Transport analysis

Railway in Sweden and Japan – a comparative study

Report 2014:12

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Preface

May 2013 saw the signing of a memorandum of cooperation in the railway area between the Ministry of Enterprise, Energy and Communications in Sweden and the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) in Japan.

The main purpose of the cooperation is to increase the mutual understanding of policies, laws, and other regulations and of organization and planning in the railway sector in Sweden and Japan and to exchange experience and technology in areas of common interest.[1] This comparative case study seeks to increase the mutual understanding of the organization of the railway sector in Sweden and Japan.

The study compares the current organization of railways in Sweden and Japan. The scope includes infrastructure and traffic organization, freight and passenger traffic solutions, and railway sector authorities.

The project has been managed by Anna Ullström, Transport Analysis (Sweden); Takaaki Furuhashi, MLIT (Japan) submitted comments on chapters four and five.

October 2014
Brita Saxton
Director General

[1] *Överenskommelse mellan Näringsdepartementet i Konungariket Sverige och Ministeriet för mark, infrastruktur, transport och turism i Japan om samarbete inom järnvägsområdet*, Tokyo den 17 maj 2013, N2013/2621/TE, Stockholm: Näringsdepartementet, 2013.

Contents

1 A comparative Sweden–Japan rail organization study

The way the railway system produces transport services can be described as a process in which various functions interact and are dependent on one another in order to deliver services to rail customers, i.e., freight companies and passengers. How the railway system is organized differs between countries.

May 2013 saw the signing of a memorandum of cooperation in the railway area between the Ministry of Enterprise, Energy and Communications in Sweden (MEEC) and the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) in Japan.

The main purpose of the cooperation is to increase the mutual understanding of policies, laws, and other regulations and of organization and planning in the railway sector in Sweden and Japan and to exchange experiences and technology in areas of common interest.[2] This comparative case study seeks to increase the mutual understanding of the organization of the railway sector in Sweden and Japan.

The study compares the current organization of railways in Sweden and Japan. The scope includes infrastructure and traffic organization, freight and passenger traffic solutions, and railway sector authorities.

Chapter 2 presents the typical functions of a railway system, while chapters 3 and 4 discuss the organization of these functions in Sweden and Japan. Chapter 5 compares the organization of these functions and finally chapter 6 discusses and analyses this comparison and what can be learnt from it.

[2] *Överenskommelse mellan Näringsdepartementet i Konungariket Sverige och Ministeriet för mark, infrastruktur, transport och turism i Japan om samarbete inom järnvägsområdet*, Tokyo den 17 maj 2013, N2013/2621/TE, Stockholm: Näringsdepartementet, 2013.

2 Functions of a railway system

This chapter presents the typical functions of a railway system.[3] The chapter is based on facts and figures from chapter 3 of *En enkel till framtiden?*, the first report from the Committee Reviewing the Organization of the Swedish Railway Sector, published in November 2013.

2.1 Value chain of the railway system

The purpose of the railway system is to deliver transport services to freight and passenger customers, thereby creating accessibility throughout the country and to neighbouring countries. The creation of accessibility can be illustrated by the value chain in which tracks, stations, terminals and depots, the selling of train services and information to customers, and the actual production of train services (i.e., the operations) are all needed in order to produce transport services. Making this value chain work requires the construction, management, maintenance, and operation of trains, sales, stations, terminals, depots, and tracks.

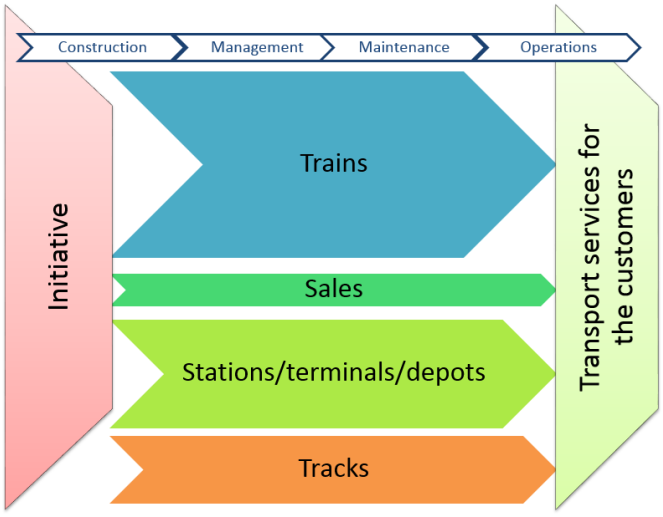

Figure 2.1. Value Chain of a Railway System.4

There can also be initiatives that affect the railway sector as a whole. These could be political and/or other initiatives or investments that change the conditions for the railway sector. These are illustrated in Figure 2.1.

[3] The presentation is based on chapter 3 in *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013.
[4] The figure is adapted from *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013, p. 43.

2.2 Functions of a railway system

The direct functions needed for a railway system to function and deliver its transport services can be divided into four main areas: building, management, maintenance, and, finally, operations. The functions included in each area are shown in Figure 2.2. On the left side of the figure is the construction of locomotives, railcars, depots, terminals, stations (and other property), tracks, and track equipment (e.g., signalling equipment). In the next area are the functions for managing this material and infrastructure. The third area consists of functions for maintaining rolling stock (i.e., locomotives and railcars), property, and tracks.

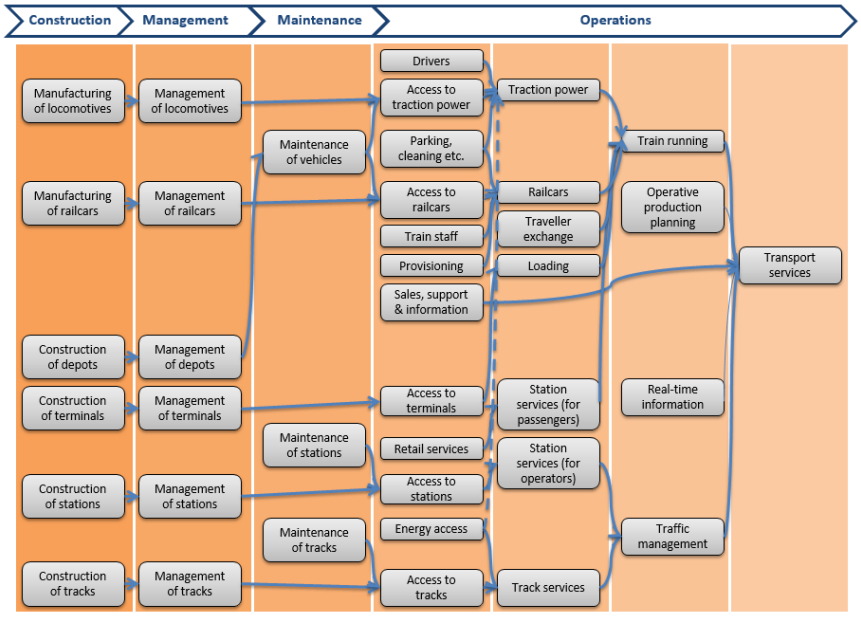

Figure 2.2. Model of the functions of a railway.5

In the last area – operations – one finds the most functions, for example, parking and cleaning vehicles, staffing, provisioning (i.e., of food and beverages), passenger sales (e.g., of tickets), information provision, providing traction power and railcars, station and terminal services for passengers and operators, traffic management, and real-time information. At the same time, various resources are used, for example, drivers, train staff, and energy.

2.3 Planning and coordination in various time horizons

The various functions of a railway system are interdependent, so planning and coordination are needed so such a system can work as desired. Planning and coordination are needed from the long-, medium-, and short-term perspectives as well as on a daily basis when the system is running. ***Long-term planning***

[5] The figure is translated from *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013, p. 45.

includes investments in rolling stock and infrastructure and decisions regarding future conditions for the railway system in terms of speed, comfort, connections, and capacity. ***Medium- and short-term planning*** include the development of traffic concepts, crew hiring and training, maintenance planning, and capacity allocation. ***Daily planning*** includes the planning of operations and coordinating service adjustments in real-time. This schema is illustrated by the three ovals drawn on the figure below, showing coordinated investments (long term), coordinated planning of production (mid and short term), and coordinated production (real-time).

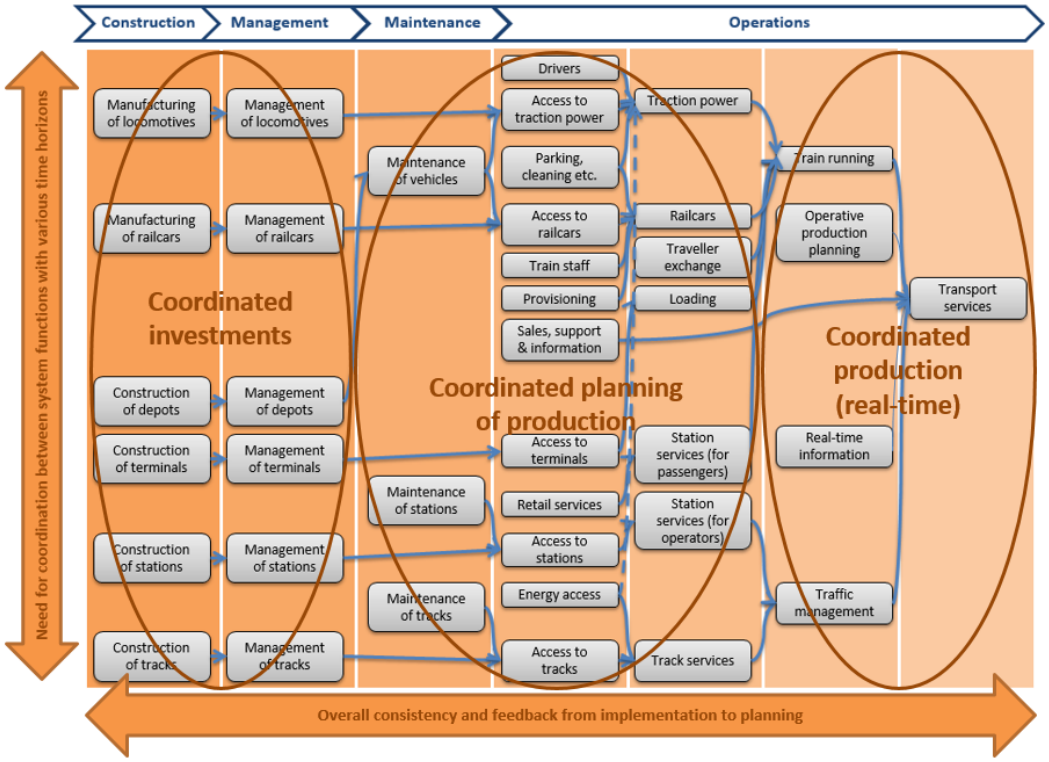

Figure 2.3. Planning processes and needs for coordination between various functions in the railway system.[6]

The need for vertical coordination between, for example, infrastructure, rolling stock, and traffic is significant regardless of the time horizon. There is also a need for opportunities to give feedback (e.g., from operations to new track planning or new rolling stock ordering), so that, for example, changes in demand can be taken into consideration. In addition, a system is needed for analysing service disruptions and punctuality problems that can identify needs for maintenance or timetable adjustments.[7]

[6] The figure is translated from *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013, p. 47.
[7] *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013, p. 48.

2.4 Rulemaking and interventions

Rulemaking and state interventions in the railway sector can be handled in various ways; for example, there can be rules concerning:

1. market access
    a. transport organization (for parties other than the operators)
    b. traffic procurement
2. market supervision and monitoring
3. safety and interoperability

In addition, special rules and instructions can apply to government agencies and state-owned companies. There can also be functions for supervising and controlling the output and function of the railway sector as a whole, and for supervising and controlling the government's steering of the sector and of state-owned companies.

2.5 Framework for analysis

The framework for analysis is based on the functions of the railway system as described above. In the two following chapters, the railway organization in Sweden and Japan, respectively, will be described using the following framework:

1. Description of the railway network
2. Description of the railway traffic
3. Characteristics of the railway organization
4. The initiative in transport policy
5. Actors, responsibilities, and roles within construction
6. Actors, responsibilities, and roles within management
7. Actors, responsibilities, and roles within maintenance
8. Actors, responsibilities, and roles within operations
9. Rulemaking and supervision
10. Current policy and future challenges

3 Rail organization in Sweden

The Swedish railway network consists of approximately 11,000 km of railway tracks in use, of which 30% are double or multiple tracks.[8] The tracks are generally multi purpose, i.e., the same tracks are used for long-distance passenger, regional passenger, and freight services.

In recent years, the transport sector in Sweden has undergone a series of major organizational changes intended to increase *market adjustment* and the opportunities for transport system *efficiency* and *intermodal coordination*. Since 1 October 2010, the rail market has been fully liberalized, making Sweden the first country in Europe to have a fully liberalized rail market. Today, railway functions are performed by many actors, i.e., government agencies, state enterprises, and private companies, which are largely foreign owned. The following describes how the transport sector in Sweden is organized today.

3.1 The rail network in Sweden

The state owns most of the tracks, which are managed by the Swedish Transport Administration. The number of worked track kilometres is shown in Table 3.1.

Table 3.1. Tracks worked in the Swedish railway network, 2008–2012 (source: Rail traffic 2012, Transport Analysis).

Tracks Worked (km)	2008	2010	2012
Length of tracks	15,351	15,497	15,633
- electrified	11,314	11,513	11,952
Length of lines			
Single track	9,206	9,296	9,190
- narrow gauge	52	52	52
Double track or more	1827	1865	1947
- narrow gauge	13	13	13
Total	**11,032**	**11,160**	**11,136**

[8] Alexandersson, Gunnar, "Swedish Railway Sector. Characteristics, Reforms and Current Issues", presentation in Stockholm, 19 February 2014.

The railway network can be divided into 50 lines, of which approximately 68% are single track. The Malmö City Tunnel, opened 4 December 2010, is approximately 6 km long, making it the longest railway tunnel in the country. Sweden has 132 railway tunnels totalling 76 km in length, and 3731 railway bridges. Igelsta Bridge in Södertälje, 2140 m long, is the country's longest railway bridge and, at 48 m high, is also the highest. Scheduled traffic on narrow gauge tracks occurs only at Roslagsbanan (a commuting line in the Stockholm area), where the track width is 891 mm.

The railway network in Sweden spans the entire country but, due to very uneven population distribution, it is denser in the metropolitan areas in the south (i.e., Stockholm, Gothenburg, and Malmoe) and sparser in the north where the country is less densely populated.

Figure 3.1. The Swedish state-owned railway network (Source: The Swedish Transport Administration).

The rail network is 81% electrified and has an energy distribution of up to 2100 GWh. The electricity for train operation is controlled and delivered by eight electric power stations and 48 substations around the country.[9]

Signalling systems

The traffic on the national rail network is monitored by the Swedish Transport Administration's eight dispatch centres located in Boden, Ånge, Gävle, Stockholm, Hallsberg, Gothenburg, Norrköping, and Malmoe. From 2014 to 2017, all dispatch centres will be upgraded to be able to handle traffic nationally.

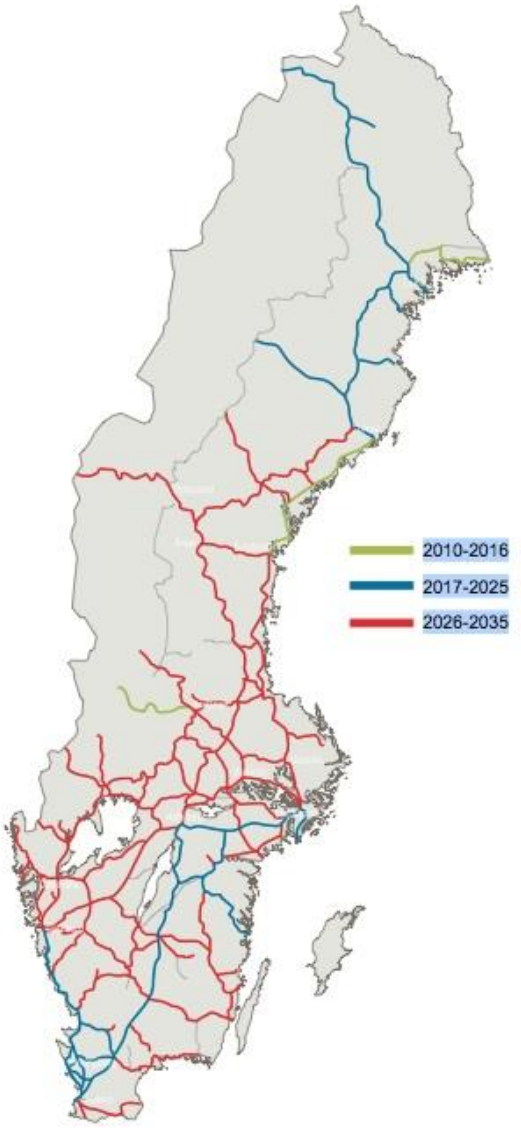

Figure 3.2. Plan for introducing the European Rail Traffic Management System (ERTMS) in Sweden (source: The Swedish Transport Administration).

[9] *Transportsystemets tillstånd – utmaningar och möjligheter*, Rapport 2011:10, Stockholm: Trafikanalys, p. 23.

The network use is currently controlled mainly by means of a signalling system supported by an automatic train control (ATC) security system with over 29,000 ATC transmitters (*balis*). The ATC system in use was developed for the Swedish railway network and is not compatible with similar systems in Europe. This means that trains operating between, for example, Sweden and Denmark must be equipped with both Swedish and Danish ATC as well as equipment that automatically switches between ATC systems. The Swedish Transport Administration has as a long-term goal of shifting to the new EU standard European Rail Traffic Management System (ERTMS).[10] In addition to making it easier to operate trains across country borders, ERTMS is expected to reduce the number of optical signals and to increase the capacity by transmitting signals wirelessly.

The first lines fitted with ERTMS in Sweden are the Botniabanan, Ådalsbanan, Haparandabanan, City Tunnel, and Västerdalsbanan lines. The introduction of ERTMS on these lines is supposed to be completed by 2016.[11] By the end of 2012, 423 km of railway lines in Sweden were equipped with ERTMS.[12]

Ongoing and planned expansions

Sweden is planning the construction of a new main high-speed rail line between Stockholm and Gothenburg/Malmoe. The construction of the first sections between Järna and Linköping (i.e., the Eastern Link) and between Mölnlycke and Bollebygd is to be initiated in 2017.

3.2 Rail traffic in Sweden

In Sweden, train travel is a common mode of transport and various categories of passenger trains run on the network, all differentiated by their distance, speed, and level of service and comfort. Long-distance passenger traffic is provided by high-speed (i.e., SJ2000 and SJ3000 trains), double-decker, intercity, and night trains, whereas local and regional passenger services are often part of urban public transport systems. Measured in passenger kilometres, the modal share of trains is 8.4% (2012).[13]

Passengers took approximately 201 million train journeys in 2013,[14] dominated by regional journeys.[15] Passenger travel by rail has been increasing over the last few years. Passenger transport performance was 11.8 billion passenger-kilometres in 2013, and from 2007 to 2013, total railway passenger transport performance increased by 15%.[16] For public transport as a whole, supply is

[10] Ibid., p. 7.
[11] Ibid., p. 23.
[12] *Rail traffic 2012*, Sveriges officiella statistic, Statistik 2013:28, Stockholm: Trafikanalys, 2013.
[13] Alexandersson, Gunnar, "Swedish Railway Sector. Characteristics, Reforms and Current Issues", presentation in Stockholm, 19 February 2014.
[14] Ibid.
[15] *Rail traffic 2012*, Sveriges officiella statistik, Statistik 2013:28, Stockholm: Trafikanalys, 2013.
[16] *Rail traffic 2012*, Sveriges officiella statistik, Statistik 2013:28, Stockholm: Trafikanalys, 2013 and *Railway transport 2013, quarter 4*, Statistik 2014:3, Sveriges officiella statistik,

measured in seat-kilometres: in 2012 the supply was 30.6 billion seat-kilometres, which is an increase of 23% since 2007.

Expressing passenger volumes relative to population size gives approximately 1230 passenger-kilometres per Swedish inhabitant per year in 2013.[17] This is a high number, and only Sweden, Denmark, Austria, and France in the European Union (EU) average more than 1000 passenger-kilometres per inhabitant, revealing the importance of rail as a transport mode in Sweden.[18]

The modal share of freight trains was 23% of total tonne-km carried in 2012.[19] A total of 66.9 million tonnes were carried by rail (excluding 38.1 million tonnes of ore on the Ore Railway) in 2013.[20] However, transport performance declined from 22 billion tonne-km in 2012 to 21.7 billion tonne-km (excluding 17.2 billion tonne-km of ore on the Ore Railway) in 2013.[21]

3.3 Characteristics of the railway organization

The Swedish railway sector is characterized by *institutional vertical separation between infrastructure and operations*. The national multi-modal agency, the Swedish Transport Administration (Trafikverket), is the main infrastructure manager, handling most of the tracks in Sweden. The agency strongly emphasizes procurement from external contractors, which means that the agency, for example, procures track maintenance as well as construction.

What is unique to Sweden is that *the tracks and the operation system are generally multi purpose*, i.e., the same tracks and operation systems are used for both passenger (long-distance and regional) and freight trains. The passenger train-kilometres dominate, accounting for approximately 70% of all train-kilometres, though the traffic blend varies considerably between routes. The proportion of freight trains is higher in the north (over 80% between Kiruna and Riksgränsen) but lower, i.e., under 10%, towards Stockholm and approximately 25% towards Gothenburg and Malmoe. The traffic blend is especially high on the southern main line and the western main line, i.e., between the three major metropolitan areas. The degree of traffic blend is much higher than in many other

Stockholm: Trafikanalys, 2014. The exact number for 2013 is 11,842 million passenger-kilometres.

[17] The Swedish population was 9,644,864 as of 31 December 2013 and 11,842 million passenger-kilometres were travelled in 2013. See www.scb.se and *Railway transport 2013, quarter 4*, Statistik 2014:3, Sveriges officiella statistik, Stockholm: Trafikanalys, 2014.

[18] Bergström, Anna and Niclas Krüger, ”Modeling passenger Train Delay Distributions – Evidence and Implications, *Karlstad University Working Paper in Economics*, nr 2013/10, Karlstad: Karlstad University, 2013 and *Rail Annual Market Monitoring Report*, IRG- Rail (13) 2, Independent Regulators’ Group, Februari 2013, p.16.

[19] Alexandersson, Gunnar, “Swedish Railway Sector. Characteristics, Reforms and Current Issues”, presentation in Stockholm, 19 February 2014.

[20] *Railway transport 2013, quarter 4*, Statistik 2014:3, Sveriges officiella statistik, Stockholm: Trafikanalys, 2014.

[21] Ibid.

countries.[22] However, even though passenger and freight trains share the same infrastructure, passenger and freight operations are functionally separated.

Both freight and passenger services have open access to the entire state-owned rail network. Even though the rail market is fully liberalized, a great many actors on the rail market are state owned, for example, the major passenger operator SJ AB, the major freight operator Green Cargo AB, the rail-related real estate company Jernhusen AB, and the railway infrastructure construction and maintenance company Infranord AB.

The responsibility for regional passenger services is decentralized to 21 regional public transport agencies (*regionala kollektivtrafikmyndigheter*, RKM). See the description of these in section 3.4.

3.4 The initiative in transport policy

On the left in the value chain shown in Figure 2.1 are *initiatives*, which are formally taken by the elected politicians in the Riksdag and by the government. However, in reality, a great many actors can act as policy entrepreneurs and participate in shaping the future railway network. This section describes Sweden's formal political organizations as well as the most influential government agencies and national and international organizations.

Political bodies

The Riksdag

Sweden is a parliamentary democracy, which means that all public power proceeds from the people. At the national level, the people are represented by the Riksdag (Swedish parliament), which has legislative power. The Riksdag is therefore the supreme decision-making assembly in Sweden. The Riksdag's tasks include making laws, levying taxes, and setting the central government budget. The Riksdag also examines the work of the government and of central government agencies.

The Riksdag is responsible for the overall strategy for Swedish railway services. In this role, the Riksdag determines the goals of Swedish transport policy, how the transport sector should be organized, the laws regulating the transport sector, and the budget for investments and maintenance. In the Riksdag, the Committee on Transport and Communications deals with matters concerning roads and road transport, railways and rail transport, ports and shipping, airports and air transport, postal services, electronic communications, and IT policy.

The Government

Sweden has three levels of government: national, regional, and local. In addition, there is the European level, which acquired increasing importance following Sweden's entry into the EU. Here, only the national government is described,

[22] Nilsson, Jan-Erik, "Restructuring Sweden's Railways: The unintentional deregulation, Swedish Economic policy Review 9, 220-254.

although both regional and local government influence regional and local transport.

The government implements the Riksdag's decisions and drafts proposals for new laws or amendments. The government is accountable to the Riksdag and must have the support of the Riksdag in order to implement its policies.

The government is assisted in its work by the Government Offices, comprising a number of ministries. There are also approximately 400 central government agencies and state-owned companies in Sweden accountable to the government and for which the various ministries act as principals. The primary function of these bodies is to implement the decisions made by the Riksdag and by the government. The government agencies are autonomous. This means they operate on their own responsibility but in accordance with guidelines formulated by the government in what are known as appropriation directions.

The Ministry of Enterprise, Energy and Communications

The Ministry of Enterprise, Energy and Communications (MEEC) is responsible for issues concerning regional development, energy, transport, infrastructure, information technology, and the business sector.

Infrastructure issues and transport policy with regard to road, rail, sea, and air transport are among the responsibilities of the Ministry. The transport agencies under MEEC jurisdiction are Transport Analysis (Trafikanalys), the Swedish Transport Administration (Trafikverket), the Swedish Transport Agency (Transportstyrelsen), and the Swedish National Road and Transport Research Institute. In addition, there are two public enterprises, namely, the LFV Group (air traffic management) and the Swedish Maritime Administration, under MEEC jurisdiction.

The following state-owned companies are also linked to the railway area: Arlandabanan Infrastructure AB, Botniabanan AB, SJ AB, Green Cargo AB, Jernhusen AB, Infranord AB, and Svedab AB.

Regional public transport agencies

The responsibility for regional passenger services is decentralized to 21 regional public transport agencies (*regionala kollektivtrafikmyndigheter*, RKM) controlled by municipalities and counties, which have their own taxation power. Most regional and some long-distance passenger services depend on subsidies and are procured by means of competitive tendering. The procuring authority normally provides the rolling stock.

Regional councils (*regionförbund*) are regionally controlled organizations that work on growth and development issues. They can be divided into two types: regional autonomous bodies (i.e., Skåne, Västra Götaland, Halland, and Gotland) and municipal autonomous bodies, which are publicly funded organizations owned by the municipalities within a given county together with the County Council. In four counties, i.e., Sörmland, Jämtland, Västernorrland, and

Norrbotten, the County Administrative Board[23] is responsible for growth and development issues.

The regional councils prepare programmes for county development and determine priorities among measures related to infrastructure when preparing county plans for regional infrastructure. They also follow up the actions and effects of development in the counties and provide an annual accounting of the actions and effects to the national government.

Transport actors in the European Union

Within the EU, there is the vision of creating a Single European Railway Area (SERA). Policies developed at the EU level affect the national policies in Sweden. As Sweden is the first and only country in Europe to have fully liberalized its rail market, it is therefore regarded as a model for European railway services. Sweden has thus been moving ahead of the EU, rather than having to adapt to EU policy.

The Directorate-General for Mobility and Transport (DG MOVE) is the EU Commission's department for transport and mobility issues. DG MOVE has decided on a programme and a budget for creating a Trans-European Transport Network (TEN-T). Two agencies under DG MOVE with special importance for the rail sector are ERA and INEA. The European Railway Agency (ERA) works on coordinating efforts to harmonize regulations in the railway sector and suggests measures to the Commission that require legislation. The Innovation and Networks Executive Agency (INEA), inaugurated on 6 March 2014, is responsible for policy decisions related to the TEN-T programmes and for implementing the decisions made regarding specific projects by providing support to the Commission and the various TEN-T projects that received funding.

Other organizations influencing Swedish transport policy

The National Road and Transport Research Institute

The National Road and Transport Research Institute (VTI) conducts R&D activities relating to infrastructure, traffic, and transport. The institute works to achieve the transport policy objectives and to continuously improve knowledge of the transport sector. With approximately 190 employees, VTI is the largest transport research environment in Sweden.

Other actors

International organizations such as the OECD's International Transport Forum (ITF) and the United Nations Economic Commission for Europe (UNECE) of course influence Swedish transport policy.

In addition to the public institutions, other actors and interest groups such as Transitio, Samtrafiken, Svensk kollektivtrafik, Tågoperatörerna, Näringslivets

[23] The County Administrative Board is the representative of the government in the region and the coordinating body for state activities in the county.

transportråd, TransportGruppen, and Resenärsforum also affect and are affected by current transport policy and practice to greater or lesser degrees.

Technology consultants hired for inspections, infrastructure studies and reports, socioeconomic calculations, and to address safety issues also have great influence on the development of the transport sector. Companies active in this area are, for example, ÅF, Tyréns, Sweco, and WSP.

3.5 Actors, responsibilities, and roles within construction

In Sweden, the manufacturing of locomotives and railcars is commercial, while the construction of depots, terminals, stations, and tracks is primarily planned and coordinated by the Swedish Transport Administration and the state-owned company Jernhusen AB. However, the actual construction work is normally carried out by private companies procured by the Swedish Transport Administration or Jernhusen AB.

Manufacturers

Vehicle manufacturers are mainly larger international companies. In Sweden, Kockums Industrier AB is the only manufacturer of freight wagons and Bombardier is the only manufacturer of locomotives and passenger rail cars. Railway companies, transport organizers, and others currently buy rail cars chosen from a number of sample models modified to the specific needs for the customer. The manufacturers of vehicles often manufacture of other railway equipment as well, such as signalling systems.

The Swedish Transport Administration (Trafikverket)

The main task of the Swedish Transport Administration is to manage, plan, and develop an efficient and sustainable transport system. In close dialogue with regions and municipalities, the Swedish Transport Administration is responsible for comprehensive, long-term infrastructure planning for all modes of transport. The Administration is also responsible for planning, constructing, operating, and maintaining state roads and railways. In addition, the Swedish Transport Administration is responsible for accessibility in interregional public transport and procures certain interregional rail traffic.

The formation of the Swedish Transport Administration meant that the functions of the Swedish Road Administration (Vägverket) and the Swedish Rail Administration (Banverket), excluding the operations of Banverket Production, now Infranord AB, were transferred to the new agency. The headquarters of the Administration are situated in Borlänge, but there is also a regional organization tailored to regional planning processes and dialogues.

Jernhusen AB

Jernhusen AB is a state-owned company that owns, manages, and develops (on commercial terms) a real estate portfolio consisting of stations, offices, maintenance depots, and freight terminals along the Swedish railway. Offices are

located in Stockholm, Gothenburg, Malmoe, Sundsvall, Kiruna, Gävle, Norrköping, Örebro, and Västerås.

Arlandabanan Infrastructure AB

Arlandabanan Infrastructure was established by the state in 1994 and was given the responsibility for procuring rail service to Arlanda Airport and for coordinating various state interests in relation to constructing this rail link. The company monitors the state's rights and obligations under existing agreements.

Svedab AB

When the Öresund Bridge was built, the Swedish state formed a company, Svedab AB, responsible for the Swedish–Danish bridge connection. The company owns the Swedish land used for the bridge project and, together with its Danish counterpart, A/S Øresund, owns the Öresund Bridge Consortium, the company that owns the bridge and manages its daily operations.

3.6 Actors, responsibilities, and roles within management

Management includes the management of locomotives, railcars, depots, terminals, and tracks.

Vehicle companies and vehicle managers

The vehicles (i.e., locomotives and rail cars, but also other track materials) can be owned and managed in several ways. Rail companies often own their own vehicles. For example, SJ AB and Green Cargo AB own most of their locomotives and railcars. Track contractors and maintenance companies normally own their work vehicles. In other cases, rail companies rent vehicles from other rail companies or from railcar companies.

Transitio is a company that owns a large part of the vehicles (primarily railcars) used for transport procured by the regional public transport agencies. The vehicles are available to the rail companies that have the contracts to run rail traffic in the regions. Transitio is owned by regional public transport agencies. However, the three largest regional public transport agencies in Sweden (in Stockholm, Skåne, and Western Sweden) own the vehicles used in their public transport services themselves.

In addition, several private vehicle companies lease out rail vehicles, mainly freight wagons, and some financial institutions own vehicles and lease them to rail companies.

The owner of rail vehicles is responsible for their maintenance and for ensuring that they meet necessary standards and are approved for traffic.

Property managers

The properties connected to the railway mainly comprise land used for railway tracks, stations, and terminals. Jernhusen AB, a state-owned company, is one of the main managers of such property. The company is run on a commercial basis, but has a responsibility to develop properties and related services to promote public transport and freight services by rail. Jernhusen owns and manages 47 properties with station buildings (e.g., the largest stations in Stockholm, Gothenburg, and Malmoe) of the total of 580 transit points in Sweden. In addition, many stations are owned and managed by the Swedish Transport Administration or by the regional public transport agencies. Some stations are owned by municipalities or are privately owned.

Platforms, elevators, and escalators in or connected to station buildings are normally managed by the Swedish Transport Administration regardless of their owner. The Swedish Transport Administration is thus also responsible for maintaining these.

Svenska Reseterminaler AB, a company affiliated to Jernhusen, manages 135 waiting rooms, regardless of the owner of the station building. At the stations, companies may also rent retail space from the station manager.

The Swedish Transport Administration is responsible for traffic information at platforms and stations. This includes continuously updated screens as well as fixed signage and public address announcements.

Every station should provide an opportunity for people with disabilities to book support people, which has to be done 24 hours in advance. The operators are responsible for booking support people for whole journeys, for providing support people at boarding and alighting, and for support people aboard trains. Several smaller train operators cooperate to offer support people on a national basis.

Train maintenance depots are also important properties within the railway system. Jernhusen owns a number of depots that are rented to companies offering maintenance services to the rail companies. In addition to those, SweMaint owns a number of maintenance depots and the private company Train Alliance owns several maintenance depots for locomotives and is planning to establish new depots at various places in Sweden.

A third group of properties comprises terminals, i.e., freight and intermodal terminals, that are often associated with nearby warehouses and other logistics properties. Jernhusen owns terminals, primarily intermodal terminals, but many terminals are owned and run by municipalities.

Infrastructure managers

Sweden has approximately 15,600 km of tracks managed by 369 infrastructure managers. The main infrastructure manager is the government agency the Swedish Transport Administration (Trafikverket). Other infrastructure managers are A-Train, Inlandsbanan AB, and Öresundsbrokonsortiet. The Swedish

Transport Administration consults these infrastructure managers in the process of capacity allocation. In addition, there are many small infrastructure managers, such as municipalities, industries, ports, terminals, and regional public transport agencies.[24]

Capacity allocation and traffic management

Capacity allocation and traffic management are two central and closely linked functions that in Sweden are the responsibility of the infrastructure manager. Capacity allocation is the process of handling requests for capacity (i.e., track access). Every infrastructure manager is obliged to inform the operators about the infrastructure and the access conditions in a yearly rail network statement (*järnvägsnätsbeskrivning*). The Swedish Transport Administration publishes not only its own network statements but also those of a large number of other infrastructure managers, for example, Jernhusen AB.

The capacity allocation process begins at the beginning of April every year with applications from the rail companies and other applicants. The process includes a timetable proposal and the coordination of applications in order to resolve conflicts of interest. If a conflict of interest cannot be resolved, the infrastructure manager must promptly arrange for dispute resolution. If the dispute resolution fails, the track may be declared congested, and its capacity can be allocated through charges or prioritization criteria. The proposed timetable is adjusted and approved; the approved timetable is valid for a year.

If the infrastructure is declared congested, the infrastructure manager is obliged to analyse its capacity and develop a plan for increasing it.

There are also opportunities to apply to run ad hoc traffic (residual capacity) that is not booked in advance. This application process is much shorter and the applicant has the legal right to receive an answer within five working days.

In operation, the infrastructure manager runs and supervises (through traffic management) how the traffic actually runs. A daily timetable that permits real-time adjustments is being developed.

The Swedish Transport Administration also procures national, long-distance public transport in Sweden. The agency only procures transport on train, bus, air, and sea routes that are unprofitable and on which no operator wishes to run commercial traffic, but where it is deemed socially justifiable to operate. Operators run profitable long-distance public transport on a commercial basis.

[24] *En enkel till framtiden?*, delbetänkande av utredningen om järnvägens organisation, SOU 2013:83, Stockholm: Fritzes, 2013, p. 54f.

3.7 Actors, responsibilities, and roles within maintenance

Maintenance is needed for vehicles as well as for stations and tracks. For all vehicles, a registered Entity in Charge of Maintenance (ECM) must be listed in the national vehicle register (administered by the Transport Agency, i.e., Transportstyrelsen) in order to be approved for traffic. Track maintenance is the responsibility of the infrastructure manager, who can choose to carry out the maintenance on its own or to procure maintenance from another actor. Today, the Swedish Transport Administration procures maintenance. Recently, however, public debate has considered whether it would be better to organize the maintenance differently in order to promote preventive maintenance and reduce corrective maintenance.

Vehicle maintenance companies

In Sweden, vehicle maintenance can be divided into “maintenance near traffic”, spare parts supply, maintenance of components, and rebuilding. Some rail companies that own their vehicles choose to conduct the maintenance as part of their own activities. One example is LKAB, a company owning mainly activity-specific wagons. In other cases, the maintenance is connected to the vehicle supplier and is included in the delivery contract. Bombardier and Alstrom deliver vehicles with such contracts. Finally, the maintenance can be conducted by an independent maintenance company, such as EuroMaint (both passenger and freight vehicles) and SweMaint (freight wagons).[25]

Track contractors

Track contractors are companies that, on behalf of, for example, the Swedish Transport Administration (Trafikverket) or another infrastructure manager, build or rebuild railways and maintain tracks. Maintenance is normally divided into preventive maintenance, corrective maintenance, and reinvestments. Important track contractors in Sweden include the state-owned Infranord AB (established through the corporatization of Banverket Produktion in 2010), Balfour Beatty Rail AB (part of an international group based in the UK), and VR Track (a company affiliated with the Finnish VR).

Infranord AB

In 2010, Banverket Production was corporatized into a state-owned company called Infranord AB. Infranord is Sweden’s largest railway contractor, delivering complete rail engineering services and working from a base in Sweden. Infranord has approximately 3000 employees, including more than 2000 engineers with expertise in rail, electrical, signalling, and telecommunication technology. Infranord has also established a presence in Denmark and Norway.

[25] Euromaint is owned by Ratos. SweMaint is owned by the freight wagon manufacturer Kockums industrier AB. Both were established when SJ was corporatized. Some independent maintenance companies are affiliated with rail companies; for example, Mantena is owned by the Norwegian NSB.

3.8 Actors, responsibilities, and roles within operations

Since 1 January 2012, public transport companies, freely and in all market segments, have been able to offer commercial public transport in Sweden. For rail passenger transport, the market opening was implemented on 1 October 2010 (the railway freight market had already been liberalized). There is no price regulation and no service obligation in Sweden. The track access charge is determined by the Swedish Transport Administration and the ticket and freight prices are determined by the rail operators. However, transport organizers procuring public transport may have specific demands when it comes to service and pricing.

Transport organizers

In the Swedish organization of the railway sector, so-called transport organizers are important actors. The transport organizers are mainly regional public transport agencies, and in some cases planning companies, which plan what local and regional public transport should be organized within a county or region.

Through procurement of this subsidized transport, the transport organizers control the supply and design of a great deal of Swedish rail transport. They arrange ticketing systems and ticket sales and often own stations and vehicles. In some cases, they cooperate within larger structures such as Öresundståg, Norrtåg, and Tåg i Bergslagen to create larger transport networks.

Entities called freight transport organizers also exist. These are mainly forwarding agents connecting various railway companies and other transport companies in a network. ScandFibre Logistics and Trätåg are two examples of specialized freight transport companies working with forestry companies. Any freight transport buyer or forwarding agent can organize its own transport and apply for routes.

Railway companies

Railway companies, or train operators as they are normally called in Sweden, perform the actual freight or passenger rail transport. They are responsible for functions such as ticket sales, hiring and training staff, providing vehicles, forming trains, and in some cases directing vehicles. The infrastructure manager (i.e., normally the Swedish Transport Administration) runs the traffic management.

Railway companies may own the vehicles they use or may choose to rent/lease vehicles as well as other services.

Operators of passenger trains

To run traffic, the rail company needs to obtain required permits from the Swedish Transport Agency as well as a track access agreement from the infrastructure manager (i.e., often the Swedish Transport Administration).

One state-owned company, SJ AB, dominates the market. In addition, a few other train operators provide passenger transport on a commercial basis or run procured passenger traffic. There are also several museum railway organizations organizing train rides on historical vehicles, sometimes on their own tracks but often using state infrastructure.

SJ AB

SJ AB is a state-owned company with a mandate to operate passenger services on commercial terms. SJ AB was formed when the former Swedish State Railways was divided into six companies in year 2000. SJ AB has five subsidiaries: Linkon AB, SJ Norrlandståg AB, SJ Event AB, SJ Service Academy AB, and Stockholmståg KB. SJ AB is also a part owner of Botniatåg together with Arriva.

Other passenger train operators

Other train operators providing passenger transport on a commercial basis are Veolia (partly owned by the French state), Tågåkeriet i Bergslagen (TÅGAB), and Skandinaviska Jernbanor (Blå Tåget). In 2015, the Hongkong-based company MTR is expected to start operating passenger service (MTR Express) between Stockholm and Gothenburg. MTR is investing more than SEK 700 million to purchase six all-new train sets to operate on the route.[26]

Operators running procured passenger traffic

The Swedish Transport Administration procures national, long-distance public transport in Sweden. The agency only procures transport on train, bus, plane, and boat routes that are unprofitable and on which no operator wishes to run commercial traffic, but where it is deemed socially justifiable to operate. Operators run profitable long-distance public transport on a commercial basis. At the moment, three operators run this kind of procured rail traffic, namely, Arriva (owned by the German Deutsche Bahn), Tågkompaniet (owned by the Norweigian state-owned NSB AS), and DSB (Danske Statsbaner, owned by the Danish state).

In addition A-train, a company owned by the Australian investment bank Macquarie Group, operates Stockholm–Arlanda passenger transport (Arlanda Express) on Arlandabanan. A-train won the competitive tendering organized by the state-owned company Arlandabanan AB and has a long-term contract.

Operators of freight transport by rail

Two state-owned companies operate freight transport by rail: Green Cargo AB and LKAB Malmtrafik.

Green Cargo AB is a broad logistics company that operates freight transport by truck and by train, both nationally and internationally. Green Cargo AB was formed when the former Swedish State Railways was corporatized in year 2000. Today the company has approximately 3000 employees.

[26] http://www.mtrexpress.se

LKAB Malmtrafik operates freight transport on the Ore Railway (Malmbanan), which runs from the mining areas in Malmberget, Svappavaara, and Kiruna to LKAB's ore harbours in Narvik (in Norway) and Luleå and to the SSAB facilities in Luleå.

In addition to the state-owned companies, several privately owned companies operate freight traffic: Hector Rail, Tågåkeriet i Bergslagen, TX Logistik, Rush Rail, Real Rail, DB Schenker, and several smaller companies. The larger companies are active on the international market.

Other support functions

To ensure that train operations function properly, a great many services are needed, for example, train cleaning, catering, and various IT services. Several private companies are active in this sector.

3.9 Rulemaking and supervision

The Swedish Transport Agency (Transportstyrelsen)

The Swedish Transport Agency deals with rail, aviation, maritime, road, driving license, and commercial traffic issues. The agency formulates rules, authorizes licenses and certificates (e.g., driving licenses), and monitors rule compliance. The Swedish Transport Agency is also responsible for the administration of ownership changes and the congestion and vehicle taxes. The Swedish Transport Agency is headquartered in Norrköping.

Notified bodies

Notified bodies (NBs) are the only recognized third-party bodies that can carry out conformity assessments laid down in the relevant harmonized European standards or European Technical Assessment.

The Swedish Competition Authority (Konkurrensverket)

The Swedish Competition Authority is a state agency working to safeguard and increase competition and supervise public procurement in Sweden. Its task is to promote efficient competition in the private and public sectors for the benefit of consumers and to promote efficient public procurement for the benefit of society and market participants.

Transport Analysis (Trafikanalys)

Transport Analysis is a government agency charged with providing decision-makers in the transport policy sphere with sound and relevant policy advice. Transport Analysis participates in developing transport policy by reviewing, analysing, following up, and evaluating proposed and implemented measures at the request of the government. Transport Analysis is also responsible for producing official statistics in the transport and communication sectors, including travel surveys and commodity flow surveys.

The Swedish National Audit Office (Riksrevisionen)

The Swedish National Audit Office is part of the central control function of the Swedish Riksdag (Parliament). It ensures that the Riksdag receives a coordinated and independent audit of state finances, auditing the whole executive power chain and conducting both performance and financial audits.

Other supervising authorities

The Swedish Accident Investigation Authority (SHK), the Swedish Work Environment Authority, the Swedish Consumer Agency, and the National Electrical Safety Board are four other government agencies responsible for supervising the rail industry.

3.10 Current Swedish rail policy and future challenges

There is no separate rail policy in Sweden. Since 2010, Swedish transport policy has covered all modes of transport and the transport agencies (i.e., the Swedish Transport Administration, Swedish Transport Agency, and Transport Analysis) have been working in an integrated way on all modes of transport. However, many measures and policies affecting the development of the rail sector have been implemented or are being discussed at the moment. Here we will discuss two important legislative decisions, the Infrastructure Bill of 2012 and the National Plan for 2014–2025, and two important investigations, the Capacity Investigation and the Committee Reviewing the Organisation of the Railway Sector.

The Infrastructure Bill of 2012

This Infrastructure Bill of 2012 complements the 2008 bill, The Future of Travel and Transport Infrastructure for Sustainable Growth. It is also based on the transport policy bill Goals for the Future of Travel and Transport and on the National long term transport plan, 2010–2021. The Infrastructure Bill establishes the framework and basis for action planning.

The Capacity Investigation

The Swedish Transport Administration was commissioned by the government to identify the need for increased capacity in the transport system and to propose any necessary steps to be taken. These measures are intended to provide additional capacity, contribute to the more efficient use of a more robust overall transport system, and promote effective transitions between modes of transport. The Swedish Transport Administration prepared forecasts for the years 2022–2025, with an outlook to 2050.

The National Long Term Transport Plan for 2014–2025

On 8 April 2014, the government adopted the National Long Term Transport Plan for 2014–2025, with a budget of SEK 522 billion, of which SEK 86 billion have been allocated for operating and maintaining the national railway system and SEK 281 billion for railroad development. The major activities to be funded include the first parts of the new high-speed rail line (the first routes between

Järna and Linköping, i.e., the Eastern Link, and between Mölnlycke and Bollebygd) as well as activities on the Ore Railway at a cost of approximately SEK 3.5 billion. The Swedish Transport Administration has also been directed to continue the planning and investigations needed for building the complete new main line.

The Committee Reviewing the Organization of the Railway Sector

In May 2013, the government appointed a Government Committee with the task of looking into the current organization of the railway sector and identifying areas in need of improvement. The Committee delivered its first report in December 2013 and received new directives in April 2014. The final report is to be delivered by the end of June 2015.

Building Sweden

In July 2014 the government launched a new initiative, called Building Sweden. The aim is to build new HSR lines connecting Stockholm with Gothenburg and Malmoe, to initiate a dialogue with Denmark concerning an additional infra-structure connection to Denmark. Building Sweden also includes suggesting a financial solution for expanding the metro in Stockholm and an Eastern road link connecting the highway ring around Stockholm.[27]

Future challenges

Currently, the railway is frequently discussed and debated, specifically concerning problems with the existing network (e.g., a backlog of track infrastructure maintenance, capacity problems, and railway organization) as well as the construction of a new high-speed rail line (mentioned in the section above). Some future problems and challenges are discussed below.

Backlog of track infrastructure maintenance

Since the 1990s, Swedish rail investments have been low, from both the historical and international perspectives.[28] As a result, the maintenance of railway infrastructure in Sweden has been neglected and there is a great need for increased maintenance efforts.

A need for higher capacity

Rail traffic in Sweden has gradually increased, especially in metropolitan areas and along the major routes through the country, leading to rising congestion and disruption. In recent years, the average train speed has decreased due to capacity problems. Therefore, increasing capacity and eliminating bottlenecks is crucial.[29]

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[27] *Sverigebygget: Fler jobb och mer tillväxt, höghastighetståg och 100 000 nya bostäder,* Regeringskansliet, 2014-07-02

[28] Vredin, Anders, ”Läggs det för lite resurser på infrastruktur?” i Brännlund, Runar m.fl., *Investeringar in blanco? En ESO-rapport om behovet av infrastruktur,* Rapport till Expertgruppen för studier i offentlig ekonomi, 2013:5, Stockholm: Finansdepartementet, p. 47.

[29] *Transportsystemets tillstånd – utmaningar och möjligheter*, Rapport 2011:10, Stockholm: Trafikanalys, p. 8ff.

Punctuality

High-speed trains are likely to get stuck behind freight trains or trains making more frequent stops. Consequently, with 70% single tracks and a high degree of traffic blend, Swedish rail infrastructure is vulnerable in itself and a disturbance anywhere in the rail network could have huge consequences.[30]

Statistics from Transport Analysis reveal that the passenger train delays amounted to nearly 4 million person-hours in 2012. Since the first measurements in year 2010, the total hours of delay, at all Swedish railway stations, declined from 6.5 million person hours to 3.8 million person hours in 2012. In 2012, approximately 90% of trains arrived at the station within five minutes of the scheduled time and the trains were usually under three minutes late on average per arrival. Approximately 25% of delays were greater than five minutes, but only 1% of delays were greater than one hour. However, cancelled trains are not included in these numbers.[31]

New entrants

In 2015, three companies are expected to compete on the tracks between Stockholm and Gothenburg. This new development on the Swedish rail market represents a challenge to the state-owned company SJ AB, in the form of competition, and to the Swedish Transport Administration, which must adapt its capacity allocation procedures to a new situation.

Strategic bidding

In the case of procured traffic, it has been a problem that companies bid strategically and then cannot deliver what they promised or go bankrupt.

Several of the above challenges are associated with the model of vertical separation between infrastructure and operations, for example, a need to monitor other actors' performance, difficulty creating complex schedules, and a lack of incentive for the track authority to invest in facilities to increase efficiency and improve safety.

[30] Ibid.

[31] *Förseningar i persontågstrafiken – mått och metoder*, PM 2013:3, Stockholm: Trafikanalys, 2013.

4 Rail organization in Japan

The Japanese railway network consists of approximately 25,000 km of railway track, of which 2388 km are high-speed rail track of the Shinkansen network. The Shinkansen is also fully grade-separated from all other railways and roads. The 53.85-km Seikan tunnel is the longest and deepest rail tunnel in the world (excluding urban metro lines with intermediate stations). The Shinkansen has carried over 9.5 billion passengers since starting operation in 1964 and has maintained a safety record of no passenger fatalities.

4.1 The rail network in Japan

The Japanese rail network is largely owned by private railway companies, but public railway companies and the Japan Railway Construction, Transport and Technology Agency (JRTT) also own tracks. Today, a total of 205 public and private railway companies operate in Japan.

The existing HSR network

The Tokaido Shinkansen line opened in 1964 in time for the Tokyo Olympic and Paralympic Games. Since then, the network has been extended to the Sanyo, Tohok, and Kyushu regions.

Table 4.1. Japanese HSR extension history.

	Distance (km)	Opening year
Tokyo–Shin Osaka	515	1964
Shin Osaka–Okayama	161	1972
Okayama–Hakata	393	1975
Omiya–Morioka	466	1982
Omiya–Nigata	270	1982
Ueno–Omiya	28	1985
Tokyo–Ueno	4	1991
Takasaki–Nagano	117	1997
Morioka–Hachinohe	97	2002
ShinYatsushiro–Kagoshima chuo	127	2004
Hachinohe–Shin Aomori	82	2010
Hakata–Shinyatsushiro	130	2011

As of 2014, 2388 km of HSR, with a possible speed between 200 and 320 km/h, are in operation. In addition, 779 km of HSR are under construction and another 617 km are planned.[32] Figure 4.1 shows the HSR network and the maximum speed of each line.

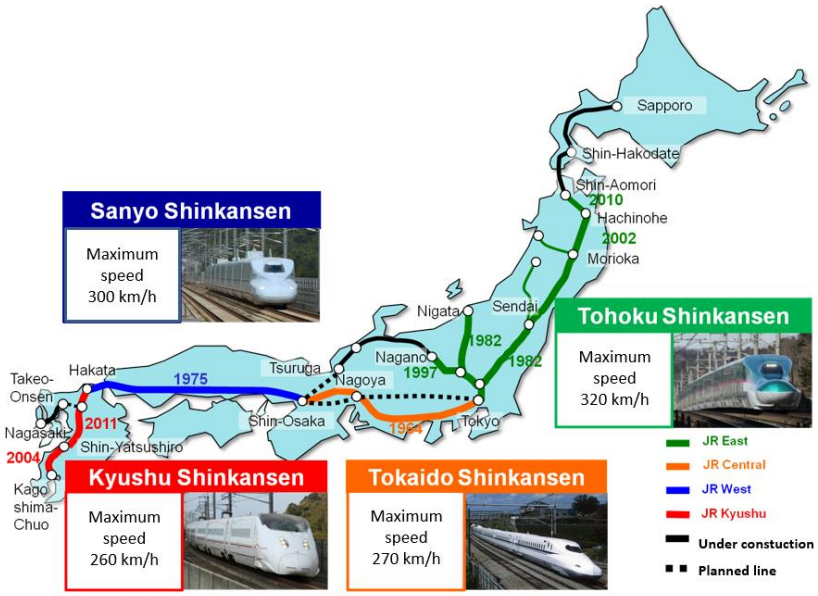

Figure 4.1. The Japanese HSR network and the maximum speed of each line.

Construction

Recent Japanese HSR lines are constructed mainly in concrete, using slab tracks. For example, the structure of the north section of Kyushu Shinkansen is 64% bridges, 31% tunnels, and 5% earthworks.[33] Due to the high air-tightness of the Shinkansen carriage body, the tunnels can be smaller than other railway tunnels, significantly reducing construction costs. The Shinkansen is also equipped with an earthquake early detection system. In 2011, when eastern Japan was hit by an earthquake, all the trains in operation stopped safely in under one and a half minutes.

Railway gauge

The conventional rail network is mainly narrow gauge (1067 mm), while the high-speed dedicated rail network is standard gauge (1435 mm). The Yamagata and Akita Shinkansen are both conventional lines whose gauge was rebuilt to the standard gauge to permit through service operations with the Tohoku Shinkansen line. Japanese law categorizes the Yamagata and Akita Shinkansen as conventional rail lines, so they are subject to regulations that apply to conventional rail lines. In the interest of safety, the maximum train speed on the Yamagata and Akita Shinkansen line is set at 130 km/h. However, being able to

[32] *Railways in numbers 2013*, Japan, p.126 and MLIT.

reach their destination without changing trains from conventional rail to Shinkansen and vice versa is a great benefit for passengers.[34]

In addition to through services, there are also so-called across-platform inter-changes with narrow gauge on one side of the platform and standard gauge on the other, making it easy for people to move between trains using different networks.

Electrification

The electrification systems used by JR companies are 1500V DC and 20kV AC for conventional lines and 25kV AC for Shinkansen. Electrification with 600V DC, 750V DC, and 1500V DC systems are also seen on private railway lines. The frequency of the AC power supply is 50 Hz in Eastern Japan and 60 Hz in Western Japan; the trains are designed to switch between frequencies without stopping at the frequency boundary.

Signalling systems

A wide variety of automatic train protection systems (ATP) have been employed in Japan since 1927. Japanese ATP systems can generally be divided into automatic train stop (ATS) and automatic train control (ATC) systems. ATS is a term used for intermittent and continuous ATP and essentially serves as a back-up to compensate for human error on the part of train drivers. ATC is a term used for continuous ATP (some modern ATS systems have the same functions as those of ATC). It predominantly controls the train, and the train driver can operate the train relying solely on this system. The Shinkansen employs ATC systems such as DS-ATC, RS-ATC, KS-ATC, and ATC-NS, which are equivalent to the European Train Control System (ETCS) level 2 and enable Shinkansen trains to operate with a headway of around three minutes at a speed of over 300 km/h.

Dispatch centres

Shinkansen operations are handled through various systems. JR Central uses the COMTRAC (COMputer-aided TRAffic Control) operation system. It controls train routes, train operations, and the allocation of staff (drivers and conductors) and rolling stock. There are general control centres in Tokyo and in Osaka (established with JR West).[35] JR East uses an integrated intelligent transport management system called COSMOS (Computerized Safety, Maintenance and Operation Systems of Shinkansen) to handle operations. COSMOS includes seven subsystems: transport planning, traffic control, yard work management, rolling stock management, maintenance work management, central information monitoring, and electric system control systems.[36]

[34] *The Shinkansen*, 3rd edition, Japan Overseas Rolling Stock Association, 2012, p.23.
[35] *Annual report 2013*, JR Central, 2014, p.8.
[36] Yahishita, Naomichi, *JR-East Shinkansen Technology*, presentation for 41th Modern Rolling Stock at the Technical University Graz, 2013-04-08.

Ongoing and planned expansions

The construction of the Japanese HSR network is planned in the Nationwide Shinkansen Railway Development Act. The following lines are being constructed or planned:

1. The Hokkaido Shinkansen line between Shin–Aomori and Shin–Hakodate will be opened by March 2015.
2. The Hokkaido Shinkansen line between Shin–Hakodate and Sapporo will be built by fiscal year 2035.
3. The Hokuriku Shinkansen line between Nagano and Kanazawa will be opened by March 2015.
4. The Hokuriku Shinkansen line between Kanazawa and Tsuruga will be built by fiscal year 2025.
5. The Kyushu Shinkansen line between Takeo–Onsen and Nagasaki will be built by fiscal year 2022.

A new superconducting maglev system

The now privately owned company JR Central is planning to link the three metropolitan areas of Tokyo, Nagoya, and Osaka with a new line using new technology. Unlike the conventional railway system, the proposed superconducting maglev system is a contactless transport system that accelerates and decelerates by means of the magnetic force generated between the onboard superconducting magnets and ground coils, enabling stable ultra-high-speed operation at 500 km/h.

The maglev Chuo Shinkansen line, like the other planned extensions of the Shinkansen network, is based on the Nationwide Shinkansen Railway Development Act. JR Central expects to open the Chuo Shinkansen between Tokyo and Nagoya in 2027 and between Nagoya and Osaka in 2045. The process of obtaining the documentation needed to meet the requirements in the Environmental Effect Assessment Act is underway for the Tokyo–Nagoya line.

4.2 Rail traffic in Japan

Passenger rail traffic

In 2011, 22,706 million passengers were carried by railways in Japan. Of these, 8837 million passengers were carried on the JR network, 3055 million on public railways, and 13,092 million on private railways. The private railways dominate commuter transport in urban areas. The number of passenger-kilometres totalled 395 billion in 2011, of which 247 billion were on the JR network, 19 billion on public railways, and 147 billion on private railways.

The carriage body of Shinkansen trains is wider than that of HSR trains in other countries, enabling a large number of passengers on each train. The Shinkansen operation system also enables trains to be operated at intervals as short as four minutes and there can be up to 15 trains per hour on a line. This enables more efficient use of stations with a limited number of tracks or space. In 2013, the Tokaido Shinkansen route between Tokyo and Osaka was used by 323 trains

per day.[37] There are three types of trains, Nozomi, Hikari, and Kodama: Nozomi stops at major stations, Hakiri stops at a few more places, and Kodama stops at all stations. All JR East's Shinkansen trains pass the same segment (30 km) between Tokyo and Omiya, which is the busiest part of the entire Shinkansen network with more than 400 trains passing every day.[38]

The modal share of rail passenger transport is approximately 28.7% (i.e., percent of total number of passenger-kilometres), of which 5.5% can be attributed to Shinkansen.

Table 4.2. Modal share of transport volume.39

Transport volume	Passengers carried (millions) 2009	Passenger-km (billions) 2009	% of total passenger-kms
Motor vehicles	**66,600**	**899**	**65.6%**
Railways	**22,724**	**394**	**28.7%**
JR companies	8841	244	17.8%
Shinkansen	289	76	5.5%
Other than JR	13,884	150	10.9%
Vessels	**92**	**3,1**	**0.2%**
Aircraft	**84**	**75**	**5.5%**
Total	**89,500**	**1371**	**100%**

However, in terms of the modal share of passenger rail, Shinkansen is much more competitive as a medium-range mode of transport, i.e., 500–600 km. On the Tokyo–Fukuoka route, which is over 1000 km, air transport accounts for a modal share of 90%.

Table 4.3. Modal share on specific lines from Tokyo.

Line	*Railway*	*Bus*	*Car*	*Airplane*
Tokyo–Nagoya (366 km)	71%	5%	23%	1%
Tokyo–Osaka (553 km)	77%	4%	-	19%
Tokyo–Okayama (733 km)	64%	2%	-	34%
Tokyo–Fukuoka (1175 km)	9%	-	1%	90%

The Shinkansen consumes less energy and emits less CO_2 per passenger kilometre than do automobiles or airplanes. The Shinkansen rolling stock weighs less than that of HSR in other countries, because its carriage bodies are made of an aluminium alloy. This also improves carriage speed and economic efficiency.

[37] *Data book 2013*, JR Central, p.7

[38] *Operation System of Shinkansen*, presentation by JR East on September 2013.

[39] *Trend of transport volume (F.Y.1980--2011)*, Policy Bureau, and Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism.

Freight railway traffic

In 1965, railways accounted for 31% of all tonne-km carried; however, that share decreased gradually, and was only 5% in 2012. At the same time, the modal share of truck transportation has grown rapidly (Figure 4.2).

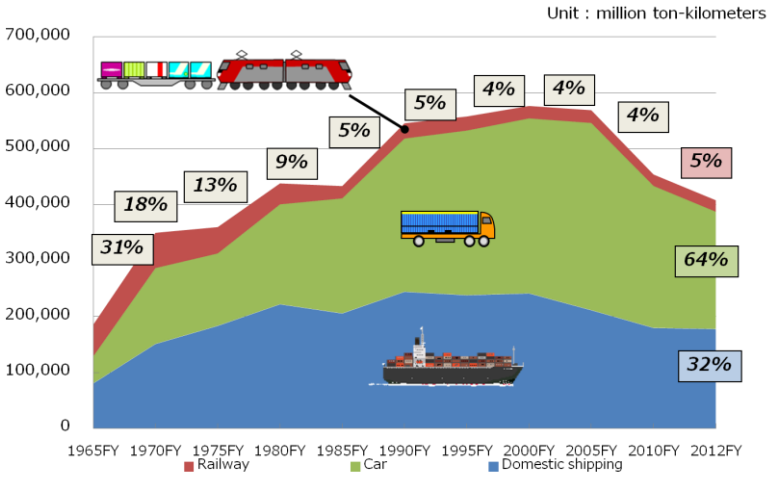

Figure 4.2. Comparison of freight transportation share (source: JR Freight).

However, in terms freight by distance, the modal share of rail freight is greater for distances over 500 km, as shown in Figure 4.3.

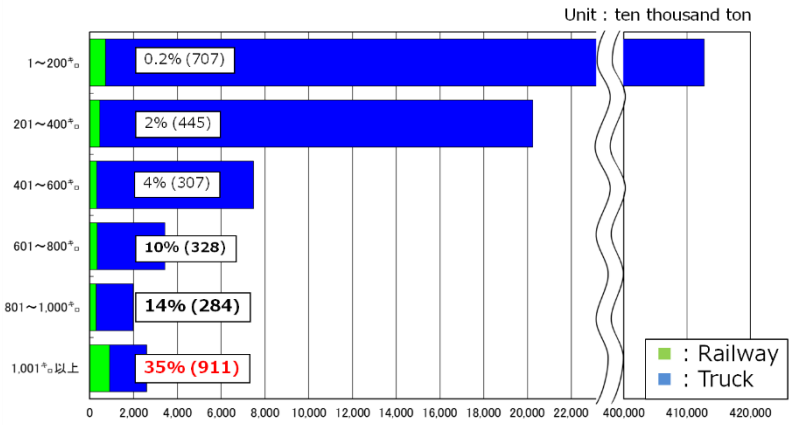

Figure 4.3. The modal share of rail freight by distance (km) (source: JR Freight).

Rail freight is dominated by the state-owned company JR Freight. In 2011, 399 million freight tonnes were carried on railways in Japan, of which 298 million freight tonnes were carried by JR Freight. In terms of freight tonne-km, 19,998 million were carried by twelve freight railway companies, of which 19,879 million can be attributed to JR Freight. The other eleven rail freight companies mainly handle shorter-distance rail freight.[40]

[40] *Railways in numbers 2013*, p.14f.

4.3 Characteristics of Japanese railway organization

The Shinkansen is often characterized by its safety, frequency, reliability, environmental friendliness, and efficiency. There has not been a single accident involving loss of life since the first Shinkansen line was inaugurated in 1964. The Shinkansen has a high level of on-time operations, with an average delay per trip of under one minute, even including delays caused by bad weather such as typhoons. In addition, the Tokaido Shinkansen is also very frequent, sometimes with a train departing every third minute. When it comes to capacity, the HSR trains on the Tokaido line can accommodate up to 1323 passengers – twice the capacity of a Boeing 747 – and the CO_2 emissions of the Tokaido Shinkansen are much lower than for transportation by air or by car.[41]

As previously mentioned, 205 public and private railway companies operate railway businesses in Japan. Many of these are private, short-distance passenger-dominated railways that provide mostly commuter-related services. See Table 4.4.

Japanese railway companies

JR companies	**6**
- *private enterprises*	3
- *public enterprises*	3
Private companies	**176**
Freight companies	**12**
- *private enterprises*	11
- *public enterprises*	1
Other publicly owned companies	**11**
Total	**205**

Table 4.4. Japanese railway companies (source: MLIT)

The state agency Japan National Railway (JNR) began the process of privatization in 1987, when it was divided into six regional passenger companies (the Japan Railways Group, known as the JRs) and one nationwide freight company (JR Freight). These six vertically integrated companies, JR Hokkaido, JR East, JR Central, JR West, JR Kyushu, and JR Shikoku, operate in different regions, as shown in Figure 4.4.

[41] Sakamoto, Ryusuke, *High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?*, Master Thesis, Massachusetts Institute of Technology, June 2012, p.20f.

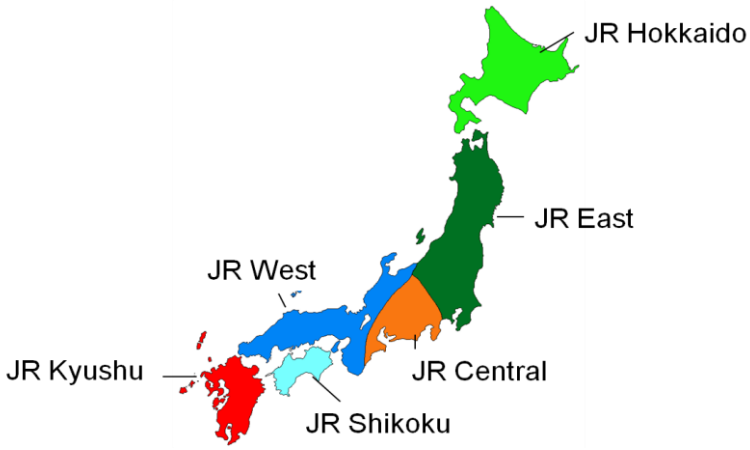

Figure 4.4. Geographical areas served by JR passenger rail companies (source: MLIT).

As of 2014, the Shinkansen is operated by JR East, JR Central, JR West, and JR Kyushu.

Three of the JR companies have been privatized, step by step. In 1993, 62.5% of the stock of JR East went on the market and by 2002 JR East was completely privatized.[42] JR West followed in 2004 and JR Central in 2006 and these three JR companies are now fully privately owned joint-stock companies[43] listed on the Tokyo Stock Exchange. Up to one third of the shares are held by foreign bodies; no single board member has any present or past working relationship with the government; and all decisions related to financial issues, business development, and CEO selection are made autonomously and free from any public interference. These three privatized rail companies receive no state subsidies.

The state has retained ownership of JR Hokkaido, JR Shikoku, and JR Kyushu. These public enterprises nonetheless act as private operators and seek to earn a profit like private companies. However, none of the three companies has been profitable and the state has been supporting them with subsidies, etc.

Vertically integrated structure

Japanese railways have a vertically integrated structure. The companies generally own their rolling stock as well as the infrastructure on which they operate. The exceptions are Shinkansen lines constructed after 2003 by the state agency JRTT and leased to the railway companies. This means that each company is responsible for operating and maintaining its own infrastructure and, in principle, will be either the only or primary user.

[42] Mizutani, Fumitoshi and Nakamura, Kiyoshi, "The Japanese Experience with Railway Restructuring", in *Governance, Regulation, and Privatization in the Asia-Pacific Region*, Volume 12, 2004, p. 307 and Sakamoto, Ryusuke, *High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?*, Master Thesis, Massachusetts Institute of Technology, June 2012, p.44.

[43] Sakamoto, Ryusuke, *High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?*, Master Thesis, Massachusetts Institute of Technology, June 2012, p.44.

Horizontal separation (or regional subdivision)

With few exceptions, passenger railway companies operate in geographically distinct areas. This could make the rail service providers better at meeting local needs and could facilitate yardstick competition across businesses. On the other hand, there may be problems due to lack of coordination between geographically separated entities as well as interface problems when the freight operator, JR Freight, which operates throughout Japan, traverses passenger networks with multiple owners.[44]

To make it easier for passengers to reach their destinations without changing trains, railway companies sign "through-operation service" agreements. These agreements allow railway companies to share rolling stock, so that passengers travelling in large cities or between regions are not affected by the change of operator.

Functional distinction (or the passenger–freight distinction)

Freight and passenger transport are organized separately. Passenger traffic dominates and rail freight had, in 2012, a modal share of only approximately 5% of all tonne-km carried. The Shinkansen uses tracks fully separated from all other railways and roads and the tracks are not multi purpose.

Smaller rail freight companies sometimes own their own infrastructure, but the main freight company, JR Freight, operates throughout Japan and traverses passenger networks with multiple owners.[45] Both tracks and operation systems differ between different parts of the network.

Competition under vertically integrated structure

A large majority of the 205 railway companies in Japan own the infrastructure on which they operate their trains. Therefore, the very concept of competition differs from the European model characterized by vertical separation and horizontal integration. Instead of several operators competing on or for a single route, competition among rail companies is organized along parallel lines or in geographically distinct areas and in terms of best practice and consumer expectations. For competition between geographical areas (i.e., between the JR passenger companies) a yardstick competition scheme is used. Under this scheme, rail operators compete with each other to improve performance, and the regulator assesses the operators' performance using common measures. The results of this assessment are used when fare revision is being considered.[46]

[44] Mizutani, Fumitoshi and Nakamura, Kiyoshi, "The Japanese Experience with Railway Restructuring", in *Governance, Regulation, and Privatization in the Asia-Pacific Region*, Volume 12, 2004, p. 339.

[45] Ibid.

[46] Mizutani, Fumitoshi, and Kiyoushi Nakamura, "The Japanese Experience with Railway restructuring" in *Governance, Regulation and Privatization in the Asia-Pasific Region*, Volume 12, 2004, p. 311.

For short-distance travel and on certain long-distance routes, railway companies compete with each other along parallel routes. This competition is especially intense in dense urban areas. This is illustrated in Figure 4.5.

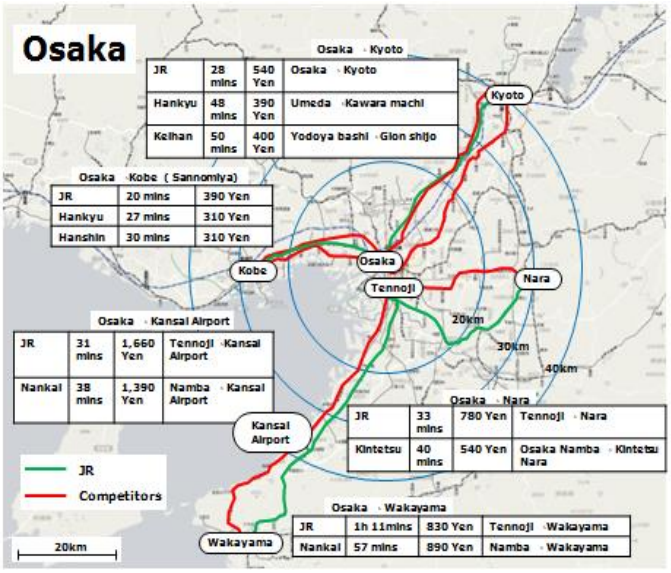

Figure 4.5. Competition along parallel lines; example from Osaka (source: MLIT).

Permission to offer non-rail services

Railway operators, including the three state-owned JR companies, are nowadays allowed to develop their business in non-railway areas. This commercial freedom has led these companies to diversify their business to increase revenue streams. They have actively expanded their business operations into travel-related activities, such as hotel management, shopping centres at stations, travel agencies, and advertising services, in conjunction with efforts to increase their core railway business revenue. This business diversification has contributed to the railways' fulfilling an urban development role, which is a distinctive element of the Japanese railways' business model.

4.4 The initiative in transport policy

Political bodies

Initiatives are formally taken by the elected politicians in the Japanese Parliament and by the Cabinet.

The National Diet

Japan's parliament, the National Diet, is the highest entity of state power and the law-making entity of the state. It is composed of two houses, the House of Representatives and the House of Councillors, whose members are elected by adults over 20 years of age through universal suffrage. The Railway Act is an example of a decision made by the National Diet affecting the Japanese railway.

The Cabinet and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

The prime minister, who must be a member of the National Diet, leads the Cabinet's work and can appoint and dismiss ministers. Railway issues are handled by the Minister of Land, Infrastructure, Transport and Tourism, who also heads the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

MLIT is responsible for determining and implementing transport policy within the terms of relevant laws. Within MLIT, the Railway Bureau specifically deals with railway issues, including policy making, regulation, and subsidy provision.

JRTT

The Japan Railway Construction, Transport and Technology Agency (JRTT) was established in 2003 by merging the Japan Railway Construction Public Corporation (JRCC) and the Corporation for Advanced Transport and Technology (CATT).[47] The objective of JRTT is to "promote the establishment of transportation systems based on mass transportation by constructing railways and providing subsidies for railway companies and marine transport companies to improve transportation facilities".[48] The agency works on developing new railway networks and on railway construction. JRTT works on new Shinkansen lines and on urban railways. It also carries out various research projects to improve the railway network. In addition, JRTT is the agency responsible for handling subsidies to railway companies to improve railway facilities and support technical development. However, JRTT does not focus solely on the rail sector. The agency presents itself as concerned with transportation networks in general. In addition to railways, this also includes the marine sector. For example, JRTT provides financial and technical support to coastal shipping companies through a joint ownership shipbuilding scheme and assists in the practical application of advanced ship technologies.[49] JRTT also has a department working on financing new railways and promoting full privatization.[50]

Local governments

Japan is divided into 47 administrative areas, consisting of 43 prefectures (counties), a big city (Tokyo), a territory (Hokkaido), and two metropolitan areas (Kyoto and Osaka). Local governments are responsible for determining and executing their local policies to address region-specific issues to the extent of the relevant laws and policy of Japan.

[47] *Contribute to the Building of Tomorrow's Transportation Networks*, brochure from Japan Railway Construction, Transport and Technology Agency (JRTT), 2013/08, p. 34.
[48] Ibid.
[49] Ibid., p. 3f.
[50] Ibid., p. 35.

Other organizations influencing Japanese transport policy

The JR companies

The JR companies are important actors in the Japanese railway sector. They initiate and finance a great deal of the development together with other actors. For example, to build a new Shinkansen line or extend an existing one, the government (MLIT) needs to cooperate with the local government in the affected area and with the JR company that will manage, maintain, and operate the line. Another example is the maglev project that JR Central is carrying out without government funding.

RTRI

The Railway Technical Research Institute (RTRI) was established in 1986, just before the break-up and privatization of Japanese National Railways (JNR). RTRI took over the R&D activities of JNR on 1 April 1987. RTRI conducts R&D in railway technology and labour science. The institute also prepares drafts of railway technology standards and original plans and proposals for standardization in line with international railway standards. RTRI authorizes qualifications for railway-related science and technology. In addition, RTRI collects and releases railway-related documents, materials, and statistics and provides diagnosis, advice, and guidance on railway technologies and science.

RTRI is funded by the government, with revenue from the JR companies and by contract revenue from private companies.

Institution for Transport Policy Studies (ITPS)

The Institution for Transport Policy Studies (ITPS) is an independent foundation established under the auspices of the Japanese Ministry of Land, Infrastructure and Transport. The activities of the Institution are non-profit and involve comprehensive research and survey programmes on transportation matters. The Institution also evaluates transport policy and offers recommendations to the Japanese government and concerned parties on transport policy issues.

The overall aim of the Institution is to contribute to the development of transport policy in order to promote the welfare and quality of life in Japan, the country’s economy, and greater harmony in international relations.

The Institute for Transport Policy Studies and the Japan International Transport Institute (JITI) are parts of the Institution of Transport Policy Studies. The Institute for Transport Policy Studies proposes policies, evaluates and analyses the effects of policies, and conducts research to obtain basic data for these purposes. The Japan International Transport Institute (JITI) engages in survey studies and research into matters concerning international transport. The Institute also actively develops and engages in a range of activities concerned with providing information and offering recommendations to the Japanese

government and concerned parties on the current circumstances affecting international transport policy issues.[51]

4.5 Actors, responsibilities, and roles within construction

In Japan, the manufacturing of locomotives and railcars is commercial, while the construction of depots, terminals, stations, and tracks is planned and coordinated by railway companies or, in the case of the Shinkansen, by JRTT.

Main lines, including the Shinkansen

When Japan National Railways was split into six regional organizations and one freight organization in 1987, each of the six passenger JR companies became the owner of the tracks in its geographical area. Each JR company also became responsible for railway construction, management, maintenance, and operations within its geographical area.

However, in the 1990s it became clear that the JR companies could not – at the time – bear the construction costs of new Shinkansen lines. The government therefore devised a new scheme for Shinkansen construction, revised the Nationwide Shinkansen Railway Development Act (1997), and made the Japan Railway Construction, Transport and Technology Agency (JRTT) responsible for constructing high-speed lines (maglev not included) in Japan. However, MLIT is required to reach agreements with both the operator and the local government before starting any new HSR projects.

The new model implies that HSR construction costs should be shared by the local government, central government, and operators. The operators contribute through a rent fee. In fiscal year 2014, the rent fee was approximately 30% of the total budget. Of the remaining 70%, the model states that local governments should pay about one third and that the central government should pay two thirds.

[51] http://www.jterc.or.jp/english/kokusai/introduction/pdf/jiti.pdf

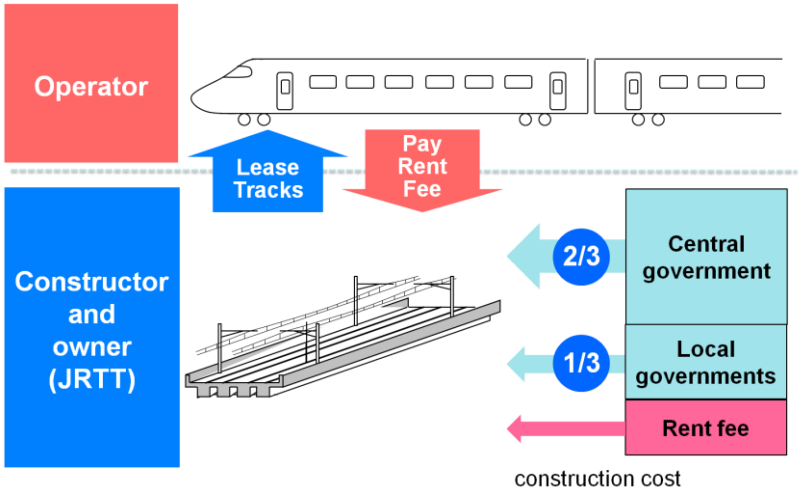

Figure 4.6. Financial scheme for new Shinkansen lines (source: MLIT).

The Japan Railway Construction, Transport and Technology Agency (JRTT) constructs the infrastructure and leases the tracks to the operators, who pay a rent fee.[52] The JR company leasing the tracks also assumes responsibility for operating and maintaining the new line.[53] JRTT does not operate any part of the railway once the line has opened. The new model creates a form of vertical separation between construction, on the one hand, and management, maintenance, and operations, on the other. At the same time JR East, JR Central, and JR West still own the infrastructure (i.e., the Tokaido, Sanyo, Jyoetsu, and Tohoku Shinkansen lines) that they bought in 1991. Therefore, the JR companies both own their own infrastructure and lease infrastructure from JRTT.

Interestingly, several recent projects have been financed by the JR companies themselves. For example, the construction of a maglev line between Tokyo and Nagoya that is due to begin in 2014 is to be funded by JR Central, through a mixture of its own cash flow, loans, and bonds.[54]

The urban railway network

Based on the Urban Railway Master Plan issued by the Transportation Policy Council, an independent MLIT committee, Japanese railway companies construct new lines or upgrade existing lines if necessary. The Master Plan was initially launched in 1956. Since then, it has been revised in accordance with changes in social circumstances. The latest plan is report no. 18 for the Tokyo area (with completion targeted for 2015), which was revised in year 2000. MLIT and the Transportation Policy Council have now started to discuss the next revision of the plan, which will be issued by fiscal year 2015.

[52] *Japanese Railway Policy – Policy on Urban Railway*, presentation from the Railway Bureau, The Ministry of Land, Infrastructure, Transport and Tourism, 26 September 2013.
[53] Sato, Yoshihiko, "Japan: first Hokuriku trains take to the tracks", in *International Railway Journal*, 11 February 2014.
[54] Sato, Yoshihiko, "Construction of Tokyo – Nagoya maglev to start in 2014", in *International Railway Journal*, August 30, 2013.

Manufacturers

Japan has many manufacturers of rolling stock, i.e., Hitachi, Kawasaki Heavy Industries Rolling Stock Company, Kinki Sharyo, Nippon Sharyo, Japan Transport Engineering Company (J-TREC), Niigata Transys Company, and Alna Sharyo. In fiscal year 2012, 1589 new vehicles were manufactured valued at JPY 168 billion; 89% (JPY 150 billion) of these newly built railway vehicles were for domestic shipment and 11% (JPY 18 billion) were for export.[55]

The operators are the actors responsible for ensuring they have rolling stock for their services. The JR companies work together with the manufacturers to develop new rolling stock adapted to the infrastructure. For example, the new Shinkansen Series E7 for JR East, manufactured by Kawasaki Heavy Industries, Hitachi, and J-TREC, began operation on 15 March 2014 on the Nagano Shinkansen, and the Shinkansen Series W7, manufactured by Kawasaki Heavy Industries, Hitachi, and Kinki Sharyo, is intended to operate on the Hokuriku Shinkansen to Kanazawa following the opening of the extension beyond Nagano in March 2015.[56]

Another example is that JR Freight and Toshiba have developed a new locomotive model adapted both to the conventional lines that JR Freight normally uses and to the new Shinkansen standard in terms of the electrical power and signal system. These locomotives are to be used for freight and overnight trains on routes that run on the triple track through the Seikan tunnel.

4.6 Actors, responsibilities, and roles within management, maintenance, and operations

As Japanese railway companies perform most of the management, maintenance, and operation functions, these functions will be described together in this section.

Railway companies within passenger transport

Japan has a number of private railways, most of which own the infrastructure.[57] In total, 175 private railway companies (including metro companies) are in operation, including approximately 20 companies in larger cities. There are also 11 public railway companies, mostly consisting of subway operators in smaller cities.[58] There are approximately 153 railway operators in Japan, excluding operators of monorails, new transit, and other light rail systems.[59]

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[55] *White Paper on Land, Infrastructure, Transport and Tourism in Japan 2012*, The Ministry of Land, Infrastructure, Transport and Tourism, 2013, p.199.
[56] "Series E7 debuts on Nagano Shinkansen", in *Railway Gazette*, 18 March 2014.
[57] Kurosaki, Fumio and Okuda, Keiko, "On-Rail Competition in Korea: A Comparison with Railways in Japan and Europe", in *Proceedings of the Eastern Asia Society for Transportation Studies*, Vol. 9, 2013.
[58] *Japanese Railway Policy – Policy on Urban Railway*, presentation from the Railway Bureu, The Ministry of Land, Infrastructure, Transport and Tourism, 26 September 2013.
[59] Takatsu, Toshiji, "The History and future of High-Speed Railways in Japan", in *Japan Railway and Transport Review*, Issue 48, 2007, p.8.

JR Central

The Central Japan Railway Company (JR Central) was fully privatized in 2006.[60] The core of JR Central's operations is the Tokaido Shinkansen, linking Japan's principal metropolitan areas of Tokyo, Nagoya, and Osaka. The company also operates a network of 12 conventional lines centred on the Nagoya and Shizuoka areas. JR Central has almost 18,000 employees and operates almost 2000 km of railway tracks. Fifty-five per cent of JR Central's network is double or multi tracked and almost 76% is electrified. Almost the entire network (97.5%) is included in the centralized traffic control system and 97.9% is equipped with the automatic signalling system. The number of rolling stock items is 4806.[61]

JR East

JR East, the first of the JR companies to be fully privatized (in 2002),[62] is the largest passenger rail company in the world.[63] It owns the Tohoku and Joetsu lines and has a rail network of 7513 km. Seventeen million passengers (the most in the world) travel by JR East every day. The company has more than 73,000 employees.[64]

JR West

West Japan Railway Company, JR West, was fully privatized in 2004.[65] JR West has a network of over 5000 km in 18 prefectures. Of these 5000 km, 644 km belong to the Hokuriki Shinkansen and the remainder (almost 4400 km) are used by 50 conventional lines. JR West has approximately 6500 passenger cars and 1200 stations. The busiest station is Osaka.

In April 2005, about a year after the full privatization of JR West, an accident occurred at the Fukuchiyama Line in Hyogo Prefecture. The accident was caused by the entry of a commuter train (a seven-car train set) into a curve with a 70 km/h speed limit at a speed of approximately 116 km/h, resulting in the derailment of five cars and the collision of two of the five cars into the wall of a condominium next to the railway track. One hundred and seven people were killed (106 passengers and the driver) and 562 were injured.[66] After the accident, JR West concentrated on safety issues, among other measures instituting the JR-West Corporate Philosophy and the Safety Charter, opening the Safety

[60] Sakamoto, Ryusuke, *High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?*, Master Thesis, Massachusetts Institute of Technology, June 2012, p.44.

[61] http://english.jr-central.co.jp, 2014-03-29

[62] Sakamoto, Ryusuke, *High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?*, Master Thesis, Massachusetts Institute of Technology, June 2012, p.44.

[63] Noda, Yumiko and Satoshi Takesada, "Shinkansen speeds ahead …Nearly 50 years after the silver bullet transformed transportation infrastructure", in *Gridlines*, PwC, 2011, pp. 15-21.

[64] *Operation System of Shinkansen*, East Japan Railway Company, presentation September 2013.

[65] Sakamoto, Ryusuke, High Speed Railway Productivity: How does Organizational restructuring Contribute to HSR Productivity Growth?, Master Thesis, Massachusetts Institute of Technology, June 2012, p.44.

[66] "English version of the Investigation Report into the train derailment accident on JR's Fukuchiyama Line has been published", *UIC eNews*, nr 363, 10 September 2013.

Research Institute and the Railway Safety Education Centre, and implementing a safety plan, the Safety Think-and-Act Plan 2017.[67]

JR Kyushu

The Kyushu Railway Company (JR Kyushu) has 2273 km of tracks divided into 22 lines with 566 stations. JR Kyushu has approximately 1700 railcars and the maximum speed on the network is 260 km/h. JR Kyushu has 9600 employees and 34 affiliated companies. In addition to passenger railway services, JR Kyushu also provides freight railway services and bus services. JR Kyushu is 100% owned by the Japanese state, with JRTT as acting owner on behalf of the state. The company has not yet earned a profit.

JR Hokkaido

The Hokkaido Railway Company (JR Hokkaido) is, aside from Sapporo's subway system, the only railway company on Japan's northernmost main island. JR Hokkaido is 100% owned by the Japanese state, with JRTT as acting owner on behalf of the state. The company has approximately 7000 employees.[68] The new Hokkaido Shinkansen, comprising 360 km of tracks from Shin Aomori to Sapporo (and later to Asahikawa, if so decided), is currently being built. The section from Shin Aomori to Shin Hakodake (through the Seikan tunnel) is scheduled to be completed in 2015–2016,[69] while construction of the 211-km extension from Hakodate to Sapporo is to be completed by 2035.[70] One section of the network, now already constructed, entails track sharing on the same roadbed for Shinkansen, conventional lines, and freight trains.[71]

At the same time, JR Hokkaido is facing numerous problems. Much of the company's rolling stock is old and only 18% of the locomotives are electric.[72] In addition, JR Hokkaido has consistently posted annual losses since the company was established in 1987. For the fiscal year 2013, JR Hokkaido's railway business reported a loss of approximately JPY 33.5 billion.[73] Recently, a series of accidents revealed a poor safety culture.[74] MLIT filed a criminal complaint against the company for violating the Railway Business Act, which was followed by a police investigation. It was suspected that data falsification after the derailment was intended to obstruct the accident investigation by MLIT and the Japan Transport Safety Board.[75] The Japan Transport Safety Board, in charge of

[67] https://www.westjr.co.jp/global/en/about-us/history/2000/

[68] Brasor, Philip, "Trouble is brewing on tracks up north", in *The Japan Times*, 5 October 2013.

[69] Yorita, Junichi, "Current Status of Hakkaido Shinkansen", in *Japan Railway & Transport Review*, No.57, March 2011, p. 16-27.

[70] *Solution for snow and ice problem at switching point. "AIRJET™" in Sweden*, Nabtesco Corporation RailRoad Products Company, presentation given on 25 September 2013.

[71] Yorita, Junichi, "Current Status of Hakkaido Shinkansen", in *Japan Railway & Transport Review*, No.57, March 2011, p. 16-27.

[72] Brasor, Philip, "Trouble is brewing on tracks up north", in *The Japan Times*, 5 October 2013.

[73] "No way to run a railway", editorial, in *The Japan Times*, 19 February 2014.

[74] "JR Hokkaido in crisis", editorial, *The Japan Times*, Nov 27, 2013, and "No way to run a railway", editorial, in *The Japan Times*, 19 February 2014.

[75] Ibid.

accident investigations, also accused JR Hokkaido of violating the Act for Establishment of the Japan Transport Safety Board.[76]

JR Shikoku

The Shikoku Railway Company (JR Shikoku), the smallest of the JR passenger companies, operates intercity rail services in four prefectures on the island of Shikoku. The company is 100% state owned, with JRTT as acting owner on behalf of the government.

JR Shikoku operates a railway system of 855 km, but has no Shinkansen line. The proportion of electrified and double-tracked lines in Shikoku is also far below the national average. Like JR Hokkaido and the JR Kyushu, JR Shikoku has not yet earned a profit. Recently, maintenance failures were discovered in the JR Shikoku network when the Board of Audit of Japan examined the results of the company's regular checks on approximately 2600 bridges in 2012.[77]

Other rail companies

In addition to the JR companies, there are other private rail companies in Japan. They play a large role in urban transit, sometimes running lines parallel to JR lines in large metropolitan areas.

Examples of private rail companies in Japan are Keisei, JT/private, Keio, Keikyo, Meitetsu, Kinetetsu, Hankyu, and Nishitetsu. The Aoimori Railway is an interesting case, as it applies vertical separation between infrastructure and operations. The Aoimori Railway has a line parallel to the Shinkansen. The company Aoimori Railway was established in 2001 to continue operating these conventional lines when they were abandoned by the JR group. For the first time, a two-tier system with infrastructure management separated from operations was established in Japan. The infrastructure is managed by Aomori Prefecture, while Aoimori Railway handles the operations. Aoimori Railway pays track fees to the owner Aomori Prefecture.[78]

Rail companies offering freight services

There are twelve freight railway companies in Japan, most of which are private.[79] The state-owned JR Freight dominates the tiny rail freight market; the state owns the stock of JR Freight and JRTT acts as owner on behalf of the state. JR Freight accesses the trunk line sections owned by the railway companies and operates rail freight services nation-wide. To ensure cooperation, "measures have been taken for the time being to keep the Japan Railways companies in mutual partnership and collaboration, assure user convenience, care for smaller

[76] "Police gear up to search JR Hokkaido", in *The Japan Times*, 12 February 2014.
[77] "JR Shikoku fails to fix 50 railway bridges", in *Kyodo News International*, 27 September 2013.
[78] Nagafuchi, Yuichi, "Aoimori Railway – Keystone to Tohoku Shinkansen", in *Japan Railway & Transport Review*, No. 57, 2011.
[79] *Japanese Railway Policy – Policy on Urban Railway*, presentation from the Railway Bureu, The Ministry of Land, Infrastructure, Transport and Tourism, 26 September 2013.

enterprises and so on in consideration of the background of the Japan Railways reform".[80]

JR Freight had 6142 employees as of 1 April 2013. The company operates 8340 km of tracks, not owning the tracks itself but paying track fees. Approximately 490 freight trains run every day. JR Freight has 457 electric locomotives and 195 diesel locomotives.[81]

Maintenance

The railway companies are also responsible for maintaining tracks and rolling stock.[82] The Shinkansen maintenance work is done at night, during the several hours between the arrival of the last train and the departure of the first.

Various inspection cars are used by the JR companies operating the Shinkansen. The Tokaido Shinkansen is inspected every ten days by the "Dr Yellow" inspection car. The stretch from Tokyo to Hakata (approximately 1100 km) can be inspected at 270 km/h. The Tohoku, Jyoetsu, and Hokuriku Shinkansen lines are inspected by the inspection car called "East I" at speeds up to 275 km/h (see Figure 4.7).

Figure 4.7. Dr Yellow (left) and East I (right) (source: MLIT).

The train sets undergo various forms of inspection following an inspection schema described in Table 4.5 below.[83]

[80] *White Paper on Land, Infrastructure, Transport and Tourism in Japan 2012*, The Ministry of Land, Infrastructure, Transport and Tourism, 2012, p.155.
[81] http://www.jrfreight.co.jp/english/corporate/overview.html
[82] *Internationell omvärldsanalys, Höghastighetsprojektet*, Stockholm: Trafikanalys, 2012, p. 35.
[83] *The Shinkansen*, 3rd edition, Japan Overseas Rolling Stock Association, 2012, p.54

Inspection type	*Period*	*Description*
Daily inspection (pre-departure inspection)	Every 48 hours	Confirmation of train functions; supplement and replacement of consumption items and materials such as oil; and inspection of pantographs, brakes, etc., without disassembly
Regular inspection (condition/function inspection)	Every 30 days or 30,000 km of running	Inspection of vehicle condition and function; inspection of pantographs, brakes, etc., without disassembly.
Overhaul (bogie inspection /major parts inspection)	Every 18 months or 600,000 km of running	Inspection of major parts of important devices such as gears, wheels, and brakes
General inspection	Every three years or 1,200,000 km of running	Removal of most parts from cars and inspection of them in detail

Table 4.5. The Shinkansen inspection system.84

As mentioned above, maintenance problems have been encountered on the conventional lines of the state-owned JR companies, particularly on JR Hokkaido's networks, over the last year.

Property managers

The railway companies also manage the stations, depots, and also often commercial zones around the stations. For example, Tokyo Station is shared between JR East and JR Central, though their tracks and platforms are completely separated.[85] JR East has built office buildings and hotels around Tokyo Station.[86]

Coordination of through-train services

Because the Japanese railway network is separated horizontally by regional subdivisions, services must be coordinated so that passengers can travel between regions. This is done by a through-train service in which trains from one integrated railway (i.e., infrastructure + operations) (A) leave their own infrastructure and access the tracks of another integrated railway (B). The fare for railway operations using A's tracks belongs to railway A even though railway A is using railway B's rolling stock. When railway A uses railway B's rolling stock, railway A pays rent for the rolling stock use to railway B.[87]

[84] *The Shinkansen*, 3rd edition, Japan Overseas Rolling Stock Association, 2012, p.54

[85] *Operation System of Shinkansen*, East Japan Railway Company, presentation September 2013.

[86] Ibid.

[87] Kurosaki, Fumio and Okuda, Keiko, "On-Rail Competition in Korea: A Comparison with Railways in Japan and Europe", in *Proceedings of the Eastern Asia Society for Transportation Studies*, Vol. 9, 2013.

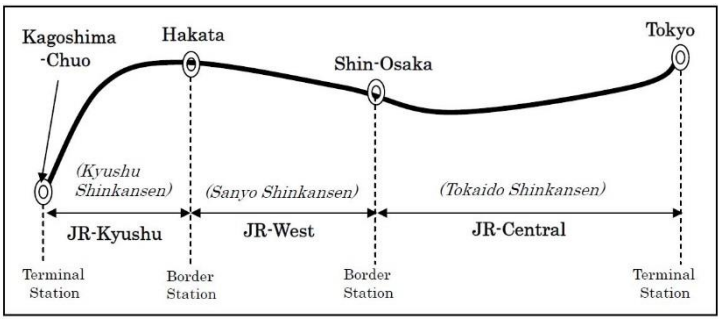

Figure 4.8. Operational responsibilities of the various Shinkansen lines.88

The railway companies have agreements on conditions of access. The responsibilities are clearly separated at the border stations, and each railway is fully responsible for the train operation on its own network. In general, the drivers are changed at the border stations and therefore only drive trains on their own network.[89] The system is also implemented on the Shinkansen lines, i.e., operational responsibilities are clearly separated at the border stations, and each integrated railway company takes responsibility for the train operations on its own network.

4.7 Rulemaking and supervision

Policy making and regulation are not separated in Japan, meaning that the Railway Bureau of MLIT is responsible for policy making as well as for regulation and financing (e.g., subsidies). MLIT is also the organization that approves companies wanting to operate in the railway sector. The trend in policy making has been to move away from detailed regulation, giving the companies more freedom to develop their own standards.

Supervising authorities

Japan Transport Safety Board

The Japan Transport Safety Board (JTSB) has been established as an independent permanent organization whose mandate is to prevent the occurrence of and to mitigate damage caused by accidents in aviation, railways, and shipping. The JTSB conducts thorough investigations to clarify the causes of accidents/incidents in order to prevent recurrence. The results of investigations are compiled into investigation reports, which are submitted to MLIT and made public. Moreover, when deemed necessary, the JTSB provides recommendations or opinions to the relevant ministers and/or parties involved in the accident concerning the necessary measures to be taken.

Regional District Transport Bureaus

There are nine Regional District Transport Bureaus at the MLIT. They are responsible for instruction, auditing, inspection, and registration across several

[88] Ibid
[89] Ibid.

modes of transportation, i.e., ships, automobiles, and railways, in each regional district in Japan.

Board of Audit of Japan

The Board of Audit of Japan is a constitutionally mandated organization that is independent of the Cabinet and belongs neither to the Diet nor the courts. The Board audits the accounts of the state, public organizations, and other bodies as provided by law, and also supervises public accounting to ensure its adequacy.[90] The Board also audits the finances of the public agencies and state-owned companies in the rail sector. The Board recently discovered failures when it examined the results of a JR company's regular checks on approximately 2600 bridges in 2012.[91]

4.8 Current Japanese rail policy and future challenges

The Traffic Policy Basic Act

The Traffic Policy Basic Act, enacted in 2013, systematically and comprehend-sively sets forth the main traffic policy, including the railway policy. It also identifies the responsibility of various actors, such as the government and the transport operators. Based on the act, the Japanese government is now discus-sing the Traffic Policy Basic Plan (2015–2021), which will be formulated in 2014. This plan will be linked to the Priority Plan for Social Infrastructure Development.[92]

The Priority Plan for Social Infrastructure Development

Based on the Act of Priority Plan for Social Infrastructure Development, a new plan (2012–2016) was formulated in 2012. The plan sets forth goals regarding the implementation of social infrastructure development as well as specifying related policies and their implementation. This plan covers not only railways but also roads, traffic safety facilities, airports, harbours, and parks and river construction.

The High-Speed Rail Basic Plan and Development Plan

The Japanese rail policy includes continued investment in HSR. Based on the National Shinkansen Railway Development Act, the Minister of Transportation formulated the HSR basic plan in the 1970s. A new development plan, in compliance with the original basic plan, was decided on in 1973 and again in 2011.

[90] http://www.jbaudit.go.jp/english/jbaudit/status.html

[91] "JR Shikoku fails to fix 50 railway bridges", in *Kyodo News International*, 27 September 2013.

[92] MLIT

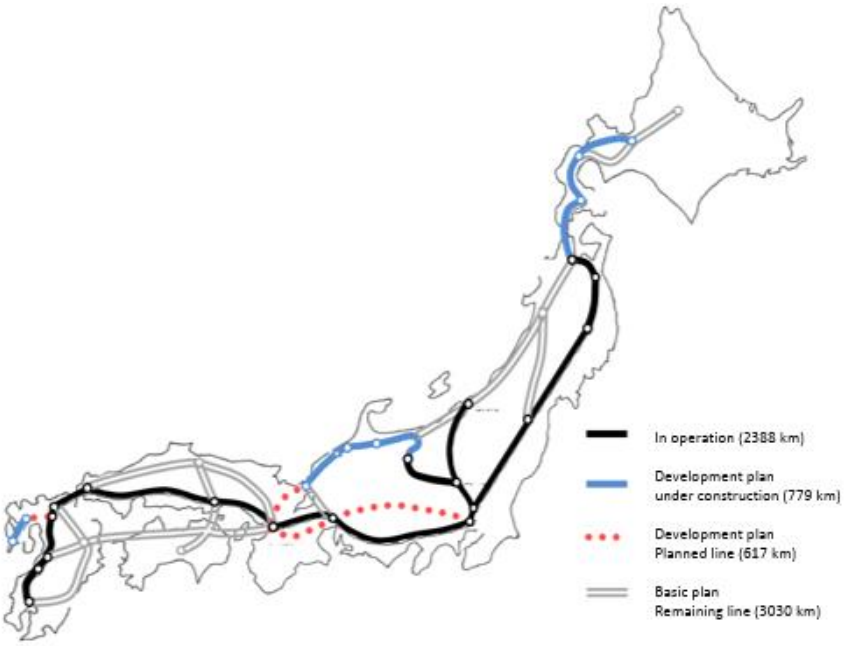

Figure 4.9. The Shinkansen Basic Plan and Development Plan.93

The latest development plan is for the Chuo Shinkansen line utilizing the Maglev system.

Urban Railway Master Plan for Tokyo

The policy goals of the Urban Railway Master Plan are dated 2015. As mentioned above, MLIT and the Transportation Policy Council are now working on the next revision of the plan, to be issued by fiscal year 2015.

[93] *Railways in numbers 2013*, p.126.

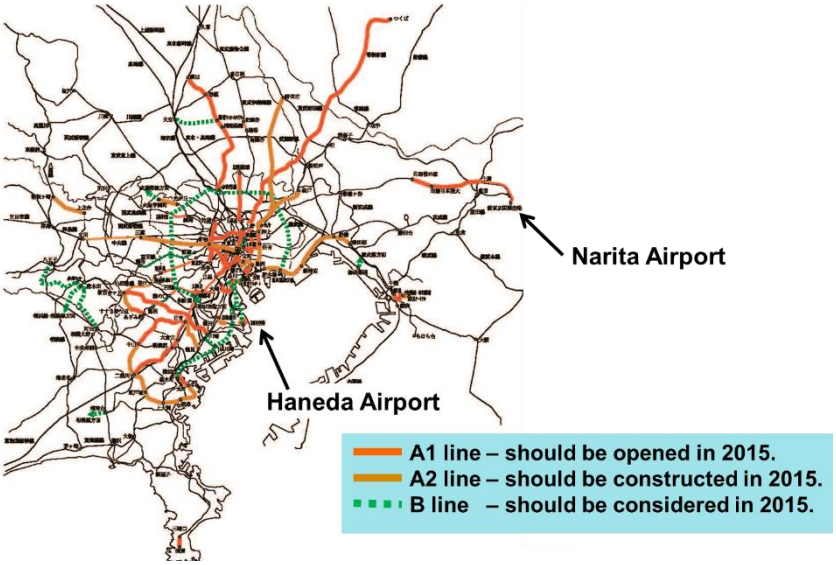

Figure 4.10. Urban Railway Master Plan for Tokyo, No. 18 (source: MLIT).

Figure 4.10 shows the lines to be opened in 2015, the lines to be constructed in 2015, and the lines to be considered in 2015.

Driving technical development

The government wants Japan to be drive technical development in the train sector. For example, the government is investing (through JRTT) in the Yamanashi (maglev) Test Line,[94] while MLIT aims to verify the durability of free-gauge trains by launching three-mode durability testing.[95]

Free-gauge trains (i.e., trains with changeable gauge) automatically change the distance between their left and right wheels to fit different gauges, such as the gauge for Shinkansen (standard gauge, 1435 mm) and conventional lines (narrow gauge, 1067 mm) for through-service operation. Free-gauge trains will be used on the Kyushu Shinkansen line between Hakata and Nagasaki, to be opened in 2020.

Figure 4.11. Free-gauge train (source: MLIT).

An example of a technological development that promotes increased safety is platform doors. In Japan, the position of train doors differs between train

[94] *White Paper on Land, Infrastructure, Transport and Tourism in Japan 2012*, The Ministry of Land, Infrastructure, Transport and Tourism, 2012
[95] Ibid.

operators. The Japanese government and industry actors are in the process of installing platform doors that can adjust to these different door positions.

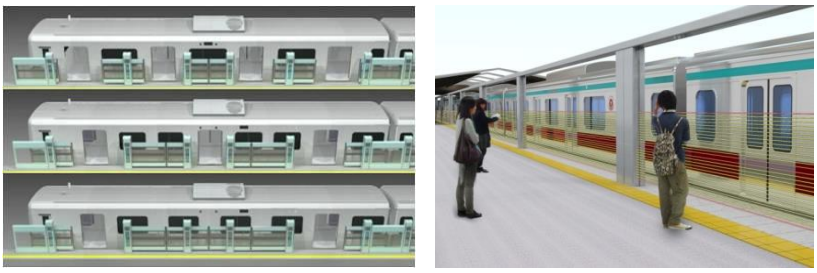

Figure 4.12. Platform doors in different positions (source: MLIT).

Main future challenges

Construction of new HSR lines

Since the inauguration of the first line in 1964 the Shinkansen network has played a key role in intercity passenger transport in Japan, thereby contributing to the well balanced development of land and the growth of the national economy.[96] Based on the National Shinkansen Railway Development Act new Shinkansen lines are currently being developed. The Japanese government is promoting the expansion of the HSR network.

Urban railway

Since the urban railway Master Plan was issued by the Transportation Policy Council, railway companies have been constructing new lines and upgrading existing lines to improve the urban railway network. The future challenge is to reduce travel time while making effective use of existing urban railway facilities and facilitating station usage. The Japanese government is promoting the improvement of the urban railway network as well as measures to counteract delays and congestion during peak commuting hours.

Regional railways

Regional railways are a critical means of transportation for dependent users such as students and the elderly; however, the number of passengers transported by such railways is decreasing and approximately 80% of regional railway companies were in the red as of 2012. Many of these companies have been in operation for more than 70 years, and the deterioration of rolling stock, tunnels, and bridge works, etc., means that ensuring safe operation is crucial. The Japanese government provides subsidies for regional railways, particularly for safety investments.

The Japanese state still owns three passenger JR companies and JR Freight, but is aiming at complete privatization in the future. However, these companies never had the internal resources to cover losses from their many rural lines and

[96] *Railway assistance towards tomorrow*, JRTT, 2013, p.4

none of them earns a profit.[97] At the same time, they play an important role in providing local transportation and in providing freight transportation with a low environmental impact. These companies also need to invest in new rolling stock and in maintenance.[98]

Rail freight

Freight railway transportation is most advantageous over middle to long distances. However, rail freight has a low modal share in Japan and a shift to rail is desirable, especially from an environmental perspective. The Japanese government provides subsidies to bolster freight railway capacity and is promoting a modal shift from trucks to railways to reduce CO_2 emissions.

Safety measures

With the recognition that safety is the top priority of railway services, comprehensive and continuous efforts to ensure safety are being promoted to improve the safety of train cars, railway facilities, and miscellaneous equipment and infrastructure (including crossings), to create a safety-prioritizing corporate culture, and to develop barrier-free systems and measures to counter earthquakes and other disasters. The Japanese government provides subsidies for measures to counter earthquakes and the deterioration of facilities, etc. Furthermore, the Japanese government is enhancing safety inspections to prevent train accidents.

[97] Terada, Kazushige, “Railways in Japan – Public and Private Sectors”, in *Japan Railway and Transport Review*, nr 27, June 2001, p.54.

[98] *White Paper on Land, Infrastructure, Transport and Tourism in Japan 2012*, The Ministry of Land, Infrastructure, Transport and Tourism, 2012, p.155.

5 Railway organization compared

5.1 The organization of the railway functions

This comparative study of rail organization uses a framework for analysis based on railway functions. For each country, the railway network and traffic as well as the characteristics of the railway organization have been described. Furthermore, the organization of each function within the overall rail organization in Japan and Sweden has been described. As shown in Table 5.1, the democratically elected political bodies retain the initiative to formulate railway policy in both Sweden and Japan. However, the opportunities for private companies to initiate new infra-structure investments are greater in Japan than in Sweden, where the Swedish Transport Administration plans and constructs new infrastructure. The Swedish Transport Administration is also responsible for management (including capacity allocation and traffic management) as well as maintenance. However, Swedish railway operations are run by both public and private companies.

Table 5.1. The organization of the various railway functions in Sweden and Japan.

	Sweden	***Japan***
Initiative	Government	Government and railway companies
Construction	Swedish Transport Administration	Railway companies and JRTT (HSR, except maglev)
Management	Swedish Transport Administration	Railway companies, both private and public
Maintenance	Swedish Transport Administration	Railway companies, both private and public
Operations	Railway companies, both private and public	Railway companies, both private and public
Supervision	Swedish Transport Agency, notified bodies, Swedish National Audit Office, etc.	MLIT and Japan Transport Safety Board

In Japan, it is common that private companies own railway infrastructure. Although the state agency JRTT plans and constructs the new Shinkansen lines, railway companies may also initiate their own projects. However, they need ministerial approval to start construction. In Japan, the passenger railway companies operating the traffic are the actors responsible for management (including capacity allocation and traffic management) and for maintaining both rolling stock and infrastructure. The state agency JRTT, which constructs new infrastructure, does not manage or maintain rail facilities or infrastructure or operate rail traffic.

The supervision is similar in Sweden and Japan when it comes to auditing and accident investigation. However, Japan has no organization equivalent to the Swedish Transport Agency. In Sweden, the supervising function is separated from policy making and from infrastructure planning, construction, management, and maintenance.

5.2 Structuring of the railway

Various structuring prototypes have been adopted to enhance competitiveness in railways. Some of the major options for railway structuring are geographical division, functional distinction, and vertical separation.[99]

Two ways of organizing the rail market

Railway market restructuring started in the late 1980s in both Sweden and Japan. Since then, the sector's regulations have continuously been revised in order to create well-functioning markets. In Sweden the railway market has offered open access since 2010. In Japan, geographical division and privatization had already been carried out in 1987, and three of the JR companies were fully privatized in 2002–2006. The four remaining companies are still state owned, and the state (through JRTT) has taken a greater responsibility for new construction projects than initially planned.

Geographical market segmentation in Japan

Geographical market segmentation is done by dividing markets into several sub-networks. In Japan, the passenger traffic handled by the JR companies has been divided between six companies covering six geographical areas, while JR Freight operates throughout the country. Urban and regional railways are also geographically divided sub-networks. In Sweden, there is no geographical market segmentation for freight or long-distance passenger traffic; however, regional and inter-regional passenger traffic could be seen as geographically divided into sub-networks.

More functional distinctions in Japan

Railways serve two basic markets: passenger and freight. Each of these has its own operational and geographical uniqueness, so one way to organize railway

[99] Mizutani, Fumitoshi and Nakamura, Kiyoshi, "The Japanese Experience with Railway Restructuring", in *Governance, Regulation, and Privatization in the Asia-Pacific Region*, Volume 12, 2004, p. 307.

service is to distinguish between these two markets.[100] Another way to make a functional distinction is to separate commuter traffic from long-distance passenger traffic, as these two markets, while often partly sharing the same infrastructure, use it in different ways. Commuter traffic is slower and makes more frequent stops, while long-distance traffic is faster and makes fewer stops. Track sharing between these two kinds of traffic is therefore complicated.

In Japan the passenger and freight markets are separated, but on the conventional rail network the passenger and freight trains share the same tracks. However, most of the tracks are owned by passenger rail companies, putting JR Freight at a disadvantage when getting track access. Freight trains cannot use the Shinkansen tracks, which is why there is also a separation between HSR and freight train tracks.

In Sweden, the freight and passenger traffic markets are separated, but the trains share the same infrastructure, so one could argue that the markets are not completely separated. The Swedish Transport Administration has the task of allocating capacity and track access in a socioeconomically efficient way, i.e., the Administration estimates the socioeconomic value of the various types of trains that need access to the tracks and decides what trains should get what slots.

In Sweden, commuting is the responsibility of local and regional governments and this traffic is often procured. However, some of the companies running procured traffic are owned by long-distance rail companies (e.g., SJ AB). The commuter trains often, but not always, use the same infrastructure as do long-distance passenger trains, making it complicated to allocate capacity between the two types of trains.

In Japan, some rail companies have businesses in both commuting and long-distance rail services.

Vertical integration and separation

There are many options when it comes to vertical separation. For example, accounting might be separated from other functions, rail operation might be separated from rail infrastructure, or there might be organizational separation involving a holding company.[101] Operation–infrastructure separation implies that natural monopolistic elements such as track maintenance and potentially competitive elements such as train operations and commercial functions are separated to enhance competiveness. However, several problems are associated with this model: high transaction costs, a need to monitor other actors' performance, the difficulty of creating complex schedules, and a lack of incentive for the track authority to invest in new facilities to improve efficiency and safety.[102]

[100] Ibid.
[101] Mizutani, Fumitoshi and Uranishi, Shuji, "Does Vertical Separation Reduce Cost? An Empirical Analysis of the Rail Industry in OECD Countries", *Discussion Paper Series 2010-48*, Rokko Kobe: Kobe University, 2010.
[102] Mizutani, Fumitoshi and Nakamura, Kiyoshi, "The Japanese Experience with Railway Restructuring", in *Governance, Regulation, and Privatization in the Asia-Pacific Region*, Volume 12, 2004, p. 308.

In Japan, the main separation model entails separation between construction, on the one hand, and management, maintenance, and operations, on the other. This means that management, maintenance, and operations are integrated. The construction is often publicly funded, while the management, maintenance, and operations are financed by the railway company responsible for the line. However, there are exceptions to this pattern. One exception is the Aoimori Railway, where separation between operations and infrastructure has been implemented. The infrastructure is managed by Aomori Prefecture, while Aoimori Railway handles the operations and pays track fees to Aomori Prefecture.[103] Another exception is the new maglev line, which is not publicly funded and not constructed by JRTT, but is being privately funded and constructed by the railway company JR Central.

It should also be noted that this model has proved successful for the JR passenger companies of the main island of Japan, but that the remaining state-owned JR companies have problems earning profit while maintaining and developing their network and rolling stock.

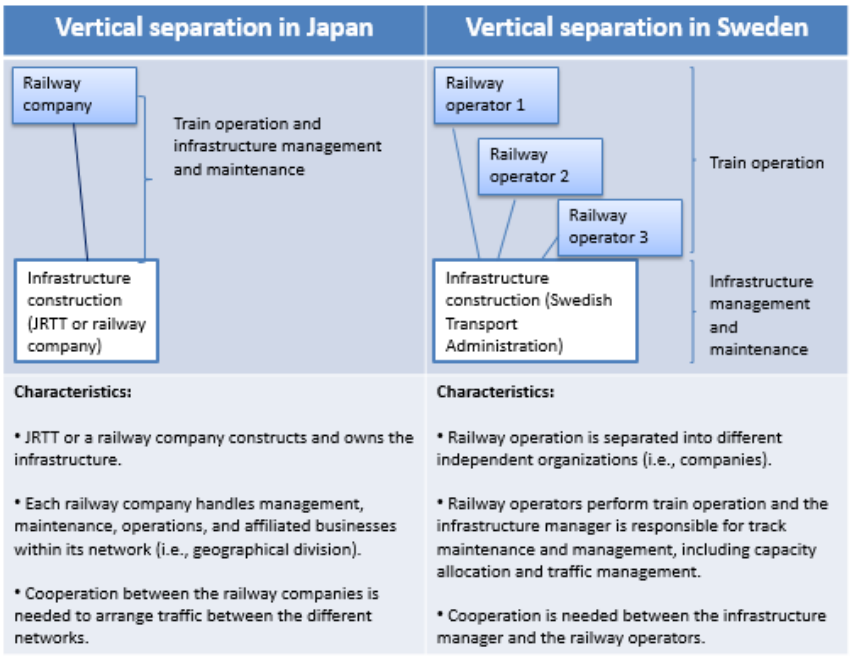

Figure 5.1. Comparison of vertical separation in Japan and Sweden.104

In Sweden, operations and infrastructure are separated. The infrastructure is managed and maintained (maintenance being procured) by the Swedish Transport Administration, but the operations are carried out by various railway companies. There is open access to the tracks and the Swedish Transport

[103] Nagafuchi, Yuichi, ”Aoimori Railway – Keystone to Tohoku Shinkansen”, in *Japan Railway & Transport Review*, No. 57, 2011.

[104] Kurosaki, Fumio and Okuda, Keiko, ”On-Rail Competition in Korea: A Comparison with Railways in Japan and Europe”, in *Proceedings of the Eastern Asia Society for Transportation Studies*, Vol. 9, 2013.

Administration allocates track access and manages the traffic. However, there are exceptions in Sweden as well. For example, on Arlandabanan there is no separation between infrastructure and operations. The tracks are state-owned but are leased to the private company A-train, which is responsible for management (including track and capacity allocation and fee structure), maintenance, and operations. This model is comparable to the Japanese way of organizing the railway sector. It has not yet been decided how the new HSR main line in Sweden will be organized.

Different competition policies

Competition policy differs between Sweden and Japan. While Sweden has opted for direct competition in the railway market (via either open access or competitive tendering to select the rail operator), Japan has chosen to apply a yardstick competition scheme (based on benchmark competition theory) to existing railway organizations and competition on parallel lines. Japan also imposes price regulation, i.e., a price cap, whereas there is no such regulation in Sweden.

There is currently no service obligation for the rail companies in Sweden or Japan. SJ AB formerly had a clear obligation to maintain service in all parts of Sweden. Nowadays, the Swedish Transport Administration determines where there must be service and competitive tendering determines what company should provide the service. In Japan there is no legal obligation to maintain local services, but depopulated communities often negotiate with the JR companies regarding the maintenance of local lines and other matters related to local service. This results in what Mizutani and Nakamura call an unofficial social contract between the rail companies and local communities.[105]

Regarding the scope of railway company business, there is no legal restriction in Sweden, though the aim is to streamline the business of state-owned companies. In Japan, most railway companies run a great many affiliated businesses that they promote actively.

Table 5.2 summarizes the differences between how Japan and Sweden have organized their railway markets.

[105] Mizutani, Fumitoshi and Nakamura, Kiyoshi, ”The Japanese Experience with Railway Restructuring”, in *Governance, Regulation, and Privatization in the Asia-Pacific Region*, Volume 12, 2004, p.316.

Table 5.2. The organization of the railway markets in Sweden and Japan.

	Sweden	***Japan***
Year new organization was initiated	1988 (complete market opening 2010)	1987
Vertical separation or integration	Vertical separation of construction, management, and maintenance from operations	Mostly integrated, but vertical separation (i.e., HSR) of construction from management, maintenance, and operations
Geographical market segmentation	No	Yes, but only for passenger rail
Functional distinctions	Partly separated markets for passenger and freight services (track sharing) Commuter and long-distance passenger traffic share the same tracks	Passenger and freight railway share the same tracks Separation of passenger from freight services (HSR)
Ownership of infrastructure	Most railway infrastructure is state owned	Much railway infrastructure is privately owned
Ownership of rail companies	Joint stock companies The major rail companies SJ AB and Green Cargo AB are 100% state-owned, but there are also several private companies	Joint stock companies Many rail companies are privately owned, but four JR companies are still 100% state owned
Open access to the entire state-owned network	Yes	No
Competition policy	Open access and full competition or procurement through direct competition Capacity allocation through valuing socioeconomic efficiency	Competition among railway companies running parallel lines
Infrastructure charges	Variable track charges	Track charges
Rail fare control	No	Fare competition under the fare ceiling authorized by MLIT
Design of services	Rail companies; the Swedish Transport Administration for unprofitable lines that are procured	Rail companies
Service obligation	No legal obligation, but the Swedish Transport Administration (and sometimes the Riksdag) decides where there should be service; if no service exists on these lines, it will be procured through competitive tendering by the Swedish Transport Administration	No legal obligation, but joint effort to maintain the local railway services involving local government, railway companies, and other actors
Scope of business allowed	No legal restriction, but the aim is to streamline the business of state-owned companies	Nonrail business (e.g., residential development and tourism) allowed

Differences in the infrastructure to be organized

In addition to the differences in railway market organization between Sweden and Japan, there are also differences in the infrastructure to which the market must adapt. In Japan there is both a conventional railway network on ballast track and a fully grade-separated network on slab track that is dedicated to HSR. This means that the tracks and operations cannot always be multi purpose, and that it can be easier to handle both maintenance and traffic management on the dedicated HSR lines. In Sweden, the tracks are multi purpose. They are constructed using a ballast track structure and can be used for commuting, freight, or long-distance rail. This makes it more complicated to allocate capacity and to use capacity for maintenance in a socioeconomically efficient way.

Table 5.3. Comparison of infrastructure and infrastructure investments in Sweden and Japan.

	Sweden	***Japan***
Main infrastructure holder	Swedish Transport Administration	Railway companies, JRTT (HSR)
Construction of new infrastructure	Swedish Transport Administration	Railway companies, JRTT (HSR)
Infrastructure maintenance	Swedish Transport Administration (procures the maintenance)	Railway companies
Infrastructure investment decisions	Government and parliament	Railway companies, MLIT (HSR)
Grade separation	No, there are approximately 7000 level crossings in Sweden	Yes, Shinkansen lines are fully grade separated from all other railways and roads; on the conventional lines there are grade crossings, but there is some grade separation
Type of track	Ballast track structure	Slab track on HSR lines; mainly ballast track on conventional lines
Multi-purpose tracks	Yes, the state-owned tracks may be used by all kinds of trains	Yes, the conventional tracks may be used by all kinds of trains, but there are dedicated HSR tracks

The construction of new railways is handled by the state in both Japan and Sweden. In both countries the government approves plans before construction and government agencies, i.e., the Swedish Transport Administration and JRTT, respectively, are responsible for construction. However, Japan offers more opportunities for private companies, such as the private JR companies, to initiate and construct new railways. In addition, private railway companies initiate and construct new urban railways in Japan. JRTT is mainly responsible for constructing new Shinkansen lines.

In railway maintenance, there is also an organizational difference between Sweden and Japan. While it is the Swedish Transport Administration that is responsible for maintaining the state-owned network in Sweden, in Japan, the passenger railway companies in each geographical area are responsible for maintaining the networks that they own or lease.

5.3 Coordination in the railway sector

As discussed in chapter 2, the various railway system functions are interdependdent and there is a need for planning and coordination to make a railway system work as desired. Planning and coordination are needed in the long, medium, and short terms as well as on a daily basis when the system is running.

The need for vertical coordination between, for example, infrastructure, rolling stock, and traffic is significant regardless of the time horizon. In Japan this is mainly handled within each railway company. As six JR passenger companies are responsible for different geographical areas in Japan, they need to cooperate and coordinate their services. The JR companies have, for example, organized a system of “through services”, i.e., traffic that continues from one company’s tracks to another company’s tracks. There is also cooperation in ticket sales and the like. Even though the HSR in Japan is divided into various companies working in different geographical areas, a systems approach is applied. The rolling stock and infrastructure are optimized to function together, the ticket sales and through services are coordinated to give passengers a better experience, and new technologies, such as free-gauge trains and flexible platform doors, are being developed to enable the various functions of the railway system to work smoothly together.

In Sweden, a systems approach is lacking. There is a need for coordination between the infrastructure manager and operators as well as between the operators. A great challenge is to allocate capacity in a socioeconomically beneficial way when commuter traffic, long-distance passenger traffic, freight traffic, and maintenance services all need access to the same tracks. There is a need to find ways to make the rolling stock and infrastructure function better together. It would also benefit passengers if ticket sales, routes, transfer points, etc., were coordinated between the various operators.

5.4 Transport policy and future challenges

When comparing the future challenges and current transport policy in the rail sector in Sweden and Japan, the countries appear to have similar agendas: Both countries are planning large investments in HSR, and both countries are emphasizing safety, reliability, and efficiency issues in railway operations.

6 Conclusions

The Swedish and Japanese railway sectors were both deregulated at the end of the 1980s. However, deregulation has been implemented in two very different ways in the two countries. Sweden has chosen vertical separation of operations from the construction, management, and maintenance of infrastructure. Japan has chosen to integrate infrastructure construction, management, and maintenance with operations and, in the case of the Shinkansen, to implement a different form of vertical separation, i.e., separating construction from management, maintenance, and operations. In addition, Japan has chosen to divide the network into geographical areas, making one passenger rail company responseble for each area; in Sweden, there is no similar geographical division. When it comes to competition, this is implemented directly with no fare regulation and no service obligations in Sweden. In Japan, on the other hand, there is competition among railway companies running parallel lines, but no service obligations. As a result, these railway structures function very differently. However, both countries face future challenges related to maintaining parts of their networks and both countries are planning for further investments in HSR. In these two areas, the two countries could learn a great deal from each other.

What can Sweden learn from Japan about rail sector organization? First, Sweden can learn a great deal from Japan about how to organize a high-speed rail network. In addition to learning from Japanese technical developments and infrastructure construction, Sweden could also benefit from the Japanese experience with functionally distinguishing between HSR and other rail traffic. Second, Sweden could study how the conventional network can be connected to the HSR network in an efficient way. Third, Sweden could learn from the systems approach that imbues the Japanese railway sector.

What can Japan learn from Sweden about rail sector organization? First, Japan can learn from Sweden about open access and capacity allocation. Second, Japan can learn from Sweden about organizing rail traffic in parts of the country where it is unprofitable to run rail traffic but where it is important for socio-economic and regional development reasons to maintain the traffic. In Japan, providing this traffic is included in the business of the railway companies; in the Swedish model, the Swedish Transport Administration determines where there should be traffic, and if no traffic can run commercially in an area that needs it, the traffic is procured through direct competition.

Comparing railway policies and related issues in Sweden and Japan is useful in order to create mutual understanding of the railway systems in both countries. Based on the Memorandum and the Action Plan, Sweden and Japan should continue to share their experience and knowledge of specific areas of railway expertise.

Sammanfattning på svenska

I maj 2013 undertecknades ett samarbetsavtal mellan Näringsdepartementet i Sverige och Ministeriet för land, infrastruktur, transport och turism i Japan. Det övergripande syftet är att öka den ömsesidiga förståelsen för politik, lagar och andra författningar, organisation och planering inom järnvägsområdet i Sverige och Japan och att utbyta erfarenheter och teknik inom särskilda områden av gemensamt intresse. Denna studie jämför den nuvarande organiseringen av järnvägen i Sverige respektive Japan. Studien omfattar organisering av infrastruktur och trafik, lösningar för gods- och passagerartrafik liksom hur myndigheter och marknad har organiserats på järnvägsområdet. Analysen utgår från vilka funktioner som krävs för att järnvägssystemet som helhet ska fungera. Järnvägsnätet, trafiken och vad som utmärker organiseringen i Sverige respektive Japan beskrivs. Även organiseringen av de funktioner som behövs för att såväl initiativ, konstruktion, förvaltning, underhåll och drift ska fungera beskrivs.

Initiativ till byggande av ny infrastruktur tas i båda länderna av regeringen, men i Japan finns även möjligheten för järnvägsföretag att på egen hand bygga konventionell järnväg. För höghastighetsjärnväg krävs dock ett regeringsbeslut. För byggande av ny höghastighetsjärnväg i Shinkansen-systemet svarar myndigheten JRTT i Japan, medan byggande av konventionell järnväg eller maglev utförs av järnvägsföretag. I Sverige har Trafikverket motsvarande roll som JRTT, men Trafikverket ansvarar för såväl konstruktionen av höghastighetsjärnväg som konventionella spår. Förvaltning, underhåll och drift sköts i Japan av statligt eller privat ägda järnvägsföretag. Det finns således en vertikal *integration* mellan förvaltning, underhåll och drift – och i vissa fall även med byggande. I Sverige ansvarar Trafikverket för förvaltning och underhåll, medan driften sköts av privata och statliga järnvägsbolag. Det finns således en vertikal *separation* mellan infrastruktur och drift. Organiseringen av uppföljning och kontroll är jämförbar när det gäller olycksutredningar, men tillsyn och granskning är mer utvecklat i Sverige. I Japan finns exempelvis ingen motsvarighet till Transportstyrelsen.

Två skilda sätt att organisera järnvägsmarknaden

I såväl Sverige som Japan påbörjades en omstrukturering av järnvägsmarknaderna i slutet av 1980-talet. Sedan dess har förändringar kontinuerligt gjorts i syfte att skapa väl fungerande marknader. I Sverige öppnades marknaden helt för konkurrens 2010. I Japan genomfördes en geografisk delning och bolagisering 1987. Tre av de sex järnvägsbolagen med passagerartrafik privatiserades under åren 2002 till 2006. Fyra bolag är fortfarande statligt ägda och staten tar, genom myndigheten JRTT, ett större ansvar för nybyggnation av infrastruktur än

vad som tidigare planerades. Nedan beskrivs några av de mer betydelsefulla skillnaderna mellan järnvägsmarknadens organisering i Sverige och Japan.

Geografisk uppdelning av marknaden i Japan

Den tidigare statliga järnvägsmyndigheten Japan National Railways (JNR) delades 1987 in i sex olika geografiska områden, som idag utgör egna nätverk. Ett JR-företag, dvs. de bolag som ersatte den tidigare statliga myndigheten, ansvarar för varje område, medan det statligt ägda godstrafikbolaget JR Freight trafikerar hela landet, men på infrastruktur som ägs av andra bolag. Även pendeltågstrafik och regional trafik är uppdelad geografiskt och drivs i många fall av JR-bolag. I Sverige finns ingen motsvarande uppdelning av fjärrtågstrafik eller infrastrukturförvaltning, även om den regionala och lokala järnvägstrafiken kan ses som geografiskt uppdelad.

Fler funktionella uppdelningar i Japan

Järnvägen har i huvudsak två delmarknader: passagerartrafik och godstrafik. Var och en av dessa har sina egna krav vad gäller drift och infrastruktur och ett sätt att organisera järnvägen är således att separera dem. Passagerartrafiken kan även i sig delas upp i olika typer av trafik, såsom fjärrtågstrafik och pendeltågstrafik. Pendeltågen är t.ex. långsammare och gör fler stopp än fjärrtågen. Om godståg, fjärrtåg och pendeltåg ska samsas om samma infrastruktur är det svårare att använda denna på ett sätt som fungerar bra för samtliga tåg. I Japan är marknaderna för gods- respektive persontrafik skilda, men godstrafiken använder det konventionella järnvägsnätet som ägs av olika persontrafikbolag. Godsbolagen har således ett underläge när det gäller att få tillgång till tåglägen. Godstågen kan heller inte använda höghastighetsbanorna, eftersom dessa inte är anpassade till så tunga tåg. Höghastighetstågen och godstrafiken är således helt separerad.

I Sverige är marknaderna för person- respektive godstrafik separata, men tågen använder samma infrastruktur och påverkar därmed varandra. Trafikverket tilldelar kapacitet till såväl gods- som persontrafiken och lagstiftningen säger att detta ska ske på ett samhällsekonomiskt effektivt sätt. Kommunerna ansvarar för lokal och regional trafik och denna är vanligen upphandlad. Det är dock vanligt att fjärrtågsbolag såsom det statligt ägda SJ AB äger de bolag som kör lokal eller regional trafik. Pendeltågstrafiken använder ofta samma spår som fjärrtågstrafiken, vilket gör att det blir trångt på spåren och är svårt att tilldela kapacitet mellan olika typer av trafik.

Vertikal integrering eller separering

I Japan är huvudmodellen vertikal integrering. Myndigheten JRTT ansvarar numera för all byggnation av nya Shinkansen-linjer. Ny infrastruktur är till två tredjedelar offentligt finansierad (en tredjedel bekostas av operatören genom banavgifter), medan drift, förvaltning och underhåll sköts och finansieras av operatörerna. Det finns dock undantag. Exempelvis äger flera operatörer Shinkansenlinjer som fanns före 1987 och som de själva byggde innan JRTT fick ansvaret för byggnation av Shinkansen. Ett annat exempel är att JR Central bekostar och bygger på egen hand den nya maglev-banan och i regionen

Aomori är den konventionella järnvägen offentligt ägd och leasas till operatören, dvs. infrastrukturen och trafiken är inte integrerade.

Tabell 1 Järnvägsmarknadens organisering i Sverige och Japan.

	Sverige	***Japan***
År omorganisering/omreglering påbörjades	1988 (fullständig marknadsöppning 2010)	1987
Vertikal separation eller integrering	Vertikal separation mellan byggande, förvaltning och underhåll respektive trafik.	Mestadels integrering, men separering förekommer när det gäller höghastighetsjärnväg och då mellan byggande å ena sidan och förvaltning, underhåll och trafik å andra sidan.
Geografisk uppdelning av marknaden	Nej.	Ja, men endast för persontrafik.
Funktionell uppdelning	Delvis separerade marknader för person- respektive godstrafik (trafikerar samma spår). Pendeltågs- och fjärrtågstrafik trafikerar samma spår.	Person- och godstrafik delar samma spår på det konventionella nätet. Godstrafik kan ej använda höghastighetsjärnvägen.
Ägande infrastruktur	Till största delen statligt ägd.	Till största delen privat ägd.
Ägande järnvägsföretag	Aktiebolag. De största järnvägsföretagen SJ AB och Green Cargo AB ägs till 100 % av staten, men det finns även privatägda järnvägsföretag.	Aktiebolag. Många järnvägsföretag är privat ägda, men fyra JR-bolag är fortfarande statligt ägda.
Marknadsöppning på det statliga järnvägsnätet	Ja.	Nej.
Konkurrens	Konkurrens på spåren eller upphandling. Kapacitetstilldelning genom värdering av samhälls-ekonomisk effektivitet.	Öppnad jämförelser och konkurrens på parallella spår.
Infrastrukturavgifter	Banavgifter	Banavgifter.
Prisreglering	Nej.	Priskonkurrens under ett pristak som beslutas av ministeriet.
Utformning av utbud	Järnvägsföretagen och Trafikverket, som upphandlar olönsam interregional kollektivtrafik. Regionala kollektivtrafikmyndigheter.	Järnvägsföretagen.
Krav på service	Nej, men Trafikverket (och ibland riksdagen) beslutar var det ska vara allmän trafikplikt. Om ingen trafik existerar på en linje med allmän trafikplikt upphandlas trafiken i konkurrens av Trafikverket.	Inga krav, men förhandlingar och gemensamma ansträngningar för att upprätthålla trafik.
Järnvägsföretagens affärer	Inga lagliga begränsningar, men järnvägsbolagen är i praktiken renodlade och koncentrerar sig på sin kärnverksamhet.	Icke-järnvägsrelaterade affärer är tillåtna och utgör en stor del av järnvägsföretagens verksamheter.

Det bör också noteras att denna modell har fungerat väl för de JR-bolag som trafikerar Japans mycket tätbefolkade huvudö, medan de JR-bolag som fortfarande ägs av den japanska staten och trafikerar mer glesbefolkade delar av landet, har problem med såväl lönsamhet som att klara av underhåll av infrastruktur och rullande material, liksom utveckling av rullande materiel.

I Sverige är drift separerat från infrastrukturförvaltning och underhåll. Infrastrukturen förvaltas och underhålls (underhållet upphandlas) av Trafikverket, medan olika järnvägsföretag kör trafiken. Järnvägsoperatörerna kan köra i konkurrens på spåren. Trafikverket tilldelar kapacitet och sköter trafikledningen. Det finns emellertid undantag även i Sverige. På Arlandabanan sker ingen separation mellan förvaltning och underhåll av infrastruktur och trafiken. Staten äger förvisso infrastrukturen, men denna leasas till det privata företaget A-train som ansvarar för såväl förvaltning och underhåll som drift och trafik. Denna modell är jämförbar med den japanska huvudsakliga organiseringen. Det har ännu inte beslutats hur den nya svenska höghastighetsbanan ska organiseras vad gäller förvaltning, underhåll och drift.

Olika sätt att se på konkurrens

Sätten att se på konkurrens i Sverige respektive Japan skiljer sig. Medan Sverige har valt direkt konkurrens på spåren har Japan satsat på öppna jämförelser mellan bolagen i olika geografiska områden och konkurrens på parallella spår. I Japan används också pristak, medan Sverige inte har någon sådan lösning.

Servicekrav

Idag finns inga krav på trafik som måste köras för järnvägsbolag varken i Sverige eller i Japan. Tidigare hade SJ AB ett tydligt uppdrag att upprätthålla trafik i alla delar av Sverige. Idag beslutar Trafikverket var det ska vara allmän trafikplikt och upphandlar därefter trafik i konkurrens på de aktuella sträckorna. I Japan finns inget krav på att upprätthålla service i mer glesbefolkade delar av landet, men de lokala myndigheterna förhandlar ofta med tågbolagen om trafik och sluter olika typer av sociala kontrakt.

Renodling eller breddning av järnvägsbolagens verksamhet

I Japan har järnvägsföretagen många olika affärsområden, som de utvecklar parallellt med trafiken. Det kan handla om bostäder, kontor, affärscentrum, restauranger etc. I Sverige har renodling av verksamheterna varit ett ledord och organisationer verksamma på järnvägsområdet är tydligt specialiserade på sina kärnuppgifter.

Skillnader i den infrastruktur på vilken järnvägsmarknaden organiseras

Utöver skillnader i järnvägsmarknadernas organisering finns även en rad skillnader i den infrastruktur på vilken dessa marknader organiseras. Dessa redovisas i tabell 2 nedan.

Tabell 2. Jämförelse av infrastruktur och infrastrukturinvesteringar i Sverige och Japan.

	Sverige	*Japan*
Huvudsaklig infrastrukturförvaltare	Trafikverket	Järnvägsföretag
Byggande av ny infrastruktur	Trafikverket	Järnvägsföretag, JRTT (höghastighetsjärnväg, ej maglev)
Underhåll av infrastruktur	Trafikverket (upphandlar underhållet)	Järnvägsföretag
Beslut om infrastrukturinvesteringar	Riksdag och regering	Järnvägsföretag Ministeriet (höghastighetsjärnväg)
Planskillnad	Nej, det finns ungefär 7 000 plankorsningar i Sverige	Ja, Shinkansen är helt planskild från alla andra järnvägar och vägar. På de konventionella järnvägarna finns det plankorsningar såväl som planskilda korsningar.
Typ av spår	Spår på ballast	Spår på betongplattor (slab) på höghastighetsspåren; huvudsakligen spår på ballast i det konventionella nätet
Spårens användning	Det statliga järnvägsnätet kan användas för alla typer av tåg	Det konventionella järnvägsnätet kan användas för alla typer av tåg, men höghastighetsnätet är reserverat och konstruerat enbart för höghastighetståg.

Infrastrukturen påverkar möjligheterna att organisera järnvägen på olika sätt. I Japan finns såväl ett konventionellt järnvägsnät med spår på ballast som ett helt planskilt järnvägsnätverk byggt på betongplattor (slab), som är reserverat för höghastighetståg.

Detta innebär att trafiken inte kan blandas, men också att det kan vara enklare att hantera såväl underhåll som trafikledning. I Sverige är spåren byggda på ballast och samma spår används för olika typer av trafik, som gods- pendeltågs-, regionaltågs- och fjärrtågstrafik. Detta gör det svårare att fördela kapacitet och även att använda kapacitet för underhållsarbete på ett samhällsekonomiskt effektivt sätt.

Samordning på järnvägsområdet

Behovet av vertikal samordning mellan infrastruktur, rullande materiel och trafik är betydande oavsett tidsperspektiv. I Japan hanteras detta i huvudsak inom varje järnvägsbolag. Eftersom de sex JR-bolagen som kör passagerartrafik ansvarar för var sitt geografiskt område behöver de samordna sin verksamhet horisontellt. Exempel på hur det sker är den service som innebär att ett bolags rullande materiel vid gränsen till nästa bolags infrastruktur byter personal och fortsätter in på den andra operatörens nät. Det innebär att resenärerna inte behöver byta tåg. Det finns även samarbeten vad gäller biljetter och biljettförsäljning. Sammantaget präglas samordningen i Japan av ett systemtänkande. Rullande materiel och infrastruktur optimeras för att fungera bra tillsammans, resor och biljettförsäljning anpassas för resenärernas bästa, ny teknik utvecklas för att lösa problem som äldre infrastruktur med olika spårvidd skapar och plattformsdörrar görs flexibla för att passa till olika typer av tåg.

I Sverige saknas motsvarande samordning ur ett systemperspektiv. Samordningen behöver utvecklas såväl mellan infrastrukturhållaren och operatörerna (t.ex. vad gäller hur rullande materiel och infrastruktur fungerar tillsammans och var det är bäst att göra förbättringar) som mellan operatörerna (t.ex. vad gäller biljettförsäljning, tidtabeller, bytespunkter). Det är en stor utmaning att tilldela kapacitet på ett samhällsekonomiskt lönsamt sätt när såväl pendeltågstrafik, regionaltågstrafik, fjärrtrafik, godstrafik och underhållsarbete behöver tillgång till tåglägen på samma infrastruktur.

Transportpolitik och framtida utmaningar

Vid en jämförelse av Sveriges och Japans framtidsutmaningar på järnvägsområdet har båda länderna, trots stora olikheter i organiseringen, liknande dagordningar: Båda länderna planerar stora nybyggnationer av höghastighetsjärnväg och båda länderna betonar säkerhet, pålitlighet och effektivitet. Båda länderna har också stora framtida utmaningar vad gäller underhåll av järnvägen. Det finns således flera beröringspunkter, där länderna kan lära av varandra.

Sverige kan ha stor nytta av Japans erfarenheter av höghastighetsjärnvägar, såväl vad gäller teknik och infrastruktur som erfarenheter från att separerar höghastighetsnätet från och samordna det samma med det konventionella järnvägsnätet. Slutligen genomsyras Japans arbete med järnvägen av ett systemtänkande som Sverige kan lära av.

Japan kan dra lärdom av hur Sverige arbetar med konkurrens på spåren och kapacitetstilldelning. De skulle också kunna lära av Sveriges system med allmän trafikplikt och upphandling i konkurrens på sträckor där interregional kollektivtrafik är olönsam men viktig av tillgänglighetsskäl.

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