2022-1289 IJOI
https://www.ijoi-online.org/

International Journal of Organizational Innovation

RESEARCH ON THE DEVELOPMENT OF ELECTRIC VEHICLES IN TAIWAN: TAKE NORWAY FOR EXAMPLE

Wu Hsun Yang*, Department of Industrial Management,
I-Shou University, Taiwan
*Corresponding Author: a8999933@gmail.com

Hsiang Chin Hung, I-Shou University, Taiwan (ROC), seanhung@isu.edu.tw

Abstract

In recent years, the environmental awareness of people and governments in various countries has risen, so electric vehicles (EVs) have attracted more and more attention from all walks of life. A great many countries have established phased policy goals for EVs and introduced policies to support the development of EV-related industries. With the introduction of relevant environmental protection policies and measures in many countries, the vehicle industry has gradually transformed. Although Taiwan boasts many competitive advantages in developing the EV industry, it still faces two limitations in terms of market size and development direction. Taiwan's governmental policy goals for EVs are not concrete enough, and the supporting measures are not well-rounded enough, which might impede the development of the EV industry. Consequently, this study presents the current situation of the Norwegian EV market and discusses the development trends and challenges of EVs as a reference for Taiwan.

Keywords: electric vehicle (EV), the vehicle industry, electric vehicle industry policies

Introduction

Bloomberg predicts that EVs will account for 54% of global sales of new lightweight vehicles by 2040. Considering the rapid growth in the number of EVs, and the fact that EVs will occupy charging facilities for a long time when charging at charging stations, intelligent networking functions should also be equipped to enhance the efficiency of charging stations apart from actively establishing charging stations (Chen & You, 2020). In 2009, the Clean Energy Ministerial (CEM) of United Nations has launched an Electric Vehicles Initiative (EVI) which aims to promote the adoption of EVs worldwide. This initiative brings together 10 member countries, including China, the United States, the United Kingdom, Canada, Japan, France, Germany, the Netherlands, Norway, and

Sweden (Yong, et al., 2015). The world is rushing into the era of EVs as climate change and air pollution are both worsening. Norway and the Netherlands, the countries with the fastest implementation of EVs, have announced bans on gasoline and diesel-powered vehicles from 2025. In addition, Germany, Europe's largest automaker, plans to ban the sale of gasoline-powered vehicles from 2030; France and the UK have announced bans on selling gasoline vehicles from 2040. Moreover, the largest auto market (i.e. China) will phase out gasoline and diesel vehicles by 2040. Likewise, the 5th largest auto market (i.e. India) will phase out gasoline-powered vehicles by 2030 (Sperling, 2018).

To achieve the goals established in the Paris Agreement, many countries are committed to promoting the development of the EV industry to reduce greenhouse gas emissions. Driven by the pressures from environmental protection policies, several leading international automakers have also started to promote the development of EVs from the supply side (He & Luo, 2021). Most multinational automakers have clear plans for producing and selling EVs by 2025, and some even set targets for 2030 (Zhao, et al., 2019). Taiwan is in the midst of an industrial transformation that the global vehicle industry is experiencing and has quite many favorable conditions for the development of the EV industry, including the production technology of EVs, a complete supply chain for the vehicle industry, and the dynamic and innovative information and communication industries. In addition, the strategy of promoting electric motorcycles in the Taiwan market also showcases that Taiwanese consumers are highly receptive to new energy vehicles. Nonetheless, there are several factors that are not conducive to the development of Taiwan's EV industry (Wang, 2017), such as the insufficient scale of Taiwan's domestic auto factories, the increasing crowding out effect of imported EVs, the government's policy goals for EVs are not clear, the related measures still have room for improvement, and the construction of EV charging facilities is not yet comprehensive. Because government policies play a crucial role in promoting the penetration of EVs, this study will first analyze the policies and benefits of promoting EVs in several countries, and then consider Taiwan's current industrial development to provide feasible guidance to promote EVs in Taiwan.

Literature Review

Electric vehicles

Back in the 20th century, the internal combustion engine technology was mature and gasoline was widely used, so only battery-loaded equipment like golf carts adopted EVs. Not until the 1990s, the public began to notice the gradual decline of oil reserves. Besides, environmental protection issues have come to the fore, and the mainstream market for global vehicle development shifted to EVs. In Europe, apart from enhancing conventional engines, the development of core technologies also focuses on EVs (Sun, et al., 2019). In the United States, hybrid power (including electric power, biomass energy, and fuel cells) was regarded as the primary driving force of EV development. In Asia, the develop-

ments of EVs are directed by Japan, focusing on the promotion of new energy vehicles powered by pure electricity, hybrid fuel and fuel cells. Regarding market maturity and consumer acceptance, the world has made EVs as the long-term development goal (Zhou, et al., 2015).

EVs can generally be categorized into four types: (1) Battery Electric Vehicles (BEV), (2) Hybrid Electric Vehicles (HEV), (3) Plug-in Hybrid Electric Vehicles (PHEV), and (4) Fuel Cell Electric Vehicles (FCEV).

(1) Battery Electric Vehicles (BEV): The drivetrain of a BEV, or an all-electric vehicle, must be completely powered by the energy stored in the battery pack; therefore, the driving distance of an EV depends on the battery capacity (Zhang, et al., 2020). A typical BEV can travel 100-250 kilometers on a single charge, while a top-of-the-line BEV can travel up to 300-500 kilometers. In addition, driving distance may be affected by driving conditions and style, vehicle configuration, road conditions, weather, battery type and health. Charging an EV without power takes much longer than refueling a conventional internal combustion engine vehicle, and charging time of EVs will depend on charger configuration, infrastructure and charging power levels. The advantages of BEV include simple structure and operation, no greenhouse gas and noise generation, and it is the most environmentally friendly type of EV (Karki, et al., 2020). Even when the BEV is driven at low speeds, its power system still can deliver high torque output. In contrast, internal combustion engine vehicles can only provide greater output torque at higher speeds.

(2) Hybrid Electric Vehicles (HEV): HEVs are powered by an internal combustion engine and an electric powertrain, and the combination of the two comes in various forms (Kebriaei, et al., 2015). HEVs are driven by an electric powertrain when power demand runs low. If the internal combustion engine is turned off completely, it can decrease fuel consumption and thus reduce greenhouse gas emissions. Consequently, HEVs enjoy great advantages in low-speed situations such as stop-and-go and traffic jams in cities. To drive at higher speeds, HEVs will switch to internal combustion engine; moreover, HEVs can have better performance if both powertrains are operating at the same time. As demonstrated by Nazari, et al. (2021), hybrid powertrains can be applied in various ways (such as accelerating cars, providing power when shifting gears, as well as reduce or completely eliminate the turbo lag issue for turbocharged cars), and further Improve car performance. The internal combustion engine drives the generator and charges the power battery. In addition, the electric powertrain system can convert the kinetic energy of vehicles into electricity through regenerative generation when the vehicle is braking. As a result, HEVs primarily leverage an internal combustion engine to drive vehicles, combined with an electric powertrain to increase driving range or improve vehicle performance.

(3) Plug-in Hybrid Electric Vehicles (PHEV): PHEVs were introduced to extend the driving distances of HEVs

(Raghavan & Tal, 2022). Both PHEVs and HEVs adopt internal combustion engines and electric powertrains, and the difference between the two is that the former uses an electric powertrain as the primary power; therefore, PHEVs require larger battery capacity than HEVs. PHEVs are powered by pure electricity most of the time, so they have less carbon emissions than HEVs, consume less fuel and reduce fuel costs. Like HEVs, PHEVs can utilize regenerative power generation to convert kinetic energy into electricity to charge the battery when braking. PHEVs can charge their batteries directly from the grid, but HEVs cannot (Naseri, et al., 2016).

(4) Fuel Cell Electric Vehicles (FCEV): FCEVs are powered by electricity generated through chemical reactions. In this power generation process, two components (hydrogen and oxygen) are required as fuel: hydrogen can be supplied by carrying hydrogen through special high-pressure tanks, and oxygen comes from air extracted from the environment (Shusheng, et al., 2020). The electricity produced by the fuel cell can be supplied to the electric powertrain of the vehicle. Excessive energy generated by fuel cells can be stored in storage devices such as batteries or supercapacitors. This power generation process produces only water, which is expelled out of the vehicle via the exhaust pipe. FCEVs have several major advantages. First of all, FCEVs emit no carbon during operation, thus reducing their carbon footprint more than other EVs. Second, the time required to refill FCEVs with hydrogen is the same as the time required to refuel traditional vehicles. The main technical hurdle for FCEVs is the lack of hydrogen fueling stations, coupled with the high cost of fuel cells, and the safety concerns of leaking flammable hydrogen. If these problems can be solved, FCEVs are bound to become the mainstream of automobiles in the future (Hsieh, 2018).

Automobile Industry

With the advent of the era of Industry 2.0, the automobile industry has a new development direction. Not only has the concept of automobile production line been established, but the production process has also been simplified, and even the original production lines with disorganized division of labor has been clearly planned (Chen & Li, 2016). Subsequently, the era of Industry 3.0 was ushered in. At this time, technology was more advanced, and the development of vehicles was more reliant on computer systems. In addition to combining electronic components and control system units, the calculation of the program also increases the difficulty for engineers' logic design. When the vehicle skids or the tires lose grip, causing the wheels to spin, the sensor signals are sent to the computer. After that, the computer program transmits commands back to the vehicle components as quickly as possible to activate necessary the safety systems such as anti-lock braking system (ABS), traction control system (TCS) or vehicle stability control (VSC), hence ensuring driver safety (Chen & Li, 2016). Similarly, Industry 4.0 in recent years has profoundly affected the development of the vehicle industry. The factors of Industry 4.0 include intelligence, electronics, big data analytics, and the Internet of Things (IoT). Shih et al. (2018) pointed out that the vehicle industry de-

veloped autonomous driving, EVs and shared vehicles under the influence of these factors. The Internet of Vehicles is gradually subverting the existing vehicle industry. Moreover, not only EVs, but also new energy vehicles are the future trends of the vehicle industry (Zhang & Qin, 2018).

The development level of the vehicle industry in each country will affect the formulation of government policies (Wang, 2017). Taking traditional automobile manufacturing countries such as Germany and Japan as examples, the policy directions of new energy vehicles in these countries are very similar, and they all focus on the production dimension. In addition, these policies also take into account batteries, charging stations, infrastructure, battery materials, and EV applications. The development direction of new energy vehicles is not limited to EVs, and self-driving technology is also the focus of development. In contrast, the establishment of related policies in Japan is not as comprehensive as that in Europe and the US. The reason may be that the market size of Japan is relatively small, or as stated in the "Japan's Next-Generation Vehicle Strategy for 2010", its domestic policy-making institutions are scattered and the personnel in charge change rapidly. Thus, the "Strategic Guidelines for International Standardization" are specifically stipulated in Japan's new energy vehicle policy, which shows that Japan pays more attention to cooperating with other automakers or other countries to develop or establish product standards. Although the United States is also a traditional automobile manufacturing country, the overall pressure of environmental policy is relatively small. Besides, EV policies are mainly dominated by state governments. As a result, the distribution of EVs in the United States has also grown rapidly in states that are actively promoting EVs (Ou , et al., 2019).

Electric Vehicle Promotion Policies: Primary Features Of Electric Vehicle Promotion Policies In Various Countries

Policy research on EV-focused countries shows that, in addition to the exact timetable for carbon reduction goals, the most common policy goals with timetables can be grouped into three categories (Xiao, 2017): 1. Prohibit the sale of internal combustion engine vehicles; 2. . Restrict the use of vehicles with internal combustion engines; 3. Promote new energy vehicles. In order to promote the development of the new energy vehicle industry, governments around the world have introduced many measures to increase the penetration rate of EVs. At the policy level, incentive measures are provided to support the R&D and production of new energy vehicles for automakers, including application R&D, cross-border cooperation, and talent training. At the consumption level, preferential measures such as car purchase discounts, consumption tax reduction, and user fee reduction are proposed. Furthermore, it is also proposed to expand the construction of infrastructure such as charging stations, implement measures to prioritize the use of new energy vehicles, and accelerate the popularization of new energy vehicles (Wang & Huang, 2011). EU countries are the most active in implementing EV-related policies. For example, countries such as Norway, the Netherlands, Denmark,

Belgium, Sweden, Israel, Ireland, Iceland, the United Kingdom, and Costa Rica will ban the sale of gasoline-powered vehicles by 2030. Japan, California, Germany and South Korea will stop selling gasoline vehicles by 2035. Canada, Spain, France and other countries will implement relevant policies by 2040 at the latest. Although a timetable has been established, the actual implementation time of each country is still subject to change (Horng, 2020). In addition, some countries will ban the entry of vehicles other than EVs by 2040, with cities as their boundaries, as a supporting experimental measure to promote EVs. These cities include Milan (Italy), London (England), Auckland (New Zealand), Barcelona (Spain), Cape Town (South Africa), Copenhagen (Denmark), Heidelberg (Germany), Los Angeles, Seattle, New York (the US), Vancouver (Canada), Hainan (China), Singapore and Sri Lanka, etc. (Chao, 2018).

The following will summarize the policies of advanced countries (Germany, Norway, the Netherlands, Japan and the United States) that vigorously promote EVs, and the promotion policies of Singapore's new energy vehicles that actively create a self-driving environment. Even though different countries have different considerations for the promotion policies of new energy vehicles, environmental protection policies are usually an important driving force for countries to promote new energy vehicles. Second, as the EV industry or market matures, the coverage of related policies will continue to expand. Nowadays, the establishment of EV supporting environment, regulations and standards has become the focus of development (Dong, 2018). The development of new energy vehicles involves a wide range of dimensions, so most countries have integrated platforms and developed relevant policies, such as Norway's Transportation Energy Authority (Transnova), Germany's Nationale Plattform Elektromobilität or the Netherlands' Action Plan for Electromobility. On the other hand, Ferries are rather common and sometimes the only mean of transportation to a destination in western and northern Norway. Therefore, the Norwegian government also offer discounts on ferry fares. EV drivers do not need to pay for EV tickets, but only for the driver and passengers in the vehicle (Barton & Schütte, 2017).

Empirical Analysis

Norway is currently the most ambitious country to support EV plans, with a complete ban on the sale of gasoline-powered vehicles within five years by 2025. At the end of 2020, over 330,000 battery electric vehicles (BEVs) were registered in Norway, with a market share of 54% (Kapustin & Grushevenko, 2020). The government's zero-carbon emission vehicle policies and incentive measures will continue until the end of 2021, after which the incentive policies will be adjusted on a rolling basis as the market evolves. Norway's tax on vehicles is based on the "polluter pays" principle, with high taxes on high-emission vehicles and low taxes on low-emission vehicles, and the tax collected is used to reward zero-emission vehicles. The Norwegian government has established a goal for new energy vehicles, expecting that by 2025 all new vehicles sold must be electric or hydrogen-powered vehi-

cles with zero emissions. It is through this green tax system, not through mandatory bans, that this can be achieved.

In terms of infrastructure for charging facilities, the Norwegian government launched a project in 2017 to fund the establishment of at least two fast-charging stations every 50 kilometers on all major roads. Today, all major roads in Norway have fast charging stations (Haugneland, et al., 2016). Besides, Norway also has a well-developed charging network. As of January 2021, a total of 330,000 EVs in Norway can be fast-charged at the same time. According to a survey, the majority of Norwegian consumers are willing to pay three times more for fast charging on the road than for home electricity (Hardman, et al., 2018).

The Norwegian government leverages vehicle purchase tax subsidies to encourage people to buy EVs. The popularity of EVs has risen rapidly in Norway in recent years, thanks to the benefits of free charging, free parking and bus-only lanes for driving EVs, coupled with increased punitive taxes on gasoline-powered vehicles. Also, the Norwegian government continues to educate the public about oil as a resource for export rather than use (Norway was the world's 7th largest gasoline producer and the 3rd largest gasoline exporter in 2016), and supports the development of EVs with the advantages of abundant hydropower (Jia & Chen, 2021).

In the 1990s, Norway's EV policy focused on nurturing domestic EV manufacturers. By 2012, the policy focus shifted to effectively increasing the penetration rate of EVs in Norway, with a target of 50,000 EVs on the road by the end of 2018. Norway then launched the "tax reduction and exemption" incentive measures. Both domestic and imported EVs are exempt from value-added tax and excise tax, reducing the purchase cost of EVs by an average of 50%. Businesses can also apply for tax reduction if they are willing to buy EVs as business vehicles. Apart from enjoying tax relief, EV drivers can also drive on exclusive bus lanes to avoid traffic jams during rush hour (Hsieh, 2018). What's more, EV drivers can enjoy a variety of benefits, including free charging, free parking and no tolls (roads and tunnels). Most public parking lots and roadside parking spaces in Norway provide free parking spaces for EVs (marked with white words on a blue background), and are equipped with charging piles for free charging (public charging piles are standard, while some are fast charging stations).

Conclusions and Recommendations

Learning from Norway's experience in expanding the EV market and increasing consumers' willingness to buy EVs, Taiwan can gradually roll out plans to allow EVs to drive on public lanes on specific roads and dedicated parking spaces in cities with heavy traffic (such as Taipei), thereby save EV drivers the time to find a parking space. Additionally, the government can offer incentives

to attract people to buy EVs (such as subsidized purchases or tax reductions), and encourage car rental companies in the vicinity of large cities to provide EV rental services and simplify the rental

process (such as online booking, or pay with EasyCards, etc.), lower barrier to use (such as monthly fee discounts), and encourage the public to drive EVs as commuting tools instead. In terms of medium and long-term planning, the government can think about the following solutions in advance: the continuous increase in the number of EVs will inevitably lead to a decrease in the smoothness of the exclusive lanes for EVs, the number of dedicated parking spaces, the operation model of charging piles, how to maintain sales after the subsidy is withdrawn, etc. Also, because Norway has been educating its people to reduce gasoline use and exports, it has secured a source of funding that can support its EV plans in the long term. Furthermore, the hydropower advantages brought by Norway's natural terrain are also conducive to developing the EV market. As Taiwan continues to promote EVs, it is recommended to obtain funds and power supply plans that can support the EV promotion strategy in a long term.

Regarding the penetration rate of EVs across countries, Norway was the first country to introduce policies related to EVs, which account for more than half of its car market. In contrast, other countries are still in their initial stage. Among them, Taiwan is the country with the slowest development of the EV market (the proportion of registered EVs is less than 0.2%). Taking the number of registered EVs for illustration, Norway has 330,000 EVs, while the number of EVs in the United States, Japan, and South Korea each reaches 100,000. The annual number of newly registered EVs in Taiwan is 7,201. After examining the EV promotion policies of various countries, several key points can be concluded. From an economic viewpoint, increasing the purchase of EVs starts with improving the price competitiveness of EVs. Among the EV incentive policies implemented in several countries discussed in this research, some provide subsidies for EV manufacturers from the supply side, and some policies provide consumers with car purchase subsidies, tax incentives, tax exemptions, and relevant measures from the demand side. Norway, which has the highest penetration of EVs, currently taxes vehicles proportional to their carbon emissions and leverages the taxes on polluting vehicles to offer incentive policies for zero-emission vehicles.

Governments around the world have been investing in the construction of the necessary infrastructure for EVs, including charging stations, charging piles, and smart grids. Besides, various government sectors have also begun to prepare for the changes brought about by the increase in the number of EVs. In the light of this, the European Union has established relevant regulations, requiring real estate operators and construction operators to build infrastructure for EV charging equipment. However, as pointed out in the discussion section of this paper, even in Europe, where EV-related policies are most actively promoted, there are still regional imbalances in infrastructure development, and governments still have considerable room for improvements.

This research aims to actively increase the market share of EVs in Taiwan, create Taiwan's special international status, and attract international auto brands to set up factories and intro-

duce new models in Taiwan. Although Taiwan's car sales are fewer than other countries, it has the potential for rapid growth in the market share of EVs (to clarify, the EV market share is calculated by dividing EV sales by total sales. Therefore, if the total sales volume is small, the market share of EVs will be higher if the same number of EVs is sold). The Taiwan government can further set a goal to become the top 10 country in terms of EV market share. Apart from offering EV rental services around the city, Taiwan's Executive Yuan aims to fully convert public buses to EVs by 2030 and ban the sale of gasoline-powered vehicles by 2040. If Taiwan wants to further develop the EV market, it can also lay a solid foundation by implementing relevant policies (such as the use of electric buses for park vehicles with relatively fixed driving routes, official vehicles, and enterprise vehicles), so the sales of EVs can be increased year by year. This can help Taiwan gain a leading position in the global EV market, thereby attracting major foreign manufacturers to set up factories or introduce new models. Taiwan is not only rich in tourism resources, but also has years of development in the EV industry chain. It has the potential to open up a new chapter with EVs in the vehicle industry.

References

Barton, B., & Schütte, P. (2017). Electric vehicle law and policy: a comparative analysis. *Journal of Energy & Natural Resources Law, 35*(2), 147-170.

Chao, C. Y. (2018). Exploring the purchase intention of electric motorcycle: Based on the UTAUT2 model. Unpublished Master's Thesis. Department of Business Administration, Tung-Hai University (R.O.C.)

Chen, J. S. & Li, H. T. (2016). An overview from industry 1.0 to industry 4.0, *Journal of CAGST, 2016*(4), 53-60

Chen, Y. R., & You, Q. Y. (2020). The development trend of electric vehicles in Europe and the USA, *Taiwan Economic Research Monthly, 43*(4), 36-44.

Dong, R. (2018). The influence of electric scooter user satisfaction on repurchasing intention: The moderation of environmental attitude. Unpublished Master's Thesis. Department of Business Administration, Tunghai University (R.O.C.)

Hardman, S., Jenn, A., Tal, G., Axsen, J., Beard, G., Daina, N., Figenbaum, E., Jakobsson, N., Jochem, P., Kinnear, N., Plötz, P., Pontes, J., Refa, N., Sprei, F., Turrentine, T., & Witkamp, B. (2018). A review of consumer preferences of and interactions with electric vehicle charging infrastructure. *Transportation Research Part D: Transport and Environment, 62*, 508-523.

Haugneland, P., Bu, C., & Hauge, E. (2016). The Norwegian EV success

continues. In EVS29 Symposium, Montreal, Quebec, Canada, 1-9.

He, W. H., & Luo, J. Y. (2021). Environmental policy and sustainable living: Hong Kong from an international perspective. HK: Chung Hwa Book, Co.

Horng, D. C. (2020). EU Development Strategy and Legal Control of Automated Vehicles. *EurAmerica: A Journal of European and American Studies, 50*(2), 349-431

Hsieh, L. L. (2018). Norway electric vehicle market analysis, *Journal of Industrial Mechatronics*, 421, 33-38.

Jia, W., & Chen, T. D. (2021). Are Individuals' stated preferences for electric vehicles (EVs) consistent with real-world EV ownership patterns?. *Transportation Research Part D: Transport and Environment*, 93, 102728. https://doi.org/10.1016/j.trd.2021.102728

Kapustin, N. O., & Grushevenko, D. A. (2020). Long-term electric vehicles outlook and their potential impact on electric grid. *Energy Policy*, 137, 111103. https://doi.org/10.1016/j.enpol.2019.111103

Karki, A., Phuyal, S., Tuladhar, D., Basnet, S., & Shrestha, B. P. (2020). Status of pure electric vehicle power train technology and future prospects. *Applied System Innovation, 3*(3), 35.

Kebriaei, M., Niasar, A. H., & Asaei, B. (2015). Hybrid electric vehicles: An overview. In *2015 International Conference on Connected Vehicles and Expo* (ICCVE) (pp. 299-305). IEEE.

Naseri, F., Farjah, E., & Ghanbari, T. (2016). An efficient regenerative braking system based on battery/supercapacitor for electric, hybrid, and plug-in hybrid electric vehicles with BLDC motor. *IEEE Transactions on Vehicular Technology, 66*(5), 3724-3738.

Nazari, S., Siegel, J., & Stefanopoulou, A. (2021). Control of hybrid boosting in highly diluted internal combustion engines. *International Journal of Engine Research, 22*(6), 1794-1807.

Ou, S., Hao, X., Lin, Z., Wang, H., Bouchard, J., He, X., Przesmitzki, S., Wu, Z., Zheng, J., Lv, R., Qi, L. & LaClair, T. J. (2019). Light-duty plug-in electric vehicles in China: An overview on the market and its comparisons to the United States. Renewable and Sustainable Energy Reviews, 112, 747-761.

Raghavan, S. S., & Tal, G. (2022). Plug-in hybrid electric vehicle observed utility factor: why the observed electrification performance differ from expectations. *International Journal of Sustainable Transportation, 16*(2), 105-136.

Risk Society and Policy Research Center. Comparison of electric vehicle policies in various countries. Retrieved from https://csr.cw.com.tw/article/42336 (Sep 8, 2021)

Shih, Y. C., Chi, C. F., Lin, R. F., & Lin, R. T. (2018). Past highlights and future of human factors and design thinking in Taiwan. *Journal of Management & Systems, 25* (3), 321-365.

Shusheng, X., Qiujie, S., Baosheng, G., Encong, Z., & Zhankuan, W. (2020). Research and development of on-board hydrogen-producing fuel cell vehicles. *International Journal of Hydrogen Energy, 45*(35), 17844-17857. DOI: 10.1016/ j.ijhydene.2020.04.236

Sperling, D. (2018). Electric vehicles: Approaching the tipping point, *Bulletin of the Atomic Scientists, 74*(1), 11-18.

Sun, X., Li, Z., Wang, X., & Li, C. (2019). Technology development of electric vehicles: A review. *Energies, 13*(1), 90.

Wang, P. T. (2017), Comparative Study between Taiwan and Korea Automobile Industry Policy. Unpublished Master's Thesis. Institute of Political Science, National Sun Yat-sen University.

Wang, R. Z., & Huang, Y. C. (2011). Energy education: International perspectives. Taipei: Higher Education Publishing Co., Ltd.

Xiao, X. H., Zhou, S. Q., & Huang, S. L. (Eds.) (2017). Urban climate issues and governance in Taiwan (National Taiwan University Press), 1-528.

Yong, J. Y., Ramachandaramurthy, V. K., Tan, K. M., & Mithulananthan, N. (2015). A review on the state-of-the-art technologies of electric vehicle, its impacts and prospects. *Renewable and Sustainable Energy Reviews*, 49, 365-385.

Zhang, L., & Qin, Q. (2018). China's new energy vehicle policies: Evolution, comparison and recommendation. *Transportation Research Part A: Policy and Practice*, 110, 57-72.

Zhang, Q., Wang, L., Li, G., & Liu, Y. (2020). A real-time energy management control strategy for battery and supercapacitor hybrid energy storage systems of pure electric vehicles. *Journal of Energy Storage, 31*, 101721.

Zhao, F., Chen, K., Hao, H., Wang, S., & Liu, Z. (2019). Technology development for electric vehicles under new energy vehicle credit regulation in China: scenarios through 2030. *Clean Technologies and Environmental Policy, 21*(2), 275-289.

Zhou, Y., Wang, M., Hao, H., Johnson, L., & Wang, H. (2015). Plug-in electric vehicle market penetration and incentives: a global review. *Mitigation and Adaptation Strategies for Global Change, 20*(5), 777-795