23rd Cambridge International Manufacturing Symposium
University of Cambridge, 26 – 27 September 2019

Business Model Design Elements for Electric Car Service based on Digital Data Enabled Sharing Platform

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Abstract

The number of electric cars have seen a steady increase in last few years, most likely due to the actions various countries have been taking to limit combustion engines vehicles access to city centres, changes in taxes based on emissions and changes in emission calculation models. On another hand the change in cost structure related to electric cars, like the price of lithium batteries is one of the high level explaining factors for this change. E.g. for last 8 years, price of li-ion batteries has dropped around 80% (Berckmans et al., 2017). From the market point of view, the traditional car manufacturers have their own service networks, while any new player such as a new electric car manufacturer does not have it. To ease up the situation, a service data platform for electric cars enables new players to enter the market by supporting independent car services to access spare parts, maintenance instructions and training material more flexibly than currently. In this context, the key aspect is how the service network will be organized. The platform enables data-based analytics to optimize service for electric cars and to foresee the spare part needs to help the warehousing, logistics and supply chain side. For the whole service network, some new innovative approaches will also be needed to support the new way to work with the data platform. The target of the paper is to present the design elements of a new business model for electric car service data platform. Data sharing enables new manufacturers to come to the market and independent car services to offer electric car maintenance to customers. Paper presents key partners, key activities, key resources, values, customer relationships, channels, customer segments, cost structure and revenue sharing.

Keywords: Data Sharing Platform; Data-based Ecosystem; Cloud Service; Electric Car Service; EV Maintenance, Spare Part Logistics Optimization

1. Introduction

Big talks on climate issues have made the electric cars sort of a hot topic of current century, especially if cities and even countries start limiting road access for gasoline and diesel engine cars (Coren, 2018; Staufenberg, 2016). One thing that seems to be missing from these talks, is the key issue that how these cars, that sort of bring future to today's life, will be maintained and serviced for their full lifetime? These new technology based electric cars will need a new service network, and especially this will be true to manufacturers that do not have tens of years of pedigree in vehicle markets. For example, just few years ago Tesla would have been classified into this group of car manufacturers. Nowadays, there is a huge number of new players who would like to enter the global electric vehicle markets (e.g. multiple Asian manufacturers: Byton, NIO, Great Wall Motor, Aiways, Xiaopeng Motors), but are somewhat limited by their unknown brands among American and European customers. There is also a little bit of disbelief of how well the service will be working over the lifetime of the vehicle. For this issue, the data sharing platform would give a good opportunity for these new electric car manufacturers to enter into new markets. A data sharing platform can put all stakeholders together: a car owner can check their car service history from platform, electric car manufacturers and service companies can make their service and support infrastructure easily available for potential customers and the service companies can get spare parts information and training material from the platform while car manufacturers can share their service data to independent car service companies.

Even when electric cars might be more expensive to buy, the cost of maintenance for electric vehicles have been shown to be less than the maintenance costs for comparable combustion engine cars have (GoUltraLow; van den Bulk et al., 2009; De Clerck et al., 2018). The main contributing factor for this difference is the inherent fact, that the electric car has less moving parts and as such requires less mechanical servicing. For example, electric vehicles do not have timing belts/chains, waters pumps, radiators, fuel injectors, fuel pumps, starter motors, sometimes not even any gearboxes, and no need to replace and change oil filter and oils for the engine and gearbox. (Gass et al., 2014) Combining all those factors together, the maintenance costs for the electric cars are inherently lower than what are the known costs of similar combustion engine cars (van den Bulk et al., 2009; De Clerck et al., 2018; Becker et al., 2009; Propfe et al., 2012). As an example for the costs structure, comparison of electric cars to petrol or diesel equivalents from the same brand in maintenance over 4 years/ 60000 miles, (GoUltraLow) did show that the savings of service of electric car can be anything from 367 £ to 1234 £. Electric cars are reliable and the interval

of service can be increased, for example Tesla gave up annual service keeping some periodic maintenance (Evarts, 2019).
As pointed out previously, electric cars are indeed quite different from the more traditional combustion engine counterparts from mechanical side of things, which means they need different kind of services. For this new need, the envisioned service data platform offers the new independent car service and car manufacturers the possibility to enter to markets, even when they do not have a long history in this market sector (e.g. new electric car manufacturer brands). The barriers to building a new service network, like lack of general electric car maintenance knowledge, empirical based knowhow how to maintain electric parts, traditions in electric car service procedures and shortage on electric car servicing manuals and instruction as well as training material can be high for new players. On the other hand, if the new companies work together, share the same information and service network and use the same "on drive data", the knowledge sharing supporting data platform can greatly reduce those barriers (Metso et al., 2019).

2. The background and the concept of platform

From the environmental impact and high level of operational performance point of view, one would probably like these new future oriented electric powered cars to monitor the level of energy usage, compared to driving conditions and driver's driving patterns in a 24/7 manner and warn the user if any inefficiencies or unexpected energy consumption would be detected. Especially, as we already know from previous studies that statistically a car has its most environmentally friendly years up until 4,7 years of age, before the level of emissions production will start to increase fast (Kagawa et al., 2013). This is probably related mostly into the researched fact, that currently e.g. new petrol running cars do 47 % less emissions than cars that have been in use for 5 to 10 years (Jezek et al., 2015). Unfortunately, at the moment, we do not have similar data for electronic cars available, but it is highly likely their energy consumption (and as such CO_2 emissions), will also start to rise fast in some certain usage age / kilometre range after purchase.
In sensoring and monitoring side, many new vehicles nowadays have active safety systems that feature always active data collecting sensors. The data from sensors is connected to driver's assistant systems which can lead to activation of light signals and sound noises to attract driver's attention to prevent e.g. accidents from occurring. But to even get into the alerting phase, the analysis of the sensor data happens in background, basically in real-time, inside the car specialised computers providing the car with systems like lane departure warning (LDW) and pedestrian collision warnings (Thompson et al., 2018). The point is, that we could also start to monitor and save this event data into the background systems to be able to start to predict in what parts of the world and when (statistically) one might predict a raised need for certain repair parts in near future. Additionally, by combining the drivers own event data to statistics we know about the driving areas general driving safety and dangerousness of driving cultures around the world (Özkan et al., 2006), we could use data-analysis to support retro fit safety parts sales, even at the private car user/owner level.
Considering all the data and processing of the data in different systems cars are generating nowadays, we are not shorthanded with data that could be used in future to enhance car maintenance services in near future. In this context, the main function of an electric car service platform is to offer car owners the on demand and current general overview status of the car. They can easily find and book service(s) for their electric cars, offered by the car service companies joined in the platform. On the other hand, the platform can help the car service companies to manage spare part flows, find service manual data and maintenance instruction, and with the shared platform they now would have more direct channel for customer communications. Car manufacturers would not need to build up their own service network from scratch, as with the platform they can find independent car service firms' service network and share the service manuals, spare part lists and instructions for maintenance through the platform. For the spare parts, the supply chain and warehousing optimization will be easier than before as based on monitoring data, the prediction of part need inside the service network gets easier than ever before. Predictions can be based on real-time data collected from the cars and from the maintenance data, provided by the platform, which allows the network to adjust inventories based on demand predictions, with the use of dynamic inventory balancing models (Happonen, 2012).
The advanced algorithms and data sharing can lead to use of enhanced demand and supply chain synchronisation (Hietajärvi et al., 2009; Salmela et al., 2012). These algorithms will be based on analysis, which are done based on both collected data and on reference data given by the manufacturers, supply chain network partners, part manufacturers, insurance companies participating into the platform service providing side and so on. More partners in the platform means more possibilities for new and innovative ways of fleet level service generation, even in corporate car fleet management level (Kortelainen et al, 2016). Based on typical big data trends, the hypothesis is that the accuracy of analysis are expected to grow while new analysis models will be added, and additional data collection will happen. However, the studies show that the accuracy can vary when the object of the analysis changes (Grolinger et al., 2016; Jetcheva et al., 2014).

3. Business model design elements

The platform does not need new technical innovations while technology is available and can be easily utilized, e.g. IoT sensors, mobile networks, Internet, etc. On the other hand, for large scale success, lots of different players will be needed to get into the platform as soon as possible. And additionally for big scale success the platform needs to get all possible players to play together to start to innovate e.g. in the supply network collaboration level to drive down the costs and to formalize the shared front end innovation work (Salmela et al., 2013) based on new data analysis capabilities. Given this high level of data dependency, the first main difficulty might lie in the analysis and how to interpret the values sensors are giving for the platform. What these values mean in the big picture and on another hand in the vehicle level and for its general status and when the service is recommended and when it is definitely needed to be done. And in larger scale, how the supply chain can find prober collaboration practices (Salmela et al., 2011), to integrate itself to the platform to be able to produce better cost efficiency, compared to what they could do by themselves. For summing up the above-mentioned factors influencing the design and development of a novel data sharing platform for electric car services, we have adapted the Osterwalder and Pigneur's (2010) business model canvas approach to present the overall view and the required elements of the platform in the business ecosystem. For the general view of business model and how different players might connect to each other in the platform ecosystem like this, please see the Figure 1.

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
Car manufacturers	Electric car service	Reliability	Road service	Car owners
Maintenance services	Spare part management	Cost-efficiency	Helpdesk	Car manufacturers
Spare part suppliers	Status of vehicle	Convenience	Digital marketing	Car services
Software developers	Partner management		Web page	
Cloud services	Data sharing		Videos	
Data analytics companies	Monitoring		Phone, fax and email services	
Wireless network service providers	**Key Resources**		**Channels**	
System providers	Sensors		Internet	
	Cloud service		Mobile	
	IoT network		Supply chain network	
	Analytics Capability			

Cost Structure	Revenue Streams
IT costs	Profit sharing
Service costs	Subscription fee
Spare part costs	Sales fee
Management costs	

Figure 1. Business canvas for Electric Car Service platform. (adapted Osterwalder and Pigneur, 2010; Ju et al., 2016).

The biggest challenge is probably the chicken – egg problem in the start, when we do not have huge customer base in the platform. If the platform is successfully developed, the advantages of platform are obvious to all stakeholders, but still the ramp up phase cannot take too long (Akkermans et al., 2019). The car owners receive better service and can check the status of car at any time. Independent car service has customers and support to execute car services. The manufacturers do not have to create their own and quite expensive service network and they can optimize spare parts together with spare part suppliers. Software and analytics service provider will have new customers and in general, data openness will help everyone in the platform to either receive better service experience / user experience (Metso et al., 2019) or to be able to generate revenues faster and with better return on investment than what they could do by themselves. See Table 1.

Table 1. Advantages of Electric Car Service platform.

Car owner	Car service	Car manufacturer	Platform service provider	Data analytics service provider	Spare part supplier
Status of vehicle Service proposal Service offer Electric service documentation Instructions	Service manuals Instructions Training material Spare part support Customers	Service network Support to car owners Real-time monitoring Spare part optimization	Spare part prediction Supply chain management? Data sharing Data collection	Data to analysis Customers	Need for spare parts is known

The car owners have many benefits by using the electric car service data sharing platform, e.g. they know all the time the status of the car and they can have simplified service manuals available. The car service companies have access to service manuals and instructions as well as training material and the main thing fueling the whole system is the well balanced spare parts support network the platform can offer. New electric car manufacturers / brands do not need to build their supply chains from scratch. They can use the network of independent car services and their shared parts warehousing and logistics channels. Additionally third-party logistics (3PL) operators and logistics service providers can join into the platform to speed up global service network channeling tasks (Salmela and Happonen, 2009). The platform can offer the real-time monitoring to the car manufacturer to investigate the condition of vehicle and spare part deliveries and buffers can be optimized based on the predicted need of spare parts / spare part modules. In addition, as the new electronic modules and data collection for the platform will mean a lot of new software development related knowhow needs, area specific software developing skills will be in high need to implement the platform within its whole envisioned size. A platform service provider will definitely be able to base their revenue model on continuous development of the platform and its support network information exchange integrations, but the knowledge needs will be similar like they have been in the current mobile application software business (Jahkola et al., 2017). By conquering the integration and software API development barriers, additional stakeholders can constantly keep joining into the network to offer continuous growth potential and tangible benefits for both the platform owner and all different parties using the platform.

4. Conclusions

Previous studies of electric cars have focused mostly e.g. to their possibility of delivering emissions reduction, battery capacity issues, future of smart cars and smart traffic, different subvention model to promote electric cars market penetration acceleration and multitude of issues that lie in the research fields of energy delivery and charging networks.

This study explain the possibilities to decrease the barriers for new electric car manufacturers to enter to market of sales of new electric car brands. From this point of view, it seems evident that the availability issues of service maintenance support for electric car needs to be organized before trying to enter into the market. The main barrier for new electric car manufacturers can be seen in the costs of building their own sales and car service network. The envisioned data sharing platform could enable the new electric car manufacturers to use independent car services and they do not have to invest a lot into a new infrastructure. This would also make the platform as one of the enablers of the ambitious targets which governments in many countries are putting into the penetration level of electric vehicles in the coming decades. The data sharing platform will also enable the spare part optimization at least on a country level but it might optimize spare part supply chain management at wider, at e.g. European level too, in the future. The electric car service is different by its nature from the traditional combustion engine cars, while a lot of moving parts are omitted by design, in electric cars. This difference causes the need for new kind of support and training for car service companies and their mechanics, electronics and multiple electronics related control units. The data sharing platform enables both support and training materials included to the service for the customers of platform.

Another advantage is that electric cars need less service than traditional cars need This can on the long run reduce the need of offer brand specific car services, by each brand themselves. The platform can enable a true multi-brand service support for car maintenance services, which would be specialized for electric cars. Other renewable energy sources of transportation are also being developed and their increased share of total cars can slow down the growth of electric cars. However, we believe that a well designed and implemented service platform can in part encourage car manufacturers, service providers, customers and regulators to support electric car development and adoption.

This study illustrated the crucial elements that should be in place in the data sharing platform service and in the related ecosystem business model. Several potential advantages of the platform for the different players in the supply network were introduced. However, although the number of advantages have been recognized, the design and implementation of the model may also have its possible obstacles. There are naturally potential issues to be solved, for example, in the availability of technologies, data access and sharing principles between within the ecosystems, but also in the customer and user acceptance on the model, which requires careful communication of the benefits compared to conventional models. Additionally, one needs to understand, that regulations between different countries are not the same. In one country, you could collect all the data and then some, to run super highly efficient and logistically optimised platform system. On another country, you could be so data limited, that the usability of the platform might be even questionable. This study is exploratory by its nature and thus was leaning on and combining the existing literature sources and related public material on the sub-areas of this wide area of research. Future research will be needed to validate the elements in the model, to evaluate the technological and analytical alternatives for the platforms and have empirical evidence for the creation and capture of the value for the electric car ecosystem.

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