging at home is one of the perks that EVs offer over ICVs. While ICVs can be refuelled in five or fewer minutes at a gas station, EVs owners can benefit from charging their vehicle at home either overnight or during the day. Home charging can be level 1 which involves

a standard 120-volt electrical outlet, without the requirement of an additional adapter (on most makes and models), which provides an estimate of 8km of range per hour. Or it can be level 2, which requires additional installation of a 240-volt outlet, in this level depending on the battery size an EV can be fully charged between 4 and 10 hours (Young, 2020). This benefit is often mixed with perceptions of the range of EVs, but even though they are related, they should be analyzed differently.

2.2 EV adoption

EV adoption research can be categorized in multiple ways. Kumar and Alok (2020) identified seven categories of EV adoption literature: an economic perspective, charging infrastructure readiness, consumer perspectives, government policies and regulations, vehicle design and performance, environmental perspectives, and marketing perspectives. Within those seven categories, they identified 23 main topics with respect to the antecedents of each study. This literature review will take the structure of those seven categories to organize the research done on EV adoption.

2.2.1 Economic perspective

Within the literature of EV adoption, some research done has been focused on the economic perspective surrounding this type of sustainable transportation. Multiple issues are commonly addressed by researchers when discussing EV adoption with an economic focus. One of them is the total cost of ownership (TCO) of EVs which sums all of the costs surrounding EVs purchase process, either before or after, also including costs related to charging the vehicle. Research has been done on ways to assess the TCO for EV owners, such as the study realized by Van Velzen et al. (2019) where, after reviewing literature and surveys, they found 34 factors that influence TCO both directly and indirectly in EVs owners. However, they highlight some

relatively important factors mentioned by the interviewees such as production costs, range, and charging infrastructure, the last two mentioned being the only factors with possible relations to marketing.

Another issue often studied in academia is the willingness to pay (WTP) of customers for EVs. This term in simpler words is how much a customer would pay for an EV. Hidrue et al. (2011) realized a survey study on potential EV adopters to find out their WTP. Their results highlight the fact that the WTP increases if the vehicle can recharge faster, meaning that some customers give strong importance to EVs charging issues. Some other cases have found that EV adopters often find deceiving some other features of the vehicles such as range, and their WTP decreases when the range does not meet their expectations/requirements (Skippon et al., 2016). There are also other types of factors influencing the WTP of customers, such as the case of the symbolism that an EV represents to a potential EV adopter (White & Sintov, 2017). In other words, WTP is based on whether the customer identifies themself with being an environmentalist or an innovator, meaning they would eventually pay more for an EV if it is going to place them on a specific status in society.

2.2.2. Charging infrastructure

Past research conducted on the charging infrastructure brought up one of the problems that EV adoption faced. The “egg-chicken” problem that exists with EVs chargers and EVs potential adopters, where customers worried about the number of chargers available, and companies do not provide more chargers due to the low number of customers (Barisa et al., 2016; Egbue & Long, 2012; Gnann & Plötz, 2015). However, this barrier is being intensively looked after by private enterprises and government programs, which are in the look for extending the charging grid to facilitate the replenishment of EVs batteries. Related to the charging infrastructure, range

anxiety is one of the top concerns of some consumers who are willing to purchase an EV (Barisa et al., 2016; Chen et al., 2015; Hidrue et al., 2011; O'Neill et al., 2019). As a solution to this range issue, PHEVs and HEVs offer the opportunity to travel long distances without the need for recharging often. Nevertheless, that extended range on HEVs is based on the use of the gasoline engine that they are provided with; hence some researchers set aside HEVs from studies related to EV adoption (O'Neill et al., 2019; White & Sintov, 2017).

2.2.3 Consumer perspectives

When a new technology is released into the market, the fact that sometimes it is considered alien or unproved sets a barrier for customers to adopt it (Egbue & Long, 2012). Thus, research has been made on consumers' perspectives for EV adoption. The research includes but is not limited to: psychological characteristics, consumer heterogeneity, symbolic attributes, environmental concern and awareness, and perceived risks (Kumar & Alok, 2020).

For instance, Axsen et al. (2015) highlight the differences in tastes and preferences among customers' tendencies when adopting a new product. They identified six classes of customers divided into environmental and non-environmental motivations for those buyers who would buy any type of EV. Another finding from their research is the preference of customers for PHEVs over BEVs despite the higher range of some BEVs, leaving then the question of whether the range is truly a barrier for customers to adopt EVs or not.

Some other studies have dedicated to analyzing the perception of customers towards a specific brand of EV. In particular, a study realized by Long et al. (2019) to car buyers and their perception of Tesla, led to the fact that the brand perception of BEV buyers is often biased by research questions asked. In addition to that, the perception of customers is strongly influenced

by a diversity of factors such as experiences with other brands, information about EVs, age, gender, to mention some.

When analyzing the customers' perception of EVs, the psychology behind customers' decisions has also been researched and given insights like that the awareness of an environmental concern plays a vital role in the decision that customers take when adopting an EV (Adnan et al., 2018). Additionally, when talking about psychological perceptions, consumer behavior has been studied to discern the perception of barriers by customers who are willing to buy an EV. For example, research on the behavior of potential EV adopters has found 5 main hurdles that limit EV adoption: attitude factors influencing consumer behavior, behavior towards pro-environmental approach, adoption behavior towards innovation, consumer symbolic behavior, and behavioral emotion towards the adoption of EVs. This concludes then that customer emotion is overlooked in EV adoption research (Adnan et al., 2017).

Taylor and Fujita (2018) categorized customer behaviour for an EV's purchase process into 5 steps: problem recognition, search, alternative evaluation, purchase, and post-purchase behaviour. They highlight the possible areas for further research, enlightening the need to analyze the EV market and focus on the purchase step of the process by analyzing the options that customers have when they intend to purchase an EV.

The symbolic attributes of EVs often are the factors that push customers towards the adoption of EVs, White and Sintov (2017) studied in a series of surveys those attributes, finding out that environmental symbolism for self-identity was the strongest and more consistent predictor of EV adoption intention. Customers who acquire an EV usually are looking to fit in a specific group of society.

2.2.4 Government policies and regulations

A wide area of research on EV adoption is directed towards government policies, regulations, and incentives existing to promote the adoption of EVs. There are diverse incentives towards the purchase of an EV, from financial support to an exception of rules regularly applied to ICV drivers. An example of this is the case of the access to high occupancy vehicles (HOV) lanes, that EVs drivers in Ontario hold. Incentives, along with toll fee waivers and parking benefits are proved to increase the adoption of EVs (Zhang et al., 2016).

Meanwhile, some other studies have found that the lack of incentives and government campaigns is an elemental barrier that needs to be solved to generate a greater adoption among customers (Jenn et al., 2018; O'Neill et al., 2019). Some studies in Canada have been conducted to analyze the impact of incentives and regulations in the adoption of EVs (Abotalebi et al., 2019; Axsen & Wolinetz, 2018; Chandra et al., 2010; Melton et al., 2017).

Abotalebi et al. (2019) analyzed the low adoption of EVs in the Atlantic region, finding that financial incentives and battery warranty play an important role in features often looked for customers who are looking to purchase an EV. However, that same study shows that potential EV buyers of the Atlantic region in Canada do not take high importance on some other incentives like HOV lane access or free parking, incentives that other provinces with higher EV adoption do consider when intending to purchase an EV.

Monetary incentives will play a key role in the uptake of EVs needed to reach future market share goals set as Axsen & Wolinetz (2018) found in their research in which they present the fact that the current policies would only take Canada's EV share to 11% by 2030, and not 30%

as aimed in scenarios like the EV30@30 campaign. However, that is only one of the many aspects to modify in EV adoption plans if a greater adoption is desired.

2.2.5 Vehicle design and performance

Range, charging time, and body type are some of the barriers that often limit EV adoption and they all have one source in common: they are related to the vehicle design (Kumar & Alok, 2020). Research directly related to vehicle design and performance has not been as extensive as the one dedicated to other barriers that limit EV adoption. Many researchers mention vehicle design and performance as results from their studies or as a variable that needs to be modified to increase EV uptake.

Chen et al. (2015) conducted a study to predict the locations where EVs would be in Philadelphia in the future. However, they noticed that one limitation for increasing EV ownership is the lack of EVs in different car classes, a fact that diverts potential EV adopters into the purchase of an ICV. They suggest an increase in different electrified body types to increase EV adoption. Axsen & Wollinetz (2018) made a similar conclusion in their research, where they suggest making more EV models available to allow the increase of adoption and reach market share goals by 2030.

When talking about different body styles for EVs there is the fact that HEVs are available in more body styles than PHEVs or BEVs. Thus, automakers could benefit from HEVs wider range of body styles and their operating similarity to increase drivers who often incline towards PHEVs. Axsen et al. (2015) highlight that potential EV customers often have a preference to adopt PHEVs over BEVs, thus increasing a wider availability of models could improve EV uptake.

One of the attributes related to vehicle design and performance that potential EV buyers in Ontario usually look for is the range of EVs (Abotalebi et al., 2019). Thus, it can directly affect a customer's decision of adopting an EV as Skippon et al. (2016) found as a result of a controlled trial, in which a customer inclination towards EVs decreased after driving a BEV with short range.

2.2.6 Environmental perspectives

A basic assumption is that the main purpose of EVs is their benefit to the environment. Thus, research on their diverse environmental perspectives and impacts has been done. For example, HEVs rebates in Canada not only increased their market share but also increased emissions since HEVs rely significantly on the use of a gasoline engine (Chandra et al., 2010). Therefore, many researchers opt not to include HEVs within the "Electric Vehicles" classification.

In a similar case, PHEVs like HEVs use a gasoline engine to power the vehicle at some point, emitting CO2 emissions to the atmosphere. Research has found that real HEVs' CO2 emissions depend significantly on the average efficiency of the gasoline engine used by the vehicle, and for the case of PHEVs, their real emissions depend on the source of the energy used to charge the batteries (Millo et al., 2014).

Some other research on the environmental perspectives of EVs has been done about the materials used for their production (i.e., the use of resources like gas, coal, oil, and lithium). This last one being the most debated due to its use on batteries for BEVs and PHEVs. Todorovic & Simic (2019) remark that even though some forecasts and estimates predict a bottleneck

problem with lithium consumption, recent reserves identified provide enough material to supply future production of EVs.

2.2.7 Marketing perspective

Marketing strategies and dealership experience are catalogued as two areas of EV adoption which haven't had much attention from researchers (Kumar & Alok, 2020; Taylor & Fujita, 2018). The exploration of these areas could bring more insights into probable gaps that customers often find and divert their attention from EVs.

As Shao et al. (2016) highlight in their research, multiple barriers divert the adoption of environmentally friendly products by customers. Among those barriers, there is the unfamiliarity with the market for environmentally friendly products, inadequate sustainability-related information for products, lack of an easily understandable format for information, non-competitive price, and more. These barriers have a direct link with the marketing of EVs, how are they presented to customers and to whom are they directed. An example of this situation is presented in the research done by Zarazua de Rubens (2019) where findings show that environmental attributes play a vital role in the adoption of EVs. This is because some vehicles give more emphasis on attributes not that important to those customers for whom the car is intended. However, some other researchers have concluded that EVs marketing should accentuate the use of EVs as a symbol rather than focusing on their instrumental attributes.

Some research has been done on customers' dealership experiences to find out weaknesses in the EV purchase process. In brief, a couple of barriers have been identified. For instance, the salesman attitude has proven to be a crucial factor in customer likelihood to purchase an EV (Matthews et al., 2017; Tromaras et al., 2017). Furthermore, the lack of EVs available on site is

considered another hurdle that customers often face along with the long waiting period for acquiring an EV (Cahill et al., 2014; Matthews et al., 2017; Tromaras et al., 2017).

2.3 Canadian EV market

2.3.1 New cars market

The percentage of EVs from the entire market available in Canada has increased slowly over the years as can be appreciated in Table 1. The introduction of EVs in the country was made with only 3 vehicles available, accounting for less than 0.5 % of the market in 2012. Those vehicles were the Mitsubishi i-MiEV, Nissan LEAF, and Chevrolet Volt. The first two being BEVs with a range no greater than 100 km, and the Chevrolet Volt a PHEV with under 60 km of pure electric range, thus, the options for first EVs adopters were quite scarce. However, the presence of EVs in the Canadian market has been growing up step by step ever since, achieving 2.3 % for BEVs and 1.4 % for PHEVs in 2016, with 26 and 16 different models available respectively. The highest share of BEVs available in the new-car market in Canada was achieved in 2020 with 3.8% of new models being 100% electric. For PHEVs, the highest share reached concerning the entire Canadian car market was achieved in 2021 with 3.8% of the market corresponding to this type of EV. Nevertheless, the total number of light-duty vehicles gathered from Natural Resources Canada that were available in Canada included vehicles with a ‘van’ body type, which is often more destinated towards commercial purposes, consequently the share of EVs throughout the years could be considered slightly higher.

Table 1 Canadian market of vehicles, models available through the years. Adapted from Natural Resources Canada.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BEV	1	9	9	14	27	23	21	35	38	27
BEV%	0.1	0.8	0.8	1.2	2.3	2.1	1.9	3.1	3.8	2.9
PHEV	2	4	6	9	16	19	25	26	30	36
PHEV %	0.2	0.4	0.6	0.8	1.4	1.7	2.2	2.3	3.0	3.8
Conventional/ hybrid	1091	1082	1068	1128	1106	1059	1083	1056	927	875
Conventional/ hybrid %	99.7	98.8	98.6	98.0	96.3	96.2	95.9	94.5	93.2	93.3
Total	1094	1095	1083	1151	1149	1101	1129	1117	995	938
Total %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Canada established a goal for 2040 of sales for new vehicles being 100% ZEVs, this implies a massive rate of adoption by the non-EV owner population in forthcoming years. However, ZEV sales are not equally distributed in the country. Quebec and British Columbia are the two provinces that in 2019 accounted for almost 80% of new ZEVs sales (IEA, 2020).

Research has been conducted to anticipate the results that Canada will get for future years if the strategies for EVs penetration keep as they are. Axsen & Wolinetz (2018) analyzed mandates, policies, and incentives available at the time in Canada, concluding that the market share forecast for 2030 would be only 11%, a share that would be significantly under the IEA projections of 30%. Nonetheless, with a mix of policies and incentives, added to an increased EV model availability, a higher market share could be reached in future years.

Regarding model availability in the Canadian EV market, there are some choices for people trying to get an EV. However, those choices are not equally distributed in the different body type

categories available in the market. This has been proven to be an issue on EV adoption since people lean toward a specific body type of vehicle when trying to get a new vehicle, based on different attributes such as income, age, and education (Higgins et al., 2017). The facts of more model availability needed to engage further customers, and the sales increase in later years, led automakers to set goals for introducing more models available for coming years. Such as Fiat Chrysler Automobiles (FCA) and General Motors who declared new targets for 2025, including an increase of the EV models in their lineup and raising the expectation level for sales of EV in that year (IEA, 2020).

2.3.2 Used cars market

With the constant growth of the new EV sales comes an increase of EVs which enter the used market. The fluctuating sales and different places of sale, make an estimated number on the exact sales that occurred throughout the year difficult to obtain. However, Statistics Canada registered little over $13 million for in-store sales in used cars dealers in 2019, and $136 million registered for new cars dealers. It could be assumed that the used cars market would be 10 times smaller than the new cars market, however, due to the price variation of new and used vehicles it would be a misleading assumption. A fact is that used car sales rely more on e-commerce than new car sales, in 2019 $125,819 were registered for used car dealers, meanwhile, new car dealers accounted for $35,443 in the same method of sale (Government of Canada, 2021b).

The total number of vehicles registered in Canada in 2019 grew by 1.8% to the year before to get to 35.7 million, and specifically for light vehicles, the growth was 335,000 units meaning 1.4% in relation to 2018 (Government of Canada, 2020). Thus, it could be said that 335,000 vehicles entered potentially into the used car market. Ontario registered 2.1% of growth in

registrations, leading the growth rate registered among the rest of the provinces. Specifically for ZEVs, the number of registrations in Ontario for 2019 was 8,423 (Government of Canada, 2021a). These numbers, in combination with the fact that used car sales rely more on e-commerce, raise concerns about how EVs are promoted in such a market, to keep them on the road and make the most of their benefits.

The automotive industry depends largely on the information available online for customers. It is one of the industries where many offline purchases are often preceded by online research. In particular, 8% of used car buyers rely only on salespeople at dealerships when making decisions, the remaining 92% do research before making a decision (Podium, 2020). Additionally, approximately 97% of customers looking to purchase, repair, or customize a car start their journey online (Whitney, 2020), hence, analyzing the different automotive strategies from sellers in the used market can lead to an increase in sales for the ZEVs sector.

2.4 Proposed framework

The most common topics in EV adoption literature are charging infrastructure development, the total cost of ownership, and purchase-based incentive policies (Kumar & Alok, 2020). Marketing strategies, dealership experience, and charging infrastructure resilience are the less-researched topics.

Literature has shown that to meet expectations in Canada such as the national GHG reduction targets by 2050, EV adoption rates must increase up to 80% to 90% (Long, Axsen, Kormos, et al., 2019). Consequently, EV market share is expected to grow and with it its adoption by new customers, customers that could enter the EV world through the used cars market.

As identified in the literature review, there is a gap in EV adoption research related to the marketing of EVs. Additionally, to the author's knowledge, there are no studies including concepts or information related to the used market of vehicles nor in Canada or other countries. Therefore, the used market for EVs in Canada is incorporated into the framework of this study.

The framework set for this research aims to find how are some of the barriers commonly faced by EV adopters addressed in the market of used vehicles, specifically in the promotion given to EVs; this would help discern whether the promotion given to used EVs can attract more customers. Long et al., (2019) found that latent demand (i.e., when a customer cannot satisfy its needs for a product because there is either a lack of product availability or lack of information about it) for Canadian EVs (excluding HEV) market exceeds sales. Therefore, customers either need to know more about EV availability or need the right information that directs towards the purchase of an EV (Barisa et al., 2016; Shao et al., 2016).

To have a product delivered accurately to the right customer a marketing plan is used, and for used EVs it is not the exception. A marketing plan is developed when a product or a service needs to be offered to a specific population target. In this case the target are the customers looking for a used car. Next, the marketing mix elements provide the marketing plan the right tools to get to the desired target (Harvard Business School Press, 2006). The elements of the marketing mix are the product, the place, the price, and the promotion. The product is that object or service offered to customers, it is also the main component of the marketing mix, including any physical and less tangible characteristics, The place refers to the point of sale and distribution of the product. The price is what customers must give to own or receive that product or service. Finally, the promotion are the activities that communicate the product’s characteristics to the customers.

Figure 1 shows the framework used by Kumar and Alok (2020) to retrieve the diverse studies related to EV adoption. Their framework is used to highlight where this research fits in the literature of EV adoption. This research addresses mediating variables presented in Kumar and Alok (2020) framework, these variables are psychological characteristics, symbolic attributes, and perceived attributes. Specifically, this research focus on how the last 2 categories are being communicated to new owners, including attributes related to sustainability, vehicle performance, luxury features, vehicle condition and sale features, to mention some.

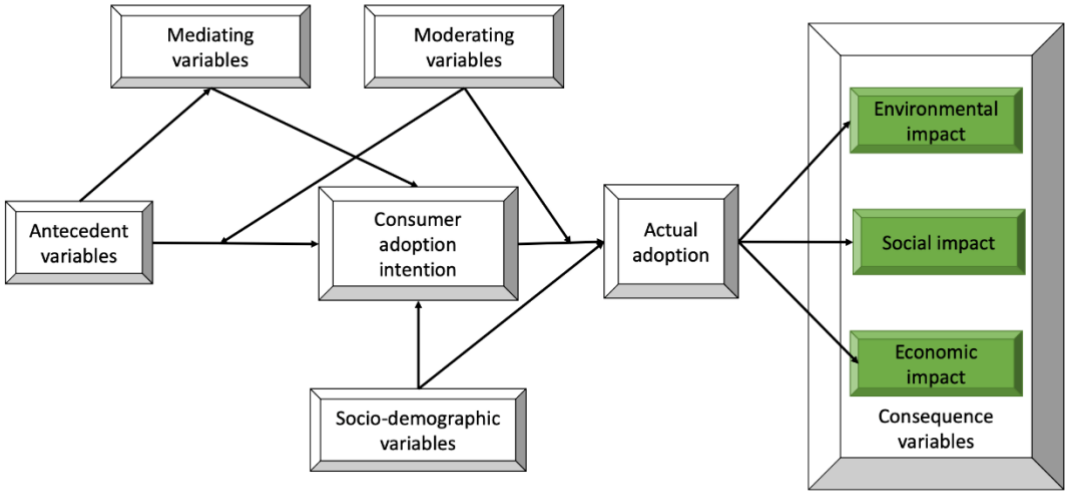

Figure 1 EV adoption framework, adapted from Kumar and Alok (2020)

To sum up, this research focus on exploring and assessing the marketing mix elements of used EVs in Ontario's used car market. Specifically, this research looks at how and what attributes unique of EVs are being communicated by sellers in the market of used cars. The communication of those attributes could help potential buyers overcome barriers frequently faced by new EVs adopters.

3. Methods

This chapter explains the research design, parameters used for gathering data, and limitations of this study.

3.1 Research design

This study explored an unstudied ground for EV adoption in Canada: the market of used vehicles. Further, this study sought to analyze how second-hand EVs are promoted, to discern what features of the vehicles are most mentioned in their description, and whether or not they have a relation with the attributes of the different types of EVs. The purpose of this research is to identify how the marketplace for used EVs can be improved when viewed through the lens of the theoretical framework of the marketing mix.

By analyzing the different EVs features communicated to the potential new customers, barriers or gaps can be identified in the marketing mix of used EVs. As mentioned in the framework created from the literature review, mediating variables influence the rate of adoption by customers, meaning that broadcasting accurately hedonic and symbolic attributes could engage new customers into buying EVs. Such an investigation can identify barriers that impede consumers from purchasing electric vehicles and identify opportunities to enhance the marketing of used EVs

This research took an exploratory approach by looking at online EVs ads that were posted on autoTrader, a well-known site for advertising cars in Canada. The scope of this research was set to Ontario only, since it has the greatest population in Canada, and the province suffered a

decrease on EVs sales in 2018. Thus, adoption of EVs by new customers is a topic that must be further investigated.

To achieve this, an exploratory e-mystery shopping approach was used. This research used an exploratory approach due to the lack of research in the area. Exploratory research allows the collection and analysis of qualitative data, to turn into quantitative data afterwards, and then clarifying the theory applied to the study (Creswell, 2014). The information collected was a combination of qualitative and quantitative data obtained from online ads in Ontario.

The mystery shopping technique has been used to evaluate consumer experiences at the retail level for several decades (Anderson et al., 2001; Holliday, 1994; Wereda & Grzybowska, 2015; Wilson & Gutmann, 1998). Researchers have also applied this technique to look at the ways in which market intermediaries are communicating the sustainability attributes of a product (My Sustainable Canada, 2012). In terms of the electric vehicle market, mystery shopping has been used as an approach to assess the interactions between a sales associate and prospective EV owner at car dealerships both in Ontario as well as across five Nordic countries (see Matthews, et all, 2017; Zarazua de Rubens et al, 2018). More recently, this technique has been expanded to include online retail shopping (Mehdipour, 2021). This research continues with this mystery shopping approach by looking at how the attributes of a used EV are communicated by dealerships and private sellers through online advertisements on sites such as autoTrader (Ellencweig et al., 2019). Ellencweig et al (2019) found that only 8% of used car buyers rely solely on in person sales associates at dealerships when purchasing a vehicle, while the majority do most of their own research beforehand.

From a procedural perspective, an online mystery shopping (or e-mystery shopping) approach resembles content analysis, in the sense that information is gathered based on themes that are then categorized and coded (Erlingsson & Brysiewicz, 2017).

3.2 Data collection

This section will describe the parameters used for this study's data collection. This study gathered information about EVs and ICVs for sale on the website autoTrader. This website allows to sell vehicles across Canada. Information of EVs available was collected between June 26th and July 20th, 2020. For ICVs information, the collection was done between August 5th and August 15th,2020.

This research data collection consisted of 2 stages. The first included gathering information about the vehicles being sold on the website, organizing their features in a table to facilitate reading and analysis. The second stage of the data collection included a coding of the description written by the sellers in the advertisements, based on the features mentioned in them. In other words, the qualitative data (description in the ad) was turned into quantitative figures by coding the first sentences/words in the description into five possible categories. In addition to the data collected from the website, screenshots of the advertisements were taken and saved for future references or validation.

The website where the data was obtained from offers a variety of parameters to be modified in a section named "advanced search," which after all parameters are set it returns all the vehicles meeting those parameters within the website. The parameters selected to create the data set are described next.

This study focused on the used vehicles market, so the condition of the vehicles was set to “used” and “certified pre-owned,” excluding the options “new” and “damaged”. The option “certified pre-owned” (CPO) refers to a used vehicle which has been exhaustively inspected to meet criteria of the Ministry of Transportation of Ontario (MTO) to register the used vehicle under a new owner's name. The first parameter selected was the location, Ontario province then was selected.

The website offers advertisements from 2 types of sellers: the first one is “private” seller which refers to an individual selling their vehicle by their own means, the second one is “dealer” seller which refers to any dealership or car lot. This research encompasses both private and dealer sales in order to have a clear comparison of what attributes are mentioned the most by each type of seller. Thus, “dealer” and “private” were selected in the seller type section.

The remaining fields (i.e., make, model, contactless services, trim, year, price, body type, exterior colour, mileage, drivetrain, engine, transmission, seating capacity, and doors) were set to their default option, except for the section "Fuel Type" where “electric,” and “gas/electric-hybrid” were selected to show the EVs available (figure 2). It is to be noted that even though the fuel type was delimited to electric vehicles, the results showed some HEVs, of which no data was collected.

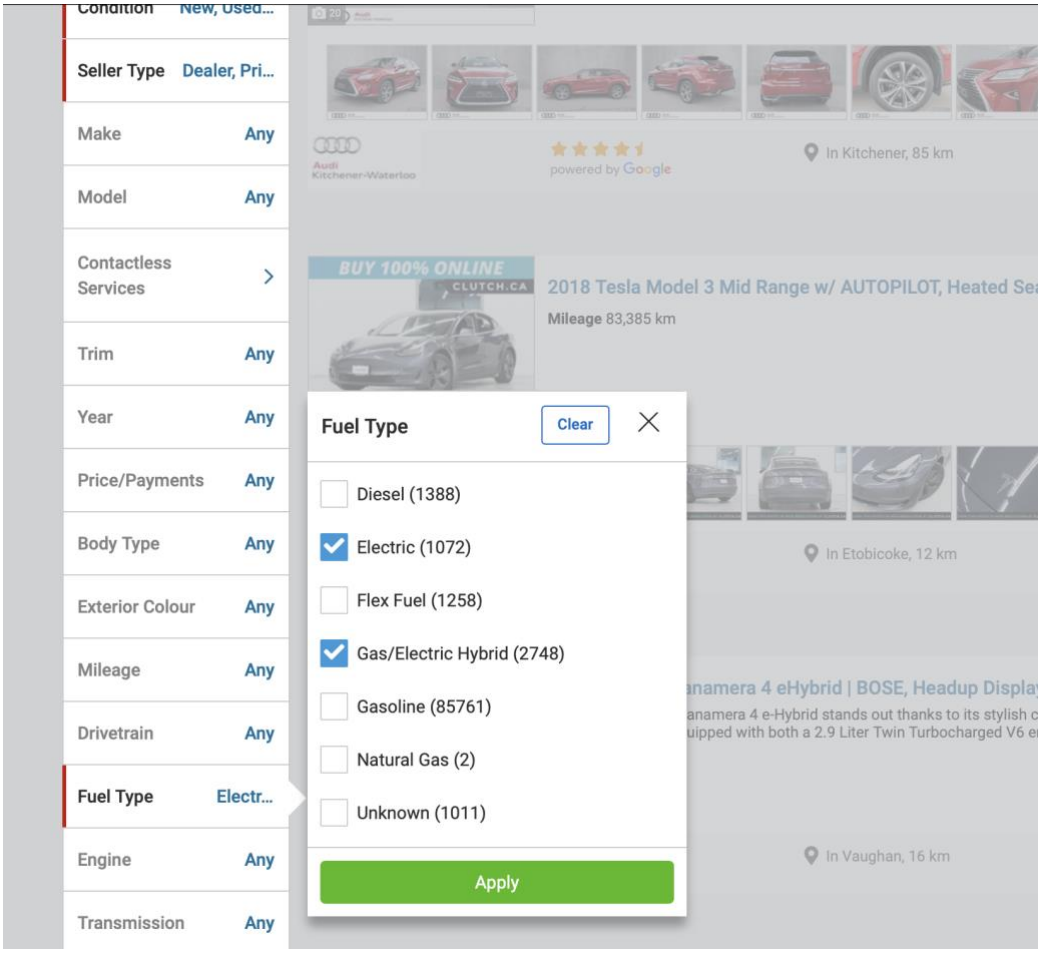

Figure 2 Advanced search parameters example in autoTrader

In addition to the EVs advertisements observed there were some ICVs advertisements observed for those EVs that had a similar ICV within the same brand and same model name, e.g., Volkswagen e-Golf (BEV) and Volkswagen Golf (ICV) (Appendix A). For the collection of the data of ICVs advertisements there were specific considerations taken since the number of possible ICVs advertisements was considerably higher than those of EVs. The search parameters for ICVs advertisements included having the same range of year model as its EV similar, and a price comparable to its EV similar. After these parameters were met, the advertisements were selected randomly if the availability was enough, selecting advertisements from both types of sellers, and the ones with lower and higher price. There were 4 to 5 ICVs advertisements observed for every EV similar model (based on parameters availability) not for

every vehicle collected, i.e., even if several advertisements were collected for one EV model only 5 ICV-similar model advertisements were collected (e.g., despite having 15 Mitsubishi Outlander PHEV advertisements collected, only 5 advertisements were collected from Mitsubishi Outlander in ICV model).

All the information gathered of the EVs and ICVs available was added to a MS Excel spreadsheet, categorizing their attributes. Additionally, a screenshot of the advertisement was taken for further references.

The data collection for this study was done amid the pandemic caused by the virus COVID-19, therefore some variations in the price and numbers of EVs can be present. This is assumed since some sellers mention in the description that the reason of selling the vehicle was either due to the need of money or for not using it by being in lockdown. Also, the price could be affected by the pandemic since many people would try to sell their vehicle faster, and as a consequence reducing the price of it.

3.2.1 Vehicle features

This section explains the different features collected from the website advertisement to create the EVs dataset. The first feature retrieved from each advertisement was the year of manufacturing of the car, which is the first thing mentioned in the title of the advertisement, along with the brand (make) of the car and the name of the model the second and third attributes collected on the dataset. Next, the trim of the vehicle was noted, the trim of the car refers to the version of the model usually depending on the equipment level of the vehicle. This attribute was often mentioned in the title of the ad, usually represented by one or two letters or words after the model of the vehicle (figure 3).

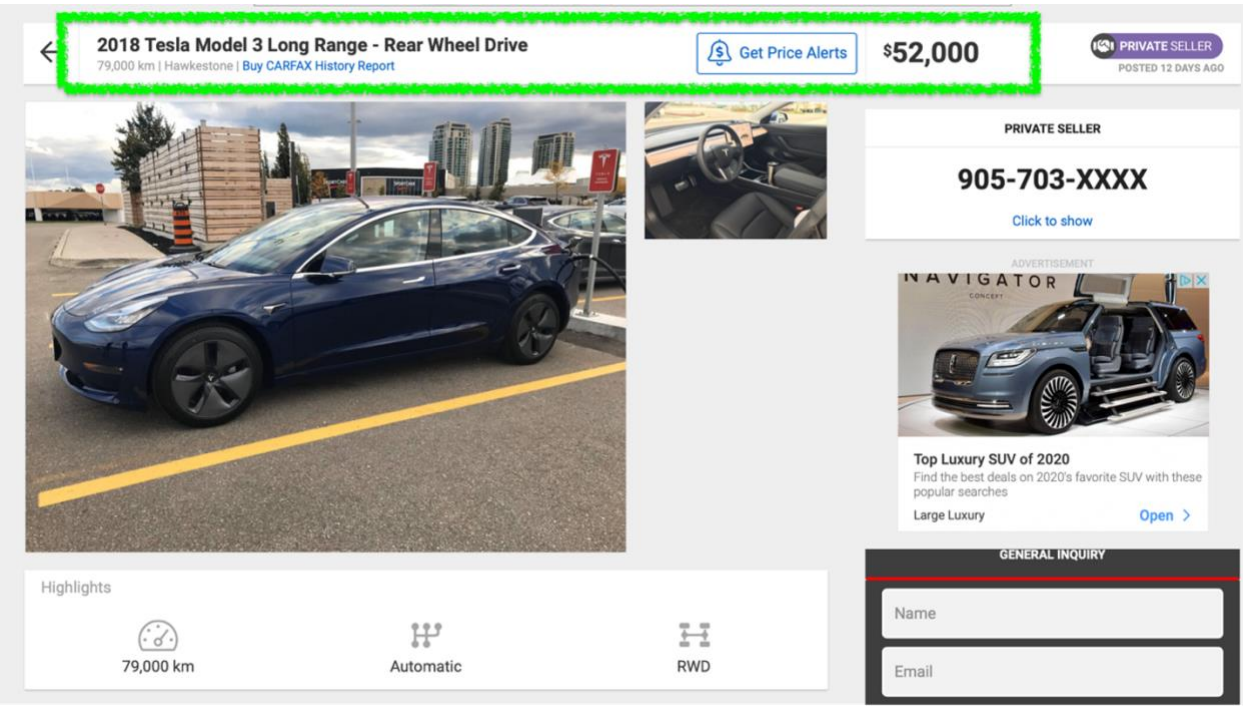

Figure 3 Screenshot taken from an EV advertisement in autoTrader

The following feature gathered was the type of vehicle being advertised (BEV, PHEV or ICV), this information could be found in the “specifications” section of the advertisement or in the description written by the seller in the advertisement (Figure 4). Next, the body type of the vehicle was set on the database. This information was also found on the “specifications” section of the advertisement. The possible options were coupe, hatchback, sedan, wagon, minivan, and SUV.

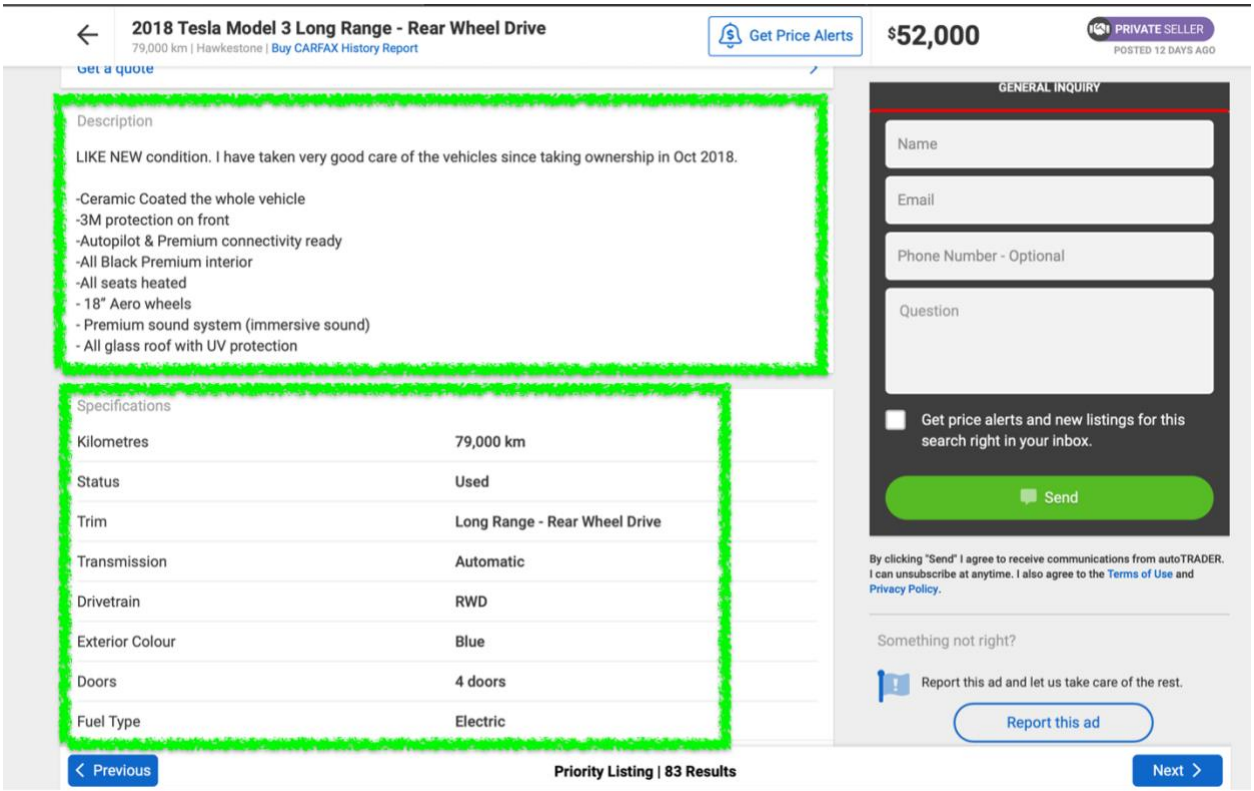

Figure 4 Screenshot of the description and specifications sections in an EV advertisement in autoTrader

After that, the mileage and price of the vehicle were transcribed to the database. That information was contained in the header of the advertisement along with the year, make, model and city of sale. The two following features collected were related to the seller. The first one was the city in which the car was being sold, information found on the header. The second one was the name of the dealer offering the vehicle or for the case of private sellers, the letters “PS” were designated (Table 2).

Table 2 Features of EVs copied into the dataset

Year	Make	Model	Trim	Type of vehicle	Body Style	Mileage	Price	City	Dealer Name	Type of seller
2018	Tesla	Model 3	Long Range(RWD)	BEV	Sedan	79,000	$52,000	Hawkestone	PS	Private

Finally, the description of the vehicle (if available) was copied exactly as extracted from the source and placed into the data set to analyze its content later (Table 3).

Table 3 Example of description written by the seller copied to the dataset

Description
LIKE NEW condition. I have taken very good care of the vehicles since taking ownership in Oct 2018. -Ceramic Coated the whole vehicle -3M protection on front -Autopilot & Premium connectivity ready -All Black Premium interior -All seats heated - 18" Aero wheels - Premium sound system (immersive sound) - All glass roof with UV protection

3.2.2 Description analysis

The second stage of the data collection was the coding of the description written by the seller in the advertisement. In this part, each one of the descriptions was read and its content categorized. First, it was noted what first, second and third attributes were mentioned in the description. To differentiate what type of attribute was described 4 categories were created. The possible options to classify those three attributes were: "EV-related" attributes, "non-EV-related" attributes, "owner use, care and/or maintenance" attributes, "sale-related" attributes, and blank (if the ad was missing an attribute on either category).

Then, each one of the descriptions was analyzed to identify features described under each of the 4 possible categories. In table 4 an example of one description analyzed can be observed, in this case color coding was used to clarify the attributes belonging to each category, "EV related" attributes (green), "non-EV related" attributes (yellow), "owner use, care and/or maintenance" attributes (blue), and "sale related" attributes (red).

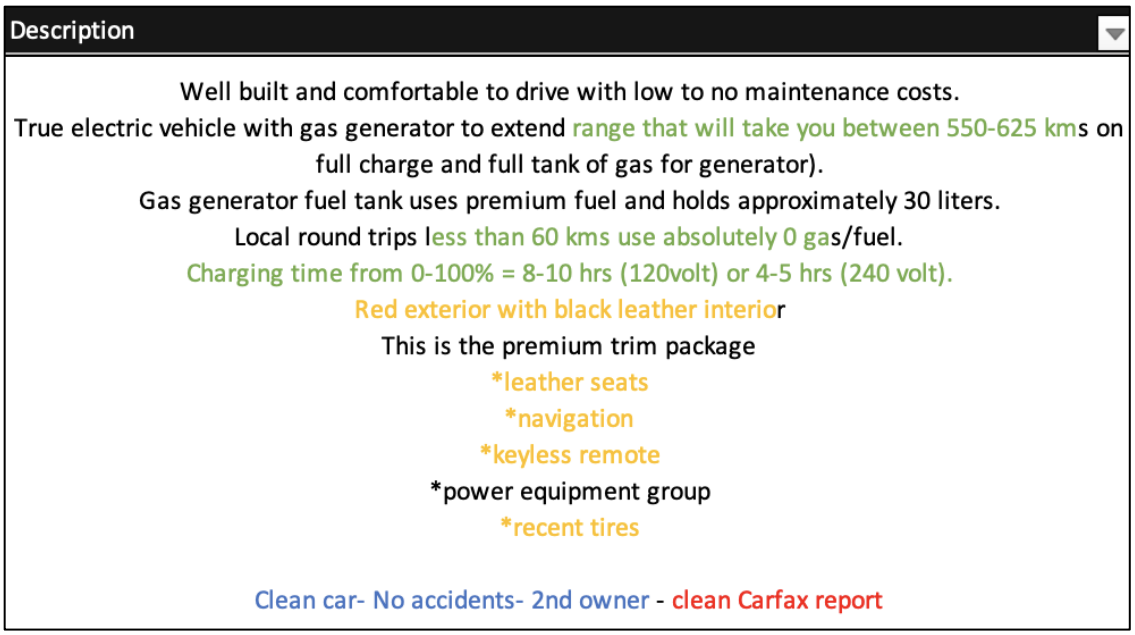

Figure 5. Example of description analyzed

3.2.2.1 "EV related" attributes

The first category of the features possibly contained in the descriptions was that related to features specific of an EV. In total there were 7 possible features in this category:

1) *Battery capacity* was the first feature. Phrases or numbers explaining the battery capacity and/or power of the electric motor were looked for (e.g., "12 bars in battery," "battery in perfect health," "80kW AC Synchronous Electric Motor").
2) *Battery warranty* feature was looked for in the descriptions. This feature was checked as "mentioned" if anything related to the remaining or expired battery warranty was present. Nonetheless, car-related warranty phrases were excluded, the description had to indicate clearly the "battery" term for the warranty.
3) *Range* feature was looked for next. To mark this one as "mentioned," the electric range of the car in kilometers had to be mentioned.

4) *Charging level* feature sought for phrases or numbers related to the charging level of the car (1,2 or 3). The charging adapters included with the car (voltage) or free supercharging (e.g., “unlimited supercharging,” “110V charger included”).
5) *Charging time* feature had to mention anything related to the time that takes to the battery to get to a specific percentage (“charging time from 0-100% = 8-10 hrs (120volt) or 4-5 hrs (240 volts)”).
6) *Green plate eligibility* feature was sought in the descriptions and marked if it stated that the vehicle was eligible for obtaining “green plates” in the province. Ontario Ministry of Transportation allows BEVs and PHEVs from model 2010 onwards to obtain Green Vehicle licence plates as a sign of commitment to a cleaner Ontario. In addition to exclusive benefits as access to High Occupancy Vehicle (HOV) lanes and no-cost access to High Occupancy Toll (HOT), even if there is only one person in the car (Government of Ontario, 2021).
7) *Incentive’s* feature was looked for in the descriptions. This feature was marked if information related to incentives applicable to EVs was mentioned (i.e., HOV access, rebates, parking).

3.2.2.2 “Non-EV related” attributes

The next category, “non-EV related” attributes, could contain any of the 18 features in table 4. Each description was analyzed for contents related to the features in the category, these features were related to the vehicle itself in general terms.

Table 4 Features contained in the non-EV related attributes category

Feature	Content
Rear camera	If the ad mentioned that the car has a rear camera (not parking sensors).
Autopilot	Phrases mentioning the car had an autopilot feature.
Lane assist	Features like blinding spot detection, lane departure or any concept related to any kind of lane assist.
Winter tires	Exclusively related to winter tires.
Seats	Any kind of feature/ characteristic related to the seats (leather, heated, positioning).
Keyless Start	Related to the vehicle being keyless entry/start.
Sunroof	If the car has sunroof, panoramic roof or glass roof.
Mats	If the car has any special mats, liners or anything related.
Paint	Related to the type of paint of the car or if it has any kind of wrap.
Rims	Related to the type/size/features of rims of the car.
Window tint	Related to any kind of tinting done to the windows or sunroof.
GPS/ navigation	If the car has GPS included or any navigation system (e.g., google maps), sometimes abbreviated as Nav.
Sirius	Related to if the car includes Sirius XM or satellite radio.
Apple/ Android Carplay	Features of the car related to the connectivity of the radio system with a phone (Bluetooth/ apple or android car play). Also, if the description mentions anything related to the display of information (size of display).
Audio/ Speakers/ brand	Related to features of the audio system (i.e., number of speakers, brand of the speakers, fm/am, premium audio)
Fuel economy	Mostly for PHEVs and ICEVs, fuel economy of gasoline engine or is electric equivalent (e.g., 2.3 Le / 100 km 2.3 city, 2.3 highway,)
Car warranty	Warranty related to the rest of the car (excluding the battery for EVs).
Performance	Features highlighting performance of the car: horsepower, torque, acceleration, handling, top speed, suspension settings.

3.2.2.3 “Owner use care and/or maintenance” attributes

5 features belonged to the category of “owner use, care and/or maintenance” attributes, which could be contained in each description (Table 5).

Table 5 Features contained in the owner-use related attributes category

Feature	Content
Overall condition	Phrases or words reflecting the car condition
Driver habits	Features related to characteristics mentioning the purpose of the vehicle and/or any type of driving habit, e.g., “daily commuter” or “city driven”
Services	Facts related to the maintenance services or recalls done to the car
Rustproof	Description had to include information related to the car being rustproofed
Damage history	Feature related to whether it is or not any damage history (e.g., collision) of the car

3.2.2.4 “Sale-related” attributes

The last category of features looked at in the descriptions was related to the sale process and seller characteristics. There were 8 features to be possibly mentioned in the description that would fall in this category (Table 6).

Table 6 Features contained in the sale related attributes category

Feature	Content
Purchase warranty	Any warranty from the dealer after the purchase is done (e.g., 30-day warranty)
Certified	If the vehicle is certified (safety certificate) or not, in order to register it.
Financing	If there is any financing/leasing option available.
Dealer services	Any services additional to the sale offered by the dealer (e.g., looking for more vehicles, trade appraisal, detailing, shuttle).
Dealer history	Phrases related to the history of the dealer (e.g., SERVING THE CUSTOMERS FOR OVER 20 YEARS/ …. since 2001!)
Dealer location	Address of the dealership.
Dealer certification	Awards or certification given to the dealer (e.g., OMVIC & UCDA Registered dealer/ rated as one of the Top Independent Dealers in Canada by Automotive Remarketing Magazine)
Carfax Report	If the seller has a Carfax report available.

3.2.3 Final samples

The final dataset contained 480 vehicle advertisements including a sample of EVs with 408 advertisements (282 BEVs, 126PHEVs) and 72 ICVs for comparing purposes. The dataset contained 11 attributes gathered for each advertisement, including the vehicle description written by the seller. Additionally, each one of those descriptions was analyzed to relate its contents with the 5 possible categories. Table 7 shows the overview of the features collected for this research.

Table 7 Overview of dataset

Attributes recorded	Values	Notes
Year	Year of the vehicle	Range from 2010 to 2020
Make	Make of the vehicle	21 different brands/makes
Model	Model of the vehicle	47 different models
Type of vehicle	BEV, PHEV or ICV	
Body Style	Coupe, hatchback, minivan, wagon, sedan or SUV	
Mileage	Kilometers that the vehicle has traveled	
Price	Canadian dollars	
City	City where the vehicle was advertised	
Dealer Name	Name of the dealer or PS	PS for "private seller"
Type of seller	Dealer or private	
Description	Description included in the ad	
First attribute mentioned	EV related, Non-EV related, Owner use, care and/or maintenance, Sale related	"Blank" in case of not having data displayed
Second attribute mentioned	EV related, Non-EV related, Owner use, care and/or maintenance, Sale related	"Blank" in case of not having data displayed
Third attribute mentioned	EV related, Non-EV related, Owner use, care and/or maintenance, Sale related	"Blank" in case of not having data displayed

3.3 Limitations of the study

This study is aimed to be one of the first of its kind because of the fact of focusing on the used market for EVs. Limitations exist for multiple aspects of the research, one of them is the lack of research in the market for used EVs and thus scarce guidance on this approach on ways to improve adoption of sustainable transportation.

Another limitation for this study is the place where all of the used car advertisements were collected. The autoTrader website is used by many customers looking to purchase a vehicle. However, it is not their only option available, multiple other websites offer used cars, and there is the option of referred sales that may happen without advertising the vehicle. Thus, for keeping the structure and information from the advertisements in a reliable and organized way this research focused only on autoTrader's website information.

By focusing only on the autoTrader website advertisements, the data available in sites like kijiji.ca, marketplace from Facebook, or individual dealer websites was not considered. This represents another limitation since there is a possibility of those sites giving more emphasis towards the transmission of EV benefits by highlighting more those features specific from EVs.

The sampling size for ICVs is a limitation that has roots on the number of EVs available with an ICV similar within the same make, that is to say that not every EV has an identical ICV to compare with. Hence, the sampling size for ICVs was notoriously smaller than the one from EVs, nonetheless the same parameters for analysis were used for both types of vehicles in order to get the most accurate results possible.

4. Results

This section shows first the descriptive statistics for all the 480 cases contained in the dataset. Subsequently, the results from the statistical analysis done to the data obtained from the autoTrader website will be shown.

4.1 Descriptive statistics

4.1.1 Year

This research gathered descriptions of vehicles that ranged from the year 2010 to 2020.
The distribution of the years for the models for the BEV shows that most vehicles were from years 2016 to 2018 with a combined 51% of the sample for that type of vehicle. PHEVs distribution reveal that most advertisements collected were from vehicles with model year 2018 with 38.1%. ICVs no not show any share for years 2010, 2012, and 2013 because of the parameters needed to meet before gathering information of them. It is important to be noted that for year 2020 shares for the 3 types of vehicles were quite low, meaning that owners keep their vehicles for at least 1 year before looking to buy another one. Regarding averages, BEVs had an average year of 2016, against 2017 for PHEVs, and 2017 for ICVs.

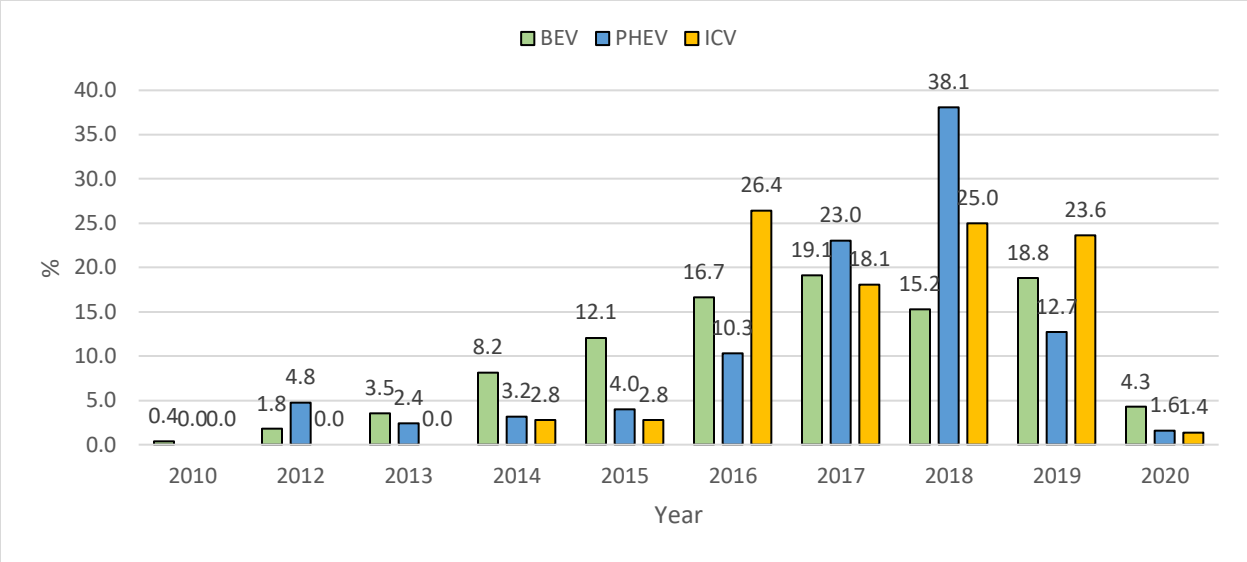

Figure 6 Year distribution in the dataset by type of vehicle (percentage per sample)

4.1.2 Makes and models

This study sought to analyze some of the used EVs available in Ontario's market, in addition to some gasoline-powered vehicles that have an electric version similar (i.e., same model and make but electric) the total number of different makes of vehicles available was 21. There was a wide variety of brands in the market, from American automakers (e.g., Ford, Chevrolet, Chrysler, and Tesla), to Asian automakers (e.g., Honda, Toyota, Nissan, Kia), and also European automakers (e.g., BMW, Audi, Porsche, Volkswagen). From figure 7, it can be observed the predominance of Tesla in the BEVs sector with 49.3% surpassing more than two times the number of vehicles available from the second most predominant brand Nissan with 18.4%. Conversely, PHEVs' predominant brand was Chevrolet with 17.5%, followed by Ford and Porsche with 13.5%.

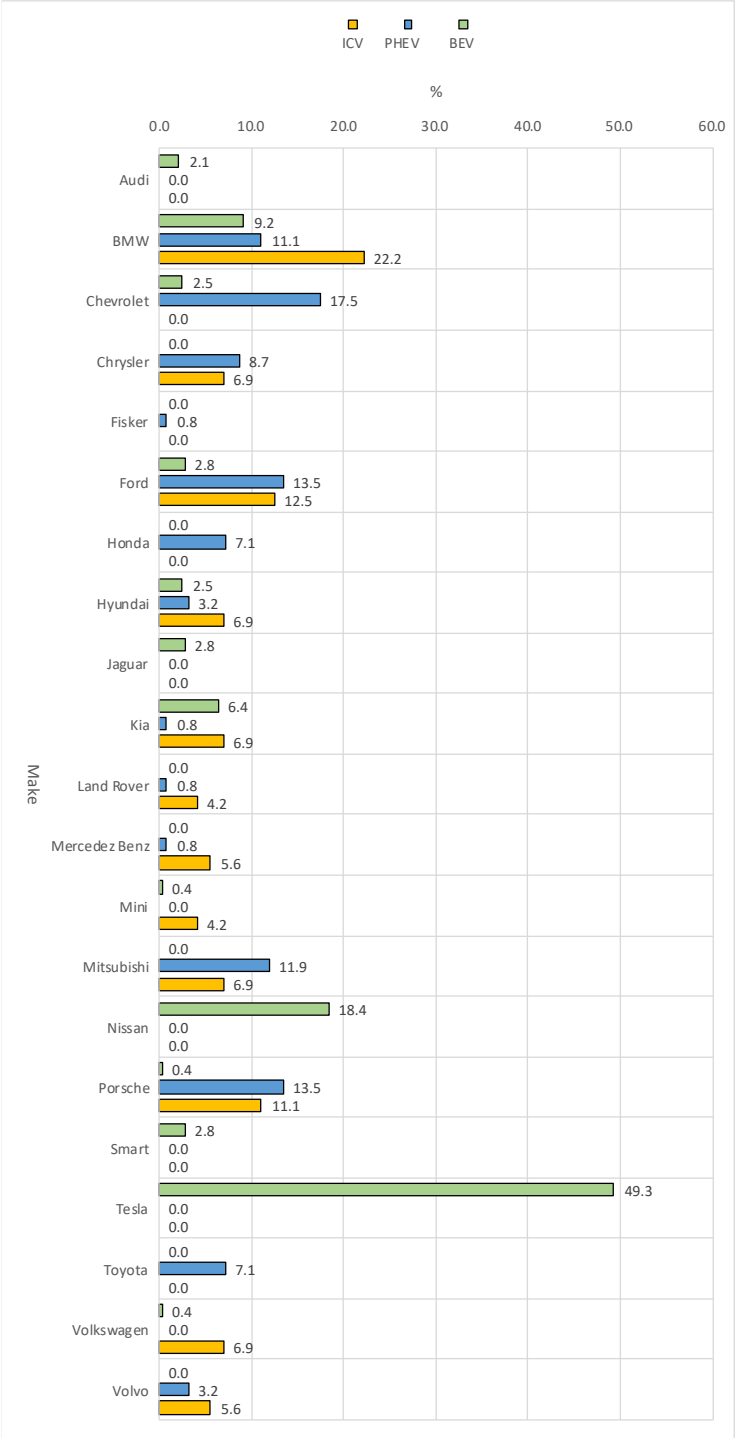

Figure 7 Brand distribution in the dataset by type of vehicle (percentage per sample)

Within the dataset of this research, there was a sample of 408 vehicles using electricity as power (BEV and PHEV). Another sample contained 72 ICV vehicles that corresponded to an

electrified version of the same model and make (e.g., Ford Fusion PHEV vs Ford Fusion ICV). For BEV sample the model with more frequency was Tesla Model S with 77 vehicles, followed by the Nissan Leaf with 52 vehicles. Regarding the PHEV sample, the model with more frequency was the Chevrolet Volt Electric with 22 vehicles (Appendix B).

4.1.3 Body style

Information related to the body type of the vehicles was also considered. The results were six different body types: coupe, hatchback, minivan, sedan, wagon, and SUV. Regarding BEVs, the most common body style was the “sedan” accounting for 40.8% of the sample, closely followed by the hatchback type with 33.7%. It is to be noted the absence of BEVs in the minivan body style segment. Illustrating then one of the common barriers for new customers when acquiring an EV, the lack of models that comply with customers’ desires/requirements such as minivans or pick-up trucks.

For the PHEVs the outlook was very similar by the fact that two body styles were more predominant than the others, sedan type with 53.2% and SUV with 32.5%. Despite having no cases for the “wagon” style as figure 8 shows, the distribution of body styles by this type of EVs could be considered more uniform, this since hatchbacks and wagons are quite similar, allowing then more choices for consumers looking for a PHEV in this category.

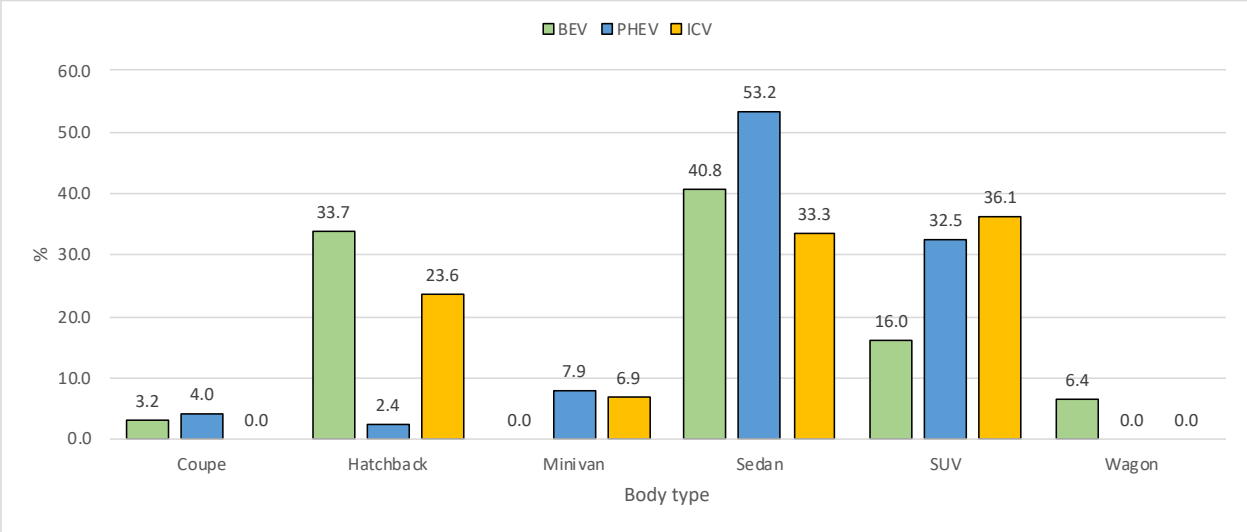

Figure 8 Body type distribution in the dataset by type of vehicle (percentage per sample)

4.1.4 Mileage

Mileage is one of the most important attributes to look for in a used car, and for EVs is not the exception. Buyers often base their purchase on the mileage of a car because it can reflect some other aspects of it, such as wear and tear of components, battery life, maintenance, and drive habits. For the sample in general, the range of mileage went from 8 km to 293,000 km. However, the mileage was categorized into 5 clusters to facilitate the observation of mileage distribution in the sample, each one of these clusters had a range of 50,000 km and were gradually increasing to 299,999 km.

In figure 9 it can be appreciated that for the 3 different types of vehicles compared, the majority of cases had a mileage between 0 and 49,999, which, unless is from a car more than 2 years old it can be considered good mileage to make a purchase. Also, it is to be noted that from 150,000 km and on, the number of vehicles with higher mileage decreased significantly. The average mileage for BEVs and PHEVs despite the sample sizing for each type of vehicle was relatively closer between them than the average mileage for ICVs. For BEVs, the average

mileage was 52,407 km, while the average for PHEVs was 52,535 km. On the other side, the average mileage for ICVs was 61,368 km, which implies a more active driving pattern than EVs.

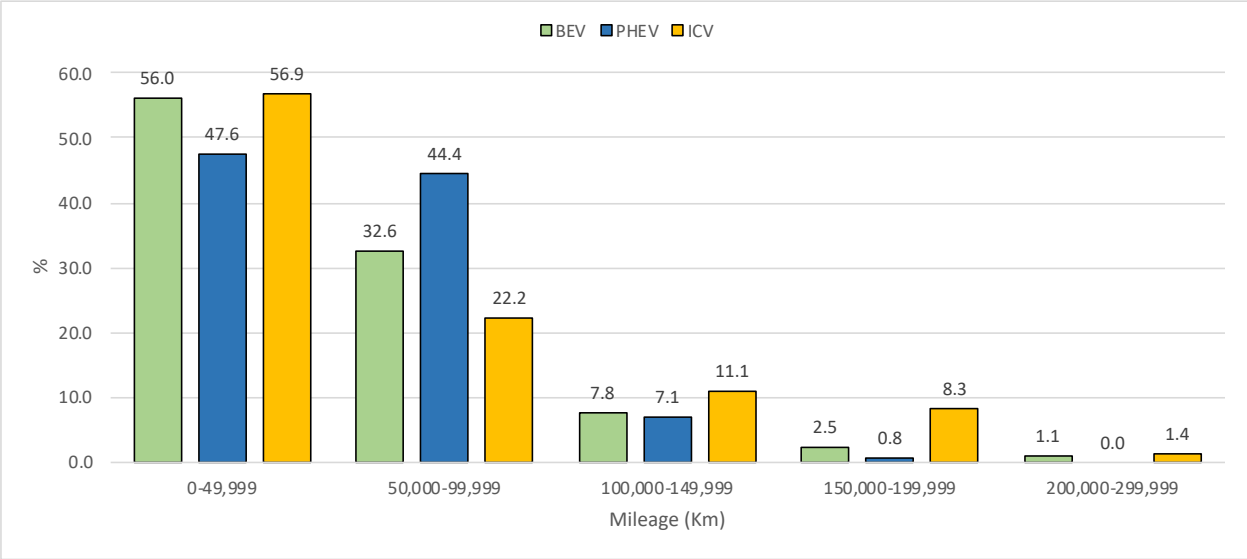

Figure 9 Mileage distribution in the dataset by type of vehicle (percentage per sample)

4.1.5 Price

The price attribute collected for this research was retrieved from the website where all of the advertisements were posted, none of them included taxes and they are in Canadian Dollars.

For the dataset in general the range was from $6,000 the cheapest to $165,980 the most expensive, with an average of $45,724. The price was also clustered in 5 groups of $30,000 ranges to have a better overview of the price distribution. As it can be observed in figure 8, the 3 types of vehicles had more presence on the first two clusters of prices, under $59,999. Most PHEVs and ICVs were found on the cluster ranging from $0 to $29,999. On the other hand, BEVs had more cases in the price range of $30,000 to $59,999. However, there was little difference of cases on the first and second price clusters for all the vehicle types. Thus, it can be assumed that the majority of the whole sample had a price below $59,999. However, the

average prices for each type of vehicle indicate that PHEVs were cheaper on average than both BEVs and ICVs. For PHEVs the average price was $38,397. Meanwhile, for BEVs and ICVs, the price was $50,448 and $40,045 respectively.

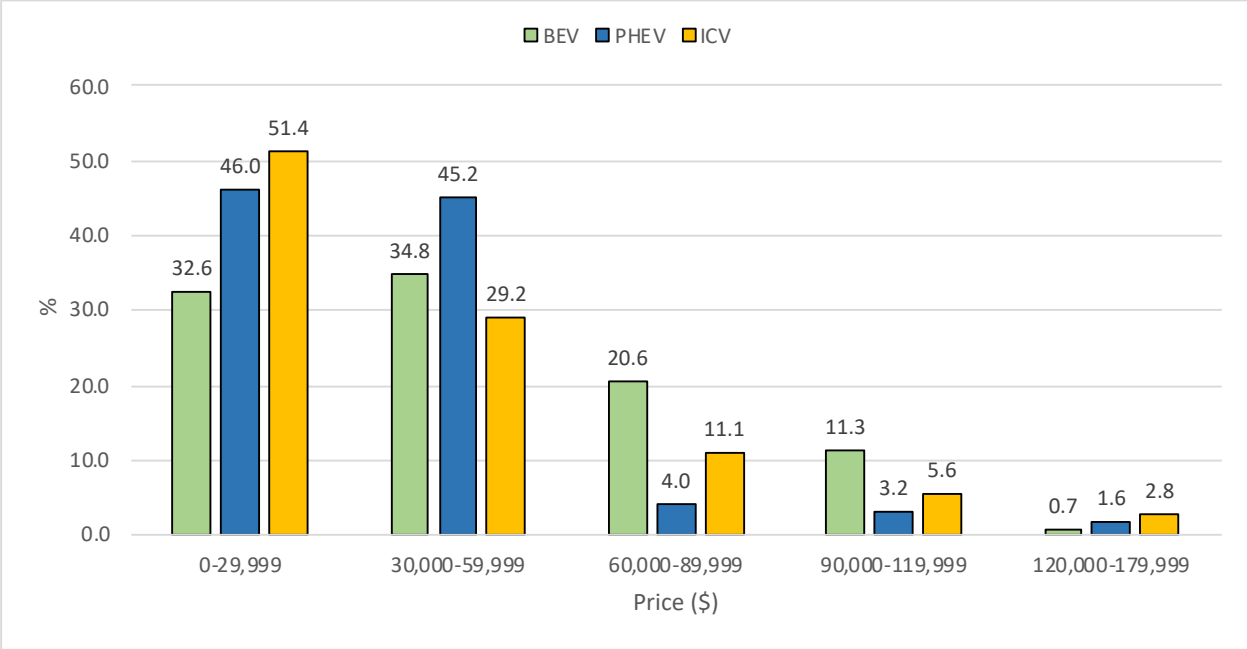

Figure 10 Price distribution in the dataset by type of vehicle (percentage per sample)

4.1.6 Cities

This research used a location parameter of a province-wide search on autoTrader's website The result was 94 different cities containing all of the 480 vehicles observed. For BEVs, most of the cases were located in Burlington and Toronto, with 44 and 42 vehicles respectively. PHEVs majority of cases was in Toronto region with 11 vehicles. Finally, for the ICVs sample the region containing the majority of the cases was Toronto as well.

4.1.7 Seller type

The information collected from the vehicles was sourced from the autoTrader website, where the place of sale could be either by a dealership/car lot or a private seller. From the dataset of 480 vehicles 130 were offered by a private seller, and 350 by dealerships. There were 177 different dealers in the data set. However, private sellers were generalized since it would have been difficult to get more information from each one of those sellers. The seller type for each type of vehicle was predominantly dealers as can be observed in figure 11. However, the proportions were different for each type of vehicle, BEVs advertised by dealers were almost 3 times the number of advertisements from private sellers, whereas PHEVs advertisements by dealers almost doubled numbers from private sellers, and ICVs advertisements from dealers where almost 4 times higher than private sellers.

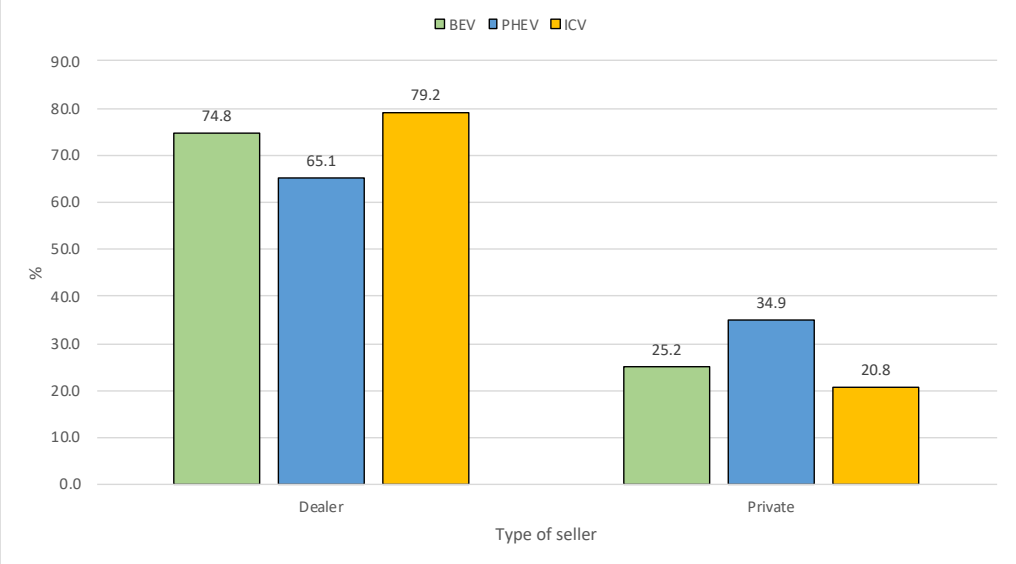

Figure 11 Type of seller distribution in the dataset by type of vehicle (percentage per sample)

4.2 Statistical analysis

This section presents the results of the statistical tests realized to find whether there exists or not relationships between the attributes of the description in the advertisements and the features of the vehicles (mileage, price, seller type).

4.2.1 Attributes mentioned in the description

The description written by the seller included in each advertisement was analyzed to find what were the first, second, and third kind of attributes mentioned. As described in section 3.2.2, there were 4 categories possible. In this section, the histograms with the categorization for the entire set will be shown, in addition to 3 other comparisons realized to the dataset.

4.2.1.1 EVs sample

The results of the distribution of attributes in the EV sample on the dataset reflect that the first attribute more frequently mentioned was “non-EV related” as figure 12 shows, followed by “owner use, care and/or maintenance,” then “sale related” attributes, and leaving the least mentioned first attribute as “EV related.” Even though all the vehicles in the sample are BEVs and PHEVs, the “EV related” features found in the advertisements’ descriptions were outstandingly low, contrary as it would be expected.

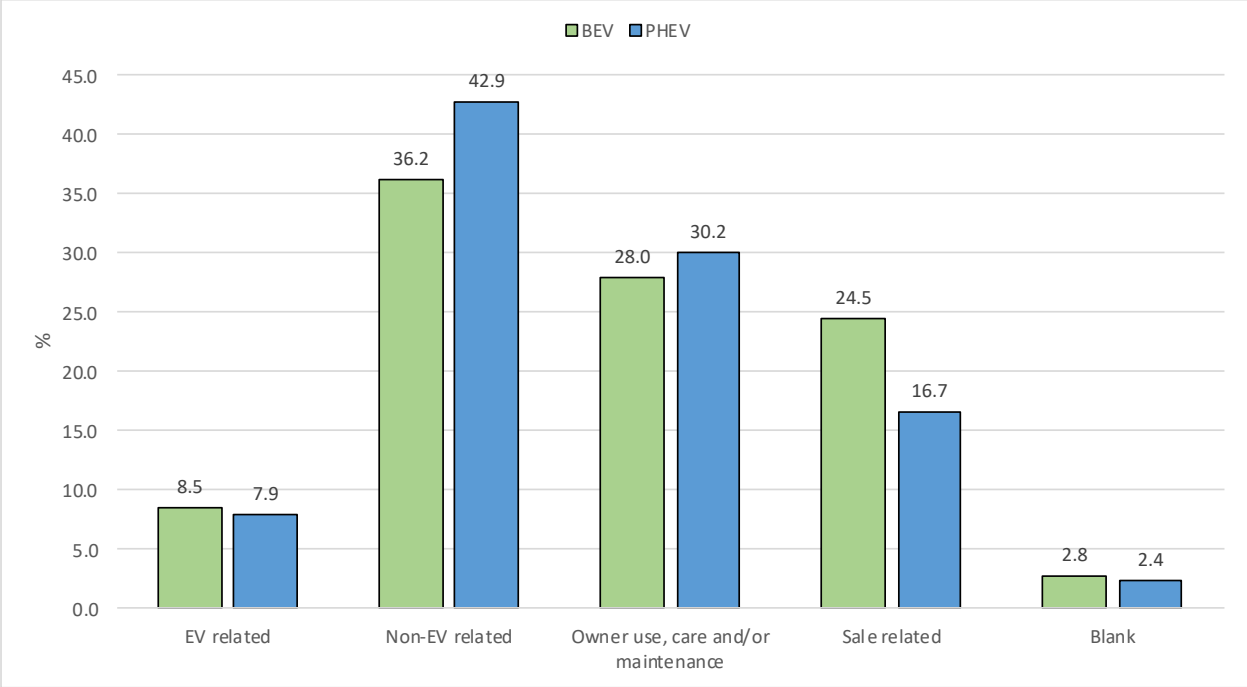

Figure 12 First attribute mentioned in description distribution in EV sample

Concerning the second attribute mentioned in the descriptions for the sample, the situation was somewhat similar to the one in the first attribute mentioned, the “EV related” related attributes were the less mentioned. However, “sale-related” attributes and “owner use, care and/or maintenance” attributes decreased their presence in the descriptions, leaving again the “non-EV related” attributes as the most reported category (Figure 13).

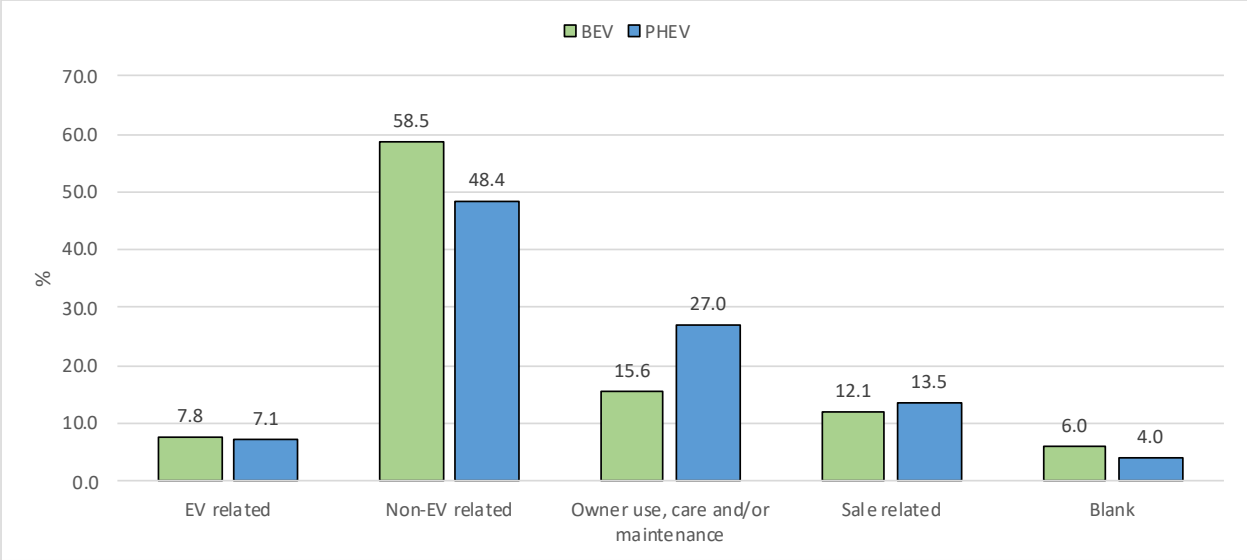

Figure 13 Second attribute mentioned in description distribution in EV sample

The third attribute mentioned in the descriptions was clearly predominant by the category of "non-EV related" attributes as figure 14 illustrates. In this case the joint share of "EV related" "owner use, care and/or maintenance" and "sale related" categories accounted for less than the half of the sample.

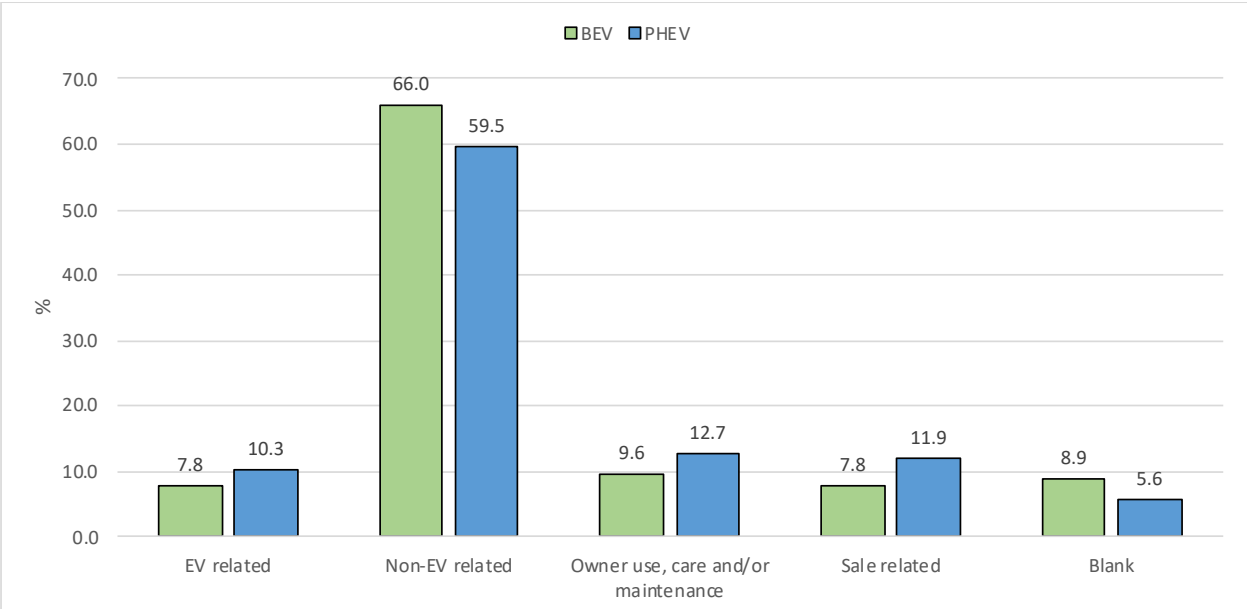

Figure 14 Third attribute mentioned in description distribution in EV sample

This part of the analysis showed that for the entire sample, the first 3 attributes were predominantly related to “non-EV related” features. Above all, the frequency order for the categories was similar in all of the 3 attributes, being “EV related” attributes the category with less mention. Thus, implying the importance given to “non-EV related” attributes even over the “sale related” attributes. In other words, for sellers in general, is more important to transmit product features (not related to an EV) to the customer, than transmitting the features that distinguish EVs over ICVs.

4.2.1.2 "Higher-end" and "Lower-end" Makes

A second analysis was done about attributes mentioned in the descriptions of the EV sample. This time the sample was divided into two tiers, one of them containing “high-end” makes and the other one “lower-end” makes. That is, for the first group, the car makes are those which are considered premium or luxury brands due to the high-quality materials and equipment they use in their cars, usually this makes their vehicles more expensive and scarcer (i.e., Audi, BMW, Mercedes Benz, Fisker, Porsche, Jaguar, Land Rover, Tesla, Volvo). On the other hand, the second group contained makes that manufacture vehicles more economic and public accessible, these brands provide mass produced vehicles with reduced prices (i.e., Honda, Toyota, Volkswagen, Mitsubishi, Kia, Ford, Smart, Nissan, Mini, Chevrolet, Chrysler, Hyundai).

The first attribute distribution displayed in figure 15 highlight the differences in the descriptions between both tiers. The first thing to note is that non-EV related attributes are more important to mention in “high-end” makes advertisements, almost twice as the next most frequent category mentioned, sale related attributes. The non-EV related attributes from “high-end” makes often referred to features like the quality of the seats, the color of the vehicle or the size of the rims to mention some. These features often strongly differentiate a vehicle from a “high-end” make to a

“low-end” one. Therefore, sellers feel the need to communicate them to potential new customers. In second place it can be observed how advertisements from “low-end” makes focus on communicate the potential new owner features related to the owner use care and/or maintenance of the vehicle. In this category features like the use given to the vehicle were mentioned (i.e., food delivery, taxi, daily commuter), also any service done to the vehicle was communicated first (brake replacement, battery service); one common feature mentioned in this category was related to the accident antecedents of the vehicle (i.e., no accident, accident free). This category was closely followed by non-EV related attributes for vehicles in the “low-end” tier while for the “high-end” tier the next category was related to the sale attributes. Nonetheless, the mention of EV related attributes by both categories where a small percentage of the sample.

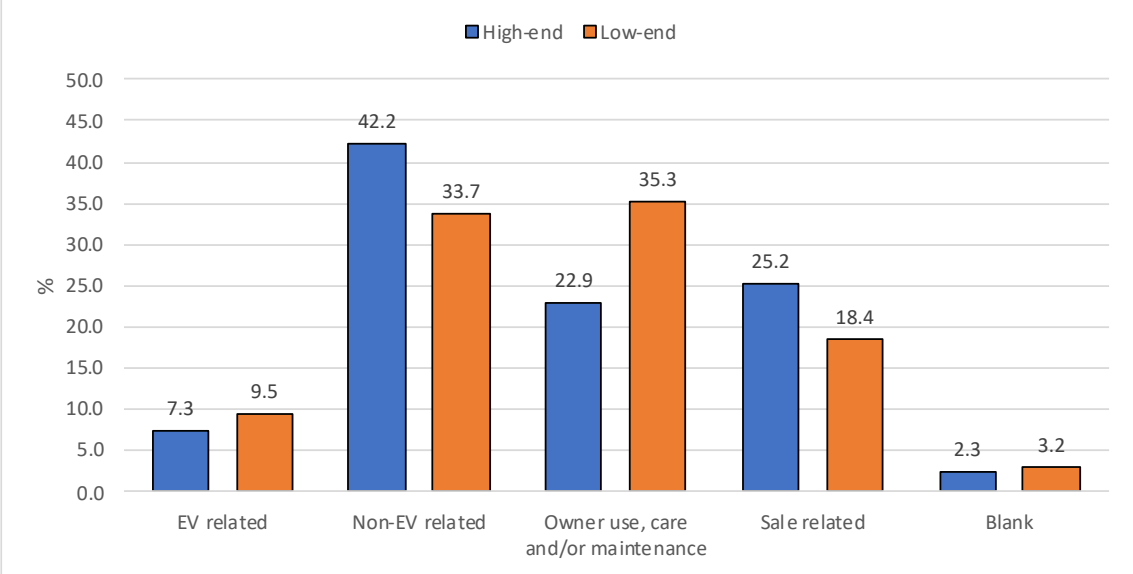

Figure 15 First attribute distribution for tiers "high-end" and "low-end" makes in the EV sample

The focus for the second attribute mentioned in the descriptions by both tiers was associated to non-EV related attributes primarily, however “low-end” makes have a higher share for the rest of categories possible than the share of “high-end” makes, in which over half of the second attributes mentioned were directed towards features of the car not related to an EV only. (Figure 16)

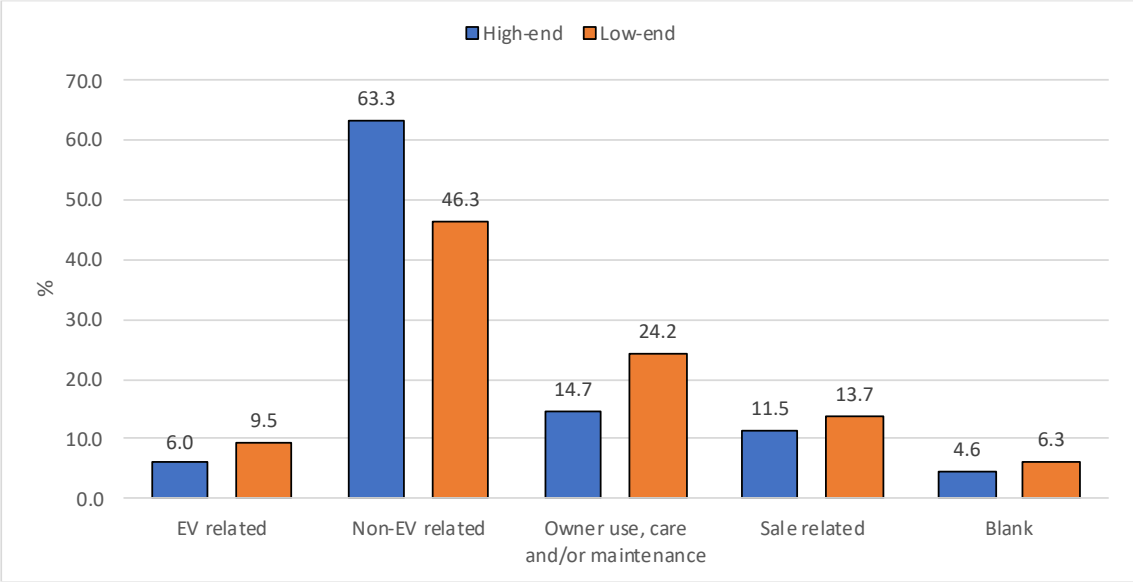

Figure 16 Second attribute distribution for tiers "high-end" and "low-end" makes in the EV sample

The distribution for the first 2 attributes mentioned in the descriptions showed some clearer differences between both tiers than the distribution for the 3rd attribute mentioned. This time the distribution was quite similar between both tiers, more importance was given towards non-EV related attributes, while the rest of the categories showed a modest share in the sample. (Figure 17)

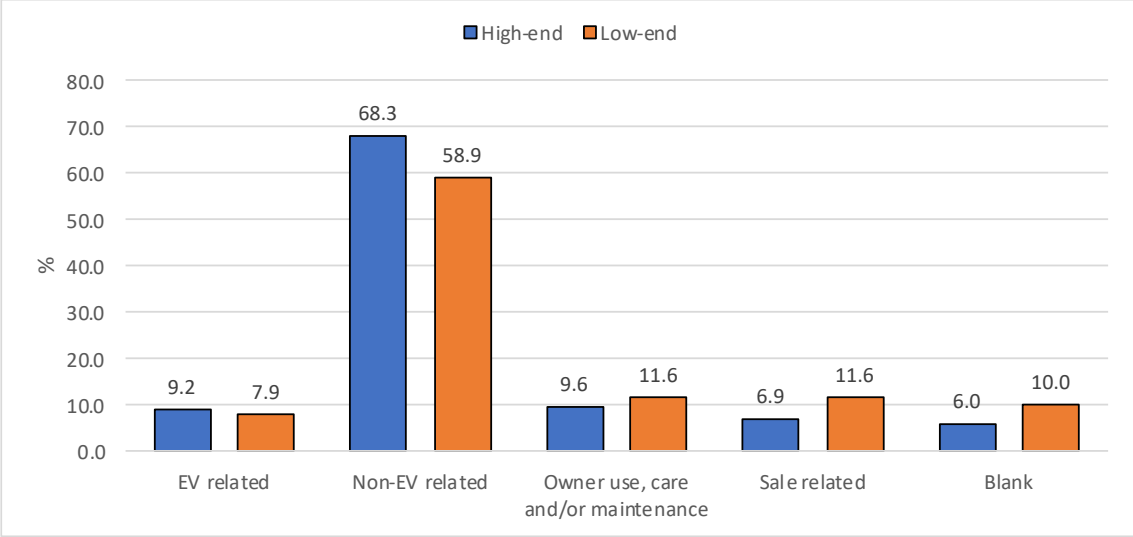

Figure 17 Third attribute distribution for tiers "high-end" and "low-end" makes in the EV sample

This analysis revealed the vast emphasis given to qualities not related to EVs for “high-end” car makes. Additionally, it could be said that this would be an expected result because of all of the possible features that “high-end” cars could offer. Thus, there is a need to transmit those to potential new customers. However, it could be beneficial for EV sales to mention those characteristics that differentiate EVs from conventional ICVs.

In contrast, “low-end” makes focused a little more on the “Owner use, care and/or maintenance” attributes on the first attribute mentioned in the description. Even though there was little difference between the most mentioned and the second most mentioned category, it could imply the need of the seller to inform the customer about the current vehicle condition or services done to it.

4.2.1.3 Private sellers and dealers

The following analysis aimed to see the descriptions of the EV sample from another point of view to look for more differences/similarities in the advertisements of EVs. This was a comparison between the 2 types of sellers in the dataset, private sellers, and dealers.

The distribution for the first attribute mentioned by both groups revealed the main focus of each type of seller. In first place, private sellers refer to attributes related to the owner use, care and/or maintenance of the vehicle, this type of features included terms like “like new”, “this car is in excellent condition”, “mint condition”, to mention some; this type of features look to express the overall condition of the vehicle and often give more of a personal touch to the private seller descriptions which refer to the care of the vehicle by the owner. The 2nd most mentioned category by private sellers was “non-EV related” attributes and the less mentioned one was the category of “sale-related” attributes. On second place, dealers focused first on “non-EV related” attributes, and next to the “sale-related” ones over the owner use, care and/or maintenance ones. The EV related category had a similar share in both types of seller samples, however private sellers focused first on this category than on the sale related one, case contrary of dealers who focused first on sale relates attributes.

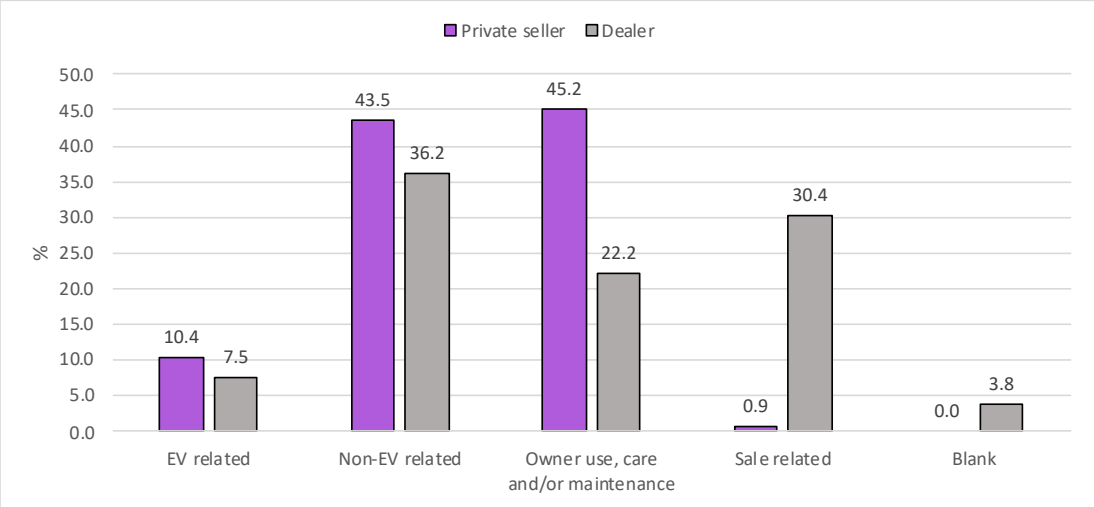

Figure 18 First attribute mentioned distribution by type of seller in the EV sample

For the second attribute mention in descriptions of the 2 types of sellers, the distribution for dealers kept the same order of importance as the first attribute, first non-EV, then sale related, next owner use care and/or maintenance, and finally EV related attributes. The share of non-EV related attributes increased, consequently the rest of the categories decreased their share. For the second attribute however, there was a change on the importance of each category, this time non-EV attributes had a bigger share on the sample, leaving owner use care and/or maintenance in second place; EV related attributes kept being more mentioned that sale related attributes (Figure 19).

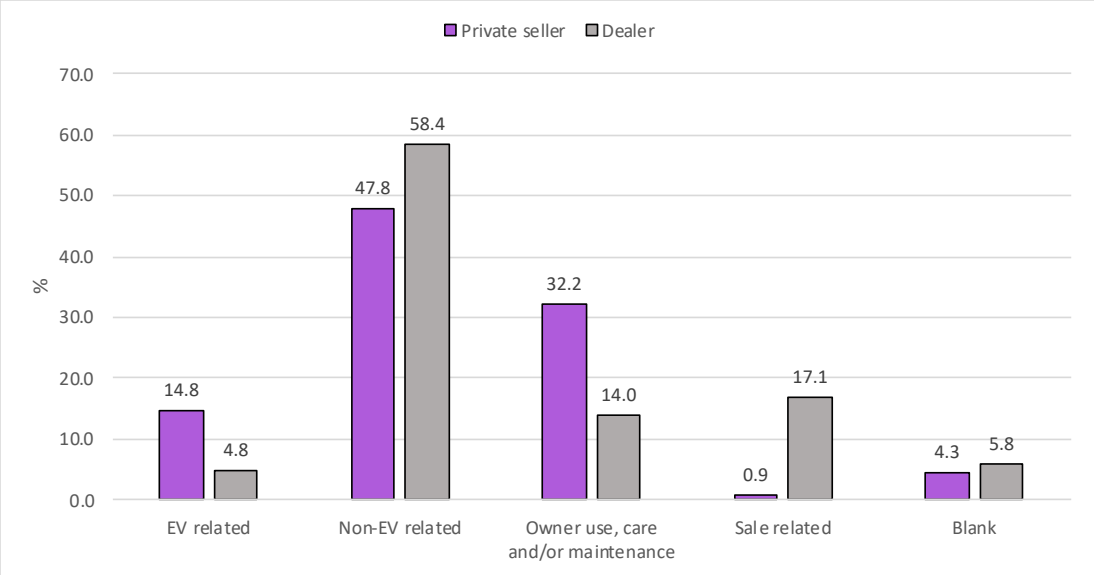

Figure 19 Second attribute mentioned distribution by type of seller in the EV sample

About the third attribute mentioned by both types of sellers, the order of importance remained almost the same with the only exception being that the share of EV related attributes was higher than the one of the owner use care and/or maintenance related attributes for dealers. For this attribute it is important to highlight the share of non-EV related attributes by both type of sellers, which as it can be observed in figure 20 was over 60% of the dataset.

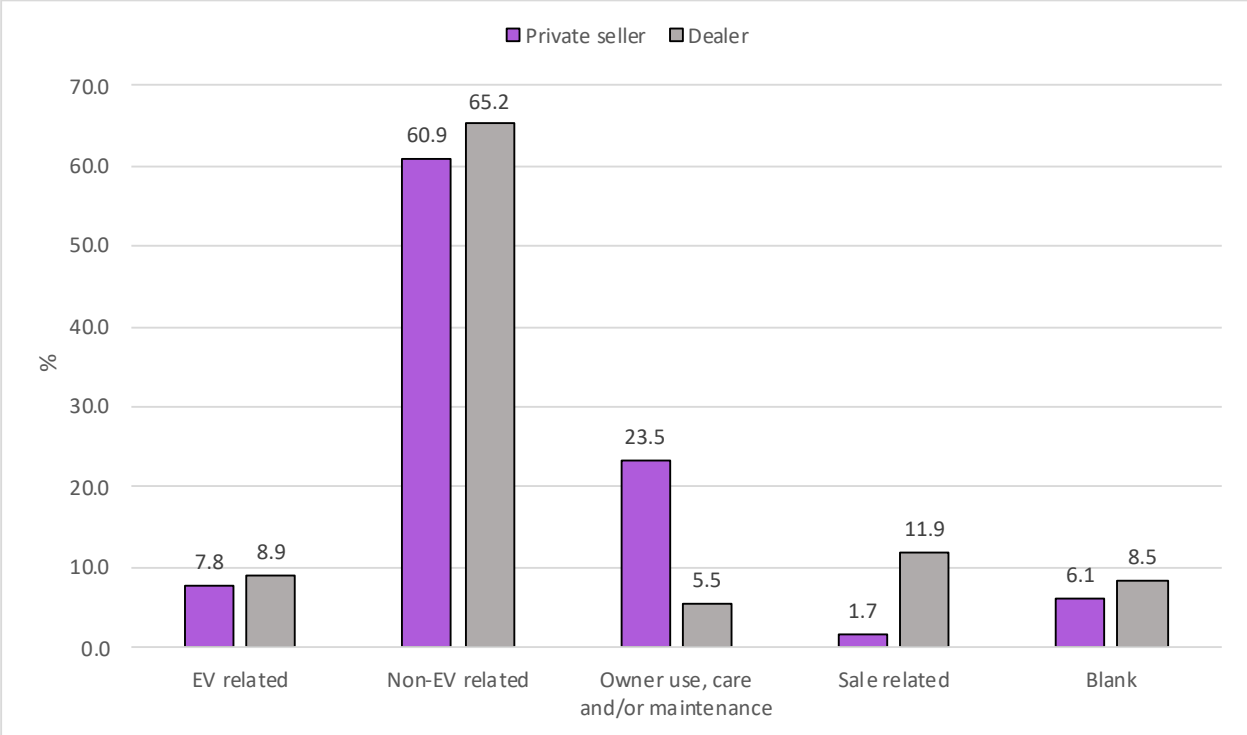

Figure 20 Third attribute mentioned distribution by type of seller in the EV sample

This part of the analysis showed a couple of interesting points, the first one being that non-EV related attributes are the most mentioned by both types of sellers. Whereas the “Sale related” attributes seemed to be less important for private sellers, who focus more on the “owner use, care and/or maintenance” attributes.

4.2.1.4 ICV and BEV + PHEV

A third comparison was made between ICVs and EVs (BEVs + PHEVs) samples to determine if there is a significant resemblance or difference between the descriptions written by the sellers for both types of vehicles. The first main difference is that ICVs will have only 3 categories, after excluding “EV related attributes” for obvious reasons.

The distribution of the first attribute mentioned in the descriptions of EVs and ICVs showed similar results on both groups. The most mentioned category is the “non-EV related” attributes one, meaning that advertisements for both types of vehicles focus on broadcasting any feature of the vehicle other than a specific feature of an EV. In second place both types of vehicles tend to mention features related to the condition of the vehicle, its use or maintenance. In third place there both groups mention features related to the sale process, either dealer characteristics, warranties or safety certificate needed for the vehicle’s registration. The category of EV-related attributes is the least mentioned among EV advertisements in Ontario (Figure 21).

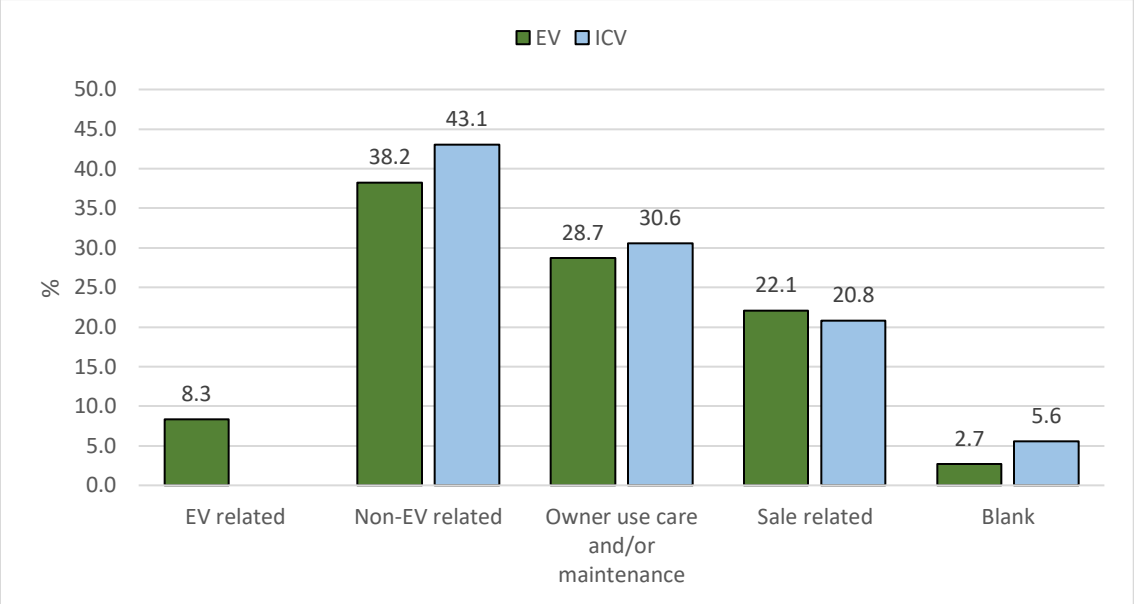

Figure 21 First attribute distribution for used EVs and ICVs samples

The second attribute in descriptions distribution looked similar to the one of the first mentioned attribute, with the slight difference of ICVs having a small increase on the share of “sale-related” attributes to get them over the category of “owner use care and/or maintenance”. However, that increase could be considered insignificant since the mention of “non-EV related” attributes increased to almost 60% of the sample of ICVs (Figure 22).

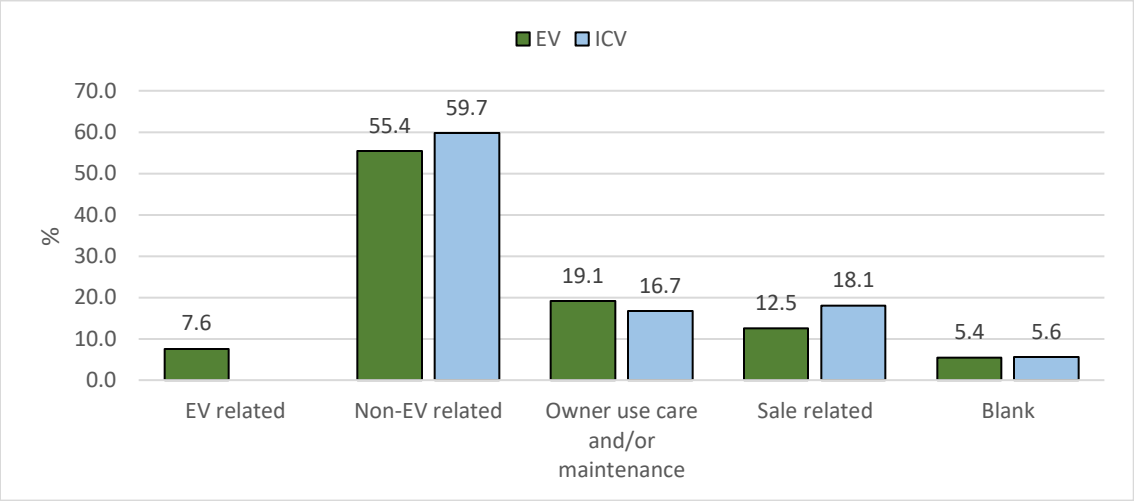

Figure 22 Second attribute distribution for used EVs and ICVs samples

In the third attribute mentioned distribution 3 main things can be noted. The first one being the increase of the share of “non-EV related” attributes mentioned over 60%of the sample for both types of vehicles. The second thing is the increase of share of “sale-related” attributes by ICVs over the share in the second mentioned attribute; this highlights the importance that ICVs sellers give to the actual sale process, trying to give as much information as possible from the beginning. The third thing to note on this comparison is the drop of shares of categories other than the “non-EV related” attributes for EVs. Additionally, for the three first mentioned attributes in EVs advertisements the category of “EV-related” attributes occupied the last place every time with less than 10% share.

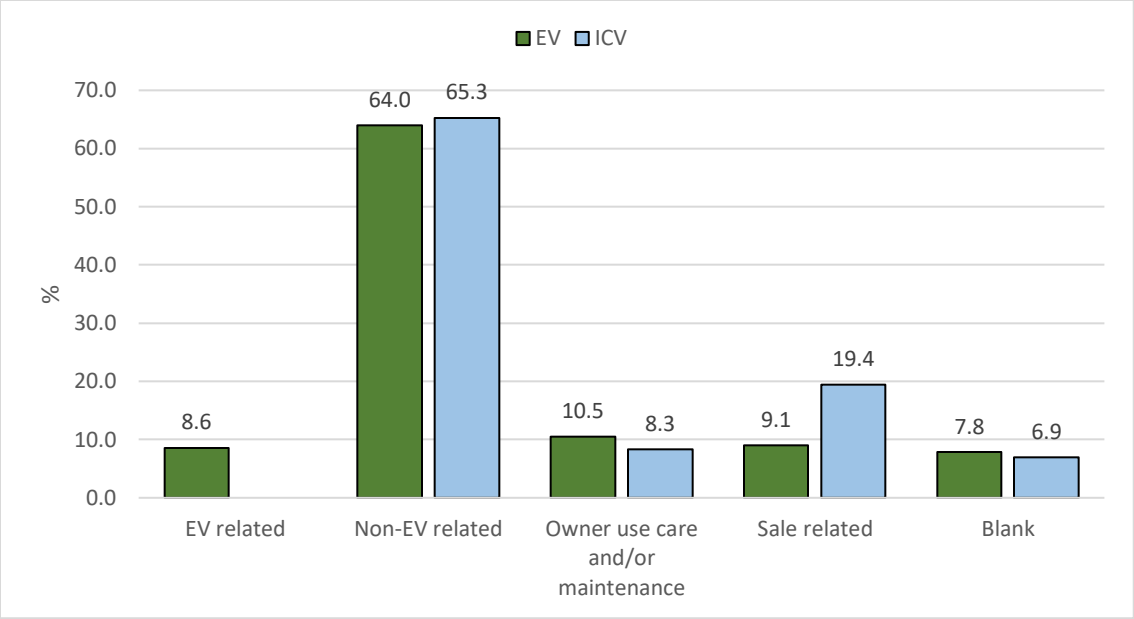

Figure 23 Third attribute distribution for used EVs and ICVs samples

From the previous analyses, it could be observed the tendency for sellers to focus on “non-EV related” in the first sentences of the descriptions posted for the vehicles. Additionally, “EV related” attributes were the less mentioned in all of the cases for the first three attributes. Thus, it can be assumed that potential customers will need to read each description further to find any kind of information regarding EVs attributes. It is possible that including EV attributes in the first part of the description could lead the interest of customers into finding more about the vehicle presented. However, that area of research needs to be further investigated.

5. Discussion

This section discusses the results obtained through the methods previously described to assess the achieving of objectives set for this research and additionally highlight the most outstanding facts of both data collection and results processes. Also in this section, the results of this research will be linked to gaps previously identified in literature.

5.1 Main findings

The main research question for this research targeted how the promotion of used EVs in Ontario is communicating benefits unique of EVs to potential new customers. What this research found is that there is a lack of sustainable attributes and EV-unique features described by sellers. Those features included among others, range of EVs, charging capabilities, ownership benefits, and incentives available. After realizing comparisons between different tiers in the EVs sample in the dataset, it was noted how sellers focus mainly on communicating “non-EV related” attributes to potential new owners. That category of attributes mentioned in its majority features such as color of the vehicle, quality of the seats, size of rims, and GPS/navigation system.

Another finding of this research is that the distribution for the first 3 attributes mentioned by sellers in the used EV descriptions followed a similar pattern in most of the comparisons made. This implied mentioning first “non-EV related” attributes, then “owner use, care and/or maintenance” ones, next “sale-related” ones, and finally “EV-related” attributes. However, there were a couple cases when sellers in a specific tier focussed on a different category for the first attribute in the description. One example of this is the difference between “high-end” and “low-end” makes advertisements, were “low-end” tier sellers give somewhat more importance to

describing the physical condition or maintenance of the vehicle in the first attribute of their description; whereas “high-end” tier sellers focussed on “non-EV related” attributes. This finding suggests that the pattern of attributes mentioned first give good results when advertising regular ICVs. However, further studies would be needed to find customers perceptions of descriptions in advertisements of used vehicles.

The next finding is the importance given to “sale-related” attributes in the 3 first attributes of each description by private sellers and dealers. Private sellers focus first on attributes related to the condition of the vehicle and attributes specific from EVs, rather that mentioning any “sale-related” features. Dealers on the other side, focus first on “non-EV related” and “sale-related” attributes, leaving features unique from EVs at last.

Lastly the comparison of EVs and ICVs advertisements answered the question of: how does the promotion of used EVs differ from that of ICVs in the used market? From the results of this comparison, it can be discerned that there is no significant difference on the promotion given to both type of vehicles. Regardless the size of samples for each type of vehicle the descriptions written by their sellers showed the same distribution overall; this is focusing on “non-EV related” attributes first and leaving “EV-related” attributes at last. This highlights the need of sellers to communicate hedonic attributes of vehicles over sustainable attributes. Implicating then that their marketing strategy is directed towards consumers specifically looking for an EV, not to any kind of buyer.

As stated in section 2.4 the framework for this research focused on the mediating variables that haven’t had enough research by academia. This study found that attributes that differentiate EVs from ICVs need to be emphasized by sellers to help adopters clarifying questions that might divert their interest of buying an EV (barriers). However, this study focussed on the first

features presented by the sellers in the advertisement's description. A full analysis of the entire description written by the seller could bring different results on the "EV-related" attributes communicated in the entire description. Additionally, improvement from the website where specific features from EVs are shown clearly on the advertisement (not description written by the seller) would be beneficial for the seller by making it easier to communicate sustainable features, and to the buyer to finding them with ease in the advertisement.

5.2 Gaps linked to literature

Since this research is one of the first of its kind, most of its findings are new to literature. However, in the descriptive statistics of the dataset could be identified some gaps previously found by researchers.

The number of BEVs in the dataset was surprisingly high, almost twice the number of PHEVs, contrary as it could be expected. The fact of having a higher number of BEVs over PHEVs in the used market could mean that many owners of PHEVs in Ontario keep their vehicles instead of selling them. This fact could back up the results of the study realized by Axsen et al. (2015) where PHEV designs are more popular than BEVs among EV adopters; in their study they found that EVs buyers find more value in PHEVs since the WTP for BEVs decreases as it is influenced by other factors, such as range or charging infrastructure availability.

The distribution of the body type feature from the dataset shows a couple of gaps in the variety of vehicles available in the used market, gaps that can be exploited from automakers to increase adoption by new customers with specific predilections. The first gap is the one existing in the minivan body type for BEVs, as shown in section 4.1.3 there is not a single car with that body type from BEVs; a fact that could divert consumers' attention towards the purchase of an

ICV, of which there are plenty of models available in the market. However, to cover partially that gap there is one EV in the market: the Chrysler Pacifica Hybrid, belonging to the PHEVs tier. Although the Pacifica Hybrid opens a possibility to specific clusters of consumers to move into EVs, there are not enough options in the market to saturate the minivan segment and attract the attention of customers. Thus, there is the suggestion that automakers should offer a greater variety of EVs to all kinds of consumers as Higgins et al. (2017) remarks after a study done to find out consumers' preferences on the different EVs body types.

The price feature from the dataset revealed unsurprisingly that BEVs are more expensive on average than the ICVs selected and PHEVs. This issue is often considered an important barrier to potential EV customers (Barisa et al., 2016; Egbue & Long, 2012; Hidrue et al., 2011; O'Neill et al., 2019; Zarazua de Rubens, 2019). It is to be noted that the average price of ICVs is higher than PHEVs due to the models selected to compare against BEVs, those models selected tend to be the most equipped ones in order to have attributes similar to the ones of BEVs, thus, making them more expensive.

Many sales of EVs from the autoTrader website were from dealerships, with 293 cases out of 408, meaning that customers in the look for a second-hand EV could end up most likely buying one from a dealer. Thus, dealers' promotion of EVs would have a significant impact on attracting customers' attention and completing the sale process for an EV purchase. Additionally, the attitude of the salesman from dealers offering EVs is proven to be an important factor in consumers' choices when purchasing an EV (Matthews et al., 2017). Therefore, since there are more used EVs for sale from dealers than from private sellers, there is a suggestion for further research on the attitudes and capacitation of salesman from dealers who offer second-hand EVs.

6. Conclusions

This research gathered the characteristics of the marketing mix of used EVs in Ontario. First, the products offered (used EVs) and their characteristics where collected. Next, the range of prices that buyers must pay for them depending on their characteristics. The place where they are being offered was also noted, it included the city of its physical location and the type of seller offering the vehicle. Finally, and the promotion of them was analyzed to find similarities and differences. All these components showed the current state of the used EVs market in Ontario.

This research highlighted the weaknesses of the advertisements or the promotion element in the marketing mix of EVs, when trying to communicate EV adopters the features needed to overcome barriers often faced by new EVs owners. After several comparisons made, the results were similar for EVs in different tiers, and against ICVs: few mentions of attributes related to features unique from EVs. Thus, there mediating variables looked for are not being effectively transmitted to consumers. One difference noted in the descriptions was that depending on the type of seller, more emphasis was made to the “sale-related” attributes (dealers) or “owner use, care and/or maintenance (private sellers). However, that difference noted was significantly low and only present for the first attribute on the descriptions, not on the 3 of them.

In other words, the market of used EVs is not developed enough to communicate the customers looking for a used vehicle the attributes that address barriers found by potential EV adopters. But is only focused to a group of people who know specifically what they are looking for and have knowledge of EVs. This research suggests that communicating the sustainable attributes and benefits from EVs could possibility of increase adoption by non-EV owners.

This research concludes that there is not a significant differentiation between EVs and ICVs in the used market of Ontario from the advertisements posted on autoTrader website. From the results of the comparisons made it can be appreciated a similar way of describing both types of vehicles by both types of sellers. The main emphasis is to describe attributes “non-EV related” which often are referring to physical features of the vehicles.

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Appendices

Appendix A List of EVs models collected and their similar ICV model

BEVs		
Make	EV Model	ICEV similar
Audi	E-tron	Q3/Q5
BMW	i3	-
Chevrolet	Bolt EV	Spark
Ford	Focus electric	Focus
Hyundai	Ioniq Electric	Elantra
Jaguar	I-Pace	e-Pace
Kia	Soul EV	Soul
Mini	3 Door	Cooper
Nissan	Leaf	Versa note
Porsche	Taycan	Panamera
Smart	Fortwo	-
Tesla	Model 3	-
	Model S	-
	Model X	-
	Roadster	-
Volkswagen	E-golf	Golf

PHEVs		
Make	EV Model	ICEV similar
BMW	330e	330
	5 series	5 series
	7 series	7 series
	i8	-
	X5	X5
Chevrolet	Volt Electric	Malibu
Chrysler	Pacifica hybrid	Pacifica
Fisker	Karma	-
Ford	C-Max Energi	-
	Fusion Energi	Fusion
Honda	Clarity Plug-in	Civic
Hyundai	Sonata Plug-in	Sonata
	Ioniq PHEV	Elantra
Land Rover	Range Rover	Range Rover
Mercedes Benz	GLC	GLC
Mitsubishi	Outlander PHEV	Outlander
Porsche	Panamera	Panamera
	Cayenne	Cayenne
Toyota	Prius Plug-in	Corolla
	Prius Prime	Corolla
Volvo	XC90 Hybrid	XC90

Appendix B EV Models available in Ontario's used car market in 2020

		Vehicle_type			
		BEV	ICV	PHEV	Total
Model	3 Door	1	3	0	4
	3 series	0	2	0	2
	3 Series	0	3	0	3
	330e Plug-in	0	0	3	3
	5 series	0	3	0	3
	5 Series	0	0	1	1
	7 Series	0	3	1	4
	Bolt EV	7	0	0	7
	C-Max Energi	0	0	3	3
	Cayenne	0	5	16	21
	Clarity Plug-in	0	0	9	9
	E-Golf	1	0	0	1
	e-tron	6	0	0	6
	Focus	0	4	0	4
	Focus Electric	8	0	0	8
	Fortwo	8	0	0	8
	Fusion	0	5	0	5
	Fusion Energi	0	0	14	14
	GLC	0	4	1	5
	Golf	0	5	0	5
	I-Pace	8	0	0	8
	i3	26	0	0	26
	i8	0	0	5	5
	Ioniq Electric	7	0	1	8
	Karma	0	0	1	1
	Leaf	52	0	0	52
	Model 3	31	0	0	31
	Model S	77	0	0	77
	Model X	30	0	0	30
	Optima PHEV	0	0	1	1
	Outlander	0	5	0	5
	Outlander PHEV	0	0	15	15
	Pacifica	0	5	0	5
	Pacifica Hybrid	0	0	11	11
	Panamera	0	3	1	4
	Prius Plug-in	0	0	2	2
	Prius Prime	0	0	7	7
	Range Rover	0	3	1	4
	Roadster	1	0	0	1
	Sonata	0	5	0	5
	Sonata Plug-in	0	0	3	3
	Soul	0	5	0	5
	Soul EV	18	0	0	18
	Taycan	1	0	0	1
	Volt Electric	0	0	22	22
	X5	0	5	0	5
	X5 Plug-in Hybrid	0	0	4	4
	XC-90	0	4	0	4
	XC-90 Hybrid	0	0	4	4
Total		282	72	126	480