

JSPMI-ERI 21-3

Research of Approaches to Cross-functional Teams and Inter-sector Technologies Required in the Period of CASE Change

Executive Summary

1. Objective of This Research

The automobile industry is in a period of change, which is said to be a great turn of the century, and CASE (Connected, Autonomous, Sharing, Electric) must be addressed in all directions. In the U.S., Tesla and Google are working tirelessly in rivalry with traditional finished automobile manufacturers (OEMs), and there are many areas where non-continuous innovation is needed. The automobile industry, with finished automobile manufacturers (OEM) standing at the top of the hierarchy, requires different elements of change in each layer, such as the OEM layer, Tier-1, and Tier-2. In general, however, it is necessary to incorporate and integrate considerably different technologies, human resources, and ideas into existing technical skills, human resources, and management. In the situation where automobiles, which have been called the king of typical “machinery,” and their parts in particular must take the lead widely in the development and evolution of “electrical equipment and electronic IT” rather than simply purchasing and procuring them (= rotation of position), and it is a challenge to OEMs and Tier-1 companies. Thus, the main objective of this research is to understand how OEMs and Tier-1 companies in Japan, the U.S., Europe, China, and other Asian countries access electrical equipment and electronic IT companies, human resources, and technologies under this new circumstance, and to grasp the typical patterns by categorizing them into several groups.

Of course, each of the abovementioned patterns must be produced from different logic depending on its own aim, region, timing, etc., and we want to not only list the patterns but also examine the logic behind them. In consequence, we will also find some implications concerning the automobile and electrical equipment and electronics industries of Japan and industrial and technological policies related to them. This research is a three-year plan and focuses on an individual complicated field in each year.

2. About the FY2020 Research

There seems to be two axes critical to CASE change: One is the aspect of IT and electronics, and the other is the aspect of electrification and computerization, such as EVs. In FY2020, we focused on the former. It is particularly related to C (Connected) and A (Autonomous: ADAS) of CASE. In this research, the Committee discussed to the level of semiconductors what electronic subsystems will become critical as “interactive response systems” with V-to-X (X: environment outside the vehicle), not limited to in-vehicle (V: vehicle), envisaging CA(SE) in an era when latency (response speed) will become much faster after 5G evolve to millimeter waves or higher frequencies in 2025 to the 2030s, rather than reorganizing the generals of “in-vehicle” semiconductors, electronic parts, and so on whose research is in progress in various areas. This is because the main performance of electronic subsystems is integrated by semiconductors.

As a result, the issues of the research were narrowed down to three points; the ideal style of the dynamic map “immediate update database” as a system to be demanded in the ADAS era utilizing 5G; edge WiFi-based wireless communication system in the millimeter wave era; and the ideal style of memory subsystems required for edge-based servers (MEC). Then, the items required for each issue and feasible solution examples were examined. The solution examples are only part of the feasible solutions, but it is meaningless to vaguely discuss future challenges without considering specific examples.

Through backcasting from each solution example, it was anticipated that it will be necessary to change the way of thinking about each of the ideal configuration of a database, the ideal style of edge-based communication, and memory subsystems required for MEC servers, etc. if the matters that should be dealt with now are overlooked (technical details are omitted).

3. About the FY2021 Research

The research focused on "motorization and electrification" (E) of CASE in FY2021. From the viewpoint of reducing greenhouse effect gas, two important aspects are the issue of shifting automobiles to EVs (WG1) and the electricity macro issue of how to "green" the electricity supplied to EVs (WG2).

(1) WG1 [Division of development and production of EVs, etc.]

In the period of CASE change, acquisitions and capital tie-ups of companies between different industries, mainly major domestic and overseas finished automobile companies, have been active, and the entry of IT-related companies into the automobile industry is frequently reported. As research and development related to CASE gets into full swing, it is obvious that these different industries have a strong impact on the automobile (mobility) industry, but it is necessary to scrutinize the fact that "collaboration models in special and specialized fields" (see the table) are steadily advancing at each stage of EV procurement planning, development and design, and consignment production.

For example, in connection with EVs, models deferent from development and production models for internal combustion engine automobiles are increasing in response to the advanced use of IT by the supply side, and role of finished automobile manufacturers (OEMs) may change from the old-style leader to the so-called platformer. It is necessary to foresee how the conventional activities and areas of OEMs will change, and the roles of special and specialized joint venture companies (in particular, the relationship between Chinese companies and domestic affiliates).

In this research, these approaches started by focusing on the activities of domestic joint venture companies. Unlike existing OEMs, placing products on the market faster than existing OEMs by starting transactions of parts different from conventional parts and establishing a relationship with other companies will be one of the approaches to differentiation for the automobile industry, joint venture companies confronted high barriers to entry into the market, and medium- and small-sized companies. Some of the studied joint venture companies have entered the electric vehicle (EV) niche market (corporate EVs) by importing EVs already sold by overseas OEMs and transforming them into Japanese specifications. What the cases of these joint venture companies imply are the change in the ideal way of EV development and production (procurement), and especially in the case of corporate EVs, the presentation of various relationship models that can exist in different industries, such as between corporations demanding logistics services, etc. and supply service providers. As an interim wrap-up, these models were considered from technical and economic aspects in this research. What become apparent in it is the possibility that the supply of conventional automobiles may not necessarily be the mainstream.

Table: Fabless x foundry initiatives for corporate demand

Customer (corporation)	Fabless	Foundry	Overview
SBSHD	Folofly (Kyoto)	DFSK Motor Co., Ltd.	- Will supply 10,000 compact EV trucks by 2030.
SGHD	ASF (Tokyo)	Guangxi Automobile	- Will supply 7,200 light EVs (export started in 2022).

(2) WG2 [Issues concerning regional renewable energy, power grids, etc.]

WG2 was discussed and studied by the Committee because it was an aspect likely to be excluded from critical points although the renewable energy ratio needs to be increased in the electricity supply system (macro electricity environment) of a whole country. In other words, the ratio of renewable energy generation in electricity by the former nine electric power companies is certainly important, but as the “electricity supply-demand system and market” are changing, the role of the complementary renewable energy suppliers, not limited to the nine major electric power companies (or ten electric power companies including the Okinawa Electric Power Company), is increasing from the perspective of promoting the use of renewable energy by various suppliers, in which only the shift to renewable energy by the former nine electric power companies is not drawing attention. In fact, the relationship between electricity and gas is also confronted with the same issue. Now, the issue of the relationship between them is now transforming into the question of whether it is possible to manage to achieve the green target as a whole through mutual cooperation and complementation beyond competition. This is the reason hydrogen was also touched on this time although electricity was the main point.

Specifically, with regard to the shift to power generation renewable energy, we focused on the potential of regional renewable energy electricity (regional renewable energy power generation and power sales business), and, at the same time, touched on its limits and issues. They are as follows:

- Commitment and issue on the renewable energy power generation mix at the former nine electric powers: We focused on the commitment and issue at Kyushu Electric Power Company, which achieves the highest renewable energy power generation ratio in Japan. Already at present, the reverse power flow from photovoltaic power generation is suppressed depending on the season, and this fact reveals that the problem cannot be resolved simply by calling for renewable energy power generation (taking measures to promote the introduction of renewable energy power generation).

- The potential and issues of regional renewable energy supply companies (suppliers) were investigated and scrutinized.

→ The analysis of the two points mentioned above clarified the higher importance of the “electricity storage” system than before.

- Hydrogen: Although hydrogen is also a gas, it also relates to electricity problems via fuel cells and has both perspectives, as well as the perspective of “electricity storage” in particular when the production of hydrogen is considered. When renewable energy-generated electricity is not immediately consumed or sold, it needs to be stored, but generated electricity will be used for the production of hydrogen, and energy will be stored in the form of hydrogen. However, when economy (to safety) is taken into consideration, there are issues that should be resolved for full-scale and all-embracing introduction, besides potential.

Finally:

- Issues related to renewal/maintenance in regional and photovoltaic power generation, etc.: Much attention is not drawn in general, but in fact, the time is already approaching when a large number of photovoltaic power generation systems need to be renewed/disposed of, and the need for full-fledged commitments to "renewal/maintenance problems and disposal/recycling problems" is increasing. The introduction of renewable energy is not the only factor that contributes to increasing the renewable energy ratio, but these systems must be maintained and enhanced in a sustainable manner in a large cycle, including renewal and other processes. We analyze these issues.

4. Toward the FY2022 (Comprehensive) Research

Although fuel supply management has become a global issue in recent years, measures from both of the automobile manufacturing (mobility) side and the energy supply side are necessary to enhance energy efficiency in the transportation sector. However, no groundbreaking measures to achieve it

still have not been proposed. The automobile manufacturing side, in particular, is required to break away from the conventional parts transaction structure, but both existing OEMs and parts suppliers tend to stick to conventional parts transactions (intra-group and long-term transactions). As described in the FY2021 research, new entry models have been presented, such as flexible partnerships between joint venture companies and other countries, but examples are limited. On the other hand, the reason the shift to electrification has been rapidly progressed in Europe, where the percentage of electrified automobiles and the power generation rate by renewable energy are higher than Japan, is that the entry of not only existing parts manufacturers but also new companies into this field, the establishment of relationships between existing and new companies centered around Fraunhofer (Germany), joint research and development by existing companies, and other factors make a contribution to the development of the parts required for electrification. Of course, the government's policy concerning industrial technology is also accelerating this trend, and it can be inferred as a case in which the shift to electrification will be facilitated through cooperation between companies and the government. Thus, the main objective of the FY2022 research is to attempt to conduct as many field surveys as possible in Europe and have interviews about how technologies, human resources, and ideas of different nature are introduced and integrated in this company cooperation, including approaches to them.

In the FY2022 research in the final year, we will compare the current situation of Japan, etc. with the results to be obtained in the abovementioned surveys in Europe in the light of proposing policies related to Japan's automobile and electrical equipment and electronics industries wherever possible.