Solid Infrastructure financing for an efficient rail system

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SOLID INFRASTRUCTURE FINANCING FOR AN EFFICIENT RAIL SYSTEM

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EXECUTIVE SUMMARY

The "Solid infrastructure financing for efficient rail systems" workshop organized by SNCF Group's strategy team on 8 July 2014 in Paris brought together some 50 European rail experts from across the industry. Representing railway operators, infrastructure managers and government officials from national ministries and the European Commission, these experts took part in three panels on topics linked to the financing and efficiency of rail:

Panel 1	The current condition of the network
Panel 2	Who pays for rail infrastructure ?
Panel 3	Rail network efficiency and the role of national performance indicators in measuring it

This report summarizes the implications and key recommendations of all three panels.

Panel 1 highlighted Europe's considerable shortfall in railway infrastructure investments, with necessary upgrades calling for significantly higher spending than in past decades. The situation is exacerbated by the age and condition of various types of equipment, with enormous pressure on network performance as traffic increases in the years ahead.

Panel 2 identified significant national differences in financing models but concluded that all can be reduced to three trade-offs—choices that every national policy-maker has to make:

1) **building new lines versus funding renewals and upgrades**;
2) **subsidizing transport services versus subsidizing infrastructure;**
3) **setting high access charges versus low access charges**.

Panel 3 compared national performance indicators and key performance indicators (KPIs), and analyzed their degrees of maturity. By definition, KPIs are multidimensional, complex and at times contradictory. Chapter 3 of this report offers a conceptual framework inspired by approaches to evaluating public policy, and tries to link input to output KPIs.

Obviously, no railway system can operate without a sound, reliable infrastructure. At the same time, railway infrastructure quality in most European countries is eroding due to insufficient investment in upgrades. Management of this issue appears to be primarily national.

There is a clear link between infrastructure investments and performance. And no matter how we measure it, performance is undeniably suffering — from the discrepancy between actual and projected infrastructure usage, from both current investment levels and investment shortfalls, from unreliable public budgeting, and from insufficient coordination between TOCs and IMs.

Recommendations. The implications of this continuing discussion are clear. National and European policy-makers must:

1) Establish transparent reporting on the condition of railway networks, including a dynamic view of aging and obsolescence.

2) Determine the cost of necessary upgrades, including rolling projections for years ahead, focusing on usage in particular.

3) Create stability by guaranteeing long-term financing (i.e., with multi-year contracts).

4) Establish a clear link between current infrastructure financing (subsidies and track access charges) and the ongoing need to invest in upgrades.

5) Take decisions based on financial realities. For example, prioritize renewing and upgrade investment rather than building new lines or new infrastructures, particularly if there is a scarcity of public resources.

6) Keep investment levels up to continue upgrading existing lines.

7) Establish valid indicators for monitoring railway infrastructure performance, taking a user-centric approach and a comprehensive view of system performance.

8) Establish pan-European regulations for transparency reporting, particularly on the network's current condition; include regularly updated variables on usage, aging and obsolescence, and task national regulatory bodies with enforcing these regulations.

INTRODUCTION

An efficient rail transport system for both passengers and goods **is crucial for competitiveness, growth and employment**. As a low-carbon, energy-efficient transport option, rail can make a key contribution to achieving **the EU energy and climate objectives**. It also generates wealth for the economy by **connecting markets and people. And the backbone of the rail transport system** is infrastructure: the capacity, reliability and security of the system's infrastructure **shape its overall performance.**

Infrastructure is also a **major cost component** of the overall system **and requires significant funding**. Experiences from different European countries show **that users cannot bear the full cost of the network through track access charges**. The figures are clear: in most European countries, so-called "farebox revenues" account for only 40% to 60% of total railway funding. In short, some public spending is necessary: the exact amount depends on operator performance, intermodal competition and other framework conditions (social and environmental factors and more).

EU principles account for this by **setting charges at the cost that is directly incurred by infrastructure managers**, with mark-ups allowed only when the market can bear them. But the way these common principles are practiced **varies considerably across Europe**, and the implementation methodology could be refined. Today, track access charges range from nearly 0 to about €7 per train-kilometer, and they are even higher for specific infrastructures (e.g., the charges for high-speed lines in France exceed €15/train-km).

EU legislation explicitly states that each member state is responsible for ensuring that its infrastructure manager's accounts are balanced over a reasonable period of time **and rail infrastructure receives significant public funding** in every European country. Despite this support, however, many rail networks suffer from an **investment backlog** (line speed is frequently reduced due to poorly maintained lines, tunnels, bridges and more), and many **infrastructure managers are deeply in debt**. To make matters worse, major portions of the infrastructure date back to the post-war period and need to be replaced, which will probably increase the need for investment in the years to come. Coping with increased traffic, eliminating bottle-necks, and developing the Trans-European Rail Network will also call for additional funds. While opening markets to competition is expected to foster innovation and cost reduction, finding a sustainable business model for the rail system today is essential to ensuring that it remains an attractive transport option in the future.

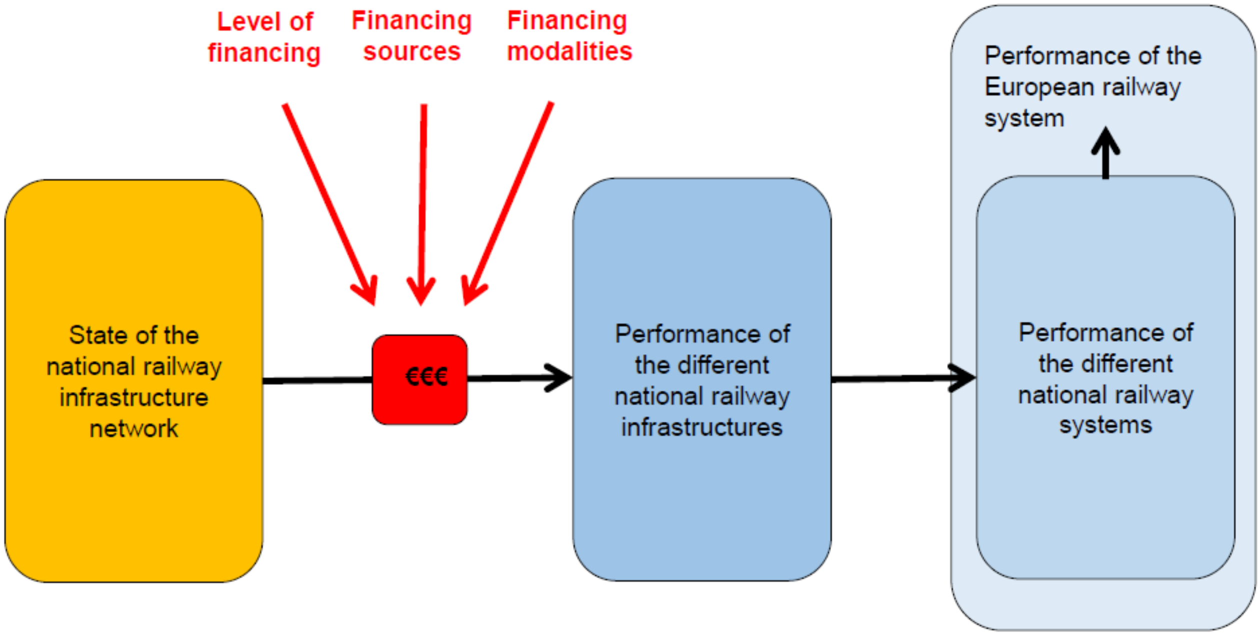
Policy objectives for rail transport vary significantly across Europe. For example, some countries **emphasize maximum use of their rail infrastructure** to increase **rail's modal share**, while others seek a higher return on the public investment in rail infrastructure. Some countries **reduce the size of their rail network**, limiting coverage to areas with significant demand, while others pursue a strategy of broad regional coverage. Some countries have built a **dense network of high-speed lines,** while others have focused on maintaining and improving **their existing network**. And some countries focus almost exclusively **on passenger traffic**, while others concentrate **on rail freight**.

What lessons can be drawn from this wide range of national experiences? Are there best practices for financing rail infrastructures? With public funds in short supply, how can we lay a solid financial foundation for Europe's existing rail infrastructure that will result in efficient rail systems?

SNCF has proposed a two-step process for drafting policy recommendations: first, an Expert seminar in Paris on 8 July 2014, where participants shared national experiences, followed by a High Level Conference in Brussels on 3 March 2015, where academics will present the conclusions reached at the Expert seminar, as well as policy recommendations drawn from this debate.

These questions, along with the three chapters of this report, are part of a broader conceptual framework that will link financing for Europe's rail infrastructures to the performance of European and national rail systems. Figure No.1 below presents this framework graphically.

Figure 1: Conceptual framework



Source: Finger

Let us briefly explain the different elements of our framework, starting from the outcomes:

The ultimate outcome, of course, is strong performance by both the European and the national railway systems—economically, operationally, technically, environmentally and socially. Achieving performance on this scale is beyond the scope of this paper, and so is defining, conceptualizing and measuring performance. But ultimately, the only thing that matters to customers is how well rail systems perform. Everything else is subordinate to this larger goal.

Since there is a clear causal relationship between a network's condition and its performance, Chapter 1 begins by examining the state of Europe's national rail infrastructures, and then provides a conceptualization of these infrastructures along with some data on their condition. Finally, it assesses the impact of infrastructure condition on infrastructure financing needs.

In Chapter 2, we discuss financing for rail infrastructures. The link between infrastructure financing and infrastructure performance is not straightforward or linear: it depends on many other factors, and in particular on efficiency incentives created by the overall governance of the rail sector. It is clear, however, that performance is significantly affected by how much financing is provided, who provides it (e.g., public or private sources), and how it is provided (e.g., PPPs, loans, user financing). Chapter 2 focuses primarily on the various financing models, along with the main trade-offs in financing rail infrastructure.

In Chapter 3, we review performance indicators for various national railway infrastructures, since infrastructure performance is crucial to the performance of any railway system as a whole. Here too, the exact nature of the relationship is complex and cannot be fully addressed in this paper. But we do take significant steps towards better conceptualization of this complex issue, identifying various performance criteria and examining how various performance indicators relate to one another.

THE STATE OF THE NATIONAL RAILWAY INFRASTRUCTURE NETWORKS

Dr. Yves Putallaz

Abstract

Infrastructures of European railway systems require renewal investment levels much higher than the ones observed on average during the past decades. This additional effort is justified by the structure of the age pyramids of the types of equipment as well as by the fact that the increase of the combined traffic represents a constant pressure on the performance of the network.

Strategic decisions related to networks objectives, in term of both extension and performance, together with the decisions dealing with the scenarios of financing, fall under national prerogatives.

This section proposes a series of thoughts and openings about the topic of the network's state (condition) and its impact on the needs for financing of the railway infrastructure. The author would like to clarify that this does not constitute a benchmark and does not have the vocation to be exhaustive.

Also, and even though this document is based on the exchanges held during the July 2014 workshop sessions, it takes a free form and its content reflects the views of the author. The document proposes some numerical illustrations provided by the network operators who have participated to the panel (cf. annexes). The readers willing to obtain more quantitative elements will refer to the works of LICB (Lasting Infrastructure Cost Benchmarking) carried out by UIC.

This chapter is structured as follows: in a first step, we will define the conditions of a network (namely technical state and substance). The second section assesses the state of the European railway infrastructure by way of concrete examples drawn from selected railway operators, focusing on permanent way, catenaries, substations, signalling, telecommunications, structures, earthworks and water ducts. The third section links railway infrastructures to financing and performance.

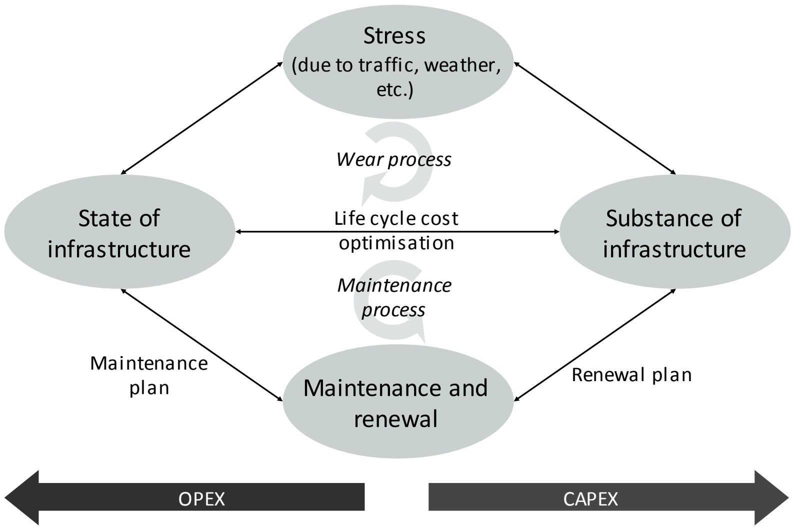
1.1 DEFINITION OF NETWORK CONDITIONS

The norm EN-13306 "Maintenance terminology" (2001) defines the current state (or condition) as the characteristics of an item at a specific point in time. The theoretical factors that determine the needs for infrastructure maintenance and renewal (namely ageing and obsolescence) are presented in annex 1. In our case, we take an interest in two types of representative characteristics of the condition: the technical state and its substance, which can be expressed as the residual lifetime or as the average residual lifetime of the equipment[1].

These two notions constitute the fundamental indicators of the lifecycle of the equipment; they enable to measure its dynamics, the history of the maintenance to which it has been subjected.

The changes in the technical state of equipment are directly considered by the maintenance policy, those in the substance of equipment by the renewal policy. Figure No.3 summarizes these elements and their relationships in graphical form.

Figure No.3: dynamics of infrastructure life-cycle



Source: Gestion de la maintenance des infrastructures de transports, EPFL-LITEP, 2000.

But the changes in the technical state and in the substance of an infrastructure are closely related. Indeed, in a simplified way and for a constant performance (RAMS):
a neglected maintenance policy reduces the lifetime of the infrastructure; on the contrary, a too ambitious maintenance policy is likely to be economically irrelevant;
a neglected renewal policy tends to increase the maintenance needs, either by ageing, either by technological obsolescence; on the contrary, a too ambitious renewal policy is also likely to be economically irrelevant.

[1] Changes in the technical state of infrastructure equipment depends on:
- technology (an intrinsic characteristic)
- trends in the stress level to which it is subjected
- its maintenance history
- the age (condition and residual life) of the equipment

The residual life equipment depends on:
- technology
- date of commissioning
- the stresses to which it has been subjected during its life

As figure No.3 above underlines, the arbitration between maintenance policy and renewal policy constitutes a significant lever of the economical optimization of the infrastructure lifecycle.

Within the framework of the panel, we mainly took an interest in the renewal needs (which consume capital – CAPEX), and therefore in the substance of the infrastructure.

1.2 SUBSTANCE OF THE EUROPEAN RAILWAY NETWORK

Although the works of LICB (Lasting Infrastructure Cost Benchmarking) of UIC allow the identification of some trends, a consolidated vision of the "average" substance of the European railway network does not exist today.

The participants to the panel considered that a consolidated European approach would not provide real added value. As a matter of fact, the state of the network arises from the proper history of each of the national railway infrastructures (under-investments, advocated maintenance policies, technologies, etc.) and their resolution falls under national prerogatives.

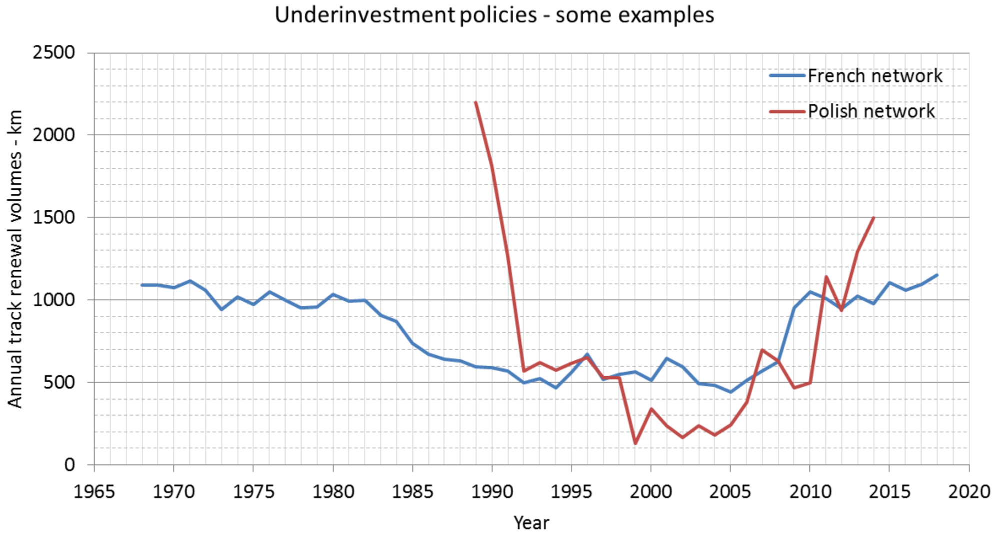
It is nevertheless interesting to explore particular issues infrastructure managers are currently facing.

1.2.1 Permanent way

Although some infrastructure managers seem not to experience any difficulty keeping the substance of their permanent way (tracks, switches and crossings), there is a global growth in renewal investments in European level. Higher investments are mainly explained by the necessity to catch up with renewal backlogs that have progressively induced significant performance reductions. These backlogs are the consequences of:
a lasting underinvestment policy reducing the renewal rate of assets that various networks experienced during the last 40 years;
a significant increase of traffic loads, combined in some cases with the commissioning of modern powerful rolling stock, that has induced new forms of wear and tear of permanent way components.

Figure No. 4 below illustrates the Polish and the French situations where one can easily identify the period of underinvestment.

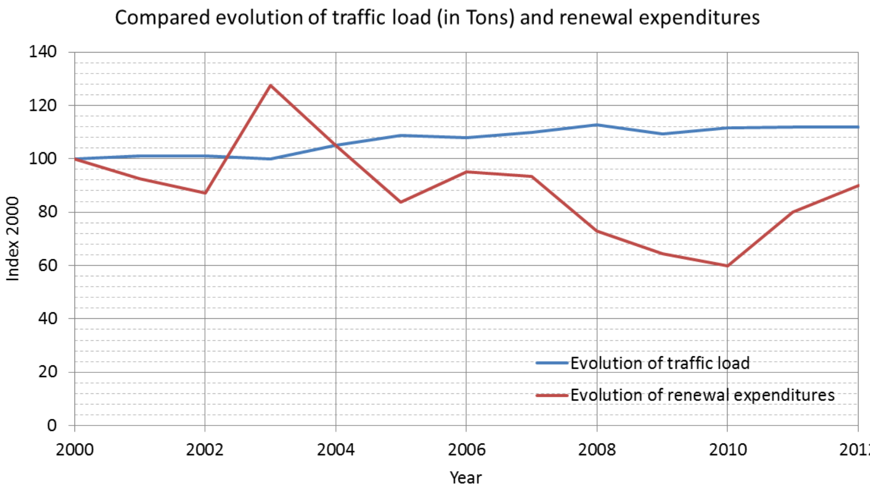
Figure 4: Examples of underinvestment policies



Sources: PKP, SNCF

Figure No.5 below shows an illustration of an increasing traffic load combined with decreasing investment volumes. Although the time period (12 years) is too short to draw conclusions (the decreasing renewal rate could be partly the effect of the age pyramid), such trends clearly constitute a risk for the asset management on the medium and the long-term.

Figure No.5: Example of an increasing traffic load versus a decreasing renewal rate



Source: Swiss Federal Railways

1.2.2 CATENARY SYSTEM AND SUBSTATIONS

It appears that the renewal of catenaries has been neglected on some networks, maybe since the risks associated to the catenaries are rarely associated to safety issues. However, failures of the catenary systems usually create significant operational traffic disruptions.

Obsolete catenary assets constitute a major risk on some networks as the back-log may be quite massive and the renewal of such an asset may induce major capacity reductions due to track possessions. These challenges are reported to be quite critical on the French network, where about 60'000 catenary poles are between 60 to 90 years old.

1.2.3 Signalling and telecommunications

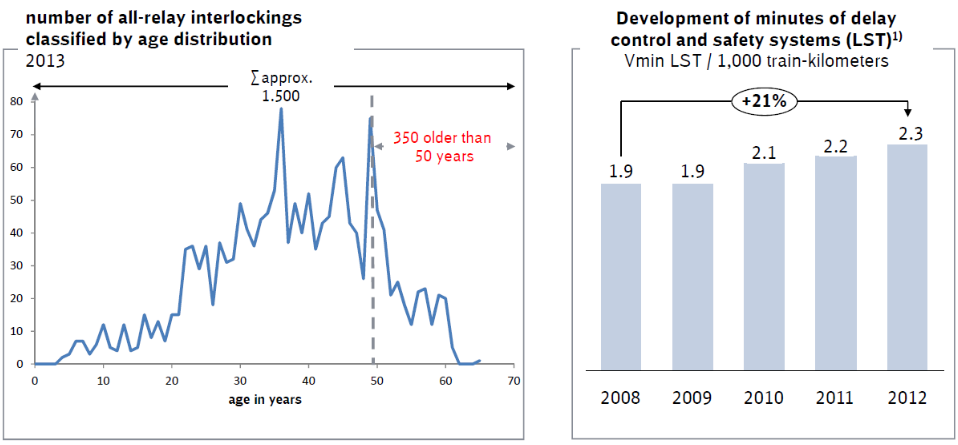
As said before, functional and technical obsolescences constitute the major issues regarding signalling and telecommunication assets. First of all, old mechanical and all-relay interlockings often do not comply anymore with current performance standards. In particular, modern, economically efficient centralized traffic management requires the ability to remote-control signal boxes; mechanical and most all-relay technologies usually cannot be remote-controlled. Moreover, some ageing technologies show worsening MTBF (mean time between failures).

Secondly, it is becoming harder to maintain such obsolete technologies on the account of the difficulty to find spare parts as well as appropriately skilled workmanship.

On the other hand, new electronic technologies are supposed to have a much shorter life time and tend to be harder to maintain in-house, which increase their vulnerability to early technical obsolescence (lack of support by the manufacturer).

The age distribution of all-relay interlockings of Deutsche Bahn, as depicted in Figure No.6 below, is quite representative of the issues discussed above.

Figure No.6: Age distribution of all-relay interlockings on the DB Network and development of delays due to safety systems



Source: DB-Netz

1.2.4 STRUCTURES, EARTHWORKS AND WATER DUCTS

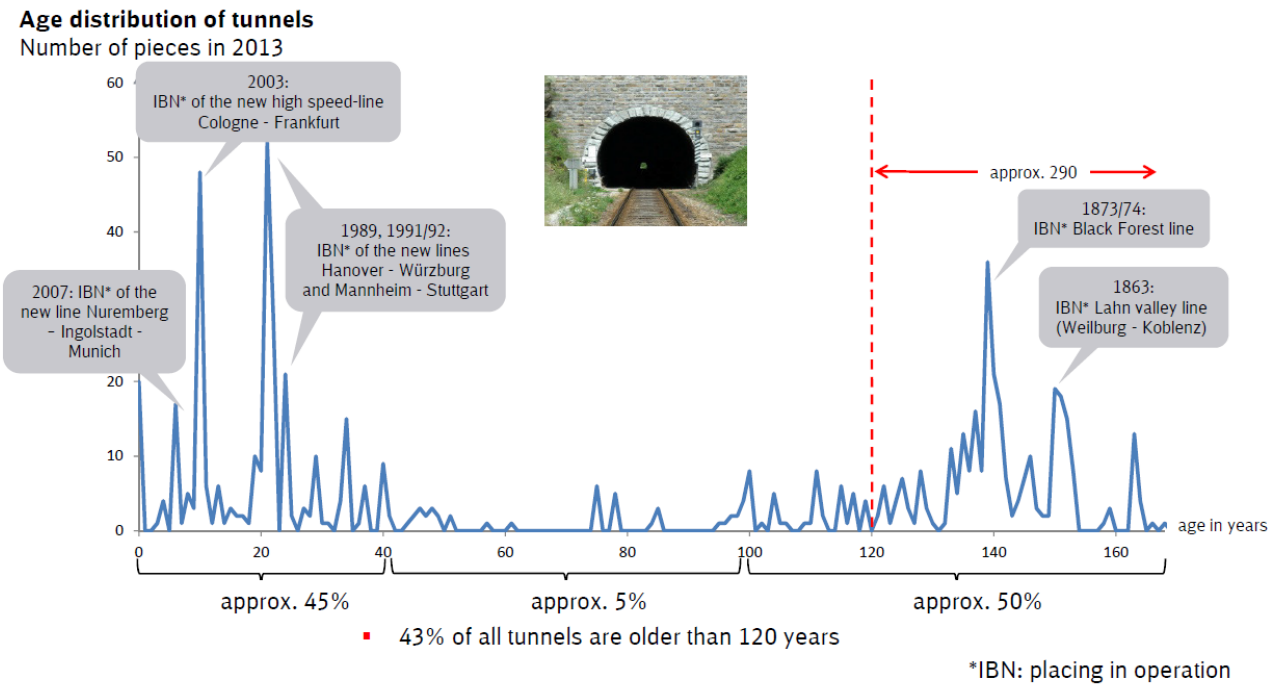
It is usually rather difficult to assess the accurate risk level of a structure (a tunnel, a bridge, a wall, etc.): wear mechanisms are in general slow or difficult to detect.

This tends to contribute to the regular postponing of structure renewal (or heavy maintenance) projects unless the latter is related to a critical structural deficiency.

Thus, the time passing, portfolios of structures may contain a large amount of assets that may be at risk, with little possibility to get an accurate vision of long-term renewal or heavy maintenance financial needs.

Figure No.7 below provides a rather typical age distribution of structures (here tunnels on the DB Network).

Figure No.7: Examples of age distribution of tunnels



Source: DB-Netz

Moreover, it happens that a significant share of these old structures is situated on local lines that do not show up on the budget priority list.

Water ducts are particular assets as their size is small and their number high (there are about 39'500 water ducts on the DB Network – one every 850 m of line). The condition of water ducts is often not accurately known despite the fact that it is an important track maintenance cost driver. Poor maintained water ducts tend to reduce the track stability and, therefore, to induce higher track maintenance needs.

1.2.5 CONCLUSIONS: THE RISKS LINKED TO THE SUBSTANCE OF THE NETWORK

The results of the LICB surveys, as well as the elements presented by the participants during the panel show that most of the European railway networks suffer from a backlog more or less significant in the renewal of their infrastructures. Recent budgets or budget estimates show an increasing trend.

The backlogs have several origins; they can be the consequence of:

- a substantial and lasting under-investment;
- a maintenance deficit which reduces the lifetime of the components;
- a substantial increase of traffic, which exposes certain components such as tracks to higher levels of stress; for a given technology, this reduces the lifetime of the components;
- the commissioning of more powerful traction units, inducing new forms of wear of the track, which have required the adjustment, sometimes costly, of maintenance and renewal policies.

In future, several elements of context are likely to exert pressure on the financial needs of renewal:
Modern centralized traffic management systems Tare based on electronic and computer technologies whose lifetime is noticeably lower (~30 years) than those based on electro-mechanical technologies (~50 years). It is likely that future annual renewal budgets will have to include a higher share dedicated to signalling equipment. In principle, these investments should be made profitable by the improvement of the productivity and of the resilience of network operations but these improvements do not obviously concern the investment account.
Also, the nearing of the end-of-life of large amount of assets of obsolete technology constitutes a major challenge. Renewing steel and reinforced concrete structures dating from the first half of the twentieth century, various electrifications dating from the beginning of the twentieth century or more recent but made by materials of lower quality, etc. will require significant investments.

1.3 MAINTENANCE POLICY AND FINANCING OF THE INFRASTRUCTURE

Experience shows it is very difficult to steer a sustainable maintenance policy for an infrastructure characterized by a weak substance (suffering of generalised ageing). Over a first phase, maintenance starts to increase but remains manageable. Beyond a specific threshold, the industrial capabilities of the entities in charge of maintenance and the capacity of the network are exceeded. At the end, it becomes impossible to ensure infrastructure's performance objectives (RAMS).

Moreover, the deficiency of a renewal policy induces an increase in the maintenance needs but usually only after a few years. On the contrary, a policy aiming at catching up on the substance (catching up the backlog) will only induce beneficial effects on the maintenance policy in the medium or in the long-run. So the required period to catch up the substance backlog is as long as the underinvestment period.

This leads us to venture that one cannot justify in a credible way, in front of the financers, a catching up effort of renewal arguing a quick decrease in the maintenance expenditures or an immediate improvement of the performance.

It underlines the importance of the sufficiency and of the stability of the investment effort dedicated to the renewal of the infrastructure.

To tend towards a sufficient and stabilised level of investment requires the unavoidable integration of financiers into the planning process. From the different means required to establish a sustainable dialogue between the infrastructure manager and the financers[2], the principle of transparency doubtlessly constitutes one of the strong messages of asset management best practices.

1.4 CONCLUSION: THE SUBSTANCE OF THE NETWORK, A NATIONAL ISSUE

Infrastructures of European railway systems require renewal investment levels much higher than the ones observed on average during the past decades.

This additional effort is justified by the structure of the age pyramids of the types of equipment as well as by the fact that the increase of the combined traffic represents a constant pressure on the performance of the network.

A longer-term multi-annual funding arrangement is essential, ensuring stability and predictability in order to realize a sustainable financing of the infrastructure. **An infrastructure of good substance turns out to be a sine qua non condition; however, this is, not sufficient, for a high performing railway system as a whole.**

It is likely that **the high level of investment which will be reached in the course of the next decade shall be maintained far beyond**. Indeed, the massive use of technologies having a lower lifetime cycle (especially the electronic and IT equipment), as well as the imminent obsolescence of asset categories of which we nowadays know the limits, will continue to exert a high pressure on the renewal needs.

This pressure could be the occasion to **think over the socio-economical equation of certain local lines on which the traffic volumes remain very far away from the technically and economically balanced point of functioning of the rail system.**

Long-term financial sustainability should be at the centre of regulatory considerations and consideration prior to political interventions. This means that, e.g., new lines should come with ensured maintenance funding for the coming decades, as it happens in some countries. A separation of fundings for maintenance and renewal on the one hand and for investments in new lines on the other hand provides more stable flows for the existing network; moreover it ensures a more reliable process for the approval of both streams. Oversight by a regulator of the relationship between infrastructure manager and government (as funder) is desirable to ensure such a balance between required outputs and funds available. In line with this, **the IM should be entitled to claim a reduction of targets or functionality if funding is unexpectedly reduced or not made available according to the plan.**

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[2] Details on the different elements required to integrate the financiers are provided in Annex 2.

Maintaining the substance of the infrastructure, as well as its financing, constitutes, through the eyes of the infrastructure managers, issues which are specific to each network. **Strategic decisions related to networks objectives, in term of both extension and performance, together with the decisions dealing with the scenarios of financing, fall under national prerogatives.**

WHO PAYS FOR RAIL INFRASTRUCTURE?

Prof. Matthias Finger

with the support of **Arsène Ruhlmann** and **Anne-Elise Guéguen** (SNCF)

Abstract

There are only two sources of cash inflow for rail infrastructures: end-users, through access charges paid by TOCs (train operating companies), and tax-payers, through publicly funded subsidies. No matter what the combination between these two sources, the European rail sector always needs public funding. European infrastructures need better public financing in general, and in some countries it will take a huge effort to upgrade the rail network.

Bottom line: it is important to stabilize debt levels in Europe's rail systems and make it clear that whatever end users cannot pay through access charges must be subsidized—and not through increased debt. In some cases, IMs (infrastructure managers) set high access charges to compensate for inadequate public financing and offset their yearly spending, and these significant increases are a real problem for TOC operating costs and competitiveness.

2.1 FRAMEWORK

Europe's rail systems have adopted operational and financing models that vary widely in many respects: economic structure (varying degrees and models of competition), network structure (long distance vs. regional), and public involvement through various central and local bodies, funding models, and public service obligations (PSOs).

Despite this diversity, all of Europe's rail systems face a common challenge: aging rail networks that require increasingly heavy maintenance expenses and upgrades to maintain their standards of quality and performance.

In the long term, the funding models for IMs need to be re-examined in light of these key questions:

- Beyond the figures, what are the key underlying principles of national funding models? Have they developed on their own over time, or are they the product of conscious decisions? How have they reached their current levels?
- Are these models good for the system? If so, what factors are essential to making the rail mode successful?
- Are these models sustainable? What adjustments should/could be made in the next few years? What (if any) are the key barriers to sustainability, and what is their nature (economic, political, other)?

To reach our analyses and conclusions, we have studied nine European financing models with very different characteristics (see Figure 1 below). Once beyond the surface differences, these models can be discussed and compared based on six key criteria:

- Overall public funding level (public budget for rail)
- Contributions by passengers and freight (versus tax payers)
- Division of public funding between IM and RU.

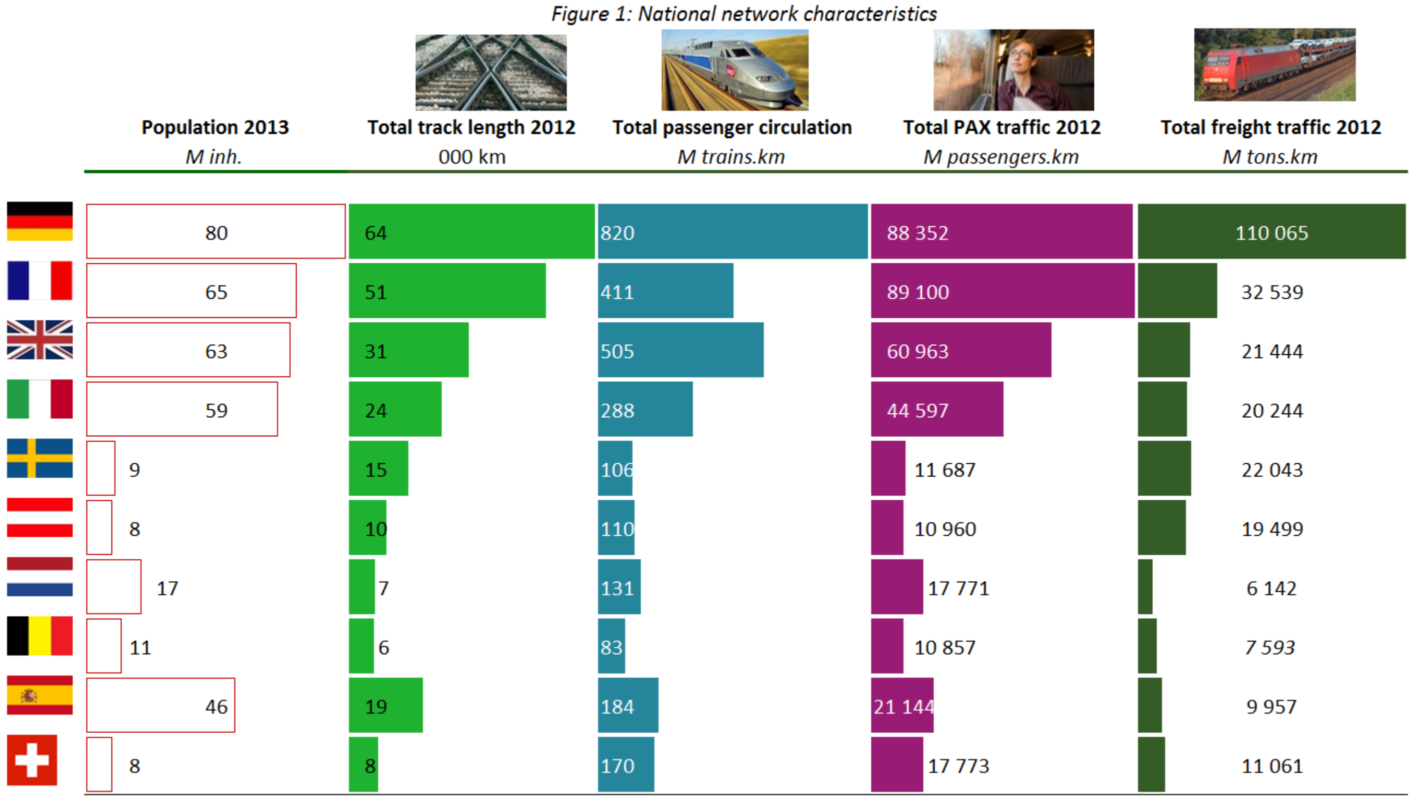
- Access charge levels
- Debt outlook for IMs (negative free cash flows)
- Level of new-project spending versus share of IMs' cash-out for upgrades and maintenance

We based our analysis on RMMS data from the European Commission[3], plus population data from Eurostat, freight traffic from UIC, and other data from Switzerland and other participating countries that are not included in the RMMS report.

RMMS and other data sources for this study

The Rail Market Monitoring Scheme (RMMS), an official European survey conducted by the European Commission, presents data provided by Member States using a uniform methodology. Our conclusions are based on the RMMS report, data provided by Switzerland's CFF (Chemins de fer fédéraux) using the RMMS methodology; information from Eurostat, UIC, the French State and other official sources; and presentations at the Experts Workshop held on 8 July 2014 in Paris.

Figure 1: National network characteristics



Sources: Eurostat, RMMS 2014 (2012 data), CFF 2013 *Switzerland: CFF only (2013 data)*

Network characteristics vary widely between countries of different sizes.
Germany has much more freight traffic than other European countries.
The IM data for Switzerland refer solely to CFF and do not include any other IMs.

[3] The RMMS report is available at http://ec.europa.eu/transport/modes/rail/market/doc/swd%282014%29186_final___en.pdf

2.2 TWO FINANCING MODELS COEXIST ACROSS EUROPE

2.2.1 Subsidies: infrastructure or transport services?

In every country studied, the economics of the rail sector rely on public investment. This is inevitable due to the economic model for rail infrastructure, which cannot be set up without massive capital investment. In this, rail differs sharply from other transport infrastructures, which are less capital intensive.

In most countries, public funds account for 30% to 50% of total inflows into the rail system. But European countries have two different funding models:

- Some countries allot subsidies primarily to infrastructure expenses and keep access charges low. This group includes the UK, Switzerland and the Netherlands.
- Others primarily subsidize transport services through PSOs (see Figure 3) instead of funding their IMs. This forces their IMs to adopt higher access charges. This group includes France, Belgium, and Germany.

Sweden and Belgium are typical examples for these two models. Sweden allots 78% of public subsidies to its IM, whereas Belgium allots only 17% of public grants to its IM. As a result, Belgian access charges are eight times higher than charges for Swedish suburban traffic, and five times higher than charges for Swedish intercity traffic.

But no matter how public funds are allotted, if subsidies do not provide a sufficient percentage of the IM's total revenues, it will be inadequately funded and run a deficit.

2.2.2 Negative cash-flow for IMs leads to increasing rail debt

Sweden is the only European country to provide massive public funding to its IM, with grants accounting for 93% of total IM revenues. This public funding model finances the entire rail system and adjusts for all imbalances: as a result, the Swedish rail system sees little increase it its debt. The IM in the Netherlands is also well-funded through grants (with positive annual cash flow of €0.5bn in 2012). In other countries, public subsidies account for around 50% to 60% of total IM revenues. In France, by contrast, that figure is 32%, and in Belgium it is only 14%, putting both countries below average.

In most countries, the lack of financing means that IMs are partially funded by debt. This funding model appears comparable to subsidies and access charges, but **IM debt is a very bad solution**. Allotting subsidies to IMs does not guarantee sustainable infrastructure financing over the long run: the UK and France have the highest deficits, yet subsidies account for a full 61% of revenues for the UK's IM and only 32% of revenues for the IM in France. Negative annual cash flow is also a function of net cash-out and investment/upgrades. If the IM has very high expenses, as is the case in the UK, it can run a deficit even when public funding is high.

Figure 2: Structure of Infrastructure Managers' (IM) revenues in 2012

	1	2	3	4	5	5A	5B	5C
	Total TAC 2012	IM's subsidies 2012*	Other IM revenues 2012	Total IM revenues 2012	Public subsidies IM (2) / total revenues (4) 2012	Annual cash flow	Public subsidies (2) / revenues+debt (4+5A)	TAC (1)/revenues+debt
	M€	M€	M€	M€	%	Bn€	%	%
	4 478	4 428	664	9 570	46%	-0,7	43%	44%
	3 383	1 844	470	5 697	32%	-2,1	24%	43%
	2 802	*4 705*	187	7 694	*61%*	-2,8	45%	27%
	1 028	1 110	166	2 304	48%	-0,1	46%	43%
	100	1 299	0	1 399	93%	-0,2	81%	6%
	449	1 086	617	2 153	50%	0	50%	21%
	251	816	416	1 483	55%	0,5	55%	17%
	663	198	548	1 409	14%	-0,36	11%	38%
	369	623	282	1 274	49%	-0,6	33%	20%
	478	926	*511* **	1 915	48%	N.A	N.A	N.A

In the chart above **perimeters of IM subsidies may change depending countries. Column 2 includes in most cases only operating subsidies but it includes investment subsidies in the UK and Germany (as DB Netz does not receive operating subsidies at all). For France, IM subsidies include the “Redevance d’Accès” (RA), paid by State for PSO-funded trains, except for the Paris region (where RA is paid by Transport Authority).*
***SNCF’ assessment.*

*Austria has a high percentage of other revenues **(column 3)**, which makes for an interesting mix: approximately 50% of subsidies, 25% of TACs (track access charges) and 25% other revenues. In Switzerland, CFF Infra has a revenue mix of 55% grants, 40% TAC and 5% real estate revenues from its CFF Immobilier, its real estate arm. Where funding is inadequate, IMs often resort to debt and negative annual cash flow—a bad solution **(column 5A)**. Thus, we can compare public operating subsidies/revenues **(column 5)** with public subsidies/revenues + annual cash flow **(5B)**: the spread is the need for public subsidies. In most countries, **subsidies account for 50% to 60% of revenue (5), but when deficits are factored in, that rate falls to 40% to 50% (5B).** Sweden (81%) and the Netherlands (55%) are particularly well funded, while France (24%) and Belgium (11%) are well below the others.*

	5	6	7	8	9	10
	Public subsidies IM (2) / total revenues (4) 2012	Public subsidies oriented to IM / PSO + IM subsidies	Subsidies IM / total circulations 2012	TAC / total circulations 2012	Subsidies IM / track length 2012	TAC / track length 2012
	%	%	€/train.km	€/train.km	K€/km	K€/km
	46%	42%	4	4	69,1	69,9
	32%	28%	4	7	36,0	66,1
	61%	98% *	*9*	5	*150,2*	89,5
	48%	39%	3	3	45,8	42,4
	93%	78%	9	1	83,8	6,5
	50%	59%	7	3	111,6	46,1
	55%	99% *	6	2	119,7	36,8
	14%	17%	*2*	*8*	30,8	103,0
	49%	54%	3	2	32,5	19,3
	48%	74%	5	2	123,2	63,6

Sources: RMMS, CFF, MEDD (France), UIC 2012 (freight traffic); BCG, ADIF & Infrabel (cash flow)

Total circulations Belgium: only passengers circulations
Switzerland: CFF only

** Direct public support in the UK and the Netherlands is very low as these Member States cross-finance their loss-making services through profitable services falling in the same public service contracts for rail services and revenues from passenger fare (RMMS report, Part 2, pp.52-53).*

*While the percentage of public subsidies is important, it is equally important to consider **how these subsidies are spent (column 6)**. Belgium and France have the highest percentage of subsidies allotted to transport services through PSOs, which account for 83% of public subsidies in Belgium and 72% in France. Germany's model is similar to France's, with a total 68% of German public subsidies going to PSOs. By contrast, other countries allot most of their public subsidies to their IMs, with levels ranging from about 60% in Spain and Austria to 78% in Sweden to nearly 100% in the UK and the Netherlands.*

As we have seen, European countries have adopted a variety of funding models, with some directing funding primarily to the IM, others focusing mostly on TOCs, and still others striking a balance. Regardless of the funding model, however, rail systems appear to be underfinanced in many countries, with structural deficits increasing IM debt and underscoring a major problem for the rail model generally. This is particularly true in today's economy, which has resulted in slower increases in revenue from traffic.

2.2.3 The impact of fare policies

The countries in our study have devised a range of compromises between subsidizing IMs and subsidizing PSO-based transport services through fare policies. For example:

- Two countries (UK, Netherlands), do not subsidize PSO traffic (1% of total revenues) and subsidize IMs only
- Most countries mainly subsidize PSOs, offering subsidies equivalent to 45% to 60% of PSO revenues
- Italy offers substantial subsidies to both IMs (61% of revenues) and PSOs (77% of revenues).

Fare policies applied to PSOs result from and reflect political decisions. Wherever fares for PSO lines are low, subsidies are inevitably high.

This being the case, it is up to policy makers to decide how much they want to subsidize PSO traffic. Our point is that **heavily subsidizing PSO traffic by offering lower fares on these services should not reduce public funding of infrastructures, since a breakdown of this type risks raising access charges and weakening the overall business model that underpins rail services.**

Figure 3 : Public Service Obligations (PSO) revenues and traffic

	Total PSO traffic 2012	Total PSO revenue 2012	Total PSO compensation 2012	PSO compensation / passenger.km 2012	PSO compensation / total inflow (passenger revenues + compensation)	Subsidies for PSO / PSO+IM subsidies
	M passenger.km	*M€*	*M€*	*€/passenger.km*	*%*	*%*
	52 000	3 750	6 000	0,115	62%	58%
	34 300	3 318	4 700	0,137	59%	72%
	58 640	8 959	94	0,002	1%	2%
	23 450	514	1 725	0,074	77%	61%
	5 438	N.A	363	0,067	N.A.	22%
	7 234	607	750	0,104	55%	41%
	16 582	1 915	11	*0,001*	*1%*	1%
	9 520	612	953	0,100	61%	83%
	10 728	681	539	0,050	44%	46%
	4 666	N.A	324	0,069	N.A.	26%

Sources: RMMS 2014 (2012 data), CFF 2012

Netherland: 2011 data, Switzerland: CFF only

PSO traffic includes suburban and intercity trains, which means rate coverage can be different for purely regional PSO traffic. Subsidies account for a similar percentage of revenues in France and Germany (59% in France and 62% in Germany). Italy makes greater use of grants (77% of PSO revenues) than other countries, but with lower subsidies/passenger-km revenues (€0.11/km in Germany, €0.14/km in France and €0.07/km in Italy).

Figure 4: Track Access Charges (TAC)

1 TAC for UIC-Type A traffic (suburban 140 €/train.km	2 Trend TAC UIC-Type A traffic 2013/2014 %	3 TAC for UIC-Type B traffic (Intercity 500T) 2014 €/train.km	4 Trend TAC UIC-Type B traffic 2013/2014 %	5 Freight TAC 2014 €/train.km	6 Trend freight TAC 2013/2014 %	7 Trend TAC revenues 2011/2012 %
4,36	3%	5,58	3%	2,68	2%	2,1%
4,00 *	5%	*5,10* *	5%	1,60 **	5%	5,2%
0,16	13%	1,19	-10%	1,93	-7%	8,5%
2,53	N.A	*2,66*	N.A	*2,45*	N.A	5,2%
0,38	5%	0,90	8%	0,63	6%	8,6%
1,86	26%	4,05	19%	3,26	3%	2,8%
0,77	-1%	1,54	-1%	2,46	-1%	4,8%
3,21	3%	4,81	3%	2,37	3%	2,1%
0,25	0%	2,51	12%	0,13	0%	1,8%
N.A	N.A	N.A	N.A	N.A	N.A	2,7%

Sources : RMMS 2014, CFF, RFF

Switzerland: Track access charges system does not differentiate between these categories
TAC France & Italy (columns 1,3, 5): 2011 data

**France: it does not include the Redevance d'Accès (cf. Figure 2). Total TAC for PSO-traffic is up to €10.9/train.km including RA.*
*** French State pays compensation to Freight Operating Companies. Without compensation, Freight TAC is around €5/train.km.*
TAC could not include in some countries mark-up and other additional specific charges.

Freight TACs are lower and rising more slowly than TACs for suburban passenger rail service.
Public financing models have consequences—more specifically, an impact on the world they serve: Sweden massively subsidizes its IM, and freight access charges are very low (€0.63 /train-km). A similar situation prevails in Spain (€0.13/train-km). Other countries have TACs ranging from €1.60 (France) to €2.7 (Germany), with other types of traffic also affected.
From 2013 to 2014, the TAC/km set by IMs for UIC type-B traffic (intercity) rose by over 19% in Austria, 12% in Spain and 8% in Sweden, but decreased 10% in the UK.

2.2.4 IM SUBSIDIES AND ACCESS CHARGES

In some countries, increased rail access charges create a decreasingly sustainable model for commercial services.

When public subsidies for IMs are analysed on the basis of total track length and train circulation, results differ from one European railway network to the other, a reminder that public subsidies and/or total inflows must be analysed in context.

Based on public subsidies/circulation (intensity of use) alone, countries fall into two groups (Figure 2, column 7):

- Countries with low subsidies by circulation, representing €3/train-km (Germany, France, Italy, Spain, etc.)
- Countries with high subsidies by circulation, with €6-9/train-km (UK, Sweden, Austria, etc.)

But when subsidies/total track length are taken into account (thus reflecting network density), only three countries are under €40K/km of track: France, Belgium and Spain. Most of the others are close to €100K/km. Some countries with expanded networks and moderate subsidies have low rates (France, Spain). Countries with the most generously funded subsidies per unit of track (Figure 2, column 9) have small networks (Austria, the Netherlands and Switzerland), high subsidies and high infrastructure costs (e.g., tunnels). Logically, the level of TAC/circulation reflects the level of subsidies.

An analysis of access charges by type of activity reflects the political choices made in each country. For example, freight operations usually face lower infrastructure access charges (cf. Figure 4, the range is between €0.13/train.km for Spain and €3.26/train.km in Austria). **By contrast, a comparison of the lines** highlights how expensive access charges are for some high-speed lines: €14.2/train.km for Frankfurt-Cologne; €11.14/train.km for Madrid-Barcelona; €16/train.km (and up to €21.1 for peak hour) for Paris-Lyon; €10.12/train.km for Rome-Milan[4]. This can be explained by the higher infrastructure and maintenance costs of these lines but also by the fact that they can bear mark-ups more easily.

In some countries, there has been in recent years **a very steep increase in rail access charges** for high-speed lines, and this increase cannot be offset by higher passenger revenues. In these cases the lack of IM financing is offset by increased access charges.

What are the consequences for freight and passenger non-PSO economic models in these countries?

On the one hand, we see no **direct correlation between different levels of access charges by activities and direct economic impact** on these activities for TOCs. Thus, Germany has both the second highest freight TAC in this study[5] and Europe's most robust freight traffic.On the other hand, high access charges for non-PSO activities in some countries, especially for high-speed lines, have put pressure on both the profitability and the sustainability of TOCs.

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[4] Source: SNCF benchmark 2014.

[5] Across Europe, if one takes into account the charges in Eastern Europe, German freight TAC are at a medium-low level.

Ultimately the use of access charges reflects a political choice: should access charges cover all infrastructure costs (i.e., operation, maintenance, and investment in upgrades and new construction/expansion, or just operation and maintenance?).

And whatever the choice, the lack of public funding poses a real challenge to IMs at a time when most European rail networks face ageing infrastructure and thus the need for massive upgrades.

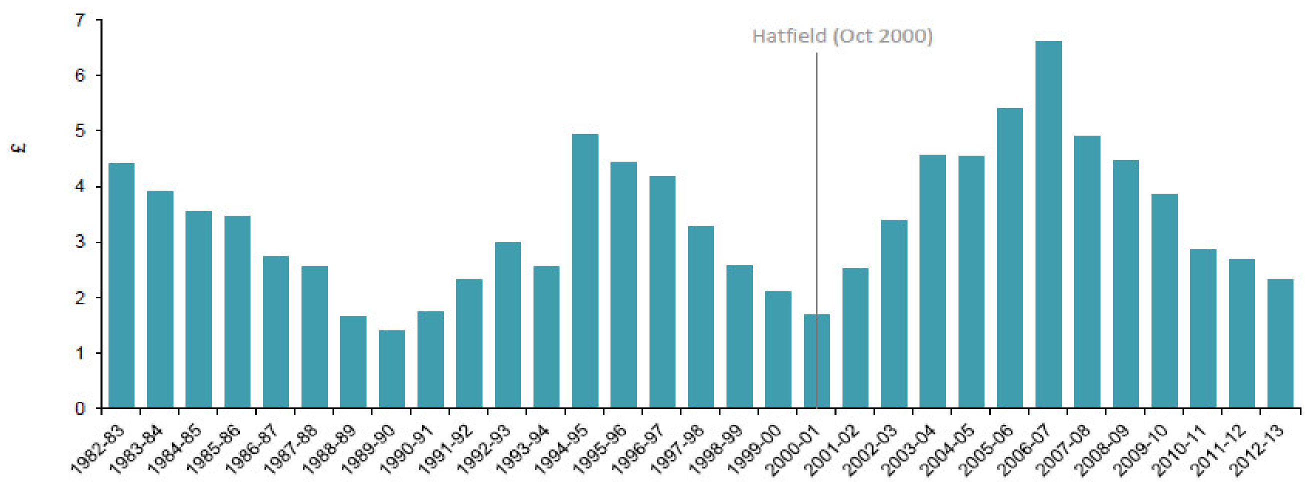
2.3 NETWORKS NEED HIGHER PUBLIC FUNDING TO ENSURE EFFECTIVE, EFFICIENT RAILWAY SYSTEMS

2.3.1 We need to prioritize investments

Given the high stakes, **there is a common need to prioritize investment decisions in Europe, and to do so clearly. The most crucial trade-off is between developing new lines vs. renewing and upgrading the existing network**: while political decisions to increase network size may be more popular (and even more easily financed/or co-financed, through PPPs), spending on maintaining the existing network should be properly planned and funded as well.

In the UK, there was limited investment in infrastructure during the 1990s, as shown in the graph below. There was also a severe shortfall in investment in the following decade, and it proved more expensive to catch up than if a steady and stable effort had been maintained. After the Hatfield rail crash—one of the most significant in recent British railway history—Railtrack launched a major upgrade effort, but rising costs led to the financial collapse of the company. Network Rail, a state-funded non-profit, was then created and invested €1.1 bn in maintenance, €2.8 bn in renewal and €2.4 bn in enhancement (in 2012). Together, these outlays generated negative annual cash flow of €2.8bn in 2013 despite very substantial public subsidies.

Figure 5: Government funding per passengers journey (£, 2013 prices)



Source: National Rail Trends[6]

[6] Note: This chart excludes government expenditure on end-receipts from major projects (e.g.: Crossrail); a grant to British rail to finance its residual activities proceeds from the sales of ROSCO's and British rail non-passengers business in 1995-96 and 1996-99.

Most European railway systems face significant future investment needs. This requires funding, either by increasing revenues from traffic, i.e., access charges (which would necessarily affect rail's modal share) or by new grants and subsidies—or, possibly, by taking on additional debt. DB's *2014 Competition report* estimates that the German rail system has an "investment backlog" due to its ageing infrastructure and under-investment in upgrades[7]. This is also the case for other countries, including France.

2.3.2 Are PPPs a long-term solution to the search for a sustainable model?

PPP financing models should be examined carefully for any investment in existing facilities. At first glance, they may reduce immediate investment required from infrastructure managers or governments, yet actual public spending may rise even more. Operating costs (generating potential losses) for RUs must also be included in the assessment of any infrastructure project.

Most PPPs in Europe are technical and operational successes, yet they often fail from a financial standpoint (e.g., Eurotunnel, Orlyval). This failure is compensated by the public sector (taxpayers).

In other words, PPPs offer a potentially attractive approach to financing infrastructure. But they should not make up for a lack of public funding which unfortunately often happens. On the one hand, PPPs are useful in reducing delays and could limit costs through controlled financial allocation. But in the final analysis **they cannot create value *per se***. In any case, all railway infrastructures, even in PPP need public funding due to the high assets needed for this network industry.
Indeed, significant investment costs limit the PPPs' effectiveness. So, in the railway sector, capital costs are considered to be higher within a PPP.

Furthermore, it is particularly difficult to estimate traffic and revenue calculations for rail. Consequently, in some projects with traffic-based concessions (the concessionaire receives commercial revenues and does not receive payments from the public authority during operating years unlike in availability-based concessions where the public authority retains the commercial risk), PPP companies have failed to make profit due to too high fares. Or they have been able to transfer the risk either to the operator through expensive track access charges, or to the public finances (by public subsidies or by debt reorganization).

The PPP financing model is one means of funding new railway infrastructure, but it is certainly not a magic bullet for long-term financing. PPPs cannot create new commercial revenues: for that, there are only two sources of final funding—passengers and taxpayers.

2.3.3 Can newly allocated taxes be a solution?

Given the arguments above, could newly allocated taxes and/or new contributors to railway infrastructures be a solution? This may appear

[7] Cf. Part 1: "The state of the national railway infrastructure network" by Yves Putallaz

difficult due to the weak economy and the challenges facing government budgets. In 2014, the French government failed to implement the so called “Ecotaxe” on heavy goods vehicles running on roadways. The revenues would have been used to finance the infrastructures, just like the German *LKW Maut* tax introduced in 2005.However, it is clear that the railway system cannot pay for all of its own infrastructure costs, nor can roads. And since roadways are well-funded by public investment, eco-friendly taxes could be created to finance other modes of transport—including rail. This would create healthier, more balanced modal competition.

In France**, the transport tax paid by businesses in cities over 10,000 inhabitants helps finance urban public transport. I**n the Paris Region, this represents 40% of the transport authority’s budget. In special cases, new taxes can be created as well. For example, to finance new metro lines serving Greater Paris (*le Grand Paris*), a special tax on offices and a portion of the land tax are directly transferred to the “Société du Grand Paris”, a public body responsible for building new transport infrastructures for the French capital.

London’s new Crossrail lines will cost £14.8bn in all, including £4.1bn in new allocated taxes on companies, as public authorities expect it to generate £42bn in profit for the British economy.

In Switzerland, a major drive to finance construction of new base tunnels (Lötschberg and Saint-Gothard) has been entirely covered by a tax on heavy vehicles (along with EU subsidies) of between CHF 2.28ct/t-km (category III) and CHF 3.10ct/t-km (category I)[8]. This is a good example of financing railway infrastructure by tackling pollution caused by other modes.

2.4 CONCLUSIONS AND RECOMMENDATIONS

From the observations above, we have drawn the following conclusions and recommendations.

There are only two cash-inflow sources for railway infrastructure: end-users (through access charges) and public money (taxpayers, through subsidies). In other words, a decrease in access charges for some trains would require either additional subsidies or an increase in access charges for others. And increased access charges could decrease rail’s modal share. Faced with such complexity, it is important to stabilize railways’ debt levels; it is obvious that all losses that customers cannot pay for through access charges must be subsidized (and not financed through increased debt).

There is a need to determine clear financial inflows, focused on specific uses / rail actors; to foster transparency in funding; and to reflect "the real cost" of rail transport. Together, these efforts will help define network needs over the medium and long term, which, in turn, will help public policy and decision makers avoid unprofitable investments. More specifically: do not add new lines without a clear business case endorsed by both IMs and TOCs.

[8] Source : Swiss Customs Administration
http://www.ezv.admin.ch/zollinfo_firmen/04020/04204/04208/04744/index.html?lang=fr

Anticipate maintenance and upgrade expenses, and dedicate a sufficient share of IMs' cash to upgrades and maintenance. Evaluate the maximum value that can be extracted from the market (passengers and freight).

In any case, there will always be a need for public funding in the rail sector. This may shift under exceptional circumstances—e.g., high demand combined with very high asset usage (traffic density and train utilisation). PPPs could be considered as a vehicle to optimize the cash-out trajectory, but not as a way to reduce overall infrastructure cost. As observed in this paper, PPP financing is not a long-term model for reducing infrastructure costs. Although it could optimize the cost-time ratio for construction of new infrastructures, **the overall global balance sheet for public finances remains negative.**

Today some European railway infrastructures are in structural deficit (France, UK, and Belgium), and to balance their yearly cash-out, IMs may freeze high-level access charges. The steep rise in access charges to offset the lack of public financing is not a sustainable solution. High access charges may pose a real problem for TOCs' operating costs and competitiveness as compared to the other modes. In a long-term perspective, some operations (e.g., high-speed rail or freight services) are threatened by an unsustainable level of access charges.

High subsidies for the Infrastructure Manager allow low access charges. Similarly, high access charges imply heavy subsidies for transport operators. **As TOCs do not receive subsidies** for open access markets such as long-distance passenger travel and freight, **access charges must be pegged as low as necessary** for these markets, in order to guarantee a fair intermodal competition between the different modes of transport.

As a result, the European rail system needs better public financing for its infrastructures. We need a huge drive for effective network renewal in almost all European countries. This necessarily means public investment in upgrading and increasing existing infrastructure rather than developing expensive new (high-speed) lines. **Ultimately it is not possible to combine in the same time low access charges, low subsidies and low fares, with high frequency, high quality of service and high performance.**

THE PERFORMANCE OF THE RAIL NETWORK

Didier van de Velde

While many reports study railway performance in a wider sense[9] this section focuses mainly on infrastructure performance indicators used in the management and regulatory context. We start with an intermediary assessment about the current usage and comparability of KPIs in selected European railway systems.

The second section sheds some light on the complex multidimensional issue of performance indicators in the railway sector by using the 'input-output-outcome' chain to bring more order in all possible KPIs. This allows positioning national performance measurement practices both in relation to each other, and also in relation to their overall relevance for the economy, the efficiency or the effectiveness of the railway. A second set of intermediate findings is then drawn in the third section concerning the usage of KPIs within governance and regulation. Finally, we will formulate some recommendations.

3.1 FINDINGS ON KPIS

The review of KPI practices in selected European railway systems (France, the Netherlands, the UK, Italy, Germany and Sweden) reveals substantial differences in practices from country to country. The comparison of cases led to a number of observations concerning the indicators used as KPIs.

The countries have substantial differences in their experience with performance measurement per se and in the usage of KPIs in contracting and incentive mechanisms in particular.

The number of indicators available varies by national cases but can run into the hundreds or even the thousands (as in the British practice) when disaggregated indicators are also counted in. Obviously, only a smaller part of such lists of indicators is used as KPIs in the regulatory context in the relationship between the infrastructure manager and the national authorities (government and/or regulator). The number of indicators reported for regulatory purpose ranges from a few to several dozens.

The indicators vary in reporting focus from production quantities to financial performance, technical performance, customer satisfaction and other performance measures. Efficiency considerations and cost reductions appear to take a more central part in some countries than in others.

The units used as indicators can be quantities, percentages or differentials (yearly increases/decreases, or ranking compared to other countries, etc.) and

[9] See, e.g., Beck et al. (2013), Neumann et al. (2012) or the recently published Railway Market Monitoring Scheme published by the European Commission (2014),

similar indicators are often measured using different data definitions and levels of aggregation, hampering international comparisons.

There are diverging national concerns, values or priorities and some indicators are linked to specific national contexts, such as policy choices, characteristics of demand or characteristics of the networks. Some indicators and measures are also directly linked to earlier performance issues that have arisen at the national level but which would not be relevant in other countries (such as the management of unusual winter conditions, etc.).

Not all indicators are linked to (financial) incentives for the regulates and those that are vary by country. The size of the incentives or sanctions associated with specific thresholds varies and can be linked to targeted output, comparative targets (benchmarks) or improvement levels. When financial incentives exist, these are not always transmitted to the management's remuneration, or not always to the same extent: this management incentive is present in some countries (such as in Great Britain – although executive level bonuses were recently reduced – or in Italy), while it is absent in other countries (it was recently removed in the Netherlands, it does not exist in Sweden where its introduction would even be unlikely to be feasible). Besides this, some countries also have a general bonus scheme for all employees (for example Great Britain).

The indicators used and reported are to varying degrees clearly linked to overarching (policy) objectives (modal split, environment, quality of life, value-for-money). In some cases the link remains absent or implicit at most, and – worse – fluctuating with short and medium term political priorities.

In sum, and very unfortunately, the differences in definition and context, and the limited overlap in KPIs between countries constrain severely the realization of international comparisons on the basis of the available data.

3.2 BEYOND LOCAL SPECIFICITIES, A GLOBAL FRAMEWORK FOR PERFORMANCE COMPARISON

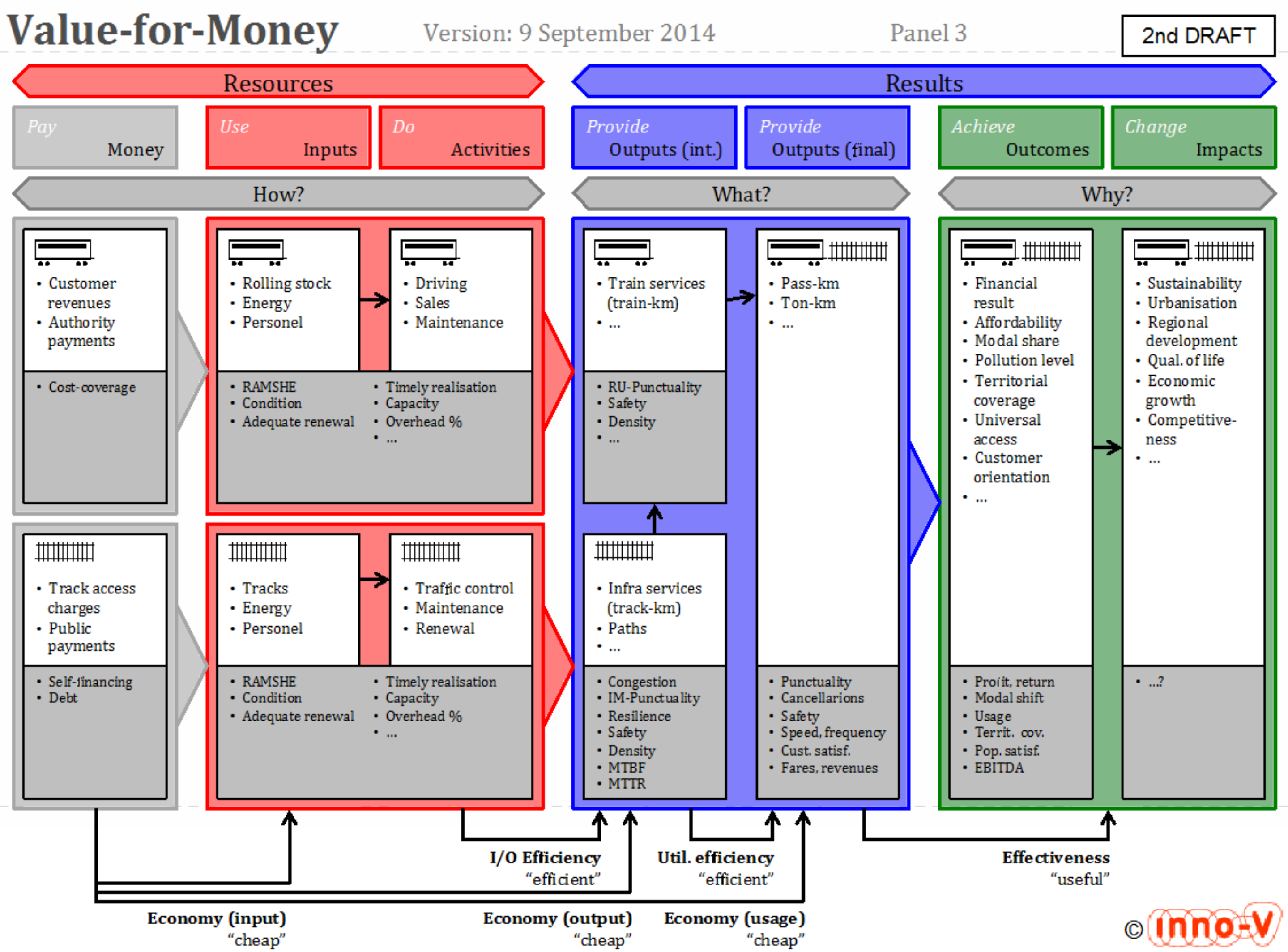
Despite the difficulties presented above, one can observe, by summarizing the practices of the countries inventoried, that the indicators used tend to cover six main information categories:

- **Basic description and condition of the assets**: with indicators on network coverage, capacity, technical standard, speed, traffic realized; rolling stock condition, age; financial sustainability of the existing asset level, etc.;
- **Availability and safety of the network and the trains run**: with availability indicators such as reliability, fitness, resilience, maintenance levels, or robustness, and safety indicators such as derailments, collisions, signals passed at danger, personnel and passenger safety, etc.;
- **Quality and reliability of service supply**: with service quality indicators (speed, frequency, satisfaction, comfort, accessibility), or environmental impact and reliability indicators covering punctuality, delays, cancellations, etc.;

- **Efficiency of usage of network and trains**: with supply indicators covering density, wasted capacity, etc. and demand indicators covering vehicle usage or loading, etc.;
- **Overall efficiency and financial results**: with efficiency indicators such as productivity, unit costs, overhead levels, etc. and financial indicators such as level of track access charges, level of cost coverage, financial results, fare levels, etc., and
- **Competition aspects**: covered by modal share statistics on the realization side and liberalization levels on the regulatory side.

These categories illustrate the multidimensional nature of the performance issue and its inherent complexity. This complex field can be clarified using a graphical representation (see further) that uses the ‘input-output-outcome’ chain to bring a logical order in all possible KPIs. This approach also allows positioning the indicators in relation to their overall relevance for the economy, the efficiency or the effectiveness of the railway. Comparing a list of national indicators with this chain then allows to fully understanding the differences in focus, approaches and measurement adopted by the various countries.

Figure No.1: Value-for-Money chain



Source: van de Velde & inno-V

The logic of the 'value-for-money' chain works as follows:
The inputs deployed are represented in red in the graph. These are the rolling stock and infrastructural assets together with the personnel and energy sources needed. These inputs are used to deploy activities such as infrastructure management and traffic control, driving and maintaining trains, engaging into sales activities, etc.

The results of these activities are intermediate and final outputs, which are represented in blue in the graph. The intermediate output are on the one hand the production of useable infrastructure services (measurable as paths and available track-km of infrastructure), and on the other hand the production of train services on that infrastructure (measurable as train runs or train-km). The combination of train and track service leads to the final output, which is the availability of transport services that are sellable to passengers and shippers. Produced services can be measured as seat-km of capacity, while sold services can be measured in pass-km and ton-km or in sales revenues.

The outcomes achieved with these services and, behind these, the impacts generated are represented in green in the graph. The outcomes are immediately related to the train product and a valuation of its characteristics (such as a contribution to modal shift, a reduced level of emissions, etc.) From a policy perspective, these have an impact on wider social goals that are aimed at with railway investments and operations funding (such as sustainability, economic development, etc.)

The funding itself is represented here in grey on the left hand part of the diagram to illustrate the link between costs and inputs. The income of operators is made up of revenues paid by customers for the services used and by transport authorities for the services ordered for public service obligations. The sectorial revenues also include the public funding of infrastructure that is not covered by track access charges, which are transfers from operators to infrastructure managers. Note that the required level of funding is interdependent with various choices made throughout the chain, in particular with policy choices made in terms of outcomes.

The 'value-for-money' chain presented above can then be quantified using three types of data to describe the performance of the railway. These three types of data also represent an important typology of KPIs.

Firstly, the indicators listed in the white boxes at each step of the chain describe the quantities of inputs, outputs and outcomes. Some of these quantities may be less easy to measure and some (in particular the outcomes) may only be available as qualitative indicators, if at all.

Secondly, the indicators listed in the grey boxes represent essentially the quality of the activities or outputs at each of the steps of the chain. These indicators constitute the major part of the KPIs used in the regulatory context, as inventoried earlier on.

Thirdly, various ratios can be calculated on the basis of the first type of indicators to provide information on the 'value-for-money' achieved. These ratios can usefully be linked to the 3 concepts: economy, efficiency and effectiveness:

- **The economy of the railway**: the extent to which a set quality is delivered at the lowest possible costs. Examples of ratios are the

operational expenses or total costs per track-km, per wagon, per driving hour, per train-km, per passenger-km, etc.
- **The productive efficiency of the railway**: the extent to which the highest possible output is delivered for the quantity of input used. The ratios can be related to the intermediate outputs (examples are staff per km of available track, staff per train-km, train-km per track-km) or to the final outputs (passenger-km per train-km, ton-km per train-km, etc.)
- **The effectiveness of the railway**: the extent to which the railway is 'useful' in that it provides benefits to society with the outputs delivered, the extent to which the policy goals are realised for which public funds have been made available. Examples are the accessibility of cities by train at peak hours, the market share of rail on specific markets, the contribution of rail to the quality of life through a reduction of pollution and congestion, etc. These ratios are much less straightforward to calculate.

This approach helps understanding the differences between national approaches by clarifying the positioning of each performance regime. This could, with associated data collection efforts, lead to more comparability at the international level. However, the realisation of international comparisons will continue to require particular care due to differences in circumstances and hidden differences in the definition of available data.

Therefore, quantitative descriptive data on the networks and services provided will need to be scaled to compensate for differences in country size (in km^2, number of inhabitants or population density), in network length, in production level or in purchasing power, etc. Quantitative data relating to quality aspects will always need to be checked to ensure that the units of measure declared are actually based on the same definitions as those of the data to which they have to be compared, or that a proper conversion can be realised.

3.3 FINDINGS ON KPIS WITHIN GOVERNANCE AND REGULATION

The review of indicators used revealed substantial differences in practices from country to country. The comparison of performance measurement practices as a whole, with the framework proposed above in the background, also revealed that substantial differences are present in the usage of KPIs in governance and regulation of the sector.

At this stage, we can draw the following preliminary conclusions.

There are huge differences in the maturity of regimes across Europe; accordingly the level of sophistication in the usage of KPIs varies considerably. One main challenge observed by the experts is to find the right balance between trust and micro-regulation.

There are a few common themes for infrastructure management across Europe (such as sustainability of financing, or efficiency improvement) but the country situations are very different making it difficult to realise a common platform of KPIs.

Even the comparison of high-level categories such as network usage, punctuality or geographic network coverage may create difficulties due to differences in national priorities and exogenous factors linked to the local geography and demand. Furthermore, non-linearity effects are present for many parameters making comparisons of countries of different sizes potentially erroneous (even if uniform definitions were used, which is often not the case in practice).

Payment structures and funding are believed to influence performance although a direct link is not always easy to establish. There is, e.g., no general correlation between financing and density of usage, as success depends on the existence of a potential for growth (untapped demand).

Elements that constitute main performance drivers are perceived to be located to a large extent in legacy issues. For example, performance may be dependent upon the discrepancy between the current usage of the network (in response to current demand) versus the reason for the original setup of the network (for a demand that has vanished in the meantime).

Performance is also dependent upon the investment and maintenance backlog. In that respect, the political (un)reliability of public budgets is perceived to be a main determinant of performance in the longer run.

Not all railway performances are immediately dependent upon the level of funding as many challenges depend upon an improved management, which is more linked to other incentive mechanisms that are not necessarily financial and to the sheer availability of KPIs.

The importance of the interdependence between the actions of the IM and the RU, in particular in term of punctuality, must also be stressed. This leads to the question as to what extent the IM and the RUs should be incentivised on the basis of system-wide performance indicators rather than only on the basis of their own performance indicators. The reason for this is that a system-wide approach might be more likely to foster cooperation leading to more prevention and solving of issues, thereby avoiding silo thinking.

Railway investments can be divided into three categories: (i) projects (new capacity or connectivity) that worsen the railway's net operating position, generating a requirement for additional future subsidies to operate the associated train services; (ii) projects resulting in an improvement in the railway's net operating position, but not sufficiently to cover the capital costs of the related investment; and (iii) projects that have a clear financial business case and are feasible on a purely commercial basis. As relatively few rail investments fall into the third category, most projects will require additional public funding.
There is a need for more transparent funding arrangements to make the affordability of different additional services clearer. It is to be expected that this leads to pressures for more disaggregated funding and subsidy, with potentially a growth of investment at local level.

Discussing the main trade-offs between railway objectives and performance is far from easy. Numerous obvious trade-offs exist between competing public values (affordability of services, geographic coverage of the network, self-financing of the infrastructure, high modal shares, self-financing of train services, quality of service, etc.). To make things worse, political choices sometimes remain implicit, leading to a lack of prioritisation and possibly funding as a result, but also potentially leading to conflicting KPIs and ineffective performance regimes.

Further trade-offs exist within infrastructure management. The quality of the service is dependent upon the maintenance and replacement policies, a reduction of maintenance or replacement will impact quality, while a postponing of maintenance (cost savings in the short run) will induce higher replacement costs, and conversely. For a same safety level, an increase in density of traffic will lead (beyond a certain point) to a reduction in punctuality. Increasing punctuality will reduce the level of density that could be realized at a specific safety level.

New approaches to train and infrastructure management, especially across the infrastructure/operations divide, may in some cases and under specific circumstances lead to further performance improvements, For examples, a higher availability of infrastructure (at commercial hours) may require higher maintenance costs (at nights). Optimisation will be dependent upon the ability to realise such trade-offs over the borderline and institutional divide between infrastructure management and train operations.

3.4 RECOMMENDATIONS

At this point, we can make the following preliminary recommendations:

Contracts should be linked more closely to user-oriented performance targets, with perhaps fewer but clearer KPIs linked to (financial) sanctions. That means:

- KPIs have to be defined at the relevant level, which is not necessarily the network as a whole but could be market segments (for example HSL, high-traffic sub-networks, low traffic lines, etc.),

- KPIs should be limited to those factors that are essential to the organization reaching its goals. A shorter list of KPIs will enhance staff focus. One should avoid having outputs overly specified by government; rather reporting should be done on high-level targets with, however, a wider range of measures used internally. The railway sector's KPIs should also be split into (short) compatible lists of KPIs for each component of the railway system, out of which the IM is one of them.

- There is a debate as to whether sanctions should be directed at the level of the infrastructure manager as a whole or more directly at its management staff.

- There should be more transparency in KPIs and in their reporting.

In general terms, reporting on performances in the infrastructure field should report on evolutions and not on single points, especially when making international comparisons:

- Comparing growth rates, trends and developments is more sensible than punctual performance comparisons. It is recommended that any study analysing such relation should cover a sufficiently long period of time (5, 10 or 20 years) to be able to discover relevant patterns and avoid misleading conclusions.

- Taking a time lag into account is particularly important when analysing the effect of funding on performance, and – through this – the effect of maintenance activities on performance.

- International comparisons are complicated to realise due to differing legacy issues, demand patterns, organisational models, delay effects and specific local measures (such as incidental efficiency programs). Such comparison requires an appropriate understanding of relevant underlying conditions (geographic, economic) and choices (political, legal, and commercial).

- Aligning KPIs into more frequently comparable data is in the interest of IMs seeking efficiencies and opportunities to improve performance – although the difficulties of doing so are clearly recognised. It is therefore suggested that the industry leads on such a complex challenge given that the outcome benefits the participants.

The regulatory approach should be based on a whole-life, whole-system, risk-based optimisation:

- The KPIs for the IM should be compatible and hierarchically properly embedded into KPIs for the sector as a whole. This points to a crucial coordination role at the industry-wide level such as to ensure leadership and compatibility at this level.

- The infrastructure manager and its customers (RUs) and suppliers should be empowered to enter into various forms of partnerships or alliancing arrangements which will improve value for money without undermining network benefits or scale efficiencies.

- Efficiency improvement depends also upon an improved management, not only upon funding level. The impact of this will differ throughout the input-output-outcome chain. The four stage planning principle (rethink, optimise, rebuild, build new) used by some countries (Sweden, Great Britain, the Netherlands) is one step in that direction, fostering more integral thinking in the sector.

Priorities and choices between those public values that will be embedded into performance incentives have to be made at the political level, however:

- It is crucial to realize that a desire to improve one performance indicator will in most cases lead to the need to reduce expectations on other performances indicators, all else remaining equal, or at a constant level of funding.

- Long-term financial sustainability should remain at the centre of regulatory considerations, before any political intervention.

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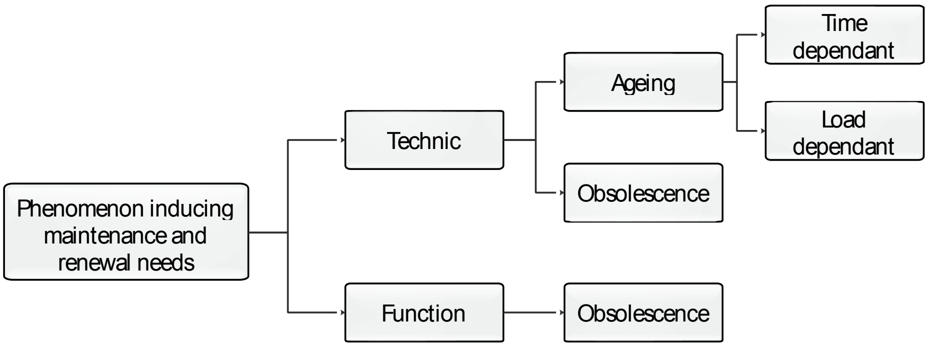
ANNEX 1: THEORETICAL CONCEPTS OF AGEING AND OBSOLESCENCE

The maintenance and renewal requirements of the infrastructure result from different phenomena which are summarily ordered in the following Figure No.2:

Figure : Types of factors inducing maintenance and renewal needs



Source: Putallaz

Among these phenomena, we can mention:
Physical (wear of the rail, etc.) or chemical (loss of dielectric capabilities of cables insulation), etc.) aging;
Technical obsolescence (increasing scarcity of spare parts, a manufacturer who leaves the market or stops the support of a product, loss of know-how, etc.);
The functional obsolescence (insufficient nominal output power of a substation, etc.).

Ageing can be a function of time (corrosion of steels, etc.), of the stress level (geometry flaws of the track, etc.) or of a combination of both.

Technical obsolescence constitutes a recurrent issue in the field of electro-mechanical and electronic equipment. The growing complexity of systems and technologies complicates the management of knowledge within entities in charge of the maintenance, phenomenon that tends to be amplified by the increasing involvement of industry in the field of railways.

Equipment becomes functionally obsolete when its nominal capabilities, such as defined during the conception process, do not comply anymore with the needs of the system it is part of. We can note that it is not always easy to distinguish the needs for investments linked to the functional obsolescence (to add power to a substation, for example) from those linked to the extension of the network (to increase the capacity of a line, for example).

Therefore, the reflections in the first section essentially concern the ageing and technological obsolescence phenomena.

ANNEX 2: MEANS REQUIRED ESTABLISHING A SUSTAINABLE DIALOGUE BETWEEN THE INFRASTRUCTURE MANAGER AND THE FINANCERS

As the opening presentation of the workshop proposed ("Introductory Observations and Strategic Challenges", M. H. Bente, Civity), such an integration should contain the following elements.

Table: Means required establishing a sustainable dialogue between the infrastructure manager and the financers

Transparent planning and results	Transparent documentation
determination of current network condition identification of reinvestment backlog forecast of long-term financial needs	clear and concise reporting illustration of consequences communication of implications on traffic quality
Modelling optimised use of funds	**Decision support**
LCC-based cost savings Simulation of budget constraints risk-based investment scenarios	integration into annual business process fundamental strategic / economic policy choices public stakeholders « embedding » solid and dependable financing stipulations on multi-annual-basis

Source: "Introductory Observations and Strategic Challenges", opening presentation of the July 8th 2014 workshop, M. H. Bente, Civity 2014