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**MESSAGES FOR RAILWAY SYSTEMS
BASED ON 30 YEARS' EXPERIENCE
OF JAPANESE NATIONAL RAILWAY
PRIVATIZATION**

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Abstract

The paper provides information for railway systems based on 30 years' experience of Japanese railway privatization. First, we introduce the background, framework, and result of the Japanese National Railway reform, especially from the perspective of the former president of the JR Kyushu Railway Company. We explain the challenges, such as diversified businesses and employee capacity building, that the company faced during that time and the creation of the business foundation in preparation for the transformation into a private company. We also discuss the tasks of the railway, including the freight transport of the high-speed railway (the Shinkansen logistics), as well as the population decline and aging society in Japan and their relationship with the railway system. Last, we summarize the implications of Japan's railway experience for a broader railway system. The high levels of safety and efficiency of Japan's railway system are based on the railway culture (hard, soft, heart) and the Japanese nationality. The railway system is extremely important for long-term economic development. In addition, we introduce the PPET Railway-ology, which integrates philosophy, politics, economy, and technology. The paper crystallizes years of railway experience and offers valuable lessons for the development of railway systems worldwide.

Keywords: railway system, railway company privatization, JR Kyushu Railway Company

JEL Classification: R4, R41

Contents

1.	EXPERIENCE OF THE JAPANESE NATIONAL RAILWAY REFORM.....	1
2.	FUTURE TASK OF RAILWAYS.....	3
3.	MESSAGES TO THE RAILWAYS.....	7

1. EXPERIENCE OF THE JAPANESE NATIONAL RAILWAY REFORM

The railway business in Japan was hit by the recession in the 1960s. Due to the rapid development of the Japanese economy, based on the boost of the railway, the Japanese were able to afford private cars. In addition to the popularization of air travel, railway use for both short- and long-distance travel declined. Railways were defeated in the service competition. In 1964, when the world-renowned Shinkansen opened, the JNR fell into deficit for the first time, which is an ironic contrast.

Eventually the situation became one of serious deficit and debt. In 1987, the government implemented a reform of the JNR. The reform basically consisted of divisionalization and privatization. The JNR was divided into six regional passenger companies and one freight company without rail infrastructure. About 100,000 employees were dismissed, leaving a total of 180,000 for the seven companies.

The state took over the past debt obligation. Among the six passenger companies, the three big companies with a larger scale on the mainland enjoyed a surplus; on the other hand, the three small companies, namely the companies for the three small islands, with a scale of less than one-tenth of the bigger companies, faced a deficit, as shown in Table 1. For revenue adjustment, the three big companies took on a partial debt burden while the three small companies were given support funds. However, this did not work well due to a sudden fall in the interest rate, and the three small island companies faced many difficulties. Mr. Ishii worked for fifteen years as the first president and chairman (CEO) of the JR Kyushu company, one of the three island companies. When he took charge of the company, he started to create the business foundation for the transformation into a private company.

Table 1: Passenger Companies after Japan's National Railway Reform

Company	East	Tokai	West	Hokkaido	Shikoku	Kyushu
Fund (billion yen)	N/A	N/A	N/A	6,822	2,082	3,877
Debt (billion yen)	35,936	5,217	12,832	745	261	801
Capital (billion yen)	2,000	1,120	1,000	90	35	160
Year of Stock Listing	1,993	1,997	1,996	N/A	N/A	2,016

In the privatization of JR Kyushu, the privatized image was enhanced by several strategies, including increasing the number of stations and the frequency and speed of trains, improving the design of the trains, and operating sightseeing trains. Though it successfully created the brand of "Beautiful and Happy JR Kyushu," it would be forever in deficit if the railway business alone was in focus. Therefore, a wide variety of diversified businesses were introduced, including real estate development, the construction of mansion and station buildings, food and beverage businesses, retail, service, tourism and leisure businesses, and so on (Figure 1). The profit from the diversified businesses made up the deficit of the railway successfully (Figure 2). International high-speed shipping routes utilizing close points to the Republic of Korea were also in the business scope.

Figure 1: Diversified Businesses

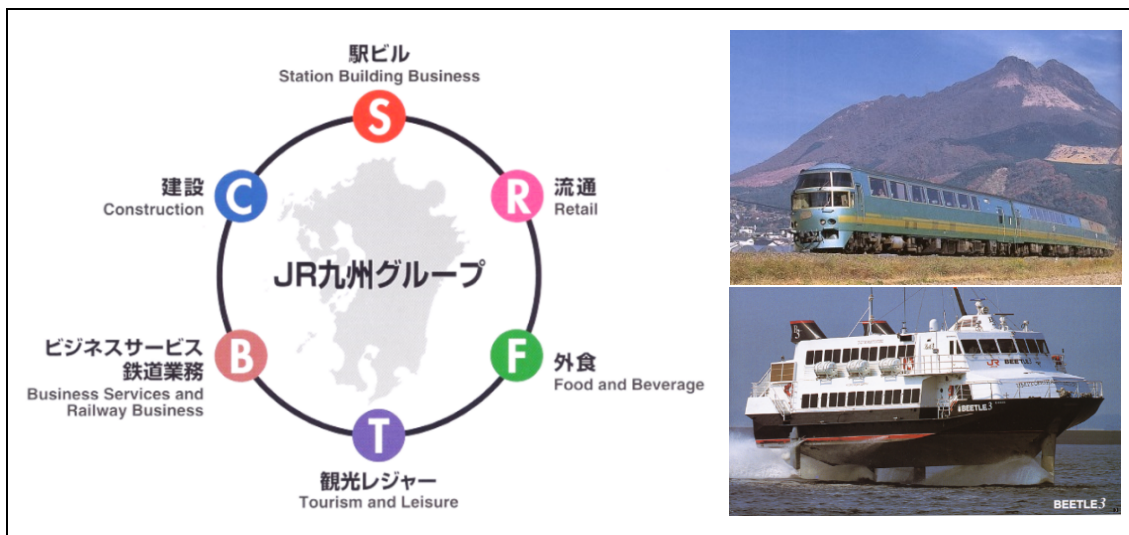
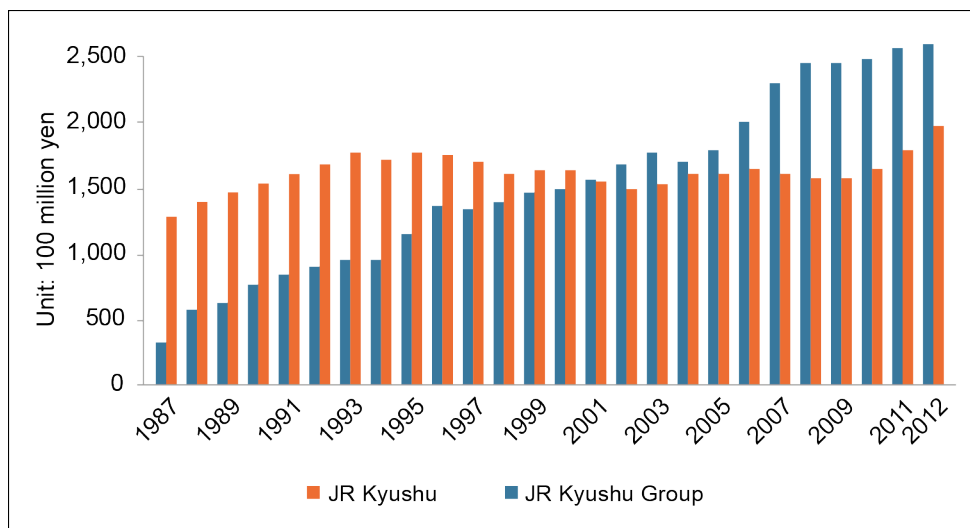
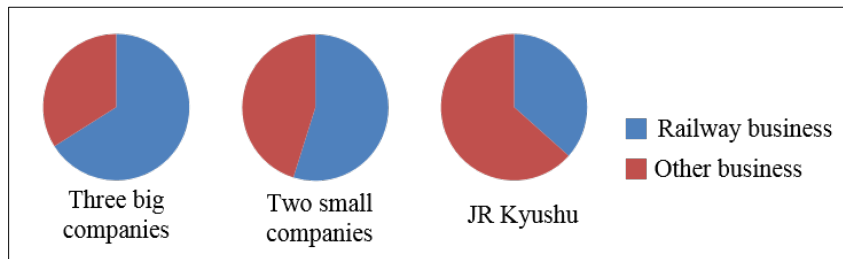


Figure 2: Sales Progress of the JR Kyushu and JR Kyushu Group Companies



It is hard for railway staff to compete with people in existing businesses in the non-railway field. To support the diversified businesses, the company adopted two strategies. First, it sent on-site employees to small and medium-sized private enterprises for about two years to learn the severity and know-how of the sector. Second, it allowed excellent mid-level executives to take charge of the diversified businesses other than the railway to clarify the responsibility of the same-level position in the railway. These two JR Kyushu-only strategies succeeded. After the privatization, the three big mainland companies were listed, while JR Kyushu was the only company of the three small ones to be listed, though it took 29 years more. Following the JNR reform, the business prospects of the other two small companies and the freight company are not yet clear. There are also system problems, such as the fact that there are no organizations to discuss nationwide, passenger, and freight issues in combination because of the absolute separation of the seven companies after the privatization.

Figure 3: Business Composition of the JR Companies

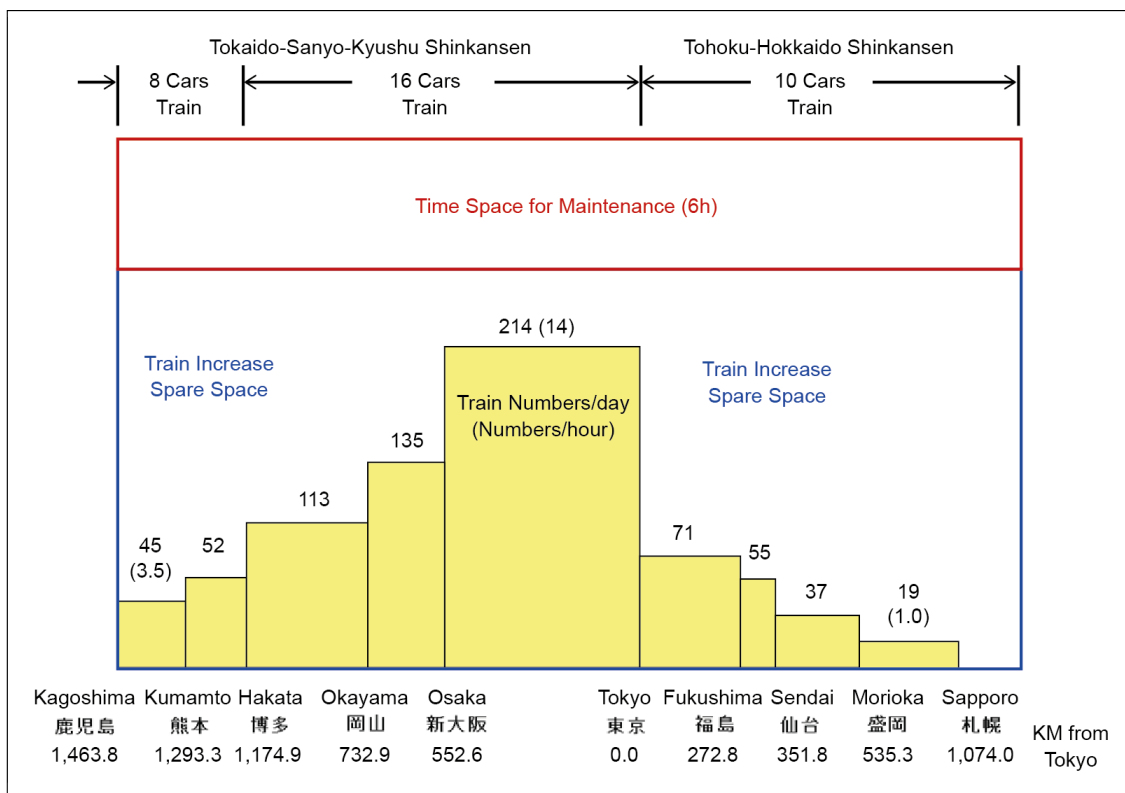


2. FUTURE TASK OF RAILWAYS

Considerable changes have happened in the last 30 years. From Kyushu to Hokkaido, the Shinkansen has become the aorta running through the Japanese islands. The total length of the network is about 2700 km as of 2018.

Schedule-wise, for the central part of the system, 14 trains operate per hour, while, at both ends, there are only one to five trains per hour. There are no trains for 6 hours (for maintenance) late at night, and this has remained unchanged for the past 50 years (Figure 4). The profitability of the Shinkansen is low for regions with a low population density if only passengers are targeted. Therefore, the companies are considering freight train operation in this vacant time zone.

Figure 4: Planned Train Numbers/Hour of Shinkansen



There are two models for freight Shinkansen. The first one is the Shinkansen Freight Train, which utilizes containers (Model A, Figure 5). At the northern end of Honshu Island, the containers are transported by automated equipment from narrow-gauge conventional trains to specialized standard-gauge Shinkansen trains and then sent to the Channel Tunnel and Hokkaido. The other one remodels the old Shinkansen trains to carry the Roll-Jit-Box (Model B, Figure 6). Boxes are arranged in order inside the cars. The latter is easy to implement due to the relatively low investment. Either model can transport freight in one-third of the time of the narrow-gauge conventional line and the expressway. Nowadays, it is difficult to ensure the supply of long-distance truck drivers. In addition, the railway has the merit of one-seventh of the CO₂ emissions and one-tenth of the energy consumption of trucks.

Figure 5: Model A: Shinkansen Container Train

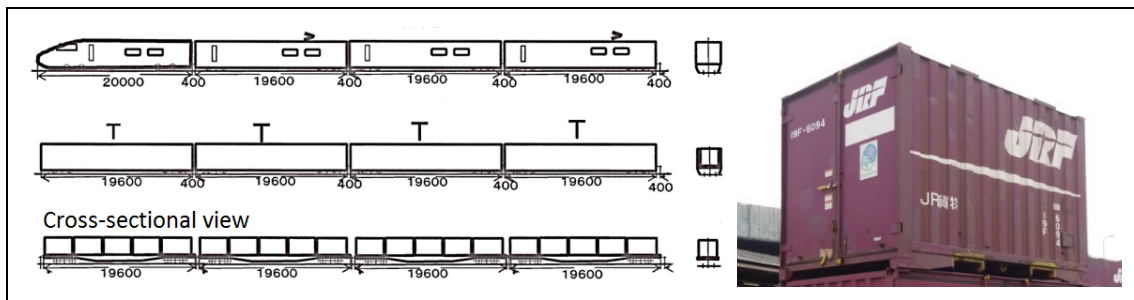
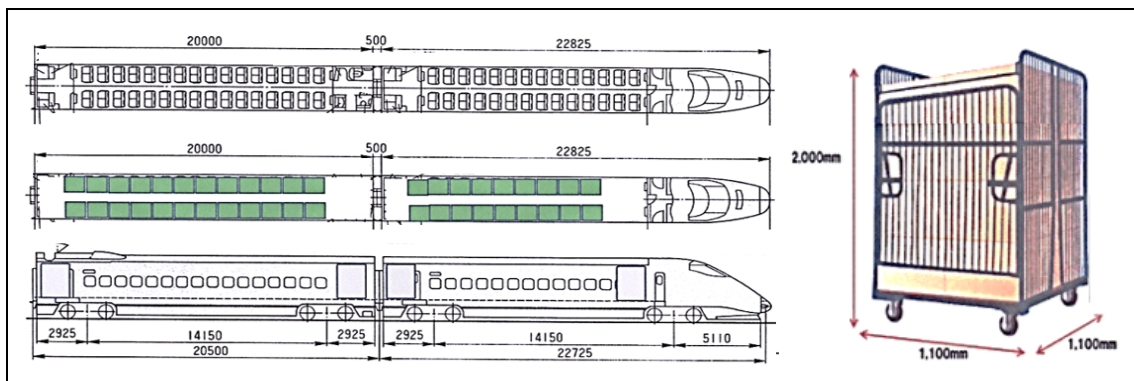
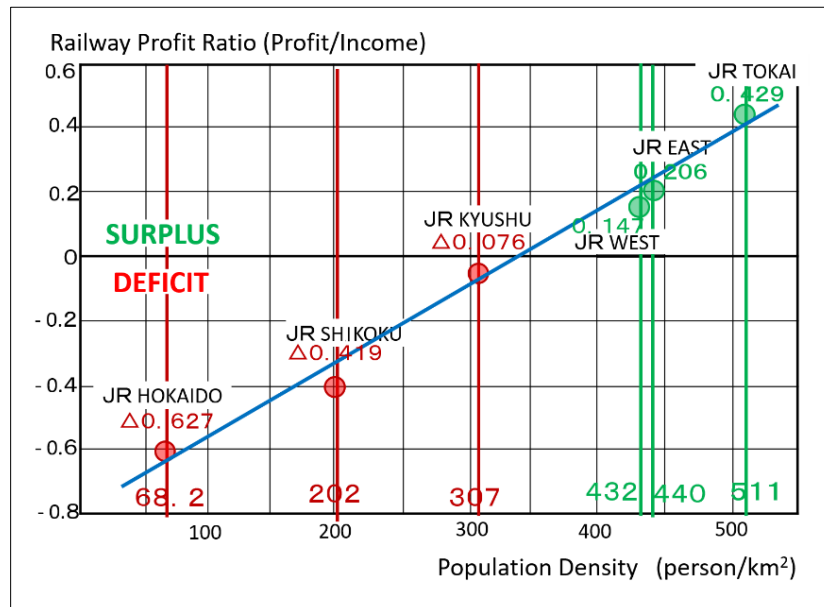


Figure 6: Model B: Roll-Jit-Box Transport



Let us think about the characteristics of railways based on the knowledge gained from 30 years' experience of the breakthrough privatization. The profit ratio of a passenger railway is perfectly proportional to the population density (Figure 7). Although the proportional multiplier will change on the basis of a country's characteristics, such as its GDP, the law is universally applicable. In Japan, the railway is in surplus for areas with a density of over 350 people/km² and in deficit for areas with lower density. This is the reason why the railway substructure, like tracks and train transportation, is vertically separated in Europe, with a low population density. The vertical separation of the railway does not seem like a relationship between roads and cars, because a railway is an integrated equipment industry. Although Japan did not adopt the separation, it may be a future problem considering the ongoing population decrease, and the situation could be the same as that in Europe after 35 years.

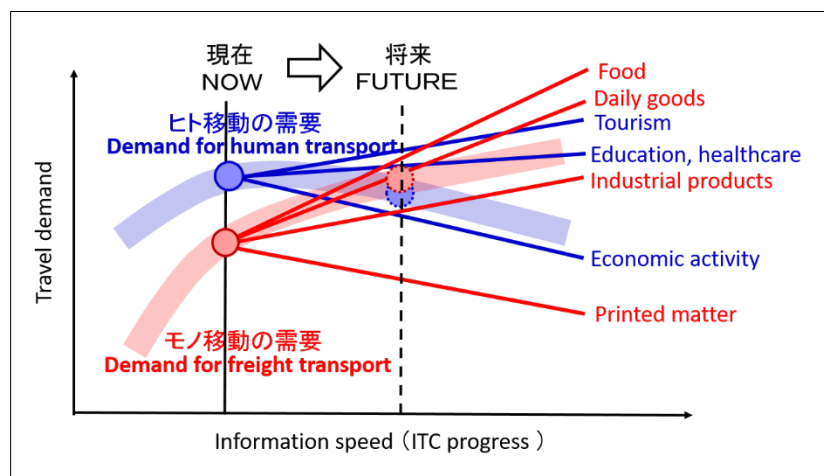
Figure 7: Railway Profit Ratio of JR Companies (as of 2015)



Japan is facing problems of population decline, birthrate decline, an aging society, and depopulation in rural areas. The faster the passenger transportation is, the greater the population concentration in metropolitan areas and the depopulation in rural areas will be. Conversely, freight transport promotes the localization of the population, so in that sense it is important to accelerate the freight transport.

Due to the rapid development of ICT (Figure 8), the need for human mobility is decreasing but the need for logistics mobility is increasing. Strengthening logistics is the trend of the times. Especially for large countries (India, etc.) and elongated countries (Japan, etc.), railway logistics is a necessary strategy for economic development. The development of ICT will deeply affect the speed of information dissemination, which will have an influence on the economy, the population transition, and the quality of life. An integrated transport system that considers the HSR strategy for both passengers and freight is necessary. While developing the hub ports and hub airports, it is also important to improve the domestic railway logistics.

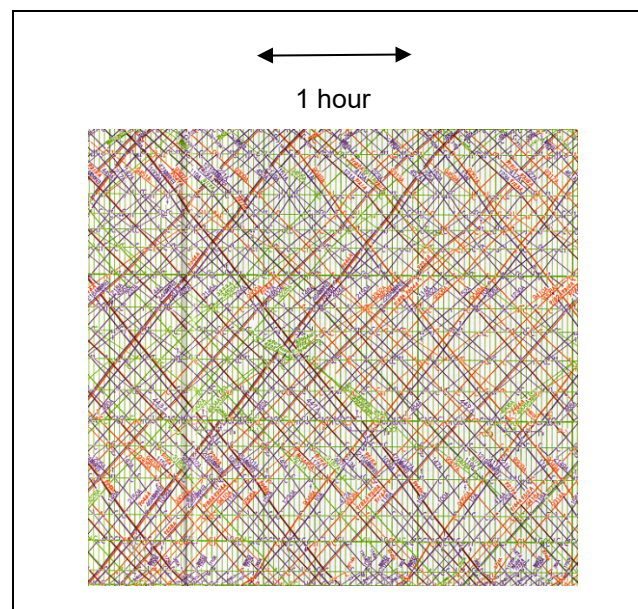
Figure 8: Forecast of the Hard Demand for Human and Freight Transport



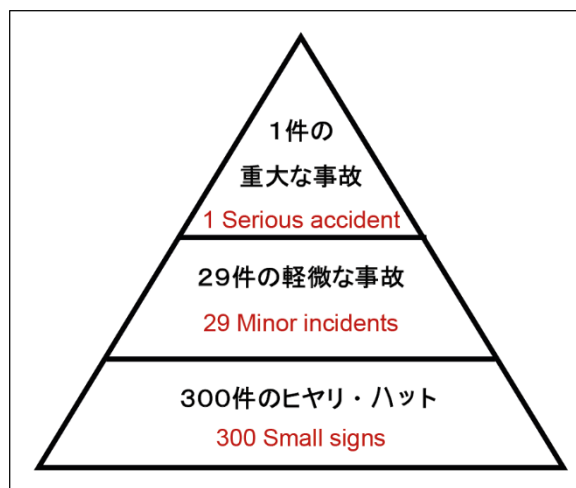
The era of the second-stage reform of the JR Group is approaching, as Japan is undergoing a time of slow growth and depopulation. The experience of such a series of railway growth, maturation, decline, reform, and second stage in Japan will be helpful for countries that are entering the development period.

In particular, we believe that Japan is very advanced in the world due to the Shinkansen technology, which connects medium distances at high speed, and the precise transportation system of large metropolitan areas, such as Tokyo. The Tokaido Shinkansen trains run almost every four minutes. Tokyo metropolitan commuter trains run almost every two minutes (see the Tokaido Shinkansen diagram in Figure 9). The figure shows the fabric's fiber, and each fiber is actually one diagram for one train. High frequency while maintaining high safety and accuracy is the proud feature of the Japan railway. In realizing it, it is very important to ensure the meticulous hard-and-soft work and even the hearts of the workers, that is, to have highly motivated and skilled employees. Furthermore, it is important to foster a sense of trust in the railway among the citizens, who are customers as well, and to create morals for railway use. The achievement of a safe and punctual railway system in Japan is based on the cooperation between railway employees and citizens who are customers, which is a credit to the Japanese nationality.

Figure 9: Tokaido Shinkansen Diagram



Heinrich's law applies to accident management (Figure 10). Behind one serious accident lie 29 minor troubles (incidents), and, behind the incidents, there are 300 "near misses" (small signs). If 300 "near misses" occur on a daily basis and companies take countermeasures, they can avoid 29 minor troubles and one serious accident. Accordingly, the employees' serious attitudes toward precise work and honest reports are important. In this regard, the Japanese are very cooperative.

Figure 10: Herbert William Heinrich's Law

The cooperation of local residents along the railway is also necessary. Though the railway dramatically modernizes the living conditions in rural areas, there are still opponents who worry about losing their vested interests from a long time ago. The companies should persuade them that all local residents will benefit rather than only some privileged classes. Moreover, they should incorporate measures that really benefit local residents into the implementation. Japan found it difficult to acquire land along Shinkansen lines. On the opening of the Tohoku Shinkansen line, due to the delay in the land acquisition, there was a temporary opening at the Omiya Station for three years, which is just 26.7 km from the current starting point, Ueno Station.

3. MESSAGES TO THE RAILWAYS

The full-scale development of railway infrastructure is the most important national project, especially for Asian countries. As everyone knows, high-frequency mass transport and high safety and accuracy are extremely important for railways. As mentioned above, Japan has accumulated know-how based on its achievement, and we are confident that it will be useful for other countries as well.

There is a belief that the standard Shinkansen train in Japan will be the best model when introducing a high-speed railway, considering the economic conditions, even if it is not the best in terms of maximum speed. The manufacturing of railway cars is not an automated industry, different from the automobile industry, but a labor-intensive industry with various detailed designs for each car. Therefore, it is necessary to assign the important parts to skilled workers. After cultivating skilled workers in Japan, the next stage is the realization of domestic manufacturing as well as possible future exports. The railway can be utilized as a tool for economic exchange and peaceful diplomacy in the future.

The improvement of large-scale, high-speed freight transportation between major domestic bases, particularly industrial, agricultural, and mineral regions, and important export-related ports will greatly influence the future economic development. On the American continent, 200 years ago, due to the intention to connect the east and west coasts as soon as possible, many curves were built into the rails, making long-distance freight transport on the railway system very difficult now.

It is important to keep in mind not only passenger transportation but also freight transportation when improving the speed and convenience of conventional railways. In the case of Japan, the improvement focused on passenger transportation shortly after World War II. This may be because the country is surrounded by the sea, but some reflection on the development history is necessary.

The improvement of over 20,000 km of conventional lines is also a major issue. Recently, the Japanese conventional lines seem to have been improving; they were a problem for commuters in the Tokyo metropolitan area for about 5 years after the war in 1945. Due to the limited capacity, commuters could not board the trains. As countermeasures, cheap cars were supplemented and more employees were recruited to resolve the worst situation in those 5 years.

The distance between rails (gauge) is important for railways. Countries around the world use different types of railway gauge. Very often, routes with the same gauge width become one economic route or sometimes an economic zone, as a direct connection between gauges is impossible. Moreover, once complete, it will be a super long-term economic zone that lasts for 100 years or 200 years. The Russian Federation’s “Siberian Railway” is a 5’ (1,524 mm) wide-gauge economic zone, while the People’s Republic of China’s “One Belt One Road” is a standard-gauge economic zone. The railway gauge issue deserves special attention when making a long-term development plan.

Finally, we would like to propose the Railway-ology, which summarizes our understanding of and perspectives on the railway system based on 30 years’ experience. We believe in the necessity of comprehensive railway science that integrating technology (T), economy (E), politics (P), and philosophy (P) (Figure 11). Comprehensive railway study at influential universities and institutions is important for research improvement, policy making, and human resources development.

Figure 11: Railway-ology: PPET Railway System

