Case Study

Electric Vehicle Rental Services:
Project in Okinawa, Japan

Claire Weiller and Andy Neely

UNIVERSITY OF CAMBRIDGE
Cambridge Service Alliance

Electric Vehicle Rental Services: Project in Okinawa, Japan

Cars are a major contributor of greenhouse gas emissions globally. Cars contribute around 12% of total carbon dioxide (CO_2) emissions in the European Union. In Japan 18% of total CO_2 emissions are caused by road transportation. With car ownership in China expected to increase from 43 cars per 1,000 people in 2010 to 320 cars per 1,000 people in 2035, global emissions from road transportation are set to rise.

The search for alternative fuels to reduce car CO_2 emissions is an important part of the climate change challenge. Electric vehicles (EVs) are one potential solution. Yet the EV market has been slow to develop. The global stock of electric vehicles was some 180,000 vehicles at the end of 2012, just 0.02% of total passenger cars.

In the early-stage EV market, electric car rental services allow drivers to trial an EV for a short time. This experience with EVs increases awareness and facilitates diffusion of the technology. That is why projects like the Okinawa Electric Vehicle (EV) Rental Service are so significant. One of the first EV projects of its kind in the world, the service is dedicated to supporting the use of electric cars and improving the environmental sustainability of tourism on the island of Okinawa, Japan.

Unfortunately, the results of the Okinawa EV Rental Service at the end of its first three-year operational phase in 2013 have failed to meet initial expectations. Low usage rates mean rental companies are making a loss. Customers worry about insufficient recharging infrastructure. Sales of used rental cars are low.

There are potential solutions to these challenges, however. New research offers fresh insights into the scheme. By adopting changes to the strategic approach – in particular, harnessing the resources in the business ecosystem and sharing the data – it may be possible to spark new life into the venture.

The service

The introduction of electric vehicles to Okinawa through the holiday rental service was the first phase of a three-part "Green New Deal" aimed at developing a smarter energy system on the island. A combination of factors makes Okinawa a suitable location: high rates of car ownership, lack of public transportation, and its popularity as a tourist destination – welcoming 5.5 million visitors per year, of which half rent a car.

Originally proposed by professors Hideaki Miyata and Kenji Tanaka from the Department of Systems Innovation at the University of Tokyo, the EV rental service complements the aim of local organisations to improve the environmental sustainability of tourism on the island.

A broad ecosystem of organisations participate in the service. Researchers at the University of Tokyo designed the business model and conducted the technical and market research. Travel agencies across Japan are the service's main distribution channel, as they offer package holidays that include electric vehicle rentals.

Three rental service companies provide 200 EVs between them: Nippon Rent-a-car Okinawa, Nissan Rent-a-Car Okinawa, and ORIX Rent-a-car Okinawa. The cars are Nissan Leafs with a range of 160 km. Car hirers either pay to use the 27 fast-charging stations on the island or recharge for free at a slow-charging station, which takes about eight hours for a complete charge.

The fast-charging infrastructure for the EVs is provided by Advanced Energy Company (AEC), a joint venture of 26 companies (Figure 1).

Other members of the EV Rental Service ecosystem include the Shiraishi Group, a major financial holdings company, local and federal public authorities, and local companies and tourist site operators that offer slow-charging stations.

Business case

For car rental companies, acquiring a new Nissan Leaf costs about 3M yen. The rental company expected a resale price of 2M yen ($20,000) after three years of rental. To break even the rental firm must generate at least 1M yen over a three-year rental period. At typical hire prices of 6,300 yen/day, that equates to approximately 18 rentals per car per year, assuming an average rental lasts three days. The target was 100 rentals per car per year.

AEC's business model is based on providing access to the network of fast-charging stations in Okinawa. Regulations governing electricity sales in Japan forced AEC to position itself as an infrastructure provider charging a flat fee, rather than an electricity provider selling kWh. AEC charges a service fee of 2,000 yen ($20) for unlimited recharging during the EV rental. After a week the service is charged according to the number of times stations are used. The business model was based on an average distance driven per rental of 250 km and the assumption that a fully charged Nissan Leaf would only need one full recharge per average three day rental.

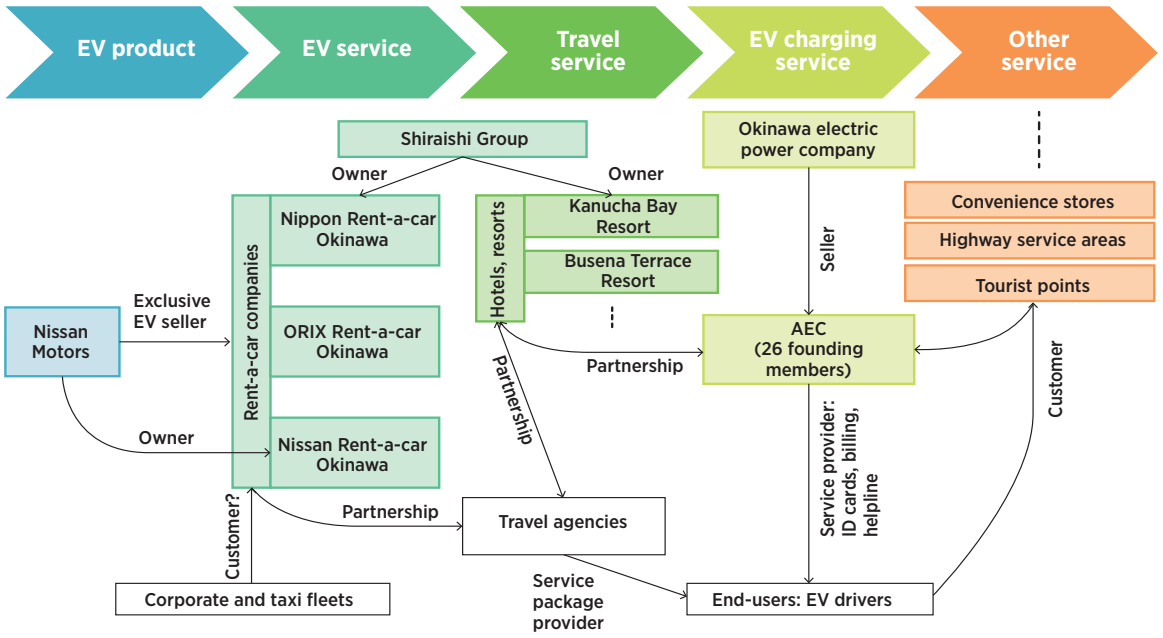

Figure 1: A customer-centric map of ecosystem relationships

Challenges

Estimates of usage rates in the original business plans proved to be optimistic. The EV usage rate reached 10.6% in 2012 and 20% overall since the start of the project – corresponding to 60 days usage/car/year.

The car rental companies met with a lack of demand for used Nissan Leaf rental cars in the local market. The average income on the island is too low to create an EV market, even for used cars. Consumers are only willing to pay around 1.5 M yen ($15,000) per car rather than the 2M yen anticipated by the rental companies.

Customer feedback suggests "range anxiety" is a major factor in the low adoption rates. Sixty per cent of customers were anxious about the number of charging stations and running out of fuel. Fast-charging station coverage was seen as too sparse when compared with gas stations. Consequently, tourists tended to recharge their hire car's charge two or three times a day, rather than once as calculated in AEC's original business plan. Customers also said that the service was not sufficiently price-competitive with conventionally fuelled car rentals to justify the risk.

Another significant challenge is the lack of incentives for travel agents to promote the use of the electric vehicle option over conventional vehicles. Because EV technology is less well-known, travel agents cannot guarantee the performance of the vehicle beyond existing official statistics about range, safety, and ease of charging. Also, they are unable to respond to concerns about the availability of charging on Okinawa.

Finally, the Fukushima nuclear reactor crisis, triggered by the March 2011 earthquake and tsunami, negatively affected consumer sentiment about the electricity industry and related innovations such as electric vehicles. Since 2011 energy infrastructure and supply companies have reduced focus on electric mobility in Japan.

Strategy turn around

A growing body of evidence suggests that an ecosystem approach is the best way for complex service providers to capture value while offering the best service possible for customers. Approaching the challenges that the Okinawa EV Rental Service faces from a complex service ecosystem perspective, it is possible to make a number of observations about the way the service was conceived, implemented, and operated over its lifetime.

One of the main barriers to acceptance of EVs on Okinawa is the lack of data about the service's EV usage and experience. Consider the moment a potential customer decides whether to hire an EV or conventional car, and the questions they might ask: Given a planned itinerary, how often would the car need recharging? Could they go from A to B to C on a single charge? How often do people tend to recharge and how long does it take them? To date the travel agents are unable to access the data needed to answer these concerns.

The vast amount of information collected over four years of operations is fragmented and not readily available to the people who need it. For example, Nissan Motors collects and exclusively keeps all vehicle-related information such as battery performance, driving modes, and GPS data from travel routes. AEC collects data from the charging stations and can only infer driving patterns and flows from the energy usage data. Travel agencies collect the usual customer information during the package booking, including basic demographic data. The rental companies do not have access to any information

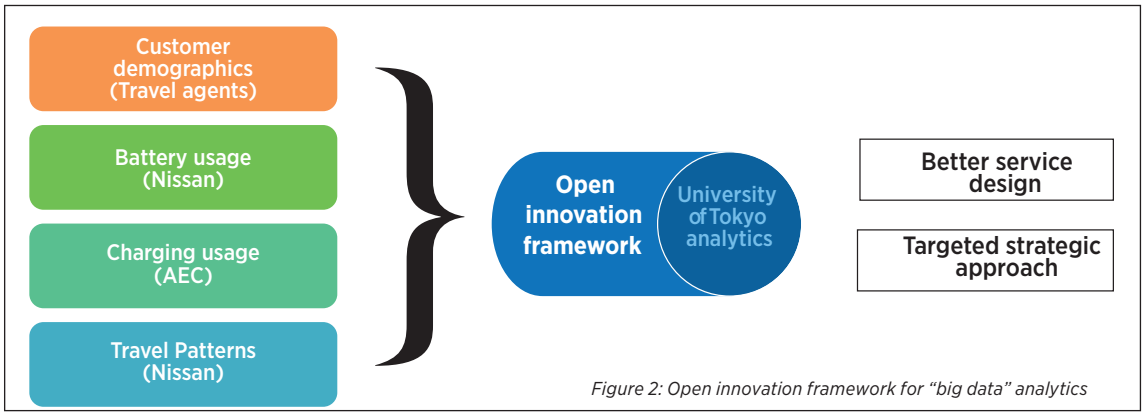

Figure 2: Open innovation framework for "big data" analytics

on users. Finally, University of Tokyo academics have theoretical knowledge on battery technology and the capabilities to analyse data from the project.

Collaboration between stakeholders to share data could help resolve some of the practical issues and customer concerns with the service. Companies in the service ecosystem would have a better understanding of customer habits, which could be used to refine and improve the service business model. The greater the information exchange between the parties in the service ecosystem, the more useful the in-car information is likely to be for the hirer. For example, better in-vehicle information about electricity consumption and recharging related to the intended route would benefit customers.

The current navigation system allows passengers to locate charging stations within a certain radius. However, an improved "intelligent route planner" could make suggestions about which charging stations to use along the journey. A better route planner, both in-car and on personal devices, could help alleviate a customer's anxiety about range and charging.

Data exchange in the ecosystem would enable travel agents to answer the key questions customers have when choosing a rental car. The smarter use of data would give travel agents greater confidence in recommending the electric vehicle option. Once travel agents know more about the EV service, they might offer an electric vehicle as the default car option in their holiday packages. Customers would have to consider the electric vehicle option, leading to a higher probability of them using the EV service.

The smarter use of data and the resulting confidence in the capabilities of electric vehicles will also enable stronger marketing across the ecosystem. A marketing campaign could raise customer awareness about the EV service at every step of the travel experience: at online booking, on the websites of the island's hotels and resorts, at the airport, and at the car rental offices.

Marketing throughout the ecosystem would significantly promote the benefits of using electric vehicles for tourism on Okinawa Island, including lower operating costs, better customer service (possibly including a 24/7 call number offered by AEC/Nissan to cover queries and emergencies), ease-of-use through mobile phone and tablet applications, added-value services such as priority parking, as well as environmental benefits.

Increased confidence in the use of electric vehicles on Okinawa should also improve ex-rental sales. Sales could be targeted at taxi and corporate fleets: ideal customers for the used vehicles as they do high-frequency, short-distance journeys and would capture considerable value from the low operating costs of EVs.

Powering up the business model

The lessons from the Okinawa Electric Vehicle Rental Service have global significance for the growth of the EV industry. As a pioneering innovative electric mobility service, it serves as an example for other e-mobility initiatives. To date, the service's popularity is lower than expected for a number of reasons. This case study offers new ecosystem and data-centric approaches to improve the service.

Taking an ecosystem perspective can help identify the weak links in the value chain to target for improvement. The travel agents' role, for example, seems to have been neglected, and reinforcing their collaboration as direct partners could provide a new source of customer revenues.

The collaborative use of the data collected over four years of operations (Figure 2) can help define a more targeted approach and better service design. Using, opening up, and sharing the data collected from the service can help increase customer confidence and improve value creation across the ecosystem.

Implementing the more detailed recommendations in this report will hopefully provide the project with the new strategic avenues it needs to succeed.

Key facts and figures

- **The Okinawa Electric Vehicle Rental Service is an innovative service aiming to provide cleaner transport for tourists and residents on Okinawa Island, Japan.**
  - The service was designed in 2009 and began operations in 2011.
- **The project was proposed by professors at the Department of Systems Innovation, University of Tokyo. Other organisations involved in the service include:**
  - Travel agents.
  - Advanced Energy Company, a joint venture company providing the fast recharging energy infrastructure.
  - Three car rental companies: Nippon Rent-a-car Okinawa, Nissan Rent-a-car Okinawa, and ORIX Rent-a-car Okinawa.
  - Nissan, manufacturers of the Leaf EV.
  - Shiraishi Group, a holding company that owns resorts and Nippon Rent-a-car Okinawa.
- **Facts:**
  - 200 Nissan Leaf EVs are offered in the rental fleet.
  - The Leaf EV has a 160km range.
  - 5.5m tourists visit Okinawa annually; half of these rent a car as part of their holiday package via a travel agent.
  - Average rental period: 3 days.
  - Average distance driven per rental: 250 km.
- **Business assumptions:**
  - Rental companies – Cost of car: 2.5/3M yen.
  - Assumed resale value after 3 years: 2M yen ($20,000); Hire price: 6,300 yen per day; Break-even: 18 rentals; Target: 100 rentals per EV per year.
  - AEC – Flat service charge: 2,000 yen for unlimited recharging for a week; Price per recharge beyond first week: 500 yen ($5); 27 fast-charging stations installed and in operation; Break-even calculated on the basis of 400 EVs: 80 rentals per EV per year.

Challenges

- **Service performance:**
  - Low fleet utilisation rate – 10.6% in 2012 (target: 20%).
  - Willingness-to-pay for used cars on the second-hand market: c. 1.5M yen ($15,000) per used vehicle (target: $20,000).
- **Users:**
  - Risk for travel agents to promote EV hire due to performance uncertainty.
  - Customer feedback shows concern about the number of charging stations and range of vehicles.
  - Customers charge cars more frequently than projected due to fear of running out.

Solutions

- **An ecosystem approach, starting from the end-user service experience and working back through the value chain, can help deliver better service value.**
- **Opening and sharing the data from the service operations to all the companies in the value chain can enable a number of improvements to the business model and service, such as:**
  - Greater confidence in electric vehicles as a rental car alternative.
  - Greater willingness of travel agents to promote the electric vehicle option.
  - Better in-car route planning information relating to range and recharging options.
  - Increased awareness in the population, leading to more customers for used EVs.
  - A better foundation to market and promote the service's merits. Each one of these solutions should lead to improving the popularity of EVs as a rental car option, resulting in higher utilisation rates and revenues for the service companies.

Cambridge Service Alliance
www.cambridgeservicealliance.org
email: contact@cambridgeservicealliance.org