Development of Eliica: Super Electric Vehicle

– Collaborative Research Between a University and SMEs –

By Yoshida Hiroichi

Project Outline

Keio University launched the Eliica Project in April 2003 with the objective of bringing lithium-ion-battery-powered electric vehicle, "Eliica" into practical use. The main motivation behind this project was the strong desire of myself and Professor Shimizu Hiroshi to help resolve environmental problems. Professor Shimizu has spent 25 years developing electric vehicles. After serving as a vice president of Sumitomo Bank (currently Sumitomo Mitsui Banking Corp.), I was appointed as a president of a leasing company of the Sumitomo affiliate. The company owned a variety of assets to lease, including vehicles and office equipment, and the problem that troubled me the most was how to dispose of assets when the lease terms had expired. I was worried that sooner or later, Japan would become one large pile of refuse, and damage the environment even more. For the sake of my grandchildren's generation, I wanted to somehow protect the earth so that it could continue to support humankind. Feelings like these grew steadily stronger, and I resolved that after I retired I would do something to help the environment.

At that point in time, I met Professor Shimizu by chance, and he allowed me to test drive his KAZ electric vehicle. Back then, the phrase "electric vehicle" brought golf carts and similar images to my mind, and I got into the vehicle embracing such preconceptions as "this will be slow, and cannot travel a long distance." I was quite surprised when it accelerated quickly and drove down the expressway. At that instant, I felt "this is it!" and I knew for sure that I needed to devote the rest of my life to the development and popularization of electric passenger vehicles. That was because I felt that global warming, although it is less visible than waste disposal, is in fact a much more serious problem. This made me think that it was important to promote as soon as possible the widespread use of electric vehicles that do not emit carbon dioxide (CO_2). From that time on, I started to assist Professor Shimizu behind the scenes.

KAZ had been able to achieve high performance, but just like the existing electric vehicles, there was no prospect of future development for practical use. Not only that, the topic of the day was the fuel-cell-powered vehicle, and the outstanding technologies of electric vehicles was in risk of being completely forgotten. Until that point, I had been supporting Keio University by introducing corporations to them, but then I was invited to formally participate in the Eliica Project at Keio University with a professorship.

The Eliica Project is a collaborative research arrangement with a membership of 30 private companies. As well as the large companies, there are also a number of small and medium-sized enterprises (SMEs) that possess high levels of technological expertise. The first Eliica vehicle was completed in January 2004. It recorded a top speed of 370km/ph and achieved great acceleration, reaching 100km/ph in four seconds and 160km/ph in seven seconds on a test run in Nando, Italy. Electric vehicle technology would not be accepted by the public if people have to put up with poor performance in order to be gentle to the environment. Eliica was developed with the dual concepts of environmental friendliness and high performance. These tests proved not only that it is effective at reducing CO_2 emissions, but it is also by no means inferior to engine-powered vehicles on the performance side.

The second Eliica vehicle was completed in June 2005, and it has undergone practical testing on public roads. We are currently working toward the development of a second prototype model.

The remaining issue for the practical realization of Eliica is its price. In order to bring down the production cost, it will be necessary to reduce the cost of large lithium-ion batteries, which are the main reason for the current high cost of the vehicle. To address this issue, in May 2004, I launched the L^2 Project (L Square Project), which aims to reduce the cost of large lithium-ion batteries through mass market penetration. Quite apart from their use in Eliica, lithium-ion batteries can serve as electric power reservoirs for a variety of areas. Therefore they can serve an extremely useful purpose in the development of radical solutions to energy issues. As a collaborative project involving 13 businesses, governmental and research organizations, the L^2 Project aims to standardize the specifications for lithium-ion batteries, which currently lack unity because they are produced on a made-to-order basis. We are doing this through a development project that integrates both the supplier and the demand side.

Characteristics of the Eliica Project

The Eliica Project is centered on Keio University, and it is operated by academic and teaching staff, graduate and undergraduate students. Since research and development (R&D) has been placed under the university's guidance, it is possible to undertake research in promising fields from a neutral, independent standpoint. Further, because it is not a for-profit undertaking, it was possible to build strong organic relationships among a number of different corporations.

When development is undertaken by a corporation at the core, there is a tendency to proceed from a point of departure determined by their existing tech-

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Eliica: The electric vehicle is powered by a lithium ion battery

nology. This makes it difficult to develop completely new technology. Engine-powered vehicles run when the motive power from internal combustion is transferred to the wheels through a transmission mechanism, while Eliica moves when its wheels receive motive force directly from the motor. That is why the development of Eliica must depend on completely new technologies, what I call "destructive technologies." The internal combustion and transmission technologies currently held by vehicle manufacturers are of no use to the project. The development of the Eliica is possible precisely because it is led by a university which can take a neutral stance in its research into technical development.

Furthermore, when development is led by a corporation, there is a risk that priority will be given to those technologies already held by the company and its client companies. However, because the university is at the center of development, it is possible to build collaborative relationships with companies which possess technologies that work best with the ones Professor Shimizu has amassed over many years. For example, the motor coil, inverter and vehicle control systems, which are Eliica's core technologies, we secured the cooperation not of large corporations but of SMEs with the necessary technical strengths. There are many high level technologies lying latent in our society, but simply because this was a research project with a high degree of freedom that was based on the technologies cultivated by Professor Shimizu, a variety of new technologies could be brought together. In this way, the high performance Eliica was born, with a performance which is not inferior to that of engine-powered vehicles.

Nature of the Project's Collaboration with Enterprises

To proceed with the project, how we built relationships with private enterprises was an important issue. The Eliica and L^2 Projects built those industrial relationships based on three principles: "sharing a common philosophy," "gaining the understanding and trust of corporate top management," and "securing the freedom of R&D activities."

When I asked various companies to participate in the projects, I did not show them a concrete project plan. Rather, I emphasized that they would eventually participate in the resolution of environmental issues. The projects proceeded smoothly because everyone shared the same philosophy.

I also decided to ask the leaders of each company directly to participate in projects. By having them understand the projects and by building their confidence, I was able to strengthen the cooperation we could receive from the staff members who participated in the actual R&D efforts.

Since we were trusted by the companies, we established a management system for the research laboratory to stabilize it. I was responsible for the overall management of the projects and Professor Shimizu was responsible for the technological aspects. In this way, I took charge of the technological management structure. As the projects progressed, this operational structure was formally adopted as a CEO/CRO system within Keio University. I was the CEO, and Professor Shimizu was the CRO. Further, to complete the management system, we established a risk management committee and an audit committee. This was the first time such committees had been established for a single research laboratory at a university. As the leader of the projects, I do not participate in either of these committees. Their proposals would be accepted as the objective opinions and suggestions of third parties, and this helps to foster the building of trustworthy management systems. In this way, by building operational and management systems that could gain the trust of companies, we were able to undertake R&D that received wide-ranging attention from the public.

Conclusion

The Eliica and L^2 Projects are being undertaken as collaborations between the university and private enterprises, and projects like these have given us the means of reviving otherwise buried technologies to make possible their practical utilization. It becomes possible to develop new technologies through sharing a common philosophy with collaborative research enterprises, by gaining the confidence of their top management, and by securing freedom of R&D through the establishment of appropriate operational and management systems.

It was by promoting these projects in this way that we have been able to develop Eliica by applying the technologies held by Professor Shimizu. Advanced technologies such as those used in Eliica exist in various places around Japan. However, I suspect the reason they have not found practical application is because management systems aimed at practical utilization have not been set up. I hope that our activities under the Eliica project can serve as a model for cooperation between industry and academic institutions in relation to the practical development of the other advanced technologies Japan has. JS

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