Feature

Global Market of Rolling Stock Manufacturing: Present Situation and Future Potential

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Until the 1980s, rolling stock manufacturing was considered primarily as a domestic industry with strong connections to the national railways of each country and with some exports based on government policy. Things changed in the early 1990s around the time of EU market integration and restructuring of national railways. In parallel with this restructuring, mergers and acquisitions (M&As) occurred among rolling stock manufacturers in N America and Europe, making them international business with little regard to national boundaries. Also around this time, as well as manufacturing rolling stock and railway equipment, manufacturers took on a system integrator role for railway projects.

In Japan, system integration has been mastered by the JRs, other major private railway operators, and publicly owned railways, forcing Japanese rolling stock manufacturers to act as carriage makers in the domestic market and system integrators in their export markets. Rolling stock is manufactured by large companies in Japan as one department in their overall business, so the types of buyouts and M&As seen in the West have almost never occurred in Japan.

The main market for new rolling stock in both the West and Japan will come from renewal of existing stock, because these railways have reached a ceiling. It is hard to expect new big demand for rolling stock due to new line constructions or increasing transport capacity. Over the next decade or so, large-scale new demand can be expected to come almost exclusively from areas experiencing rapid economic growth, like China and SE Asia. Japanese manufacturers are keen to do business in these markets and to supply the replacement market in N America, but they face stiff competition from manufacturers in Europe, N America, S Korea, and China.

This article examines today's global rolling stock manufacturing industry and market, points out some of the differences between the West, E Asia, and Japan, and looks into the future.

Early Beginnings and Developments

From the advent of railway transport until the mid-20th century, one yardstick of a country's industrial prowess was whether it manufactured rolling stock. In the early days, railway equipment was imported as part of the drive to industrialize, but the means to manufacture rolling stock domestically came with industrial success and economic growth. In some cases, domestically manufactured rolling stock became sufficiently advanced that it found export markets in other countries. This evolution—from dependent importer to exporter—has occurred in one form or another in a number of European countries, and in Japan and S Korea.

In summary, the first railways started in Britain, and other countries in Europe, Asia and elsewhere imported the bulk of their rolling stock from Britain until the beginning of 20th century. However, once the railway industry in other European countries had become sufficiently developed, those countries manufactured and exported their own rolling stock to countries building railways. This placed them in direct competition with Britain. The same evolutionary path occurred in Japan, and more recently in S Korea, India, and China; low labour costs give these three newcomers an edge in the export market.

But rolling stock design has changed considerably since the 1980s. Locomotives, electric multiple units (EMUs), and diesel multiple units (DMUs) have computer systems, power-control electronics, advanced control systems supported by software etc., almost as standard. As a result, rolling stock has higher development costs and the manufacturing works require high-level facilities and technologies. The strengths of manufacturers in the West and Japan in these areas place them at an advantage. However, they still face a disadvantage—demand for new rolling stock has shifted from Europe and Japan, to China and SE Asia where strong economic growth is driving fever-pitch demand for high-speed intercity, freight, and urban transport. This explains why demand for new rolling stock is

Series 700, basis for T700 serving Taiwan High Speed Rail, running on Tokaido Shinkansen (Author)

concentrated in E Asia (excluding Japan), and because costs are increased by shipping rolling stock over long distances, why production in technically advanced works close to the local market offers great advantages. S Korea and China have made rolling stock manufacturing a cornerstone of their industrial policy and when a foreign company bids on a rail project in these countries, there is always a strong technology transfer component in the bid conditions. This has led to a growing trend toward international cooperation in the manufacturing of rolling stock. In a typical case, Western or Japanese companies may develop the rolling stock systems and software, and manufacture the high-technology equipment, while S Korean and Chinese companies may manufacture and assemble the carriage bodies, bogies, and some components.

Worldwide Rolling Stock Market

Table 1 lists rolling stock worldwide by type and quantity, indicating the current size of the market. It gives an overview of overall trends, but does not include Russian Railways nor subways and other non-UIC railway operators.

From the data we can calculate the following global usage ratios for different types of rolling stock:

- Diesel locomotives: N & S America, 31%; EU & EFTA, 24%; China, 16%; Asia & Oceania (except Japan, China & S Korea), 11%; Central & Eastern Europe, 10%
- Electric locomotives: EU & EFTA, 49%; Asia & Oceania (except Japan, China & S Korea), 15%; China, 14%; Central & Eastern Europe, 12%
- Electric railcars/EMUs: Japan, 35%; EU & EFTA, 33%; Central & Eastern Europe, 22%
- Diesel railcars/DMUs: EU & EFTA, 70%; Japan 20%
- Passenger carriages: EU & EFTA, 33%; Central & Eastern Europe, 21%; Asia & Oceania (except Japan, China & S Korea), 19%; China 18%
- Freight wagons: N & S America, 33%; Central and Eastern Europe, 24%; EU & EFTA, 17%; China, 11%; Asia & Oceania (except Japan, China & S Korea), 9%

Table 1 may under-represent the ratios for Japan for two reasons: 1. EMU numbers in Japan are calculated a little differently, and the rolling stock of Japanese subway and 2. suburban train operators—who are not UIC members but operate many trains—are not included in the figures.

Broken down by region and rolling-stock type, the figures show:

- In N and S America, most operations are non-electrified freight transport.
- In China, freight predominates; passenger and freight trains are hauled by locomotives.
- In Japan and S Korea, passenger transport predominates, with passenger trains tending to be EMUs or DMUs.
- In the EU, EFTA, and Central and Eastern Europe, passenger and freight transport are about equal; there is a mix of EMU, DMU and loco-hauled passenger trains.

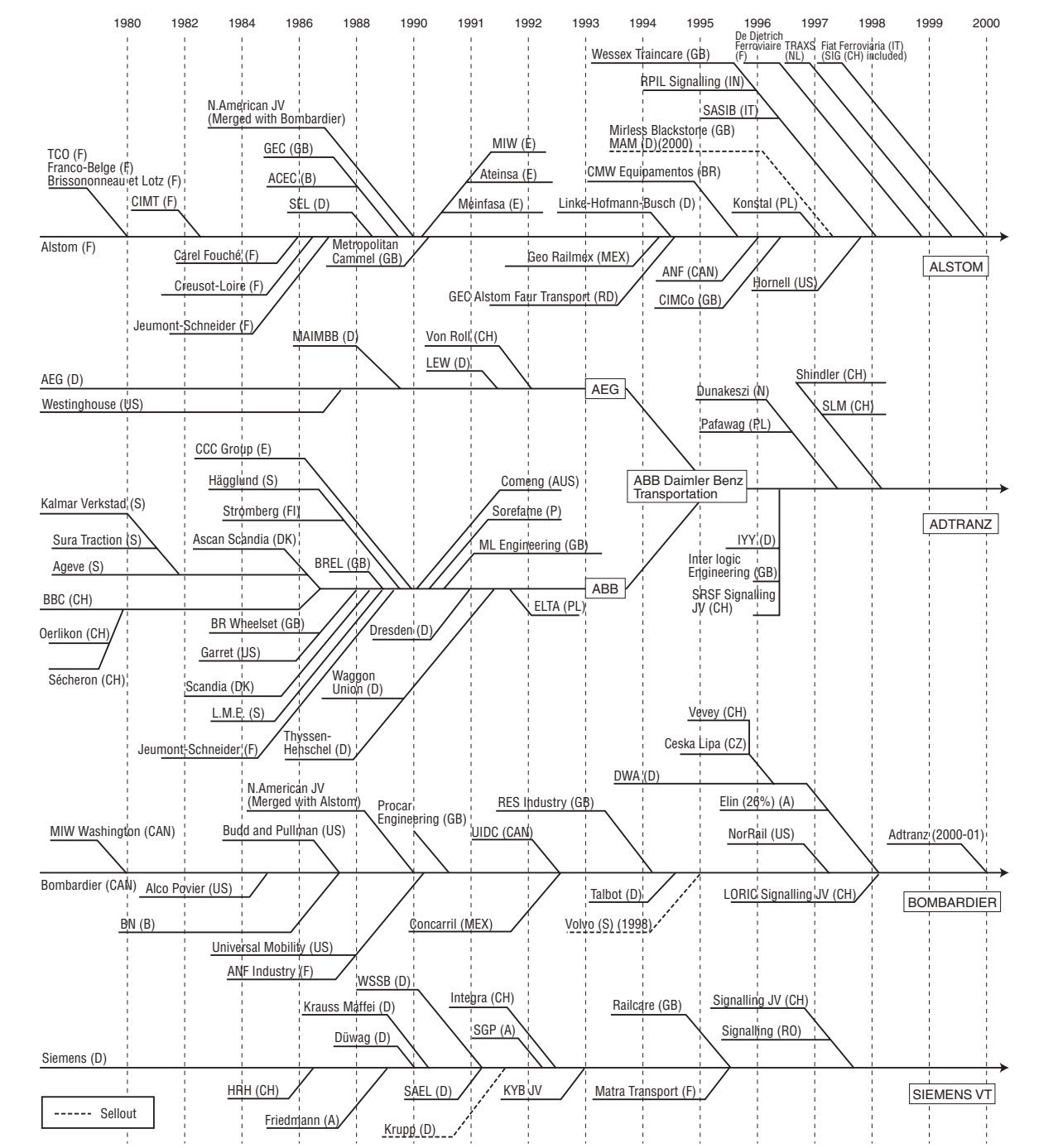
China's transport systems may change dramatically in the future due to the country's remarkable economic growth, promotion of new lines, and modernization of passenger systems. In Central and Eastern Europe, efforts to improve railway management are lagging behind expectations, but freight transport may be greatly rationalized.

Table 1 Rolling Stock of UIC Members

Region or country	Diesel locomotives	Electric locomotives	Steam locomotives	Electric railcars/ EMUs	Diesel railcars/DMUs	Trailing carriages coupled to EMUs or DMUs	Passenger carriages hauled by locomotive	Freight wagons
EU	15,685	13,435	137	11,305	8,240	38,555	67,708	634,005
EFTA	714	1,203	1	446	32	573	4,413	22,294
Central & Eastern Europe	6,569	3,587	244	7,780	390	18,102	45,720	944,221
Northern Africa and Middle East	2,413	100	0	101	36	941	6,050	62,904
Africa south of Sahara	2,164	1,984	1	0	11	29	7,520	145,655
N & S America	21,005	46	3	0	5	0	3,263	1,300,338
Asia & Oceania (except Japan, China & S Korea)	7,531	4,355	161	2,117	160	6,320	41,249	365,911
Japan	494	780	10	12,406	2,354	9,541	776	15,410
China	10,752	4,298	109	0	0	0	37,942	446,707
S Korea	482	96	1	1,662	610	2,272	1,678	14,113
Total	**67,809**	**29,884**	**667**	**35,817**	**11,838**	**76,297**	**216,319**	**3,951,558**

Source: *International Railway Statistics 2002*, UIC
Note: Statistics for DMUs and EMUs in Japan taken from publications of seven JRs for 2004

Figure 1 Elimination and Consolidation of Rolling Stock Manufacturer



Source: Les concentrations dans l'inctustrie ferroviaire, *Le Rail*, No.82, 9/10 2000.

Note: A=Austria, AUS=Australia, B=Belgium, CAN=Canada, CH=Switzerland, CZ=Czech, D=Germany, DK=Denmark, E=Spain, F=France, FI=Finland, H=Hungary, GB=Great Britain, IN=Indonesia, IT=Italy, MEX=Mexico, N=Norway, NL=Netherlands, P=Portugal, PL=Poland, RO=Romania, RU=Russia, S=Sweden, US=United States

Europe

Before the advances in European economic integration in the early 1990s, most railway operators procured their rolling stock and other railway equipment domestically. However, economic integration opened the door to procurement anywhere within the EU and EFTA. Even before integration, there had been a movement to replace domestic rolling stock standards with pan-European standards. This trend went hand-in-hand with the M&As between manufacturers, irrespective of national boundaries. As Figure 1 shows, this process was very complex and resulted in most manufacturing becoming concentrated between three corporate groups: Alstom Transport, Siemens, and Bombardier. Although Bombardier has production centres in Canada and Europe, here we treat it as a European manufacturer. These three corporate groups can manufacture everything from carriage bodies and bogies to electrical equipment, power-supply systems, and signalling systems and each is large enough to be considered a railway conglomerate. An overview of the three groups is given in Table 2.

After Hungary and the Czech Republic, which once belonged to Council for Mutual Economic Assistance (COMECON), joined the EU, rolling stock manufacturers in the two countries were free to pursue ties with the above-mentioned three corporate groups. Restructuring of the sector has entered a new phase and we can assume that it is having a considerable impact on Russian rolling stock manufacturers, although details are sketchy.

Any study of rolling stock manufacturing in Europe must mention the Union of European Railway Industries (UNIFE), representing the interests of manufacturers of rolling stock, signal devices, components, and other railway equipment. Like the Community of European Railways (CER), it wields some influence in the European Commission's Directorate-General for Energy and Transport and offers advice on development of transportation policy. The two organizations also help coordinate the industry's efforts to develop standards.

Table 2 European Rolling Stock Manufacturers

	Alstom	Bombardier	Siemens
Capital	1,921	3,250	27,312
Total sales (A)	16,699	13,859	75,167
Transport-related sales (B)	4,862	6,231	4,310
Ratio of transport-related sales to total sales (B/A)	0.29	0.45	0.06
Employees (C)	76,811	64,600	434,000
Number of employees in transport-related manufacturing (D)	29,000	28,000	17,930
Transport-related sales per employee in transport-related manufacturing (B/D x 1000)	168	223	240
Number of factories in Europe	12	28	9
Notes	December 2004	Figures for number of employees in transport-related manufacturing, etc., after rationalization plan released in March 2004	December 2004

Notes: Capital and sales in €millions.
Bombardier's capital in C$million.
Figures for transport-related sales per employee in transport-related manufacturing in €1000.

Europe's rolling stock market is divided into three sectors: high-speed rail, freight, and urban transport, including light rail transit (LRT). Demand will likely remain fairly strong in all three sectors, because railway transport is being promoted at the expense of air and road under an EU policy to cut CO_2 emissions.

European policies promoting railway transport can be grouped into three categories described below.

High-speed rail links between major European cities

France, Germany, Italy, and Spain used to work independently promoting their own high-speed railway projects, but the policy today is to expand these systems into an international railway network operating at maximum speeds above 250 km/h. The network will be integrated with some conventional lines rebuilt to support operations above 200 km/h. Plans for this high-speed network have changed greatly since the days before creation of the EU, because of today's expanded EU and changes in Europe's industrial structure. During the Cold War years, there were plans to construct a high-speed railway network linking the capitals and some major cities of France, Italy and the former W Germany. However, German re-unification and EU expansion to include former Warsaw Pact countries have stimulated demand for a high-speed railway system serving the growing number of people travelling east–west. The outdated railway infrastructure in former Eastern Bloc countries needs upgrading, and important other infrastructure projects include developing air–rail links (ARLs) with high-speed railways stopping at airports. Pressure to implement these improvements forced revision of plans for a high-speed railway network in the EU. Of course, implementation of the new plan requires more direct investment in rolling stock. Another needed change is the establishment (under an EU directive) of

Alstom-developed TGV family (Author)

German tilting ICE developed by Siemens and Bombardier (Author)

the Technical Specifications for Interoperability (TSI), creating uniform standards for rolling stock, signals, wireless transmissions and electric power-supply systems. Without these standards, trains cannot provide through services on lines managed by different operators. At the present, TSI-related standards are being drawn up and a unified signalling system and train-control system is being developed for EU-wide use. (The above-mentioned three corporate groups are assisting this development.) The standards will promote railway transport within the EU and guide European technical development projects in the near future. The more distant future may be even brighter for Europe, because the unified standards will give it a strong advantage when competing in the global railway equipment market.

Improving rail freight network

As mentioned above, railways are now being encouraged to play a stronger role in an expanded EU. Therefore, the plans also call for improvements in the EU railway freight system. In W Europe during the Cold War, roads took a leading role in freight transport, but there is now a drive to change this and reduce dependence on road freight. However, railway freight in W Europe is still inefficient. In the east, where communist countries embraced planned economies, rail freight was encouraged and protected. When these countries shifted to market economies, they liberalized the transportation industry, often permitting road freight to replace rail freight, except for haulage of bulk commodities like coal. These rapid changes brought problems, such as road congestion, urban gridlock, pollution, higher CO_2 emissions, and more vibration and noise. Under EU policies promoting railway transport, the freight operations of former national railways were restructured, placed under private management, and given a competitive footing. This made it possible to establish companies promoting international rail freight operations, in addition to the domestic operations formerly managed by the national freight carriers. The TSI are also being applied to freight transport, creating uniform technical standards for through services on lines managed by different operators. The approval process for enterprises entering the freight market was also harmonized. This harmonization promoted development of locomotives with standardized specifications, giving manufacturers an incentive to participate in a competitive market. These locomotives are now being marketed to established rail freight carriers who took

Eurostar developed by Alstom to solve interoperability problems (Author)

over the freight operations of the former national railways, as well as to new carriers. In Switzerland, north–south road freight is controlled by a national limit on truck weight (max. 28 tonnes in Switzerland, compared to EU standard of 40 tonnes). The lower maximum weight limit forces large trucks operating between Germany and Italy to detour via France or Austria. This problem will be solved by a new Alpine railway tunnel currently under construction. When completed, it will consist of two large-diameter tunnels comparable in size to the Channel Tunnel between England and France. Plans call for trucks to piggyback on trains through the tunnel.

Urban railway transport

Many European cities are too crowded to allow cars unimpeded access. To reduce congestion and air pollution, some cities without railway systems are now building subways or laying LRT tracks. Manufacturers are seizing the initiative, standardizing their systems and rolling stock to make it easier for them to sell railway systems and rolling stock to new entities that have little expertise or experience in railway transport management and maintenance. (Many cities are constructing railway transit systems for the first time.) One incentive on offer is a comprehensive maintenance package for rolling stock and ground infrastructure. When ordering such a package, the railway operator asks the manufacturer to quantify the reliability of products and the expected mean time between repairs and to back up these projections with a description of the design and manufacturing processes. Life-cycle costs are estimated as early as during the planning stage and are verified over time. These measures have helped municipal governments with little know-how or experience in railway operations to understand what is involved in operating a railway system. The measures offer manufacturers advantages too and they have been implemented since the 1990s. Acceptance of these measures is reflected in EU standards and has strengthened the positions of the three European rolling stock manufacturing groups.

Solutions to problems

The EU and EFTA member states have about 31,000 locomotives, 58,000 EMUs and DMUs (including coupled cars), 72,000 passenger carriages, and 656,000 freight wagons. Expansion of the high-speed railway network has increased the number of train sets on that network. Many trains are locomotive hauled—EMUs play a more dominant role in urban transit. More urban systems are being

DB Class 423 developed by Bombardier for German commuter trains (Author)

Potsdam LRV standard developed by Siemens (Author)

electrified, and subways and electrified LRT systems are being constructed. This indicates that demand for electric rolling stock will increase. However, we can assume that demand for rolling stock will still focus more on locomotives, passenger carriages and freight wagons to replace existing stock.

This has created a dilemma for European manufacturers who are struggling with excess production capacity after a period of rapid expansion following M&As. Actually, this overcapacity was noted even before the European integration. Corporate restructuring increased this overcapacity, making reduction even more imperative. However, the problem was ignored when railway operators were buying new rolling stock, energized by restructuring of national railways and the need to invest in urban railway transit systems. Overcapacity remains a problem for Alstom Transport and Bombardier. Alstom is now restructuring its operations and has obtained assistance from the French government. Bombardier is closing a number of factories in order to reduce its production capacity to manageable levels. Siemens appears to have survived a management crisis immediately after the 1992 launch of Deutsche Bahn AG (DB AG).

These problems have been compounded by new geopolitical challenges. Expansion of the EU member states and European marketplace brought countries with lower wage structures into the fold. At first, EU production centres for rolling stock shifted from UK, France and Germany to Italy, Spain, and Portugal. Some former Eastern Bloc countries also took on this role after the end of the Cold War. Today, Germany, France and Britain remain rolling stock development centres, but manufacturers now have the option of shifting production to the former Eastern Bloc. Local communities strongly oppose job losses due to factory closures, making it difficult for companies to move eastward. To remain healthy without making the move, they must succeed in the export market.

N America

Rail freight in N America is characterized by heavy diesel-locomotive haulage (although similar loads are sometimes seen in Brazil and S Africa). Locomotives and freight wagons are manufactured in the USA and Canada for their respective domestic markets; axle loads exceed 30 tonnes and heavy freight trains are commonly more than 10,000 tonnes. Demand for rolling stock for heavy haulage is almost exclusive to the USA. Railways in Europe and China are working hard to increase maximum tonnage, but axle loads hover around 23 tonnes and the lack of space at stations and yards prevents use of 10,000-tonne trains. Instead of increasing weight, European and Chinese operators are trying to raise freight speeds. Therefore, the Electro-Motive Division of General Motors, the American manufacturer of rolling stock for the freight market, is in a different league from manufacturers in Europe, Japan, S Korea, and China.

Basically, US companies have stopped manufacturing rolling stock other than locomotives and freight wagons, so new stock for urban transit systems and New York's metro is supplied by Bombardier from its works in Canada, as well as by manufacturers in Europe and Japan. However, the Buy American Act restricts imports by requiring 50% to 80% US content for rolling stock. In order to satisfy the conditions of the Act, manufacturers other than Bombardier (which is protected by the Canada–US Free Trade Agreement) use American-manufactured parts and materials and assemble their rolling stock in the US.

S Korea

With a view to increasing its exports, S Korea has encouraged development of heavy industry. Rolling stock manufacturers have benefited from this since the 1970s. One result of S Korea's currency crisis in the late 1990s resulted in the merger of three rolling stock manufacturers (Daewoo, Hyundai and Hanjin) to establish a new company called Rotem. In 2002, Rotem

was capitalized at Won2.57 trillion (approximately $2.4 billion), and had 3650 employees and two factories. It is unclear what percentage of the company's production is railway related.

Rotem supplies rolling stock to the Korean Railroad and the Seoul Metropolitan Subway, and has exported to Taiwan, Hong Kong, Brazil, and Syria. It is the sole supplier for the domestic market and is an active exporter, taking advantage of the nation's relatively low wage structure.

In the early days, S Korea's exports of rolling stock tended to be passenger carriages and freight wagons with little value-added content, but exports shifted about 20 years ago to value-added items like diesel locomotives and EMUs. However, over the last few years, sales seem to be under threat from makers in China and India.

At one time, S Korea's rolling stock manufacturing industry depended on technology developed in Japan and France, but it is now gaining the ability to develop and produce rolling stock on its own. High-technology items such as VVVF inverter systems are still imported from Japan. The nation's high-speed railway system uses TGV technology from France, but high-speed equipment is increasingly being manufactured domestically. South Korea has developed its own high-speed G7 rolling stock and is now in testing with target speeds of up to 350 km/h. Rotem's predecessors competed with each other to master TGV technology, but merged before high-speed services started. Rotem had two advantages in developing the G7—it brought the development resources of its predecessors under one roof, and it was able to use their TGV expertise.

China

Under the Chinese Ministry of Railways' policy of promoting privatization, rolling stock factories under its control have been given independent status and split into two groups—the China Northern Locomotive and Rolling Stock Industry (Group) Corporation (CNR) and the China South Locomotive and Rolling Stock Industry (Group) Corporation (CSR) (Table 3).

Table 3 Chinese Rolling Stock Manufacturers (2003 Data)

		CNR	CSR
Number of factories		19	19
Number of research centres		2	1
Number of employees		108,457	109,755
Sales (million Yuan)		12,968	14,197
Number of manufactured units	Locomotives	493	627
	Passenger carriages	939	600
	Freight wagons	15,115	12,328
Number of units repaired	Locomotives	575	836
	Passenger carriages	1,583	1,576
	Freight wagons	20,052	27,227

Japanese Series E2 shinkansen to be exported China as modified series (Author)

The two groups enjoy a favourable position due to strong domestic demand, their production capacity is large, and their supply system has a short turnaround time. China's rapidly growing economy is driving expansion of the railway network and boosting transport capacity, so its railways are modernizing more quickly than anywhere else in the world. Because China does not have the development capacity to keep up with demand, it has recently reversed its protectionist policies, and is now actively importing foreign technology and promoting technical ties with foreign companies, especially European ventures. The CNR is strengthening its relationship with Alstom, while the CSR has turned to Siemens. Japanese companies have been a little slow getting into the running because of concerns that Chinese legislation hampers the business activities of foreign corporations.

Table 4 Production of Japanese Rolling Stock Manufacturers (2003)

	Nippon Sharyo, Ltd.	Kawasaki Heavy Industries, Ltd.	Hitachi, Ltd.	The Kinki Sharyo Co., Ltd.	Tokyu Car Corp.	Alna Koki Co., Ltd.	Niigata Transys Co., Ltd.
Locomotives	1	18					
Passenger carriages	108						1
Diesel railcars/DMUs	14				1		44
EMUs	205	381	199	240	218	5	4
Freight wagons	59	24					
Total	**387**	**423**	**199**	**240**	**219**	**5**	**49**

Even so, in 2004, Japanese companies negotiated the marketing of semi-high-speed rolling stock, leading to an agreement for a group of Japanese manufacturers to tie up with CSR and deliver EMUs with a Japanese shinkansen design. Plans call for the first four train sets to be assembled in Japan, then for assembly to shift gradually to China. It appears that contracts with other manufacturers include the same type of conditions. China's goal is to have Chinese and foreign corporations work together in order to obtain technical knowledge from abroad.

China's market is attractive both because it is vast and because it is now promoting higher quality standards. The growing railway network—with longer lines and new track—requires more rolling stock, new passenger carriages for higher-speed operations, longer and faster freight trains, and higher-performance rolling stock. Success is being achieved in all these areas. As more lines are electrified, a greater percentage of operations are electric; passenger train speeds are being boosted from 120 to 160 km/h; double-deck passenger carriages are being introduced; suburban railways and subways are being constructed to combat urban road congestion caused by the massive surge in cars purchased by consumers with more disposable income. These developments are changing China's main transportation mode from bicycles to modern railways almost overnight.

Clearly China offers great potential to rolling stock manufacturers. Foreign companies have recognized that potential and are rushing to establish affiliations with Chinese businesses to sell their products and technical knowledge.

Japan

Japan had many rolling stock and parts manufacturers by the 1920s and nearly all stock and parts were being produced domestically. Today, rolling stock manufacturing is concentrated in the hands of seven companies, five makers of rail-related electrical equipment, and a number of parts manufacturers. (See pp. 14–23 in this issue of *JRTR* for a more detailed description of Japan's rolling stock manufacturing industry.)

With the exception of some parts manufacturers, few companies specialize exclusively in railway-related products. This is because the railway manufacturing sector no longer plays a large role in Japan's manufacturing economy, and although some companies started off as rolling stock manufacturers, they diversified operations and reduced their dependence on the rolling stock market. The M&As that occurred in the West, where rolling stock operations were sold to establish new companies specializing exclusively in manufacture, are foreign to Japanese practice, because a reasonable number of manufacturers must compete in a domestic market with low demand.

Table 4 shows the production of Japanese rolling stock manufacturers for 2003. Numbers at Kawasaki Heavy Industries and Nippon Sharyo were relatively high, but somewhat lower and similar at Hitachi, Kinki Sharyo and Tokyu Car. The table does not include JR East, which produces about 250 EMU carriages annually at its Niitsu Rolling Stock Manufacturing Factory (see pp. 30–33). The relatively large number of manufacturers forces them to compete fiercely for domestic orders. To succeed, they all have flexible development and production systems that permit them to accept small orders.

The former Japanese National Railways (JNR) was so large that it could dictate the design of rolling stock in Japan and could farm out manufacturing to makers who were expected to follow JNR designs. For example, JNR would determine the specifications for electrical equipment, and these would be followed by makers specializing in the manufacture of such equipment. JNR would instruct rolling stock manufacturers to make the bodies, bogies, fittings, etc., but the manufacturers did not determine the specifications for an entire rolling stock unit, nor did they design it. The same system was followed by railways operated by municipal governments and private companies—the operators would determine the specifications for the electrical equipment, bogies, brake systems, etc., and select the suppliers for these component parts. Manufacturers would then gather the component parts and assemble the rolling

stock. This system continued after establishment of the JRs in 1987. However, Japan's aging population is placing railway operations on a weak footing with little prospect for long-term recovery. Passenger operators can no longer hire many technical specialists, so they can no longer set their own specifications or order custom-made stock. As a result, today's trend is towards buying off-the-peg rolling stock. The Japan Association of Rolling Stock Industries (JARI) now sets the standards and design and development is shifting from operators to rolling stock manufacturers. The exceptions are JR East, JR Central and JR West that have sufficiently large operations and technical staff to maintain control over rolling stock development.

Since their establishment in 1987, the JRs have recognized the benefits of globalization and have indicated an interest in using foreign products. Although WTO agreements restrict import of finished rolling stock, some JRs are importing a few sub-systems and parts. However, these are subject to long testing and trials before entering service, because Japanese railways want to maintain the highest standards of reliability. Many Japanese operators hesitate to import and use foreign technology because they fear that differences in claims practices would cause difficulties when malfunctions occur. So far, JR East and Keihin Electric Express Railway are the only two operators in Japan that have gone out of their way to import foreign components for their rolling stock.

Future of Rolling Stock Manufacturing Industry

Globalization is rapidly changing the rolling stock manufacturing industry and attention is now focused on E Asia, especially China. Manufacturers in S Korea and China are establishing ties with their counterparts in the West and Japan. These ties are not a win–lose type of venture, instead both partners benefit from sharing the other's strengths. European manufacturers have the advantage of offering products designed to EU standards. Japanese manufacturers have been slow off the mark, but can offer other advantages, such as superior reliability and a flexible production system. Railway operators in Japan tend to make detailed and varied requests even for small lots and Japanese manufacturers can meet these requests. This made it possible to sell Japanese rolling stock to Eire, a niche market that could not be supplied by the European conglomerates. China and SE Asia are experiencing rapid economic growth, and unless their railway systems and those in Central and Eastern Europe are upgraded to lure people out of their cars, greenhouse-gas emissions will continue to rise and energy resources will dry up. One challenge facing the railway industry is to develop systems and products permitting rail to show its superiority over air and road. Of course, competition between manufacturers is necessary, because it stimulates development of new products. But while competing, manufacturers can also form ties and cooperate in projects, taking mutual advantage of their strong points. This flexible approach should make it possible for railway industries in Japan, the West and S Korea to cooperate with their counterparts in China and elsewhere to improve railway systems and raise their efficiency. ■

JR East's standard Tokyo commuter EMU developed in 1999 (more than 1500 carriages in service) (Author)

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