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[Field Research]

A Study of Servitization Strategy for Electric Vehicles*

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Abstract

Purpose - This study proposes a framework for service innovation strategy to cope with the emergence of electric vehicles.
Research design, data, and methodology - This study designs an electric-vehicle lease program and collects the resulting data to analyze. By analyzing the previous studies on the electric-vehicle market with cases, a theoretical framework based on existing theories is to be set.
Results - This study proposes a strategy for the rapid diffusion of electric vehicles. First, a partitioned-pricing system is proposed to create an advantage for electric vehicles in terms of initial purchasing cost relative to traditional internal combustion vehicles. Second, focusing on reducing switching costs is important because electric vehicles have relatively low resale values due to the uncertainty of battery life. Third, a battery-leasing strategy is supposed to reduce the cost of switching from a traditional internal combustion vehicle to an electric vehicle.
Conclusions - This paper can provide strategic guidance for decision makers in firms that have already entered the electric-vehicle leasing market by making a recommendation such as a service innovation strategy. The proposed strategy can be considered as an electric vehicle market in the future and can contribute to the wider diffusion of electric vehicles.

Keywords: Electric Vehicle, Battery-Leasing Strategy, Servitization, Disruptive Innovation.

JEL Classifications: L52, L62, M13.

1. Introduction

The capital structure of the automotive industry has been formed by mass production and the continuous expansion of the selling market. This structure has driven overproduction, rapid market maturation, and a sharp decrease in the value of new products (Humphrey & Memedovic, 2003; Nieuwenhuis & Wells, 2003). Therefore, it is concluded that the automotive industry has focused on traditional internal combustion (IC) vehicles, for which the market is already mature. Companies operating in that mature, competitive market are attempting to survive by transitioning from a manufacturing-focused value chain to a service-focused value chain in order to generate new profit streams.

The automotive industry's value chain can be broadly divided into an upstream and a downstream portion: component suppliers are upstream, service providers are downstream, and automakers (OEMs) are in the middle of the value chain. Upstream activities include the production and assembly of components and systems, and downstream activities include the sale and use of the vehicles. Due to the maturation of the IC vehicle market, the core of the value chain is moving from the manufacturing end (upstream) of the value chain to the service end (downstream), which includes R&D, marketing, post-sale service, and financing. Servitization—the process whereby manufacturing firms develop capabilities to provide services and thus offer a bundled product–service offering—has been accelerating recently.

During this change in the structure of the automotive industry, a disruptive innovation called the "electric vehicle" (EV) has emerged. The EV is also expected to bring service-related transform in the structure of the car manufacturing industry. The strengthening of fuel-efficiency regulations is the major reason for the acceleration of the

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development of EVs. For example, the European Union has passed a bill reducing the carbon dioxide emissions limit by approximately 27%, from 130 g/km in 2015 to 95 g/km by 2021. The United States has introduced a system to reduce 81% of tailpipe emissions by 2025 and 70% of fine-dust emissions by 2017. China has announced a policy of increasing fuel efficiency by approximately 38%, from 14.5 km/L in 2015 to 20 km/L by 2020. Global automakers continuously release next-generation vehicles to comply with each country's increasingly stringent regulations for fuel-efficiency and emissions. Most scholars now agree that individual transportation will eventually be powered by electricity rather than oil, as evidenced by the success of the Model S offered by Tesla Motors in the United States (Barkenbus, 2009; Sierzchula et al., 2012).

The evolution of EVs begins with hybrid EVs, continues with plug-in hybrid EVs, and finally results in fully electric vehicles being manufactured and driven. During this process, the automotive industry's value chain is expected to gain new players, such as energy suppliers, software companies, and information technology companies. These new players will require closer relationships with other industry players such as automobile manufacturers and service providers. In addition, the advent of the EV era may require a new business model to disrupt the existing automotive industry's value chain. Likewise, EVs will change not only the manufacturing segment of the automotive industry but also the service segment. However, the government and automotive industry are focusing only on subsidies for vehicle purchases, battery-charger infrastructure, and R&D for major components such as the battery. However, consumers who purchase EVs face additional factors. Egbue and Long (2012) pointed out that studies analyzing the motivations or needs involved in EV purchases are not sufficient and that gaining an understanding of consumers' purchasing motivations and perceived purchasing barriers and developing measurement tools for conducting such an analysis will widen the diffusion of EVs.

This study tries to answer four major research questions regarding the changing landscape brought about by the emergence of EVs and related research trends. First, how does the emergence of the EV market affect the servitization of the automotive industry? Second, what servitization strategy can help the automotive industry cope with the disruptive innovation of EVs? Third, what are the perceived purchasing barriers and purchasing motivations of EV purchasers? Fourth, what can service providers do to enhance consumers' purchasing motivations and reduce their perceived purchasing barriers?

This study proposes a strategy for the service industry to adopt in the era of the EV. Based on these four research questions, the author considers the servitization of the automotive industry that would occur in response to EVs, and analyzes the major purchasing barriers as well as the services and products that could mitigate them. This paper include the following three sections. In the theoretical background, it provides relevant information about EVs and the major factors that companies and consumers should consider within the existing theoretical framework. Next, a battery-leasing strategy is important as an example of the servitization of the automotive industry, as well as a framework by which to rapidly spread that strategy.

2. Theoretical Background

2.1. The Dawn of the EV

An EV is a vehicle powered by electricity rather than fossil fuel. The EV was developed in 1834, before the IC engine, and thus has 180 years of history (Chan, 2002). Until the early twentieth century, EVs were used widely in transportation and were three times more common than vehicles with IC engines. However, the innovations of manufacturing processes and, specifically, mass production made gasoline vehicles more popular, cost-effective, and better performing than EVs. As a result, in 1935, the production and development of EVs stopped. During the energy crisis of the 1970s, EV production started again but rapidly decayed due to poor performance, poor infrastructure, and lack of participants.

The historical evolution of technological competitiveness in the automotive industry comprised five stages: 1) 1885–1905, during which there was no specific dominant technology because neither electricity nor gasoline power units existed; 2) 1905–1920, during which the market dominance of gasoline vehicles was established; 3) 1920–1973, during which the gasoline vehicle market was integrated and EVs disappeared; 4) 1973–1998, during which the weaknesses and limitations of gasoline vehicles and gasoline-power technology were recognized; and 5) 1998–present, during which regulation is motivating the resumption of EV production (Cowan & Hultėn, 1996). Stages 2, 3, and 4 focused on the market for gasoline vehicles. Stage 5, the current stage, is focused on overcoming the attachment to gasoline vehicles. Therefore, finding a strategy for overcoming this attachment requires an understanding of the attachment.

Three different types of vehicles run on electricity as shown in Table 1: battery electric vehicles (BEVs), which run only on battery, without IC engines; hybrid electric vehicles (HEVs), which run on both IC using fossil fuel and electricity from a battery; and fuel-cell electric vehicles (FCEVs), which is driven by electricity generated by the fusion of oxygen and hydrogen.

As interest in environmental issues and energy saving has increased, EV technology has developed rapidly. Because EVs do not emit carbon dioxide and do not use

fossil fuel, they are more environmentally friendly than are IC vehicles, which are a main source of urban pollution, and are helpful in reducing petroleum dependence. Therefore, the emergence and diffusion of EVs will not only foster the energy, environment, and transportation industries but will also motivate the development of high technology. Thus, EV technology will have a major economic effect by transforming existing industries and creating new ones.

In the near future, EVs and HEVs will become established. Due to its short range and long charging time, the EV will be used for mass transportation; due to its high fuel efficiency, the HEV will be welcomed by long-distance drivers (Chan, 2002).

<Table 1> Types of Electricity-powered Vehicles

	Hybrid Electric Vehicles (HEVs)	Fuel Cell Electric Vehicles (FCEVs)	Battery Electric Vehicles (BEVs)
Propulsion	▸ Electric motor ▸ Internal combustion engine	▸ Electric motor	▸ Electric motor
Energy System	▸ Battery ▸ Ultracapacitor ▸ Internal combustion engine	▸ Fuel cell	▸ Battery ▸ Ultracapacitor
Energy Source and Infrastructure	▸ Gas station ▸ Recharging equipment	▸ Hydrogen ▸ Ethanol ▸ Gasoline	▸ Recharging equipment
Feature	▸ Microinjection of toxic substance ▸ Long range ▸ Petroleum dependence ▸ Commercially available	▸ Non-or microinjection of toxic substance ▸ High efficiency ▸ Non-dependence on petroleum ▸ Acceptable range ▸ High price ▸ In development	▸ Non-toxic fuel ▸ Non-dependence on petroleum ▸ Short range (100–200km) ▸ High price ▸ Commercially available
Major Issues	▸ Battery size and battery management system		▸ Battery and battery management system ▸ High performance of propulsion ▸ Recharging equipment

Source: Chan (2002)

The diffusion of EVs in a country is affected by the nation's vehicle fuel efficiency regulations. <Table 2> summarizes the fuel efficiency regulations in the United States, China, European Union, and Japan. Other countries plan to raise their fuel efficiency limits from 20.0 km/L to 24.4 km/L. If an automobile manufacturer does not meet these new fuel efficiency limits, it may be subject to fines and be prohibited from further production. A business environment is defined as a package of policy, legal, institutional, and regulatory conditions that govern business activities (Malek, 2016). Therefore, in the near future, the dominant electricity-powered vehicle type will shift from HEV to EV.

<Table 2> Fuel Efficiency Regulations in Selected Countries

	United States	European Union	China	Japan
Fuel Efficiency Limit	23.2km/L (effective in 2025)	24.4km/L (effective in 2020	20.0km/L (effective in 2020)	20.3km/L (effective in 2020)
Penalty for Violation	Fine imposition	Fine imposition	Prohibition of production	Open to the public and fine imposition

Source: Media data integration

2.2. Current Discussion of Issues about the Diffusion of EVs

Various approaches for improving the diffusion of EVs in South Korea are being suggested, and research on the main considerations for consumers is in progress. Three main issues are being considered: technological features, infrastructure, and government subsidy.

Concerning technological features, the short range of EVs compared to IC vehicles is the main concern, and battery life is key to this issue. Chan (2002) insisted that technology satisfying both energy density and stability must be developed. He also noted that, because there is no technology to replace the lithium-ion battery, the development of a super-capacitor, fuel cell, or other energy system will be the key event in popularizing EVs.

The next main issue is infrastructure, especially recharging equipment. Recharging is currently done via a charger installed at a home or public parking lot, and high-speed charging technology capable of recharging a battery within 10 minutes rather than eight hours is being developed. Increasing the availability of charging stations and reducing the charging time also will be key to the popularization of EVs.

Finally, government policy can encourage the diffusion of EVs. Governments can promote EVs in various ways, including via subsidies, tax credits, congestion fee exemptions, and EV sharing for consumers and permits and subsidies for leasing businesses. In <Table 3>, a specific list is provided.

<Table 3> System Improvements and Tax Incentives to Encourage the Diffusion of EVs

Steps	Major context
Production and Purchase of EVs	Tax credits for consumers who purchase EVs Temporary credits for consumers' automobile sales taxes, registration fees, or other taxes Temporary credit for manufacturers' corporate taxes Tax credits for companies that purchase EVs
EV Use	Congestion fee exemptions and priority public parking for drivers of EVs Electric-vehicle sharing Permits for leasing businesses Environmentally friendly license plates for EVs, which may provide special benefits to the driver
Infrastructure for EVs	Road signs Requirement for builders to install electric charging stations at new homes Corporate tax break (e.g., land possession tax exemption for installing a charging station) Installation of high-speed charging stations and battery change booths in gas stations

Source: Hwang (2009)

2.3. Influence of EVs on the Automotive Industry

The automotive industry comprises a large share of South Korea's economic growth. Korean Automotive Industry plays a core role in the manufacturing industry, which has been leading Korean economic growth since the 1990s. Based on the data from the Korea Automobile Manufacturers Association, Korean auto industry has already exceeded 10% share of the national economy in the areas of employment, production, and exports.

The auto industry ranks 1st in employment, production, and added value in Korean manufacturing industry. The automobile industry is export-oriented, accounting for 68.3% of total Korean production. Export value totals US$74.7 billion, accounting for a 13.4% share of total national exports as a top exporting item (KAMA, 2014). Green and future strategic automobile innovations, including hybrids and fuel-cell vehicles, are the next generation of the core industry. In fact, the share of cutting-edge electronic components in the automobile industry is expected to expand to 40% in 2015 and 50% in 2020 (KAMA, 2014).

<Table 4> South Korea's Automotive Industry as a Share of Overall Manufacturing, 2013

(Thousand persons, trillion won)

Classification	Automobile & Auto parts	Petroleum Product	Semiconductor	Machinery	Petroleum & Chemical
Exports	74.7	52.8	57.1	46.4	48.4
Share of Total Exports (%)	13.4	9.4	10.2	8.3	8.7

Source: Korea Automobile Manufacturers Association (2014)

The emergence and diffusion of EVs is expected to create new value for both upstream and downstream strategic activities along the value chain and enable the implementation of a differentiation strategy in which products and service are integrated. With more than $1 billion sales profit and more than 10 million employees, the auto vehicle manufacturing section is one of the largest manufacturing industry in the world. Furthermore, the automotive industry is related to traditional industries, such as steel, machinery, and materials, as well as new industries, such as information technology, biotechnology, energy technology, and environmental technology (Kim & Kee, 2004).

2.4. Another Major Factor in the Diffusion of EVs

The main plan for the diffusion of EVs excludes several of the practical factors that consumers consider when purchasing vehicles. To increase EV diffusion, consumers' purchasing patterns for traditional IC vehicles should be understood first. Prior beliefs about a product can affect consumers' judgments of WOM information on it (Feng, 2016). Consumers want to acquire various types of information about high-involvement products—products that are expensive and that carry high risk, like automobiles—so that they can carefully consider whether to purchase. A purchase decision involves risk when the outcome is uncertain and possibly undesirable (Kim, 2016). In fact, consumers actively research the product in an effort to reduce risk. Less information is available for EVs than for traditional IC vehicles; therefore, buyers have difficulty evaluating the risk and deciding whether to purchase despite the high price. Given these circumstances, a new marketing strategy—and an operational strategy in support of it—is required.

<Table 5> Factors Influencing Consumer Purchasing Behavior for EVs

Author(s)	Factor
Cheron & Zins (1997)	Economy, fair price of parts, reliability, durability, power, road handling, comfort, safety, mechanical breakdown
Gallagher & Muehlegger (2011)	Government incentives (tax incentives), preferences for environmentalism, changes in gasoline prices
Graham-Rowe et al. (2012)	Cost minimization, vehicle confidence, vehicle adaptation demands, environmental beliefs, impression management, perception of EVs
Jensen et al. (2013)	Environmental attitude, carbon emissions, purchase price, driving range, top speed, fuel costs, battery life, battery stations, charging
Klockner (2014)	Personal norms, awareness of need, attitudes, intentions, responsibility, perceived behavioral control, knowledge, planning ability
Peters & Dutschke (2014)	Social norm, observability, relative advantages, ease of use, compatibility, trialability

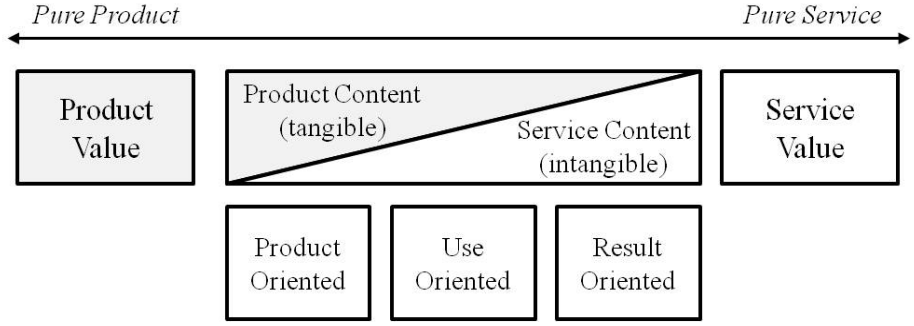
The factors influencing purchasing behavior for alternative fuel vehicles from previous studies are summarized in <Table 5>. Some factors are psychological, such as the negative perception of EVs and environmental concerns, whereas other concern points include factors which are related to actual situation, such as gasoline prices changes and tax reduction. However, few research has been studied about the perception on the consumer acceptance of EV or on the interrelationships among them. The most important barriers for EV adoption were driving distance, charging time, charging convenience, purchasing cost, operating cost, residual value, battery replacement cost, recycling cost, and auto insurance cost (Lai et al., 2015). Government policies aimed at encouraging EV diffusion do not consider residual value, battery replacement cost, or recycling cost. Popularizing EVs requires new plans that consider all of the major factors important to consumers.

3. A Proposal for the Servitization of the EV Market

3.1. Servitization of EV Manufacturers

To encourage EV diffusion, automobile manufacturers must servitize. Automotive industry service—mostly in Europe and the United States—is focused on building new value for the company's development. Previous studies (Baines et al., 2009; Baines et al., 2010) have emphasized the sustainability of the product–service system.

Servitization is a staged transition from a manufacturing company that sells a product to a service company that offers a product–service bundle in which the service component is comprehensive, including education, information, remote support, and troubleshooting for self-service as well as more traditional service (Wiesner, Peruzzini, Doumeingts, & Thoben, 2013). As servitization progresses, the service component of the bundle—which was previously considered simply a means of facilitating product sales—gradually becomes the core offering and driver of the company's profits. The product–service bundling approach expands the concept of profit creation from the traditional manufacturing sector to the service sector, providing new value for both consumers and companies (Morelli, 2006).



Source: Tukker (2004)

<Figure 1> Product–Service Bundling Approach

<Table 6> Product–Service Bundles in the EV Market

	Contents	Examples
Product-oriented Service	Vehicle service	Product maintenance, assurance, and vehicle financing (Europe)
	Education and consulting related to the vehicle	Information about fuel efficiency and energy efficiency and driver education regarding how to achieve high fuel efficiency
Product-use -oriented Service	Vehicle lease	Athlon Car Lease International, Alphabet International, and LeasePlan
	Vehicle sharing	Swiss Mobility, ICS Italy, European Car Sharing (ECS), Greenwheels, SnappCar, AlphaCity (owned by BMW), Zipcar (owned by Avis), car2Go (owned by Daimler), Europcar, Ford2Go (owned by Ford), DriveNow (owned by BMW and Sixt), Hertz On Demand (owned by Hertz)
	Vehicle pooling	Meerijden, Uber, BlaBlaCar, Carpooling.com (acquired by BlaBlaCar in 2015), Toogethr, RoadSharing, wheelsforall, Wundercar
Product-output-oriented Service	Mobility management and outsourcing	Fleet management and vehicle transportation
	Vehicle rental based on distance traveled	Autoplus and Travelcard
	Vehicle rental based on function	Deutsche Bahn (DB) in Germany, NS (bicycle, train, and taxi) in the Netherlands, and Mobility Mixx in the Netherlands

Source: Tukker (2004)

The product–service bundle concept in the automotive industry has greatly evolved. Recent servitization has incorporated customer satisfaction at each point of contact, thereby focusing on coordinating the product and the service, in contrast to the traditional automotive industry view in which the contact between customers and the company exists only at the points of sale, possession, use, and disposal (Williams, 2007).

However, as the automotive industry transitions from IC vehicles to EVs, the extent of servitization will expand, and the share of profit created by servitization will increase, not only for automotive manufacturers but also for the entire automotive industry. As the EV market expands, the concept of a vehicle is very likely to become one of paying a price for its use rather than buying or selling a physical product. In other words, use rather than possession will be spotlighted. If this happens, production and consumption patterns will change dramatically (Baines et al., 2009). Consumers will be able to borrow a vehicle rather than purchase it. Based on Tukker (2004) and Williams (2007), the author classified the degree of servitization in the EV market as product–oriented service, product-use-oriented service, and product-output-oriented service (see <Table 6>).

The integration between vehicle and service is ongoing in various fields, as shown above, and the establishment of a servitization strategy that integrates the EV and service products will be required in order to diffuse EV use.

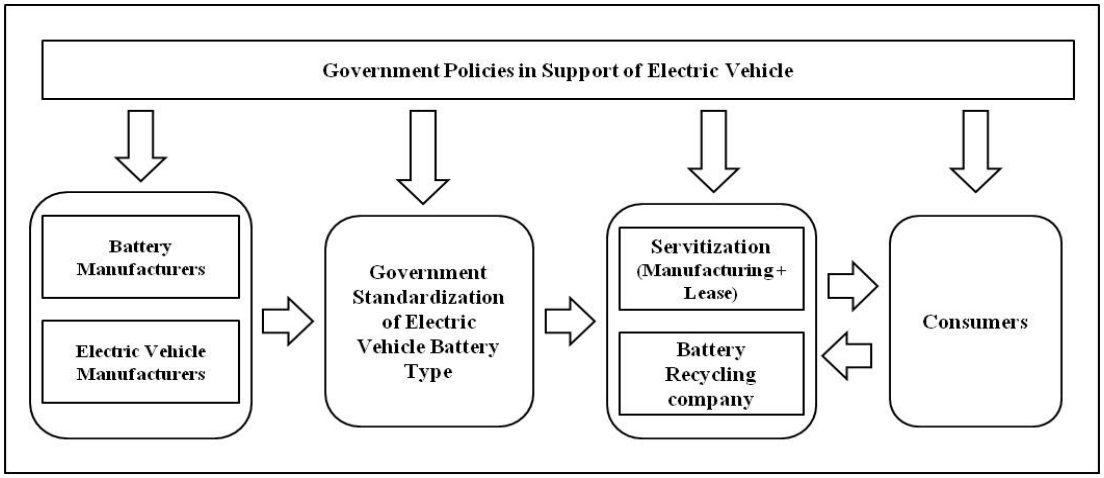
3.2. Servitization via a Battery-Leasing Strategy

Electric vehicles are expected to be cheaper than IC vehicles if the price of the battery is excluded because EVs have approximately 60% more components than IC vehicles do, and the EV structure is very simple. However, when the expensive battery is included, an EV costs much more than an IC vehicle does; furthermore, an EV is less convenient and has a shorter driving range. Therefore, a consumer who is deciding whether to purchase an EV may not perceive any advantages relative to an IC vehicle. Battery life and purchase price will be barriers to the diffusion of EVs even as the costs decrease due to the continuous development of battery technology. Given these circumstances and in order to ease the battery cost burden for buyers of EVs, Ministry of Trade in South Korea government, Industry and Energy started a battery-leasing business in July 2015. The business model consists of consumers paying the vehicle price, excluding the battery, and then making monthly payments based on fuel savings. Recently, South Korean government chose a private company, Begins Company, with which to test a battery-leasing business in Jeju Island.

3.3. A Servitization Strategy for the Diffusion of EVs

There are several limitations impeding governments from leading EV leasing businesses. A battery-leasing strategy will not be effective if only a couple of businesses participate, as a standard battery type does not yet exist. A clearinghouse method, rather than competition among individual companies, could pose another purchasing barrier to consumers.

South Korea's domestic EV battery market is dominated by three large companies (Samsung SDI, LG Chemical, and SK Innovation), and each of them has different battery type. Without the standardization of battery type and assembly method across battery manufacturers, the battery-leasing business will struggle. To lower purchasing barriers, EV manufacturers and EV battery manufacturers should lead the battery-leasing market.



Source: Author's own work

<Figure 2> A Framework for a Servitization Strategy for EV Diffusion

Therefore, this study proposes a battery-leasing strategy for the diffusion of EVs. In this process, the role of governments is as follows. First, governments should establish a policy of tax support for EV manufacturers and battery manufacturers. Second, they should establish battery standards for the expansion of a battery lease system. Third, they should support the battery lease business, focused on EV manufacturers and establish a policy of nurturing battery reuse firms. Finally, they should establish a diffusion policy for EV buyers. An integrated policy and service strategy of the kind suggested above is required. However, such a strategy is difficult to execute unless new battery-leasing companies emerge under the leadership of EV manufacturers and battery manufacturers. Unless a battery standard is proposed and agreed to by EV manufacturers and battery manufacturers, any other approach to battery leasing will lead to unnecessary costs. Therefore, government policy in support of EV diffusion should follow the framework shown in <Figure 2>.

4. Conclusion

4.1. Summary

This study proposes a framework for a service innovation strategy intended to address the emergence of EVs, a disruptive innovation. Diffusing EVs requires the expansion of infrastructure and government grants as well as a new service innovation strategy for reducing obstacles to EV purchases. This paper suggested a battery lease system and a framework for service innovation to foster the rapid diffusion of EVs. First, the author observed the necessity of a partitioned price system to enable consumers to enjoy the relative advantage of initial purchasing costs in contrast to IC automobiles. This can reduce the financial burden by officially separating the price of the car from that of the battery. Second, the new service strategy should focus on reducing the switching cost. Consumers may be reluctant to purchase EVs because of the uncertainties concerning battery life and the underdeveloped used EV market. Third, the author suggested a battery lease system that would reduce cost factors and motivate switching to EVs from IC automobiles. This suggested framework could help foster EV diffusion.

4.2. Discussion

This study suggests the following framework for service innovation strategies to facilitate the diffusion of EVs. First, the current EV market is suitable only for high-end consumers. From a consumer perspective, BEVs have disadvantages in terms of driving range and maximum speed relative to IC vehicles. Thus, EVs do not meet IC vehicle performance standards, and their purchase prices are higher than are those of IC vehicles. In addition, consumers are not attracted to EVs due to purchase and use barriers. The used EV market is also immature; therefore, consumers have difficulties evaluating the probable residual value of EVs. The value of an EV decreases sharply after purchase due to the high cost of battery replacement. Second, to enhance the diffusion of EVs, consumer purchasing patterns for traditional IC vehicles must be understood. Deciding whether to purchase an EV is difficult not only because EVs cost more than IC vehicles but also because the relative lack of product information makes evaluating the risks associated with the EV difficult. A new marketing strategy, one different from that used for IC vehicles—and an operational strategy in support of that marketing strategy are required. Third, the lack of a battery standard poses

limitations to the servitization of the EV market. Private enterprises can hardly set battery standards autonomously. Therefore, EV diffusion via such a battery-leasing strategy will not happen smoothly unless EV manufacturing companies and battery manufacturing companies work together to establish a battery standard. Finally, government policy should consider all of the factors that are important to consumers. Specifically, governments must support the major groups of players in the market as well as battery standardization.

This study contributes to the research both theoretically and practically by promoting an understanding of EV technology through a description of the barriers to and facilitators of the diffusion of EVs. Furthermore, it gives a new perspective on the proliferation of EVs. Following a servitization strategy for integrating a new service (battery leasing) that eliminates purchasing barriers can create value and contribute to EV diffusion.

4.3. Limitations and Future Research

The limitation of this study is its lack of empirical analysis of the causal relationship between acceptance attitude and the major determinants preventing EV diffusion. It also lacks an in-depth study of the expected effects of a servitization strategy on EV diffusion and related considerations. Future studies should empirically examine the determinants of EV diffusion and the causal relationship between them and consumers' acceptance attitudes.

References

Baines, T. S., Lightfoot, H., Benedettini, O., Whitney, D., & Kay, J. M. (2010). The adoption of servitization strategies by UK based manufacturers. *Journal of Engineering Manufacture*, 224(5), 815–829.

Baines, T. S., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E., & Swink, M. (2009). Towards an operations strategy for product-centric servitization. *International Journal of Operations and Production Management*, 29(5), 494–519.

Barkenbus, J. (2009). Our electric automotive future: Co2 savings through a disruptive technology. *Policy and Society*, 27(4), 399–410.

Chan, C. C. (2002). The state of the art of electric and hybrid vehicles. *Proceedings of The IEEE*, 90(2), 247–275.

Cheron, E., & Zins, M. (1997). Electric vehicle purchasing intentions: The concern over battery charge duration. *Transportation Research Part A: Policy and Practice*, 31(3), 235–243.

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy*, 48, 717–729.

Feng, Z. (2016). The effect of the products` review on consumers' response. *International Journal of Industrial Distribution & Business*, 7(2), 13–20.

Gallagher, K. S., & Muehlegger, E. (2011). Giving green to get green? Incentives and consumer adoption of hybrid vehicle technology. *Journal of Environmental Economics and Management*, 61(1), 1–15.

Humphrey, J., & Memedovic, O. (2003). The global automotive industry value chain: What prospects for upgrading by developing countries. *United Nations Industrial Development Organization*, 1–62.

Hwang, Sang-Kyu (2009). Reviews on the strategies of recharging infrastructures for promoting electric vehicles. *The Korea Transport Institute*, 2009–15.

Jensen, A. F., Cherchi, E., & Mabit, S. L. (2013). On the stability of preferences and attitudes before and after experiencing an electric vehicle. *Transportation Research Part D: Transport and Environment*, 25, 24–32.

KAMA (2014). Korean automobile industry Annual Report 2014. *Korean Automobile Manufacturers Association*, 4–46.

Kim, Ahn-Ho, & Kee, Sung-Rae (2004). Economic Effects of the Automobile Industry: Focusing on the input-output analysis. *Review of Business & Economics*, 17(4), 1057-1075.

Kim, Eun-Hee (2016). Difference in perceived financial risk according to price discounts and product type of consumers in Korea and Thailand. *International Journal of Industrial Distribution & Business*, 7(2), 25–32.

Klockner, C. A. (2014). The dynamics of purchasing an electric vehicle: A prospective longitudinal study of the decision-making process. *Transportation Research Part F: Traffic Psychology and Behaviour*, 24, 103–116.

Lai, I. K. W., Liu, Y., Sun, X., Zhang, H., & Xu, W.

(2015). Factors influencing the behavioural intention towards full electric vehicles: An empirical study in macau, *Sustainability*, 7(9), 12564-12585.

Malek, J. (2016). Environment of doing business in East Asia: South Korean experience. *International Journal of Industrial Distribution & Business*, 7(1), 19–25.

Morelli, N. (2006). Developing new product service system (PSS): Methodologies and operational tools. *Journal of Cleaner Production*, 14(17), 1495–1501.

Nieuwenhuis, P., & Wells, P. (2003). *The Automotive industry and the environment: A technical, Business and Social Future*. Cambridge, UK: Woodhead.

Peters, A., & Dutschke, E. (2014). How do consumers perceive electric vehicles? A comparison of German consumer groups. *Journal of Environmental Policy and Planning*, 16(3), 359–377.

Sierzchula, W. Bakkerb, S. Maatb, K., & van Weea, B. (2012). The competitive environment of electric vehicles: An analysis of prototype and production models. *Environmental Innovation and Societal Transitions*, 2. 49–65.

Tukker, A. (2004). A. eight types of product-service system: Eight ways to sustainability? Experiences from susProNet. *Business Strategy and the Environment*, 13(4), 246–260.

Wiesner, S., Peruzzini, M., Doumeingts, G., & Thoben, K. D. (2013). Requirements Engineering for servitization in Manufacturing Service Ecosystems (MSEE). In Y. Shimomura, & K. Kimita, *The Philosopher`s Stone for Sustainability* (pp. 291–296), Heidelberg, GM: Springer.

Williams, A. (2007). Product service systems in the automobile industry: Contribution to system innovation? *Journal of Cleaner Production*, 15(11). 1903–1103.