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The optimal setup of a rail system – Lessons learned from outside Europe

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AAR	Association of American Railroads
BC Rail	British Columbia Railway
bn	billion
BNSF	Burlington Northern and Santa Fe Railway
BTS	Bureau of Transportation
CA	Canada
CAD	Canadian Dollars
CAGR	Compound annual growth rate
CAPEX	Capital expenditure
CEO	Chief Executive Officer
CGR	Canadian Government Railway
CHY	Chinese Yuan, Renminbi
CIA	Central Intelligence Agency
CN	Canadian National Railway
CP	Canadian Pacific Railway
CTA	Canadian Transportation Agency
DB	Deutsche Bahn
DOT	Department of Transportation (USA)
EU	European Union
EUR	Euro
FAZ	Frankfurter Allgemeine Zeitung
FRA	Federal Railroad Administration (USA)
GT	Grand Trunk
GTP	Grand Trunk Pacific
GZ	Guangzhou
HS	High Speed Rail
ICC	Interstate Commerce Commission (USA)
JPY	Japanese Yen
JR East	Japan Railway
JV	Joint venture
KCS	Kansas City Southern Railway
L.A.	Los Angeles
m	million
MLIT	Ministry of Land, Infrastructure and Tourism (Japan)
MOR	Ministry of Railroads (China)
MTA	Metropolitan Transportation Authority (Chicago)
NJ Transit	New Jersey Transit
OECD	Organization for Economic Co-operation and Development
OPEX	Operational expenditure

p.a.	per annum
pkm	passenger kilometers
PPP	Purchasing Power Parity or Public Private Partnership
PRIIA	Passenger Rail Investment and Improvement Act
ptkm	passenger ton kilometers (passenger kilometer + ton kilometer)
RMB	Renminbi, Chinese Yuan
RU	Russia
RUB	Russian Ruble
RZD	Russian Railways
SBB	Swiss Railways
SNCF	Société Nationale des Chemins de fer français
SP	Southern Pacific Transportation Company
STB	Surface Transportation Board (USA)
SZ	Shenzhen
TC	Transport Canada
tkm	ton kilometers
TSB	Transportation Safety Board of Canada
UP	Union Pacific Railroad
USA	United States of America
USD	United States Dollars
VHS	Very High Speed Rail
YTD	Year To Date

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1. Introduction

1.1 Target and background

At present, the optimal setup of a rail system is being discussed intensely at the European level. For several reasons, these discussions focus mainly on the vertical structure. First, the European Commission has initiated infringement proceedings against Member States for not fully implementing certain provisions pertaining to the structure model, which the European Commission considers to be mandatory[1]. Second, the question whether or not the financial flows between operators of infrastructure and the holding company should be suppressed has been discussed during the legislative procedure of the so-called Recast of the First Railway Package. Third, the European Commission is examining the issue of vertical unbundling in its preparatory work for the Fourth Railway Package.

This study aims to support the discussion on the optimal setup of a rail system by looking at selected countries outside Europe in order to identify the main lessons learned. A special focus is given to the question of vertical integration vs. separation of infrastructure and train operation. In this study, "vertically integrated" means that managing both infrastructure and train operations is the responsibility of a single group/company (the system integrator) notwithstanding the implementation of un-bundling provisions within this group (e.g. accounting, legal and operational unbundling).

The overall setup of a country's rail system is a major factor that can support railways in – or hinder them from – operating efficiently and maximizing the general economic, environmental and social benefits of rail. The overall setup of the rail system involves several key factors:

- **Vertical integration** of railways
- **Separation** of public and private spheres
- **Shareholder** structure of major railway(s) and intensity of **government financing** (assets, operation)
- Type of railway **regulation** (regarding safety, non-discriminatory treatment, etc.)
- Organization of intramodal **competition** (non-existent, on the tracks, for the tracks, on parallel tracks, etc.)

The setup is, of course, influenced by economic factors (demand for transport of large volumes of heavy goods over long distances, demand for passenger rail, price

[1] Individual proceedings against EU member states, example Germany: In the European Commissions' view, the independence of the infrastructure manager is not guaranteed in terms of organization and decision-making, although the infrastructure manager is legally independent; Source: Action brought on 26 November 2010 - European Commission vs. Federal Republic of Germany, Case C-556/10

level/acceptance, etc.), demography, geography, the maturity of railways (stage in the transformation process) and the social and environmental role of rail in the respective country. However, in a given environment, one setup will be superior to others in terms of overall efficiency and overall economic benefit. In some regions/ countries (EU, China, etc.), the setup is under discussion. While much research has been done on rail systems in Europe in order to determine the effects of vertical separation of railways (e.g. in the UK, the Netherlands and Sweden), less is known about experiences made outside Europe. Deutsche Bahn AG and SNCF Group commissioned this study in order to close this gap.

1.2 Positioning of this study with respect to existing studies

Extensive research has been done over the past few years to find the optimal setup of rail systems, especially on vertical integration. Although, according to the World Bank's "Railway Reform Toolkit", **only two percent of global railway traffic is carried on vertically separated railways[2],** the vertical structure has been a major focus of this research. Many studies cover European countries due to the abundance of very different system setups. The majority of studies appear to either support integrated railway systems or not to reach a clear conclusion.

Pittman[3] names key characteristics of railways that are important in order to understand research results relating to separation and integration effects:

- High percentage of fixed network costs compared with more variable transport costs
- Large economies of scope

In particular, the latter point emphasizes the structural advantages of integrated railway systems.

The World Bank reveals that separating railways vertically "creates complexity and adds transaction costs and regulatory burdens". It also accounts that "some governments have considered separation but rejected it as too complex or as putting at risk some of the possible benefits of integration"[4].

Laabsch et al.[5], after analyzing data from nine European countries from 1994 to 2009, conclude that ownership separation tends to weaken rail considerably in the segment of passenger transport.

Friebel et al.[6] evaluated rail reforms in general with respect to their effect on railroad efficiency across EU countries over a period of 20 years. The study finds that reforms

[2] Source: The World Bank.
[3] Source: Pittman.
[4] Source: The World Bank.
[5] Source: Laabsch, C., Sanner, H.
[6] Source: Friebel, G., Ivaldi, M., Vibes, C.

have efficiency-increasing effects only if the reforms are done sequentially. The introduction of multiple reforms in a package has at best neutral effects.

Another pan-European study conducted by Growitsch et al.[7] adds economies of scope to Pittman's list of attributes, concluding that greater efficiency can be generated in joint operations than in separate railways.

In addition, a joint study of *Swiss Railways (SBB)* and *Roland Berger Strategy Consultants*[8] revealed that separation of railways leads to a deterioration in service quality, and no efficiency increase. The introduction of a new railway structure model entails substantial risks with regard to efficiency and customer satisfaction. Moreover, no significant effects on volume growth, punctuality or customer satisfaction could be identified.

The study further found that separation of infrastructure does not automatically lead to more intense competition. In fact, it is neither necessary nor sufficient to separate infrastructure in order to foster competition in rail traffic. This finding is supported by the research of Nash et al.,[9] who also show that a reform's success does not always fulfill the initial expectations.

Mc Nulty[10] deduces that the British rail industry exhibits a 40% lower efficiency when compared to rail industries of other European countries (i.e. France, Sweden, Switzerland and the Netherlands), because of the intense market fragmentation and the insufficient collaboration between the infrastructure owner (Network Rail) and train operators.

Several studies concluded that no consistent results could be derived from vertical separation.
Mizutani et al.,[11] in their study of 23 OECD countries from 1994 to 2007, revealed that the impact of vertical separation depends on train density and especially that with higher train density vertical separation leads to increased costs.
Drew et al.[12] differentiate between cargo and passenger rail. According to their comparison of aggregate data, countries with vertically integrated railways exhibited faster growth in rail passenger traffic, but slower growth in freight traffic.
Lijesen, et al.,[13] in contrast, found in their analysis of the Dutch rail market that vertical unbundling led to efficiency and performance increases in the rail cargo sector, whereas passenger transportation did not continue its success story after vertical separation.

[7] Source: Growitsch, C., Wetzel, H.
[8] Source: Swiss Railways SBB, Roland Berger Strategy Consultants.
[9] Source: Nash, C., Nilsson, J., Link, H.
[10] Source: Mc Nulty R.
[11] Source: Mizutani, F., Uranishi, S.
[12] Source: Drew, J., Nash, C.
[13] Source: Lijesen, M., Mulder M., Driessen, G.

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Serrano et al.[14] suggest, after analyzing European railways in the period from 1985-2005, that vertical separation and related reforms led to efficiency and productivity increases.

Overall, the research is inconclusive as to whether railways should be vertically integrated or separated. In several European countries, the railway industry structures are currently evaluated and may be modified. This study aims to add answers to this key question based on a selection of railways outside of Europe.

1.3 Methodology

The countries selected for the study host some of the world's leading railways outside Europe in terms of size, efficiency or maturity. Countries were chosen based on the expected value of the lessons to be learned for railways in Europe:

- **USA and Canada:** Very pure forms of large, vertically integrated, liberalized, publicly listed and self-financing cargo railways and a non-integrated passenger railway operating in a difficult environment (very large distances, high affinity of population towards car, etc.)
- **Japan**: Very pure form of large, vertically integrated, publicly listed and self-financing passenger railways
- **China**: Strongly growing rail system with one highly dominant system integrator that both regulates the industry and operates trains
- **Russia**: Very large, vertically integrated cargo and passenger railway in the midst of a reform and privatization process

All five countries were first looked at individually and lessons drawn from each one. These were used to generate overall lessons learned across countries.

The study focuses on the period of the last ten years between 2002 and 2011. However, according to data availability and specific situations, the time scope had sometimes to be modified.

Data was gathered predominantly from:

- Desk research (country statistics, annual reports, prior studies, etc.) and
- Interviews with key railways, railway ministries and rail experts.

The total share of global rail traffic of the five countries in scope amounts to approximately 80% for cargo and 50% for passenger transport (see fig. 1.A).

[14] Source: Cantos, P., Pastor, J.M., Serrano, L.

For each of the five countries, we evaluated the:

- Key steps in the **history** of the rail industry
- **System setup**, incl. key players, their tasks, and degree of vertical integration of key railways
- Organization of **competition** in the industry (intramodal, intermodal)

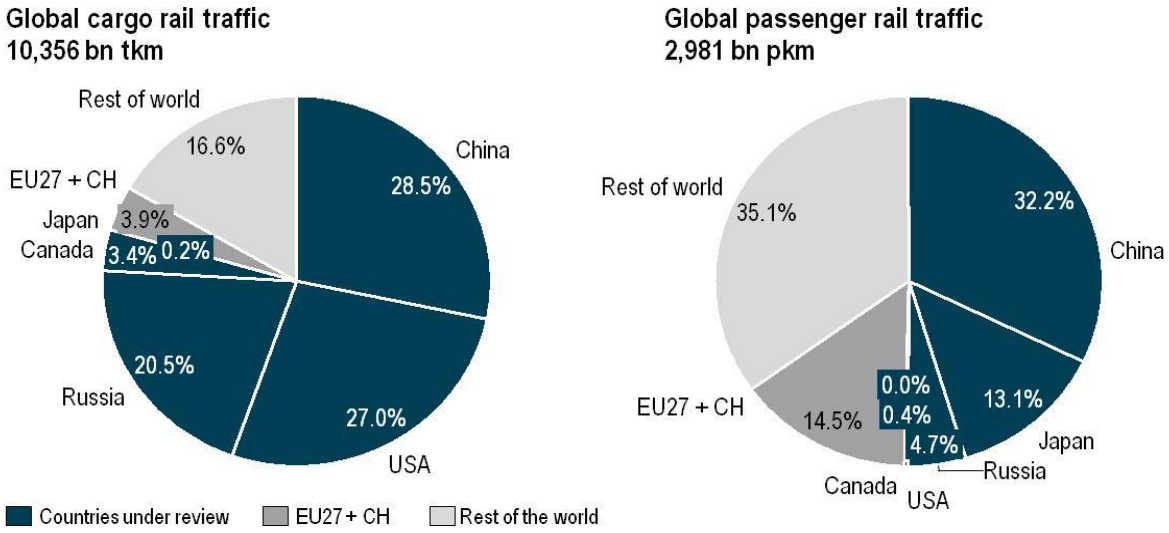

Fig 1.A Global traffic share of covered countries[15]

Then we gathered the past development of indicators in four categories for a ten-year period in each country (dependent on availability of data):

- **Traffic** (absolute, intermodal share)
- **Investments** (private, government)
- **Efficiency** (cost, assets, employee) and
- **Quality** of service (punctuality, safety etc.)

Indicators (absolute values) can be, and to some extent are, compared across countries, but these comparisons are usually of limited significance because:

- Environments for the railways differ significantly
- Price levels and government support differ significantly across countries and
- The railways are at completely different stages in the transformation process.

[15]According to latest available data.
Source: China YearBook; Russian Federal Statistics; DoT BTS; Rail CAN; MLIT; Thomson; ProgTrans.

1.4 Specificities of railways compared to other network industries

With regard to vertical separation of traffic and infrastructure, the rail industry is often compared with other network industries, especially air transport, telecom, electricity, gas and water. Indeed, all of these do share some common features, e.g.

- Dependency of transport on a physical, fixed **infrastructure**
- Typically **large investment** needs, therefore
    - Large **asset** base
    - High share of **fixed costs**
    - Considerable **economies of scale and scope**

Important lessons can be drawn from other network industries and transferred to railways. However, there are key differences that must be very clearly understood before transferring experience from other network industries to railways:

- **Permanent physical interaction between track (infrastructure) and wheel (train operator)** – this does not hold true for air transport, telecom or electricity
- **Strong mutual dependency and interference of wear and tear of key assets** (rolling stock and infrastructure) – this does not hold true for gas and water, telecom and electricity, or air transport
    - The cost and quality of train operations depend on the condition of the tracks (high maintenance requirement for rolling stock, low maximum speed, etc. if tracks are in bad condition)
    - The cost of infrastructure maintenance depends on the condition and operation of rolling stock (high wear and tear of tracks if wheels are uneven, speed is high, braking is strong, etc.)
- **Dependency on government funding** for infrastructure investment and regional passenger rail in most countries globally – this is not true for gas and water, telecom and electricity, or the majority of air transport
- **High complexity of traffic management** due to competition between different types of traffic on the same infrastructure: Strongly differing characteristics of cargo and passenger traffic (especially speed, weight, technological requirements) – this does not hold true for gas, water, electricity and telecom
- **High safety risk in the event of malfunctioning operations** (high potential number of fatalities in train accidents) – this is not true to the same extent for gas and water or telecom

Therefore, much caution must be exercised when trying to transfer lessons learned from these industries to railways.

2. Summary of key findings across countries

This chapter summarizes the key findings across all researched countries. The eight lessons learned can be categorized under A) Setup of railway system and B) Performance of railway system, see fig. 2.A.

A. Set-up of railway system

1. Main railways in all countries under review are **large, vertically integrated** companies – China experimented with vertical separation, but had a negative experience and reversed course
2. A **separation** of tasks and competencies between the railway and the regulatory body can be observed in countries under review
3. All countries under review have either initiated **privatization** or granted access to private capital
4. Key **competitive pressure** comes from inter-modal competition; in North America, also from intramodal competition on separate tracks

B. Performance of railway system

5. In all four major cargo rail countries, cargo **traffic** increased – In two out of three major passenger rail countries, passenger traffic increased
6. Railways in all countries under review increased their **investments** in infrastructure and rolling stock
7. Most railways in the countries under review enhanced their **efficiency**
8. Railways have slightly improved **punctuality** or are already on a very high level and increased **service quality**

Fig. 2.A Overview of lessons learned across countries

The key lessons learned are described below. The statements apply to all countries researched within the scope of this study ("countries under review") unless indicated otherwise: USA, Canada, Japan, China and Russia. Issues are elaborated on in the respective country chapters.

1. Main railways in all countries under review are large, vertically integrated companies – China experimented with vertical separation, but had a negative experience and reversed course

All major railways in the countries under review own and operate both track infrastructure and trains – they are vertically integrated, see fig. 2.B. The respective railways see this vertical integration as a key success factor. China actually had a negative experience with vertical separation in the past. If at all, railway operations are typically split regionally, not vertically.

Setup
In countries with a very strong dominance of either cargo (USA, Canada) or passenger traffic (Japan), the primary segment is operated by vertically integrated railways, and the remainder left to railways operating mostly on other railways' tracks via commercially negotiated track access rights. In countries where both passenger and cargo traffic are of significant size (Russia, China), one integrated railway operates both segments.

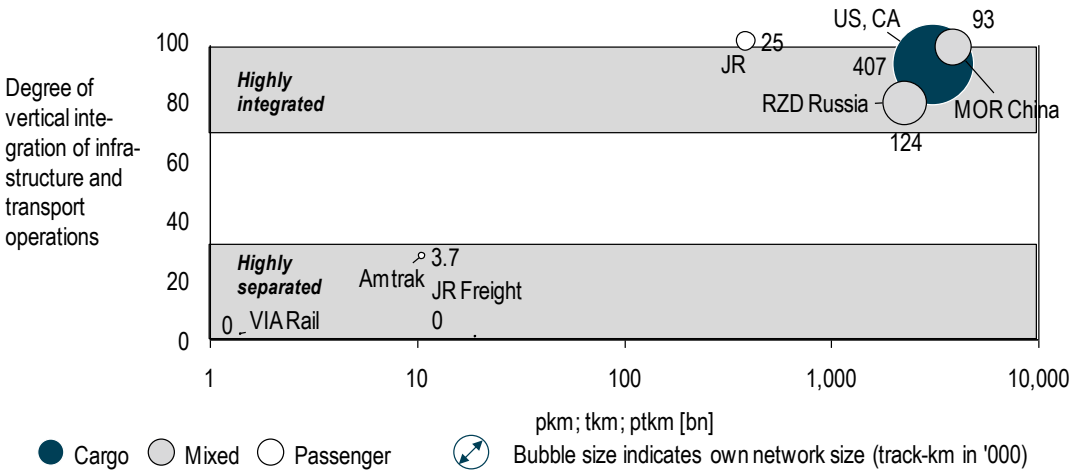

Fig. 2.B Degree of vertical integration of infrastructure and train operations[16]

Whenever railway operations are separated, the split is done regionally rather than vertically. In China, for instance, regional bureaus operate within the *MOR*. In the USA, for instance, *BNSF* and *Union Pacific* operate west of Chicago, and *Norfolk Southern Railway* and *CSX* east of Chicago. And in Japan, *JR* passenger railways operate in clearly defined, non-overlapping regions.

Arguments

Especially in the USA, Canada and Japan, integrated railways are often regarded as the only possible model. In interviews with senior executives at railways, the following main reasons (plus examples) were stated in favor of an integrated railway:

- **Only an integrated railway allows for optimum resource allocation**.

  For example, *Norfolk Southern Railway* confirmed that *"investment decisions usually involve infrastructure and rolling stock, and therefore the economically rational decision can be made only if both areas are considered jointly and in an unbiased manner".*

- **Key operational processes can be handled much more efficiently by an integrated railway, especially in the event of short term changes. Vertical separation leads to high additional costs.**

[16] Y-axis: Share of transport operation on own track: cargo tkm, passenger pkm, mixed ptkm;
US/CA: Railways operating to some extent on other railways' tracks;
RU (RZD): Approx. 50% of cargo wagons operated privately, but locomotives operated by RZD: tkm of private wagons split (50% RZD, 50% wagon operator).
Source: Annual reports of corresponding railways.

For example, *JR East* notes for the Japanese case, that "*one entity generally has both the train operator and the infrastructure and this system works well in terms of achieving higher safety, customer-service and operation efficiency*"

The *AAR* strongly believes that "*integrated railways can operate much more cost-efficiently and can react to the market for transportation services much more effectively than can railways that separated infrastructure and [train] operations*".

- **Integrated railways balance operation and maintenance toward optimum scheduling and service level.**

  For example, *BNSF* states that "*track maintenance heavily influences train operations. Train operation heavily influences track maintenance requirements. For sure, an optimum can best be reached at an integrated railway*".

- **Employee motivation is highest in an integrated railway.**

  For example, *JR East* has come to the conclusion that "*rolling stock maintenance workers are better motivated with more customer-oriented mindsets, by considering themselves as a part of a major railway group rather than being part of a repair shop*".

- **Integrated railways generate superior customer service.**

  For example, speaking with *JR Central*, we learned that "*high service quality can best be reached at integrated railways. This is due, for instance, to the much higher speed of internal decision-making*".

In the USA, *Amtrak* is operating on its own (approx. 30% of Amtrak network) and on other railways' infrastructure (approx. 70%). It clearly favors the integrated railway system setup and confirms the above-mentioned points especially stating that "operations work a lot better on own infrastructure". Also the Ministry in Japan (*MLIT*) concludes that "the infrastructure [incl. stations, freight terminals and marshalling yards] should be a division of the railway".

Experiences in China[17]

In China, the rail regulator and rail operator are represented by the same entity: the MOR. The drawbacks of vertical separation are confirmed by experiences: China experimented with vertical separation in passenger transport from 1998 onward, but due to massive problems resulting from this in the pilot regions, all operations were reintegrated four years later.

- In 1998, *MOR* **proposed splitting** itself into one infrastructure operator, 5-7 passenger railways, 2-3 cargo and 2-3 specialized railways (e.g. cold-chain transport).
- Some passenger railways (*Zhengzhou, Kunming and Nanchang Passenger Railway*) were **selected as pilots**, and infrastructure and passenger train operations were split accordingly and managed by independent entities.
- Numerous **problems occurred** as a consequence, such as:
  - Cost and efficiency – duplication of functions: After separation, employee figures rose because several positions were duplicated, increasing overall cost. For instance in scheduling: The passenger railways set up a scheduling department, and then applied to *MOR's* regional bureau, which already had a similar department installed. *MOR's* regional bureau coordinated all railways' scheduling. The same happened in some administrative departments, such as safety control, public security and labor union. No significant efficiency or revenue enhancements were observed to counteract this effect. Zhengzhou Passenger Railway yielded a breakeven before 2000 and suffered an annual loss of RMB 70 m after separation (2001/2002).
  - Overall efficiency and conflict of interest – ticket sales: Railway operators were charged an infrastructure fee based on the number of passengers. The number of passengers was measured by recorded ticket sales at stations. In order to reduce infrastructure fees, passenger railways encouraged passengers to buy tickets on trains rather than at the station. There was no system integrator that corrected this development.
  - Employee motivation – remuneration: Employees of the infrastructure operator felt discriminated against due to the generally higher wages of passenger railways. Some safety staff in stations and railway crossing personnel went on strike, putting system safety at risk. Again, there was no central mechanism that corrected these adverse effects.
- As a result, infrastructure and train operators in pilot regions were **reintegrated in 2002**.

[17] See country chapter China for a more detailed description of railways' historical development.

Sources: Dong Daily [Chinese newspaper]; People's Daily [Chinese newspaper].

2. A separation of tasks and competencies between the railway and the regulatory body can be observed in countries under review

In general, the separation of tasks and responsibilities of the railway(s) and those of the regulating authority is widespread, and this separation will likely be kept for the future.
In the USA, Canada, Russia and Japan, railway operations and supervision by public authorities are institutionally separated. In the USA, the overall government influence on railways is particularly low (in international comparison). Russia has separated government and railway functions more clearly during the reform of the past ten years (especially the establishment of *Russian Railways Public Corporation JSV RZD* in 2003, followed by the partial privatization of cargo wagons and heavy maintenance) and plans to continue this process.
In China, since 2011, the discussions regarding a forthcoming rail reform include a split between regulator and operator (currently, all discussions regarding the future setup are on hold following the Wenzhou accident in July 2011).

Stability in the reform process is of particular importance from the point of view of the railways. According to *CP*, "ongoing stability of the overall setup is the most important point", because railways "need to know the rules of the game in order to make sound long-term decisions". In the USA, for instance, liberalization and the separation of railway and regulator functions was clearly laid out in the 1980s and adhered to during the following decades.

Fig. 2.C shows different government intervention forms in the railway industry and provides an overview of the presence of these types of intervention in the five countries.

Government body/entity …

	… Sets safety regulation	… Sets/controls track access tariffs	… Plans & oversees infrastructure projects	… Sets service fares for pass-enger & shipper	… Controls and owns market leader
USA	✓				
Canada	✓	(✓) only in certain situations	✓		
Japan	✓	✓	(✓) jointly with private sector companies	(✓) approves prices	
Russia	✓	✓	✓	(✓) not on freight wagon level	✓
China	✓	✓	✓	✓	✓

Fig. 2.C Degree of government intervention[18]

[18] See respective country chapters for detailed analysis.

3. All countries under review have either initiated privatization or granted access to private capital

We observe a tendency to privatize railways in all of the countries under review.

In the USA and Canada, all major cargo railways are publicly listed. The comparatively small passenger railways *Amtrak and VIA Rail* remain in state hand. In Japan, the three largest passenger railways *JR East, JR Central* and *JR West* are publicly listed. In all of these countries, liberalization and privatization proved successful through the performance enhancements made by the railways (see sections 5 to 8).
In China and Russia, the main railway is state owned. However, China opened the railway sector to private investors via Joint venture railways (public private partnerships). Vast expansion plans will most likely require further private investments. In Russia today, about half of all cargo wagons are privately held and operated, and heavy maintenance of rolling stock has partially been sold to private investors. Here, plans for the future setup are currently under discussion. Discussions include further privatization of cargo wagon operation, cargo locomotive operation, total passenger transportation and light maintenance of rolling stock.

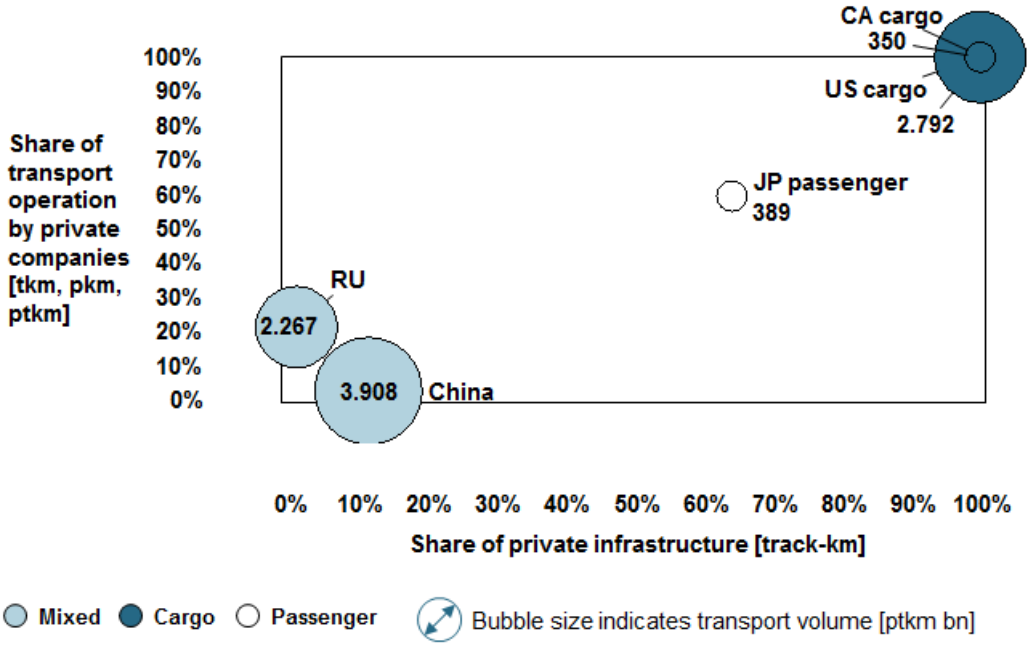

Fig. 2.D Ownership of train operations and infrastructure (excl. minor rail operations: cargo in Japan and passenger in the USA and Canada)[19]

[19] Russia (RU): Approx. 50% of cargo wagons operated privately, but locomotives operated by RZD: tkm of private wagons split (50% RZD, 50% wagon operator).

4. Key competitive pressure stems from intermodal competition; in North America, also from intramodal competition on separate tracks

Significant intramodal competition on the same tracks is not seen in the countries under review. Fierce intermodal competition exerts strong pressure on the railways, whereas intramodal competition is limited to North America.

The positioning of the countries under review with regard to intramodal and intermodal competition is shown in fig. 2.E.

- X-axis: The total intramodal share of non-dominant railways serves as a (rough) indication of the intensity of competition among railways. A high share indicates strong competition.
- Y-axis: The intermodal share of rail is used as a (rough) indication of the intensity of intermodal competition (rail vs. road/air/waterways/pipelines). A low share indicates strong competition.

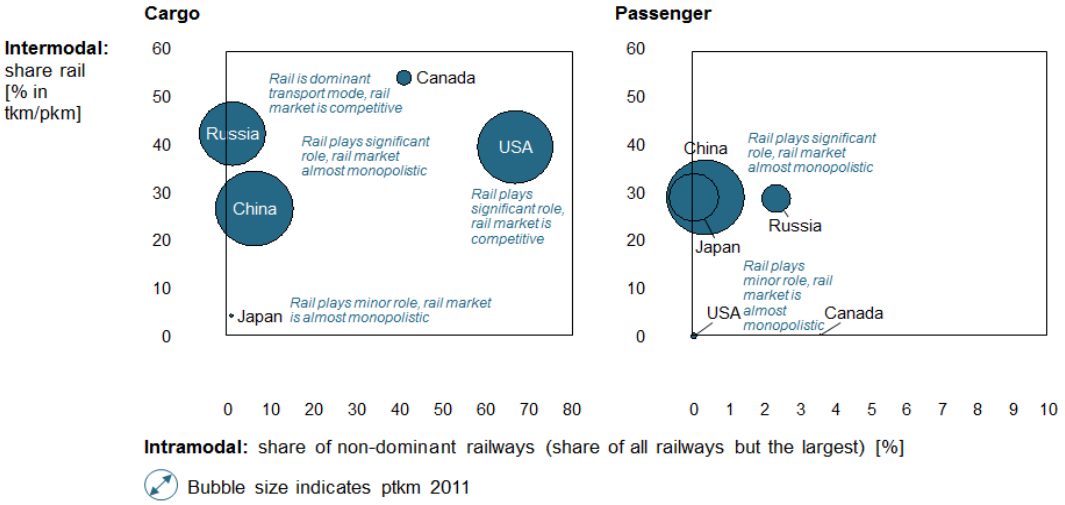

Fig. 2.E Intramodal and intermodal competition[20]

Source: China YearBook; RZD; Russian Federal Statistics; OECD; CIA; DoT BTS; Rail CAN; MLIT.

[20] Cargo RU: Private wagon operators not considered railway (no traction).
Passenger JP: JR companies do not compete due to regional monopolies.
Passenger US: Amtrak without competition in US intercity rail market.
Source: China YearBook; Russian Federal Statistics; OECD; DoT BTS; Rail CAN; MLIT; Transport Canada.

Key results for the countries under review:

- Intermodal competition is omnipresent:
  - Significant intermodal competitors are abundant in all countries under review in both the **cargo** and the **passenger** segment (intermodal share of rail well below 70% in all countries under review).
  - In China, Russia and Japan, intermodal competition is a major competitive force in the **cargo** and **passenger** segments (share of non-dominant railway well below 10%).

- Intense intramodal competition takes place in North America on separate tracks of each railway
  - In China, Russia and Japan, there is no significant intramodal competition in **cargo** (share of non-dominant railways well below 10%). Only the USA and Canada show significant competition among railways. Note that, first, competition takes place in these countries between integrated railways on own, separate tracks, and second, there are typically two key competitors on a given route (e.g. *UP* vs. *BNSF* on L.A.-Chicago). Competitive rivalry in such duopolies can be high while the railways realize economies of scale at the same time.
  - There is no significant intramodal competition in **passenger** traffic in all countries under review (share of non-dominant railways well below 10%).

Thus, overall, intermodal competition is the dominant competitive force across the countries under review. In North America, intermodal and intramodal competition are roughly equally strong (confirmed by interviews with *Class I* railways). In Japan, Russia and China, intermodal competition proves to be much stronger than competition among railways.

Competition is generally considered to be one of the key drivers for performance enhancements (see sections 5 to 8). In this respect, the incentive to enhance performance stems first of all from intermodal competition in the countries under review.

Furthermore, shareholder expectations serve as a core driver, especially for publicly listed North American cargo and Japanese passenger railways. These railways are managed very efficiently as business entities.

5. In all four major cargo rail countries, traffic increased – In two out of three major passenger rail countries, traffic increased

Between 2002 and 2011, rail cargo and rail passenger traffic increased in absolute terms and, to some extent, also in relative terms (intermodal share) in almost all countries under review and segments, see fig. 2.F.

The absolute rail traffic increased (y-axis), except for the effects of the financial and economic crisis in the late 2000s:

- Cargo: Transport volume in Canada, China, Russia and the USA increased, while Japan represents the only exception. In Japan, tkm remained stable 2002-08, but fell strongly during the financial crisis in 2009/10.
- Passenger: China, Japan and the USA saw an increase in passenger traffic, while Russia represents the only real exception (*Via Rail* Canada traffic minor). Here, too, traffic decreased strongly during the financial crisis.

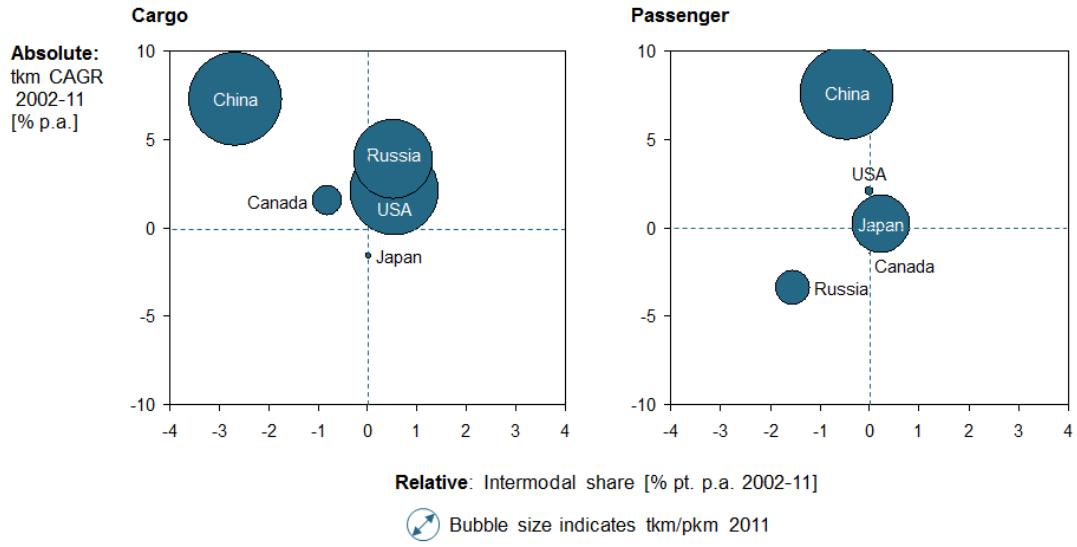

Fig. 2.F Traffic and intermodal share development, 2002-11[21]

[21] Y-axis Average % growth/decline in tkm/pkm p.a.
X-axis Average %-point growth/decline of rail intermodal share p.a.
Cargo CA: Absolute 2002-10; relative 2002-09; decrease tkm 2008-10: -26%
RU: Relative: 2005-10
Pass. CA: Absolute 2002-10; relative 2002-09
RU: Absolute 2005-11, relative: 2005-10
US: Relative 2002-10

Source: China YearBook; Russian Federal Statistics; OECD; DoT BTS; Rail CAN; MLIT; Transport Canada.

The development of intermodal shares shows a mixed picture (x-axis):

- Cargo: In the USA and Russia, the intermodal share of rail has further increased in recent years and consistently totaled between 40% and 50%, whereas the respective shares in China and Canada fell (both from a very high level >50%). In China, strong growth in rail transport was surpassed by even stronger growth in road transport. In Canada, road and pipelines increased market share at the expense of rail traffic
- Passenger: In Japan, the intermodal share increased from 27% (2002) to 29% (2011), whereas the intermodal share in Russia decreased strongly during the financial crisis in 2009/10.

Overall, traffic volumes increased at all major railways in all countries under review, except for Russia due to the financial crisis of 2009/10.

6. Railways in all countries under review increased their investments in infrastructure and rolling stock

Major railways in all countries under review strongly increased their investments in the past ten years, see fig. 2.G.

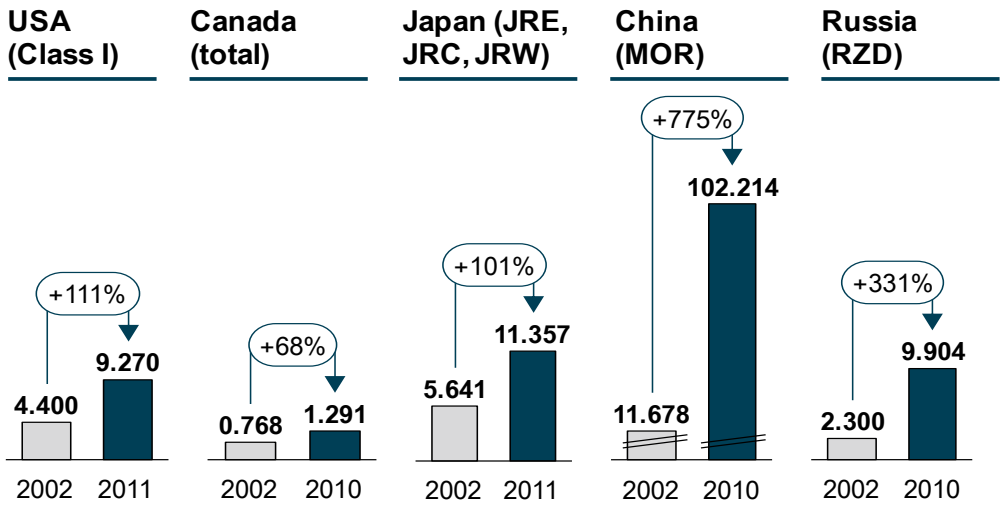

Fig. 2.G Investments of railways, nominal [EUR bn][22]

The massive increase in China is primarily due to the government's ambitious expansion plans: 84% of investments in 2010 were used to extend rail infrastructure, and 3% were spent on infrastructure upgrades.

[22] Source: China YearBook; RZD; DoT BTS; AAR; Rail; JR Central, JR East, JR West.

During the course of the study we found that integration has a positive effect on investments. Integrated railways:

- Can most exactly and reliably forecast future transport needs based on their direct customer access
- Need an extensive and well maintained network to allow for their own transport and have therefore an incentive to pursue life-cycle-cost approach, which drives investment,
- Are usually sufficiently large to have the financial capabilities to invest high amounts (in general, the smaller a player, the riskier a given investment).

The increased investments also hold true for entirely privatized railways in the USA and Canada (see section 1). One typical argument against privatization of railways is the fear of decreasing investments. The experiences in the USA and Canada prove that this is not true in general.

The state financially supports railways in all countries under review, apart from privatized cargo railways in North America.

In China, government investments are done entirely via the *MOR* (see data in fig. 2.G). In Japan, recent infrastructure extensions for *JR East* were financed by the state. Furthermore, regional transport is subsidized. *JR Central* states that it never received state subsidies. Russian *RZD* is fully state owned (for recent privatization, see section 3), so railway investments can be considered state investments.

In North America, there are no state subsidies for publicly listed railways.[23] In the USA, for instance, government spending of EUR 1.27 bn in 2011 was mostly used to cover *Amtrak* losses (EUR 1.04 bn ≙ 82%).

7. Most railways in the countries under review enhanced their efficiency

The existing market forces appear sufficient to strongly enhance efficiency. As we have seen above, these stem mostly from intermodal competitors and shareholder expectations.

Most railways in the countries under review have strongly improved their efficiency in the past ten years. Here, efficiency refers to various areas, especially:

- Employee efficiency (e.g. measured by ptkm per employee) and
- Asset efficiency (e.g. measured by tkm per cargo wagon, ptkm per track km or seat load factor).

[23] Subsidization only in very special cases, e.g. track upgrades to allow for enhanced passenger traffic on cargo network, etc.; since 1980 approx. 1% of rail investments by state (AAR estimate for USA).

Fig. 2.H and 2.I show the development of key ratios in these three categories. In all countries, strong efficiency gains have been achieved in the past ten years. This is especially remarkable because large gains were already made before 2000. In the USA, for instance, efficiency improved massively in the two decades after the liberalization (especially after the Staggers Act in 1980). Today, efficiency gains in the

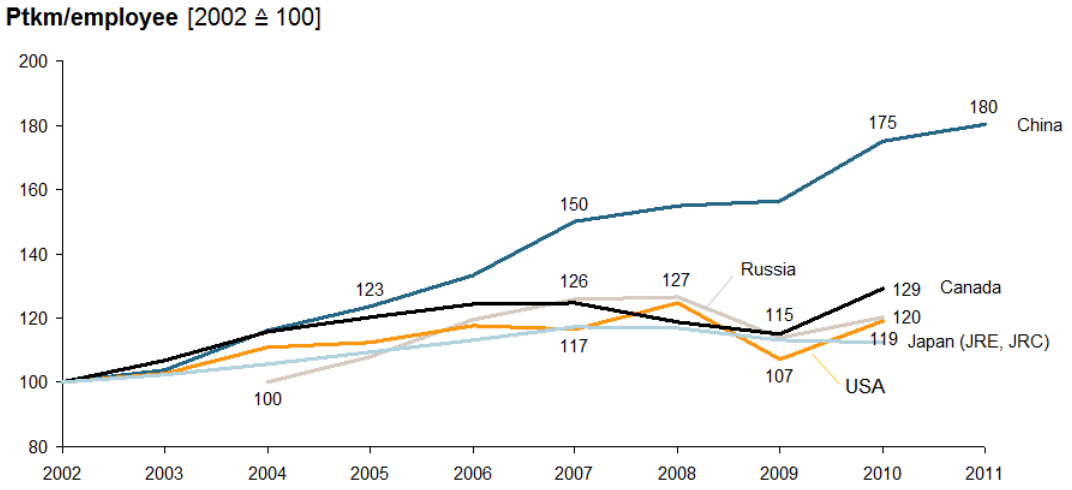

Fig. 2.H Development of employee efficiency, 2002-11[24]

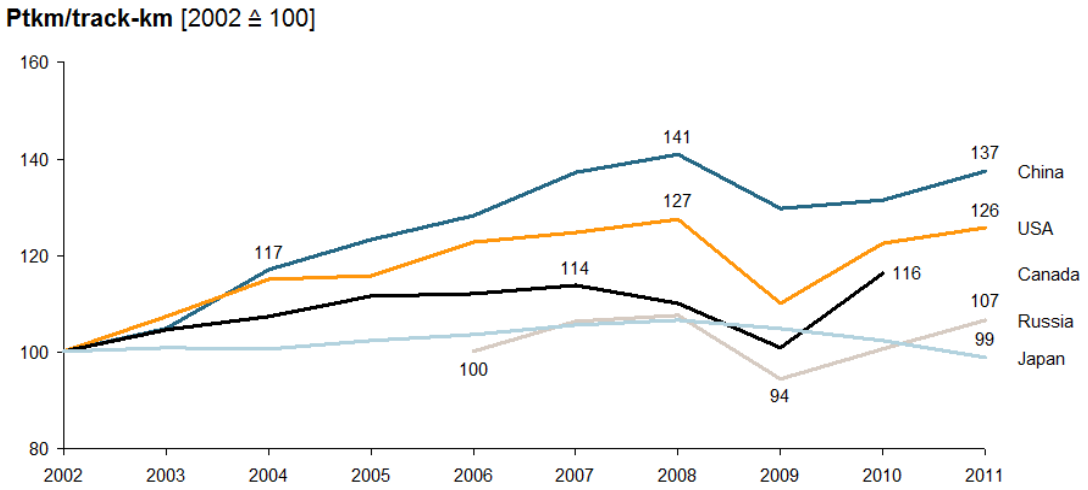

Fig. 2.I Development of asset efficiency, 2002-11 (here: traffic volume per track length)[25]

[24] RU: RZD only (in 2010, almost 50% of tkm transported on privately owned wagons), 2004≙ 100.
Source: China YearBook; Russian Federal Statistics; OECD; DoT BTS; AAR; Rail CAN; MLIT; Transport Canada.
[25] RU: 2006 ≙ 100.

USA are driven mostly by process (e.g. dispatching of trains and enhanced scheduling of maintenance vs. operation) and technology enhancements.

Employee efficiency (here: traffic volume per employee) increased in all countries, see fig. 2.H. Only a very limited share of this was due to outsourcing.

Asset efficiency (here: traffic volume per track km) increased in all countries under review, except Japan, see fig. 2.I.

8. Railways have improved punctuality or are already on a very high level and increased service quality

Railways in all countries aim to enhance the quality of their service.

Compared with the categories mentioned above (traffic, investments, efficiency, safety), service quality is somewhat difficult to quantify:

- There is a wide variety of service characteristics
  - Passenger: Punctuality, travel time, individual space and comfort, noise, cleanliness, availability of restrooms, electricity and internet access, etc.
  - Cargo: Punctuality, delivery time, share of lost goods, share of damaged goods, additional services offered, etc.
- Service is sometimes difficult to measure objectively
- These are often internal railway data that are not published in consistent time series

Despite the unavailability of quality data for most railways, it is evident that railways in all countries must enhance their service constantly, while being under strong cost constraints:

- Railways are closely scrutinized – not only by individual customers and regulatory bodies, but also by the media, the general public, passenger associations, etc.
- Customers usually have alternatives, railways face strong intermodal competition (see section 4 above)

Because of the lack of comparable data on service quality, the analysis was focused on punctuality. Fig. 2.J displays the development of punctuality measures for three selected railways.

- In China, punctuality in passenger traffic was enhanced in the past ten years, while traffic density increased strongly. Cargo punctuality decreased slightly because priority is generally given to passenger trains.

Source: China YearBook; Russian Federal Statistics; RZD; OECD; DoT BTS; CIA; Rail CAN; MLIT.

- In the USA, *Amtrak* punctuality remains at a rather low level in international comparison, but increased after the Passenger Rail Investment and Improvement Act (PRIIA) in 2009, which sets penalties for host railways (cargo railways) that hinder Amtrak traffic. The 2005/06 dip was due to capacity constraints on the cargo railway side.
- In Japan, *JR Central* average delays per train have fluctuated around half a minute in the past ten years and thus have remained at a very low level.

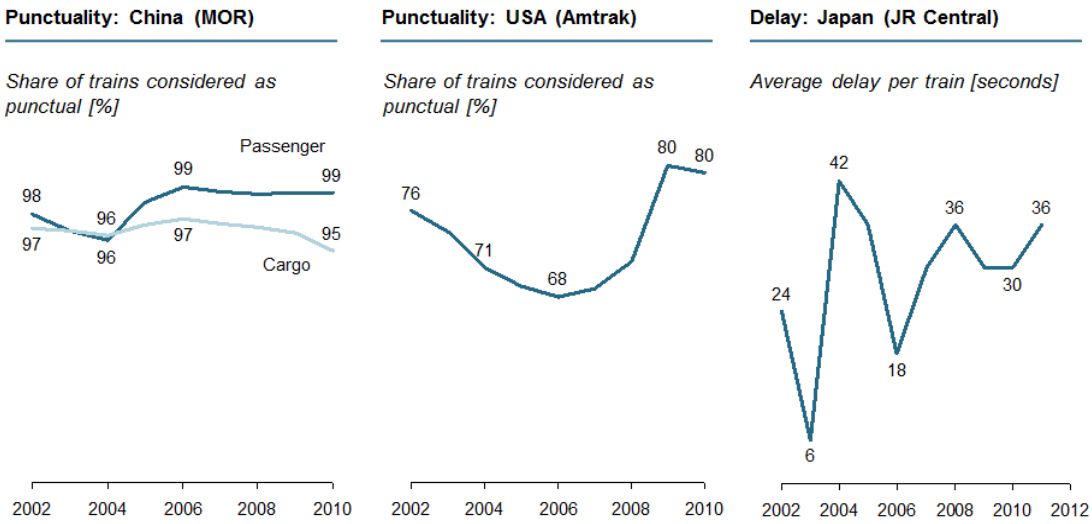

Fig. 2.J Punctuality/delay development of selected railways[26]

Railways in all countries enhance their service offering by offering electricity as well as Wi-Fi infrastructure.

- *Amtrak, JR Central, JR West* and *RZD* provide power outlets for every first and business class seat. The availability of electricity access is reduced for economy class.
- *Via Rail* and *JR East* provide power outlets for all seats.
- North American railways as well as *JR Central* and *JR West* offer free Wi-Fi to passengers on selected routes.
- *JR East* provides Wi-Fi on selected routes which is subject to additional charges.

[26] Punctuality: At arrival; USA/Amtrak: Buffer 10 min. < 250 miles – 30 min. > 550 miles; China/MOR: Official definition of punctual trains is "exactly as scheduled". However, strict application of this rule, and therefore comparability with other countries, are questionable; Japan/JR Central: Multiples of 6 sec.; very limited availability of data for cargo US and cargo CA, RU and other railways in JP.
Source: MOR; Amtrak; JR Central.

Overall, we found a clear trend towards quality improvements in the countries under review. This development is especially depicted by increased safety figures, improved punctuality data, as well as an increasing customer orientation.

Excursus: There seems to be a positive effect of integrated railway systems on the domestic rail supply industry

As an excursion, a brief analysis on the rail supply industry worldwide provides interesting findings. The largest ten rail supply companies worldwide do stem mainly from countries with integrated rail systems. The only exceptions are Alstom from France with a mixed model (where SNCF performs a large part of the infrastructure value chain) and Hyundai Rotem from South Korea with a recently separated model.

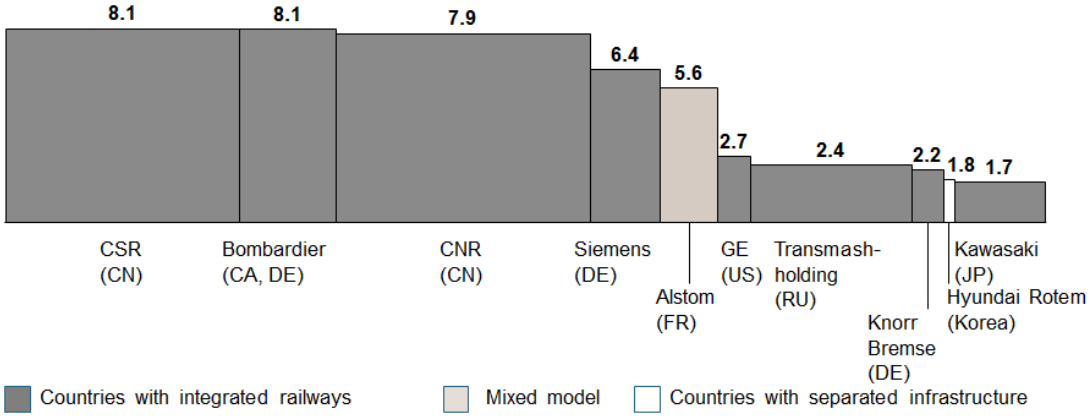

Figure: 2.K Ten largest rail supply companies ranked by revenue 2010 [EUR bn][27]

Many of the large suppliers (Siemens, Bombardier, etc.) are systems integrators, supplying not only rolling stock, but also rail control, services or infrastructure in a package, and thus are on a par with the integrated railways in their country and in the regions they export to. The total staff of above 350.000 in just these ten companies display the importance of this sector for the economy as a whole.

[27] Column width indicates total staff; CSR includes non-rail related revenues (max. 20%); Siemens Mobility 2009 incl. airport, postal, road; France: infrastructure functions partly delegated back from RFF to SNCF; GE incl. Marine, Mining, Drilling, Stationary Power, Energy Storage; Transmashholding 2009; Hyundai Rotem revenue 2010 as planed in 2008

3. Conclusion

The countries under review in this study host the leading railways outside Europe, accounting for a **total of 80% of global tkm and 50% of global pkm.** These include several of the only publicly listed railways worldwide, which operate without any public funding. Several conclusions can be drawn from these countries.

First, the main railways in these countries are integrated railways, i.e. infrastructure and transport services are provided by one firm or holding company. These integrated structures result in optimum resource allocation and efficient processes, while avoiding additional costs. Integrated railways are able to act as a system integrator and help reach decisions by **considering infrastructure and rolling stock jointly,** based on their direct knowledge of customer requirements. As stated by several senior executives in these countries, key operational processes can be handled much more efficiently by integrated railways, especially when changes on short notice come into play and in case of intensely used infrastructures. Integrated systems also avoid the additional interfaces and transaction costs of separated systems.

Second, there are several features/developments of the industry structure that are essentially the same across all countries.

- The tasks and competencies of railways and public or government authorities are clearly separated. Only China still has to achieve its goals in this area.
- Among the countries under review, privatization is a major trend. North American cargo railroads as well as the three largest Japanese passenger railways are publicly listed. Chinese railways opened up to private investors by way of public-private partnerships. In Russia, about half of all freight cars are privately held and operated, and some heavy maintenance of rolling stock was sold to private investors. Additional plans for privatization exist (e.g. for light maintenance, passenger transportation, cargo locomotive operations).
- The main competitive pressure in all countries under review comes from intermodal competition. Intramodal competition can be observed primarily in North America, where it takes place on separate tracks of the railways.

Third, the railways in the countries under review demonstrated **significant performance improvement** over the last decade. Cargo transportation increased in all four major freight rail countries. Compound annual growth rates range from 1.5% in Canada to 7.3% in China. In the past decade, passenger traffic grew in two out of the three major passenger rail countries (CAGR USA: 2.0%, China: 7.6%). In addition, railways in the countries under review increased both their employee and asset productivity. Employee efficiency (measured by ptkm/employee) increased by about 20% in most countries, while in Canada this growth was almost 30% and in China 80%. In terms of asset productivity (measured by ptkm/track-km), the picture is much more diverse. Japan experienced a slight decline of 1%. The range for the other countries lies between +7% in Russia and +37% in China. Punctuality of passenger

trains improved slightly in China (+1%) and the USA (+4%) – but both with fluctuations. In Japan, punctuality remained stable on a very high level, with an average delay of 36 seconds per train in 2011.

Fourth, the railways under consideration **invest increasingly in assets**. One reason could be that, due to direct customer access, integrated railways are in an ideal position to forecast future transport needs and the required assets. They have an incentive to invest in infrastructure as they are its main users. Nominal investments in the last decade increased by about two thirds in Canada, doubled in Japan and the USA, increased threefold in Russia and rose by more than 750% in China. In China, 84% of investments in 2010 were part of the country-wide rail extension program.

Both the findings from data analysis and comments by CEOs, ministry officials and experts in the study raise **doubts as to whether the separation of infrastructure and transport services is the right way to increase intramodal competition and railway performance**. A viable alternative would be to facilitate intramodal competition in an integrated railway system. In this case, the regulator would have to be able to use important levers to achieve rail competition, for instance by safeguarding third-party access and fair-track access charges. Intermodal competition would remain a main driver for performance and efficiency improvements at railways, as confirmed by the countries under review.

Providing an additional perspective on competition, comments made about potential market entry provide indications as to some of the directions Europe could take.

When asked if they were considering entering the market in Europe, almost all interviewees said no. Their reasons included the following:

- Lack of technical uniformity across countries
- Very complex rail regulations
- Little reliability and consistency of railway regulations and reform processes

This feedback confirms that the EU Commission's policy is on the right track with its efforts to harmonize technical norms and principles of rail regulation across EU member states. These statements and the largely positive results from transforming the integrated railways under review should be considered in the future regulatory setup of rail systems in Europe.

4. Country analysis

This part of the report documents the in-depth analysis of individual focus countries. For every country, the development of the rail industry, system set-up and competitive environment, as well as traffic performance, investments, efficiency and quality indicators are analyzed.

4.1 USA

History

The rise of USA railways began in the early 20th century along with the development and connection of all USA territories on the North American continent. During these times, the many private railway companies experienced strong growth and operated as profitable integrated railways. Standardization took place already at this early stage due to mutual agreements among the railway operators, without government pressure. This was partly due to the manufacturers' aspirations to achieve higher economies of scale, as well as the consideration of railway operators to sell their rolling stock to other companies at some later time.

However, the success story of the early days of the railway industry could not be maintained. Until the 1970s, railway companies saw increasing external influence through regulation. This can be seen in the increasing number of regulating agencies, the *Interstate Commerce Commission (ICC)* being the main body. In addition, public regulation made it difficult to refrain from the loss-making passenger division. However, the declining success of USA railways in the second half of the 20th century was due not only to the increasing regulatory influence, but also to the government support for alternative modes of transportation (e.g. significant public funding for highways and airports), which led to a competitive disadvantage for railways. In the end, these developments led to the bankruptcy of several railways. The financial default of these railway operators led to the closure of 21% of national track mileage.

Due to the fact that particularly the passenger division was unprofitable, the United States saw an urge to intervene in order to keep the passenger transportation system going. Therefore, *Amtrak* was founded under public authority in exchange for trackage rights in 1970. However, this government intervention was not enough to return the USA railroad system to profitability.

This is why the *Staggers Rail Act* was put in place in 1980 to further liberalize the market. Through this new legislation, **cargo** railway companies were now able to set their own rates and to enter into confidential contracts. This allowed for market-based rates and price differentiation, leading to higher profits for railway companies. In addition, a greater degree of freedom in mergers and acquisitions was granted to set

the way for consolidation in the industry. Seven major railways – the *Class I* railways (*Burlington Northern Santa Fe Corporation (BNSF), Union Pacific Railroad (UP), CSX, Norfolk Southern Railway (NS), Canadian National Railway (CN), Canadian Pacific Railway (CP), Kansas City Southern Railway (KCS))* – emerged from this phase of mergers and acquisitions out of originally 37 operating companies. The resulting layoff of many employees led to labor disputes that were settled through pension plans due to the newly developed efficiency gains. Furthermore, new job profiles were created. However, as the prerequisites differed due to computerization, containerization and new loading techniques, it was difficult to retrain the mature labor force working in the railway sector.

While the cargo branch was mostly profitable due to efficiency gains resulting from consolidation and the impact of the *Staggers Act*, the **passenger** business run by *Amtrak* continued to struggle until 2009, which led to further legislative interventions by the government. Service quality was increased through the *Passenger Rail Investment and Improvement Act,* as well as the *Recovery Act*. In addition the USA government provided *Amtrak* with funds to stimulate the government-owned corporation. However, neither act has, as yet, led to profitable operations; *Amtrak* still accounts for significant losses from passenger operations. This unprofitable business is due to several factors, among which are the lack of an own railway track in line with customers' needs, as well as a high cost structure.

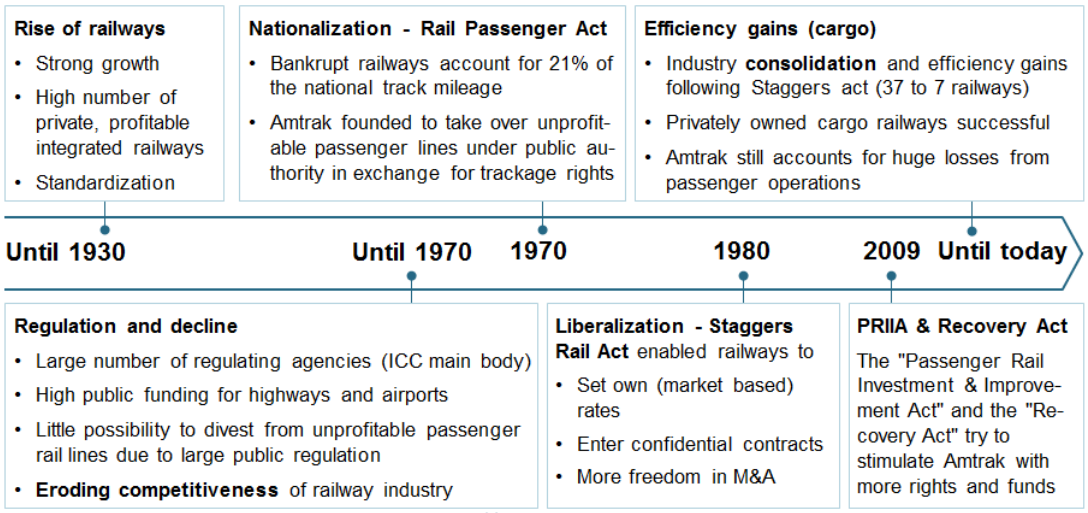

Fig 4.1.A Milestones in USA rail history[28]

[28] Standardization with mutual agreements already took place in the first half of the 20th century without government pressure. Ongoing labor disputes were settled through pension plans, which were enabled by the efficiency gains.
Source: AAR; FRA.

System setup

The USA railway system differentiates in its setup between the dominant cargo rail and the minor passenger rail. **Cargo** rail is, to a large extent integrated, dedicated and publicly listed. The cargo market is dominated by seven major C*lass I* cargo railways, shown in fig. 4.1.B.

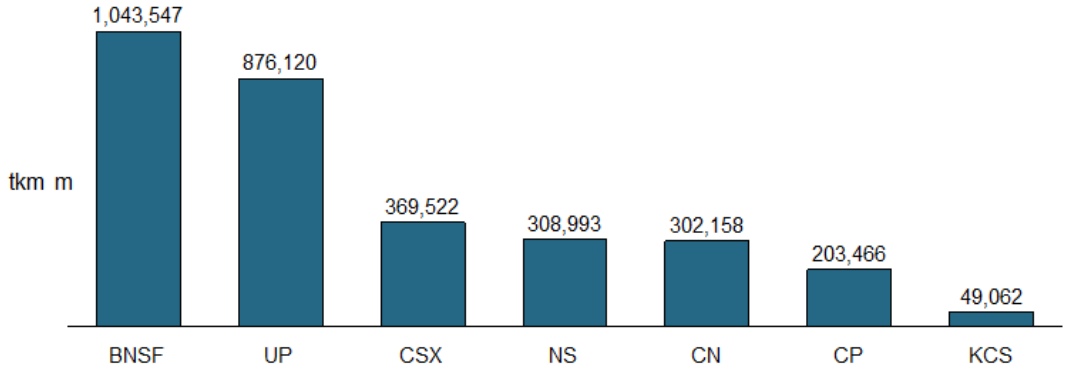

Fig 4.1.B Comparison of the major seven *Class I* railway companies 2011[29]

Passenger rail is state owned and mostly operates on the infrastructure of the cargo railways, making it heavily dependent on external influences of cargo railways. The long-distance passenger market is currently operated by one main provider (*Amtrak)* with a highly loss-making operation (EUR 1 bn loss in 2011).

Overall, **government influence** is fairly low as a result of the legislative liberalizations in the 1980s, including market-based price setting and confidential contracts. The main regulative body is the *Surface Transportation Board (STB)* – the successor of the *Interstate Commerce Commission*. It is installed by the *Department of Transportation (DOT)* and the *Federal Railroad Administration (FRA)* and acts as the economic regulator for cargo rail companies, while overseeing competition and cargo tariffs. The passenger transportation company *Amtrak* is regulated and guided by the *DOT* and *FRA*, and receives funding from the *STB.*

Despite the juridical influence of the *STB* on disputes and on *Amtrak*-related extraordinary regulations granting it preference over cargo trains, **track access** is subject to voluntary agreements between *Amtrak* and cargo railways and is negotiated on a commercial basis. Apart from the special case of *Amtrak*, there is no obligation to provide track access. However, *Amtrak* is granted only the availability of track access, not a minimum service level. Other railways bilaterally agree on track access in win-win situations and enter into market-based contractual agreements. Usually, both railway parties involved will be exchanging track access. It is very seldom that only one party receives new track access. At the request of other cargo

[29] CN and CP operate in Canada and the United States.
Source: Annual reports of *Class I* railways.

railways, the *STB* performs a posteriori checks of issued rates. In addition, the *STB* can force railway operators to grant access if abuse of market power has been proven. However, as the burden of proof is very high, such cases have occurred only once or twice in the past 30 years.
Railway operators sometimes enter into contractual agreements in order to prevent regulation by the *STB*. Other cases, in which track access is granted through the *STB,* concern bottleneck situations as well as M&A covenants. The former is described as the non-agreement of track access for short distances. The latter concerns the situation when a certain amount of trackage rights can be granted to competitor railways as a result of a merger & acquisition (e.g. UP and SP merger rights for BNSF). Fig. 4.1.C shows the structure of the USA railway system in an overview.

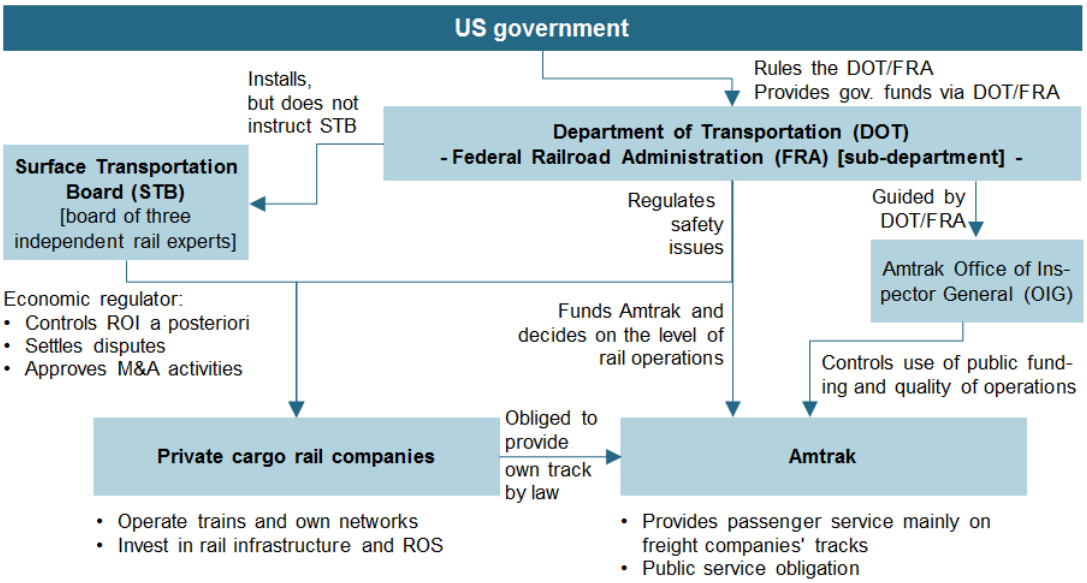

Fig 4.1.C Structure of the railway system in the United States[30]

Competition

The USA railway network (excluding urban networks) is characterized by a heterogeneous ownership structure, as each of the seven *Class I* cargo operators owns its own track. Thus, 96% of all USA railway tracks belong to the large cargo railway operators. The remaining 4% are divided among *Amtrak*-owned tracks and other local-investor-owned tracks outside the rail industry. Fig. 4.1.D shows the regionally separated tracks of the *Class I* cargo operators. *Amtrak* owns only 0.87%[31] of the tracks and mostly uses the cargo network for its passenger operations.

[30] Source: AAR; FRA; Economist.
[31] Source: Amtrak interview; CIA.

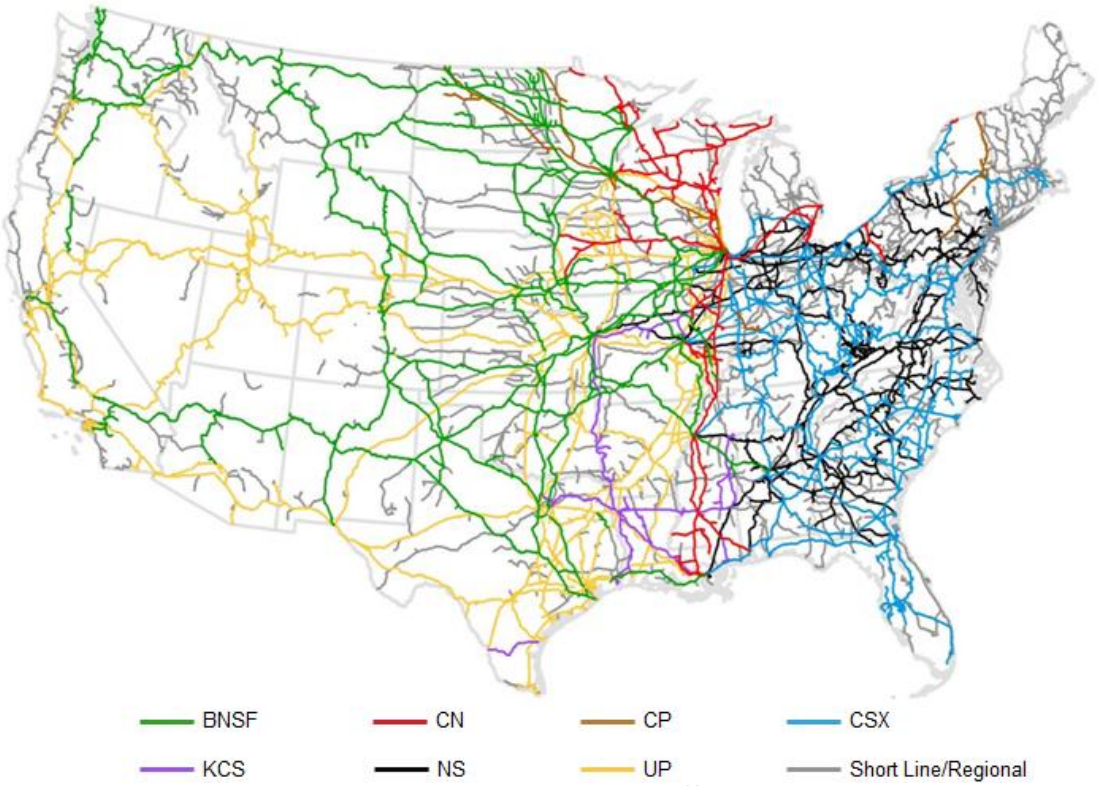

Fig 4.1.D Network of seven Class I rail cargo operators[32]

The USA **cargo** railway market is versatile. Seven major C*lass I* railway operators compete on the North American market and operate as dedicated railways, having only a minority (5-20%) of operations run on non-owned infrastructure. As a result, major routes and areas are typically served by two or more railways (e.g. L.A. – Chicago: *BNSF* and *UP*). All together, the seven *Class I* railway companies have a share of between 0.5% (*KCS*) and 6% (*BNSF*)[33] of total revenues in transportation.
Although the cargo railway operators differ in products and customers on the same routes, the **intramodal** competitive pressure can be considered high due to the similar product offerings. Cargo railways try to differentiate themselves through quality factors such as punctuality or fewer deviations from the scheduled delivery (UP offering the best service in both categories[34]).
Competition, however, stems not only from intramodal, but also equally strong from **intermodal** transportation. Despite the fact that rail cargo transportation accounted for 40% of the intermodal market shares in 2011 (tkm), road transportation is to be considered strong competition. Not only are the products carried by rail and road very similar (e.g. forest, metal, minerals, automotive, etc., but no coal), but the cost of

[32] Source: DoT BTS.
[33] Total market includes trucks, domestic air cargo, rail and water transport revenues in 2009 – latest figures of BTS.
[34] Soy Index, 2011.

transportation can also be kept at a low level due to a publicly funded highway system and the absence of taxation on carbon emissions.

As ***Amtrak*** operates 72% of its traffic on the infrastructure of cargo railway companies, it can be characterized as a separated railway company. The government-owned corporation is dependent to a large extent on cargo railways' rail track due to historic settings, when track access was granted by law. Competition derives only from **intermodal** competition, as *Amtrak* is in a monopoly position for inter-regional passenger rail operations in the United States. However, the intermodal competitive pressure is high. There are several reasons for this: For one, the American population prefers road and air transportation over passenger rail, as large distances between the metropolitan areas favor the former modes of transportation. In addition, the price advantage for rail transportation as seen in Europe is non-existent, as no tax is imposed on gas prices. Therefore, rail transportation is not competitive in price. Finally, due to the limitations of *Amtrak's* track (e.g. average possible speed), other modes of transportation are more competitive.

Traffic

Since 1992, not only the total **cargo** traffic, but also the intermodal share of rail cargo traffic has been growing, amounting to 40% of all cargo traffic in 2011. Only in 2008/09 did cargo volumes experience a decline due to the financial crisis. However, the rail intermodal share was not negatively affected by this dip in ton-kilometers. This overall gain in modal share over the past ten years is largely attributable to a decline in water transportation and can be explained by the following reasons: Historically, water transport was preferred over rail due to cost efficiencies. Since the North American railway companies were able to vastly improve their operations over the past 30 years, the rail industry shows higher efficiencies today. In addition, manufacturing companies that were traditionally based in the east moved to the southern and western parts of the United States, where transportation service by water is not as available as in the eastern part of the country, making rail transportation more attractive (see fig. 4.1.E for detailed development of cargo intermodal share figures).

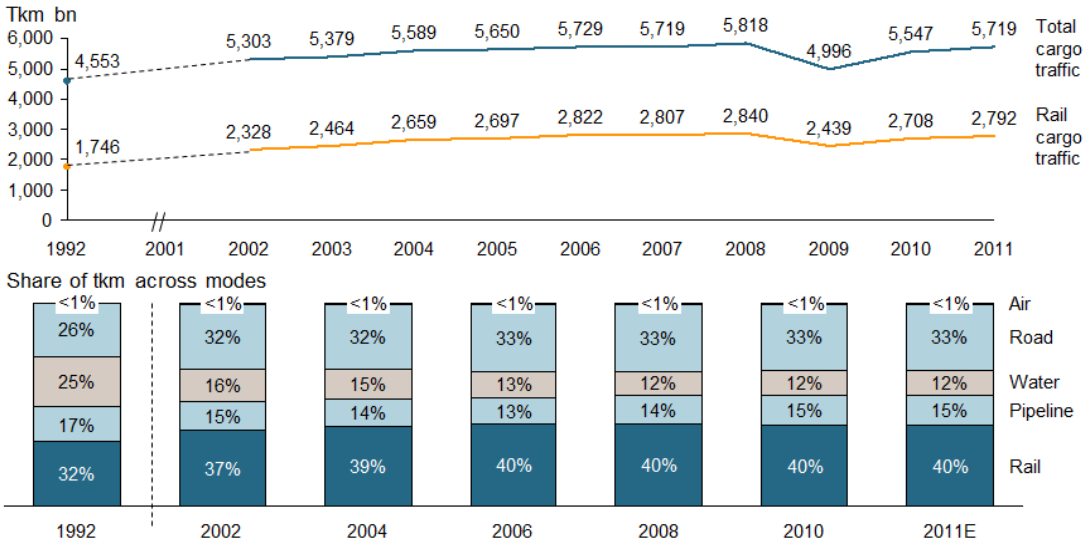

Fig 4.1.E Intermodal share distribution of cargo transportation in tkm[35]

The **passenger** sector of rail transportation shows a different picture. Representing only an intermodal share of less than 1%,[36] the development of total passenger kilometers saw small fluctuations and only started to grow on a continuous basis in 2000. This low modal share can be explained by the well developed highway system in the United States, as opposed to the rail track that was developed based on the needs of cargo transportation. Furthermore, USA inhabitants have a historical affinity for traveling by car and plane. The overall passenger numbers experienced the same crisis dip as cargo did in 2008/09, but unlike cargo railway, the passenger sector has not yet recovered from the decline (see fig. 4.1.F for detailed development of passenger intermodal share figures).

[35] Estimates for air, water and trucks in 2011 based on revenue ton growth of total transport
Source: OECD; DoT BTS.
[36] Source: AAR; DoT BTS.

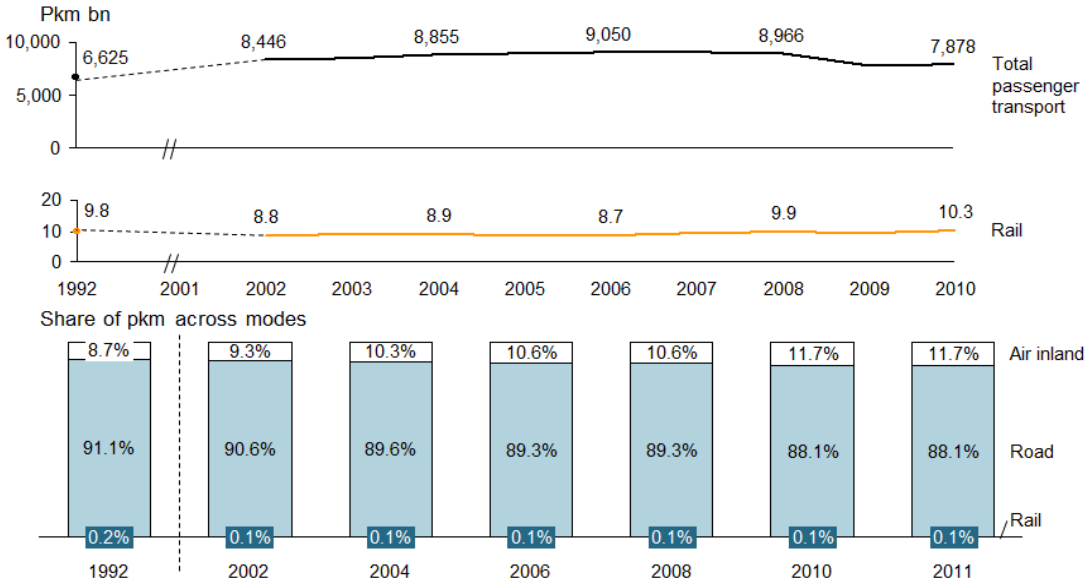

Fig 4.1.F Intermodal share distribution of passenger transportation in pkm[37]

Investments

In order to maintain the infrastructure, each of the *Class I* **cargo** railway operators invests in its track and facilities individually. *BNSF* and *CN* are the railway operators with the highest capital expenditures,[38] each amounting to almost EUR 2.5 billion. However, relative to the generated revenues, the comparatively small operators[39] *KCS* and *CP* invest the largest amount for maintenance/replacement and expansion of their rail infrastructure (see fig. 4.1.G for a detailed comparison between the CAPEX/revenue investment percentage figures for the seven *Class I* railway operators).

While government funding of the rail industry remained almost constant over the past ten years, with the majority of investments covering *Amtrak* losses, investments by *Class I* railways more than doubled over the same period, from EUR 4.4 billion to EUR 9.3 billion. This development in investments supports the idea that integrated publicly listed railway companies have a clear understanding of accountability, and want to remain independent from state influence through private funding of maintenance and extension of railway infrastructure. In addition, Norfolk Southern Railway confirmed that "investment decisions usually involve infrastructure and rolling stock, and therefore the economically rational decision can be made only if both areas are considered jointly and in an unbiased manner."

[37] Source: DoT BTS.
[38] Source: SEC; CN.
[39] In terms of investments.

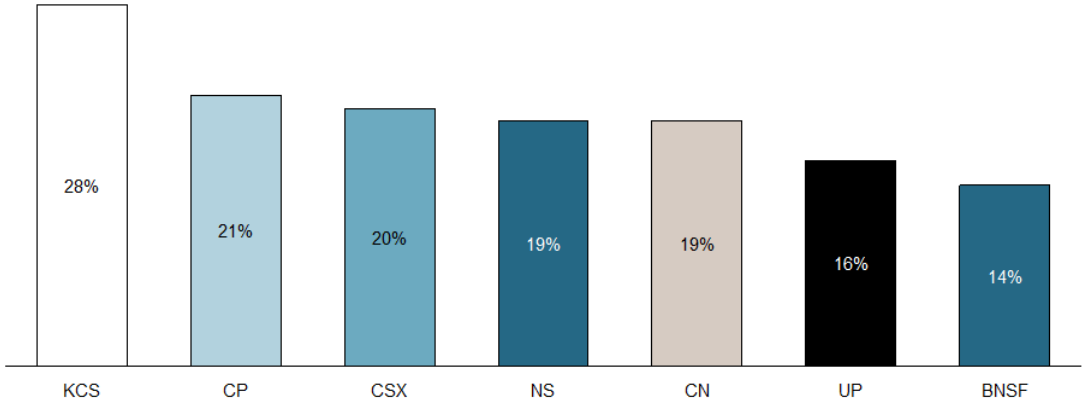

Fig 4.1.G Degree of investment (CAPEX/revenues) in %, all figures from 2011[40]

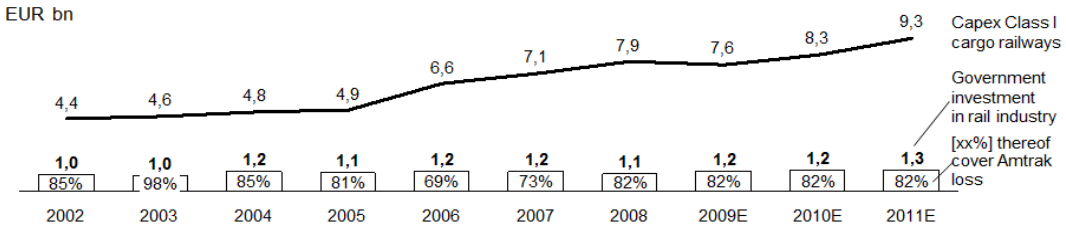

Fig 4.1.H Development of investments of USA railways (cargo and passenger)[41]

Efficiency

After the liberalization of the railway market in the 1980s (*Staggers Act*), **cargo** railways were able to increase their efficiency significantly. Today, most efficiency gains are achieved through process and technology enhancements. These gains in efficiency consist of operational aspects, as well as asset, cost and energy efficiency, showing that integrated, publicly listed cargo railways provided with some degree of freedom can operate successfully.

Management representatives from *BNSF* emphasize the high efficiency by stating that efficiency can be achieved only in integrated systems because they balance rail operations and maintenance toward optimum operational speed and service level.

It is notable that those *Class I* railway companies with the highest revenues from cargo operations (e.g. *BNSF*, *UP*) are more cost-, employee- and asset-efficient. Comparatively smaller railways are more efficient in terms of fuel usage and train efficiency (tkm/train-km). This is due to the fact that the large railway companies operate in the western part of the United States, mainly connecting long-haul destinations across the Midwest (average of 1,500-1,600 km) on a frequent basis

[40] Source: Annual reports 2011 *Class I* railways.

[41] Government investment estimated based on Amtrak loss 2009-11.

Source: AAR; DoT BTS.

(70-80 trains/day) and operating with large trains (approx. 20,000 t). The large cargo operators are able to achieve economies of scale and distance, as they invested heavily in infrastructure over the past 20-30 years.
The total gains in efficiency were also passed on to customers, which becomes evident in the decreasing tariff development over the past 20 years.

Fig. 4.1.I shows the detailed development of selected cargo rail efficiency figures.

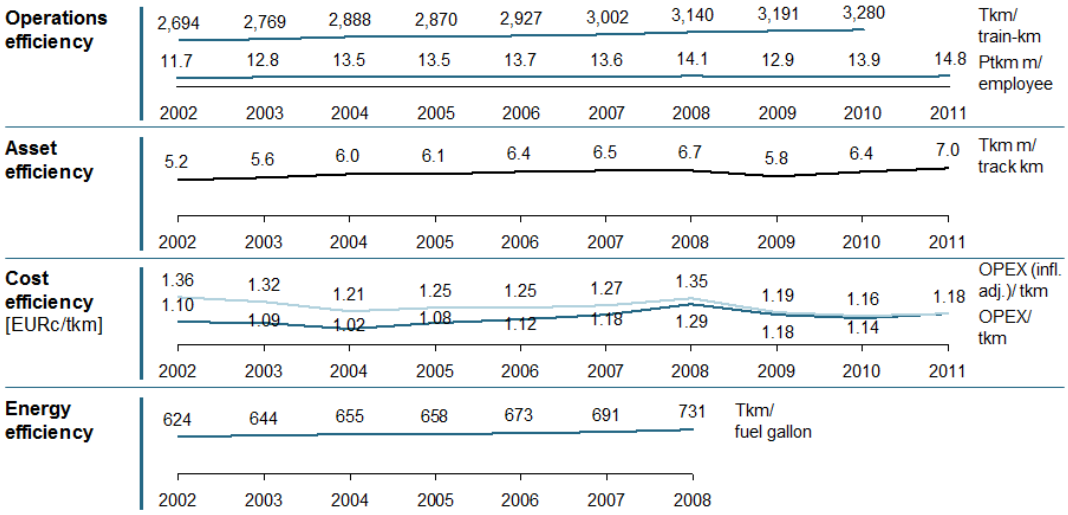

Fig 4.1.I Development of cargo rail's operational, asset, cost and energy efficiency

The unprofitable **passenger** transportation sector operated by *Amtrak* also showed some efficiency gains in terms of operations and cost efficiency, as well as seat load factor. This improvement in efficiency can be partly explained by the fact that *Amtrak* benefitted as well from the gains generated by the cargo railways, as the passenger line operates on cargo track. Nevertheless, the CEO of *Amtrak* acknowledges that "our operations work a lot better on the infrastructure we own. It would be ideal if we owned all the track".

Quality

Aside from gains in efficiency, the seven *Class I* **cargo** railway companies were also able to achieve an increase in several service quality categories. Not only did the overall average train velocity increase, but operations also became safer. In the past ten years, a continuously decreasing number of accidents and fatalities were reported. Punctuality and customer satisfaction figures in general saw an upward trend in the last decade. Yet, in 2005, several cargo companies, e.g. *CSX* and *BNSF*, struggled with their on-time delivery service and only partially recovered from that dip. This is attributable to a steep increase in fuel prices, moving goods from road to rail. However, as the cargo rail capacity was not sufficient for this increase in demand, performance figures suffered. Since then, railway operators have continuously

invested in infrastructure, leading to improved reliability. As a result, rail is used as just-in-time delivery transportation, e.g. for General Motors, today.
Overall, it can be concluded that the trend for integrated cargo railway companies in terms of service level and punctuality is positive.

In **Passenger** transportation however both, service level and punctuality remain to challenge *Amtrak's* operations. Furthermore the unprofitable and inefficient operations are coupled with unsatisfactory service for customers. This evaluation is based on a consistently poor ranking (always below "adequate" standard) of rail station conditions. Punctuality figures declined even after the introduction of the *Passenger Rail Investment & Improvement Act* in 2008, while cases of *Amtrak* responsibility for the delay increased. Nevertheless, a disproportionate share of train delays still result from host track operation.[42] Therefore, *Amtrak* itself is convinced that rail companies are able to provide superior customer service only as an integrated railway.

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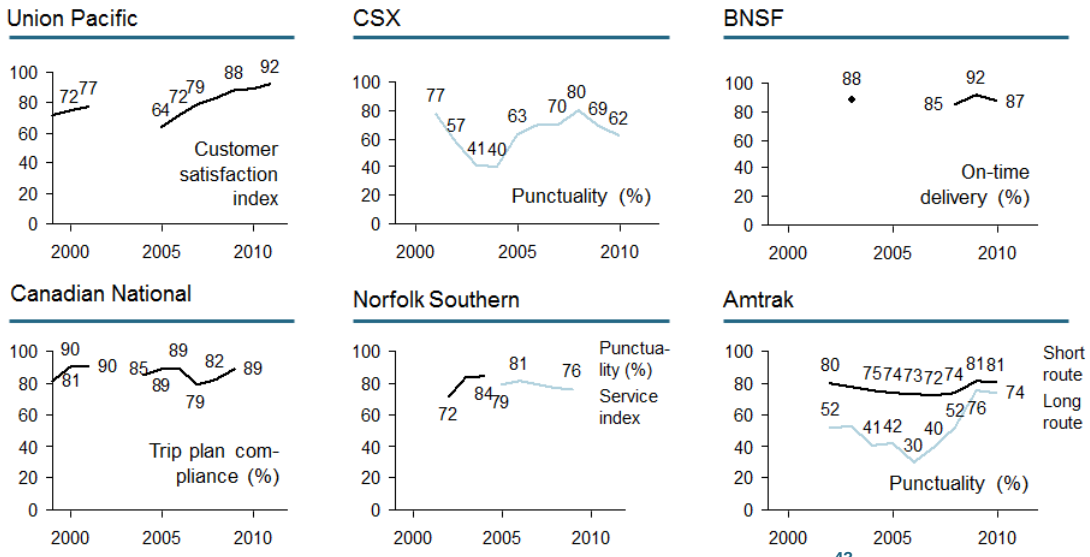

Fig 4.1.J Selected quality figures for cargo and passenger railways[43]

Conclusion

The example of the United States shows integrated cargo and unbundled passenger railway systems being financed privately and by the government. We found that, through deregulation of the railway system, the privately run and integrated **cargo** railways were able to vastly improve their efficiency and thus become profitable. In contrast, none of the legislative changes had any significant impact on the efficiency or quality level of *Amtrak* providing **passenger** transportation.

[42] Source: DoT BTS.
[43] Source: Annual reports; Investors Presentations; Company Websites.

Thus, it should come as no surprise that the intermodal share of rail cargo transportation continuously increased over the past decade, while the intermodal share of passenger transportation stagnated. Overall, all interviewed company representatives agreed that a separation is not necessary to induce competition.

4.1.1 Excursus: Commuter rail in the United States

System setup

As representative commuter networks, the system setup of exemplary agencies is described for New York City and Chicago. Both systems are characterized by a high degree of complexity.

In the case of **New York City**, a clear regional division can be seen. Whereas *NJTransit* covers the region south of New York City, the *Long Island Rail Road* provides commuter service in the east of the city and the *Metro-North Railroad* completes the commuter network to the north of New York City. Although the *Port Authority of New York and New Jersey* acts as a system integrator of several infrastructure and transportation facilities in the state of New York and in New Jersey, none of the three commuter lines is run or operated by the authority. Instead, *NJTransit* operates as a privately owned company, and the *Long Island Rail Road* and *Metro-North Railroad* operate under the authority of the *Metropolitan Transportation Authority* as government-owned commuter lines. Adding to the complexity of having different responsibilities within one commuter network, only the *Long Island Rail Road* has its own dedicated track. Both *NJTransit* and the *Metro-North Railroad* share their track with other passenger, cargo and commuter lines. Fig. 4.1.1.A provides an overview of the New York City commuter network.

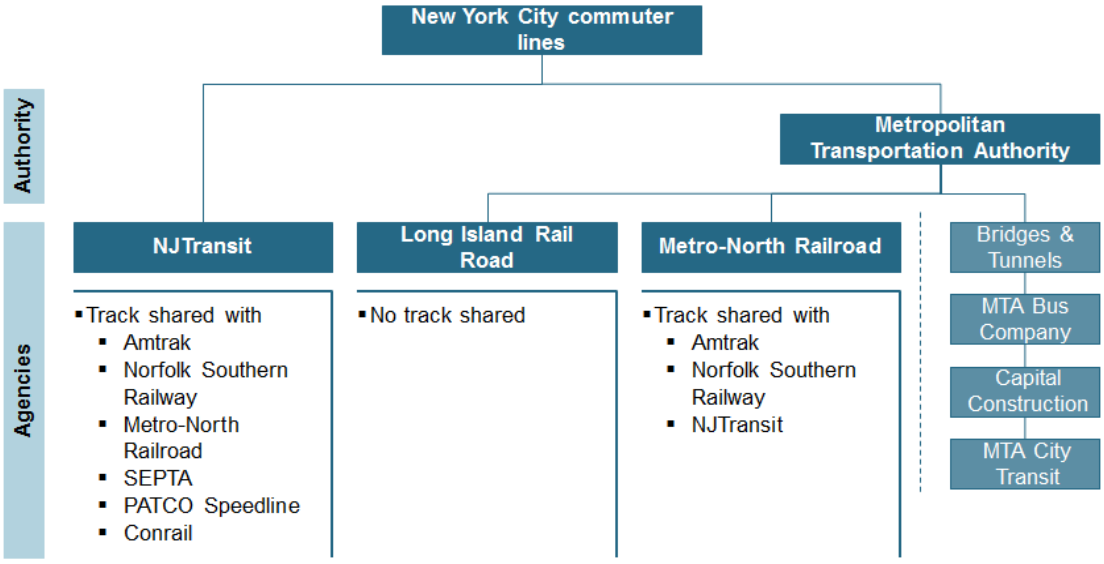

Fig 4.1.1.A New York City commuter network[44]

[44] Bridges & Tunnels, MTA Bus Company, Capital Construction and MTA City Transit are Metropolitan Transportation Authority subsidiaries, but not commuter-rail related.

The picture is no less complex in **Chicago**. Even though only one line provides commuter services (*Metra*) and is overseen by only one authority (*Regional Transportation Authority*), *Metra* shares its track with several other cargo and passenger lines, and even runs lines on 100% not-owned track (e.g. Union Pacific North line). Moreover, *Metra* is influenced by public authorities on several levels. All stakeholders involved, e.g. the city itself, neighbouring counties, and both state and federal authorities want to be involved in planning and decision processes. However, this setup leads to nontransparent accountability, and thus to a lack of responsibility for investments. Fig. 4.1.1.B provides an overview of the Chicago commuter network.

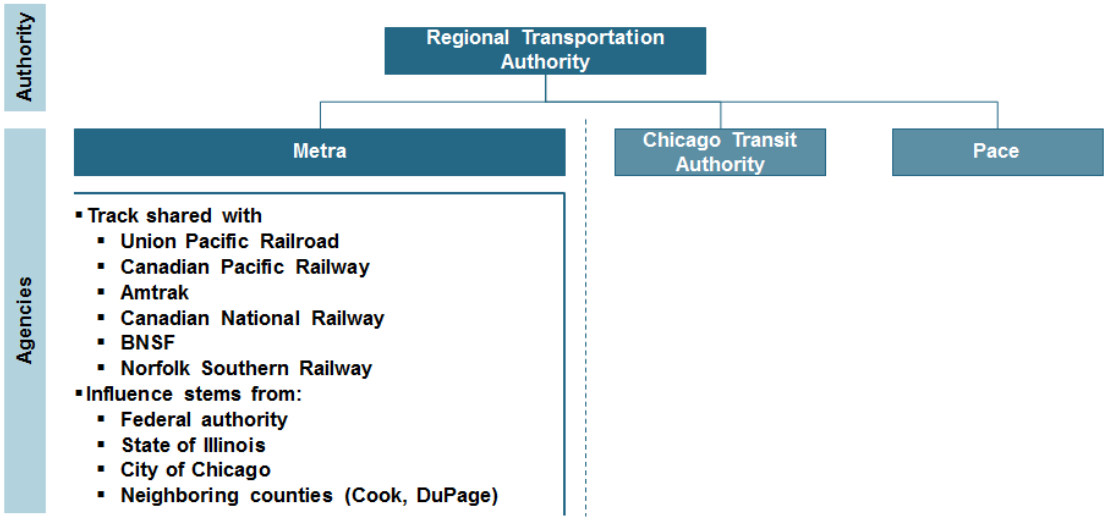

Fig 4.1.1.B Chicago commuter setup[45]

Competition

Apart from the three commuter lines operating in New York City and the one line operating in Chicago, there are no other **intramodal** competitors in these cities. In addition, it should be noted that there is no direct intramodal competition among the existing lines. For the New York City commuter network, the lines each cover different regional areas and therefore do not cannibalize each others' services. In Chicago, it is evident that *Metra,* as the main rail commuter operator, has no direct intramodal competition.

Thus, the main competitive pressure arises from **intermodal** competition, such as public transportation systems, e.g. bus, subway or ferry, and private commuter transportation through own cars, car-sharing and taxis. Nevertheless, in New York City, rail commuters account for more than 50% of the transit commute mode share, whereas the intermodal competition in Chicago demonstrates more strength, as rail

[45] Chicago Transit Authority and Pace are Regional Transit Authority subsidiaries, but not commuter-rail related.

commuters only represent one fourth of all transit passengers, with cars being the main commuter vehicle.[46]

Traffic

Across **all USA commuter rail lines**, the total passenger kilometers increased over the past 20 years and began to stagnate in 2007. Thus, this development proves that separated railway systems can be successful in attracting customers. However, this figure must be interpreted carefully, as commuters may not always have a choice between different modes of commuter transportation, due to unavailability or inflexibility of competitors (see fig. 4.1.1.C for detailed development of passenger kilometer figures).

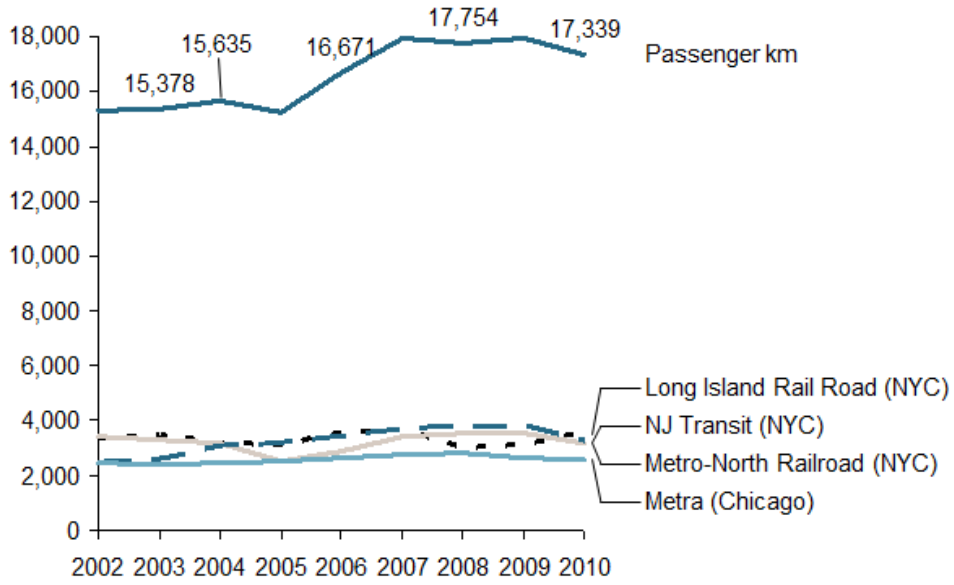

Fig 4.1.1.C Commuter rail pkm (in million) development over time[47]

Efficiency

Fig. 4.1.1.D shows that commuter railways in the United States have not achieved any significant improvements in the selected key performance indicators employee, vehicle productivity and cost. Regarding asset utilization, there were minor fluctuations over the monitored time span, but a negative trend in terms of efficiency. Among other reasons for this stagnation in efficiency is the lack of incentives for improvement due to the large federal influence. As most commuter lines are either state owned or tightly governed by federal authorities, these railways have less incentive than publicly listed corporations to increase their efficiency. In addition,

[46] Yonah Freemark, *Transit Mode Share Trends Looking Steady; Rail Appears to Encourage Non-Automobile Commutes,* The Transport Politic, October 13, 2010.
[47] Source: DoT BTS; National Transit Database.

most commuter lines have no urge to improve their operation and utilization figures, as their customer's demand is mainly inelastic.

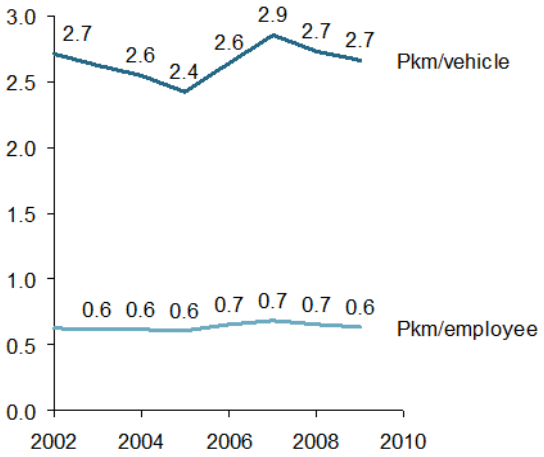

Fig 4.1.1.D Efficiency performance indicators[48]

Quality

Fig. 4.1.1.E reveals that, over the past years, USA commuter railways have become increasingly unsafe, as the total number of accidents and fatalities increased. Additional analyses are needed to determine to what degree this development is due to the separation of railway and infrastructure. Experts at *Amtrak* state that vertical separation will most likely result in safety issues.

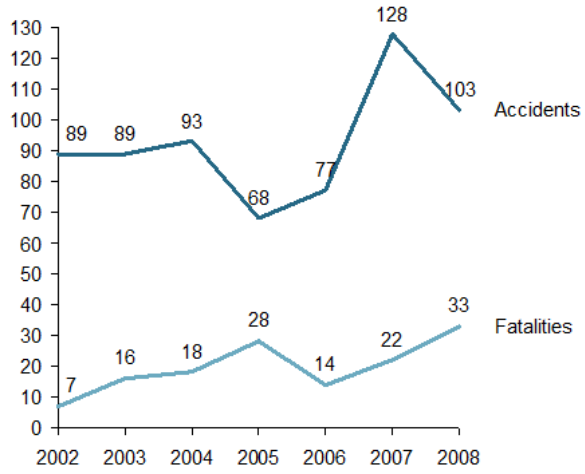

Fig 4.1.1.E Development safety performance indicators USA commuter railways[49]

[48] Source: DoT BTS.
[49] Source: DoT BTS

4.2 Canada

History

In the early 20th century, the Canadian rail industry was characterized by rapid expansion due to a growing economy, as well as large immigration streams. Furthermore, railways became increasingly prosperous as the long-haul routes generated economies of distance, and legislation guaranteed high ticket prices and cargo tariffs.

But World War I stopped this period of prosperous growth. As both financial support and immigrants disappeared due to the effects of the war, the Canadian railways could hardly support their initial expansion plans. Until 1923, the three major railways (*The Canadian Northern (CN), Grand Trunk (GT) and Grand Trunk Pacific (GTP)*) were nationalized and merged together with *Canadian Government Railways (CGR)* into the *Canadian National Railway*.

After 1923, *CN* and *CP* were the largest railways. Their efforts to increase profitability included not only consolidation, but also divestment of unprofitable track. In 1935, governmental influence started to increase with the creation of *Transport Canada* as a regulator for the Canadian railway sector.

In the second half of the 20th century, rail cargo transportation grew and generated profits, but the passenger transportation of the major railways did not achieve the same results. The growth of subsidized intermodal competition (e.g. investments on highway infrastructure) made it difficult for the existing railways to compete on the passenger transportation market. Although many railways tried to terminate this unprofitable segment, the discontinuation of passenger service was not to be achieved easily through government intervention. As a result, the Canadian government founded *Via Rail* in 1977. The new passenger corporation took over the operations of *CN* and *CP* to provide inter-regional passenger transportation in Canada.

In the 1990s, the federal government decided to privatize *CN.* In order to prepare the railway for this structural change and to increase productivity, a disruptive change in management as well as large layoffs and the discontinuation of several branch lines were undertaken. By 1995, all shares had been transferred from the Canadian government to private investors.

During that time, changes in the regulatory environment took place as well. *Transport Canada* was changed from an authority with operational responsibilities into a department focusing on regulation and policies. Furthermore, the *Canadian Transport Act* entitled the *Canadian Transportation Agency (CTA)* to be the new economic regulator in an integrated, privatized cargo market to deregulate the railway sector. Today, the major operating cargo railways continue to undertake further efforts to increase efficiency and profitability. In this regard, *CN* acquired *Illinois Central* and

Wisconsin Central Transportation, and partnered with *BC Rail*. Moreover, *CP* joined this movement of acquiring of other privately owned railways, enabling both cargo operators to continuously increase their efficiency.

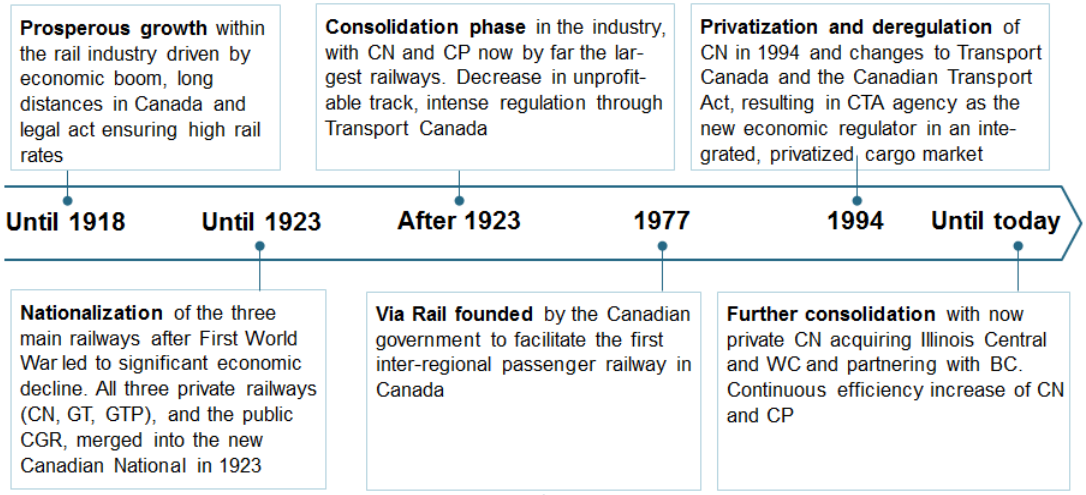

Fig. 4.2.A Milestones in Canada rail history[50]

System setup

In its setup, the Canadian railway system differentiates between the dominant cargo segment and the minor passenger rail. **Cargo** railways are largely integrated, dedicated and privately owned. The cargo market is dominated by two major *Class I* cargo railways, shown in fig. 4.2.B. The long-haul routes are characteristic for the Canadian rail infrastructure. East-west tracks connecting the Atlantic and Pacific Ocean are especially important for the transport of agricultural products. Along the north-south axis, routes run deep into USA territory (e.g. to New Orleans).

Passenger rail is state-owned and mostly operates on the infrastructure of the two *Class I* railways, making it heavily dependent on external influences of cargo railways. The passenger market is mainly operated by *Via Rail*. However, it must be noted that passenger rail is very limited in Canada (1,412 m pkm, see fig. 4.2.F).

Compared with other countries, the overall **governmental influence** can be considered moderate, especially after legislative changes in the 1990s to deregulate the Canadian railway market. The government is represented by *Transport Canada (TC) Ministry of Transport*. As the ruling body, *TC* guides the not fully independent economic regulator *CTA* and sets the federal safety level for all inter-regional rail companies for the *Transportation Safety Board of Canada (TSB)*. In turn, the *TSB* enforces and controls these safety regulations with respect to the *Class I* cargo railroads and other smaller rail companies. Apart from the *TC*, the competition bureau

[50] Source: Canadian Encyclopedia; CN website; Transport Canada; Via Rail.

influences the *CTA* as regards competition rules. To ensure a well run railway system, the *CTA* is in charge of conciliation between *Class I* and smaller railways, and is in charge of enforcing the *Canadian Transportation Act,* regulating the network, competition, service levels, network access, track access and special rates.

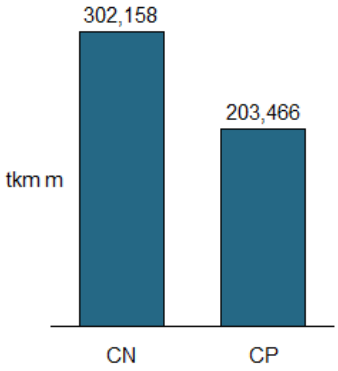

Fig. 4.2.B Comparison of the two major *Class I* railway companies[51]

Track access is granted primarily on a basis negotiated between the parties involved. Instead of a defined formula, market-based rates are applied. As *Via Rail* operates mainly (98.8%[52]) on non-owned track, it has to pay track access fees to the host railway. The *CTA* intervenes only if the interswitching rule applies. This is the case when no alternative railway is within a 30-km radius of the shipping company. The economic regulator can then enforce track access for the shipper with track access at "reasonable rates". In any other events of disputes over track access, the *CTA* is in charge of settling these conflicts. Fig. 4.2.C shows the structure of the Canadian railway system in an overview.

Competition

The Canadian mainline rail network is dominated by integrated cargo railways, as *Via Rail* owns less than 1% of total track. The two Canadian *Class I* railways *CN* and *CP* operate the largest parts of the network. Fig. 4.2.D shows the different tracks of the *Class I* cargo operators. Their main connections link the Pacific and Atlantic Ocean, as well as the southern part of the continent. Most of the Canadian network is concentrated in the south of Canada and also runs additional lines in the USA territories.

[51] CN and CP operate in Canada and the United States.
Source: CN; CP.
[52] Source: Via Rail website.

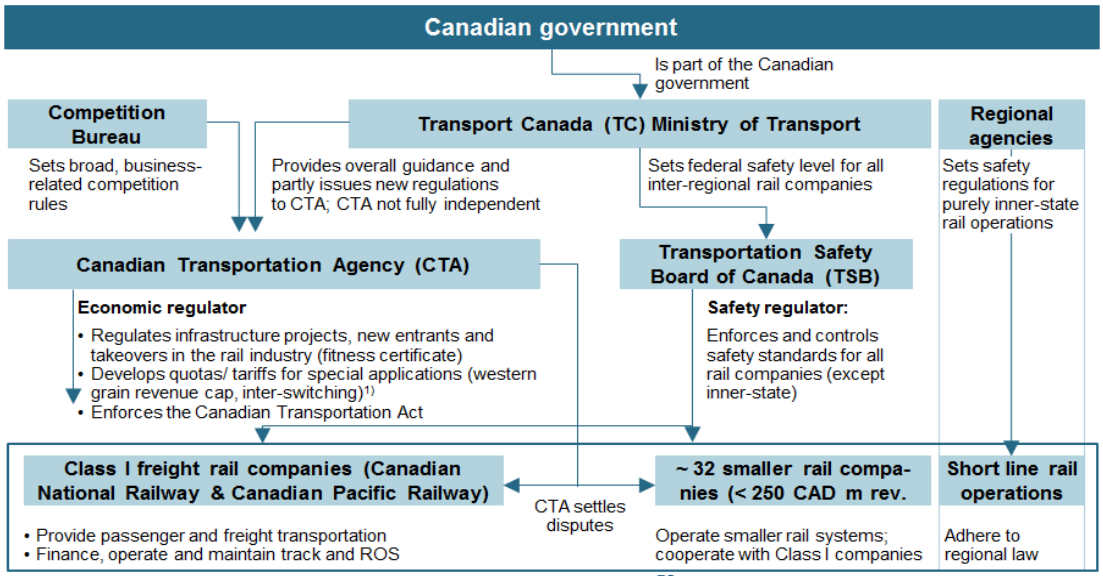

Fig. 4.2.C Structure of the railway system in Canada[53]

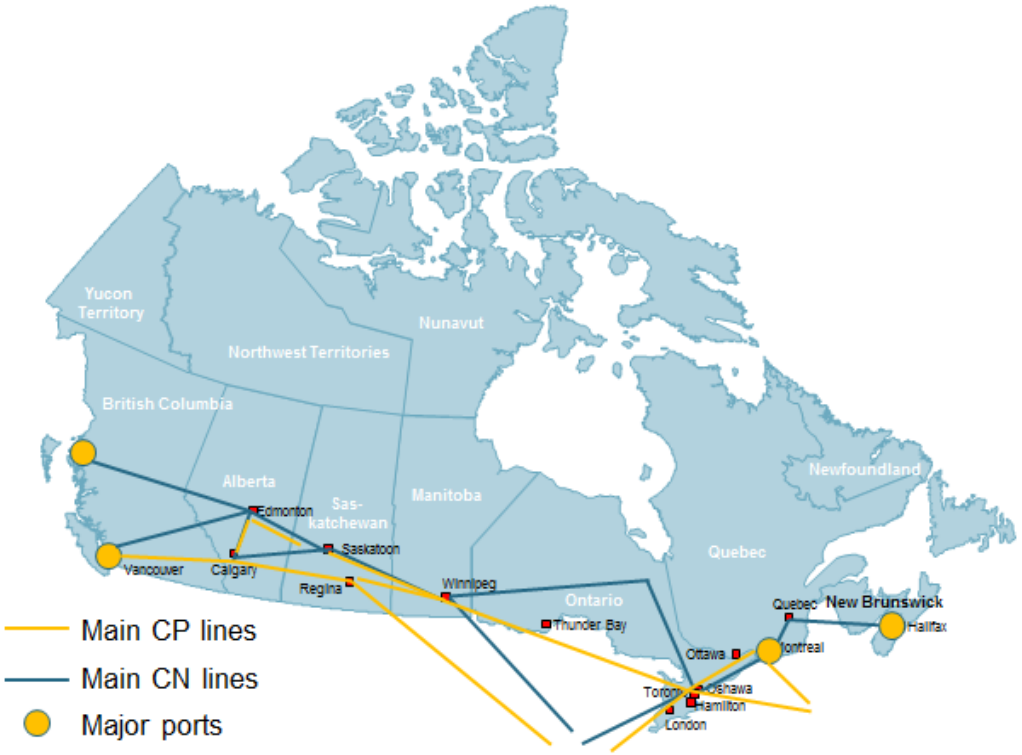

Fig. 4.2.D Network of two Class I rail cargo operators[54]

[53] Source: CTA; Transport Canada; Rail CAN.
[54] Source: Transport Canada.

The Canadian **cargo** railway market can be described as a duopoly, as two railway companies provide similar services, connecting the same Canadian cities. Both *Class I* cargo railways operate to 95% on their own infrastructure. *CP's* total track network is almost twice as large as *CN's*, so *CP* maintains and operates the majority of Canadian railways.
Although the two railways differ in their products (*CN* transporting a diversity of different commodity groups and *CP* focusing on bulk goods, such as grains and coal), the **intramodal** competitive pressure can be considered to be high due to the similar service offering. No significant differentiation in terms of service quality was identified. According to the NAFTA agreement, Canadian railways compete not only with themselves, but also with USA *Class I* railways covering each other's territories.
Intermodal competitive pressure can be considered to be rather low. This is due to the fact that, firstly, air and water cargo share is very low. Secondly, road cargo transportation is competitive only on routes < 300 miles. As the majority of traffic is transported on long-haul routes, the competitive pressure is limited. Finally, although pipelines are very efficient for long-haul routes, these can be used only for liquid products, and are thus no alternative for most of the goods carried on rail (e.g. metals, grain, etc.).

As *Via Rail* operates > 99% of its traffic on the infrastructure of cargo railway companies, it can be characterized as a separated **passenger** railway company.
In Canada, *Via Rail* is the only inter-regional passenger railway and can therefore be characterized as a monopoly in this sector. There is thus no **intramodal** competitive pressure in this context. In urban areas, small commuter and other regional lines may pose some competition for *Via Rail*, but this is minor.
The **intermodal** competitive pressure is high. There are several reasons for this: As the average passenger travels a distance of 328 kilometers, airlines are a significant competitor. In addition, the lack of extensive long-haul high-speed rail offerings prevents competitiveness of passenger rail. Over the past decade, the majority of Canadians continued to travel by car, representing a share of more than 90% today.

Traffic

Total **cargo** traffic saw an almost continuous increase from 1996 to 2002, when it stagnated and then decreased during the financial crisis of 2008/09. Thereof, the intermodal share of cargo railway experienced a peak in the beginning of the 21st century, but constantly declined thereafter. Today, with a modal share of 54%, cargo rail still represents the primary mode of transportation for cargo in Canada. However, the loss in modal share is mostly attributable to the increasing popularity of pipeline usage. Being highly efficient for long-haul transportation, the long-term investments in a pipeline infrastructure showed their effect in the continuously increasing intermodal cargo traffic share. Today, pipeline transportation accounts for more ton kilometers than road traffic (see fig. 4.2.E).

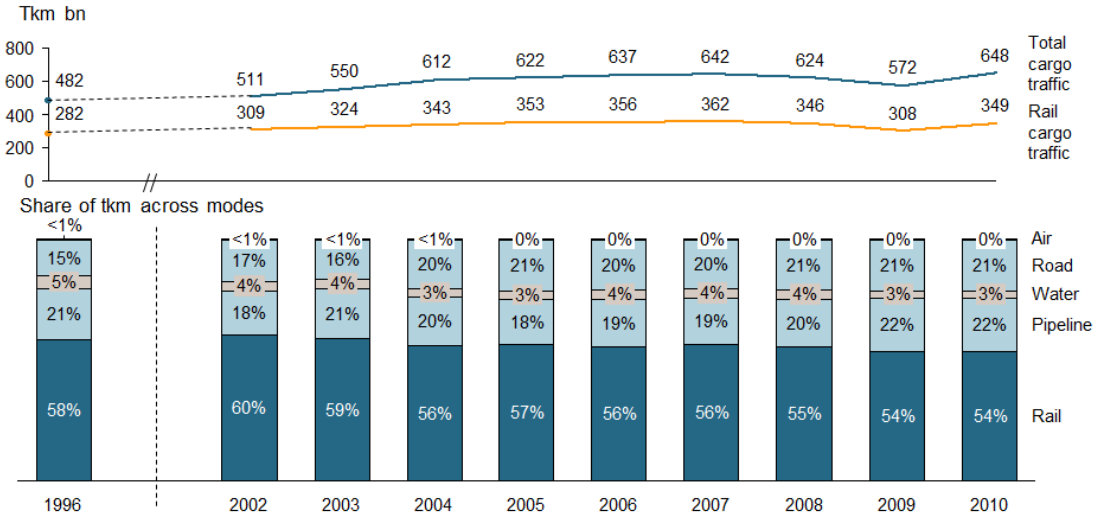

Fig. 4.2.E Intermodal share distribution of cargo transportation in tkm[55]

The **passenger** sector of rail transportation shows a different picture. Representing an intermodal share of only 0.3%, the total passenger volume experienced a large decline in 2008. It has not recovered from the effects of the financial crisis so far and continues to stagnate at the same traffic level. Despite the fact that the aviation industry gained two percentage points over the span of a decade, road transportation continues to account for more than 90% of all passenger kilometers.

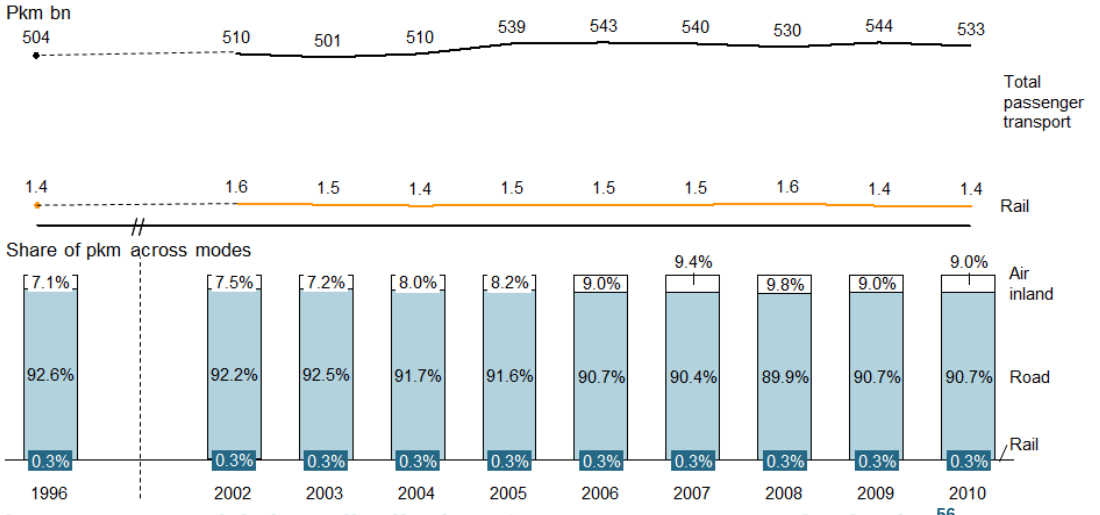

Fig. 4.2.F Intermodal share distribution of passenger transportation in pkm[56]

[55] Source: Rail CAN; Transport Canada.
[56] Source: Rail CAN; Transport Canada.

Investments

In order to maintain the infrastructure, the two *Class I* cargo railways depend on private investments in their track and facilities. Although, in absolute terms (CAPEX), *CN* invests more in its network than the smaller cargo operator *CP,* relative to the revenues generated, *CP* invests more for the replacement and expansion of its rail infrastructure.
In 2005, PPP investments (including government funds) experienced an increase. In 2010, however, government investments in the rail industry almost doubled over the previous year. This is explained by the support for improvements to passenger rail services (e.g. higher train frequencies, enhanced on-time performance, increased speed). During the past decade, 78-90% of these government investments were dedicated to *Via Rail*. Thus, it becomes clear that the passenger railway in Canada is not run as profitably as the cargo sector, and therefore relies to a large extent on government subsidies.

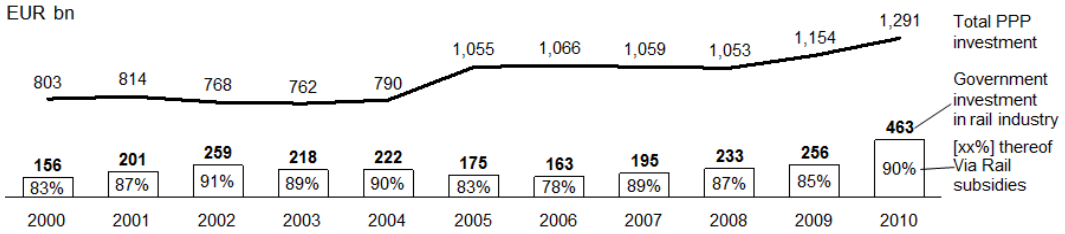

Fig. 4.2.G Development of investments in Canada railways[57]

Efficiency

Over the past decade, Canadian **cargo** railways were able to consistently increase their efficiency in major categories: operations, asset, cost and energy efficiency. Reasons for these developments can be found in several areas. For one, while the existing track network was not expanded as heavily as in earlier days, track utilization was increased due to better scheduling. In addition, the involvement of higher technology standards in rolling stock increased the volume transported, thus further improving operations and energy efficiency.
Yet, the same efficiency levels were not reached in terms of cost efficiency. Operating expenditures (adjusted for inflation) per tkm increased steadily during the past ten years. This development is due to several factors, such as a faster increase in wages, fuel prices.
As the overall efficiency trend across categories shows, the integrated cargo railways are able to operate not only profitably, but also efficiently.
However, although cargo railways suffered cost increases, these were not passed on to consumers. As cargo tariff developments have shown, prices have not increased during the past decade.

[57] Source: Rail CAN; Transport Canada.

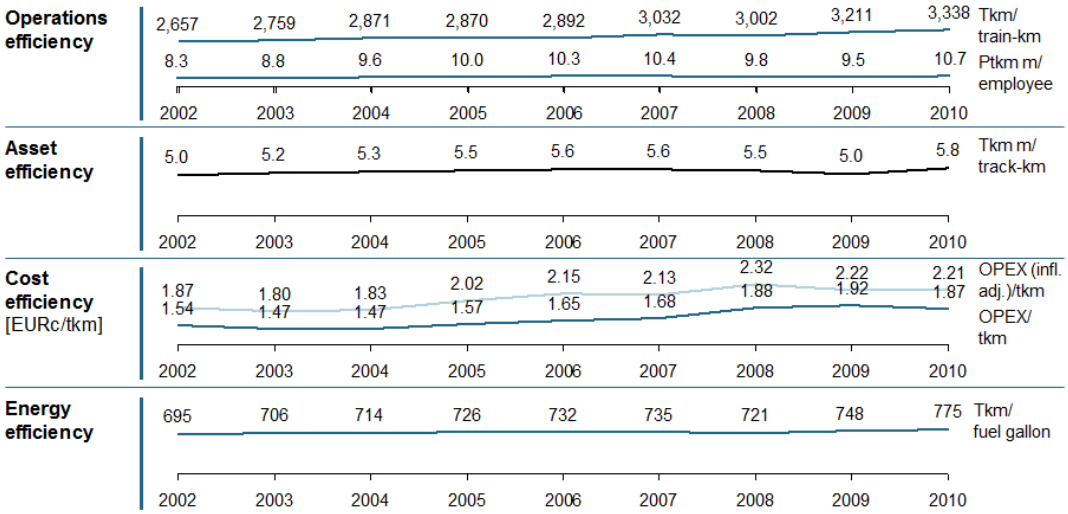

Fig. 4.2.H Development of cargo rail's operational, asset, cost and energy efficiency[58]

Overall, the heavily government-subsidized **passenger** railway *Via Rail* was not able to achieve similar efficiency gains as the cargo sector. When scrutinizing several categories, including operations, employee and cost efficiency, or seat load factor, in none of the above categories did *Via Rail* improve over the past decade. Yet, while operations efficiency and seat load factor deteriorated marginally over the past ten years, cost efficiency saw a significant decrease. This development can be explained by external factors, e.g. higher wages and oil prices, as well as by internal factors: As *Via Rail* improved neither its profitability nor its efficiency, e.g. with regard to pkm/employee, it is inevitable that cost efficiencies will deteriorate. Passenger ticket price levels rose continuously over the past ten years despite growing government support. A significant increase in fares was seen in 2005 due to the introduction of a new fare structure, as well as an expanded offering of the restructured *Via Rail*.

[58] Source: Rail CAN; Transport Canada.

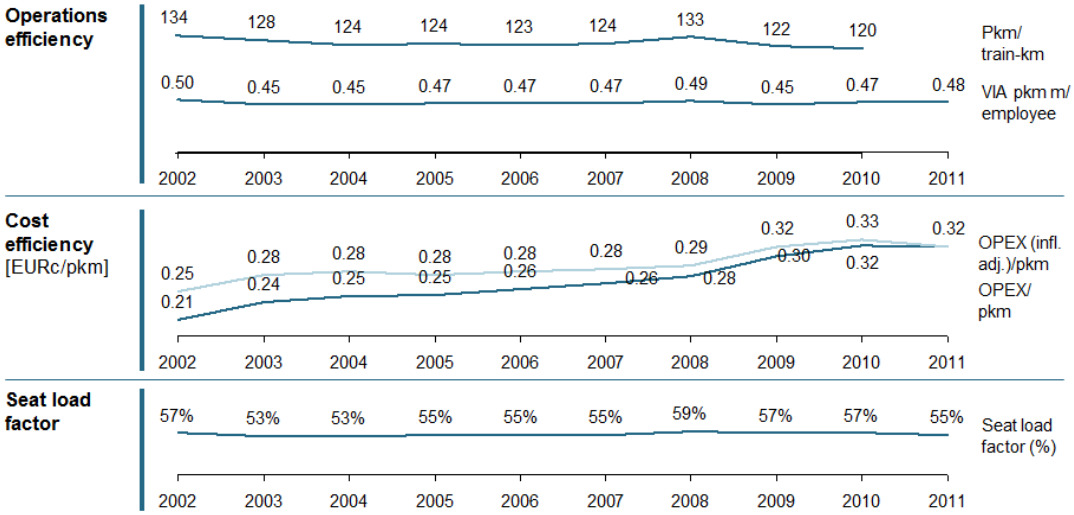

Fig. 4.2.I Development of Via Rail's operational, cost efficiency and seat load factor[59]

Quality

When examining the quality developments over the past ten years, a completely different result can be seen than that for efficiency developments. After both, the **passenger and cargo** railway segments saw a decline in on-time performance/trip plan compliance in 2004, both were able to continuously improve their quality standards. Today, more than 80% of all cargo and passenger railway customers are satisfied in terms of punctuality/trip compliance (see fig. 4.2.J).
In addition, quality performance improved not only in terms of time, but also with regard to safety . Over the past decade, the total number of both accidents and fatalities dropped significantly. This shows that, despite an increase in profitability and efficiency for the cargo railway sector, and despite *Via Rail* struggling with its operational figures, safety did not suffer.

[59] Source: Rail CAN; Via Rail. Train-km 2011 not available

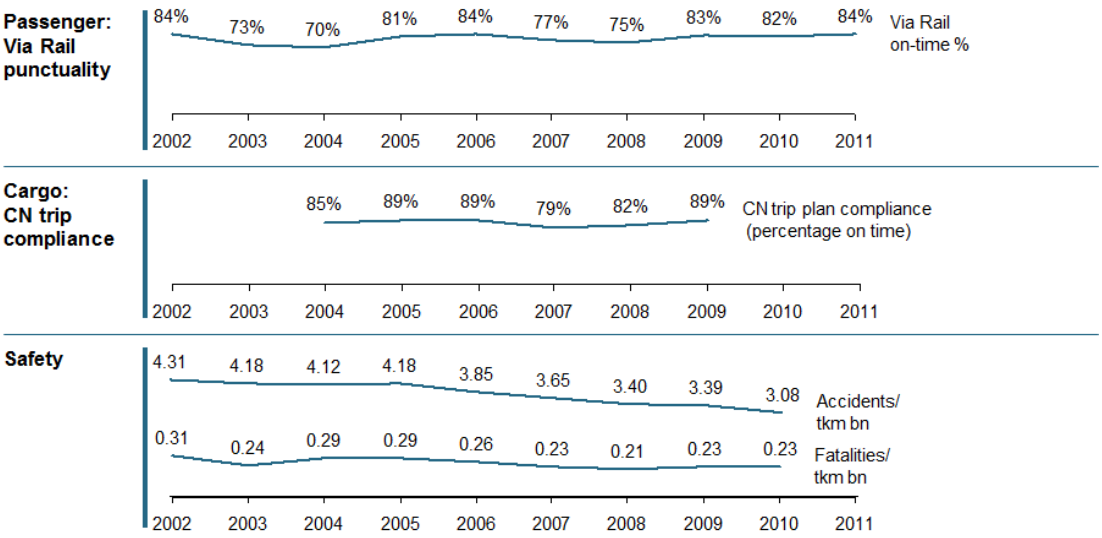

Fig. 4.2.J Selected quality figures for cargo and passenger railways[60]

Conclusion

The developments in the Canadian railway industry over the past decade have shown diverging pictures for the integrated and publicly listed cargo railways as opposed to the separated and state-owned passenger railway *Via Rail*.

We found that **cargo** rail was able to expand its predominant role, especially with regard to long-haul transport. Thus, cargo railway is the means of transport for a majority of goods, being threatened mostly pipelines, which also operate at high efficiency rates over long routes.

In contrast, Canada was not yet able to turn the **passenger** railway into a profitable company after taking over this rail segment in the 1970s. As a result, *Via Rail* can be seen as an example where state-owned, separated railways have difficulties in developing into a profitable and efficient company and becoming competitive against other modes of transportation.

[60] Source: Rail CAN; Transport Canada; Via Rail.

4.3 Japan

History

The development of the Japanese railway system started as early as the 19th century, when the Japanese started to build the first rail tracks, relying heavily on the financial and technological support of the United Kingdom. Being dependent on imports, the Japanese government promoted railway operations, which developed into a major source of transportation. Until 1964, *Japanese National Railway* and several integrated companies, public and private, operated on own infrastructure and trains. In 1964, Tokyo and Shin-Osaka were the first cities to be connected by the high-speed railway line *Shinkansen*.

However, as travelling by plane became increasingly available to the public and highways were expanded, intermodal competition began to increase, until 1985. Instead of travelling by train, a growing number of people decided to go by plane or car because of time and/or cost savings. Thus, the profitability of Japanese railways deteriorated, while the debt constantly increased. This financial burden was further enforced by the indebted *Shinkansen* lines.

This decline in modal share and its resulting effects led to consistently unprofitable operations of three minor lines (*JR Hokkaido, JR Shikoku, JR Kyushu)*. Yet, as a major pillar in the Japanese passenger transportation system, management stabilization funds (MSF) were instituted to aid this segment.

Finally, in 1987, *Japanese National Railways* was privatized in order to resolve the major problems: unprofitable and inefficient operations, bad financial performance and insufficient customer orientation. In order to achieve improvement in these areas, the *Japan Railways Group (JR),* with its six passenger lines (*Central Japan Railway Company (JR Central), West Japan Railway Company (JR West), East Japan Railway Company (JR East), Hokkaido Railway Company (JR Hokkaido), Shikoku Railway Company (JR Shikoku)* and *Kyushu Railway Company (JR Kyushu)*) each covering different geographical regions, and one cargo line (*Japan Freight Railway Company (JR Freight)*), resulted from this privatization. However, the Japanese government maintained ownership of the companies until the early 1990s. In addition, the *Shinkansen* line, being almost insolvent, was privatized as well, resulting in a separate holding combining four dedicated high-speed lines.

In 1991, not only the *JR* passenger lines, but also the *Shinkansen* were geographically divided. Ownership of each of the lines was distributed to the operations of *JR Central, JR East* and *JR West* according to their geographic location. This split was made in order to further benefit from an integrated railway system and thus from further operational and quality efficiencies. It took until 2002 for the Japanese government to give up all control over the three major passenger lines (*JR Central,*

JR East, JR West), when all shares were sold. The remaining three passenger lines and one cargo line remained government property.

In the beginning of the 21st century, Japanese railway operators' continuous efforts to achieve higher efficiencies resulted in a deterioration of safety that culminated in major accidents in 2005. In order to recover from this reputational damage to its rail operations, the operators began to invest in new technologies, thus increasing the safety of operations while also improving efficiency figures.

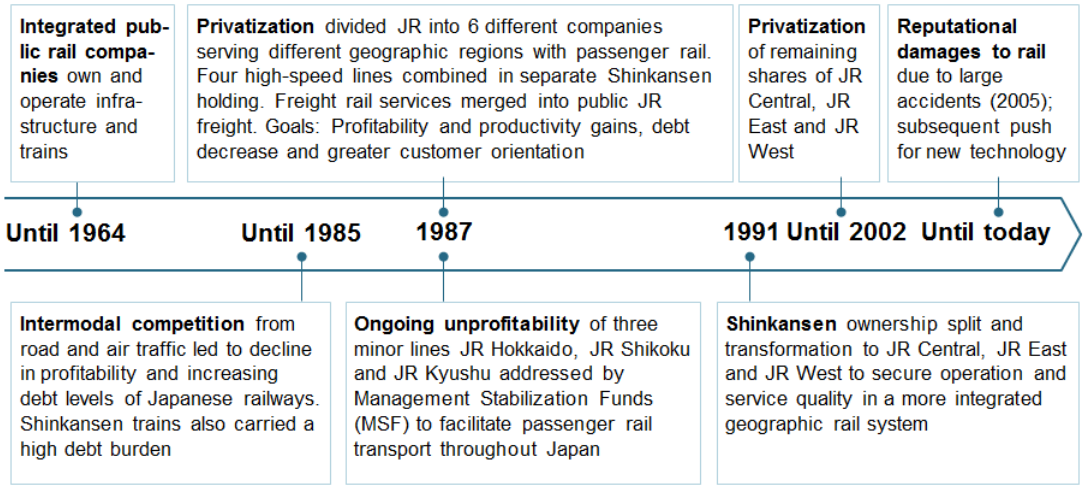

Fig. 4.3.A Milestones in Japan rail history[61]

System setup

The Japanese railway system differentiates in its setup between the dominant passenger rail and the minor cargo segment. **Passenger** railways are largely integrated, dedicated and privately owned. Each of the *JR* railways operates primarily on own track in their respective geographic regions. The Ministry of Land, Infrastructure and Tourism (MLIT) considers this regional split with integrated operation and infrastructure to be one of the main advantages of the Japanese railway system in creating a profitable business.[62] The three major players (*JR Central, JR East, JR West*) in the Japanese passenger market are shown in fig. 4.3.B. The remaining government-owned passenger railways represent only a small share of total passenger kilometers and can thus be neglected for the scope of this study. Other private railways focus on commuter routes and are therefore also excluded from this analysis.

[61] Source: MLIT.
[62] Source: MLIT Interview

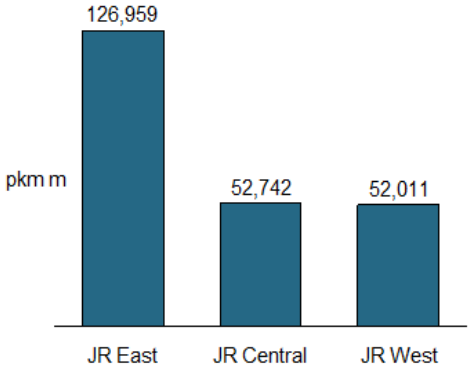

Fig. 4.3.B Comparison of the major Japanese railway companies (2010)[63]

Cargo rail, operated by *JF Freight,* is owned and financed by the government and operates mostly on non-owned track, making it heavily dependent on the external influence of passenger railways[64].

Although the three major passenger railways are publicly listed, there is still considerable **government influence** on railway operations. As for the **passenger** sector, *JR Central, JR East* and *JR West* not only provide passenger transportation on their own dedicated track, which is operated and maintained by the respective railway, but they also jointly plan rail infrastructure with the Japanese government. In addition, the government has to approve passenger fares set by the *JR* passenger railways.
Overall, all operating railways are regulated by the *Ministry of Land, Infrastructure, Transport and Tourism (MLIT)* with regard to safety.

As each of the *JR* passenger railways has dedicated tracks, only a small fraction of operations is performed on non-owned track. However, as *JR Freight* lacks this infrastructure, **track access** must be granted by the passenger lines. Instead of applying market-based rates for this a defined formula that accounts for attrition, electricity, weight and speed is used to calculate track access fees. In the case of passenger transportation, track access depends only on the operator's decision. Fees for the usage of non-owned track is negotiated on an individual and market-based basis. Track access for the remaining private passenger railways is controlled by the government, and the *MLIT* must approve track access charges. Fig. 4.3.C shows an overview of the structure of the Japanese railway system.

[63] Source: JR Central; JR East; JR West.
[64] Excluding Shinkansen

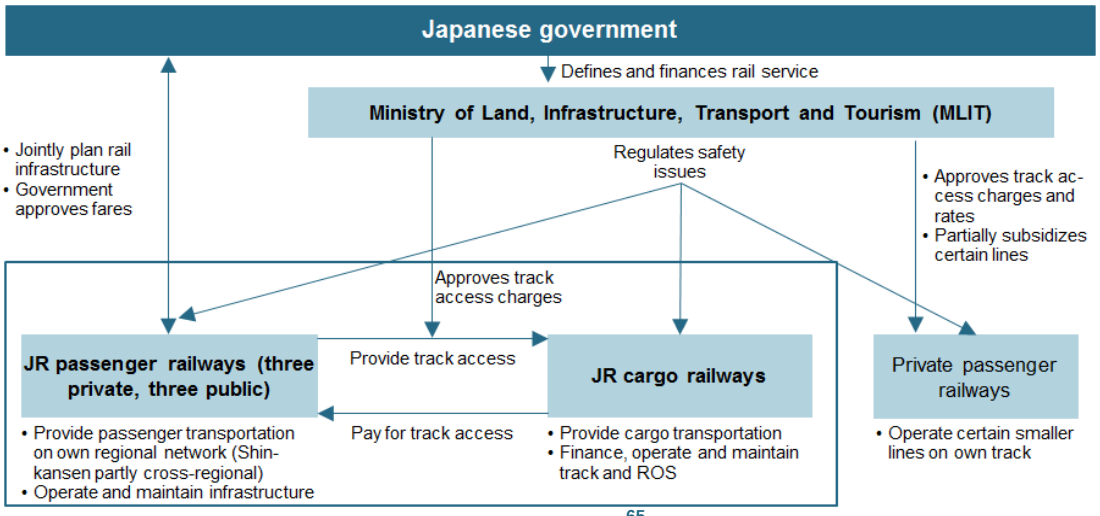

Fig. 4.3.C Structure of the railway system in Japan[65]

Competition

The Japanese railway system is characterized by a high degree of regional separation. Each of the six *JR* passenger lines operates on its own track. Japan is geographically divided into six regions of unequal size, each of which is covered by a different passenger railway. The six *JR* passenger lines own 87% of all Japanese railway track. The remaining 13% is divided among other privately owned railways, which operate mainly as regional commuter lines, and *JR Freight*. Fig. 4.3.D shows the different tracks of the six major Japanese railway companies. *JR Freight* owns only 50 km of own track.

Apart from the regional division, the **passenger** railways differ in both ownership structure and size. While the three state-owned railways (*JR Hokkaido, JR Kyushu, JR Shikoku*) are rather small in size, the three fully privatized railways (*JR Central, JR East, JR West*) represent the majority of track kilometers in Japan.

As a result, only in very few cases do tracks of different passenger lines overlap. **Intramodal** competition can therefore be considered very low. Only in urban regions, such as the suburbs of Tokyo, can intramodal competition arise from other privately operating railways that focus on regional transport.

[65] Source: MLIT.

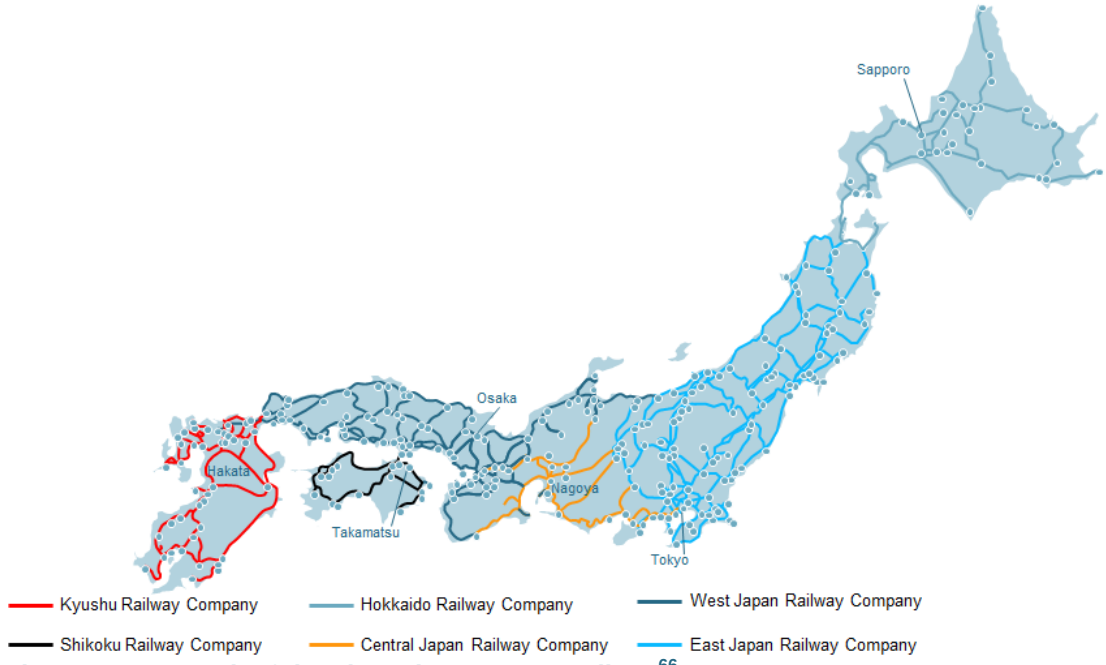

Fig. 4.3.D: Network of the six major passenger lines[66]

The main competition thus stems from **intermodal** competition. Despite the fact that, compared with other developed countries, Japan still shows a significant share of rail transportation, the majority of the Japanese population prefers to travel on road rather than on rail. This preference can be explained by the increasing wealth of the Japanese people in the second half of the 20th century. Yet, intermodal competition is weaker for the urban parts of Japan and stems mostly from other public transportation systems or going on foot/by bicycle, as the intermodal share of rail transportation remains above the country average in these metropolitan areas.

In contrast to the regional split within passenger transportation, after the privatization of *Japanese National Railways*, only one **cargo** railway resulted from this organization: *JR Freight*. This railway company still remains under the ownership and control of the Japanese government. As it operates nearly 100% on non-owned track using the infrastructure of the well developed passenger network, *JR Freight* can be described as a separated railway. This dependence on external track can be handled, as *JR Freight* was granted the right to operate on dedicated passenger track after the privatization in 1987. The objective of this vertical separation was to relieve the cargo company from the heavy financial burden of infrastructure. As *JR Freight* is the dominant rail cargo operator with almost no competition, there is no **intramodal competition** in rail cargo.

Like passenger transportation, the strongest competition stems from **intermodal** competition. As rail cargo transportation accounts for just 4.2% of cargo carried,

[66] Source: MLIT.

major competitors can be found on roads and waterways. *JR Freight* is obligated to operate during the free slots the passenger railways can provide, especially in the busy urban areas. Therefore, the cargo company is not only disadvantaged by the inflexible infrastructure, but also by time. Thus, other modes of transportation are more attractive due to their flexibility.

Traffic

From 1992 until the beginning of the 21st century, total **passenger** transportation figures saw only a small increase, followed by a decline. Thus, comparing today's figures with passenger traffic 20 years ago, we find a stagnating development. It should be noted that the decline (-0.1%) in the Japanese population over the past decade can partly explain the decrease in overall passenger kilometers (-0.6%).
As for the passenger transportation industry as a whole, we found stagnating development of passenger kilometer figures for rail transportation. Apart from a rather severe drop in the intermodal share in favor of road and air traffic early in the second half of the 20th century, there have been no significant changes. Comparing rail passenger figures with the change in population, there was even a small positive change in rail traffic (see fig. 4.3.E for detailed development of the passenger intermodal share).

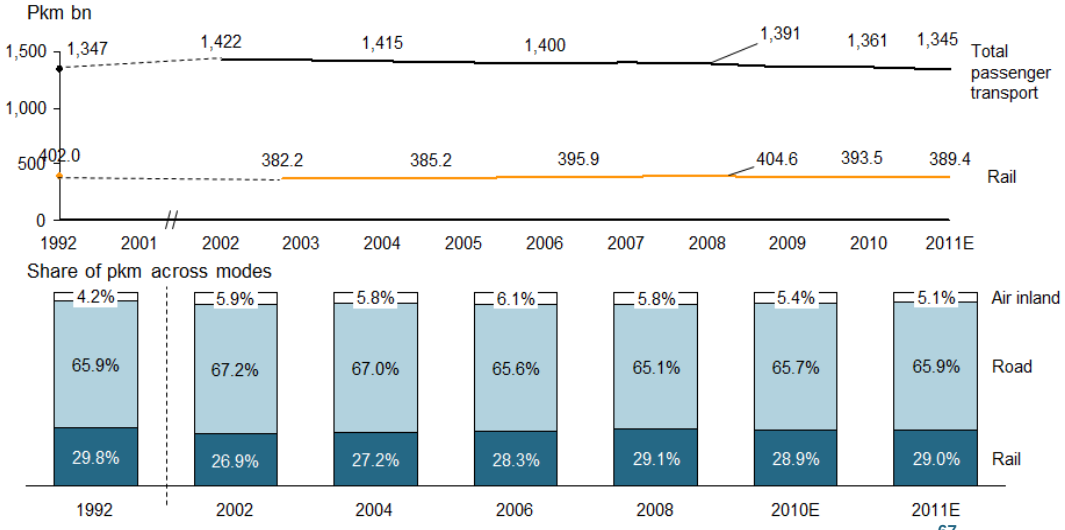

Fig. 4.3.E Intermodal share distribution of passenger transportation in pkm[67]

The rail **cargo** sector shows an even severer picture with regard to traffic development. Over the past 20 years, we found stagnating total cargo traffic figures,

[67] Road data available only through 07/2010; subsequent months estimated based on total traffic and other modes; figures for rail and air available through 10/2011; remaining months estimated according to YTD growth.
Source: MLIT.

and they have not yet recovered from the downturn in 2008. This reduction in cargo transportation can be explained by two major events: the financial crisis led to a decline in tkm in 2008, and this dip was further enforced by the nuclear catastrophe in 2011. Japan has not recovered from these two major events of the past 5 years.

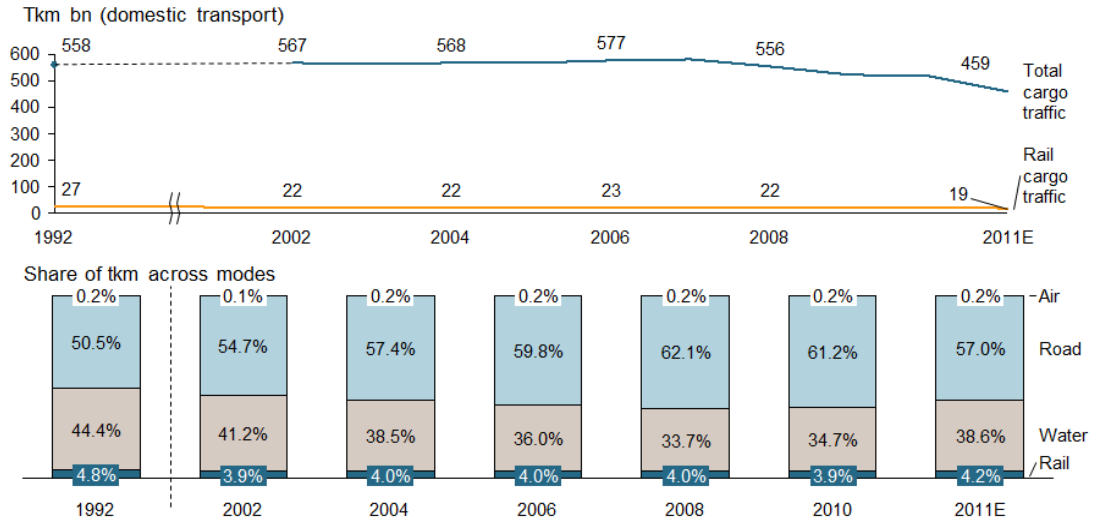

Fig. 4.3.F Intermodal share distribution of cargo transportation in tkm[68]

Overall, with a 4.2% share, rail cargo traffic represents only an insignificant portion of total cargo transportation. Over the past two decades, the losses in the sea transport modal share were mostly gained by road cargo traffic, leaving air and rail cargo traffic to remain constant in their modal share. Today, road transportation is the preferred choice for cargo traffic, representing more than half of the intermodal cargo share (see fig. 4.3.F).

[68] Figures available through 10/2011, remaining months estimated according to YTD growth. Source: MLIT.

Investments

In order to maintain the infrastructure, each of the three major private **passenger** lines invests in its track and facilities. An increase in investments was seen for all railways. Especially *JR East* shows significant growth in investments, quadrupling its capital expenditures over the past decade. This overall increase in capital expenditures can be explained by the railways' efforts to increase their efficiency and quality in the medium to long term, while operating with the latest technological equipment available (see fig. 4.3.G for a detailed comparison of investments over time between the three major passenger railways). While *JR Central* reports that it has never received government subsidies, infrastructure extensions for *JR East* were financed by the state.

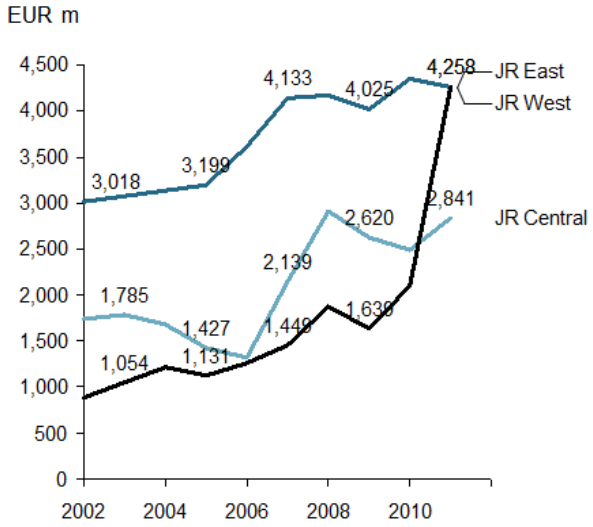

Fig. 4.3.G Development of CAPEX of the three major passenger lines[69]

[69] Source: JR Central; JR East; JR West.

Efficiency

In the early 1980s, the majority of **passenger** railways operated inefficiently. One of the goals of the 1987 privatization and division of *Japanese National Railway* was to increase efficiency figures. A positive trend is evident in operations efficiency measured in pkm per train-km or pkm per wagon-km. The interpretation of these figures that integrated railways have more efficient operations is supported by the expert of the Ministry of Land, Infrastructure, Transportation and Tourism, who stated for instance that " it is necessary that the railway operators are subjectively involved in the management of infrastructure as well as operation for establishing a safe, reliable, and efficient railway system."

However, we found that passenger railways did not achieve any significant cost or asset efficiencies over the past two decades. This diverging finding can be explained by the following reasons: Operations efficiencies increased as the railway operators continuously invested in new equipment and new technologies (see fig. 4.3.G: Development of CAPEX of the three major passenger lines). Therefore, passenger capacity per wagon and train continuously improved. Yet, fig. 4.3.E reveals stagnating development in rail passenger traffic. Nevertheless, the railway companies did not reduce investments in their track and infrastructure system, so, with decreasing passenger km figures, no asset efficiency improvements were achieved. The same underlying reason holds true for cost efficiency, as operational expenditures did not decrease by the same level as passenger kilometers did over time.

Fig. 4.3.H shows detailed development of selected passenger rail efficiency figures

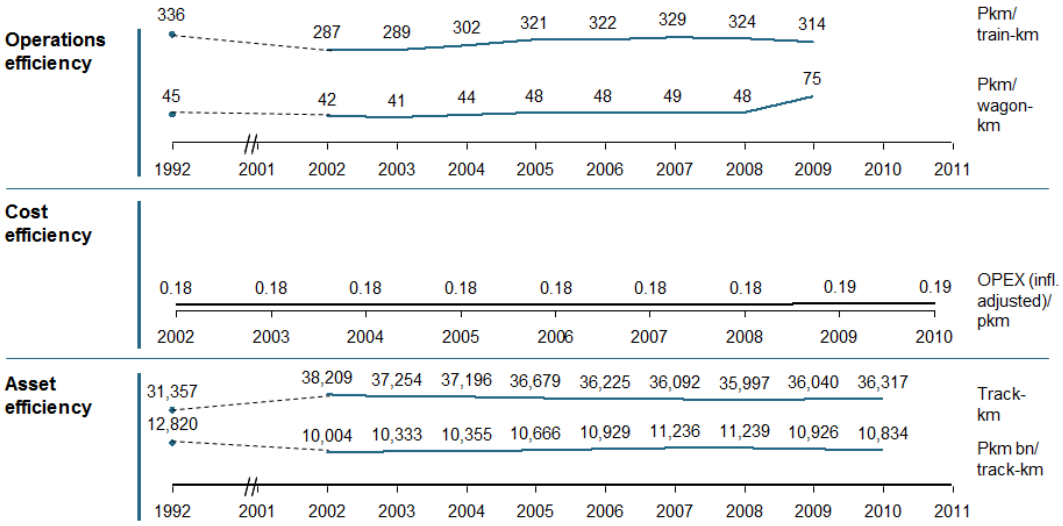

Fig. 4.3.H Development of passenger rail's operational, cost and asset efficiency[70]

[70] Source: MLIT. Data partly not available for 2010, 2011

Regarding the **cargo** rail sector, we found no significant efficiency increases. Both operations efficiency and asset efficiency show a negative trend over the last two decades.
This negative trend can be explained by two main factors: First, as a government-owned corporation, incentives to increase efficiency are smaller than for privately held entities. In addition, fewer investments were made to improve existing infrastructure and technologies, and as a result, there were no significant increases in operations efficiency.
Furthermore, the same argumentation as for passenger railway holds true when interpreting asset efficiency: As the total number of tkm decreased over time, with no divestments of assets being undertaken, asset efficiency showed a downward trend over time.

Our findings for cargo efficiency figures support the hypothesis that a non-integrated railway company is less able to achieve efficiency gains, as it is unable to control most parts of the operation, but is dependent on the host provider of track and other infrastructure. Fig. 4.3.I shows detailed development of selected cargo rail efficiency figures

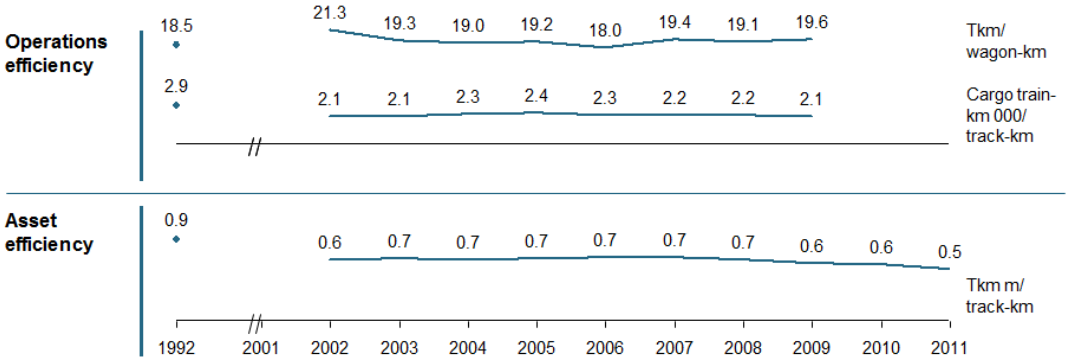

Fig. 4.3.I: Development of cargo rail's operational and asset efficiency[71]

Quality

After the rapid increase in fatalities in 2005, the major **passenger** rail operators took action and began to invest in new technologies with better safety measures. All interviewees of the three major passenger lines are convinced that vertical separation would worsen the safety of their operations. For instance, *JR Central* warns that "safety issues might arise if the system is vertically separated".

However, as fig. 4.3.J shows, *JR Central*, as a representative passenger railway, has achieved high quality levels in terms of punctuality. With only one peak in 2004, *JR*

[71] Source: MLIT.

Central has kept its delays at a very low level in international comparison. Today, trains are on average 30 seconds late.

Concerning the overall quality aspects of railways, we encountered qualitative arguments in favor of integrated railways, as *JR Central* states that "high service quality can best be achieved with integrated railways. This is due, for instance, to the much higher speed of internal decision-making".

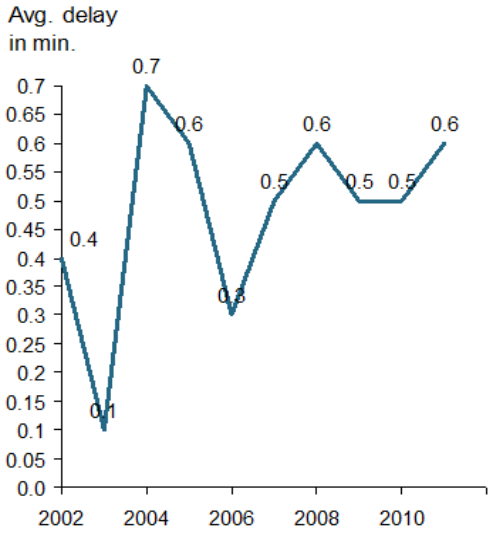

Fig. 4.3.J JR Central punctuality development (average delay in min.)[72]

Conclusion

The example of Japan shows integrated passenger and unbundled cargo railway systems being owned privately and by the government, respectively. We found that, through the privatization of the passenger railway system, the three major *JR* **passenger** railways were able to improve their operations and thus become profitable, unlike in the 1980s, when most railways fought against insolvency. In contrast, the publicly owned **cargo** railway *JR Freight* continues to struggle with its efficiency figures, merely being competitive against other modes of transportation.

However, both models of integration and separation experienced not only a decline in total traffic volume, but also a decline in intermodal share, due to a drop in total traffic, the increasing attractiveness of other modes of transportation and declining population. Due to this bias in the analysis, no consistent evaluation can be derived in terms of the (dis)advantages of integrated and separated railway systems. However, the interviewees of *JR Central* and *JR East* confirm that in their view system integration is the decisive factor for the success of a railway system.

[72] Source: JR Central.

4.4 Russia

History

The Russian rail industry evolved from the disintegration of the USSR in 1991 and the subsequent split of the USSR railways into Russian railways and individual railways for the other CIS countries.

In the first stage of the railway reform (2001-2002), the role of the government was reduced and the management of Russian railways was separated from the government function. On this basis, the *Russian Railways Public Corporation (RZD)* was formed as a government-owned national rail carrier.

In the second stage of reforms, subsidiary companies were set up and *RZD* property was transferred to them. Cross-subsidization of passenger and raw material transportation segments was reduced. For example, subsidization of raw material transport by more expensive cargo was reduced. Efforts to improve the performance and efficiency of Russian railways through enhancement of competition continued throughout the last decade.

In the current third reform stage, stakes in cargo wagon subsidiaries were sold to private investors and the capital raised was invested in the development of the rail infrastructure. Passenger transport was wholly transferred to subsidiaries. The service offering was enlarged to include repair services and contract logistics (see fig. 4.4.A).

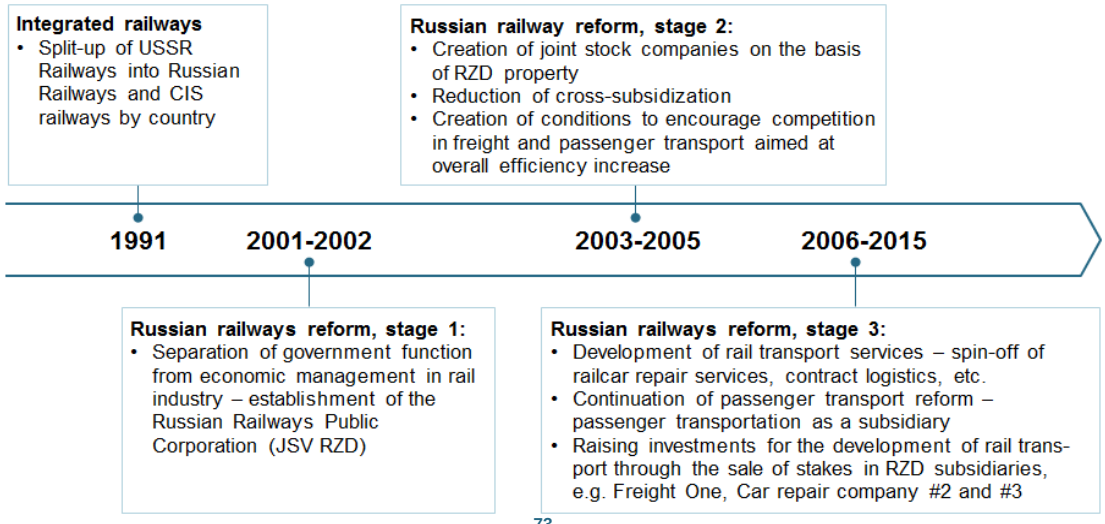

Fig. 4.4.A Milestones in Russia rail history[73]

[73] Source: RZD.

System setup

Rail traffic in Russia has a relatively high cargo share, while passenger traffic is at comparatively low level. Its tkm/pkm ratio of approx. 14.5 in 2010 is much higher than that of China (approx. 3.2), but lower than the USA and Canada (262.1 and 247.2) which are historically very cargo-driven markets with marginal passenger traffic.

There are six rail infrastructure operators in Russia. All of them are vertically integrated, at least in their cargo undertakings:

- RZD owns and maintains almost 99% of the Russian railway network, of which 51% is electrified
- Five other companies (Yakutia Railways, Yamal Railway, Gazpromtrans, Gazpromdobycha Nadym and Norilsk mining company) own rail tracks as well (see fig. 4.4.B and 4.4.C).

Industrial railroads have the sole function to serve their own transportation needs, and thus do not offer transportation services to other potential customers.

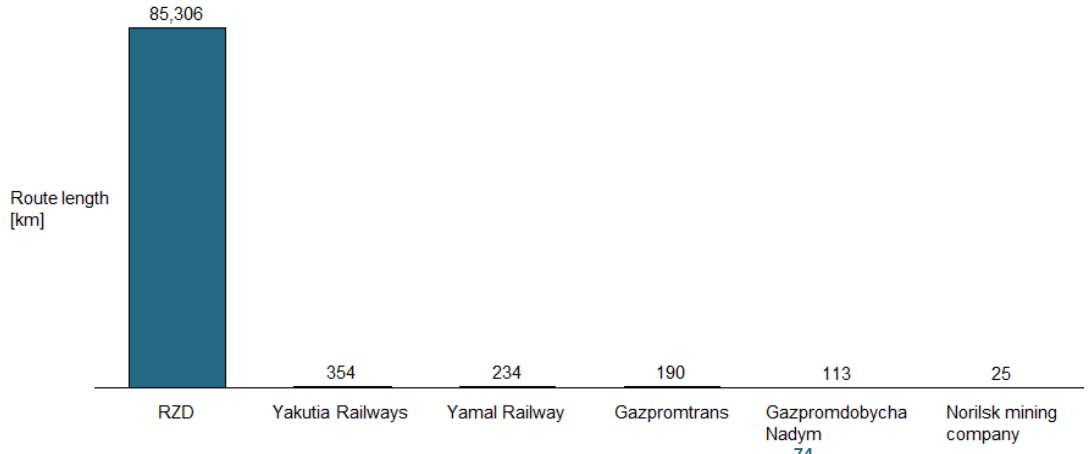

Fig. 4.4.B Comparison of rail infrastructure operators in Russia[74]

As a **cargo train** owner and operator *RZD* is in a dominant position, albeit with a decreasing tendency because as part of reform it

- transferred cargo wagons to subsidiaries of the company (e.g. Freight One) and
- sold stakes in these companies to private investors

This has led to 50% private ownership of cargo wagons. The private companies do not only own, but also operate the wagons (they sell the transport service to shipping companies, organize the transport, and use RZD as the traction provider). In further reform steps, transferring locomotives to the private sector will also be pushed. A powerful political lobby representing newly formed fleet owners is pushing for the

[74] Source: RZD.

liberalization of the traction market, but RZD has been postponing implementation so far.

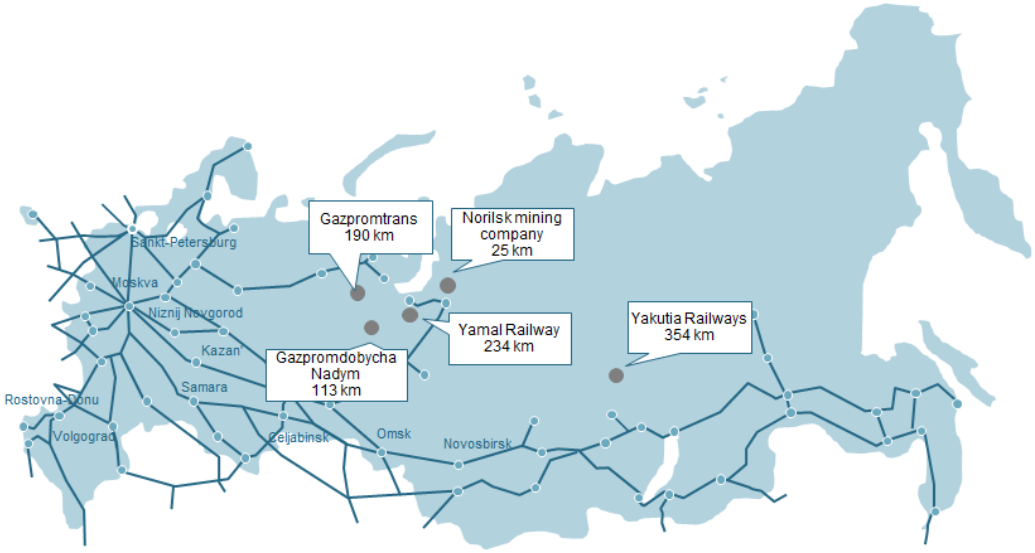

Fig. 4.4.C Main railway trunks in Russia[75]

As a **passenger** rail operator, *RZD* has completely transferred its operations to subsidiaries (e.g. *Federal Passenger Company*). Long-term plans might lead to a privatization of passenger rail as well if operations are profitable enough.

The maintenance and service offering of *RZD* has also been completely transferred to subsidiaries in preparation for a sale to the private sector. While some heavy maintenance plants for wagons have been sold to private investors, other less profitable plants were retained by *RZD* for lack of interest from the private sector. Furthermore, *RZD* plans to start privatizing light maintenance plants for wagons. One proposed plan foresees dividing the plants equally among three private sector companies (40 plants per company). Moreover, a major locomotives heavy maintenance asset (*JSC Zheldorremmash*) is expected to be privatized in the summer of 2012.

The privatization of *RZD* assets is partly criticized for lack of transparency and the resulting acquisitions below market price.

[75] Source: RZD.

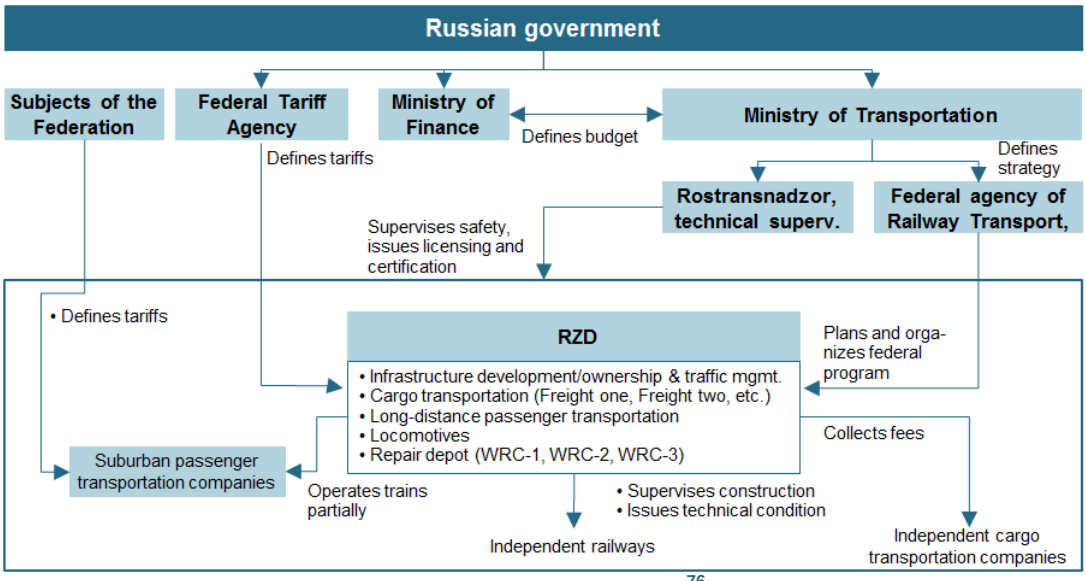

Fig. 4.4.D Stakeholders in the Russian railway industry[76]

As depicted in fig. 4.4.D, the **government** still controls the rail industry through various channels:

- Government bodies define and monitor RZD freight tariffs, as well as tariffs in suburban passenger rail,
- The Ministry of Transportation plans and ratifies infrastructure strategy and development projects

However, independent cargo wagon operators have constantly increased their traffic shares (in tkm) as well as their ownership of cargo wagons in the past decade. In this respect there is competition at the wagon-owner-operator level and clear vertical separation between infrastructure ownership, traction (*RZD*) and wagon operation.

Independent players have increased their market share (in total tkm) since 2003 from almost 20% to almost 50% in 2011 (see fig. 4.4.E). Meanwhile, *RZD* has actively transferred its market shares to its cargo subsidiaries and now has only 53% of total tkm, down from 78%.

[76] WRC wagon repair company, 75% of Freight One was sold to the private sector in October 2011.
Source: Government of Russian Federation.

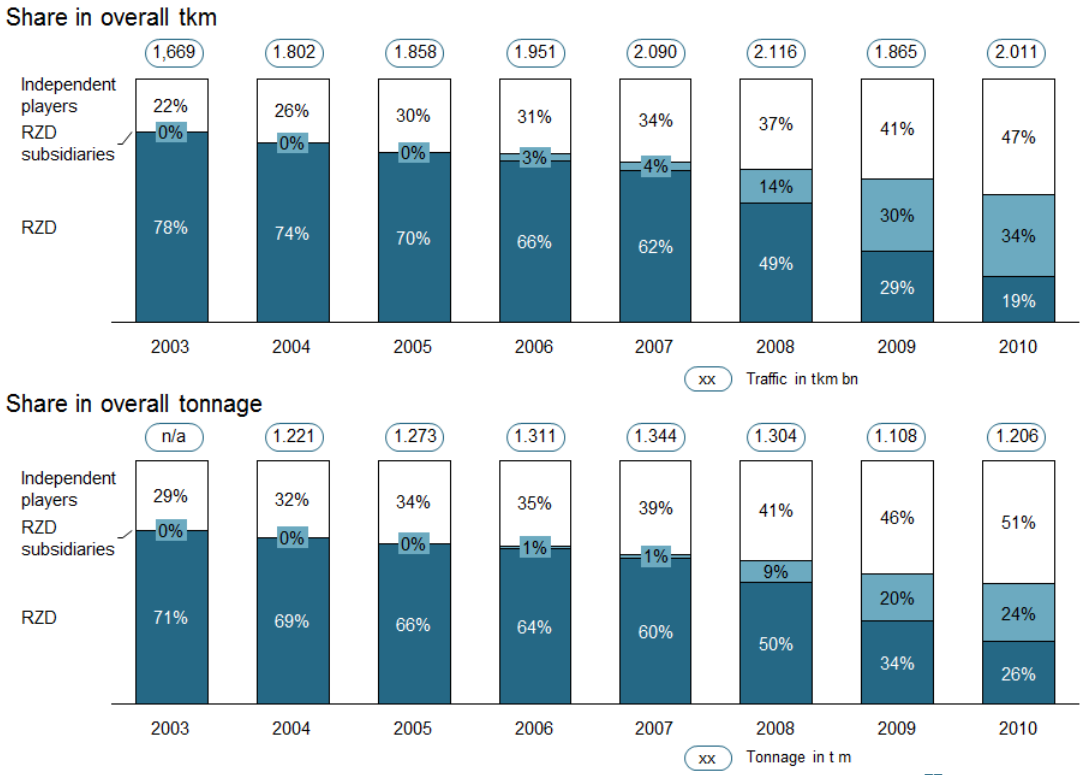

Fig. 4.4.E Competitors and market shares in the Russian rail cargo market[77]

We see the same development in the ownership structure of cargo wagons, see fig. 4.4.F. While the installed base of wagons increased significantly (by more than 25%) since 2003, *RZD* reduced its share of freight cars to 21% until 2010 by transferring a major share of cars to its subsidiaries. Independent players increased their ownership to 50%.

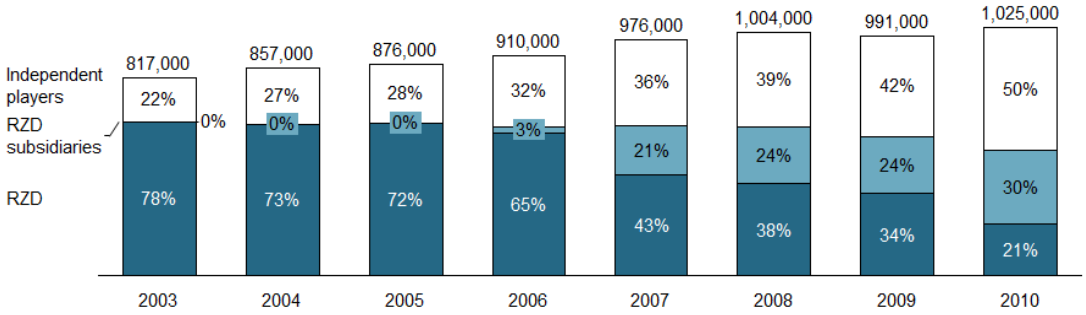

Fig. 4.4.F Ownership structure for cargo wagons in Russia[78]

[77] Figures for 2002 and 2011 not available
Source: RZD.

[78] Figures for 2002 and 2011 not available
Source: RZD.

The **intermodal** competitive environment is relatively intense. In **cargo**, pipelines, which account for around 50% of the market (in tkm, see fig. 4.4.G), are the cheapest transport mode for transportation of light oil products and gas. Heavy oil is usually transported by sea/inland waterways, which are a cheaper alternative to rail. Road transportation is quite expensive in Russia, with restrictions in haul distance and cargo weight.

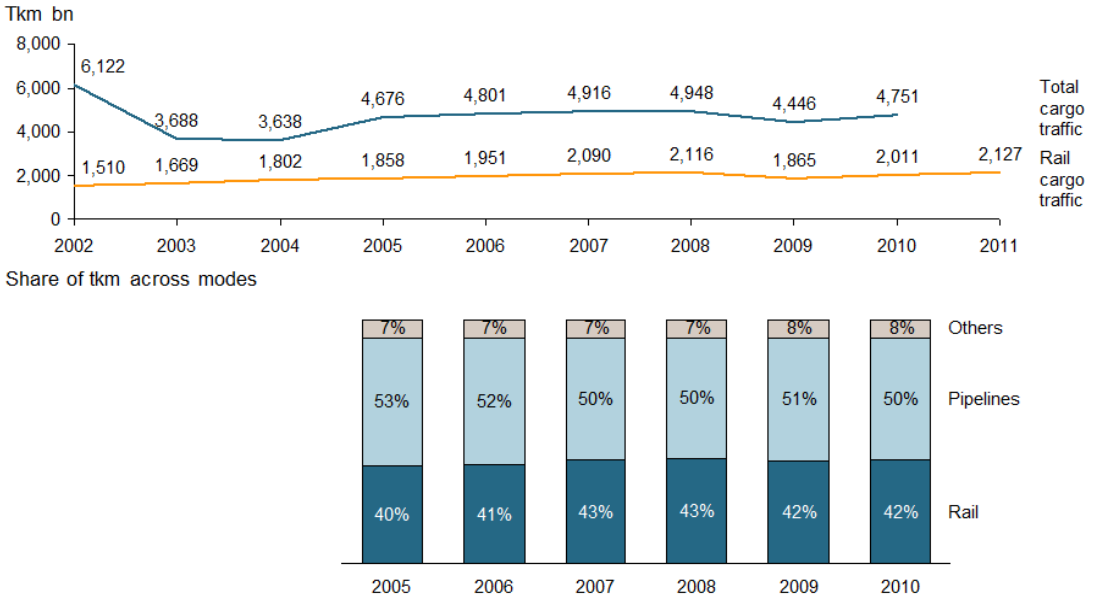

Fig. 4.4.G Modal split and traffic development in cargo traffic in Russia[79]

RZD has a dominant position in the rail **passenger** transportation market, with a 99% market share for long-distance trips. Private players cover the remaining 1% (e.g. *Grand Service Express, Tverskoy express, TransClassService*). In regional passenger transportation, RZD has created around 50 joint ventures (JVs) with regional governments. RZD shares in these JVs varies between 51% and 99%. These JVs cover 100% of the market.

We see more intense competition on the intermodal level (see fig. 4.4.H). For distances over 1,000 km, air transportation is generally preferred, and for distances below 150 km, road. While the share of rail transportation has declined to the benefit of air transportation, its core market (distances between 150 km and 1000 km) has stayed robust. A typical journey from Moscow to St. Petersburg (630 km) is up to 50% cheaper by train than by bus, and 20% faster.

[79] "Other" includes road, air, sea and inland waterways; figures for 2002 – 2004 and 2011 not available; figures for 2011 not available for total cargo traffic.
Source: Russian Federal Statistics.

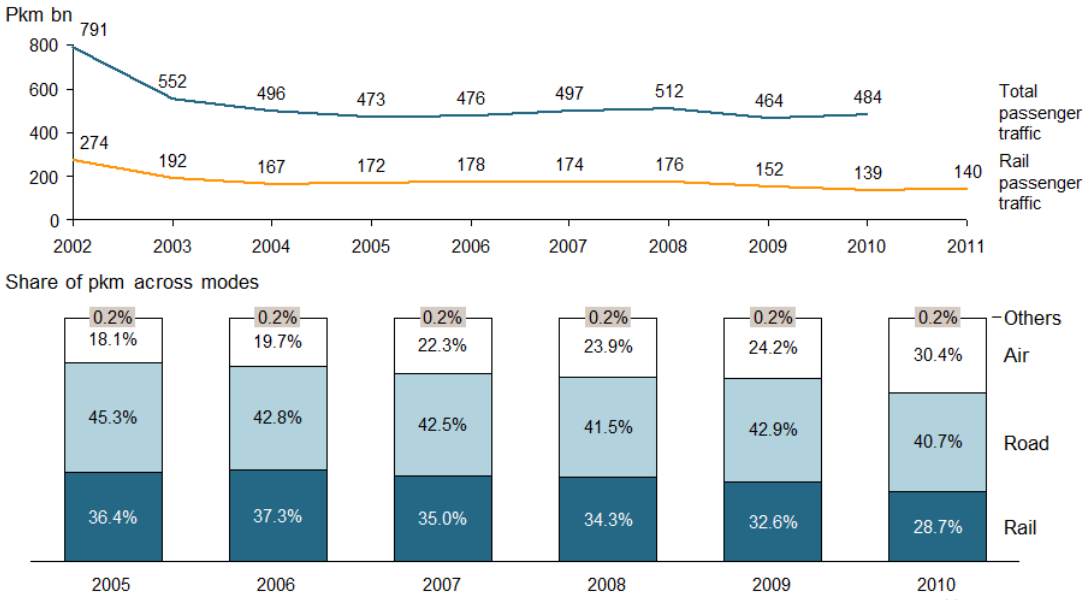

Fig. 4.4.H Modal split and traffic development in passenger traffic in Russia[80]

Traffic

Total **cargo** traffic increased steadily from 2005 until the economic crisis in 2008-2009, then dropped by more than 10% to pre-2005 levels. By 2010, cargo traffic still had not recovered completely from the crisis. Rail cargo traffic witnessed a similar decline during the 2008-2009 economic crisis, also dropping by around 10%. It had, however, completely recovered by 2011 (see fig. 4.4.G). All in all, rail cargo grew faster than the total cargo market between 2005 and 2010, and thus increased its share of the market.

The **passenger** market fell by 10% during the crisis and has yet to recover (see fig. 4.4.H). The total passenger rail market dropped by 14% (regional transport was affected less). Overall, rail transportation grew more slowly than the total market between 2005 and 2010. Thus its share decreased significantly from 36% to 29%.

Investments

Investment volumes of *RZD* have increased significantly since 2003. They have more than quadrupled from EUR 2.3 bn to EUR 9.8 bn in 2008, dropped to EUR 8.3 bn during the 2008-2009 economic crisis before quickly reaching 2008 levels again (see fig. 4.4.I). Planned investments in 2012 are EUR 10.3 bn. Noteworthy is the fact that the investment volumes are higher than depreciation/amortization. The asset base is

[80] "Other" includes sea and inland waterways; figures for 2002 – 2004 and 2011 not available for modal split; figures for 2011 not available for total passenger traffic.
Source: Russian Federal Statistics.

thus continuously being enlarged. Until 2008, the difference between investment volumes and depreciation/amortization increased every year.

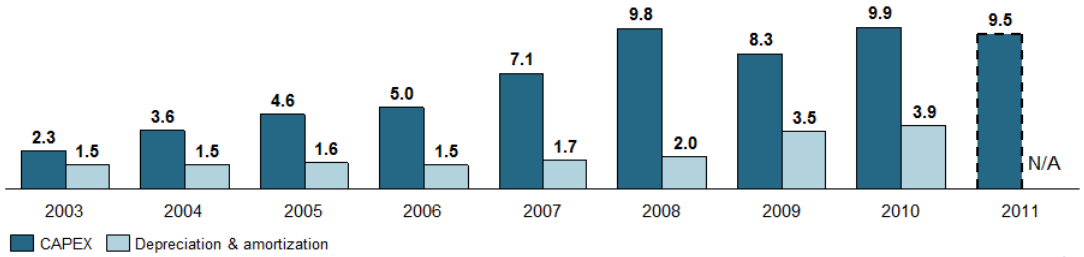

Fig. 4.4.I Development of investment volumes and depreciation/amortization for RZD[81]

Reforms were able to push higher investment flows towards the rail industry as fleet operators and leasing companies investing heavily in new wagons. While the average age of wagons was 21 years in 2009, it has currently dropped to 17 years (see fig. 4.4.J). Within the CIS only Kazakhstan witnesses such a dynamic investment flow. Ukraine for instance has an average age of 23 years and few monetary resources to update its fleet, in spite of concrete plans to reform and privatize its rail industry (terms were extended last year from 2015 to 2019).

Fig. 4.4.J Age distribution by year of construction and average age of cargo wagons in CIS[82]

Efficiency

The efficiency of cargo wagons in Russia increased until 2006 and dropped afterwards (see fig. 4.4.K). This drop was exacerbated in 2009 by the economic crisis, bringing wagon efficiency to the lowest level in the timeline for which data is available. *RZD* shows similar development in cargo wagon efficiency.

[81] Figures for 2002 not available, 2011 estimated
Source: RZD.
[82] Source: RZD.

In 2006, *RZD* started effectively transferring its cargo wagons to its subsidiaries. In three of the four years preceding this endeavor, *RZD* had a higher efficiency level than the independent players.

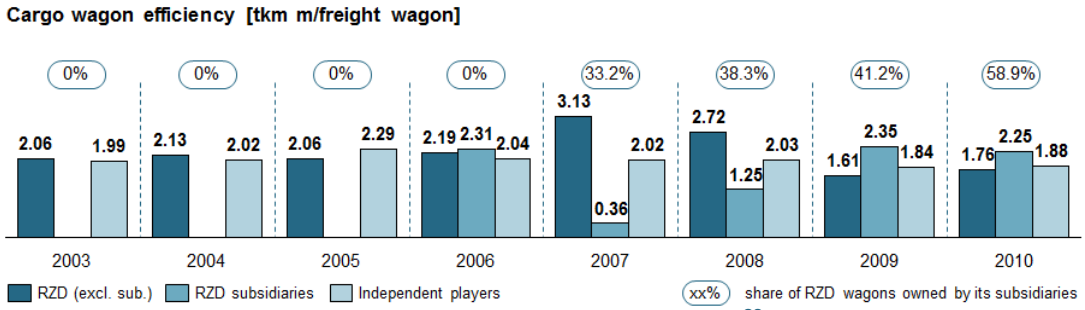

Fig. 4.4.K Development of cargo wagon efficiency in Russia[83]

A look at the development of the distances travelled by unloaded cargo cars compared with those travelled by loaded cargo cars in Russia reveals a decline (see fig. 4.4.L). The portion of unloaded cargo cars has increased after forming subsidiaries, transferring cargo cars to them and (partially) privatizing them.

Both indicators, thus show a similar development. By transferring not only cargo cars but also the associated planning and scheduling activities to its subsidiaries, and indirectly to private companies, *RZD* has practically decentralized this function. Previously, *it* was able to optimize vehicle rotations and to control its wagon fleet in order to avoid railway traffic jams by loading idle wagons. Through decentralization, information flows and incentives are impaired in a way that makes such planning impossible.

Infrastructure limitations and traffic management problems at *RZD* created huge traffic jam problems. At the government level, it is currently being discussed whether *RZD* should act as an agent for the cargo wagons it has transferred to its subsidiary Freight Two. Thus, RZD could retain the planning activities and manage the wagons' operation in a more centralized and efficient way.

[83] Depicted figures refer to the first quarter of every year; figures for 2002 and 2011 not available.
Source: RZD.

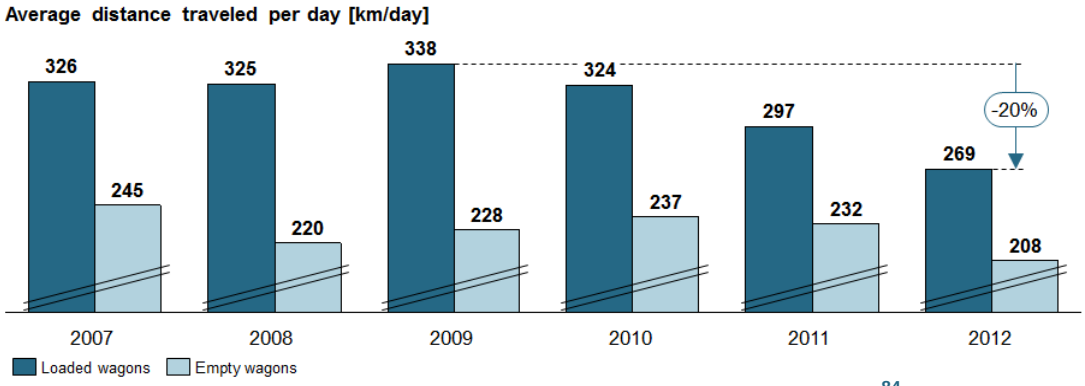

Fig. 4.4.L Development of average distance travelled per day in Russia[84]

In the **passenger** segment, the efficiency figures (pkm per passenger locomotive, (see fig. 4.4.M) show a steady decline with a CAGR of -5.3%. While the figures relate to *RZD*, they represent a good view of the passenger rail market in general (see above). Since 2006, the decline has been exacerbated by the clear mismatch between demand and supply in this market (see fig. 4.4.N). The year-on-year growth in the locomotive installed base was always positive from 2003 until 2010. In the four years since 2007, where data is available, it was higher than the growth of pkm, which was negative in three of those years. The mismatch is especially apparent in the last two years.

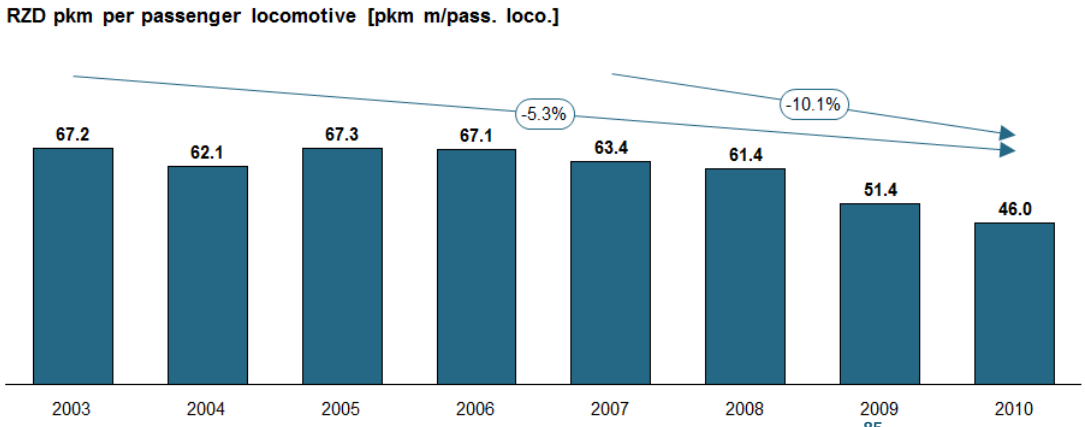

Fig. 4.4.M Development of passenger locomotive efficiency in Russia[85]

[84] Figures for 2002 and 2011 not available.
Source: RZD.
[85] Figures for 2002 and 2011 not available.
Source: RZD.

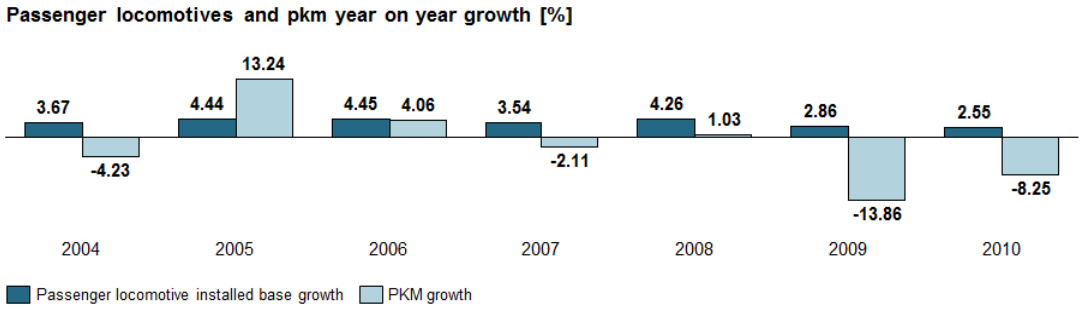

Fig. 4.4.N Mismatch in demand and supply development in the passenger sector[86]

All in all, costs per ptkm have increased significantly since 2003 by a CAGR of 4.1% (see fig. 4.4.O). The development of cost efficiency is a mirror image of the passenger and cargo vehicle efficiencies shown in the previous figures. Other efficiency indicators (asset and operations efficiency) are either declining or stable in passenger rail and slightly increasing in rail cargo.

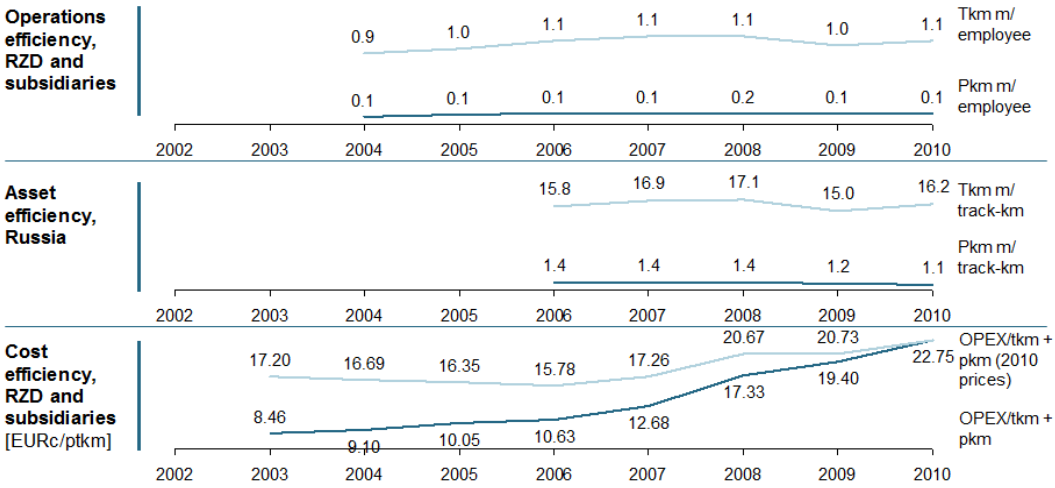

Fig. 4.4.O Efficiency indicators for Russian railways[87]

Quality

The two available safety indicators show improvements (see fig. 4.4.P). The number of people affected by train accidents decreased by an average of 11% per year since 2004. Security violations decreased by an average of 2.5% per year.

[86] Figures for 2002, 2003 and 2011 not available.
Source: RZD.
[87] In 2010 prices; figures for 2002 and 2011 not available.
Source: Russian Federation Statistics; RZD.

RZD invested heavily in programs to enhance its safety levels, e.g. in the implementation of technologically advanced rail control systems with satellite technology.

Fig. 4.4.P Safety indicators for RZD[88]

Conclusion

The railway system in Russia is in the middle of a reform process. *RZD* remains the dominant player in both passenger and cargo rail. It is an integrated railway company with total control and ownership of the country's railway network and passenger rolling stock, and the primary operator for cargo locomotives.

Regarding freight cars, however, we see a clear and progressing separation between cargo wagon operators (with direct contact to shippers) and *RZD*. The implications of this strategy, which was initiated in 2006, when *RZD* started transferring its cargo car stock to newly formed subsidiaries and preparing them for sale to the private sector, are evident in many performance aspects. *RZD's* market share has dropped significantly since then, but also performance indicators were affected, especially with regard to efficiency.

To counteract these effects, discussions are being held at the government as to whether *RZD* should take the role of an agent in the cargo segment. This way, it would retain direct contact with shippers, and planning and scheduling activities could once more be centralized and concentrated at *RZD*. The competitive environment that is pursued currently could thus be maintained, while guaranteeing more efficient operations.

[88] In 2010 prices; figures for 2002, 2003 and 2011 not available.
Source: RZD.

4.5 China

History

Up until 1986 ownership and operation responsibility of Chinese railways was concentrated in the *Ministry of Railways (MOR)*. Afterwards *MOR* began experimenting with decentralizing ownership and operation to regional bureaus. The decentralization was however reversed by 1992, due to some arising safety issues.

1998 saw a proposal for vertical separation of Chinese rail into

- One infrastructure owner and operator,
- Five to seven passenger rail operators,
- Two to three rail cargo operators and
- Two to three specialized rail operators (e.g. cold chain logistics).[89]

After concluding several pilot projects in the passenger rail segment the project was discontinued and its effects reversed in 2002. Primary issues and setbacks were:

- Duplication of operative and administrative functions, without increases in efficiency or revenue to justify it:
    - Scheduling was performed centrally at *MOR* and conflicted with the profitability targets of the newly formed passenger rail operators, a fact that pushed them to establish their own scheduling departments
    - Administrative functions such as safety control, public control and labor unions were also duplicated
- Clear conflict of interests between *MOR* and newly established operators: For example infrastructure fees were pegged to tickets sold in stations which pushed the operators to incentivize ticket sales on trains, rather than in stations
- Employee motivation declined as a result of the new setup: For example infrastructure operator employees received less monetary reward than employees at the more profitable operator, which led to more frequent work interruptions and strikes.

This affected the profitability of the newly established operators. As an example, the Zhengzhou Passenger Railway, which broke even before this reform, experienced a loss of approx. RMB 70 m afterwards.[90]

In an effort to support the *MOR's* high financing needs, infrastructure financing was liberalized in 2005 to allow for private funds to flow into rail infrastructure. As a result joint venture entities based on public private partnerships (PPPs) were established. However operation and management is still highly controlled by *MOR*.

[89] Source: Caijing [Chinese magazine].
[90] Source: Dong Daily [Chinese newspaper]; People's Daily [Chinese newspaper].

Currently, further reforms with regards to decentralization and liberalization are being discussed. Proposals primarily focus on splitting regulatory and operative functions as well as regional decentralization rather than vertical separation. After the Wenzhou train collision in July 2011 the push for reforms weakened.

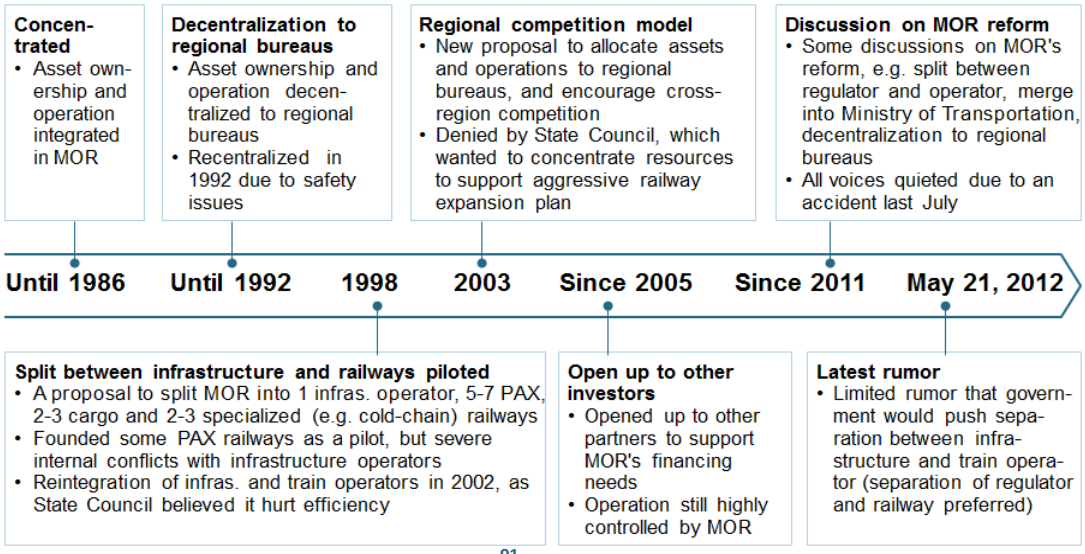

Fig 4.5.A Milestones in China rail history[91]

System setup

There are three types of entities that own and operate rail infrastructure trains in China:

- MOR
- Independent regional railway companies (not to be confused with the MOR regional bureaus)
- Joint-Ventures

MOR has a dominant position as an infrastructure owner, with ownership of 73% of total railway length in China. As a train operator, *MOR* controls basically all passenger traffic and almost 94% of cargo traffic in China. It thus represents a vertically integrated railway undertaking. *Central MOR* is responsible for infrastructure investment planning and execution as well as procurement of locomotives and passenger rolling stock. Its regional bureaus make procurement decision for cargo wagons, own the infrastructure and operate the railway traffic in their respective regions.

[91] Source: MOR.

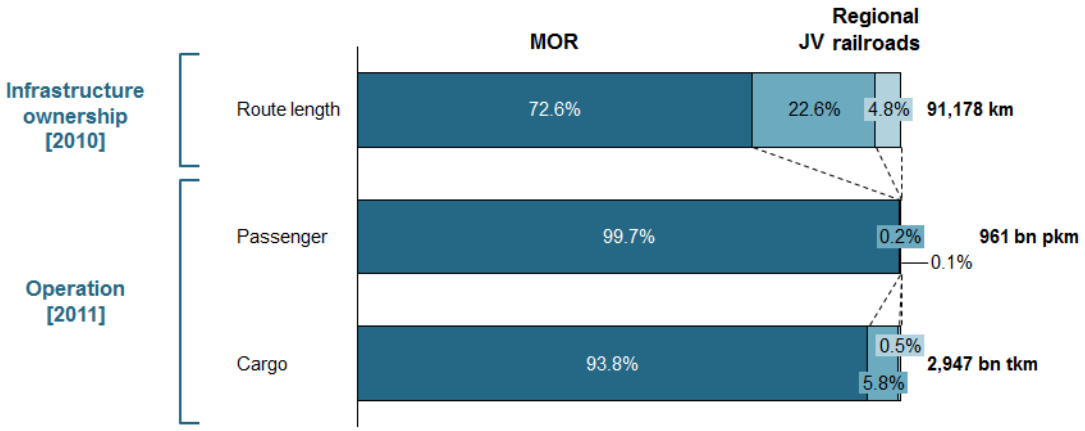

Fig 4.5.B Ownership and operation in Chinese railways[92]

Joint ventures are also vertically integrated with ownership and operation of infrastructure and trains. They have a focus on cargo traffic and a significant portion of the infrastructure network in China, because of the *MOR's* intention to diversify rail infrastructure financing. Regional railway companies typically invest in infrastructure and operate transportation within their own regions or provinces.

An example for JV is the *GZ/SZ Railway company* which owns and operates rail routes between Shenzhen, Guangzhou and Pingshi, with a total length of 481 km. *MOR* is the biggest shareholder (37.1% of shares) via its total ownership of the *Guangzhou Railway Group*. Other shareholders include private investors, public offering funds, and a portion of the shares are publicly traded in the Hong Kong stock exchange. The *Shandong Railway* is a regional railroad company which owns and operates four routes within Shandong province (total route length of 320 km).

Most trunk routes are owned by *MOR*, with small portions owned and operated by JVs (see fig. 4.5.C).

[92] Source: China YearBook; MOR.

Fig 4.5.C Trunk routes of the Chinese railway network[93]

The Chinese railways are highly controlled and regulated by *MOR* with regard to pricing, scheduling etc. (see fig. 4.5.D). While JVs and regional companies have control over their operation within their own railways, inter-network operations are controlled and overseen by *MOR* in the following ways:

- General inter-network policies are set and monitored by *MOR*
- Conflicts between entities are resolved by *MOR*
- Scheduling is executed by *MOR*
- Ticket prices, cargo tariffs and infrastructure usage fees are determined by *MOR*
- In many cases revenues in inter-network connection are collected by *MOR* and then corresponding portions are distributed to the stakeholders
- Service prices within JV and regional railways network can be determined individually, but usually adhere to general *MOR* guidelines

[93] Source: MOR website.

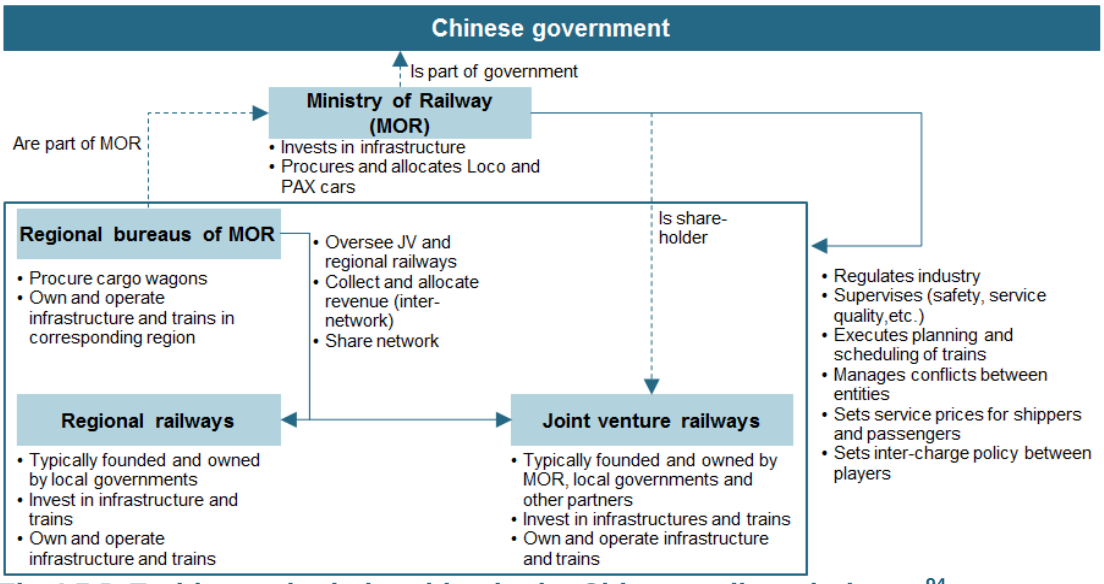

Fig 4.5.D Entities and relationships in the Chinese railway industry[94]

The **government** controls the railway industry through various channels. Aside from the national legislator (*National People's Assembly*) passing rail-related laws and the *Ministry of Finance* defining the budget for *MOR*, the state council approves long-term rail network plans. Furthermore the *National Development and Reform Commission* reviews network planning, and approves service prices as well as new routes and new railways.

Competition

On the **intramodal** level, both cargo and passenger traffic are very much dominated by *MOR*. In 2011, competing JVs and regional companies operated a small portion of cargo segment traffic (6.3%) and a negligible portion of passenger traffic (0.3%).

In the **cargo** segment, JVs have increased their market share from 2.4% in 2002 to 5.8% in 2011, reaching a peak of 6.5% in 2007. Regional companies' growth was more moderate from 0,4% in 2002 to just below 0,5% in 2011, with a maximum share of 0.6% in 2008 (see fig. 4.5.E).

[94] Source: MOR.

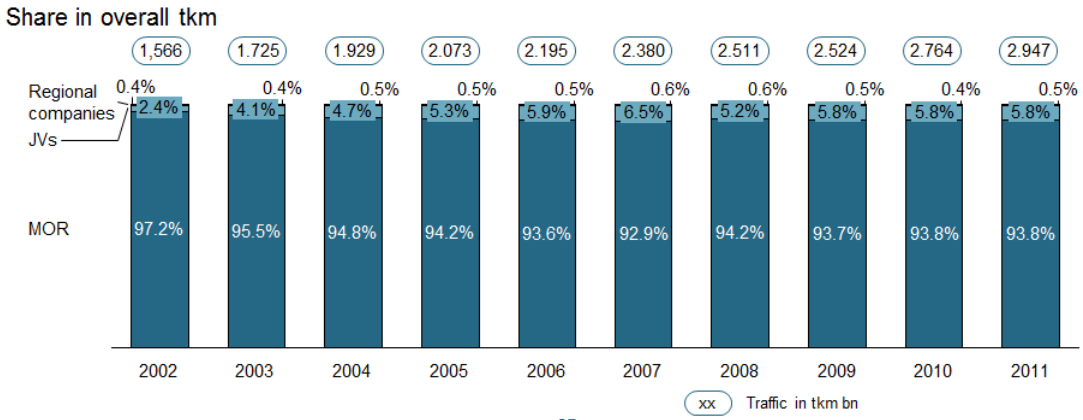

Fig 4.5.E Intramodal competition in rail cargo[95]

On the contrary, in **passenger** rail, JVs' and regional companies' market shares declined between 2002 and 2011. JVs' market share dropped from 3.2% in 2002 to 0.2% in 2011, while regional companies market share dropped from just above 0.1% to 0.07% in the same period (see fig. 4.5.F).

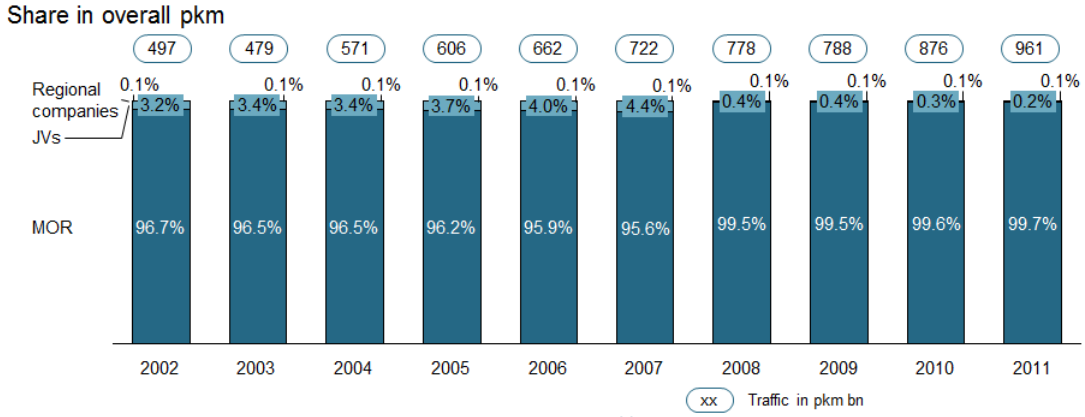

Fig 4.5.F Intramodal competition in passenger rail[96]

On the **intermodal** level we see more competition and stronger market dynamics. In **cargo** traffic, rail lost a dominant position. In 2002 rail still controlled more than half of the traffic (52%), while in 2011, with growing traffic, its market share fell to 41%. Market share was mainly lost to sea. All in all rail did not benefit entirely from the strong cargo traffic growth rates in China. (see fig. 4.5.G).

[95] Source: China YearBook.
[96] Source: China YearBook.

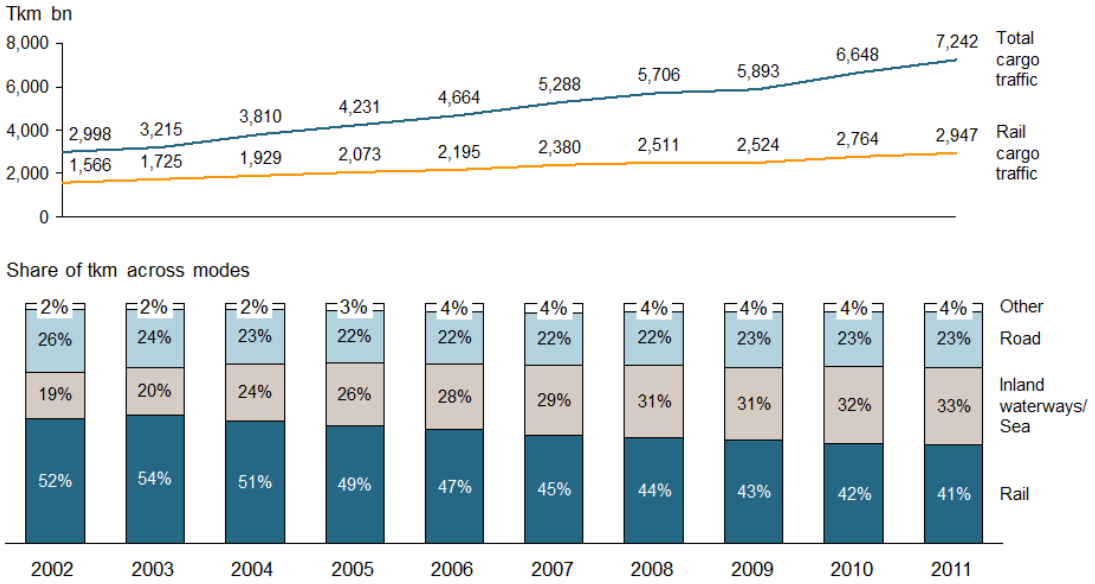

Fig 4.5.G Modal split and traffic performance development in rail cargo[97]

In **passenger** transportation (intermodal level) rail has also lost market share, albeit not at the same rate as in rail cargo. Its share has decreased from 35% in 2002 to 29% in 2011. Market share was mainly lost to air transportation, which saw an increase in market share from 9% to 15% in the same period. Road was and remains the dominating transportation mode for passengers (see fig. 4.5.H).

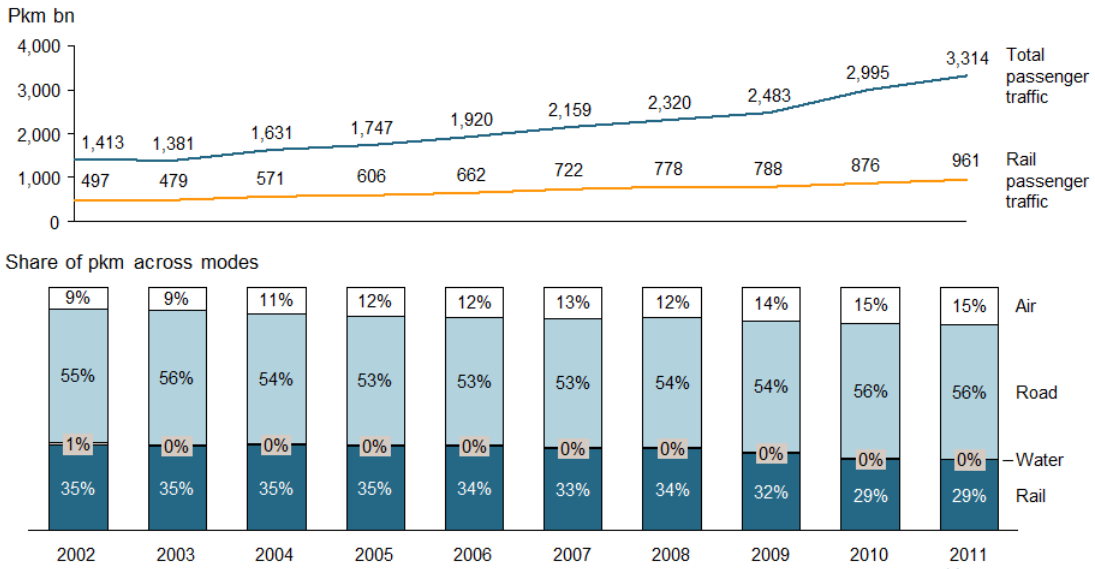

Fig 4.5.H Modal split and traffic performance development in passenger rail[98]

[97] Source: OECD; China YearBook.
[98] Source: OECD; China YearBook.

Traffic

Total **cargo** traffic has increased every year since 2002 and grew with a CAGR of 10% between 2002 and 2011. It has more than doubled from 2,998 bn tkm in 2002 to 7,242 bn tkm in 2011. Rail cargo transportation was not able to keep up with the fast growth rates of cargo traffic. Its recorded CAGR between 2002 and 2011 amounted to only 7% (see fig. 4.5.G).

Passenger traffic grew by CAGR of 10% between 2002 and 2011, from 1.413 bn pkm to 3.314 bn pkm. Here also rail was not able to keep up with these growth rates. It recorded a 8% CAGR in this period, and thus lost part of its market share mainly to air transportation (see fig. 4.5.H). While the trend shows a steady decline in rail, the ambitious investments in (very) high speed rail in the last five years, which will be completed by 2013, will lead to an increase in attractiveness of rail passenger transportation.

Investments

The development of rail investments by *MOR* can be divided into two separate periods:

- Between 2002 and 2005 investment volume grew at 11% CAGR
- Between 2006 and 2012 it recorded a growth of 44% CAGR

The second period with the high increases in investments comes after the total reintegration of infrastructure and railway operation (after separation plans were abandoned) and after financing has been opened to outside and private investors. Driving this increase in investments were the ambitious plans for the construction and operation of VHS/HS rail between 2005 and 2010.

Traditional financing accounted for under 10% of total investment volumes (approx. EUR 1 bn and EUR 8 bn from central government fiscal budget and internal *MOR* cash flows, respectively). The remaining capital came from commercial loans, discount interest loans, local government fiscal budgets and other investors.

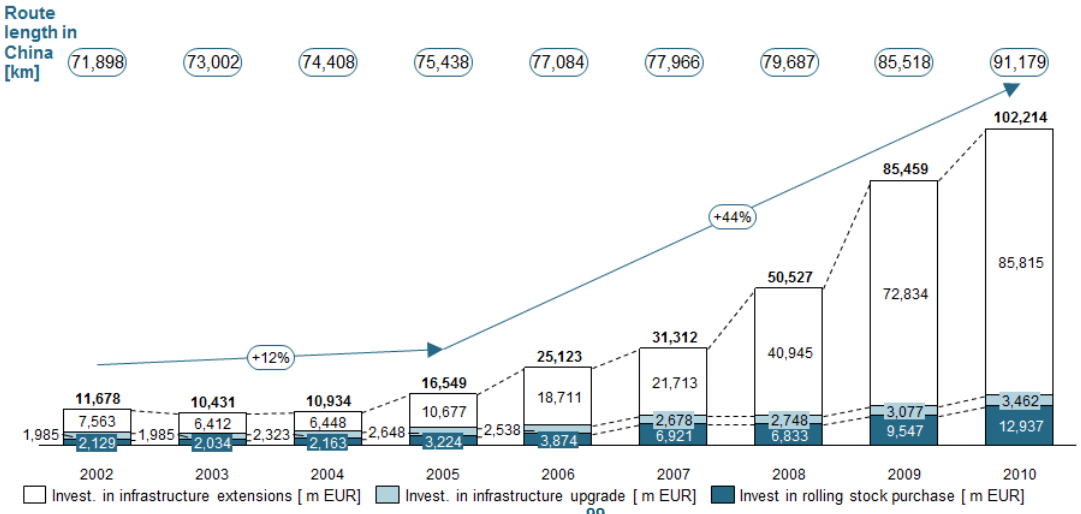

Fig 4.5.I Rail infrastructure investment in China[99]

Efficiency

Labor efficiency almost doubled between 2002 and 2011 as transport volumes (ptkm) witnessed growth in this period while employee head count was stable (see fig. 4.5.J).

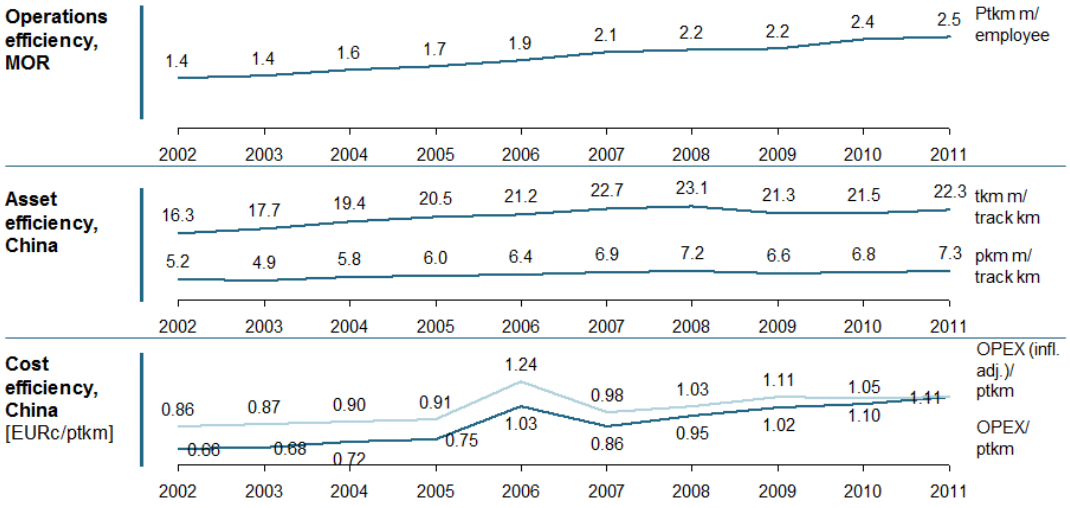

Fig 4.5.J Efficiency development in Chinese rail[100]

[99] Source: China YearBook; MOR; MOT.
[100] Source: China YearBook; MOR.

Costs per transport unit increased in the same period in nominal as well as in real terms. This results from the following factors:

- High inflation, especially in fuel and labor prices
- High investments, especially from 2005 onwards, lead to higher depreciation

The increase in unit costs has been met by a corresponding pricing and revenue developing strategy (see fig. 4.5.K):

- Structural upgrade of passenger rail and increase of VHS/HS portion in total revenue led to higher unit revenues (per pkm)
- In cargo, prices were adjusted upwards more than eight times between 2002 and 2011, however because of policies to develop cargo rail in underdeveloped regions and the resulting price reductions in theses specific regions, average prices did increase in the same rate as in passenger rail

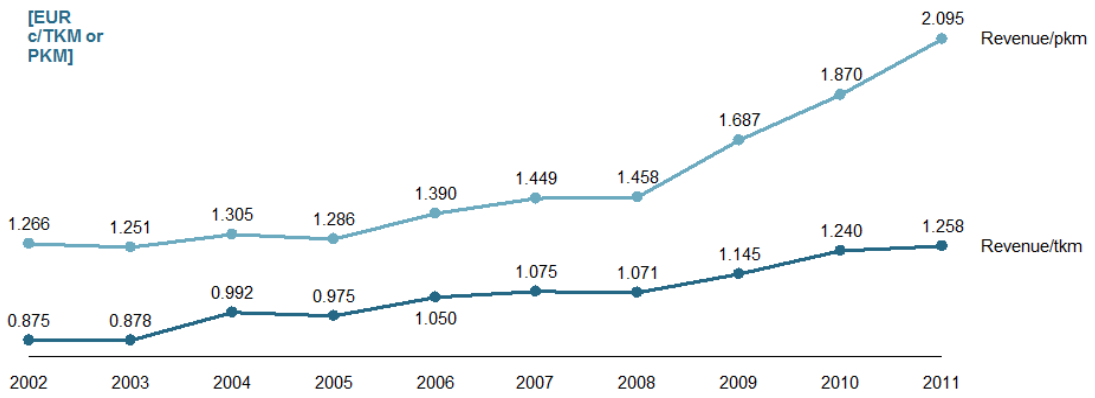

Fig 4.5.K Unit revenue in Chinese rail (passenger and cargo)[101]

Asset efficiency witnessed similar gains for cargo and passenger between 2002 and 2011 (approx. 40%).

Quality

Average speed in passenger trains improved gradually between 2002 and 2011 with an increase from approx. 62 km/h to 70 km/h. Cargo trains, however, have seen more or less stable speeds over this period (see fig. 4.5.L).

[101] Source: MOR Bond Prospectus; MOR Auditing Report; OECD.

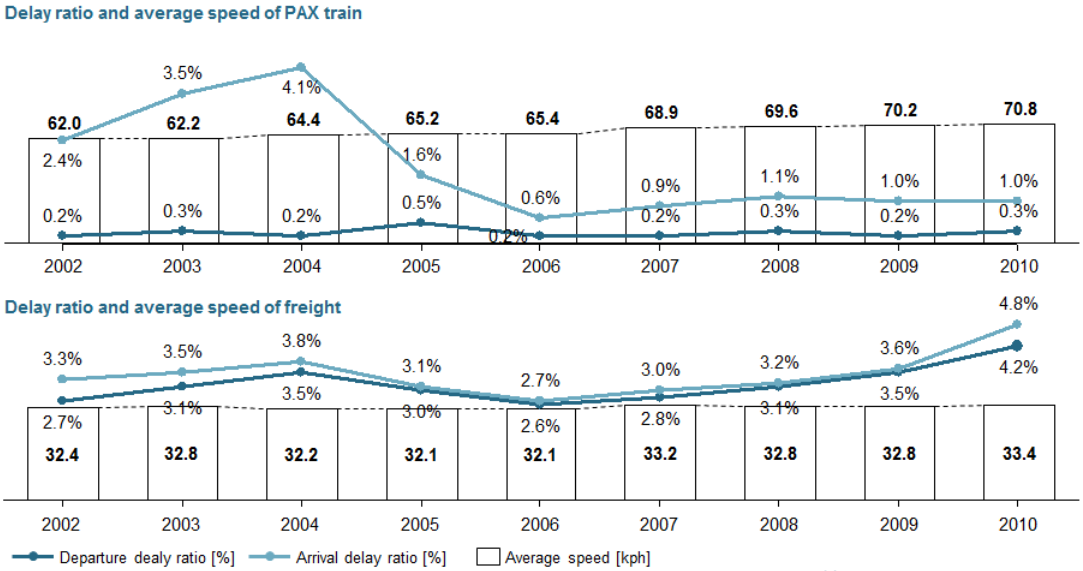

Fig 4.5.L Quality indicators in Chinese rail (passenger and cargo)[102]

Arrival delays saw an improvement in passenger transport, that is not mirrored in the cargo segment. This is because, in general, passenger trains have higher access priorities than cargo trains. Non-delays are defined by *MOR* as arrivals exactly on schedule.[103]

Train safety has witnessed large improvements in between 2002 and 2011 (see fig. 4.5.M). Total number of train related fatalities fell by 82% while rail performance increased. As a result the unit fatalities (#/bn ptkm) was one tenth as high in 2011 (including Wenzhou train collision in July 2011) as it was in 2003.

[102] Source: China YearBook.
[103] To what extend this definition has been strictly adhered to is questionable.

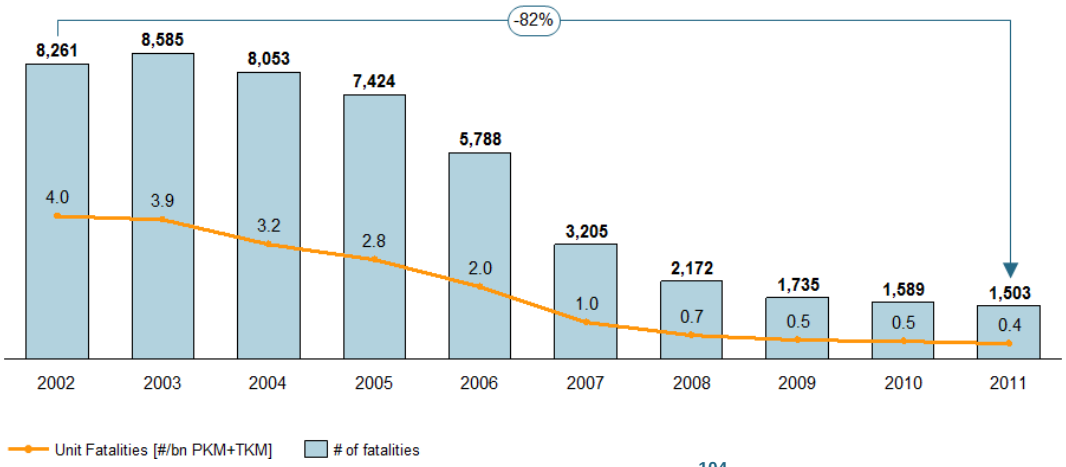

Fig 4.5.M Total fatalities and unit fatalities in Chinese rail[104]

Conclusion

Obviously, the rail transformation process in China is behind the European development. However, a split of tasks between regulator and operator is high on the agenda.

Chinese railways experienced a real but temporary separation of infrastructure and operation, which was piloted in the late nineties and abandoned by 2002. Structural and monetary disadvantages led to problems in piloting phases, which were enough to justify a termination of the project.

Chinese railways have not been able to benefit to full extent of the high growth of Chinese transportation performance, neither in passenger rail nor in rail cargo. Both sectors lost market shares to other transport modes. Still in both cases rail traffic has almost doubled in absolute terms. Moreover given the liberalization of the infrastructure financing and the resulting growth in investment volumes since 2005 as well as the strong government support, rail attractiveness in relation to other transport modes has increased.

To enable growth, the sector was opened to private investment. However, this has not been done by vertically separating the system in order to privatize train operation only, but via vertically integrated Joint venture railways.

Operation and asset efficiency have shown improvements over the last decade and the same can be said about the quality of Chinese railways, measured by average speed, arrival delays and train casualties in train related accidents.

[104] Source: China YearBook.

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Strategy Consultants

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Interview list

Name	Company	Function	Date
Yosuke Mizukami	JR East	Director, Paris Office	02.05.2012
Akihiko Nakamura	JR Central	General Manager, London Office	03.05.2012
Kosuke Hayakawa	JR Central	Manager, London Office	03.05.2012
Alexey Kamenobrodskiy	RZD	Head of the Center for Project Management	17.05.2012
Matthew Rose	BNSF	President and CEO	21.05.2012
Ghislain Houle	Canadian National Railway (CN)	Vice President, Strategic and Financial Planning	22.05.2012
Denis Cousineau	Canadian National Railway (CN)	Chief of Staff	22.05.2012
Joseph Boardman (with Richard Slattery)	Amtrak	President and CEO	23.05.2012
Charles Moorman	Norfolk Southern (NS)	President and CEO	23.05.2012
Charles Eisele	Union Pacific (UP)	Senior Vice President, Strategic Planning & Administration	24.05.2012
Don Campbell	Canadian Pacific (CP)	Senior Vice President, Financial Planning & Strategy	30.05.2012
Carolyn Crook John Doran	Transport Canada	Director – Rail Policy Policy advisor- Rail Policy	04.06.2012
Prof. Kenneth Button	Mason School of Public Policy	University Professor; Director, Center for Transportation, Policy, Operations and Logistics	08.06.2012

Yasaburo Hikasa Manabu hokari	Ministry of Land, Infrastructure, Transport and Tourism	Director Deputy Director	11.06.2012
John Gray	Association of American Railroads (AAR)	Senior Vice President, Policy and Economics	12.06.2012