Development of the Tokaido Shinkansen started in 1957, the year I graduated from university and entered graduate school. And after joining the work force, my first job turned out to be motion analysis of Shinkansen rolling stock. Those proved to be events in my life which have given me special feelings for the Shinkansen. The Tokaido Shinkansen was more than just a speed-up railway. It created a new concept for railway systems, which now have become the norm. It brought forth new innovative railway systems, such as the elimination of road crossings, specialization of passenger transport, operation of all trains at the same speed, protection of trains by ATC replacing wayside signals, and computerized seat reservations.

Speeding up transport systems is an exciting and thrilling development area for those involved. The enthusiasm is on an entirely different level from that of other work. And all other technologies that comprise railway technology are stimulated and grow with faster transport systems.

Although the lawsuit claiming damage from noise pollution filed soon after the successful inauguration of the Tokaido Shinkansen and the period when people complained of the “evils of high-speed rail” may have been something of a nightmare, it did lead to the creation of noise and vibration control technologies. In this same way, experiences with severe earthquakes and heavy snowfalls have fostered technologies against natural disasters. In the near future, high-speed railways will start to be constructed in densely populated developing countries. The day that these environmentally adaptive technologies become a bargaining chip is sure to come.

Recently, France’s TGV recorded a maximum speed of 574.8 km/h in a test run. The highest operating speed for a railway is 430 km/h on the Shanghai Maglev TR-08. The average citizen and policy makers (politicians?) have a weakness for such figures. But only professionals can appreciate the true value of “system technology”—high speed/high-density technology that provides safe and stable transport—that Japanese railways have achieved.

The system technology that has achieved safe and stable high-speed/high-density transport has been built up through a “bottom-up” approach, that is, constantly improving component technologies such as those for infrastructure, rolling stock and signals. But the typical Japanese mentality lacks a clear way to explain such superior system technology, as systematic thinking is not the forte of many Japanese. Even when high quality and reliable Japanese products swept the world in 1980’s, Japan could express those only in terms of Japanese production methods (combination of “just-in-time” production, “kanban” (labeling system), “kaizen” (constant improvements), “andon” (Current Production Report System) etc.). But it did not take researchers at MIT long to deduct what they called “lean” production methods, through systematic and theoretic study. I hope that Japanese themselves learn to systemize and theorize the above-mentioned railway system technology, and if possible standardize it.

Fig. 1 shows an example of my view of systemization. I have illustrated a system...
composed of six layers. The second layer of “structure” and the third layer of “application” are well known. The fourth layer, “variability”, means that system handling is completely different when operating under normal conditions and when there is an abnormal situation. In the long run, a system may change due to the introduction of new technologies, and that is constantly visible to others in the fifth layer, “evaluation”. The sixth layer, “environment”, refers to the unique non-theoretical issues present within the Japanese system, and other social changes which may take place in the future. These are reflected to the fifth layer of “evaluation”.

After World War II, theories such as operations research (OR) and system engineering were introduced from the United States. As recent systems are complicated and large-scaled, concepts such as “systems” engineering or “system of systems” engineering seem to be taking hold. The probable reason for this is that systems are becoming much larger, in addition to the time variation of subsystems. This is included in the meaning of the forth layer, “variability”.

There may be many ideas regarding systematization, but the most important thing is to list components by layer without omission. The next step is to describe the relationship of layers to each other and to examine the importance of those relationships, preferably quantitatively. RAMS (Reliability, Availability, Maintenability and Safety) is such an example.

Now that more than forty years have passed since the inauguration of the Tokaido Shinkansen, it may be about time to launch a new concept for Japan’s Shinkansen. I would hope that the systemization shown in Fig. 1 provides a basis for such. I hope that the new concept goes beyond just achieving higher speeds, but also takes the system up to the next step as a transport service system.

I recall that, at its outsets, JR East placed emphasis on railways as a lifestyle support system based on technology. JR East has improved convenience for customers as seen in its in-station businesses, which has also raised profits. In transport service, the backbone of railways, I would like to see all phases from starting point to destination being seamlessly safe, comfortable and convenient.

Fig. 2 shows railway use from the passenger’s perspective. For a passenger, all phases from starting point to destination comprise a continuous trip. While railway service plays only a part of the trip, it still must continue to provide a safe, comfortable and convenient space and access to information from departure to the arrival.

At departure, such a railway service should provide personal shopping information, restaurant information, directions within the station and other information to individual passengers by mobile phone or other information terminals. The railway service also should provide personal secretary-like information services such as notification of departure time and processing at the ticket gate for boarding, guidance to the reserved seat on the train, and other needed information.

Looking over the stretch of space from the first step into the departure station to the last step out of the station of arrival, the comfortable spaces in the station building and in the train passenger cars are currently interrupted at the platform. On the platform, we are exposed not only to the sometimes-severe natural environment, but also to external noise of trains and loud announcements from speakers that compete with train noise. I would like to suggest that railway operators offer waiting passengers a comfortable space as if it were a lobby.

“Service” is the act of providing a sense of satisfaction. Since a train simultaneously transports a large number of passengers who are strangers to each other, unlike in private cars, it is no easy chore for railways to provide personalized services. But overcoming this difficulty could lead to new concepts for the next-generation railway. I thus have great expectations for railways to come.