EU-Way vs JP-Way Development – Efficient & Effective Development Approach -

Masato (Max) Nakagawa

DENSO CORPORATION , Global Technical Affairs

*Tokyo Office, 2-7-1 Nihonbash, Chuo-ku, Tokyo, 103-6015, Japan**

Hiroshima University, Guest Professor

1-3-2 Kagamiyama, Higashi-Hiroshima 739-8511, Japan

Abstract

This Plenary Speech will cover three elements described as follows; Firstly, "Factory-IoT" technology which is DENSO's globally strategy manufacturing. Secondly, collaboration between Germany and Japan in terms of innovation. Thirdly, "EU-Way" development which is an efficient and effective manner of development. From 14 consecutive years experiences working in Germany, The United Kingdom and the Netherlands, "EU-Way" development will be explained. One of the key points is that in EU they differentiate between "Competition Field" and "Non-Competition Field" in each technical domains. In the "Non-Competition Field", also called a "Cooperative Field", Europeans cooperate together in the same industry sector to create common specifications or to establish standardization so that they can concentrate on differentiated technology in the "Competition Field". This approach is one of the driving forces for development and innovation within EU.

1. DENSO's "Factory-IoT"

1.1 Roadmap of Production System

DENSO is a manufacturing company mainly for automotive components and systems. DENSO started using the single automated manufacturing process like a spot machine in the 1950's. After that DENSO expanded automation to the production line unit and then further expanded to factory unit and now to global unit like a global network.

One of the features of DENSO manufacturing is the in-house development and fabrication of the robot machines since the early 1970's. Figure-1 represents the roadmap of the DENSO production system. DENSO pursuits "DANTOTSU" factory.

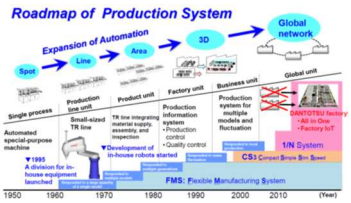

Fig.-1 Roadmap of Production System

1.2 DANTOTSU Factory

"DANTOTSU" originates from DANZEN + TOP in Japanese, meaning Outstanding. DENSO's target of manufacturing is the status of "DANTOTSU factory". By pursuit of "DANTOTSU factory", DENSO respects human development which is a company legacy and in the company DNA.

In addition, DENSO pursues Concurrent Engineering as a foundation of their manufacturing concept.

With respect to Automation and Robotics, DENSO uses automation technology, mainly in Assembly and, Visual inspection processes and for in-plant logistics by using in-house machines and robots. There is however still human-based manufacturing process left for these three fields. DENSO has been working on these fields by using the intelligent technology of robots. One of the features of this technology is "collaborative robots" which means that two-robots collaborate and co-operate each other. It contributes to working efficiency and quality in the manufacturing plant.

1.3 Principle of "Factory-IoT"

It is said that IoT technology is a tool for keeping maintenance of stable production in the field of manufacturing. DENSO's unique point of IoT is that humans are involved in this process. By utilizing human skill and knowledge, sustainable growth and continuous evolution can be achieved. This means that both human and machine can provide the optimal solutions thanks to co-creation by human and machine. DENSO pursuits the "Factory-IoT" technology for all of plants globally by connecting each plant.

2. Collaboration between Japan and Germany

2.1 Example of collaborations

There are several examples of collaboration between Japan and Germany in terms of innovation. One example is that a Germany engineer invented the Facsimile machine in 1929. However it was not popular in the market at that time due to the large size of the machine and high price. TELEX was a tool for communication device until the early 1990's. In Japan, the Japanese language characteristics are so complicated such as Kanji, Hiragana and Katakana with many different characters. Therefore, TELEX is not a suitable tool for the Japanese market and society. This is the driving force for Japanese engineers to further develop the Facsimile machine to make it compact with reasonable price.

Another example is the Rotary Engine for use in automobiles. The Rotary Engine was invented by a German engineer, however it was not mass production. Japanese car manufacture MAZDA developed the Rotary Engine and put into the market.

2.2 Example of Diesel Engine collaboration

The Diesel Engine was developed by Dr. Rudolf Diesel in 1892. His motivation was to develop an Internal Combustion Engine with better fuel consumption compared to the Gasoline Engine. From this viewpoint, his achievement was a big contribution to our society. Especially, in Europe, Diesel Engines account for approximately 50% of Internal Combustion Engines for passenger vehicles. On the other hand, heavy-duty and bus/truck applications are almost 100% powered by Diesel Engines.

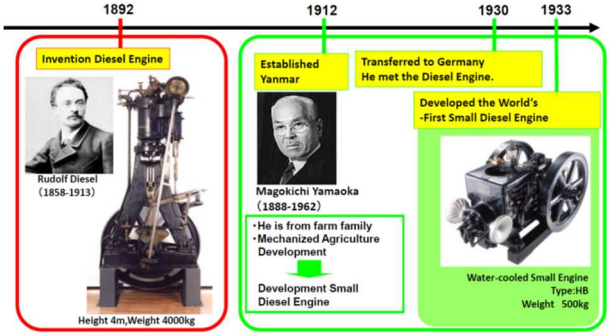

Fig.-2 Diesel Engine Development History

When Dr. Rudolf Diesel invented the diesel engine, the engine size was too big and heavy for small vehicle applications. Mr. Magokichi Yamaoka who is a founder of Yanmar wanted to utilize a diesel power unit for agriculture applications.

1858 Born in Paris (Parents are German)
1870 Transferred to Augsburg-city where his relatives lived in
1880 Graduated from Technical University München with the best performance
1893 Received the Patent for Diesel Engine
1897 World-first serial production Diesel Engine by MAN
1913 Passed away during his business trip to UK (55 years old)

Fig.-3 Dr. Rudolf Diesel Profile

He was born into a farming family in Japan. At that time, machines were not available for agriculture works. All of the jobs were done by human power. He saw very heavy load and work every time and he wanted reduce the human work load by machine. He decided to go to Germany to study the diesel engine to make it more compact and light weight for agriculture applications like

small tractors and combine machines. He developed the world-first small diesel engine for mass-production applications based on Dr. Rudolf Diesel's engine technology. Both engineers contributed to the Internal Combustion Engine for us. Mr. Magokichi Yamaoka received the Diesel Gold Prize by the Germany Patent Agency thanks to his contribution. He donated the Japanese garden in the "Rudolf Diesel Anniversary Park" in the city of Augsburg where Dr. Rudolf Diesel spent most of his life.

Fig.-4 Mr. Mogokichi Yamaoka Profile

Later, the city of Augsburg decided to name streets in the city from Mr. Magokichi Yamaoka's home town in Japan. Nagahama-Alle and Amagasaki-Alle. This is one of the successful and beautiful collaboration stories between Japan and Germany. We should recognize the former engineer innovation spirit.

Fig.-5 Nagahama-Alle & Amagasaki-Alle in Augsburg

3. EU-Way vs JP Way Development

3.1 Comparison between EU-Way and JP-Way

Figure 6 represents the comparison between EU and JP development ways.

This chart summarizes the main features development ways, working styles and business models based on the Automotive sector of Japan and Europe. In this chart, for EU, the German development way is used as a typical example. There are significant and remarkable differences in the EU development way compared to that of Japan-Way. In Germany, there is a clearly two fields of development style. One is "Competition Field" and the other is "Non-competition Field" for development. They co-operation and collaborate among the same industry domains in the base technology field. They establish the common technology field like standardization and/or regulations. Thanks to this system, they can concentrate on their resources on development within the unique technology field. Then, they could create the differentiated technology. On the other hand, in Japan, OEMs develop almost all technologies by themselves. In this approach, they could create unique technology, however, recently there are many new technologies to be developed like Electrification, AI and IoT connect to automobile.

Therefore, there are concerns regarding the lack of resources for the development of their unique technologies.

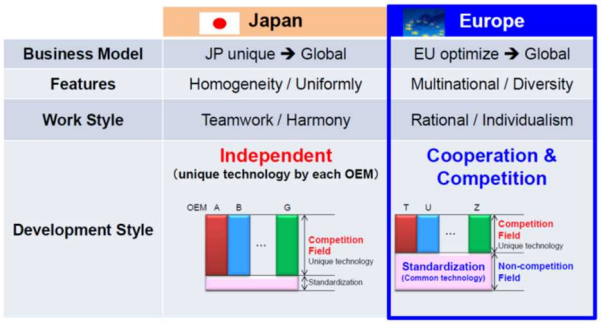

Fig.-6 Comparison of Europe and Japanese Characteristics

3.2 Collaboration Concept between Germany & Japan

There are good points to be learnt from German-Way development. For example, efficient and rational development by using industry standard tool-chains, model base development, cutting-edge simulation automated calibration etc. In addition Germany OEMs cooperate with R&D Engineering companies for their vehicle and engine development in not only the research phase but also for application engineering. There are remarkable R&D Engineering companies in Europe who have sophisticated development tools, testing facilities and high-talented engineering resources. In Japan also, there are good points for their development way like teamwork and harmonized development approach with dignity.

Fig.-7 Collaboration Concept between Europe and Japan

The key point is to respect each other of their development ways, then reflect and accept the good points into their development ways. Figure 7 represents the concept of collaboration between Europe and Japan. The important point is that both good points to be well-arranged like a fusion. In this case, a new development way which is a fusion between Europe and Japan could become a global competitive engineering approach.
Both parties should respect their development ways and inspire each other in research and development fields.

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