

Promoting the Wider use of Electrical Vehicles in Hong Kong: A Strategic Proposal

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Abstract—This paper sets to point out that pure technological advancement is not enough for innovation with a significant impact to the society. Good technology has to be commercialized and transformed into useful, useable, and desirable products or services, and formulated into a viable business models, or else it could never be widely adopted by the public. Studies indicate that most successful product innovation cases integrated technological feasibility with human desirability and business viability, and the critical tool to integrate the three essential factors is *Design*. To demonstrate this argument, this paper seeks to employ this methodological framework to design for Hong Kong a rental and sharing service integrating appropriate EV technologies with customer-focused understandings and a feasible business model. The strategic proposal focuses on utilizing electric vehicles shared by the growing population of HongKong-Shenzhen cross-border travelers, aiming to formulate a successful prototype-showcase for the Hong Kong government and the public on how to promote the wider use of electric vehicles in future.

Keywords—Strategic design, transport design, innovation, electric vehicles, car rental service.

I. INTRODUCTION: THE SMART CASE

“We are at a turning point in the history of the automobile industry... This worldwide economic recession will come to an end, but we cannot go back to business-as-usual. We are reinventing our industries with a new commitment to the environment.” said Shinjin Kowase, President & CEO Mitsubishi Canada Ltd. when he was introducing the company’s i MiEV to British Columbia, Canada, on 6 April 2009. [1] Obviously Mitsubishi is not the only company who thinks that way — Since the beginning of the year, a new green vehicle is introduced almost everyday, either hybrid or electric, hydrogen-fuel-cell or hydrogen internal combustion engine, from the Zero electric motorbike [2] to the full-sized Tesla S [3]. Yet it has to be seen if these mostly concept models will be able to excel in the market.

New technological innovation and design does not automatically result in business success. The globally well-known Smart, a brand of Daimler, took over a decade to take shape. The project was first initiated by the Swiss watch manufacturer, Swatch, whose vision was to develop a car which is easy to park and short enough to be parked “nose-in”, allowing two or three Smart Cars to be parked in a parking space which normally fits one vehicle only. Although a wildly successful watch brand in the 90s, Swatch was inexperienced in the automotive field. They searched for suitable partners to proceed with their development, such as General Motors and Volkswagen.

Unfortunately, General Motors did not think it could be profitable and rejected them. Volkswagen initially accepted the project, but due to Volkswagen’s financial problem at the time, the project never reached the final stage. Swatch then took the project to Daimler-Benz to establish a new joint venture with them in 1994 and a purpose-built factory was set up in France.

The final car design was not up to the expectations from Swatch, because the eco-engine technology anticipated by Swatch was more expensive than a 4- or 5-seater sold in Europe. The joint venture has led to heavy loss and Swatch decided to pull out.

The car design was then forced to be tuned down so that it could be more affordable. It was finally launched in 1998, called the Smart City-Coupé (later renamed as Smart ForTwo in 2004). The company went on to develop and launched the Smart Roadster and Smart ForFour in 2003 and 2004 respectively. Unfortunately, due to the low sales volume, Smart GmbH was liquidated, and recorded a lost of nearly €4 billion between 2004 and 2006. Its operations were then absorbed by Mercedes-Benz Automobile Group and it now became a brand under the Mercedes-Benz automobile group called Smart. [4]

II. INNOVATION: MORE THAN TECHNOLOGY

It has been realized that investing just in scientific and technological R&D, acquiring more patents generated from it, do not automatically bring much sustainable economic benefits. Since 2005, Booz Allen Hamilton (BAH), a strategy and technology consulting firm, has been conducting studies on the relation between R&D spendings and corporate performance in innovation with the world’s 1,000 largest corporate R&D spenders. The studies brought insights that despite the substantial spendings, only 10% of those companies are “high-leverage” innovators, and patents generally do not drive profits. [5] Not until these technologies become affordable, and through design transformed through a properly-managed innovation value chain into usable, useful and desirable products / services, they are still investment rather than revenue. This phenomenon is also valid in the green automobile category: Bio-fuels, clean diesels, natural gas, fuel cells, and various hybrid technologies are playing greater roles today than ever. Yet although these green vehicles “have been around for years, but almost always as one-off utopian designs or experimental models that were designed mainly to attract good green press.” Today EVs may look most promising in the race for sustainable mobility, they “remain costly, and even the

best batteries still don't offer the same range as a full tank of gasoline." Toyota Prius, probably the most popular green car in the world to date, took almost a decade to become business-viable and profit-making, while GM "still have years of bleeding red ink ahead of them." [6] The Tesla Roadsters, the world's fastest EV though, went through loads of redesigns, still has bugs and costs more than planned. [7] Today, virtually every car company in the world is ramping up intriguing green-car projects, but the winner which can make a real difference will not be in technology, but whether it can build a EV eco-system to facilitate that technology, a business model that provides offerings desirable for the users and viable for the investors. Innovation driven not by a focus on what the customer is willing to pay for but on solving a technical or engineering problem will be doomed for success. This sets out the need to understand below on how successful innovation could be achieved:

III. THE 3 PILLARS OF INNOVATION

1. *Technological feasibility*

Technology has no doubt played an extremely crucial role in enabling innovation since the Industrial Revolution. Since then human history saw an accelerating pace of production and consumption, and has no sign of slowing down or saturation. On the contrary, technology will become even more important with the entry to the knowledge-based economy and ahead. However, technology should not be taken as the final aim for innovation. Cagan and Vogel (2002) argued that successful new products and services were often created by identifying an emerging trend in people's lifestyle, and that trend was matched with the right technology (p. 11) — technology which is not especially advanced like rocket science, and sometimes it could be just some existing or matured technology that became affordable, or forgotten technology revived to be applied appropriately. The Apple Newton was a pioneering PDA with many of its technologies found in PDAs and smart phones today, but its cost and size proved its appeal was beyond mass affordability and desirability. When new technology became available, the window of producing successful new products and services is often small. Even there are products created based on it, in most cases it would be too early. Successful technology-driven products are usually found only in professional and military applications where style and ergonomics are not as important from a competitive standpoint. They require a skilled user who is willing to overlook the ease of use for performance (p. 44). [8] Technology is well-worth the value to consumers only when it is appropriated and articulated in a user-friendly manner. This gives insights on why and how it could be done when the HK government intended to investigate on the feasibility and promote the wider use of EVs in HK. [9]

2. *Human desirability*

BAH's 2007 report started like this: "How do companies innovate successfully? They can spend the most money, hire the best engineers, develop the best technology, and conduct the best market research. But unless their research

and development efforts are driven by a thorough

understanding of what their customers want, their performance may well fall short." [10] Genuinely valuable innovation is generated through understanding, engagement, and participation of direct customers coming together with some kind of a technology improvement. BAH's vice president Alexander Kandybin commented that "[i]f a company's engineers don't understand the market from the standpoint of consumer needs, they are usually much less successful at creating markets, even if they have good technology." In their survey conducted in Oct 2004, nearly half of the responded European senior executives (mostly CEOs, chief technology officers, and vice-presidents of engineering and product development) "said they were dissatisfied with their company's innovation performance... And they weren't unclear about how to solve the problem: Out of a list of 12 potential steps their companies could take to improve their innovation practices, executives ranked understanding their customers better as the most important step to increase the value of innovation created in the product development process.

"So why haven't they done it already? Institutional barriers are perhaps the biggest reason. Often engineers are tucked away so far within a company that they don't see firsthand what customers really need... [E]ngineers often become so focused on solving technical problems that they overlook the ways in which the customer actually defines value.

"George Day, a professor of marketing at [The] Wharton [School of the University of Pennsylvania], also sees this overconcentration on technology as one of the most common sources of trouble. "... strongly engineering-driven companies that don't really appreciate the emotional attachment people have to products or their emotional reactions to them, and think it's all about very specific product attributes," he says. [11] BAH's 2007 report continued to reflect that companies that get the greatest return from their R&D investment attributed much of their success to their focus on customer insight throughout the innovation process. [10]

3. *Business viability*

As said earlier, mass adoption of EV is still not popular today since it involves a lot of investment not only in R&D for the car manufacturers, but also in infrastructure for electricity supply and building public charging stations, etc. by the electricity provider and the government. The HK government did reveal the intention to promote the wider of EVs jointly with the manufacturers. With all stakeholders having their own agenda and concerns in terms of investment and return, one needs the wisdom and skill to align the needs, expectations and strengths of all. Not until a business model that fulfils this need is designed, one can hardly see the wide adoption of EVs in HK in the near future.

In pursuit of a feasible business model integrating appropriate technology and customer desirability, the notion of "design" has to be revisited.

III. DESIGN: THE PATH TO INNOVATION

Traditionally, ‘design’ is placed in the same category of ‘art’, and is considered as a means for cosmetic improvement. Both the design community and the public in HK need to re-consider ‘design’ as a strategic and critical tool in creating and adding value when applied in the business context. In fact, it is getting more prevalent that international discourse related to ‘design’ is seeing it as a professional business activity, encompassing discipline, skill and knowledge in a manner similar to engineering, accountancy or any other crucial discipline in industrial and commercial life. [12] Using design and design thinking applied top-down from corporate management to the operation level in a company or government, one can explore innovation not just on product and service features and offerings, but across the whole spectrum of business activity, covering finance (business model, networks and alliances), process (enabling process, core processes), offerings (product performance, product system, service), and delivery (channel, brand, and customer experience). [13] The more design is injected into innovation, the higher the impact and its value.

Strategic design, while mostly unaware of its potential in HK, is the pathway to realize innovation not just by designing new products and services to cater existing market needs in currently identifiable ways, but also new business models endeavouring to create unexplored and new markets [14] through user and lifestyle research and identification of emerging trends [15]. It seeks to integrate insights, ideas, and interests among engineers, marketing experts and end-users right at the start of the innovation process. The pioneering MyCar case, which caught much press attention since the announcement of the government intention to promote EVs, reflected how design reinvented the notion of “Made in China” from low-end copycat products into authentic and desirable brand name. MyCar, a strategic design-driven project which aligned the strengths of Italian car design, the advantage of low production cost in HK and China, as well as the convenience of capital raising in HK, realized a viable business model for HK to ignite its automobile market, as well as creating new opportunity for its auto parts industry. Cars made in China never play an important role in the global car market, but through design, MyCar gives a completely new perception that a China-made car could also be desirable. [16]

When design is understood as such and applied as a way of thinking utilized at the conceptual and management level, one can adopt this approach to design for HK a model for promoting the wider use of EVs. Important characteristics of this approach is that it will (1) focus on the end users; (2) explore by brainstorming and creating alternatives; (3) build prototype to evaluate possible ideas; (4) seek to solve complex problems, including those mentioned earlier: technical feasibility, human desirability, business viability, as well as aligning the needs of all stakeholders.

To demonstrate the approach, the followings layout the concerns, process, and details on how the policy makers can start out to promote the wider use of EVs in HK.

IV. DESIGNING AN EV PLATFORM FOR HK

In order to study the possibilities of implementing EVs in HK, the following concerns need to be addressed:

1. *Appropriate policy*

Government policy is important in promoting the growth of EVs greatly if it is set appropriately and have the other stakeholders in the industry motivated and encouraged. In February 2009 the Financial Secretary of HK proposed “to extend the exemption for electric vehicles from First Registration Tax... for a further five years instead of three years as in the past.” [9] In addition to it, researching for government policies on EVs in other countries is necessary. By comparing all these policies, optimized recommendations can be given to the HK government on their approach to the next automotive technologies, including the changes in the existing laws and how to encourage the purchase of EVs in HK.

2. *Appropriate technology*

Today hybrids and EVs are no longer niche vehicles. Although it looks like that plug-in EVs are around the corner, batteries are not keeping up, they “remain the biggest challenge to getting these cars on the road in big numbers. Even the latest lithium-ion batteries need six to eight hours to charge and typically offer a range of 100 miles or so. They’re also frightfully expensive” [17]. So both the heat and price issues are still waiting to be resolved and need to be understood, especially when HK manufacturers are also interested in developing their own EVs.

As the performance of EV systems and/or technologies will be affected greatly by the weather conditions, they have to be analyzed and the most suitable ones for the HK environment need to be identified.

User research in relation to the technology is also important. Whether EVs will be welcomed by HK people and the possibilities of owning one will determine whether the implementation of EVs in HK will be successful or not. The average driving range in which people will drive everyday (in order to set the basic requirements for battery capacity), ways of people prefer to charge their cars, equipments they would like to have in their car, and also how much they would pay and could afford for an EV, etc., all are the areas which could not be ignored.

3. *Infrastructure with a long-term significance*

For a feasible EV platform, an infrastructure of charge stations, rather than long-lasting batteries, is the key to the success for the wider usage of EV in HK. The Financial Secretary recognized that “[r]echarging facilities are crucial for the wider use of electric vehicles.” [9] But to build a sustainable EV platform, one needs a long-term vision of this infrastructure and how it could enhance the adoption of EVs: Former president at software giant SAP, Shai Agassi’s new venture Better Place “envisions the

[electric] vehicle as a node on a network. Smart charge stations would replace today's gas stations.... "If there weren't gas stations everywhere, you won't buy a [gasoline] car," says Agassi." [18] In an interview with Newsweek, Agassi expressed that they "put the infrastructure ahead of the cars. In our case, the infrastructure is a combination of a massive amount of charge spots and the ability to switch batteries in less time than it takes you to fill up with gasoline." [19]

Because infrastructure is always a long term investment, the EV infrastructures and systems being planned and under construction in different countries around the world will need to be understood. By comparing their infrastructures and systems we can evaluate which type of infrastructures and systems or collaboration of systems are most suitable for the situation in HK. It is a pity that there are not many existing cases in the world today that HK can make reference to on the use of EVs. HK is actually one of the cities which show intention of early adoption. In addition, given HK is already a highly dense city where one can hardly renovate entirely the infrastructure (like adding charging stations between parking meters), optional approaches include identifying possible test zones (e.g. small districts like Discovery Bay, golf resorts, HK Science Park, The HK Disneyland, Ocean Park, etc.) or isolate certain usage in the city so that one will know how it performs in a real-HK scenario. The strategic proposal put forward below is based on the latter approach. It is logical to use this pilot smaller-scale implementation of EVs for the policy makers to evaluate all these issues, a prototype to test mass market reception.

V. CROSS-BORDER EV RENTAL & SHARING SERVICE

To promote the wider use of EVs in HK, the followings is a strategic proposal on a cross-border EV rental and sharing (R&S) service based on the innovation principles explained earlier, sketching out a model which fits into the mega-trends described below. [see ACKNOWLEDGEMENT at the end of this essay]

This idea not only conforms to the government's intention to promote the wider use of EVs, but also seeks to offer customers a service that can attain convenience, green lifestyle and cost-effectiveness. It could be said as a blue ocean strategic concept filling the market vacuum at this stage since there is no competitor who is trying to offer a similar service.

1. The right moment for implementation

The following current situations and trends make it the ideal timing for the introduction of cross-border EV R&S service:

1.1. A bigger Hong Kong

HK and the PRD are getting closer, not geographically but in terms of human interactions and activities due to improved transportation infrastructures and hence reduced travel time. The recently announced *Outline of the Plan for the Reform and Development of the PRD (2008–2020)* (《珠三角發展規劃綱要(2008–2020)》, [20]) set the

Chinese government's tone and determination to integrate HK and the PRD into a "1-hour living sphere (一小時生活圈)" [21] and even the inevitable merge of HK and Shenzhen (SZ) into a metropolis despite the two cities are running under "One Country, Two Systems". Yet it cannot be denied that although Hong Kong people can travel freely to China, we do not travel in a fashion like those living in metropolises like London and New York, where people have much greater and easier mobility by travelling with just one car between destinations as far as from London to Paris and even throughout Europe, needless to interchange for trains, coaches or underground transit for inter-city or even international trips. Although the long-delayed HK-Zhuhai-Macau Bridge is now confirmed to start building within 12 months, but the earliest time of completion would be 2016, or the HK-SZ-GZ Express Rail Link will not come to HK earlier than 2013, HK people still need a feasible solution which could immediately improve their cross-border travel experience in the region, with the frequency keeps growing [22]. With consumers are becoming more empowered and sophisticated, their wants and needs keep on evolving, and basic mass transportation means no longer meet their expectations, the government's determination to promote the wider use of EVs thus provide an immediately stimulus to make this proposal especially suitable to provide the consumers a more comprehensive mobility experience.

1.2. People just like to drive... their own car

Although HK has very well established public transport infrastructure and system, the number of private cars still keeps growing and is giving the government headaches in solving the congestion and pollution problems. By talking to many private car owners in HK, although most of them only drive their cars during weekends and park them in weekdays, they still think the 2-day driving experience gives them much pleasure and relaxation after a busy and tiresome working week. The kind of privacy you cannot find in public transport is an important and desirable factor for most people.

Yet although it is only 2 days a week, people in HK prefers to drive their own cars rather than renting. Renting a car in HK today is fairly expensive [23], thus limiting the growth of the car rental market. Utilizing EVs provides new opportunities to explore for new innovative models in this market. Arguably it will tap into a "demotorization" trend (which is especially significant in car-saturated cities like Tokyo) when the meaning of owning a car is shifting from a status symbol to just a mobile utility, which will be highly beneficial to the car rental market. [24] In addition, taking into consideration of the limited mileage of EVs for each recharge, rental services tailor-made for urban and inter-city drivers within a mileage zone of 100 km will be ideal, and this just matches what most HK-PRD cross-border work travelers need.

1.3. Urge for eco-friendliness

Eco-sustainability is already an important issue and is likely to remain so for an indefinite time. It will drive investment, product categories, performance and

convenient packaging decisions well into the next decades. Not only environmental accountability keeps more demanding in most products and services, consumers believe embracing them will provide them a better self-identity and thus are more willing to consume eco-aware products and services. Adding to the fact that oil prices keep either fluctuating or increasing and the price of electricity is comparatively much more steady and predictable, a zero-emission-and-no-noise EV R&S service will sound highly welcomed by the public. In fact, promoting the wider use of EVs in HK will definitely ease the negative image of HK being a highly-polluted city as mentioned earlier.

2. Target customers

The proposed EV R&S service targets mainly on four types of users:

2.1. Affluent free independent travelers (FIT)

In view of the increasing number of FIT from the Mainland and the issue of multi-visit VISAs to SZ ID card holders since April 2009, they will be getting more familiar with HK and will likely seek for new ways of sightseeing and visit more remote locations in the city. A short-term car rental and sharing solution would be a very good choice for them.

2.2. Cross-border travelers

Those who need to travel between HK and the PRD for business or leisure purposes, crossing the border on a regular basis, may need a more convenient, less time-consuming and more cost-effective traveling solution.

2.3. Foreign expatriates

Foreigners who temporarily work in HK, SZ or the PRD, may want to cross the border during weekends for both work and sightseeing purposes. They already have the culture of driving rather than utilizing public transportation means. They also do not see the need in owning a car for just such a short-term stay. While the existing car rental service in HK is very expensive and not flexible, they will find a “greener” EV car rental service more preferable.

2.4. Occasional drivers

These people find owning a car and bearing its cost unnecessary, but they would like to drive when they are on holidays and enjoy the freedom and mobility that driving gives them.

Section 4 provides 2 typical user scenarios to illustrate how the above target customers could actually benefit from the proposed R&S services.

3. Business offerings

The proposed EV R&S service is basically an integration of existing car rental service with existing EV technology with some customized components, strategically designed to meet the increasing demand, in both quantitative and qualitative terms, from travelers who need to cross the HK-SZ border regularly and occasionally.

3.1. Customized EVs

Since the HK government intends to conduct a test with the Mitsubishi i MiEV [25] as its stepping stone to promote the wider use of EV in HK [26], the proposed EV R&S service in this essay will take this into consideration for its detailing, since the vehicle’s specifications will fit into the proposed business model. But to make the car suiting the highly dense urban environment and to strengthen the service’s uniqueness, the vehicle will need to be customized in following aspects in collaboration with Mitsubishi: (1) central driving position so that the car will be suitable to be driven in both HK and the PRD; (2) on-board GPS system for travel information of the PRD so as to help drivers who are not familiar to the region to find their ways easily; (3) 24-hr one-touch SOS road assistance system for emergency service.

3.2. 24-hr service points

Since the initial phrase of the EV R&S service will be operated within a 100 km mileage zone with HK as its headquarter, the initial service points should be set up at the following locations:

- Shenzhen Bay custom — covered parking station
- Central, HK and Tsim Sha Tsui — underground station
- Remote residential areas, e.g. Stanley in HK Island, Sai Kung in the NT
- The HK and SZ airports
- CBD in SZ, e.g. Lo Wu and Futian
- CBDs in cities in the PRD, e.g. Dongguan, Zhongshan...

Service points will provide not only EV R&S service, but will also perform charging, maintenance and diagnostics.

To provide the ultimate convenience to the customers, a charged point-to-point pick-up and drop-off (P2P-P&D) service in its rental and return procedures could be provided: (1) a customer can call the operator or book an EV through the operator’s website at his location; (2) the operator of this service will have a staff driving the car from the nearest service point to that location; (3) the customer can pick up the car and start driving right away, or choose at a set fee (see section 3.3 below) to request the staff to be his driver in that journey; (4) when the customer finished using the car, s/he can either return the rented EV to the nearest service point, or have the operator’s staff to pick up the car at an agreed location, saving parking fees.

3.3. Service plans

The proposed details include:

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| • a monthly membership fee | HK\$388/month |
| • rental duration | HK\$45/hour |
| | (6 hours or up will be counted as 1 day at a fixed rate of HK\$350 with the EV to be returned on the same day) |
| • mileage charge | HK\$3.2/km |
| • P2P-P&D service charge | HK\$40 |
| • personal driver service upon request | HK\$100/hour |

The service plans will include insurance, service points access and so on.

3.4. Value-added services

To add incentives, and to establish a longer-term relationship with the customers, the following value-added services could be included:

- Corporate rates
- Golfing plan — to collaborate with strategic marketing alliance with well-known golf courts (e.g. Mission Hills) in providing special discount to small groups, e.g. rent 2 cars and enjoy a 20%-discount
- Octopus discounts and bonus point purchases
- Tourism plan — shopping discount coupons
- additional info to be downloaded through the GPS and the road assistance device, e.g. HK and PRD news, latest road conditions, entertainment media and shopping promotions, etc.
- self-service WiFi cafés at service points
- “Rent-to-own” program — a member who has joined the R&S membership for a period of time (e.g. 2 years) and has accumulated a certain mileage or number of hours (e.g. 4,000 hours), the operator could offer him to purchase and fully own a used EV in an affordable one-off payment (e.g. HK\$10,000), and still enjoying the services (access to service points, charging facilities, road assistance for emergency service) offered by the operator. Not only this could build customer loyalty, but also help to recycle and keep fresh the EV fleet.

4. User scenarios

To illustrate the feasibility of this EV R&S business model, the followings are 2 typical user scenarios to evaluate the model from the user-centred point of view:

4.1. Mr. Wong

Mr. Ivan Wong is a program manager of a HK-based electronic company but with its R&D arm located in the Nan Shan Science Park in SZ. His role is to monitor the progress of projects. In order to communicate with his team, he has to visit the R&D engineers in SZ at least twice a week. Ivan lives in the southern district of HK Island, where there is no direct transportation that enables him to take a single ride from home to Nan Shan.

Ivan’s routine home-to-work route includes: (1) take a taxi from home to the nearest MTR station at Central; (2) take MTR Kwun Tong Line from Central to Kowloon Tong to interchange for East Rail Line; (3) take the train from Kowloon Tong to the Lo Ma Chau HK-SZ border; (4) cross the border and take taxi from Fu Tian to his Nan Shan office. Although the distance between Ivan’s HK home and his Nan Shan office is less than 40 km, the journey took 2.5 hours, spending tiresomely almost half a day on the road and is obviously not time- and cost-effective.

	Public transportation	EV rental
Membership fee per day	\$0	\$13
Rental round-trip (80 km / 2 hours)	\$0	\$346
P2P-P&D	\$0	\$40
1 public transport x 2 and 2 taxi trips x 2	\$87 \$290	\$0
Daily total cost	\$377	\$398
Total travelling time of a	5 hours	2 hours

return round trip		
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Ivan’s travelling expenses:
Comparison of public transportation and EV R&S service

With the proposed EV R&S service, Ivan can jump on to the car right downstairs at home using its point-to-point pick-up service after booking for an EV by phone or through the operator’s website the night before the trip. Then he can drive (1) from home to the Lok Ma Chau customs; (2) cross the HK-SZ border and drive from there to his Nan Shan office. Ivan then can use the convenient P2P-P&D service and have the EV returned. Although using the R&S service has a higher cost than using public transportation, the whole journey saves 60% of Ivan’s time on the road by taking only an hour to arrive at his office from home, plus the enjoyment of convenience, driving pleasure and privacy, and less tiresome mood for work.

Ivan’s case typically represents most cross-border workers and business people who need to shuffle between HK and SZ on a regular basis. From the user-centred point of view, such convenience will certainly be highly desirable.

4.2. Mr. Ma

Mr. Jacky Ma is a typical HK middle-class married family man with 2 kids aged around 10. He lives in Tseung Kwan O and owns a Japanese car which he drives mostly during weekends for family gatherings, including shopping, dining, picnic and sight-seeing in the countryside. On weekdays Jacky does not drive to office, nor he needs to drive his wife or kids, so he just parks his car in the carpark in those time.

Jacky finds owning a car does give him a status symbol, but the expenditure associated with owning a car is not less, especially the parking fee. What troubles Jacky is that even though he is a weekend driver, the parking fee he needs to spend is somewhat similar to a daily driver, and thus sounds not cost-effective. He did consider selling his car and just rent a car for weekend use for his family. Whether it is more cost-effective in renting a car or keep being a weekend-driver-car-owner, the followings is a comparison:

	Weekend drivers	Daily drivers
License	\$4,000	\$4,000
Insurance	\$2,000	\$2,000
Maintenance	\$3,000	\$3,000
Petroleum / gas	\$6,000	\$21,000
Parking	\$42,000	\$42,000
TOTAL	\$57,000	\$74,000

The annual cost of owning a car in HK

	Own a car	EV rental
Monthly fixed cost (calculated from the above cost for a weekend driver)	\$4,750	\$388 (monthly membership fee)
Rental (4 Sats and 4 Suns)	\$0	\$2,800
Mileage charge (120 km for each weekend)	\$0	\$1,536
Parking at destinations (3 hrs/day x 8 days)	\$960	\$0
P2P-P&D	\$0	\$640

(2 sets of P&D/day x 8 days)		
Daily total cost	\$5,710	\$5,364

**Jacky's family expenses on travelling in a weekend:
Comparison on owning a car and EV R&S service**

Not to mention the above comparison has not include the purchasing cost for a car, just evaluating what is offered with this proposed EV R&S service, what is appealing to Jacky is that the hassle of worrying and dealing with car parking, insurance, repairs and maintenance, and the fees associated with it, are all taken care of — what is left to him is the part of enjoying driving, the fun and freedom associated with it. Besides, one can see the hourly charging plan combined with the P2P-P&D service make it more cost-effective than any daily or weekly car rental plan currently available in the market.

5. Business development

Given that there is a limited quota of cars that can cross the HK-SZ border directly, the R&S service could be operated in a way that a customer start renting an EV in HK and drive to the border, then change for another car after crossing the border, at the service points like Lo Wu and Fu Tian set up right next to the customs, and then drive to his/her destination. The operator should work with both the HK and SZ governments on coming up with a policy that can ease this hassle so that one day a customer could drive the same EV crossing the border. One possibility is a commission could be given to the governments in exchange for an exclusive license granted to the operator's EVs so that the customers do not need to change cars.

As EVs become more popular in both cities, it could be foreseen that more charging facilities will be built on the road as part of the infrastructure. The operator of this R&S service could consider sharing their charging stations with those set up by the governments, so as to expand this network of charging stations and gives to the customers maximum convenience.

IV. CONCLUSION

The above strategic design proposal on EV R&S service provides a feasible framework that the policy makers could adopt and endorse so as to serve as its initial step in promoting the wider use of HK, and it also demonstrated how technology like EV could be appropriated by designing a model within the context of business viability and human desirability.

It is extremely important when the policy makers are promoting a green and technology-based economy for HK, they do not look at technology by itself. Creativity and strategic design knowledge and skills are equally important to make technology useful, useable, and desirable. Through it, innovation with an impact to the majority of the society could be made possible and realized, productivity and competitiveness could thus be enhanced. Hong Kong will then become a more sustainable world city.

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