Electric Car-sharing for Environmental Sustainability and Customer Relationship Management

By

LEE, Jinseo

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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Approval as of May, 2021

ABSTRACT

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The sharing economy, a platform based business model expedited by the 4th industrial revolution, has been grown rapidly by introducing and integrating diverse forms. As collaborative and on-demand economy, the sharing economy has introduced a variety of business models by highlighting social, economic, and environmental sustainability benefits. In particular, electric car-sharing, known as an eco-friendly car-sharing service, fosters sustainability, which is main purpose of sharing rather than producing. Electric car-sharing services have been paid attention as opposed to the traditional car-sharing using gasoline by reducing Green House Gas (GHG), noise, and traffic. This study proposed the following research questions: i) how does the perception on factors of electric vehicles – cost-efficiency, inconvenience, emotion, safety, health, and environmental sustainability – affect electric car-sharing users' or potential users' attitude?; ii) how does the customer attitude affect intention to use of sharing electric cars?; iii) how does the customer attitude affect satisfaction for sharing electric cars?; and iv) how does user's satisfaction affect customer loyalty? This study collected data via online survey. Data analyses including factor analysis, regression analysis, and independent-samples test are applied in this study. The results revealed that effects of these factors on attitude, intention, satisfaction, and loyalty are meaningful, which might be related to purchases of electric cars. Further, this study provides managerial and policy implications. For managerial implications, it is expected that through experience of electric car-sharing, customers' willingness to use and purchase electric car will be enhanced, while car industries should put more efforts to promote electric cars through better relationship with customers. For policy implications, this study provides which strategies at the governmental level should be better adopted to interact with citizens that also meet the 'Green New Deal' for sustainability.

Keywords: Sharing Economy, Sustainability, Eco-friendliness, Electric Car-sharing, Attitude, Intention, Satisfaction, Loyalty

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I. Introduction

The sharing economy, a platform based business model expedited by the 4th industrial revolution, has been grown rapidly by introducing and integrating diverse forms. Every industrial revolution has presented new waves of the economy and business by addressing different roles of supply and demand. The 1st industrial revolution with an improved manufacturing system by steam engine led to opening of Capitalism 1.0, which is also called as laissez-faire capitalism. (Smith, 1776). When mass production was introduced by Fordism, Capitalism 2.0 (van Parijs, 1998), known as the 2nd industrial revolution, emphasized government's role in controlling demands to activate economy. During the development of Internet and Communication Technology (ICT), however, government's heavy intervention rather delayed economic growth in 1980s. As a tool to solve this, Capitalism 3.0 (Barnes, 2006), known as the 3rd industrial revolution, preferred alleviated regulations to promote growth of global markets. As of the 4th industrial revolution, a new form of economy requires a fusion of few regulated markets and many efficiently operated markets with transparency, so called capitalism 4.0 (Kaletsky, 2011).

The 4th industrial revolution has been emphasized with the emergence of Information Communication Technology (ICT) that has paved the way for new business models (Björkdahl, 2009). The sharing economy, coined by Lessig (2008) or crowd-based capitalism, coined by Sundararajan (2016) became a significant model in one's life with issues of global sustainability and environment. Botsman and Rogers (2010) argued that collaborative consumptions involving exchanging, redistributing, renting, sharing, and donating information, goods, and talent lead to the improving social cohesion and minimizing usage of resources (Heinrichs, 2013). As a matter of fact, sharing economy addressed efficient use of remaining resources by emphasizing sustainability and environmental issues. Since economical usage of goods helps saving scarce

resources necessary for production (Böcker & Meelen, 2016), sharing economy contributes to reducing pollutants, emissions, and carbon footprints by preventing massive productions. Although there is controversy about the presumed sustainability benefits of the sharing economy because of value destruction (Frenken & Schor, 2017; Yang, Evans, Vladimirova, & Rana, 2017), still a variety of sharing business models are introduced as a way for realizing sustainable growth in various aspects.

Among sharing economy models highlighting sustainability, this study explores that frequent usage of electric car-sharing services and promoting them significantly help foster sustainability and environmental issues. As technology development for electric cars has rapidly advanced, electric car-sharing receives attention as one of sustainable business models in the sharing economy. According to Mounce and Nelson (2019), electric vehicle car-sharing systems have potential for improving sustainability with rapid usage of ICT including smartphones. Since car-sharing services and electric car are both closely related to sustainable development, combining these two might lead to a reasonable solution for future problems such as pollution, congestion, resource exhaustion (Brandstätter, Kahr, & Leitner, 2017). Given that transportation tremendously accounts for greenhouse gas emissions, it might be very important to encourage people experience electric cars and pinpoint the factors that attract their intentions.

To sum up, the purpose of this study is to investigate factors that affect electric car-sharing service by addressing various factors including environment and sustainability. This study examines customers' perception on factors of electric car-sharing that affect customer attitude, intention to use, satisfaction, and loyalty. By investigating the effects of factors, this study is expected to help encourage customers' usage and purchase intention of electric car.

1.1. Development of Research Questions

Among various types of sharing economies, this study will investigate the effects of electric car-sharing. Electric car-sharing is selected as citizens' usage of electric car-sharing might help improve intention to purchase electric cars for their future consumption. Ultimate goal of this study is to increase electric car usage by addressing policy issues regarding environment and sustainability. This study proposed factors that affect customers' attitude in the usage of electric car-sharing business model. Proposed factors include cost-efficiency, inconvenience, emotion, safety, health, and environmental sustainability. In addition, this study investigates how the attitude affects intention to use, satisfaction, and loyalty. Further, by examining the effects on customer attitude, this study provides implication on how users feel toward and react to sharing the renewable-energy automobiles (i.e. electric vehicles). The proposed research questions include the following: i) how does the perception on factors of electric vehicles – cost-efficiency, inconvenience, emotion, safety, health, and environmental sustainability – affect electric car-sharing users' or potential users' attitude?; ii) how does the customer attitude affect intention to use of sharing electric cars?; iii) how does the customer attitude affect satisfaction for sharing electric cars?; and iv) how does user's satisfaction affect customer loyalty?

Following the introductory chapter, Chapter II describes overall review of sharing economy; Chapter III will expound sustainability of sharing economy and electric car-sharing as a mean to improve eco-friendliness and sustainability; in Chapter IV, the theoretical background of Intention to Use, Satisfaction, and Loyalty in car-sharing is arranged; Chapter V develops hypothesis that this study will investigate; Chapter IV methodology part will examine data analysis; and the last chapter will interpret data to make the conclusion of the hypothesis and provide an insight for electric car-sharing companies, automobile manufacturers, and other

scholars.

II. Literature Review

2.1. Sharing Economy

According to perspectives, different characteristics of sharing economy are emphasized; collaborative consumption (Botsman, 2010), access-based economy (Bardhi & Eckhardt, 2012), on-demand economy (Jaconi, 2014), hybrid economy (Scaraboto, 2015), and others. This study compares various terminologies related to sharing economy and explores factors that affect customer's intentions to use and satisfaction for an environmental-friendly car-sharing service.

2.1.1. Definition of Sharing Economy

As one of methods to interact, sharing has always been around our daily lives. Exchanging and redistributing or donating knowledge and skills are commonplace within a society. Nowadays, however, sharing is more than just 'using together'. The scale of sharing is much larger than that in the past, and has drawn attention as one of mainstreams in economy that a variety of business models have newly been developed. Walsh (2011) stated that "we yearn to trust and be trusted, and sharing things allows people to make meaningful connection" and simultaneously suggested that the sharing economy will change the world. According to focal points, sharing economy is often called by different names; collaborative economy (Botsman, 2015), the access-based economy (Bardhi & Eckhardt, 2012), on-demand economy (Jarconi, 2014), hybrid economy (Scaraboto, 2015), and others. According to each perspective of sharing economy, these terminologies are used interchangeably (Trivett & Staff, 2013).

The term "Sharing Economy" was first coined by Lessig (2008). Lessig (2008) explained in his book that sharing economy is an opposite concept of commercial economy in terms of non-ownership, temporary access, and redistribution of resource. According to

Belk (2007), sharing has been always very significant for sustaining a life or a family from early age of humankind, and this is an alternative to the private ownership that is emphasized in both marketplace exchange and gift giving.

Continuously, Botsman (2015) defines collaborative economy is the decentralized networks and marketplace that match underused assets to the needs of the resources via platforms, which enables an immediate repose to on-demand, so-called 'On-demand economy' (Jaconi, 2014). According to Scaraboto (2015), the context of various modes including market-based exchange, offering, and sharing defines hybrid economic forms. Access-based consumption can be defined as market mediated transactions without the ownership transfer, which include several characteristics; temporality, anonymity, market mediation, and others (Bardhi & Eckhardt, 2012).

To sum up, the sharing economy can be identified as collaborative consumptions by offering an immediate response to on-demand with temporary access to using resources via Internet, mobile, or other platforms. Table 1 shows diverse terminologies describing sharing economy.

Table 1. The Summary of Definition of Various Terminologies related to Sharing Economy (Modified from Upward Trajectory of the Sharing Economy & Policy Reaction 2019 by Lee (2019))

Terminology	Description	Publication
Collaborative Consumption	Renting, lending, swapping, sharing, and trading which are the reinvention of traditional market behaviors that take places	(Botsman & Rogers, 2010)
Access-Based Consumption	Allow customers offer products and services among others without any trasnferration of ownership	(Bardhi & Eckhardt, 2012)
On-demand Economy	Fufill customer demand through providing immediate goods or services using technology such as Information and Communication Technology	(Jaconi, 2014)
Peer-to-Peer Economy	Each individual directly or indirectly interact to form a market where he or she can buy or sell goods and service with others without third-pary such as a company	(Hayes, 2015)
Hybrid Economy	Contexts of market-based exchange, offerig, sharing, and other modes of exchange that occur at the same time	(Scaraboto, 2015)

Although these terminologies are different from one another (Botsman, 2015), the core ideas within the descriptions are similar and overlapped in some aspects. Therefore, people use these words interchangeably (Trivett & Staff, 2013) and consider the terms as synonym. Key players in the transactions were requesting users, service suppliers, and platform providers. Nowadays, however, other entities such as government and enterprises also have influences on the operation of sharing economy indirectly (Mi & Coffman, 2019). As social, economic, and environmental sustainability become the main issue of modern economy, especially, the role of government is getting paid attention more than ever.

2.1.2. Current Issues of Sharing Economy

In the middle of fourth Industry revolution, the world has witnessed a rapid growth of sharing economy by utilization of improved platform technology and consumer's effort to participate in peer-to-peer transactions. Indeed, PwC (2014) expected that the market size of sharing economy is set to reach 335 billion by $2025. As an indicator of growth of sharing economy, according to Yaraghi and Ravi (2017), the valuation of Uber and Airbnb experienced massive increases from 2014 to 2016.

Even with these optimistic views regarding sharing economy, several critical issues, such as regulatory problems and Covid-19, threaten further growth of it and require some reassessment whether this kind of transaction can survive in the future economy. Regulatory challenges have always been one of main problems to solve in sharing economy. As a matter of fact, various issues such as hotel law, tax law violation, and illegal business assistance have been raised in US. According to Park (2019), most commonly raised issues regarding short term rental include escaping registration and collecting-requirement, violation of lease terms, property theft, and insurance issues pertaining to overall safety.

Secondly, Covid-19 deteriorates the growth of sharing economy as people become feared of sharing something with others. Many sharing companies in the world are indeed mired in the unexpected pandemic crisis. Airbnb anticipated that the company's revenue loss for the first quarter would be around $1 billion (Park, 2020). There some decreases in ride-sharing business as well. Uber is reported to experience about 65 percent reduction in demand for main markets according to many US media. In order to overcome Covid-19, Popular companies including Uber and Airbnb are making efforts to create creating new strategies to make sure that customers feel safe about using the businesses and cope with unexpected future (Overstreet, 2020).

2.1.3. Types of Sharing Economy

According to Botsman and Rogers (2010), the typology of collaborative consumption is classified into three specific types which contain product service systems, redistributing markets, and collaborative life styles, while Schor (2014) suggested a divided system of sharing economy into platform types and trading systems. Specifically, Owyang (2015) described sharing economy with honeycomb involving companies from 16 industries in 41 categories. Figure 1 shows basic model of sharing economy operated through platform.

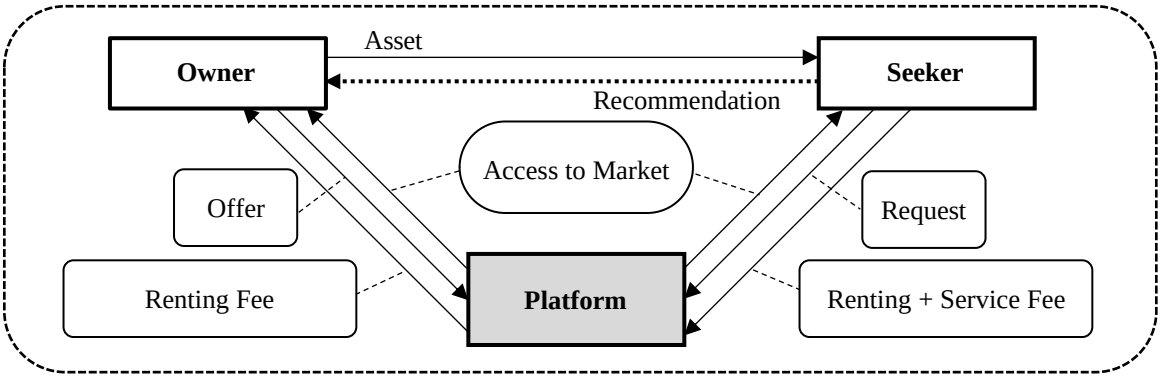

Figure 1 Model of Sharing Economy (Modified from DHL, 2017)

2.1.3.1. Mobility Sharing

Mobility sharing basically provides access to customers for certain period of time without

any ownership transfer. The range of mobility sharing becomes more diversified including bicycles, buses, car, and even helicopters. Especially, car-sharing exists with a variety of business models from B2C to P2P and even carpooling. As sustainable issues become more significant, mobility sharing can be one of the main models of sharing economy which improves efficiency of idle transportation and potentially reduces emission as well.

Regarding environmental sustainability, mobility sharing is considered one of solutions in terms of efficiency and pollutions. A variety of shared mobility services recently have been operated to match the supply and demand of sustainable vehicles in cities (Firnkorn & Müller, 2011). According to Katzev (2003), the car-sharing could reduce the number of cars and consequently decrease air pollution as well as the increasing use of public transit. With bike-sharing system, Shanghai was successful in saving 8,358 tons of petrol and reducing CO2 by 25,240 in 2016 (Zhang & Mi, 2018).

2.1.3.2. Accommodation Sharing

Basically, accommodation sharing implies offering unused or idle rooms to those who want to stay, and reservation can be made through platform. The most well-known example is Airbnb. Founded in 2008, Airbnb is now one of the most successful sharing companies employing 13,000 workers and having 31 offices around the world (Airbnb Plus, 2020). Since the size and rapid growth of Airbnb (AlltheRooms, 2020), many countries try to design proper laws and regulations to accommodate various types of accommodation sharing businesses including Airbnb.

Users can easily register or reserve room via Airbnb website or mobile platform. Hosts can upload their idle room with photos and explanation to attract guests. Those who are looking for a room can choose a date and a place to stay. They indirectly experience conditions of the

room by checking reviews from other users. This review system is very significant in platforms such as Airbnb because it prevents from information asymmetry. The theory of asymmetric information (Akerlof, 1970) expounds that those who have better information might take advantage by manipulating the price of goods. It possibly brings problem for fair transactions in that the other side who does not have enough information to make a purchasing decision may pay much more than the real value of the good.

Regulations regarding Airbnb have always been issued throughout the world. Effects of regulation strictness on region and house have been studied continuously (Quigley & Raphael, 2005; Ihlanfeldt, 2007), which significantly influence prices of accommodations, rents, and vacant land (Uzunca & Borlenghi, 2019). The legal issues regarding Airbnb comprehends illegal short-term rentals, tax obligations, and a state of flux – laws, enforcement, and taxation (Guttentag, 2015). However, government regulation is not a solution, but a "least worst" approach to managing externalities, given the high costs (Webster, 1998; Gurran, Searle, & Phibbs, 2018). Therefore, it is still questionable that regulations should be implemented to what extents.

Coronavirus have been influencing almost all sharing businesses including Airbnb. This year, about 64% of guests had a tendency to cancel rooms, while hosts have lost $90 on average for their daily rates (Lane, 2020). Given that the duration of pandemic crisis has not yet forcasted, Airbnb is trying to overcome Covid-19 by virtual experiences such as providing online classes. This might indicate evolution of sharing businesses adapting to changing circumstances.

2.1.3.3. Space Sharing

Space sharing, also called as a spatial sharing, is somewhat similar to Airbnb. However, the purpose of Airbnb is offering housing accommodation while space sharing comprehends

other type of space as well such as kitchen, office, school, home, and even a theatre. Considering the idle or dead time for the property to use, it might be much more reasonable for people to utilize these spaces more. WeWork, an office sharing business, has headquarters in New York and provide workspace over 800 locations where and how users need it (WeWork, accessed in 2020). WeWork provides shared workplaces for startups and mainly target for small size companies.

2.1.3.4. Other Types of Sharing

Other than mobility, accommodation, and space sharing models, there are other kinds of sharing economy such as crowd-funding, peer-to-peer lending, co-working, knowledge and talent sharing, and even niche services. Among these businesses, some are absence of monetary transactions such as Wikipedia. This knowledge sharing website enables text editing by volunteers so that specific information and details can be shared with others. (Petrini, Freitas, & Silveira, 2017) Considering the various forms of business models, there must be a potential to grow further in sharing businesses, and these will evolve according to changing circumstances. Therefore, analyzing collected data in sharing economy is integral to monitor and evaluate the effects of sharing economy on people, society, and the planet in terms of sustainability.

2.2. Car-Sharing

In the last years, the private mobility is shifted from ownership to service use by the rapid growth of new and sustainable way of transportation, car-sharing service (Ferrero, Perboli, Rosano, & Vesco, 2017). Ferrero, Perboli, Rosano, and Vesco (2017) stated that the car-sharing help community members conveniently arrive places where they were unable to reach by walking or public transportation. According to Millard-Ball, Murray, Schure, Fox, and Burkhardt (2005), car-sharing is a service that allow customers obtain access to vehicles rather

than receiving ownership.

Today car-sharing has been evolving that a free-floating set-up system is offered in car-sharing business. This system enables users to share and return a vehicle hire at any point within a specified region, making it easier to use the service (FirnKorn & Müller, 2011). According Millard-Ball, Murray, Schure, Fox, and Burkhardt (2005), car-sharing services offer various advantages at different levels: i) at the level of individual, benefits include cost savings, greater mobility, and convenience; ii) at the next level of car-sharing benefits implies more parking lots and efficient vehicles; and, iii) at the level of society, environmental advantages of car-sharing gets paid attention from researchers and academics as a way of sustainability.

2.2.1. History of Car-Sharing

Sefage, which initiated in Zurich, Switzerland, is one of the earliest car-sharing (Harms & Truffer, 1988). From 1948, this program attracted those who could not purchase a car (Shaheen, Sperling, & Wagner, 1999). European car-sharing programs, 'Green Cars' began to spread out from 1970s.were also spread out that "Green cars" in Britain in the late 1970s, and "Vivalla Bill" in 0rebro, Sweden, in 1983 (Shaheen & Cohen, 2007). Indiana was the first car-sharing in North America (Doherty, Sparrow, & Shinha, 1987). Another major U.S. car-sharing project was the Short-Term Auto Rental (STAR) begun in San Francisco in 1980s (Shaheen, Wright, & Sperling, 2002).

Contemporary car-sharing form was mostly developed from cases of Switzerland and Germany, which is 30 years ago from now (Millard-Ball et al., 2005). In 1987, the independent establishment of two corporations was the first car-sharing programs that were operated in large scale in Switzerland (Millard-Ball et. al., 2005). As of 1990s, car-sharing in began to spread out from place to place. One of well-known car-sharing activitities include Car co-op

from Singapore in 1997 (Sperling & Shaheen, 1999). Honda and Toyota also started two experimental programs in 1997 and in 1999, respectively (Sperling & Shaheen, 1999). In Korea, there are two major car-sharing services, 'Greencar' and 'Socar'. In addition, car-sharing services for renewable energy-based vehicles (e.g. electric and hybrid cars) are actively introduced, as sustainability and eco-friendliness is continuously emphasized in society.

2.2.2. Types of Car-Sharing

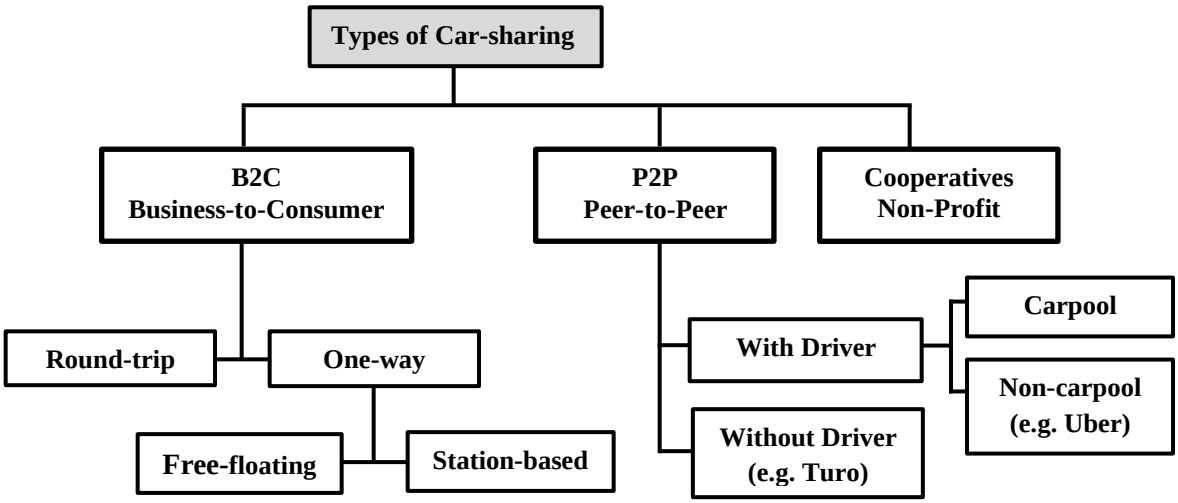

Figure 2 Types of Car-sharing
(Modified from Münzel et al., 2019)

Providers of car-sharing can vary in terms of objectives, business models, technology, and markets (Millard-Ball, 2005). According to Shaheen, Mallery, and Kingsley (2012), automobiles offered by car-sharing operator are spread out in B2C car-sharing; members access the vehicles with a reservation and are charged for hourly-basis. Shaheen, Mallery, and Kingley (2012) also mentioned that such traditional car-sharing is very effective for relatively short trip and suited for walkable, high-density, and urban areas where public transportations are developed.

In order for profits and sustainability, B2C car-sharing can also be divided into two groups, roundtrip and point-to-point. (Cohen & Kietzmann, 2014). Roundtrip models such as

Zipcar want members to return the automobile to the place where they borrowed, while point-to-point types allow customers to park a car anywhere in designated areas (Cohen & Kietzmann, 2014).

On the other hand, Peer-to-Peer platforms for car-sharing were introduced around 2011 that car owners can borrow cars from other peer customers (Münzel, Boon, Frenken, Blomme, & Linden, 2019). The new business model of car-sharing allows users to have access to idle vehicles, and thus private car owners help the customers take advantages from their vehicles without costs or responsibilities (Hartl, Sabitzer, Hofmann, & Penz, 2018). According to Kietzmann, Hermkens, McCarthy, and Silvestre (2011), power of social network via internet and mobile technologies enable P2P ride sharing to prosper. Given that P2P platforms such as Turo allow both sellers and buyers get benefits from immediate exchanges by using resources more efficiently, P2P car-sharing models are advantageous in creating values in a mutual way. Apart from B2C and P2P, other types of business models in cars-sharing exist such as carpooling, flexible carpooling, nonprofit/cooperative carpooling, and vanpooling (Cohen & Kietzmann, 2014).

III. Sharing Economy for Sustainability

3.1. Sustainability in Sharing Economy

According to Heinrichs (2013), sharing economy possibly open a door for sustainability. Although cojecturing benefits of the sharing economy for sustainability is not easy (Frenken & Schor, 2017) because of its linkage to value destruction (Yang, Evans, Vladimirova, & Rana, 2017), still many studies expound positive effects of sharing economy on sustainability. Although there exist social, economy, technology and environmental aspects of sustainability, environmental sustainability is most frequently discussed as a virtue of sharing economy. From early 2010s, environmental issues have become major public concern (Kalafatis, Pollard, East, &

Tsogas, 1999), resulting in that Europe and North America considered environmental protection to be one of the most significant public agendas (Dunlap & Scarce, 1991). Indeed air pollution, climate change, and resource scarcity require people to take more sustainable methods for cosumption. (McDonald, Oates, Young, & Hwang, 2006). Daunoriene, Draksaite, Snieska, and Valodkiene (2015) argued that several environmental motivations for sharing economy exist depending on following conditions; i) environmental sustainability in sharing economy secures the stability of biological and physical systems; ii) environmental sustainability in sharing economy reduces production, which leads to having sustainable consumption modes; and iii) environmental concern has a deep relationship with participation rate of sharing economy. Piscicelli, Cooper, and Fisher (2014) find that 32% of their respondents chose Ecomodo, a UK-based online markpetlace, because of their preference for "to be green".

Among the myriad of environmental issues, greenhouse gas has always been mentioned as a big problem for the planet. Among the causes of pollutions, the current fossil fuel–based transportation system is higly responsible for air pollutions (EPA, 2018). Consequently, electric mobility area is paid attention more and more as a solution to problems regarding air pollution (Wappelhorst, Dobrzinski, Graff, Steiner, & Hinkeldein, 2016) and sharing cars (Nobis, 2006). In fact, car-sharing businesses tend to become 'greener' (Bardhi & Eckhardt, 2012).

3.2. Electric Car-Sharing for Sustainability

Big cities in the word have already been facing with side effects of rapid urbanization inlcuing traffic jams, air pollution, and insufficiency of resources. (Lee, Nah, Park, & Sugumaran, 2011). As one of solutions to these problems, various electric car-sharing services Zipcar, Turo, and ShareNow have been introduced, ever since the 'Witkar', which means white car, took to the roads as the first world's electric car-sharing scheme as a campaign to reduce pollution on the

streets of Amsterdam in 1974 (BBC, 2018). Now, electric car-sharing services have evolved with better technology that improves efficiency and effectiveness.

The manual for using electric car-sharing is basically the same as that for using conventional car-sharing. Based on electric car-sharing service in Korea, users can easily reserve a car via online platforms like conventional car-sharing service. The fee is 10 minute-basis for at least two-hour reservation, so users opt for and pay for time they want. Different from the conventional car-sharing, however, electric car-sharing services require users to recharge the vehicle for a certain amount as a return policy. The total rate is calculated based on the basic rental fee and charging electricity which is much cheaper than fueling non-electric cars. Table 2 describes the prices of various car-sharing companies for both electric and non-electric cars.

Table 2. Price Comparisons in Major Car-Sharing Services in US and Korea

	B2C Car-sharing Companies							
	Korean Car-sharing Company				**International Car-sharing Company**			
	Socar		Greencar		Zipcar(US)		ShareNow (Germany)	
	Types	Price($)	Types	Price($)	Types	Price($)	Types	Price($)
Electric	Hyundai Ionic	55.01	KIA Soul B.	87.83	Volkswagen e-Golf	150.94	BMW i3	23.90
	Chevrolet Bolt	63.59	Chevrolet Bolt	87.83	-	-	-	-
	Hyundai Kona	91.19	Hyundai Kona	94.04	-	-	-	-
	Benz EQC	128.21	KIA Soul	94.74	-	-	-	-
Non-electric	KIA Morning	50.24	Chevrolet Spark	49.78	Ford Focus	78.57	Category XS	62.89
	Hyundai Avante	66.49	KIA K3	70.17	Honda Civic	78.57	Category S	75.44
	Hyundai G80	201.73	KIA K5	83.48	Hyundai Elantra	98.21	Category M	88.01
	Benz C200	146.93	KIA K7	95.60	Benz C300	141.19	Category L	100.58
	P2P Car-sharing Company (Turo)							
	Tesla		Price($)		Others		Price($)	
Electric	Model 3		114.59		BMW i3		63.70	
	Model S		129.43		Chevrolet Bolt		74.33	
	Model Y		162.34		Fiat		47.86	
	Model X		258.89		Audi E-Tron		197.46	

These days, electric automobiles are considered to be one of essential ways for sustainability, especially in the perspective of environment. Currently, there are three types of electric vehicles, hybrid, plug-in, and full electric; the major difference between these types is battery charging methods (Poullikkas, 2015). The higher efficiency and lower average energy consumptions of electric vehicles reduce carbon emissions compared to cars with an internal combustion engine (Wappelhorst, Sauer, Hinkeldein, Bocherding, & Glaß, 2014). Based on the analysis for effects of vehicles on environmental costs from 2015 to 2016, Jeon (2017) found that costs of environmental damage from electric cars were 5.74~7.8 won per kilometer, which are lower than those from non-electric cars. Yi (2018) also argued that greenhouse gas reduction from using electric cars rather than conventional ones is about 58.5g per kilometer, and the level of fine dusts emitted by electric cars was only about 3.7% of non-electric cars. In addition, some researches have expounded that electric cars can not only lower air pollution but also reduce traffic noise (Brady & O'Mahony, 2011; Hawkins, Singh, Majeau-Bettez, & Strømman, 2012). Apart from environmental sustainability, electric vehicles usually have less expensive charging and maintenance fees, which results in reducing overall operating costs (Ga¨rling & Thøgersen, 2001). Equipped with relatively few parts, electric vehicles can significantly lower the necessity of repair compared to conventional cars, which can contribute to less production and sustainability. Although driving range is relatively shorter than conventional cars (Guo, Yang, & Lu, 2018), it is clear that electric vehicles still have such various advantages over the petro or diesel cars, and may become most optimal mode of transportation.

Car-sharing systems, which lower production and share resources, are also closely related to environmental sustainability as mentioned previously. Since car-sharing decreases the vehicle ownership, it suggests not only reduction in air pollution and traffic congestion but also much

increased number of parking slots (Efthymiou, Antoniou, & Waddell, 2013). Indeed, car-sharing policies leads to reduction of Vehicle Miles/Kilometers Traveled (VMT/VKT) and greenhouse gas (Rodier & Shaheen, 2003; Rodier, 2008). In addition, car-sharing users do not have to concern about maintenance fees or taxes because these are all covered by sharing platforms. Given these social, economic, and environmental effects of car-sharing, applying electric vehicles on this system might lead to much greater benefits. According to Brandstätter, Kahr, and Leitner (2017), electric car-sharing programs have potential to solve future problems such as air pollution, traffic, and shortage of resources by combining the benefits of electric vehicles and car-sharing system. Therefore, electric car-sharing as one of transportation modes is expected to be helpful and effective in creating a sustainable ecosystem.

3.2.1. Political Issues of Electric Car

Stepping with rapid growth of electric cars, policymakers in various countries are trying to utilize industrial policies for boosting the development of electric cars. There are two motivations for promoting electric car industry; i) risk management for environmental harm and oil dependency; ii) advancement of industrial policy by helping chosen industry overcome the market barriers (Keohane, Revesz, & Stavins, 1998; Budzinski & Schmidt, 2013). Although each government's political strategy is not exactly the same, industrial polices for electric cars commonly invovle consumer incentives for purchase, subsidies for recharging stations, and financial aids for a factory to produce lithium ion batteries. (Lane, Messer-Betts, Hartmann, Carley, Krause, & Graham, 2013).

In case of United States, Obama administration's 'New Deal' tried to develop industries of electric cars and create jobs by financial investments based on American Recovery and Reinvestment Act (Lee, 2019). The 'New Deal' includes several major policies to promote

electric vehicles. First, gas stations or businesses which installed a renewable energy based fuel pump were given tax credits and consumers who bought electric cars could earn tax credits up to $7,500 (Choi, Park, & Kim, 2012). Second, the government announced an incentive plan, of which the size was $2400 million providing support for all industries in the process of manufacturing electric cars (Chou, Park, & Kim, 2012). In 2016, in addition, the government also invested $5 trillion on charging infrastructures (Kwon, 2016). Although incentives for electric vehicles are temporarily cancelled because of anti-environmental policy during Trump's administration, the world's trend for eco-friendliness and sustainability is expected to continue further.

In Korea, the cumulative number of supplies for electric cars was 91,744 in 2019, and the number will increase up to 150,000 if purchase incentives are provided this year (Department of the Environment, 2020). Domestic market for electric cars has been developed based on the purchase subsidies, supporting infrastructures such as charging stations, and financial incentives (Park & Kim, 2020). During Moon's administration, Korean government has utilized various policies for the 'Green New Deal' plan. The plan is a policy that supports sustainability in terms of both environment and human society. One of the major tools include offering purchase subsidies for those who buy electric cars. Korean government provides subsidies up to $8,000 for buying electric vehicles (Pulse, 2020). In addition, based on the 'Development and Distribution of Eco-friendly Cars Plan', the government tries to construct 1400 public charging facilities with diversified charging systems until 2020. With such policies, the government is expected to achieve the accumulation of total 350 thousands of electric cars and 100 thousands of rapid charging facilities (Choi, 2019). It is true that the incentives mentioned for developing the market and industry for electric vehicles have been certainly effective, further analysis is still necessary

whether the outputs from the supports can exceed the costs of the various subsidies, incentives, tax credits, and etc. Therefore, it might be very significant for governments to pinpoint the break-even between benefits and costs of supports, and also how long these policies should be maintained.

3.2.2. Smart City with Electric Car-Sharing

As big cities are getting more complicated by myriads of the interdepenmdent characteristic among citizens, businesses, and transportations, which directly or indirectly leads to environmental problems are raised by increasing urbanization and growing population (Neirotti, De Macro, Cagliano, Mangano, & Scorrano, 2014). As a solution to these problems, smart city has been paid attention for improving sustainability and constructing much eco-friendlier cities. Although there are various definitions of the city according to focal points, the term is widely used as an ICT-based city for improving efficiency and sustainability. Regarding smart city, Caragliu and Del Bo (2018) mentioned that smart city possibly affect economic growth, quality of life, and sustainability in a positive way. In order for smart city to be environmentally sustainable, usage of transportation in the city might have a very important role. Dupont, Hubert, Guidat, and Camargo (2019) argued that electric cars, as future urban mobility, are one of major components of smart city. In fact, big cities usually suffered from heavy air pollution from a variety of sources, especially transportation. Park and Kim (2020) argued that transformation to electric vehicle turns out to be effective in reducing greenhouse gas and fine dust emissions. By increasing number of electric cars in smart cities, therefore, the quality of air and eco-friendliness can be improved. As a way to enhance the usage of electric cars in these cities, electric car-sharing can be one of objects for consideration. Based on the analysis about factors affecting the intent of purchase for both consumers and actual buyers of electric vehicles,

government incentives, knowledge of electric vehicles, recognition of electric vehicles, and recognition/experience of electric vehicles are found to be very significant determinants (Park, Kim, & Kim, 2019). This analysis implies that a government can increase the number of electric cars in smart cities by creating an environment offering people direct experience for electric cars. In this sense, electric car-sharing is plausible way to boost people's perception on electric cars, which possibly leads to more purchases electric cars. sustainability in cities. In addition, given that mobility-sharing itself possibly reduces traffic and pollution (Cocca, Giordano, Mellia, & Vassio, 2018), electric car-sharing can be much effective option for less traffic, noise, and emission compared to an internal combustion engine car. By accelerating the usage of electric cars, smart cities can be more sustainable, and the influences can be expanded to the extent of suburban or local areas.

IV. Theoretical Background of Sharing Economy

4.1. Intention to Use, Customer Loyalty, and Satisfaction Theory

Fishbein and Ajzen (1980) stated that most behaviors of social relevance are predictable from intentions in that the behaviors are under volitional control. The empirical research conducted by Ajzen and Fishbein (1970) implied very high and important correlations between measures of intentions and behavior (Ajzen, 1971). Based on the Fishbein-Ajzen's Behavioral Intentions Model (Fishbein & Ajzen, 1975), two major factors determine behavioral intention; first one is a personal or 'attitudinal' factor, and second is a social or 'normative' factor, which ascertains how attitude and subjective norms affect behavioral intentions (Miniard & Cohen, 1979).

According to Giese and Cote (2000), definition of customer satisfaction still lacks consensus. Indeed, many researchers and academics have tried to define the meaning of customer

satisfaction based on their studies. Typically, Gundersen, Heide, and Olsson (1996) defined customer satisfaction as a evaluation for post consumption regarding a specific product or service. This conceptualizing customer satisfactions has been consistent with a half of decade of research (Oliver, 1980, 1997). Oliver (1997) described customer satisfaction as a judgment about product or service feature. In addition, disconfirmation theory developed by Oliver (1980) stated that the level of satisfaction is a result of the difference between expected and perceived performance.

According to Yi (1989), definitions of customer satisfaction can be largely defined in two different types in terms of an outcome or a process. In the perspective of outcome-oriented approach, Howard and Sheth (1969) argued that the level of remuneration for opportunity cost determines the buyer's cognitive state of being adequate or inadequate as customer satisfaction. Oliver (1981) described customer satisfaction as the result of psychological state when the customer's prior feeling about consumption experience was combined with the emotion surrounding inconsonant expectations. In terms of an evaluation-process approach, on the other hand, customer satisfaction is an evaluation for the consumption experience whether the quality was at least as reasonable as it was supposed to be (Hunt, 1977). According to Tse and Wilton (1988), customer satisfaction is closed related to how customer respond to the evaluation of the difference between expectations and the actual performance after its consumption.

Loyalty refers to the level that customers feel committed to suppliers and do not look for any other alternatives (Oliver, 1999). Customer loyalty is not the same with customer satisfaction. Rather, these are interlinked in that the both affect customer retention (Gerpott, Rams, & Schindler, 2000). Although the relationship between satisfaction and actual loyalty behavior is not clearly defined (Rust, Zahorik, & Keiningham, 1995; Ganesh, Arnolz, & Reynolds, K.E., 2000), customer loyalty and satisfaction are connected inextricably (Oliver, 1999). According to

Flint, Blocker, and Boutin Jr. (2010), satisfaction is a mediator for loyalty. Since customer satisfaction and loyalty are also positively related to profitability and market share (Anderson, Fornell, & Lehmann, 1994; Reichheld, 1993), it might be very significant to analyze the relationship between the two.

4.2. Attitude Theory

Ajzen (1989) stated that "an attitude is regarding with individual's tenedency to respond favorably or unfavorably to any object with their own disciminations." Although definitions of attitude can vary according to each perspective, most researchers and theorists believe that attitude measures how favorably or unfavorably customers react to an object (Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975; Osgood, Suci, & Tannenbaum, 1957; Petty & Cacioppo, 1986). Eagly and Chaiken (1993) also argues that essential aspects – evaluation, attitude object, and tendency define attitude.

Spears and Singh (2004) explain that for two reasons attitudes are a popular research target in many studies: First, analyzing attitudes is very helpful in predicting behaviors of a customer (Mitchell & Olson, 1981). Second, several theoretical frameworks for the study of attitudes are available from social psychology researchers (Eagly & Chaiken, 1993), which can facilitate research on this pivotal construct. According to Fishbein and Ajzen's (1975) model, behavior is affected by attitudes through behavior intentions. In some cases, attitudes directly influence behaviors (Bagozzi, 1981, 1992b). Meanwhile, Barta and Athola (1991) suggest that customer attitudes theoretically involve distinct hedonic and utilitarian components, and that product categories are different in the extent to which their overall attitudes are come from these two components.

V. Hypothesis Development

This study examines the effects of electric car-sharing factors on customer attitudes. Proposed factors include price, inconvenience, emotion, safety, brand value, and environmental sustainability. This research investigates both effects of attitude on intention to use for customers without experience and effects of attitude on satisfaction. In addition, the study measures how each customer's intention and satisfaction affects expected satisfaction and loyalty, respectively.

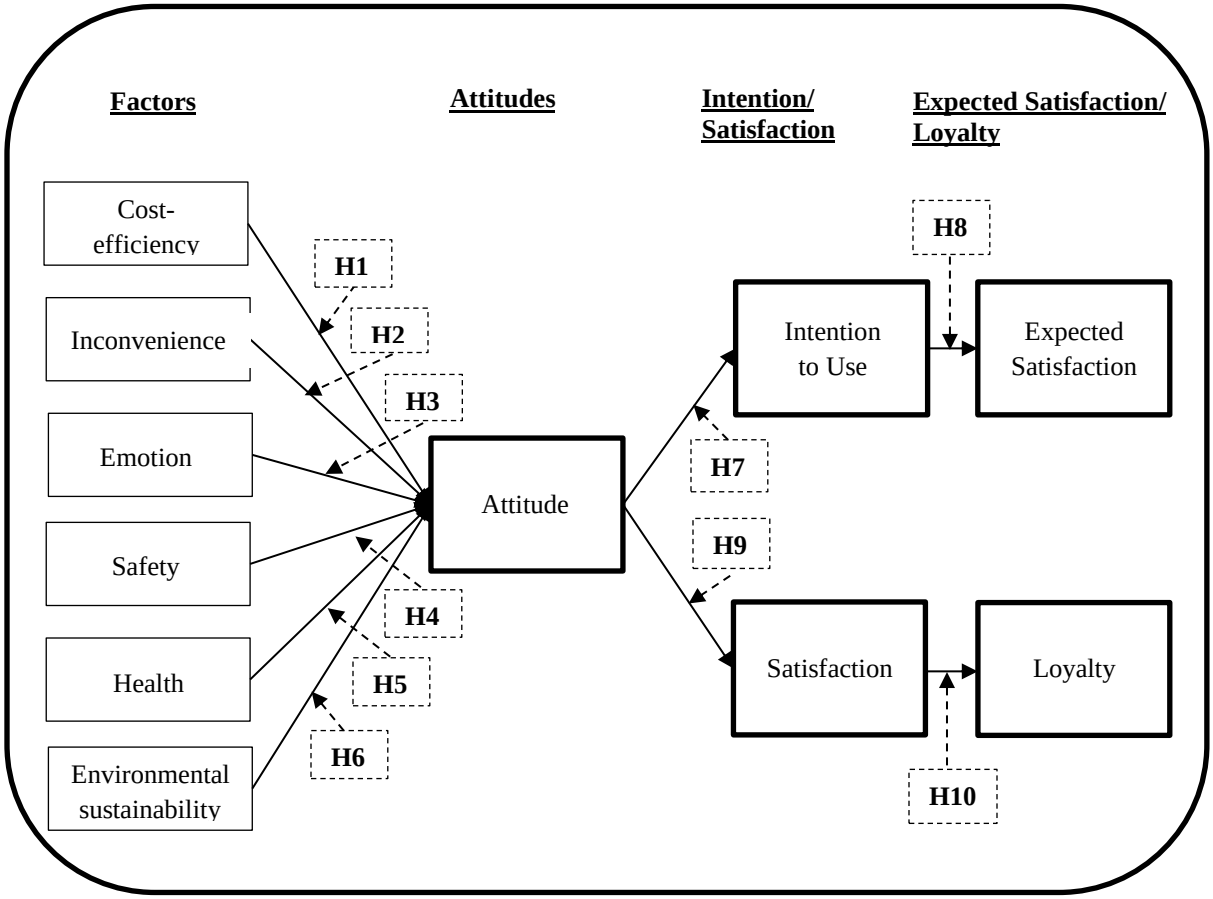

Figure 1 Proposed Model of Attitude, Intention, Satisfaction & Loyalty on EV Sharing

Henning Thurau, Henning, and Sattler (2007) extended the Beckaerian customer utility model to see how other utilities affect the people's tendency to choose illegal copy in file sharing of motion pictures. Later, Lamberton, and Rose (2012) applied the concept to the context of a car-sharing and established a study that various utilities such as transaction utility, mobility

utility, storage utility, social, and etc. affect customers' propensity to opt for a car-sharing system. This study refines the theoretical backgrounds and uses term 'factor' instead of 'utility' to develop a hypothesis that various factors in sharing electric cars have influences on customer attitude, intention to use, satisfaction and loyalty.

5.1. Effects of Factors on Customer Attitude

5.1.1. Effects of Cost-efficiency

From the two perspectives, electric car-sharing's cost efficiency can be maximized. First, car-sharing service improves cost-effectiveness. In general, car-sharing has been referred to as a "missing link" (Britton, 2000; Millard-Ball et al., 2005; Shaheen & Cohen, 2007) in that car-sharing can fill the gap in mobility needs that can only be satisfied by private automobile, not public transportation, taxis, cycling, and walking (Cooper, Howe, & Mye, 2000). Car-sharing is the most fit for "mid-distance trips where flexibility is required" option, and that is to say, car-sharing is the most cost effective for intermediate-lengthy trips (Millard-Ball et al., 2005).

Secondly, fuel-efficiency of electric vehicles is much better than that gasoline or diesel automobiles. According to Department of Energy in United States, charging costs for hybrid and electric vehicles (only about $0.11 per kilowatt-hours) are lower than fuel costs for conventional vehicles. The lower price is also applied in electric car-sharing services. In case of electric car-sharing services in Seoul, distance-based fare of electric car is about 5 cents per kilometer, which is much lower than that of a conventional car (about 18~25 cents per kilometer). Therefore, cost-efficiency is amplified by using electric car-sharing services, and the following hypothesis can be developed:

H1: *The customer perception on cost-efficiency affects customer attitude of sharing electric*

vehicles.

5.1.2. Effects of Inconvenience

The inconvenience factor is related with how users feel about sharing electric vehicles in aspects of easiness and comfortableness. It might include all sorts of inconvenience experienced from a vehicle itself, using gas-stations, and platform interfaces. However, this study specifically deals with battery charging-station problem. Guo, Yang, and Lu (2018) stated that "the lack of charging infrastructure and the inability to fuel anywhere people want means that customers are hesitant about purchasing or driving an electric vehicle." This hesitancy indicates "range anxiety," which is the worry that people feel about the driving range of renewable-energy cars (i.e. electric vehicles). This can be one of obstacles to customers' purchasing intentions (Eberle & Von Helmolt, 2010). In Korea, there were approximately 29,000 charging stations, which are never enough to meet the demand of electric cars (Hyundai Tech, accessed in 2020). Insufficient number of these stations possibly make EV drivers roam around everywhere to look for chargers, which can offer awful experiences. Therefore, this leads to the following hypothesis:

H2: *The customer perception on inconvenience affects customer attitude of sharing electric vehicles.*

5.1.3. Effects of Emotion

In oder to improve brand power and seel more, numerous advertisements try to appeal diverse emotions to customers and to make themselves exceptional among competitors (Edell, Agres, Dubitsky, & Lowe Marschalk, 1991). For example, BMW describes how joyful driving a car is by "Stories of Joy", a customer-participated worldwide communication campaign (Mogilner, Aaker, & Kamvar, 2012; J.D. Power and Associates, 2010), while Coca-Cola implemented "Open Happiness" strategy to help customer enjoy small communities to share information (Mogilner, Aaker, & Kamvar,

2012). Electric car-sharing is not an exception.

Given that it is relatively new for people to use or share electric vehicles, riding electric automobiles can offer both original experience and feelings to them. Indeed, emotional factors have shown to be very important in the context of sustainable mobility (European Commission, accessed in 2020). There appears to be support for the idea of including emotional factors in predicting the behavior toward relatively environmentally friendly products or issues (Moons & De Pelsmacker, 2012). Hence, emotional appeals might be very essential to fulfill customers' social and psychological need for purchasing behavior (Belch & Belch, 2015). This leads to following hypothesis:

H3: *The customer perception on emotion affects customer attitude of sharing electric vehicles.*

5.1.4. Effects of Safety

Generally, battery stability is a major safety issue regarding electric vehicles which can significantly affect customer attitude. Indeed, level of battery safety massively affect systems' functionality and market acceptance, which is directly concerned with customer's recognition toward electric vehicles (Levy, 1997). With regard the issue, Larsson, Andersson, and Mellander (2014) mentioned that current Lithium-ion batteries for automotive can be controlled by Battery Management System (BMS) and have proved an enhanced safety related to fires. Compared to cars operated by gasoline and diesel fuel, it seems to be clear that battery-based electric vehicles have advantageous for absence of large fire. Beyond battery safety, there are other incidental issues regarding safety of electric cars as well. According to U.S. Department of Energy (accessed in 2020), EVs must meet the rigorous safety standards and are equipped with a lower center of gravity compared to conventional vehicles, lowering possibility to roll over and enhancing quality of driving. In addition, internal combustion engines (ICE) of conventional vehicles are riskier compared to EV in the perspective of catching fire (Mandal, 2019). Since

safety is very essential for electric car-sharing program, the following hypothesis can be developed:

H4: *The customer perception on safety affects customer attitude of sharing electric vehicles.*

5.1.5. Effects of Health

Various types of air pollutions from different reasons have become one of serious problems worldwide because the pollutions destroy both environment and human health. Among the causes of pollutions, the current fossil fuel–based transportation system accounts for large part of air pollutions (EPA, 2018), and it negatively affects human health (Grabow, Spak, Holloway, Stone Jr., Mednick, & Patz, 2012). Therefore, electric car-sharing which lowers resource-usages and reduces intakes of polluted air in daily life has potential to improve human health. Apart from lowering the emissions, some researches argued that electric cars can also reduce traffic noise (Brady & O'Mahony, 2011; Hawkins, Singh, Majeau-Bettez, & Strømman, 2012). The absence of mechanical noise by electric vehicles reduces level of noise in city, making a preferable environment (Campbello-Vincent, Peral-Orts, Campillo-Davo, & Velasco-Sanchez, 2017). Thus, electric car-sharing is expected to lower the traffic noise and potentially have positive influences on human health by eliminating stress and unstableness.

H5: *The customer perception on health affects customer attitude of sharing electric vehicles.*

5.1.6. Effects of Environmental Sustainability

The factor of environmental sustainability may be one of the most compelling reasons why people are willing to use electric car-sharing platforms. Martin and Shaheen (2011) argued that the environmental benefit of car-sharing has been proved especially in the perspective of number of car parked and circulating in cities. Not only for these, but also Böcker and Meelen (2017) mentioned that most apparent environmental benefits are expected from car-sharing given

the negative environmental impacts of car production and car ownership. Meanwhile, a renewable energy automobile itself can be environmental friendly in many aspects. According to Karplus, Paltsev, and Reilly (2010), electric vehicles can potentially lower substantial amount of CO2, especially in markets that possess low carbon intensity of electricity generation. From the environmental comparison, Granovskii, Dincer, and Rosen (2006) proved that electric cars have advantages over other types of cars such conventional vehicles although it depends on energy sources. Also, the environmental advantages foster people's preference for electric vehicles (Jensen, Cherchi, & Mabit, 2013). Thus, sharing electric vehicle programs have potential to significantly improve environmental sustainability, which leads to the sixth hypothesis:

H6: *The customer perception on environmental sustainability affects customer attitude of sharing electric vehicles.*

5.2. Relationship between Attitude, Intention, Satisfaction, and Loyalty

Fishbein and Ajzen (1975) argued that attitude is the most antecedent of behavioral intention. According to Abdul-Muhmin (2011), pre-purchase attitudes must be a precursor of overall satisfaction which is always a post-experience construct such as a purchase. In addition, customer loyalty is very concerned with the intention of customers to repurchase product or service later (Oliver, 1997), which seems to be closely related with satisfaction and attitude. Therefore, this study examines how customer attitude affect customer's intention and satisfaction, which will also have the chain effect on loyalty.

H7: *Positive attitude toward sharing electric vehicles affects higher level of customer satisfaction*.

H8: *Higher level of customer satisfaction on sharing electric vehicles affects higher level of loyalty in sharing electric cars.*

H9: *Positive attitude toward sharing electric vehicles affects higher level of intention to use electric car-sharing.*

V. Methodology

6.1. Data Collection

This study investigates how the attitude affects intention to use, satisfaction, and loyalty by measuring proposed factors of electric car-sharing which might improve sustainability. Data was collected by online survey. Survey was distributed via various platforms including online community, messenger, social network, blog, and others. The questionnaire items were developed for this survey, which include items that were revised from related studies (Oliver, 1997; Rochelandet & Le Guel,2005; Hennig-Thurau, Henning, & Sattler, 2007; Lamberton & Rose, 2012). This study applied 5-point Likert scale from 1 = strongly disagree and 5 = strongly agree for major variables. The total of 138 respondents completed the survey with response rate of 89.03%

In order to check reliability, this study first conducted Cronbach's alpha tests in Table 3.

Table 3. Cronbach's Alpha Test for the Factors in Electric Car-sharing

Factors	Statements	Data items
Cost-efficiency	1. I think that driving cost of electric car is less expensive than non-electric car.	Statement 1
	2. I believe that driving cost of electric car is affordable (5cent/km).	Statement 2
	3. I think that using electric car-sharing is more efficient compared to non-electric car.	Statement 3
	Reliability (Cronbach's Alpha)	0.692
Inconvenience	1. I think that charging system of renewable-energy car (i.e. electric vehicle) is inconvenient.	Statement 4
	2. I think that charging time takes too long.	Statement 5
	3. I might experience range-anxiety when I use electric car-sharing because the number of charging stations are few.	Statement 6
	Reliability (Cronbach's Alpha)	0.643
Emotion	1. I prefer to have electric car-sharing experience.	Statement 7
	2. Driving on a renewable-energy automobile will be my pleasure.	Statement 8
	3. Using an electric car-sharing service makes me feel civilized.	Statement 9
	Reliability (Cronbach's Alpha)	0.768
Safety	1. I expect that electric cars are fire-resistant.	Statement 10
	2. I expect that electric cars are safe when facing an accident because	Statement 11

		electric cars have lower center of gravity which reduces possibility of rolling over.	
	3.	I expect that electric car-sharing is safer than non-electric car-sharing.	Statement 12
		Reliability (Cronbach's Alpha)	0.777
Health	1.	I believe that electric car-sharing might help prevent me from air pollution.	Statement 13
	2.	I might consider using electric car-sharing services due to less noise.	Statement 14
	3.	I think that electric car-sharing can relieve my stress because I can enjoy fresh air.	Statement 15
		Reliability(Cronbach's Alpha)	0.647
Environmental Sustainability	1.	I think that electric car-sharing services are good for environment by using less fossil fuel.	Statement 16
	2.	I believe that using electric car-sharing improves air quality by lowering emission.	Statement 17
	3.	I think that using eco-friendly electric car-sharing will be helpful enhancing environment.	Statement 18
		Reliability (Cronbach's Alpha)	0.901

Table 4 shows the demographics of samples.

Table 4. Sample Demographics

	Total	
(N =138)	*%*	*N*
Gender		
Male	47.8%	(66)
Female	52.2%	(72)
Marital Status		
Married	21.7%	(30)
Unmarried	76.1%	(105)
Other	2.2%	(3)
Age		
20-24 years old	7.2%	(10)
25-29 years old	60.1%	(83)
30-34 years old	14.5%	(20)
35-39 years old	0.7%	(1)
40-44 years old	3.6%	(5)
45-49 years old	3.6%	(5)
50-54 years old	4.3%	(6)
55-59 years old	2.2%	(3)
60-64 years old	3.6%	(5)
Education		
High school or below	7.3%	(10)
Bachelor degree (2 or 4 years)	72.2%	(99)
Master degree or higher	21.2%	(29)
Occupation		
Central Government	2.2%	(3)
Local Government	7.3%	(10)
Corporation – Public Sector	1.5%	(2)
Corporation – Private Sector	7.3%	(10)
Non-profit Sector (e.g., NGO-IGO)	27.0%	(37)
Academic Sector	2.9%	(4)
Research Organization	11.7%	(16)

Other	40.1%	(55)
Average Annual Salary		
Not applicable	29.7%	(41)
$10,000 or less	7.2%	(40)
$10,001-$20,000	%	(75)
$20,001-$30,000	8.3%	(17)
$30,001-$40,000	1.5%	(3)
$40,001-$50,000	1%	(2)
$50,001-$60,000	14.1%	(29)
$60,001-$70,000	3.9%	(8)
$70,001-$80,000	15.1%	(31)
$80,001 or More		
Area of Residence		
Seoul	39.4%	(54)
Gyeonggi	20.4%	(28)
Chungcheong	20.4%	(28)
Geongsang	4.4%	(6)
Jeolla	11.7%	(16)
Gangwon	-	(-)
Jeju	0.7%	(1)
Other	2.9%	(4)

6.2. Data Analysis

By using extraction method with a varimax rotation of Kaiser, this study applied factor analysis for the factors of electric car-sharing to check validity. To filter out significant factors, the analyzing procedure was repeated for the six factor which are cost-efficiency, inconvenience, emotion, safety, health, and environmental sustainability.

Table 5 summarizes the result of factor analysis for each factor that affects customer attitude toward electric car-sharing

Table 5. Component Matrix: Factors of Electric Car-sharing

		Components					
Factors	**Scale Items**	**1**	**2**	**3**	**4**	**5**	**6**
EC 1	I think that driving cost of electric car is less expensive than non-electric car.	0.714					
EC 3	I believe that driving cost of electric car is affordable (5cent/km).	0.693					
EC 2	I think that using electric car-sharing is more efficient compared to non-electric car.	0.680					
CON2	I think that charging system of renewable-energy car (i.e. electric vehicle) is inconvenient.		0.811				
CON1	I think that charging time takes too long.		0.807				
CON3	I might experience range-anxiety when I use electric car-sharing because the number of		0.669				

	charging stations are few.				
EMO2	I prefer to have electric car-sharing experience.	0.903			
EMO1	Driving on a renewable-energy automobile will be my pleasure.	0.818			
EMO3	Using an electric car-sharing service makes me feel civilized.	0.774			
S3	I expect that electric cars are fire-resistant.		0.869		
S2	I expect that electric cars are safe when facing an accident because electric cars have lower center of gravity which reduces possibility of rolling over.		0.823		
S1	I expect that electric car-sharing is safer than non-electric car-sharing.		0.807		
H3	I believe that electric car-sharing might help prevent me from air pollution.			0.787	
H1	I might consider using electric car-sharing services due to less noise.			0.763	
H2	I think that electric car-sharing can relieve my stress because I can enjoy fresh air.			0.762	
ES1	I think that electric car-sharing services are good for environment by using less fossil fuel.				0.918
ES3	I believe that using electric car-sharing improves air quality by lowering emission.				0.913
ES2	I think that using eco-friendly electric car-sharing will be helpful enhancing environment.				0.912

Table 6 summarizes the result of factor analysis for customer attitude, intention, and expected satisfaction toward electric car-sharing.

Table 6. Component Matrix: Attitude, Intention, and Expected Satisfaction

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
AT2	I positively evaluate electric car-sharing services.	0.934		
AT1	I have a positive attitude on electric car-sharing services.	0.920		
AT3	I think that I enjoy electric car-sharing services when/if I use.	0.856		
I2	I believe that I am interested in using electric car-sharing.		0.896	
I3	I am going to use electric car-sharing service because of sustainability.		0.895	
I1	I have intention to use electric car-sharing service in the near future.		0.887	
EXS1	I think that electric car-sharing service will satisfy one of my needs.			0.937
EXS2	I think that I will be satisfied with electric car-sharing service.			0.934
EXS3	I believe that electric car-sharing might enhance quality of life.			0.888

Table 7 shows the result of factor analysis for satisfaction and loyalty in electric car-sharing.

Table 7. Component Matrix: Satisfaction and Loyalty

Items		Components	
Factors	**Scale Items**		
ST2	I am satisfied with my experience with electric car-sharing.	0.894	
ST1	I think that I prefer electric cars compared to non-electric cars in car-sharing.	0.856	
ST3	I feel that I might consider purchasing electric car in the future. (again)	0.842	
LT2	I am going to pick an electric car again in car-sharing service.		0.930
LT1	I am willing to inform others of electric car-sharing services.		0.930

This study applied factor scores for regression analysis to find out the significant of each factor. Table 8 indicates how much each factor of electric car-sharing affect the customer attitude.

Table 8. Effects of Factors on Attitudes

Variable (Independent → dependent)	Standardized Coefficient (*t*-value-Sig)
Cost-efficiency → Attitude (H1)	0.258 (3.048***)
Inconvenience → Attitude (H2)	0.069 (0.800)
Emotion → Attitude (H3)	0.578 (8.130***)
Safety → Attitude (H4)	0.428 (5.399***)
Health → Attitude (H5)	0.594 (8.377***)
Environmental Sustainability → Attitude (H6)	0.533 (7.174***)

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance

In order to test the effect of customer attitude on intention to use electric car-sharing, regression is conducted with attitude as an independent variable and intention as a dependent variable. Table 9 shows the result that it finds the model is significant at 0.01 level with F = 74.420 (*R-square* = 0.401). Based on the findings, hypothesis 7 is accepted.

Table 9. Effects of Attitudes on Customer Intention

Variable (Independent → dependent)	Standardized Coefficient (*t*-value-Sig)
Attitude → Intention (H7)	0.634 (8.627***)

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance

Table 10 shows the result of regression analysis to examine the effect of customer intention on expected satisfaction. According to the ANOVA, the model is significant at 0.01 level with F= 185.773 (*R-square* = 0.622). Based on the finding, hypothesis 8 is accepted.

Table 10. Effects of Attitudes on Expected Satisfaction

Variable (Independent → dependent)	Standardized Coefficient (*t*-value-Sig)
Intention → Expected Satisfaction (H8)	0.789 (13.630***)

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance

To examine whether attitude affects satisfaction significantly, regression analysis is conducted based on the items in the survey. Table 11 indicates the results of regression, and the ANOVA indicates that the model is significant at 0.01 level with F= 31.140 (*R-square* = 0.609). Based on finding, hypothesis 9 is accepted.

Table 11. Effects of Attitude on Satisfaction

Variable (Independent → dependent)	Standardized Coefficient (*t*-value-Sig)
Attitude → Satisfaction (H9)	0.780 (5.580***)

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance

Table 12 represents the results of regression analysis based on factor analysis for how customer satisfaction affect loyalty. The ANOVA indicates that the model is significant at 0.01 level with F= 21.116 (*R-square* = 0.514). Based on finding, hypothesis 10 is accepted.

Table 12. Effects of Satisfaction on Loyalty

Variable (Independent → dependent)	Standardized Coefficient (*t*-value-Sig)
Satisfaction → Loyalty (H10)	0.717 (4.595***)

*** p < 0.01, ** p < 0.05, * p < 0.1 denotes statistical significance

In conclusion, the result of hypotheses testing of factors in electric car-sharing is summarized in Table 13.

Table 13. Summary of Effects of Factors in Electric Car-sharing

Determinant	Hypothesis Testing	Result
Cost-efficiency	Cost-efficiency → Attitude (H1)	Accepted
Inconvenience	Inconvenience → Attitude (H2)	Rejected
Emotion	Emotion → Attitude (H3)	Accepted

Safety	Safety → Attitude (H4)	Accepted
Health	Health → Attitude (H5)	Accepted
Environmental Sustainability	Environmental Sustainability → Attitude (H6)	Accepted

Table 14 shows the results of testing hypothesis 7 and 8, which are the effect of attitude on intention and the effect of intention on satisfaction, respectively.

Table 14. Summary of Effects of Attitude and Intention

Determinant	Hypothesis Testing	Result
Attitude	Attitude → Intention (H7)	Accepted
Intention	Intention → Expected Satisfaction (H8)	Accepted

Lastly, Table 15 represents the test results about how significantly attitude affects satisfaction and the influence of satisfaction on loyalty.

Table 15. Summary of Effects of Attitude and Satisfaction

Determinant	Hypothesis Testing	Result
Attitude	Attitude → Satisfaction (H9)	Accepted
Satisfaction	Satisfaction → Loyalty (H10)	Accepted

VII. Conclusion

7.1. The Summary of Results

First of all, regression analysis was conducted to measure the effect of factors in electric car-sharing on attitude among customers. Based on the customer attitude toward electric car-sharing, this study also measured how the attitude affected intention to use and expected satisfaction for potential users and satisfaction and loyalty for existing users. Based on the results from regression analysis, five factors including cost-efficiency (H1), emotion (H3), safety (H4), health (H5), and environmental sustainability (H6) were found to be significant in determining customer attitudes. These factors were all accepted at confidence level of 0.01 among the participants in survey. Among these variables, health, emotion, and sustainability were stronger variables that affect customer attitude in electric car-sharing rather than cost-efficiency and

safety factors. Interestingly, health was the most significant variable for attitude. On the other hand, Inconvenience factor (H2) was rejected. Although this study considered that users of electric car-sharing felt inconvenient because of the lack of charging facilities or drive range, users were not seemed to experience or expect much inconvenience from using electric car-sharing.

In case of survey participants who had not used electric car-sharing service, analysis was conducted to see the effect of attitude on customer intention and also how the customer intention affected expected satisfaction. Based on the results, H7 was accepted that customer attitude regarding the six factors significantly affected intention. H8 was also accepted that expected satisfaction was significantly affected by customer intention. In order to find out whether attitude affects satisfaction (H9) and loyalty (H10), regression analysis was conducted among existing users. Both the hypotheses were accepted that satisfaction was significantly affected by customer attitude for the five factors, and also had influences on loyalty for electric car-sharing service.

7.2. Additional Findings

In order to acquire additional findings, this study conducted independent-samples T test and one-way ANOVA, and the results showed interesting information regarding electric car-sharing. First of all, this study found that customers had different level of satisfaction and loyalty according to gender. Based on the results from independent-samples T test, the mean of customer satisfaction for the males was 4.31 (SD=0.630), while that of customer satisfaction for the females was only 3.33 (SD=1.118). The p-value was 0.017(T=2.615), which indicated that the men were more satisfied with electric car-sharing than the women. In addition, there was a significant difference in the customer loyalty for male. The analysis expounded that the mean of males for the first question asking loyalty was 3.92(SD=0.862), while that of females was

3.00(SD=0.943) only. On the other hand, the mean of males for the second question was 4.31(SD=0.480) and that of females was 3.56(SD=0.527). The p-values for each question were 0.023(T=2.445) and 0.002(T=3.472), respectively. In summary, the males among survey participants had more satisfaction and loyalty for electric car-sharing experience than the females did.

On top of this, there was significant difference about how survey participants think about environmental sustainability according to their occupations. The ANOVA indicated that the difference was significant at 0.000 level with F= 4.168 based on the question 6-2 in the survey. The result suggested that the participants with diverse jobs had different opinions about the statement that electric car-sharing improves air quality by lowering emission. Not only this, but also significant difference existed among the participants with discrete jobs for the health factor. Based on the question 5-1 in the survey, the ANOVA showed that the difference was significant at 0.001 level with F= 3.944. Furthermore, this study found that survey participants felt different levels of convenience according to their residential areas. The ANOVA suggested that there was significant difference at 0.042 level with F=2.254. The result might be useful to pinpoint local-specific problems and investigate which areas require better charging system or infrastructure such as charging poles.

7.3 Managerial Implication

The purpose of this study is to explore factors that affect electric car-sharing by fostering the issue of sustainability and environmental friendliness that are crucial for global warming. This study examined customers' perception on those issues by using electric car-sharing as the usage of both electric car and car-sharing play a key role to improve sustainability. Dealing with

factors of electric car-sharing service, this study offers significant insights for electric car-sharing service providers, electric car businesses, and government team related to smart city. First of all, this study suggests how businesses should promote their products and services to customers by fostering impacts such as cost-efficiency, inconvenience, emotion, safety, health, and environmental sustainability on customer attitude, intention to use, satisfaction, and loyalty. As the result shows, health, emotion, and sustainability factors show stronger effects among other significant factors, which imply that customers' perception on electric car and car-sharing closely associated with the issues of global warming. In terms of managerial implication, marketers of electric car-sharing services and electric car manufacturers should more strategically target customers by building better relationships that also evoke emotional feelings. Especially, it might be important to help customers feel eco-friendlier and more civilized in the context of sustainability. Since electric cars are normally emphasized for making environment more clean, the strategic approach for customers' emotion in the same context possibly reduces cognitive dissonance (Festinger, 1957), which will eventually improve the level of satisfaction.

The result of this study also suggests that customers become smarter and smarter, and even consider potential and augmented benefits from products or services. Apart from eco-friendliness of vehicle itself, customers begin to think of their health which might be affected by using electric car-sharing service. In addition, this study proves that users of electric car-sharing believe that the service can improve health by reducing air pollution and noises. Therefore, further research for examining actual effectives of electric cars on people's health might be very important for offering positive customer perception. Both electric car-sharing service and businesses related to electric cars might highlight the perception of health improvement as a marketing tool to fascinate more customers, especially who are stressed out from air pollution

and noises. In addition, anticipating enhanced health from the usage of electric car-sharing service is also related to environmental sustainability in that customers are looking forward the benefits of eco-friendliness. As stated by Chu (2017), individual propensity for eco-friendliness and knowledge for electric vehicles have influences on purchase of electric cars. As a result, electric car manufacturers necessarily provide more information about effectiveness of electric vehicles in terms of environmental friendliness and through better Customer Relationship Management (CRM). Beyond this, electric car companies might consider participating in or promote electric car-sharing services to improve recognition of electric cars by offering customers chance to experience their products.

Not only for electric car-sharing providers and electric car corporations, government plans need to focus more on electric car-sharing services to improve sustainability. In Korea, government's one of major urban planning for sustainability is smart city. As a solution to the problems from increasing urbanization and growing population (Neirotti, De Macro, Cagliano, Mangano, & Scorrano, 2014), smart city has been paid attention for improving sustainability and constructing much eco-friendlier cities. In order to do so, activating electric car-sharing services in government level is recommended in cities as car-sharing mechanism reduces the total number of cars on the roads (Lee, Nah, Park, & Sugumaran, 2011). Beyond solving heavy traffics, electric car-sharing potentially improve sustainability in cities by offering solutions to the problems such as heavy air pollutions and noises. For these reasons, electric car-sharing is a worthy of consideration for government leaders as an important mean for sustainability in a smart city. Further, government supports are definitely required to improve recognition and increase usage rates of electric car-sharing services in cities. Most importantly, there are not enough necessary infrastructure such as charging poles, which can cause inconvenience to

electric car-sharing users. Although the participants of this study responded that they did not experience serious inconvenience regarding electric car-sharing, still many researches reveal the necessity of sufficient charging facilities. Cocca, Giordano, Mellia, and Vassio (2018) argued that electric car-sharing systems demand setup of an infrastructure of charging stations, which can enhance customer intention for the service. Therefore, government leaders might promote electric car-sharing and improve sustainability in cities by installing more charging facilities and supporting other requirements for the system.

7.4 Policy Implication

Although car-sharing is well-known to people these days because of rapid growth of sharing economy, electric car-sharing still lacks wide recognition from sharing users or customers. According to the survey in this study, the number of users who have used electric car for sharing is much lower compared to the number of those who use internal combustion engine vehicles for sharing. The experienced users participated in the survey was 22 out of 155, which was only about 14.2%. Some people might think that electric car-sharing does not fit their preferences for some reason. However, it is apparent that improving recognition of both electric cars and electric car-sharing services is necessary. Chu (2017) argued that individual knowledge for electric vehicles affects purchase intention of electric cars. Certainly, there might be lower possibility that people intend to use electric car-sharing or purchase electric car because reasons such as lack of recognition and knowledge for electric cars. Park, Kim, and Kim (2019) also found that government support, knowledge of electric vehicles, recognition of electric vehicles, and recognition/experience of electric vehicles are important factors in determining purchasing intent. Therefore, it might be very important to promote electric cars with proper information at government level. Given that many governments are trying to improve eco-friendliness and

sustainability, enhancing customer perception on electric cars can help achieve their goal as well.

In case of Korea, ‘Green New Deal’ is one of such government programs that emphasize ‘transforming to renewable energy sources’ and ‘sustainability’. In this program, the Korean government tries to develop vehicles with renewable energy sources such as electric and hydrogen cars. Especially, the government offers various benefits such as subsidies for purchasing electric cars, tax credits, and installation of infrastructures such as public charging stations. Because of the governmental supports, the number of electric vehicles is expected to increase up to 150,000 (Department of the Environment, 2020). Still, however, further efforts might be considered such as introduction of electric car-sharing services in particular locations such as major or new cities to offer direct experiences and improve sustainability. Given that purchasing electric cars can be accompanied with high costs, enhancing the public awareness and motivation with electric car-sharing can be a necessary strategy. Furthermore, the government potentially maximizes the effect of Green New Deal program by having a chain reaction that electric car-sharing services help to increase the total number of electric cars by raising awareness of the vehicles. Since this study found that environmental sustainability significantly affects customer attitude toward electric car-sharing, introducing the services for eco-friendliness and sustainability at government level possibly earns much attention and participation from people. Therefore, government officials need to contrive proper policies and infrastructures to activate electric car-sharing services at least in cities where solutions for air pollutions and traffics are urgent. By supporting electric car-sharing at government level, customers will readily obtain information about electric cars and chance to directly experience electric cars, which can improve overall recognition for electric cars. Further, electric car-sharing service can help the government to achieve its ultimate goal for environmental friendliness and sustainability as well.

7.5 Theoretical Contributions

Electric car-sharing is in the period of growth and development compared to other sharing businesses such as accommodation and non-electric car-sharing services. Certainly, customer recognition and knowledge for electric car-sharing are relatively low that not many people have experienced the electric car-sharing service. Furthermore, study and research about the relationship between customer and the service are immature as well. In order to suggest directions, therefore, this study identifies factors that influence customer attitude and offers a theoretical framework for empirical research. The focal points of this study are figuring out how each factor of electric car-sharing service affects customer attitude and what are the relationships between the attitude and intention to use or satisfaction. Most importantly, the defined factors in this study could be applied and expanded to future studies to find out customer perception on electric-car sharing because majority of the factors are proved to be significant in determining customer attitude which influences both customer intention and satisfaction. As a result, this study provides foundational data for further research about CRM and actual influences of electric car-sharing on economy and human society.

7.6 Limitations and Opportunities

Although this study offers useful insights for electric car-sharing, still several limitations exist. First of all, the sample size of existing users is not enough to conduct separate analysis for the users only. Since there might some distinctions according to whether customers have actually experienced electric car-sharing before, further study with more samples can be helpful to verify the effect of electric car-sharing experiences. Second, this study might have not explored all the potential factors that affect customer attitude, intention, satisfaction, and loyalty toward electric

car-sharing. Therefore, further research for exploring other significant factors should be conducted to fully understand customer perception on electric car-sharing. Third, future study might consider to analyze effects by classifying car-sharing business types into B2C and P2P. Lastly, future research for sharing types of other renewable energy-based vehicles such as hydrogen car might be considered to figure out the ways to enhance sustainability much effectively.

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Appendix

Exploring Factors that affect Intention to Use and Satisfaction in

an Environmental-Friendly Sharing Model

: The Case of Electric Car-sharing

Please take 10 minutes to answer the following questions. Your responses to this survey are strictly confidential and will not be revealed to anyone other than researchers. Participation in this survey must be voluntary. All data will also be kept anonymously. The intent of this work is academic research purposes only. No individual or organization will be identified in any analyses or reports connected to the survey data.

The purpose of this survey is to investigate factors that affect customer intention and satisfaction in electric car-sharing. Your contribution to this survey is very important for the future research. Thank you.

Researcher: Jinseo, Lee
Email: jakekrkr713@naver.com

Section I. Questions based on Experiences of Sharing Economy

Please answer the following questions based on your experience from B2C car-sharing service.

1. Have you ever heard about Sharing Economy? (e.g. Airbnb, Uber, Taskrabbit, Greencar, Socar)

① Yes ② No **(if no, go to #4)**

2. Have you ever used any service among Sharing Economy?

① Yes ② No

2.1. What kind of sharing economy service have you used at most? (Select the one)

Car-Sharing ( ) Bike-Sharing ( ) Accommodation Sharing ( ) Office Sharing( )
Kitchen Sharing ( ) Crowd-funding( ) Goods Sharing ( ) Others ( )

3. Have you ever used any car-sharing service?

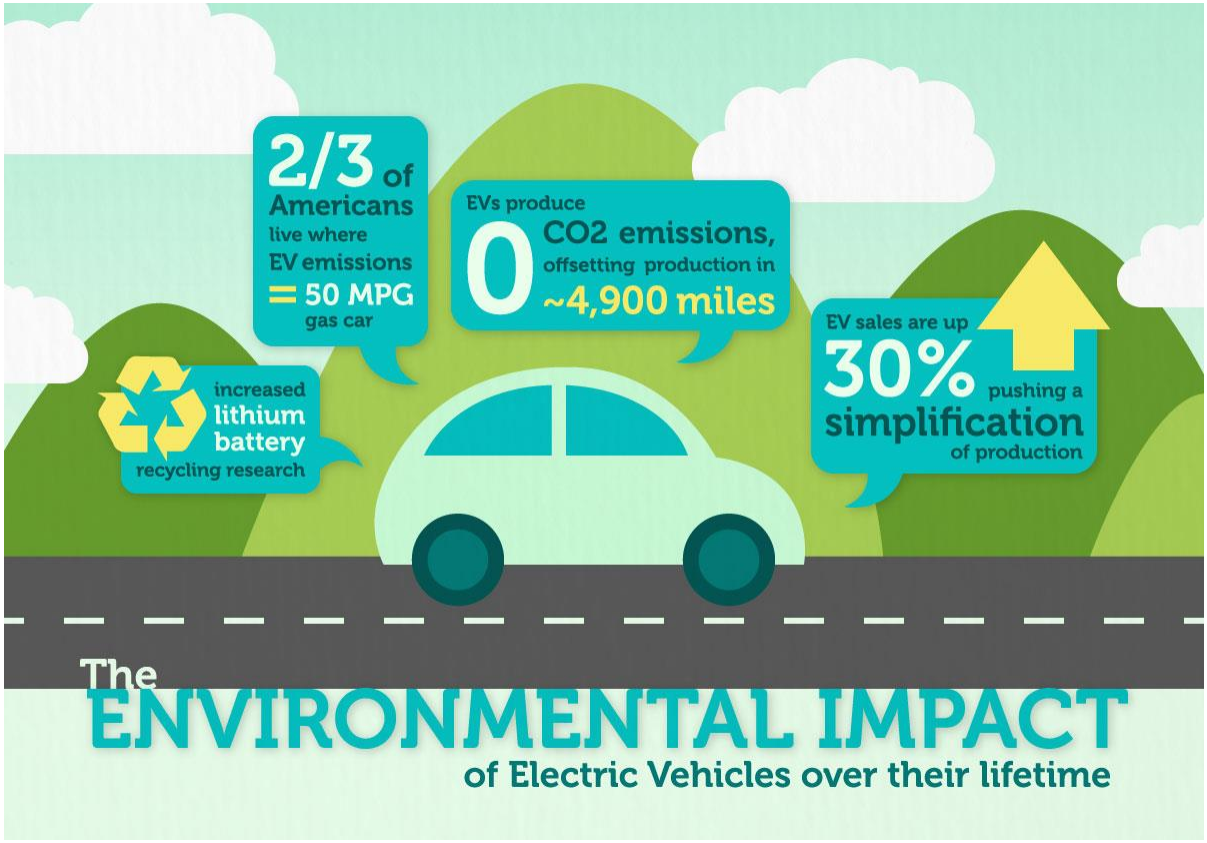
① Yes ② No

4. Have you ever used electric car?

① Yes ② No

Section II. Questions based on Benefits from Electric Car-sharing

Electric car-sharing has experienced rapid growth in various countries. One of the most important benefits in electric car-sharing is sustainability, which can be a solution to the problems such as limited resources, air pollutions, traffic noises, and even deterioration of human health.



(Source: Quick 220)

Please answer the following questions.

1. Cost-efficiency	Strongly Disagree	Strongly Agree

1-1	I think that driving cost of electric car is less expensive than non-electric car.	1	2	3	4	5
1-2	I believe that driving cost of electric car is affordable (5cent/km).	1	2	3	4	5
1-3	I think that using electric car-sharing is more efficient compared to non-electric car.	1	2	3	4	5

2. Inconvenience		Strongly Disagree				Strongly Agree
2-1	I think that charging system of renewable-energy car (i.e. electric vehicle) is inconvenient.	1	2	3	4	5
2-2	I think that charging time takes too long.	1	2	3	4	5
2-3	I might experience range-anxiety when I use electric car-sharing because the number of charging stations are few.	1	2	3	4	5

3. Emotion		Strongly Disagree				Strongly Agree
3-1	I prefer to have electric car-sharing experience.	1	2	3	4	5
3-2	Driving on a renewable-energy automobile will be my pleasure.	1	2	3	4	5
3-3	Using an electric car-sharing service makes me feel civilized.	1	2	3	4	5

4. Safety		Strongly Disagree				Strongly Agree
4-1	I expect that electric cars are fire-resistant.	1	2	3	4	5
4-2	I expect that electric cars are safe when facing an accident because electric cars have lower center of gravity which reduces possibility of rolling over.	1	2	3	4	5
4-3	I expect that electric car-sharing is safer than non-electric car-sharing.	1	2	3	4	5

5. Health		Strongly Disagree				Strongly Agree
5-1	I believe that electric car-sharing might help prevent me from air pollution.	1	2	3	4	5
5-2	I might consider using electric car-sharing services due to less noise.	1	2	3	4	5
5-3	I think that electric car-sharing can relieve my stress because I can enjoy fresh air.	1	2	3	4	5

6. Environmental Sustainability		Strongly Disagree				Strongly Agree
6-1	I think that electric car-sharing services are good for environment by using less fossil fuel.	1	2	3	4	5
6-2	I believe that using electric car-sharing improves air quality by lowering emission.	1	2	3	4	5
6-3	I think that using eco-friendly electric car-sharing will be helpful enhancing environment.	1	2	3	4	5

Section III. Questions based on Attitude
Please answer the following questions.

1. Attitude on electric car-sharing service		Strongly Disagree				Strongly Agree
1-1	I positively evaluate electric car-sharing services.	1	2	3	4	5
1-2	I have a positive attitude on electric car-sharing services.	1	2	3	4	5
1-3	I think that I enjoy electric car-sharing services when/if I use.	1	2	3	4	5

2. Have you ever used electric car-sharing service?

① Yes ② No

If you answered ② No, then please proceed to ***Section IV***

If you answered ① Yes, then please proceed to ***Section V.***

IV. Questions based on the Intention to Use and expected satisfaction for Car-sharing Services

Please answer the following questions.

1. What will be your main purpose of using electric car-sharing service?

Traveling ( ) Commute ( ) Shopping ( ) Buying an electric car ( ) Work-related ( ) Pick-up/Drop-off ( ) Others ( )

Intention to Use for Electric Car-sharing Services		Strongly Disagree				Strongly Agree
2-1	I believe that I am interested in using electric car-sharing.	1	2	3	4	5
2-2	I am going to use electric car-sharing service because of sustainability.	1	2	3	4	5
2-3	I have intention to use electric car-sharing service in the near future.	1	2	3	4	5

Expected Satisfaction for Electric-car sharing		Strongly Disagree				Strongly Agree
3-1	I think that electric car-sharing service will satisfy one of my needs.	1	2	3	4	5
3-2	I think that I will be satisfied with electric car-sharing service.	1	2	3	4	5
3-3	I believe that electric car-sharing might enhance quality of life.	1	2	3	4	5

(please proceed to demographic questions)

Section V. If you have used B2C electric car-sharing service previous, please answer this section.

1. What was your main purpose of using electric car-sharing service?

Traveling ( ) Commute ( ) Shopping ( ) Buying an electric car ( ) Work-related ( )

Pick-up/Drop-off ( ) Others ( )

2. How many times have you ever used electric car-sharing service?

N/A ( ) 1-2 times a year ( ) more than 6 times a year ( ) 1-2 times a month ( ) 1-2 times a week ( ) 3-4 times a week ( ) More than 5 times a week ( )

3. What was the major reason for the experience of electric car-sharing?

Environmental concerns ( ) Experience ( ) Tech-savvy ( ) Trendy ( ) Cost-efficiency ( ) Safety ( ) Others ( )

Questions based on Customer Satisfaction

Customer Satisfaction		Strongly Disagree				Strongly Agree
4-1	I am satisfied with my experience with electric car-sharing.	1	2	3	4	5
4-2	I think that I prefer electric cars compared to non-electric cars in car-sharing.	1	2	3	4	5
4-3	I feel that I might consider purchasing electric car in the future. (again)	1	2	3	4	5

Questions based on Customer Loyalty

Customer Loyalty		Strongly Disagree				Strongly Agree
5-1	I am going to pick an electric car again in car-sharing service.	1	2	3	4	5
5-2	I am willing to inform others of electric car-sharing services.	1	2	3	4	5

(please proceed to demographic questions)

Demographic Questions

1. Gender: ① Male ② Female

2. Marital Status: ① Married ② Unmarried ③ Other

3. Age:

①	②	③	④	⑤	⑥
under 19	20~24	25~29	30~34	35~39	40~44
⑦	⑧	⑨	⑩	⑪	
45~49	50~54	55~59	60~64	Older than 65	

4. Educational Background

①	①	②
High school or below	Bachelor degree	Master degree or higher

5. Occupation

①	②	③	④	⑤
Central Government	Local Government	Corporation - Public Sector	Corporation - Private Sector	Non-profit Sector (e.g., NGO-IGO)
⑥	⑦	⑧		
Academic Sector	Research Organization	Other:_____		

6. Average Annual Salary

①	②	③	④	⑤
Not applicable	$10,000 or less	$10,001-$20,000	$20,001-$30,000	$30,001-$40,000
⑥	⑦	⑧	⑨	⑩
$40,001-$50,000	$50,001-$60,000	$60,001-$70,000	$70,001-$80,000	$80,001 or More

7. Area of Residence

①	②	③	④	⑤
Seoul	Gyeonggi	Chungcheong	Geongsang	Jeolla
⑥	⑦	⑧		
Gangwon	Jeju	Other:_____		

Thank you ☺