

Domestic Transportation in Japan – Present and Future

The transport market of a country is sometimes not easily understood by outside observers. Japan's *Shinkansen* and the French TGV (High Speed Train) are famous but few people know exactly how these high speed trains function within the economies of these countries. Japan's domestic transportation market is, like in other industrialized countries, extremely competitive. Railways are struggling for survival in a fiercely aggressive environment. The theme of the special feature in this issue is "Japan's domestic transport system". Views and insights have been contributed by individuals from the academic and governmental spheres and from people within the railway industry. In addition, we have a contribution from a slightly different standpoint by a British researcher on current issues affecting Japan.

Japan's Transport Market – Railways as a Major Player

Yataro Fujii

Transportation systems in any country have factors common to the same socio-economic developmental stage, and unique factors depending on the natural and social environment. Unlike in the West, Japan's railways play a major role in the domestic transport market.

1. Natural and social environments

Japan consists of a long archipelago stretching from northeast to southwest. The major part of the country is the main island (Honshu) and three smaller islands connected to Honshu by long bridges and tunnels. The extreme tips of these islands are approximately 3,000 km apart by rail. If Japan were placed in Europe, it would stretch from Stockholm, across Western Europe, to the Pyrenees.

Japan falls between Britain and France in terms of size (378,000 km²) but its population (120 million) is twice that of Britain or France. Steep mountains, including 21 higher than 3,000 m, run down the spine of the islands. Most cities and industries are found in a belt along the coast.

The steep mountains and rapids prevented early development of road traffic. Unlike in the West, there was no age of horse-drawn coaches partly due

to the natural environment and partly due to the restricted bridge construction during the feudal period. The belt-like development of cities and industries along the coast led to the formation of markets that were ideal for railways and coastal shipping. The country's mountainous land separated by straits also contributed to the rapid progress of civil aviation in Japan.

The largest metropolitan area in Japan is Tokyo. Over 8 million people live in Tokyo alone and 29 million people live within a 50-km radius. In short, nearly one quarter of Japan's population live in this area. The second-largest metropolis is Osaka with 2.5 million people living in the city and 16 million within a 50-km radius. Eleven cities including Tokyo and Osaka have populations over 1 million.

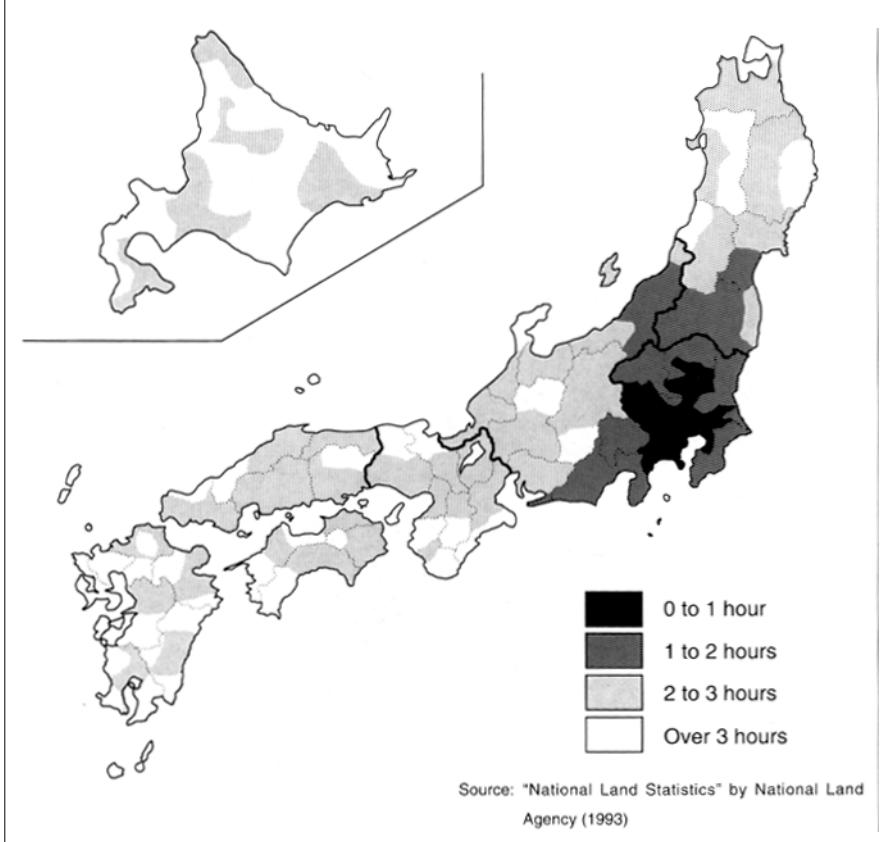
Post-war Japan achieved rapid economic growth starting in the 1960s. The population and economic activities centralised in large cities, particularly Tokyo, in the process of growth. Resi-

dential areas sprawled outward, and people living in the suburbs now spend 1 hour on average, commuting one way to the city centres. Congestion is an everyday phenomenon and the traffic is always overcrowded.

To correct the regional disparities resulting from excessive centralisation in Tokyo, Japan has established a policy of shifting from centralisation to multipolar distribution. Under this policy, various measures have been taken to consolidate rapid transport systems (*Shinkansen*, motorways, and airports) on a nationwide scale. Figure 1 shows the travel times from Tokyo to various places in Japan. At present, people can travel to nearly 70% of local areas within 3 hours including access time. However, the decentralisation policy has not yet created the intended results and centralisation of population in large cities is actually accelerating.

2. Changes in transport market

Figure 2 shows the contributions of various modes of transport to the domestic market in major countries. As far as the passenger service is concerned, the single most unique aspect of the traffic in Japan is the high contribution ratio of the railway. The ratio was 82% in terms of passenger - km in 1955, and fell below half the original ratio to 35% after nearly 40 years. Nevertheless, it is still high compared to railways in the West. The second unique aspect is the high share of civil aviation. These

Figure 1 Travel times from Tokyo

aspects reflect the natural and social conditions of the country.

Unlike the passenger service, the railway has a very low contribution ratio for freight transport in Japan. The ratio is lower than the railways in Europe. It fell drastically from 53% in terms of tonne-km in 1955 to only 5% today. The second unique aspect is the big percentage of coastal shipping, although marine cargo is limited to oil, ore, cement, and other bulky goods.

The current transport infrastructure in Japan consists of 20,000 km of railways (including 1,800 km of Shinkansen) operated by the six regional passenger companies (JRs) that once formed the Japanese National Railways (JNR), 600 km of subways in 9 cities, 2,900 km of railways operated by 15 major private railway companies in large cities, and 3,400 km of railways operated by about 100 local private railway companies in rural areas (including tracks abandoned by JNR).

Japan has 5,500 km of motorways, 500 km of urban motorways, 47,000 km of national roads, and a total of 1 mil-

lion km of national and local roads. Major cities are connected by air via about 90 airports.

Railways

The first railway in Japan was built in 1872 by the government. Many railways were built later by private companies throughout the country. Then, in 1906, all the inter-city trunk railways were nationalised. The ownership was changed after World War II from the government to a public corporation. This lasted until 1987 when JNR was split into several private companies.

The initial construction of railways owed much to British technologies, including the narrow-gauge (1,067mm) tracks. But the standard gauge (1,435mm) was preferred for subways and private railways in urban areas built later. The *Shinkansen* runs on standard-gauge tracks. Some conventional narrow-gauge tracks were later converted to standard-gauge tracks allowing *Shinkansen* through trains to run on them.

As explained above, Japanese railways

play a far more important role in passenger transport than elsewhere, but their share of domestic freight transport has fallen drastically over the past decades. It plummeted due primarily to the growth of rival modes of transport, energy conversion (from domestic coal to imported oil), and the change in the traffic structure accompanying the country's economic growth (from heavy bulky cargo to high added-value small lightweight cargo). Frequent labour disputes in the 1970s also impaired the reliability of railway transport, which was replaced gradually by mushrooming road transport companies.

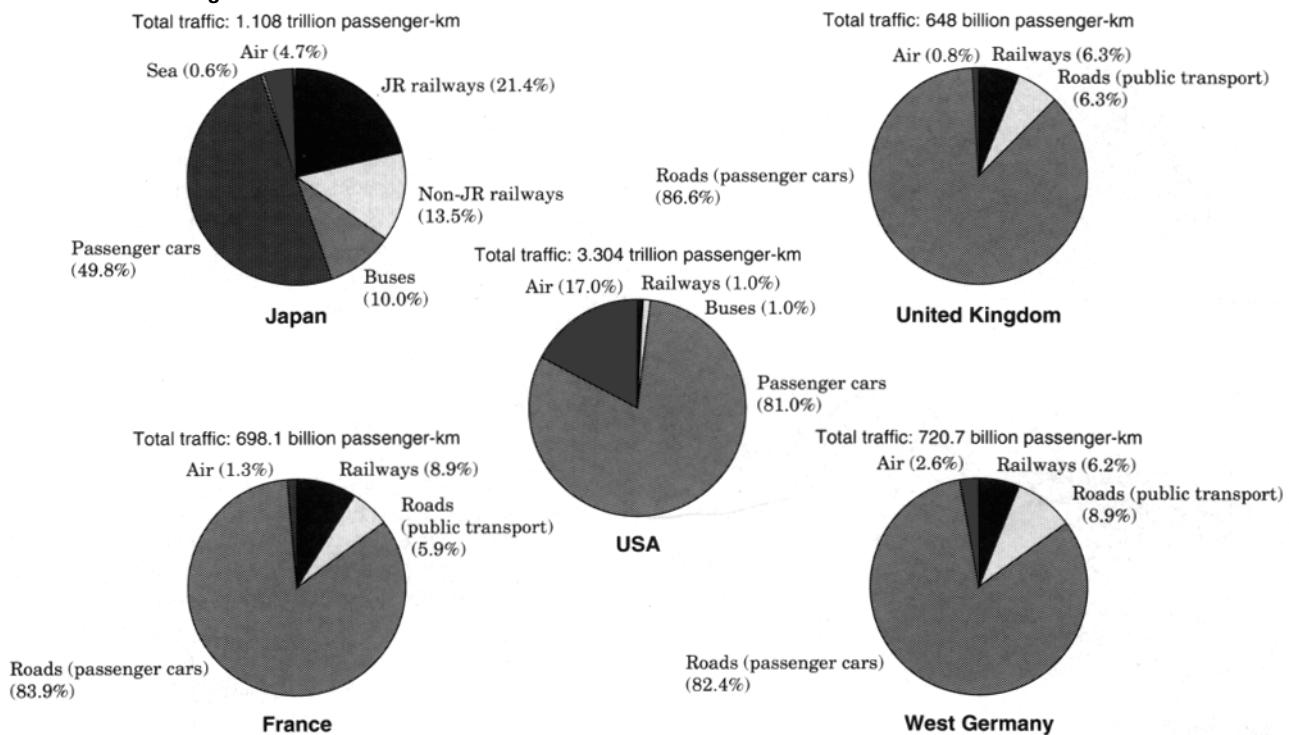
On the other hand, passenger transport by railway saw a completely different development. The rapid increase in competition between different modes of transport reduced the railway's competitiveness to medium-distance travel on trunk lines, commuting, and moving about in urban areas. When the first *Shinkansen* was completed in 1964, there was public pessimism about railways competing with the rapidly-growing road and air transport. But the "bullet trains" soon proved very competitive and inspired revitalisation of Japanese railways.

One prominent feature of the passenger market in Japan is the important role played by private railway companies in large cities. Figure 3 shows they carry the same passenger loads as the JRs in large cities. For example, central Tokyo is served by subways operated by public corporations. Suburban areas are served by private railway companies along with JR East. Many of their lines are connected directly to subway systems, serving through runs. The private railways are presently trying hard (with little government subsidy) to build new tracks or introduce quadruple-tracks to increase passenger capacities.

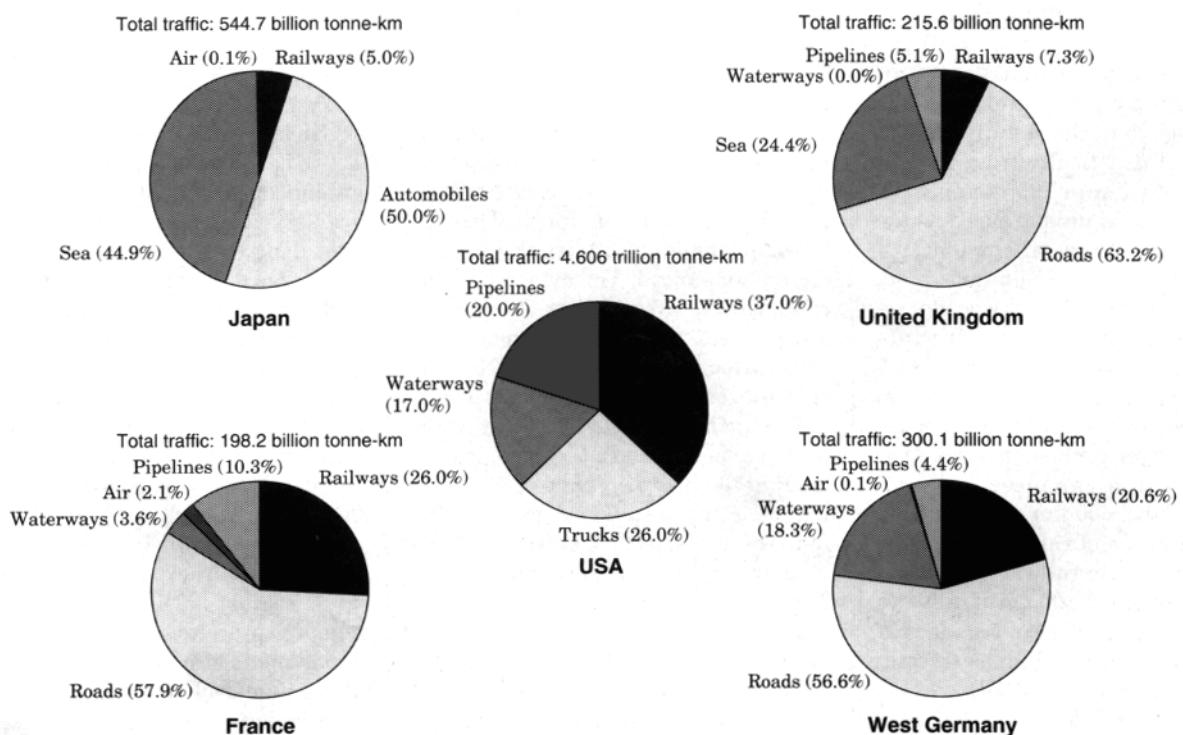
The ridership alone does not fully reflect the importance of the private railway companies in the development of urban areas. They are also engaged in a wide variety of activities including housing projects and management of department stores and supermarkets along their railways. In fact, the private railway companies are dedicated primarily to regional development projects including railway operation.

Figure 2 International comparison of modal split (1990)

– Passenger traffic



– Freight traffic



Sources: Government statistics of each country



■ Tokyo International Airport Courtesy: *Kotsu Shimbun*

This is endorsed by the fact that the railway business represents only 50% on average of their total income. For example, a new housing project was completed by one of the private railway companies in southwestern Tokyo and is now home to more than 400,000 people.

Roads

Roads in Japan were undeveloped until fairly recently. There were enough roads in terms of quantity, but quality was very poor due to the natural and social environments mentioned earlier. A World Bank delegation visiting Japan in the mid-1950s about loans for building motorways was often quoted as saying Japan was full of roads-to-be.

Two measures were taken to correct the situation: the Fuel Tax introduced in 1954 as a source of funds to improve roads using 5-year rolling plans; and the toll system on motorways to build a nationwide motorway network. These measures were effective, but the overall quality of Japanese roads is still low compared to the West. Congestion is common in large cities and the roads are often vulnerable to natural disasters. Environmental issues are also a concern.

Motorways are important in competing in the traffic market. Since the first motorway was completed in 1964,

Japan's network has increased to 5,500 km over 30 years. The plan calls for building 14,000 km of motorways in total, and approximately 250 km are being completed each year recently. The plan is being executed on a geographical basis so that anyone can reach the nearest interchange within 1 hour in all parts of the country. Most large cities are now connected by motorways. Motorways only represent 0.5% of the total roads in Japan in length, but their contribution ratio is as high as 10% in terms of vehicle-km.



■ Truck congestion Courtesy: *Kotsu Shimbun*

The single unique aspect of the motorway construction in Japan is the pooled toll system. The pooled tolls are used to build the national motorway network. Construction of motorways is financed primarily by government loans, and the loans are repaid over a predetermined period (30 years in principle) using the toll revenues. The national subsidy only represents about 3% of the annual expenditure on motorways. The construction cost of the first motorway completed 30 years ago has already been paid by tolls, and the tolls from that part of the motorway network are being used to expand the network.

Some large cities in Japan have their own network of motorways. The users of these urban motorways must pay tolls determined in the same way as the inter-city network. They are fairly high and also play some role as a "congestion tax". In the case of Tokyo, the largest drawback of its road system is that loop motorways are yet to be completed. Vehicles originating outside Tokyo and going to places other than Tokyo are often forced to drive through the city centre for lack of adequate bypasses.

Civil aviation

When jets were introduced to Japan's skies in the 1960s, civil aviation deprived the railways of long-distance travellers. One of the busiest domestic air routes in the world today is between

Tokyo and Sapporo. However, as faster trains are introduced, they are often preferred by some passengers to air travel.

Five-year plans were introduced in 1967 to improve the airport network. Airlines are required to pay landing fees and the Jet Fuel Tax as sources of funds for airport improvements. But the ear-marked funds are insufficient and small national subsidies, slightly larger than the amounts for motorways, are provided by the country. More recently, a self-accountability system has been introduced when building airports in large cities. The New Tokyo International Airport (Narita) was built and is operated by a public corporation under this system. The Kansai International Airport in Osaka, scheduled for completion in 1994, will be run by a stock corporation partly owned by the private sector. To minimize environmental problems, Japanese airports are under strict regulations in terms of operating hours. The Kansai International Airport will be the first airport in Japan operating around the clock because it is built offshore. The work to build additional runways at Narita has been suspended due to conflict with the local commu-

nity. Consequently, it is unable to meet the demand from foreign airlines.

Civil aviation was strictly controlled during the post-World War II reconstruction period to protect the industry in infant stages. The number of airlines was limited to three in 1967 and their route rights were fixed. However, as the aviation market has expanded after partial deregulation in 1987, they compete with each other on more routes. But airports in major cities are operating at full capacity and further deregulation is unlikely to allow new entrants. The airline companies are subject to price regulations which enables them to produce profits from domestic services and to cross-subsidise part of these profits to their international operations. Nevertheless, the government has taken some steps towards gradual deregulation.

3. Investments in railways

Investment by JRs and other private railway companies

Investment is creating controversial problems in the Japanese railways from the standpoint of the traffic market as a whole. The first problem is related to the investment policy between

railway companies.

JNR was privatised in 1987 and was divided into six passenger railway companies and one freight railway company (commonly referred to as JR's).

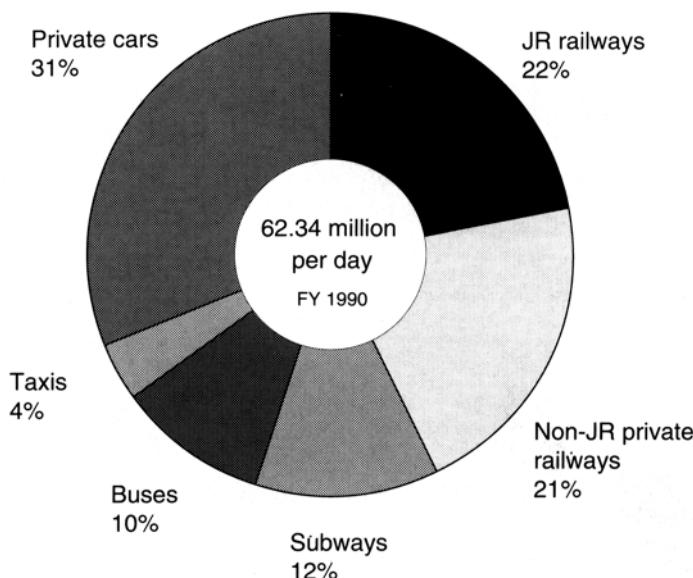
On the occasion of privatisation, rural JNR lines operating with deficits (3,200 km in total) were abandoned before privatisation. At the same time, the number of employees was reduced (from 276,000 to 215,000). The new JR's were excused the huge debts that JNR had accumulated. (Of the ¥37.1 trillion deficit, the new JR's inherited ¥14.5 trillion directly belonging to the inherited facilities at their book values, and all other liabilities were handed over to a settlement company, remaining to fall on taxpayers.) These remedies substantially reduced the burden on the JR's.

Fortunately, the booming Japanese economy after the privatisation had a positive effect in terms of demand. The single most important effect was the improved morale of both labour and management. Their market-oriented business efforts are worth attention. For example, although they placed major emphasis on rapid trains between large cities, they also introduced frequent services between medium-size cities in local areas using a small number of cars per train. This greatly helped to boost the railways. The JR's have not raised their fares during the past 6 years following privatisation. The other private railways have raised their fares twice in the same period.

Nevertheless, the JR's have restricted their investments other than in safety improvements and introduction of new cars. They, in general, are operating under a policy that limits their investments in the infrastructure to such an extent that they are within the range of normal depreciation. It is only natural for the relatively-young, reborn JR's to be cautious about large investment in capital equipment.

However, in this regard, one cannot neglect the fact that the continued investment by the former JNR in building quadruple-tracks, especially in the Tokyo area, since the 1960s is proving extremely useful today. The lines in large cities, especially Tokyo, are the largest contributors to the railway companies. The brisk financial situation of the JR's

Figure 3 Contribution levels of different modes of passenger transport in Tokyo



today owes much to the capacities of the infrastructure that JNR created in the past so as to be ready for an increase in passengers and to be able to develop new demands. Ironically, it was these long-range investments that were criticised as pressing the former JNR financially. At present, new *Shinkansen* lines are under construction as national projects. However, the cost sharing between government, local authorities and JR's has not yet been finalised.

The non-JR private railway companies in large cities are now investing in quadruple-track train operations to reduce congestion and provide more comfortable rides for long-distance commuters whose numbers are increasing constantly. Their recent investments are more than twice the depreciation on average, quite contrary to the JR's investment policy. In fact, the private companies quoted the increased capital cost as the main reason for raising fares last time. The present rules governing railway fares (full-cost pricing regulations) lack consideration of investment.

Separation of infrastructure from operation

One way of solving the investment problem of railways is the separation of infrastructure from operation. Such separations have been seen in individual cases in the past, but the first systematic separation of infrastructure from operation was the Japan Railway Construction Public Corporation established in 1964. It is a group of railway engineers with a fund procurement function that constructs new railways with government loans and then either sells or leases them to railway companies on long-term installment plans. Part of the *Shinkansen* was built by this system. In addition, when the former JNR was divided into the JR's, the *Shinkansen* Holding Corporation was formed and all the *Shinkansen* lines were handed over to the new corporation which leased sections of the *Shinkansen* lines to the regional JR's. However, the leased sections were later sold to the JR's to prepare for listing on the Tokyo Stock Exchange.

The separation of infrastructure from operation in Japan was designed to promote investment, not to provide open

access for competition. In other words, it was designed to facilitate easier financing to reduce the risk for railway companies and to spread the burdens of capital costs over a longer period. At the same time, it also ensures equal footing for competition with road transport and civil aviation which already benefit from the separation of infrastructure from operation.

With the skyrocketing costs of construction and purchasing land, new railway infrastructures are now usually built by the third sector through joint funding with government, municipalities and private sectors and are then operated by the JR's and other private railway companies.

Total adjustment of investment

The second problem in railway investment is related to the relations with the infrastructure of other modes of transport. As discussed earlier, 5-year rolling plans are used for road, airport, and harbor construction projects, and they are implemented with earmarked sources of funds. The railways do not have such a continuous plan and only have limited and temporary sources of funds. In other words, the railways do not have a system for investment coordinate in any way with the investment in infrastructure by other modes of transport.

Before privatisation, JNR's plans were the railway plans of Japan; when JNR was divided into JR's, the overall perspective in planning was lost. In 1991, the Railway Development Fund was created to integrate all subsidies for railway improvements, but it is a special public body which only has a limited role in planning.

One problem resulting from the lack of integrated planning is related to the networking of freight transport. Since the privatisation into several JR's, the newly-formed Japan Freight Railway

Company does not have its own tracks and pays fees to operate on the tracks owned by the JR passenger companies. For this reason, the interests of the two parties could possibly conflict and the freight company may have difficulty in getting the necessary access when it wants to increase services. In addition, since the *Shinkansen* trains run on standard-gauge tracks, some existing narrow-gauge tracks might be abandoned when new *Shinkansen* lines are installed in the future. This means the freight company's network will be cut to pieces putting the company in a difficult position in competing with road transport. The government is drafting a new policy as part of its environmental, energy, and congestion-prevention measures, whereby freight transport will be shifted from trucks to trains, but this does not necessarily ensure coordination with the construction of new *Shinkansen* lines.

Furthermore, government allocation of investment funds among various public works—hence among Ministries—is often criticised as stereotyped and too fixed, and corrective actions are needed. Here again, overall adjustment is essential and all modes of transport must be given due consideration. The lack of the necessary adjustment is due in part to the organisation of the Japanese government. That is to say, roads are built and maintained within the jurisdiction of the Ministry of Construction whereas railways, air traffic, road traffic and harbors come under the Ministry of Transport. All are to be controlled by another ministry, the National Land Agency, but it does not have practical authority over the needed adjustment. ■



Yataro Fujii

Mr. Fujii graduated from the Faculty of Economics, Keio University in 1959. He is a professor of the Faculty of Business and Commerce of Keio University and has served as Faculty Dean.

A renowned scholar of transportation economics and public utility projects, Mr. Fujii is playing an important role in drafting policies for the Japanese government as a specialist member of the Council for Transport Policy and the Council for Civil Aviation (Ministry of Transport), the Road Council (Ministry of Construction) and of the Electric Utility Industry Council (Ministry of International Trade and Industry) and the Council for Statistics (Management and Coordination Agency).