

International benchmarking of Network Rail's operations and support functions expenditure

Final Report

Office of Rail Regulation

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Executive Summary

The Office of Rail Regulation (ORR) is currently determining Network Rail's funding for Control Period 5 (CP5). In this context, the ORR commissioned civity to benchmark Network Rail's operations and support functions expenditure against other European railway infrastructure managers to understand how they compare.

All major Western European railway infrastructure managers were invited to take part in the study; in addition to Network Rail, six agreed to participate actively. The peer group consists of a mixture of dedicated railway infrastructure managers, vertically integrated railways, and administrations that manage the infrastructure for all modes of transport. In order to enable reliable comparisons, only data relating to railway infrastructure management was considered in this study. It should be noted that most of the peers have networks which are smaller than 10,000 main track-kilometres. Therefore, differences relating to economies of scale in certain functions such as asset management or procurement should be considered when interpreting the results.

The operations functions include all activities required to operate the infrastructure to enable trains to run, such as signallers and traffic control staff. In this benchmarking only operations expenditure is considered, which represents 7% of Network Rail's total annual expenditure. Within the peer group, Network Rail currently has the least centralised and automated network operations. A large workforce is employed to operate a high number of manned control points. However, the cost per train-kilometre is lower than average, which is the result of a large and well utilised network.

The analysis of labour which is the most important driver of operations expenditure, shows that Network Rail has the highest labour unit costs in the peer group due to a relatively high labour cost level and because its control staff work the lowest number of hours per week.

Network Rail's current migration strategy is a long term programme which will consolidate signalling from over 800 dispersed locations into fourteen modern rail operating centres. This would bring Network Rail to the leading position within this peer group in terms of centralisation. In parallel, the frontline

operations workforce will be reduced from 5,600 to less than 1,500 in the longer term. Annual operating cost will be reduced by GBP 250 million over 15 years, which would result in less than 50% of today's expenditure¹.

Support functions include activities that enable Network Rail's core business. The study focuses on six of these functions: workplace management, asset management, information management, human resources, procurement, and finance – as these cover nearly 90% of Network Rail's support functions expenditure, a similar level to the comparators.

This benchmarking provides a high level positioning of Network Rail's support functions expenditure. The level of Network Rail's total support functions expenditure (representing 8% of the total annual expenditure), in relation to the network size, is in the middle of the peer group. This also applies to each of the individual functions, except for procurement for which Network Rail is the highest in the peer group. As all support functions are aggregated from a number of sub-functions, the current positioning cannot be used to draw reliable conclusions on efficiency. For each individual activity a more detailed scope, intensity and quality of output would be needed to do so.

Since railway related core activities are mainly to be found in asset management we would recommend a development of the comparison and analysis in this area. The focus could be on specific activities such as LCC optimal asset strategies, the use of decision support tools and modelling, research and development or asset information planning and controlling, and in particular the quality and effectiveness of the output.

Expenditure for workplace management, information management and human resources is highly influenced by local market conditions. Thus a further in-depth analysis could focus on UK organisations in order to determine cost saving opportunities. The costs of finance related functions such as procurement and finance itself are driven by the size of the organisation, budget availability, and the outsourcing strategy. The highest cost savings are expected from labour productivity improvements supported by tailor-made software applications and intelligent bundling of activities in certain activities. Some economies of scale could be achieved in functions such as asset management or procurement.

¹ Network Rail CP5 Efficiency Summary; Document ref: SBPT220; page 24

Network Rail's plans to deliver 19 per cent of efficiency savings in CP5 for support (incl. property)² through several measures such as adoption of more efficient processes and enabling technology, centralisation of management accounting, and rationalisation of support in line with company headcount reduction.

² Network Rail CP5 Efficiency Summary; Document ref: SBPT220; page 8

1. Introduction

1.1 Background and objectives

The 2013 Periodic Review covers the assessment of the scope for Network Rail's efficiency improvements in Control Period 5. Several studies have already been carried out in order to understand how Network Rail's maintenance, renewal and enhancement expenditure compare to other international railway infrastructure managers.

In the 2008 Periodic Review, ORR looked at support and operations expenditure from regulated network companies comparable to Network Rail. The work identified an efficiency gap of 35% to good practice³.

In order to complete the picture and to determine appropriate funding levels, expenditure on support and operations is now to be analysed further. Network Rail's current expenditure is approximately GBP 6 billion for network operation, maintenance, renewal and enhancements, of which about 7% is for each of support functions (GBP 470m) and operations (GBP 439m).

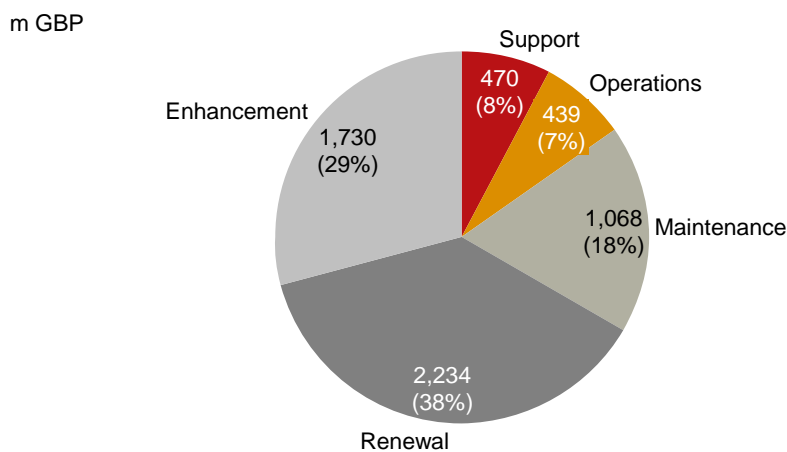


Figure 1: Network Rail's expenditure in 2010-11

In the course of the McNulty 'value for money' study, civity carried out an initial benchmarking of both operations and support. This analysis suggested that both in terms of cost per track-km as well as by percentage of total costs, Network Rail's commercial overhead appeared to be higher than other railway infrastructure managers. The same applied for network operations costs which

³ ORR Periodic Review 2013: Establishing Network Rail's efficient expenditure; July 2011; page 7

were the second highest in the peer group. Network Rail's traffic management staffing level was also comparatively high. A more in-depth analysis was recommended to explore the underlying reasons for this gap, which was done by this benchmarking study.

In April 2012, ORR initiated a benchmarking exercise to help to identify both the magnitude of and the reasons for this gap to good practice in support and operations expenditure.

This report reflects the findings of the benchmarking analysis which is based on quantitative data supplemented by interviews held with Network Rail and the other participant international railway organisations.

civity would like to thank the ORR, all representatives of Network Rail and external parties who dedicated their time to this review and supported the study through the provision of information and data.

1.2 Structure of the report

This report consists of four chapters. In chapter 2 we explain our approach and methodology. Guidance is given by our previous benchmarking studies on overhead and traffic management. We describe the scope of the analysis for both network operations and support functions followed by the work steps and deliverables.

Chapter 3 summarises the results for the international benchmarking of Network Rail's network operations expenditure. It is structured into cost efficiency, degree of centralisation, signalling technology, and labour cost and productivity.

Key findings from the benchmarking of Network Rail's support functions expenditure are highlighted in chapter 4. We explain the results of the six most important economic functions covering nearly 90 per cent of Network Rail's total support functions expenditure. Those are namely workplace management, asset management, information management, human resources, procurement and finance.

Additional information on interviews held can be found in the appendix.

2. Approach and methodology

2.1 Operations and support functions

Support and operations were formally grouped together as operating expenditure in the ORR's 2008 Periodic Review (PR08). It is ORR's intention for the 2013 Periodic Review (PR13) to treat support and operations separately, as these two types of expenditure are very different, with different cost drivers. Central support functions such as human resources or safety and compliance provide a central resource to all the organisational units within an infrastructure manager's business, whereas the operations function is core to the infrastructure manager's business, enabling the operation of train services across its network. Therefore it is both useful and appropriate to benchmark the support and operations expenditure separately.

Network operation is typically a dedicated organisational unit within a railway. It covers the operation of the control and signalling equipment and all activities in connection with traffic control like planning, monitoring or incident response. The main differences between railways in Europe are signalling technology, the degree of centralisation and the resulting staff size, which in turn affect the labour cost and productivity. All of these aspects were taken into account in the benchmarking.

The range of support functions is much wider. All railway infrastructure managers have basically similar common organisational units such as human resources, finance or information technology, but the tasks and functions of several other organisational units (e.g. asset management) depend heavily on the organisational set-up of the railway itself.

Network Rail is a dedicated railway infrastructure manager. In Europe there are also vertically integrated railways (e.g. BLS from Switzerland), and those within a holding organisation (e.g. SNCF/RFF). In Scandinavia we find traffic organisations responsible for the entire transport infrastructure including rail, road or waterways (e.g. the Finnish Transport Agency). Therefore, only data relating to railway infrastructure management was considered in this study.

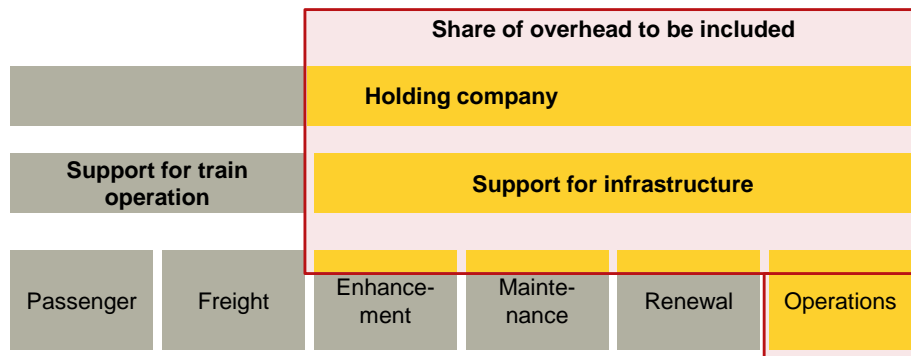


Figure 2: Scope of analysis

The figure above illustrates the structure of a railway infrastructure manager within a holding company. The cost and headcount of the central overhead functions which are carried out in the holding company were allocated to the relevant functions only in relation to the headcount in that organisational unit. The same logic applies for infrastructure managers responsible also for the road network of a country. In addition, costs and performance figures for decentralised but dedicated support functions were also included. The scope of the study is indicated by the red framed box.

Most of the support functions are typical office jobs with most of the total costs due to labour costs, some materials or equipment (e.g. in IT) and some external spend (e.g. in public relations). Similar studies at public transport companies identified a share of approximately two thirds of labour in support functions. The share of labour in network operations was identified to be even higher (~90%). As a result the study focuses on labour costs and headcount. Due to the diversity of the different support functions, it was agreed with ORR to further analyse labour productivities for operations only. The scope of the analysis of both the support functions and operations is described in the next subsection.

2.2 Work stages

After an initial set-up phase, the study was built on three consecutive work steps which were carried out in parallel for both support and operations. The following illustration provides an overview and shows the key outputs and deliverables from each work step.

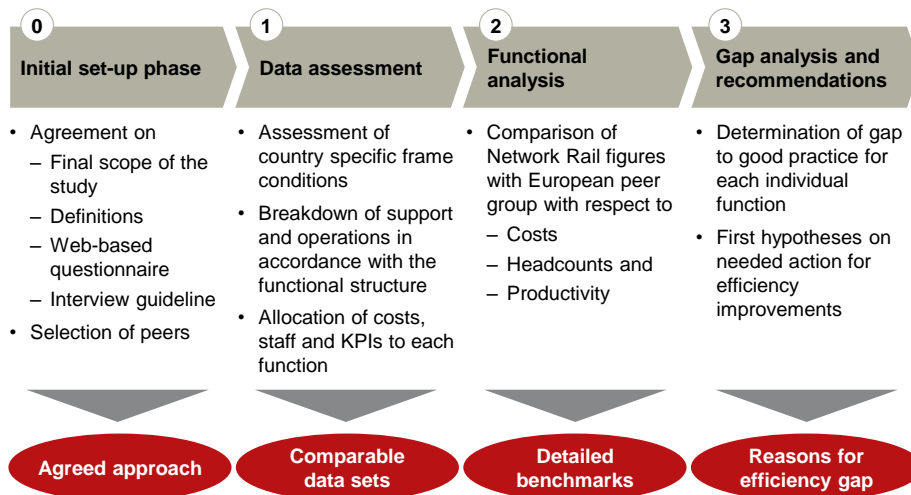


Figure 3: Work stages

Initial set-up phase

In addition to Network Rail, all major Western European infrastructure managers were contacted and asked for their participation.

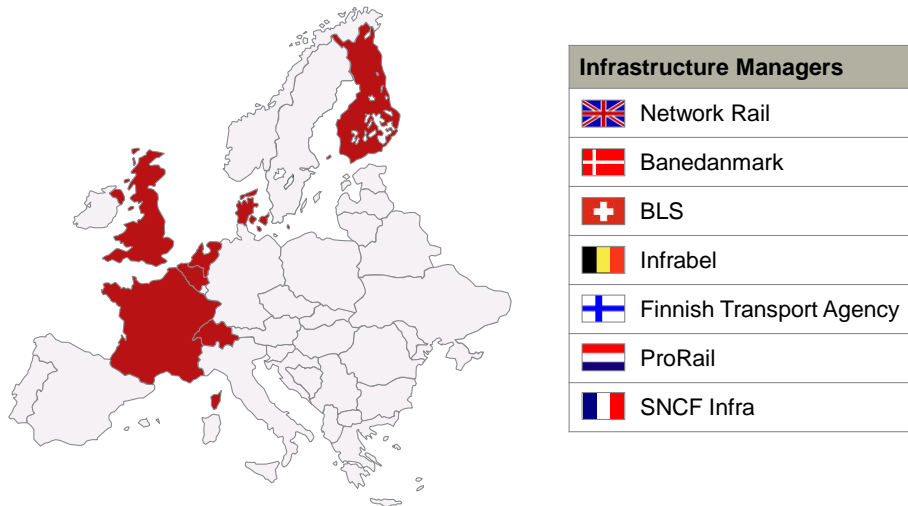


Figure 4: Participants

Six agreed to participate actively in this benchmarking study, as shown in Figure 3 above. ProRail and Banedanmark are dedicated railway infrastructure managers. Although Infrabel is a part of the SNCB group, it is an independent infrastructure manager. Whereas ProRail has subcontracted all infrastructure maintenance, renewal and enhancements, Banedanmark and Infrabel are performing operative infrastructure work also with their own staff. BLS from

Switzerland is the largest private Swiss and vertically integrated railway. SNCF Infra maintains the French network on behalf of the owner RFF. Some support functions are done exclusively, or at least mainly, by RFF. The Finnish Transport Agency manages the infrastructure for all modes of transport; the operation of the railway signalling system is subcontracted to the Finnish train operator VR.

In cooperation with ORR a questionnaire and interview guideline for the data assessment covering quantitative as well as qualitative aspects was developed and disseminated among the participants.

Data assessment

During the first work step, data was assessed using web-based, easy-to-use questionnaires followed by individual visits to the participant railways. Country specific frame conditions were discussed. Costs, personnel figures, resource indicators and KPIs were collected per function. All peer data refer to the most recent fiscal year, i.e. 2011. An exception is ProRail's support functions which are plan figures for year 2012.

Functional analysis

The second work step concentrated on the analysis of the current situation itself, covering Network Rail's costs and performance as well as those of the peer comparators. Each individual dataset was checked for plausibility. Extraordinary effects or functions out of the study's scope were separated. Finally, all input data has been accepted and approved by the peers.

The comparative analysis was carried out by using a comprehensive calculation tool. International currencies were converted to Pound Sterling using GDP-based purchasing power parities as published by the OECD.

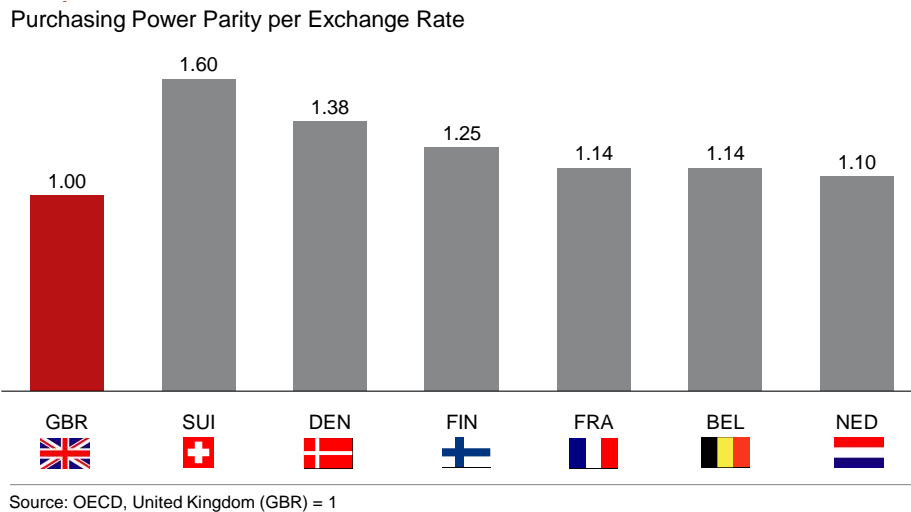


Figure 5: Comparative price levels 2011

As illustrated above, all countries have higher comparative price levels than Great Britain. That means all comparators have to pay a higher amount of money in their home countries than in Great Britain to receive the same basket of goods. Key outputs of this work step are detailed benchmarks on sub-functional level.

Gap analysis and recommendations

The detailed gap analysis was the main task of the third work step. First hypotheses on action needed for efficiency improvements were developed for each individual cost function. A draft report was presented to ORR in December 2012.

This final report was complemented by a peer workshop. The first part of this meeting was the presentation and discussion of the comparative analysis. The second part was dedicated to a multilateral exchange of good practices by individual presentations of each participating railway infrastructure manager.

Finally, this report will also be disseminated among the participating railways. Owing to confidentiality agreements with the participants, their submissions have been anonymised.

3. Expenditure on railway infrastructure operations

The costs of railway network operations are largely made up of the cost of labour, with few materials costs. The maintenance of the physical signalling assets does not tend to be included in network operations, but included in infrastructure maintenance and renewals expenditure. The level of labour productivity is driven to a large extent by the degree of centralisation. To reduce costs and improve productivity, new technologies have been introduced, enabling railways to centralise and automate traffic management, although the degree to which this has been achieved varies significantly between European railway infrastructure managers. This view is consistent with the findings of the McNulty Value for Money study⁴.

Whilst a range of levels of signalling centralisation and automation exists amongst European railway infrastructure managers, most fall into one of two categories:

- **Leaders** with a high degree of centralisation/automation

For these railways, which include ProRail in the Netherlands, productivity gains are becoming harder to achieve with less opportunity for improvement remaining. New technology is pushing these railways into shorter life cycles with higher reinvestment needs. The increase in the capital cost of new equipment, now and into the future, is therefore a primary concern for these leading railways to keep costs under control. The asset life for traffic control equipment that was sometimes above 40 years may reduce to between 15 and 25 years for some of the core elements, and even shorter periods for software.

- **Followers** with labour-intensive network operations

For these railways, which include, among others, Network Rail, Infrabel and for the conventional network SNCF/RFF (i.e. excluding high speed), migration to new systems is still slow. A lack of funds is the main underlying reason. Typically, there is also much room left for productivity improvement through better human resource management.

⁴ Realising the Potential of GB Rail, ORR 2011, page 266 ff.

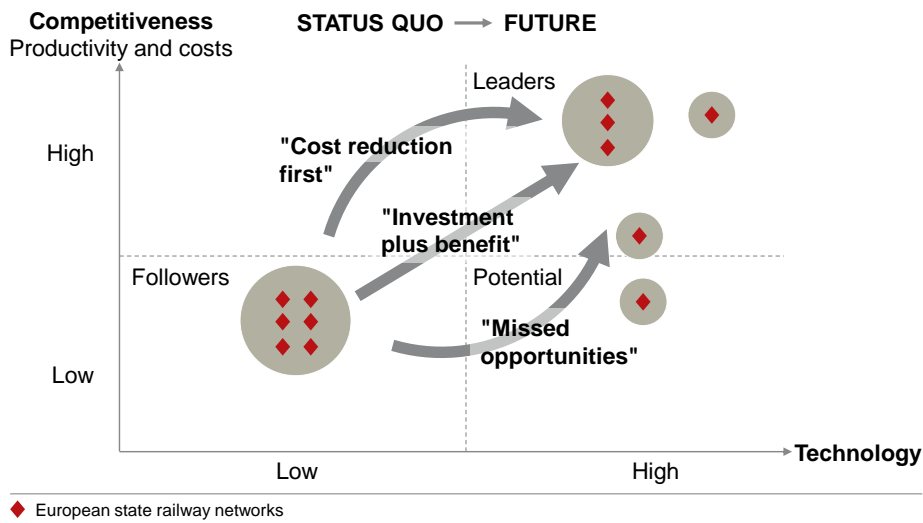


Figure 6: Patterns of network operations

The arrows in the figure describe the different migration strategies. The upper arrow reflects those railways which focus on efficiency improvements ahead of investing in new signalling technology. The middle arrow describes the 'optimal' path of technology upgrade in parallel with cost and productivity improvements; the lower arrow represents those infrastructure managers who are investing in new signalling systems but might have not prepared an associated human resource strategy.

The illustration below describes the areas analysed in the course of this benchmarking study and how they relate to each other.

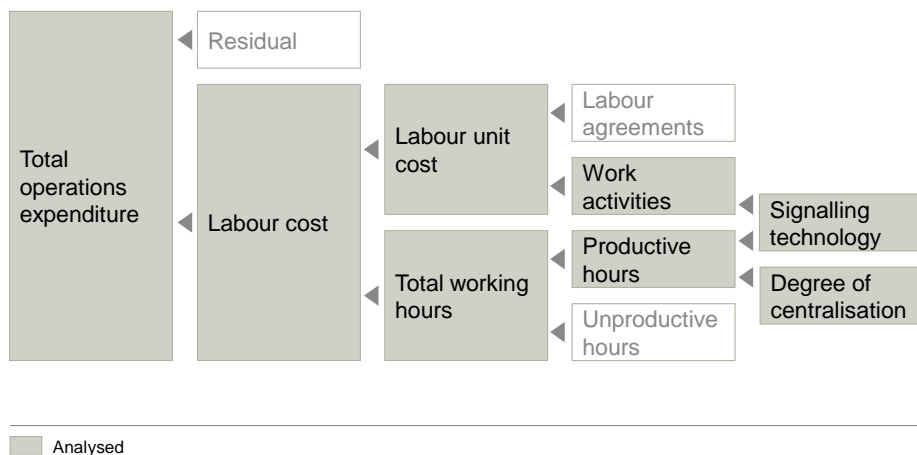


Figure 7: Areas analysed

Total operations expenditure is predominantly driven by labour cost. Labour cost is complemented by a small share of residual cost, covering administrative goods such as office supplies. Thus the focus is on labour which is the product of labour unit cost and the number of total working hours delivered.

Unit costs are strongly determined by labour agreements which were not subject to our analysis. They are not in direct control of the infrastructure manager and differ from country to country, e.g. due to different social security and insurance schemes. On the other side, unit costs also depend on the different work activities. An employee responsible for the supervision of the entire network operations is expected to receive a higher remuneration than staff working in signal boxes setting train paths. The variety of work activities – and hence the educational level of staff deployed – is mainly driven by the technology in place, which again is in direct control of the infrastructure manager.

Firstly, the number of working hours needed to operate the network is driven by labour productivity. Subject to labour agreements, gross working hours vary and result from weekly working hours. Furthermore, “unproductive” time related to bank holidays, sick leave etc. reduce the number of hours that staff is effectively available. As mentioned before, these aspects were not analysed in detail.

Secondly, the number of productive working hours needed to control one train kilometre is strongly determined by the degree of centralisation and the signalling technology. At small signal boxes, an additional workshift might be needed only to cover some certain short peak times, which results in an under-utilisation of human resources. In contrast, the team size in large control centres can be much easier adjusted to the daily traffic profile. Finally, modern technology is assumed to better support daily operations and thus to increase staff productivity.

Respective figures were collected and compared; the results are described in the following chapters.

3.1 Cost efficiency

In comparisons of cost efficiency the overarching question is how much each infrastructure manager requires to control one train-kilometre and the reasons for this.

Network Rail spent GBP 439m on operations costs in 2010-11 which accounts for 7% of its total annual expenditure.

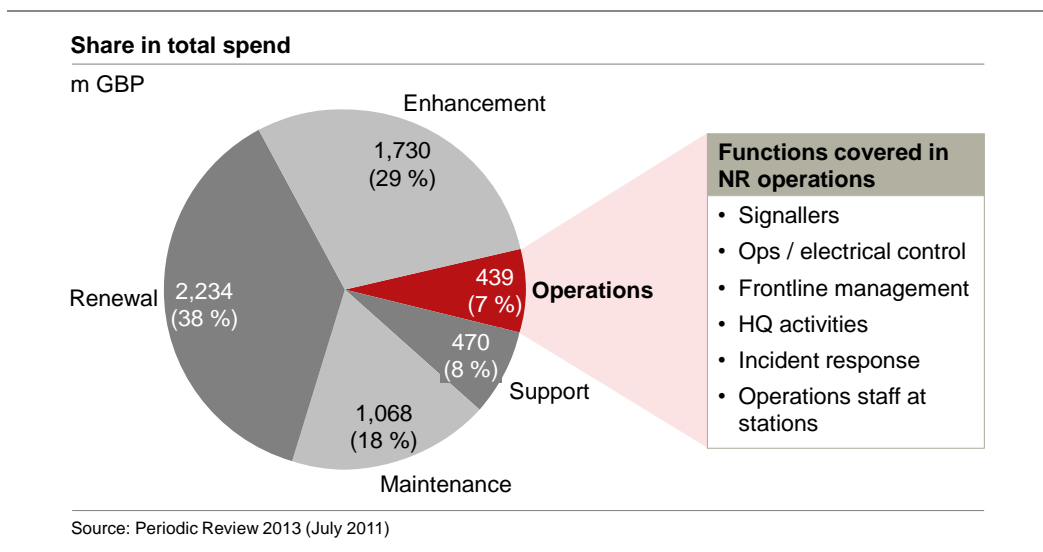


Figure 8: Network Rail's operations expenditure 2010-11

Currently, more than 6,000 Network Rail employees are performing activities that operate the signalling system as set out below.

Operative staff

All employees directly engaged with traffic control and in the operation of signalling equipment on the railway infrastructure, such as

- Signallers,
- Level Crossing keepers,
- Shift Signalling Managers,
- Local Operations Managers,
- Operations Managers.

Administration and network supervision

All activities carried out to aid the operation of the railway, and employees engaged in providing response to operational incidents on the railway infrastructure, such as

- Mobile Operations Managers,
- Electrical Control Operators & Control Room staff.

As a first step, total expenditure was related to the total traffic volume as the main 'product' of network operations.

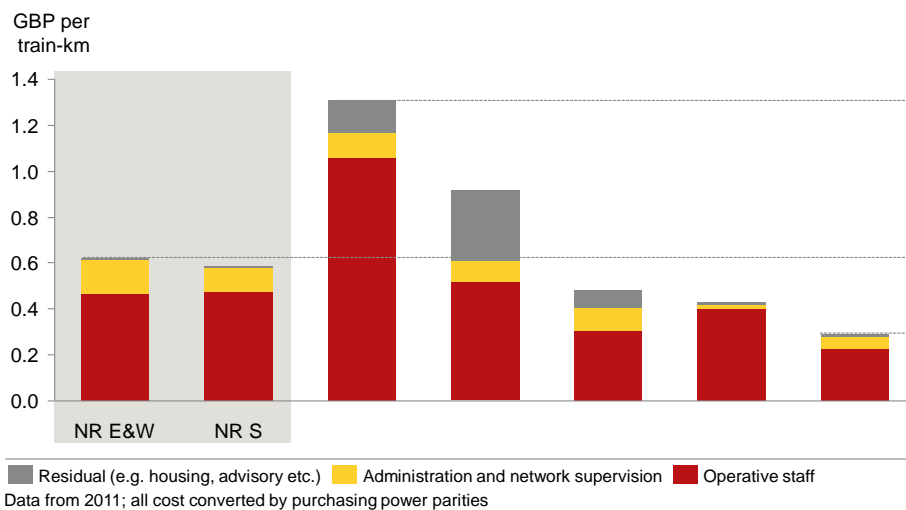


Figure 9: Annual network operations expenditure

The red bars indicate all decentralised operative staff located at the control points, which clearly represents the highest share of total costs. The yellow bars illustrate the costs for administrative labour and centralised tasks such as network supervision or timetable planning. The grey bars represent all residual costs such as housing or office supply. The comparison identifies Network Rail's operations expenditure per train-kilometre broadly in the middle of the peer group.

Cost efficiency is defined by expenditure per train mileage. Expenditure is driven by labour, i.e. by the size of the workforce as well as by the level of labour cost. Train mileage is the product of train frequencies and travel distances; thus a high efficiency (i.e. low costs per kilometre) can be delivered either by a small workforce or by a large train mileage, the latter being the case for Network Rail. In other words, a large and well utilised network is likely to appear efficient, even if train control is less centralised.

Thus the next step is to look how Network Rail's degree of centralisation compares to its international peers.

3.2 Degree of centralisation

The degree of centralisation for network operations can be described by three guiding questions:

- How big is the railway infrastructure network for scheduled train operations?
- How many manned control points are installed in the network?
- How many track- (and train-) kilometres are managed on average by one manned control point?

The next figure emphasises the different frame conditions the railways currently have to deal with. The x-axis represents the network size; the y-axis shows the number of manned control points in the respective network.

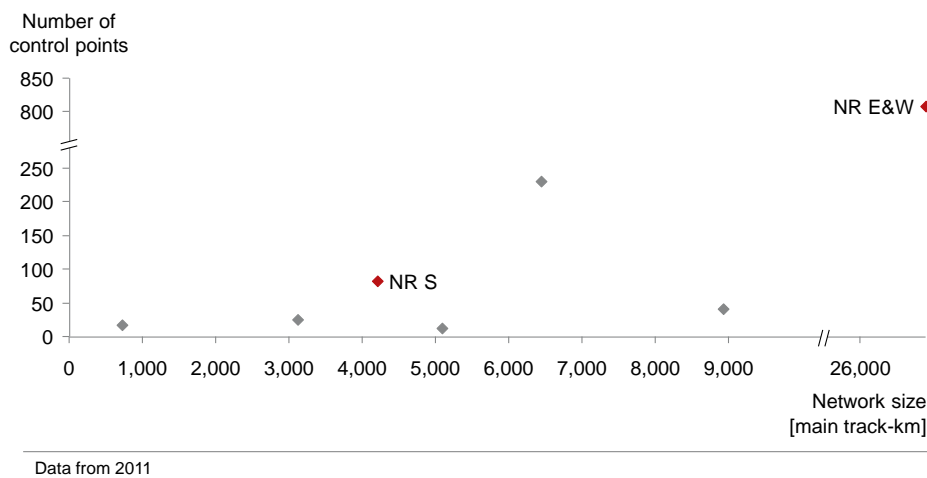


Figure 10: Network characteristics

England & Wales is by far the largest network among the peer group, with the largest number of control points. It would be preferable to compare Network Rail England & Wales to larger, more similar railway networks, but these are not included in the current peer group.

There are two peers with less track km per control point than Network Rail Scotland and three peers which control significantly more track on average per control point. This ratio which describes the degree of centralisation is clearly illustrated in the next figure.

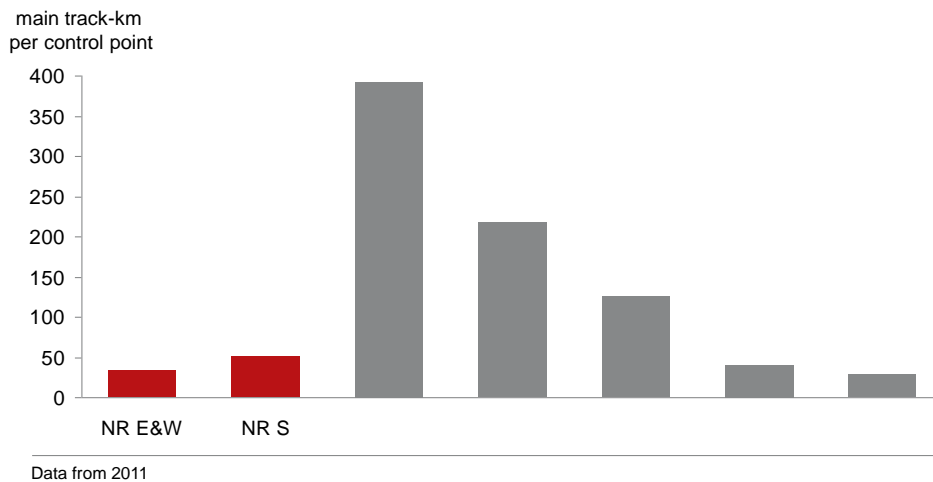


Figure 11: Degree of centralisation

Network Rail's degree of centralisation, measured in main track-kilometres related to the total number of manned control points, is relatively low. It appears that Network Rail has significant potential to further centralise network operations which should lead to higher staff productivity. Network Rail's Operating Strategy is to migrate operational control into fourteen modern control centres in parallel with a reduction down to approximately 25% of the current frontline operations workforce in the medium to longer term (15 years)⁵.

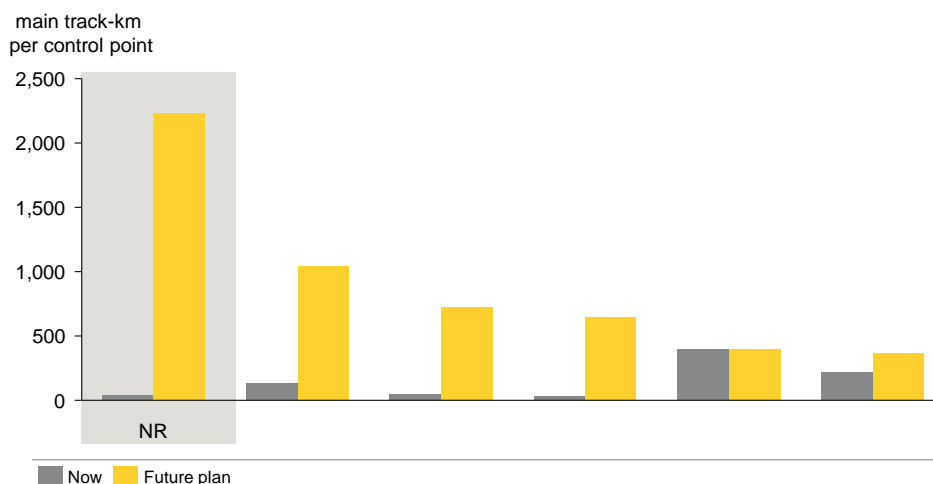


Figure 12: Future degree of centralisation

Most of the other countries included in the study also have plans to centralise their network operations further. Assuming all future plans are realised,

⁵ Network Rail CP5 Efficiency Summary; Document ref: SBPT220; page 24

Network Rail would have the highest coverage with more than 2,000 kilometres of main track per manned control point in this sample, as illustrated above.

Once a certain degree of centralisation is achieved through the introduction of electro-mechanical remote control technologies, a migration to electronic control centres is needed in order to enable higher distances of traffic control. The following section describes the different categories of system technologies currently in use at Network Rail and its international peers.

3.3 Signalling technology

The benchmarking provides answers to some of the key questions for the signalling technology:

- How can different categories of system technologies best be described?
- What technology is currently in place?
- What is the relation between different system types and cost efficiency?
- What productivity improvements can be expected by technology migration?

It needs to be stated clearly that this benchmarking does not provide a business case by answering the question of the required or appropriate level of investment into technology migration.

For reasons of history, preferred national manufacturers and different investment cycles, the signalling technology in use in different countries varies widely. The technologies in use range from legacy systems with locally operated switches, some even without signals, through remote controlled interlockings which have enabled the first steps in centralisation of traffic controllers, to modern computer based control centres which can deliver the highest degree of centralisation.

To help analyse this pattern, the report sets out four system types of signalling technology.

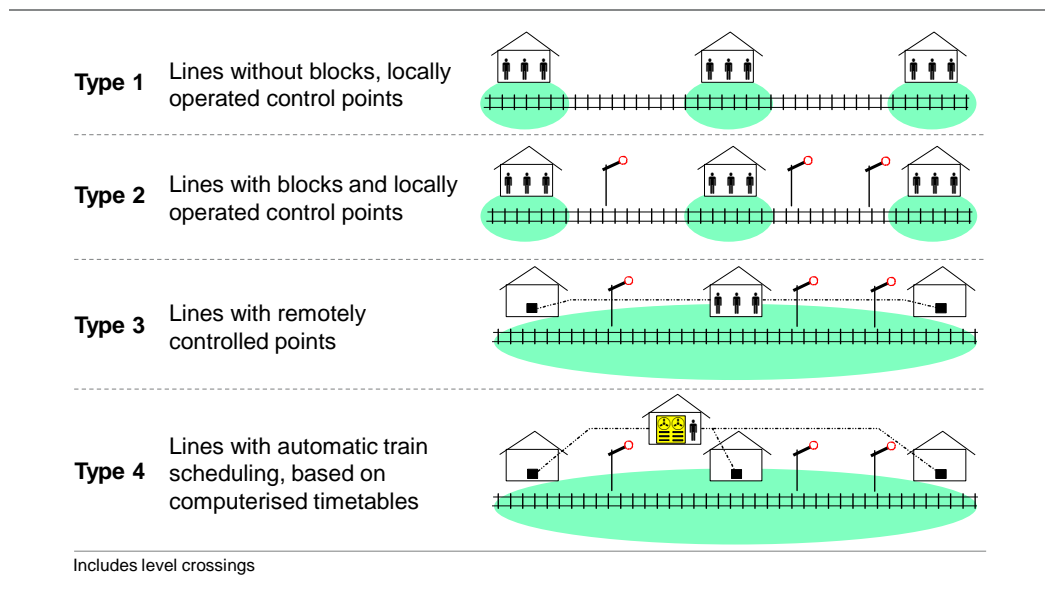


Figure 13: System types

System Type 1:

- Signalling control points with locally controlled point operating equipment on non-signalled lines (i.e. have no signals or block controls).
- 'Non block' signalling control points managing local signalling assets (e.g. level crossing monitoring gate boxes)

System Type 2:

- Signalling control points with locally controlled point operating equipment on signalled lines.
- Typically these are mechanical signalling control points, or small signalling control points with a single interlocking, where control of assets is direct without transmission systems.

System Type 3:

- Signalling control points with both locally and remotely controlled point operating equipment and signalling.
- These are signalling control points which control more than one interlocking, controlling interlockings and/or signalling equipment remote to the signal control point via transmission systems.

System Type 4:

- Type 3 signalling control points which are also fitted with automatic route setting and computerised time tables.

As a first step, the network was disaggregated into the different system types for all comparators.

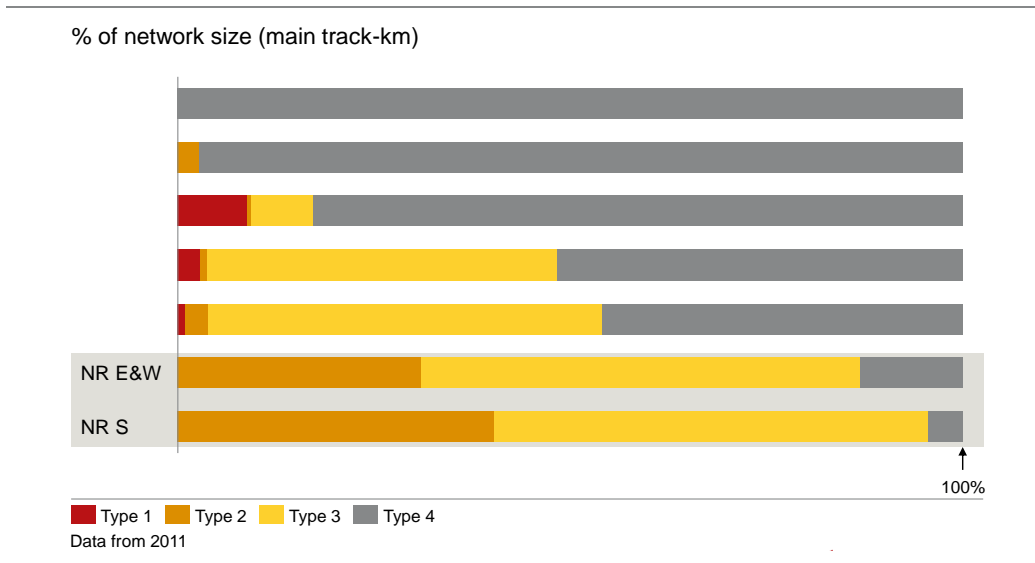


Figure 14: Disaggregation into system types

The orange bars in the picture above indicate that Network Rail still has the highest level (~33%) of locally operated control points. The peer railways have only a few locally controlled network sections with low train utilisation. The share of remote control at the other railways is at least 90% of the entire network as indicated by the yellow and grey bars.

The recent Strategic Business Plan sets out Network Rail's intentions to increase the level of (automated) remote control in Great Britain:

'We have developed an operating strategy that will transform the way in which we control and operate the rail network. By centralising operational control and introducing modern control system technology, we will reduce our annual operating costs by £250 million over 15 years and deliver significant improvements in performance, capacity and customer service. This strategy has been informed by benchmarking our approach with other railways.'

Our operating strategy is a long term programme which will see us migrating operational control into fourteen modern rail operating centres. This will allow us to reduce our frontline operations workforce from 5,600 to less than 1,500 in

the longer term. To date, eight of the new rail operating centres have been built with the remaining six to be completed early in CP5.'

All the organisations in the peer group have either already realised a significant reduction of control points or they are planning to do so until 2020:

- The current re-signalling programme in Denmark will enable traffic management to operate the network with two remaining control centres by the end of 2020. By then the network will be fully equipped with ERTMS level 2. The programme has started in 2009 for Fjernbane (regional and long-distance operations) and S-bane (suburban rail for Copenhagen). The programme including procurement, design, test and roll-out is scheduled for 12 years.
- BLS aims to control their network with ETCS level 1 by 2017 and to centralise network operations in one single control centre. The implementation of ETCS level 1 is embedded in a nationwide strategy to upgrade the entire regular gauge network on ETCS level 1 standard. This programme has started in 1999 and will be completed in 2017.
- Infabel's reduction of signal boxes will enable traffic management with 10 electronic control centres in 2020. The programme has started in 2005, when the network was managed by 368 signal boxes. Until the end of 2015 the number shall be reduced to 31. A transition phase of two years is intended to implement additional technology, and integrate functions and increase the level of automation.
- The Finnish network will be operated by 6 control centres, and the number of locally operated control points is planned to be halved (~15 remaining) by 2020.
- In the Netherlands there are no plans to further centralise network operations. Already 25 years ago, ProRail started to migrate to 12 centralised and fully computerised traffic control centres. Nederlandse Spoorwegen was the first railway in Europe which ordered an electronic interlocking. The concentration process was part of the introduction of the automatic train control, which was completed in the early nineties.

Technology migration typically can lead to significant productivity improvements and ultimately to cost savings in network operations, as indicated in the next figure.

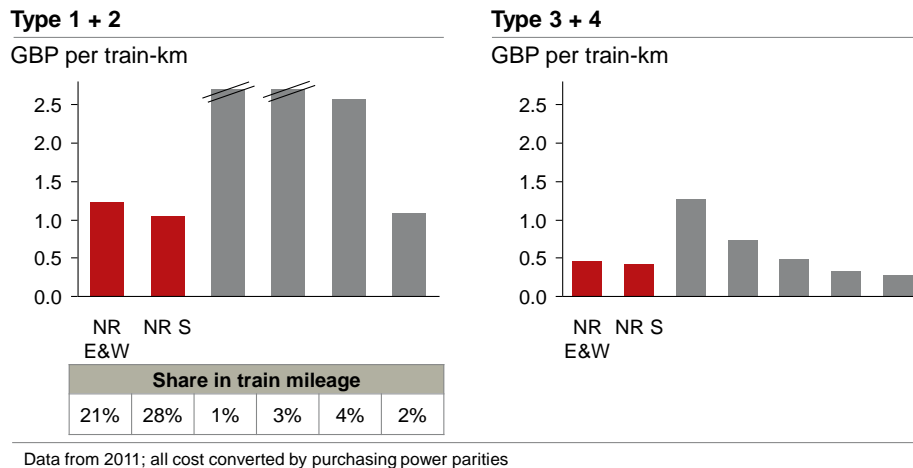


Figure 15: Annual network operations expenditure by system types

The figure above shows that compared to the peer group, both for types 1 and 2 and types 3 and 4 Network Rail has a lower than average cost per train km. This analysis suggests that for current levels of signalling technology, at the current average level of traffic density, Network Rail's operations costs per train km do not compare unfavourably with the peers included in this study. A caveat is for the comparison of locally operated lines (see table below left diagram), as the high cost per train-kilometre is driven by the extremely low train mileage at the comparators.

However, operations expenditure for locally operated lines (types 1 and 2) appear to be more than twice as high as those for remote control (type 3 and 4), and this would suggest a migration strategy. This is reflected in Network Rail's CP5 efficiency plans to reduce annual operations expenditure by GBP 250 million over 15 years, which results in less than 50% of today's expenditure.

3.4 Labour costs and productivity

As well as centralisation of control and technology migration, further differences between the peers were identified for both labour productivity and level of cost. The following questions were addressed in this context:

- How is the impact of centralisation on labour productivity?
- What are the different unit cost levels per full time equivalent in signalling?
- To what extent are unit costs influenced by working arrangements?

The following evaluation looks at whether productivity increases with a higher degree of centralisation, using the productivity indicator of the number of train km controlled per employee.

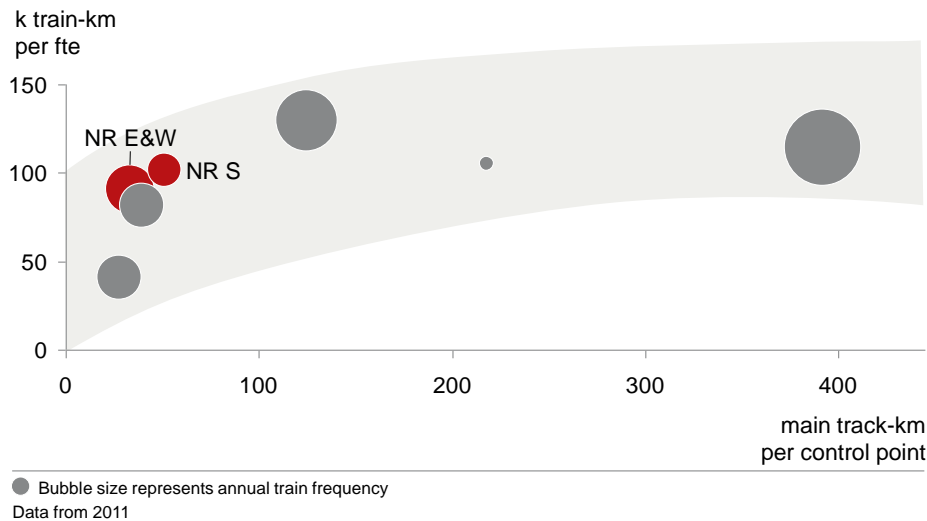


Figure 16: Productivity versus centralisation

In the figure above, the x-axis represents the degree of centralisation; the y-axis illustrates the productivity of network operations, and the size of each bubble represents the average train frequency. Both Network Rail England & Wales and Scotland currently achieve a relatively high productivity despite the low degree of centralisation as indicated by the red bubbles. It appears that Network Rail is on the migration path of 'cost reduction before technology migration', as described in the introduction of this chapter.

The evaluation indicates that centralisation appears not to be the only driver of productivity. As indicated by the bubble size, the higher train frequency increases the likelihood of perturbations that could lead to a higher demand for control staff to deal with these incidents. This could also be the case for the peer with highest degree of centralisation. Another reason for low productivity can be found in disadvantageous labour arrangements.

Total operations costs are predominantly driven by labour costs, as already discussed above, and therefore gross labour costs – i.e. including salaries, insurances, premiums etc. – are clearly part of the explanation for different total cost levels.

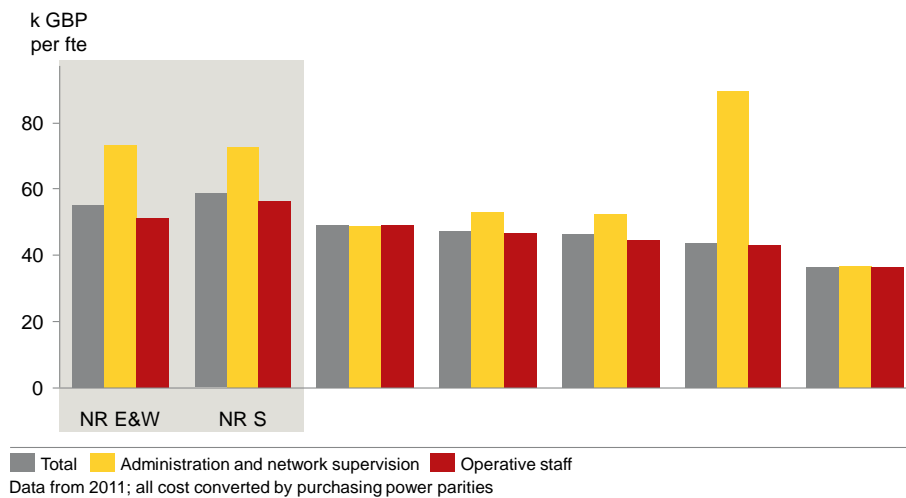


Figure 17: Labour cost levels

The figure above shows that Network Rail's labour cost level, normalised for purchasing power parity, is relatively high compared to the peer group. The red bars represent labour costs for decentralised operative staff at the control points of different system types. The yellow bars illustrate the costs for administrative labour and centralised tasks such as network supervision or timetable planning.

Labour costs are one clear explanatory of total cost levels. These labour costs are heavily influenced by local market conditions and national effects (labour taxes) such as health or unemployment insurance, which are only partially under the control of the railway itself.

In addition, the 'availability' of a full time equivalent is different from country to country, and this needs to be taken into account. The gross working time is defined by the number of working hours an employee is contractually obliged to work. Deducting times for bank holidays, individual holidays, sick leave and other absences (e.g. travel times, training ...) results in net working hours per year and full time equivalent. This is the relevant measure as it indicates the effective time an employee is available for work.

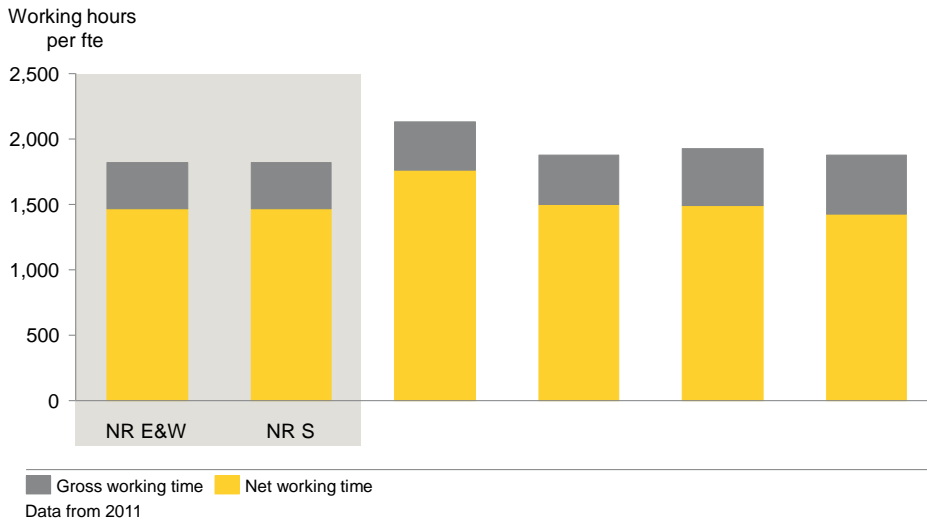


Figure 18: Annual working hours per full time equivalent

Information has been collected for gross and net working hours of the participating railway organisations. The net working time of Network Rail's operations staff is at the lower end of the peer group, as indicated by the yellow bars. This has several causes, one of which is the number of working hours per week which the employees are contractually obliged to work.

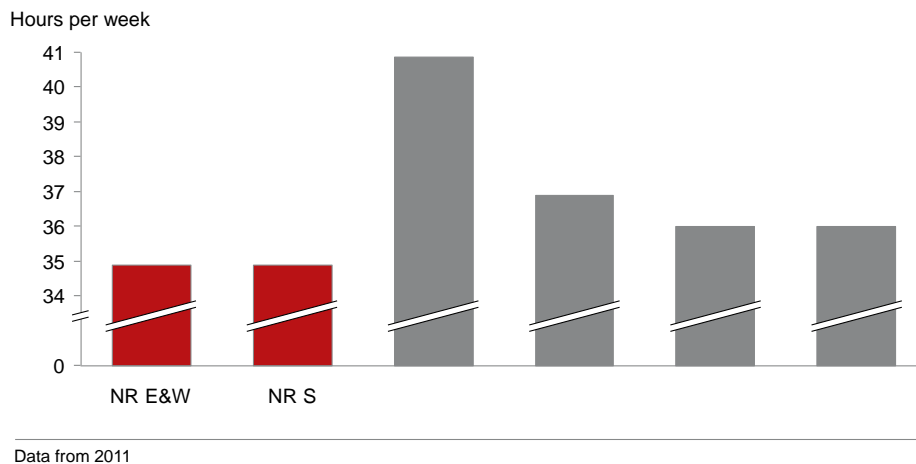
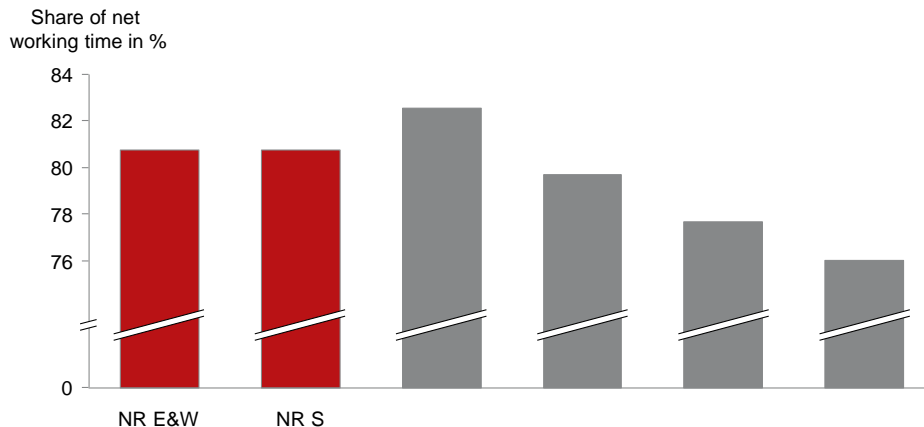


Figure 19: Gross working time

The comparison shows that all peers have a higher number of weekly working hours in network operations than Network Rail. Given that fact, it is of further interest how much of the contractual working time is left available to carry out the job. The ratio of net to gross working time is shown in the next graph.

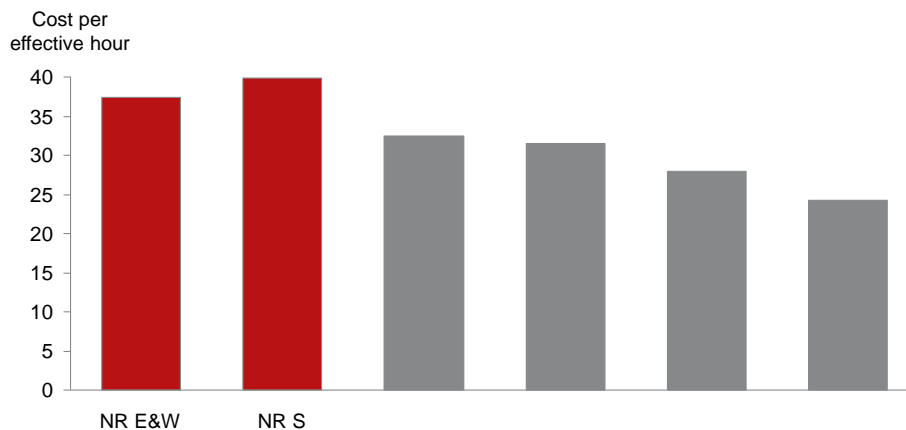


Data from 2011

Figure 20: Effective working time (after deducting absences)

Network Rail staff achieve a relatively high share of net working time, even if they have the smallest number of weekly working hours and also a relatively low number of total net working hours as seen above.

Dividing the average labour cost level by the number of net working hours results in an average cost level per available working hour.



Data from 2011; all cost converted by purchasing power parities

Figure 21: Labour costs

Network Rail's cost per hour is the highest in the peer group, as illustrated above. This is the result of a high labour cost level amplified by a relatively low number of net working hours. As a hypothetical conclusion, the total operations cost position of Network Rail would look much better if the comparators railways were to have similar labour cost levels and effective working times.

The combination of both centralisation and efficiency improvements can unlock substantial cost reductions. Several European infrastructure managers have started programmes to centralise control centres and reduce the number of interlockings. This is an opportunity to reduce the number of staff and increase the productivity of manned control centres. The full savings potential can only be unlocked by a number of additional measures aiming at an improvement of efficiency such as

- IT-based traffic planning and decision support to dispatchers
- A reduction of traffic perturbations which create additional workload
- The application of sophisticated staffing rules by calculation methods, parameters and time values
- An increase of productive working time by shift flexibility, multitasking, part-time work, management of take-over times and the optimisation of working hours
- A reduction of hourly cost of labour by increasing net working hours

A good practice example was presented by one of the peers of the study. The organisation developed an approach and a calculation model to optimise the staffing at control centres, taking into consideration the maximum output achieved in trains per hour. The approach consists of three elements:

- A spreadsheet mapping the current staff roster against the 24 hour train profile, visualizing periods of over- and understaffing;
- A checklist which is then applied to consider local conditions of individual control centres which are not reflected in the model;
- A risk evaluation assessing the major impacts of changing the staffing, e.g. the risk of more vulnerable operations or insufficient traffic information.

The application of this tool resulted in a number of improvements:

- Human resources have been better allocated to control centres which also led to reduction of staff;
- The model provided more insight into longer term staff needs and provided a better overview of recruiting needs;
- Despite the reduction in capacity staff works more effectively, handling significantly more possessions and ad hoc situations;
- The transparency of the approach and the involvement of the staff has increased the level of motivation.

3.5 Conclusions

Network Rail currently has the least centralised network operations within the peer group, i.e. a high number of manned control points and therefore a large operational workforce. However, for the density of service provided Network Rail has below average costs per train km.

This comparison might be slightly misleading as the network size together with a good train frequency directly results into a high train mileage and therefore into an advantageous efficiency position. This becomes visible especially in the cost comparison of system types where the comparators are much more expensive, as only a fraction of the total train mileage is produced in locally operated network sections.

The analysis of the most important driver of operations expenditure showed that Network Rail has the highest labour unit costs in the peer group due to a relatively high labour cost level and because its control staff work the lowest number of hours per week.

Almost every railway in the peer group plans to further centralise network operations. Most of the programmes cover time spans of 15 to 20 years, going through several phases of consolidation. In some cases transition phases are added to ensure that the new technology can unlock best its benefits, e.g. with regards to automation and rationalisation. Target numbers of central control centres range from one to twelve.

The operating strategy set out in its Strategic Business Plan for CP5 would appear to bring Network Rail to the leading position within this peer group in terms of centralisation of operations, and – assuming no change in the peers – in terms of operations efficiency. However, it needs to be kept in mind that the scope of this study was to look at operations, and it has not considered capital investment, and therefore does not take account of either the investment needed to achieve this change or the relative length of the re-investment cycle, and hence whole life cost, for different signalling technologies (e.g. electromechanical and electronic).

However, the choice of signalling and control technology needs to be appropriate for the density of service and line speed. For example, lines supporting a low density of traffic lines may be equipped with low cost remote controlled solutions, whereas areas with high train frequencies and more complex service patterns will need a higher level of sophistication in the technology used to deliver robust and reliable train services.

In addition, network sections with an already high degree of centralised control (i.e. types 3 and 4) should aim to be more efficient by increasing the ratio of available working hours and by optimised roster plans aligned to the respective traffic profile and by flexible working rules.

4. Expenditure on support in railway infrastructure

An organisation's support functions enable the effective operation of the business' core activities. These support functions are very heterogeneous, consisting of a number of individual functions that perform very different tasks. Results from previous overhead analyses of public transport companies in Europe, carried out by civity, have identified challenges such as lack of service orientation, poor productivity or staff competency issues, resulting in low motivation and performance.

The classic overhead with its sub-functions is a crucial element in a company's organisation. Representing 8% of Network Rail's current expenditure, it is significant from a cost perspective. Furthermore the level of service provided by the corporate support functions is of a high importance to the business units they serve.

Support functions can be carried out at different organisational levels within a railway. Therefore, all the functions reviewed were described explicitly by activity, and all the individual work activities / task descriptions of the peers were matched to Network Rail's structure. In this way both centralised and decentralised activities were defined and captured accurately.

In the course of this benchmarking exercise, the following data were collected for each function:

- Headcounts in terms of full time equivalents,
- Total costs,
- Share of staff costs.

Network Rail's overhead is structured across several support functions. As illustrated in the bar chart below, six functions cover nearly 90% of Network Rail's support functions expenditure. Therefore in order to focus effectively on cost efficiency, it was agreed with ORR to compare these six functions with the international peer group.

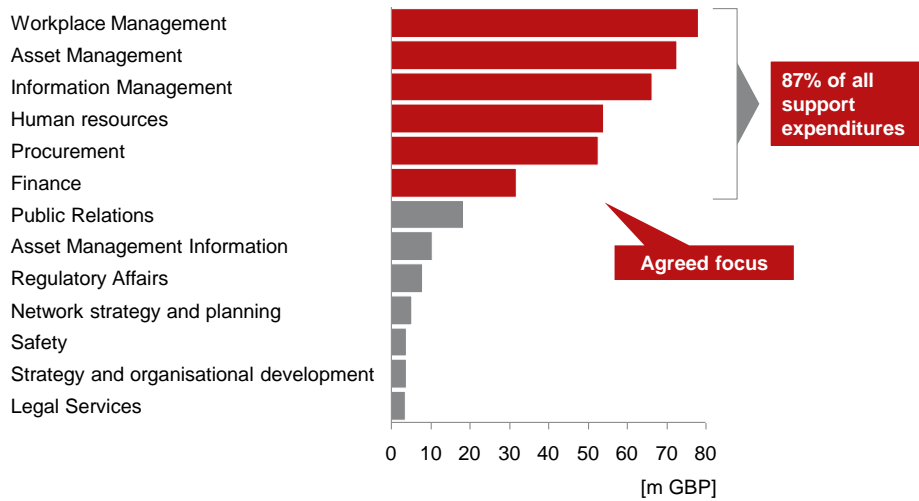


Figure 22: Network Rail's support function expenditure 2011-12

At the comparator organisations as well, the largest share of expenditure is spent on these six key functions, as illustrated in the next graph. However, the comparison also depicts a very different distribution of expenditure by function. Whilst the percentage of budgets dedicated to finance is fairly similar, the share of expenditure on asset management and other functions varies broadly.

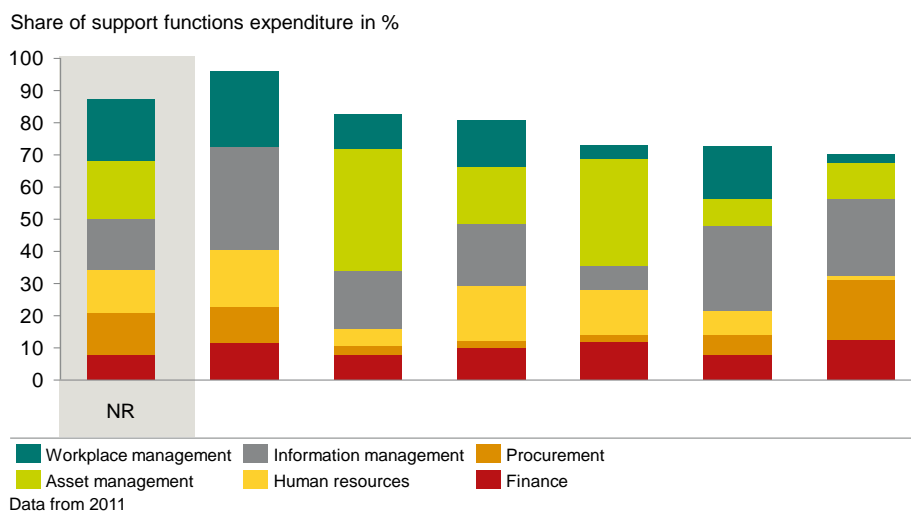
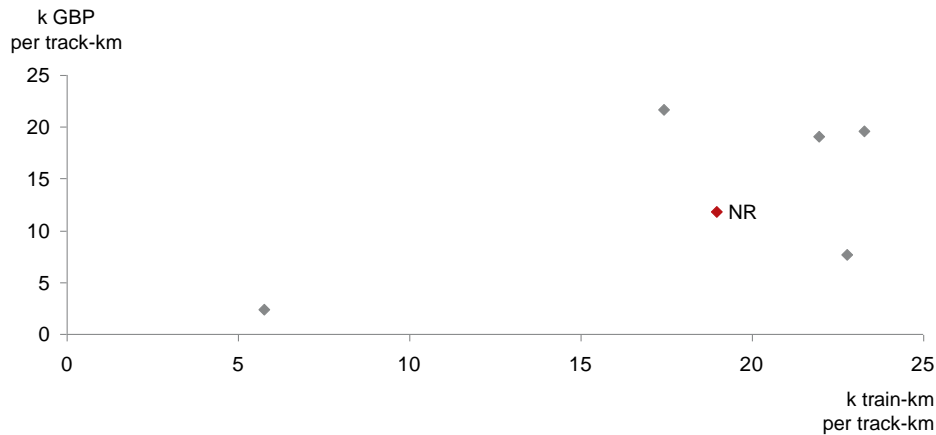


Figure 23: Share of Network Rail's top six functions in other railway organisations

Infrastructure expenditure can be related to the network size in terms of track-kilometres as a key indicator of the size of the organisation. Network utilisation is also an important cost driver; the higher the train frequencies, the more core activities of infrastructure management (i.e. maintenance and renewals) are needed. Thus also a higher share of support could be expected.

The next evaluation identifies the position of the peers in terms of network utilisation and support functions expenditure.



Data from 2011; all cost converted by purchasing power parities

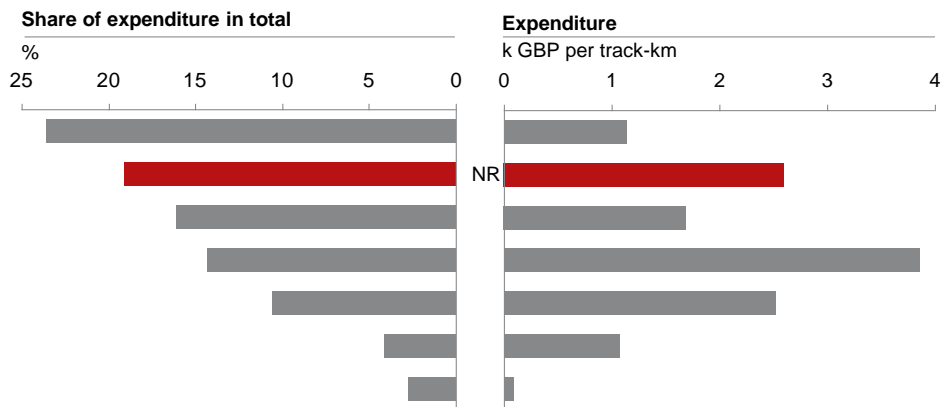
Figure 24: Selected support functions expenditure versus train frequency

In the figure above, the x-axis represents the annual network utilisation measured as train frequency. The y-axis illustrates the cost efficiency represented by the sum of expenditure across the six selected support functions related to the network size. Network Rail is in the middle of the peer group. It is not surprising that the comparators with higher train frequencies also have a higher support expenditure level compared to the outlier peer with a low density of service. However, a direct impact between utilisation and cost cannot be derived without having analysed the intensity and output quality of the support functions in detail.

The results for each individual support function are described in the following chapters.

4.1 Workplace management

Workplace management covers the corporate cost for accommodation (rent) and facility management. It has been agreed with Network Rail to exclude the costs of utilities (i.e. electricity, gas, water) as well as carbon tax and land and property development, as these operating costs cannot be assigned to those workplaces we considered in the study.

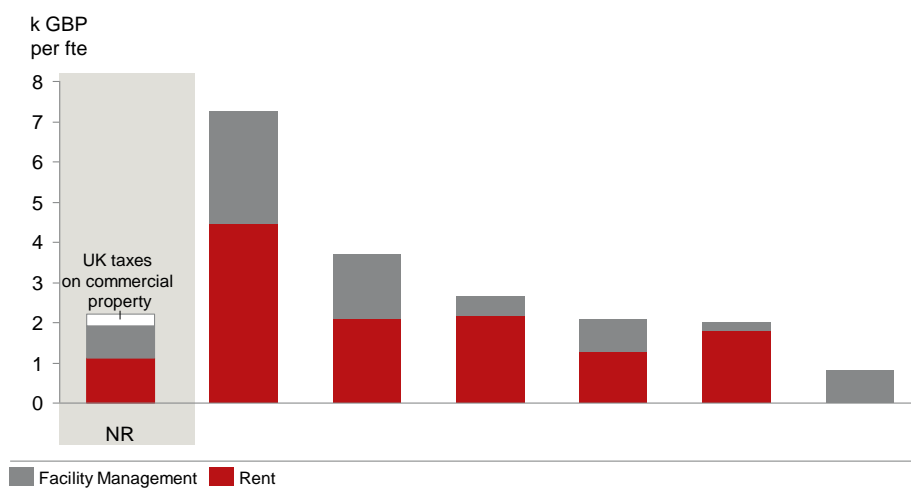


Data from 2011; all cost converted by purchasing power parities

Figure 25: Workplace management expenditure

The diagram on the left shows that workplace management is a large cost driver for many railways with a share of 10% or above. At two railways this function is less significant. Network Rail's expenditure is ranked second highest and with 19% workplace management accounts for the largest share of Network Rail's total support expenditure. In relation to the size of the network (right diagram), Network Rail's expenditure for workplace management is the second highest in the peer group, although significantly below the highest level.

If the expenditure on workplace management is related to the total number of staff Network Rail's unit cost per full time equivalent are closer to the lower end.



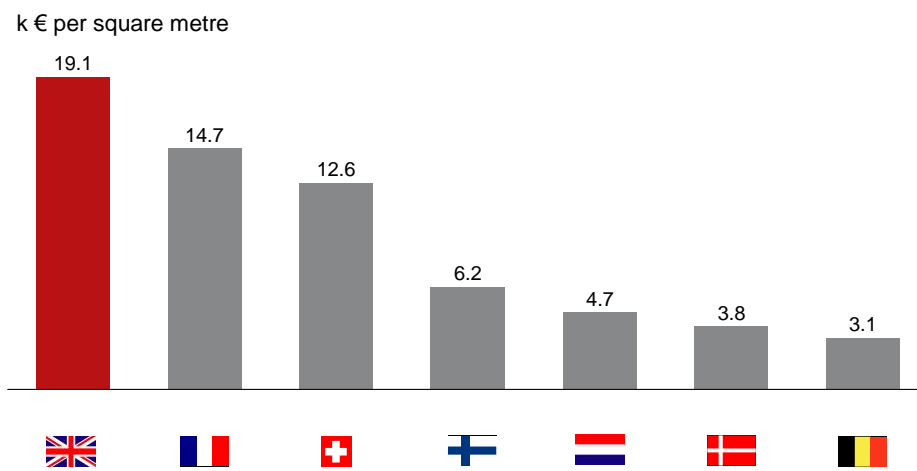
Data from 2011; all cost converted by purchasing power parities

Figure 26: Composition of workplace management expenditure

Rent accounts for only half the workplace management costs at Network Rail. The comparison also shows that facility management costs are high relative to the peer group.

The limited data available does not allow for an accurate assessment of the railways' relative efficiency. Nevertheless, some observations need to be kept in mind for a meaningful interpretation:

- The key cost driver is the market price for commercial property in different countries or cities. This has an impact on an infrastructure manager's decision on whether to rent or own. Thus a comparison with other UK organisations, in comparable locations, would be more meaningful than with international railway organisations situated in different locations.
- The share of rent depends on the area of rented workplaces, which differs significantly among the peer group. One railway does not pay rents at all as it owns all its offices. Also local market conditions have a high impact on rental prices.
- The amount of money spent for facility management depends on the floor area of the workplaces, the condition of facilities and the service quality level. Some cost saving opportunities may be found through the outsourcing of facility management.
- UK taxes on commercial property account for a significant share (~13%) of workplace management costs, which is not the case for the peers.



Source: <http://www.globalpropertyguide.com/Europe/square-meter-prices>

Figure 27: Apartment price in capital city

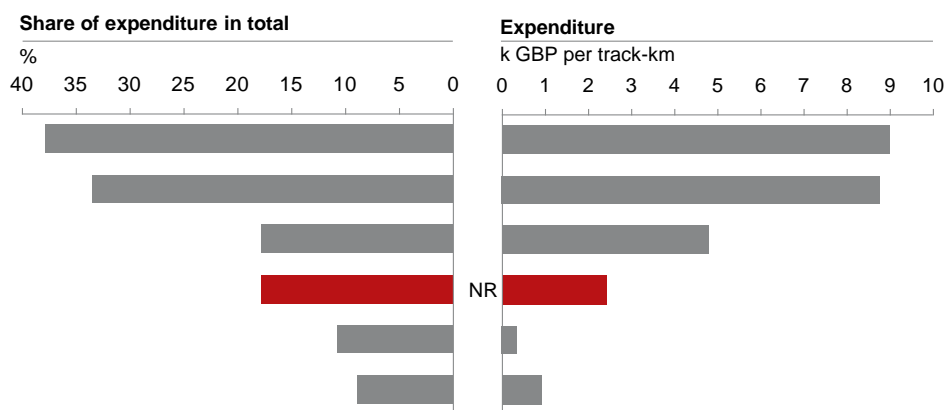
A comparison of current market prices emphasises the large range of costs for housing between countries and cities. A future more in-depth analysis should

aim to identify the underlying reasons of all the factors set out above. The focus should be on those costs which are under the direct control of the infrastructure manager such as service quality of the facility management or the area and size of workplaces, e.g. square metres per employee or single offices compared to open plan offices.

Network Rail aims to achieve 28% efficiency improvement in CP5 (i.e. opex costs in FY 13/14 and FY 18/19) for property (workplace management).

4.2 Asset management

Asset management covers all railway infrastructure assets, i.e. track, signalling, power supplies, communication systems, civil structures. It includes a range of functions such as development of design, standards and policies, system solutions such as modelling & decision support tools, innovation, research and development, etc. All the railways included in the study, confirmed consistently that their asset management function is responsible for all these activities. Of course, the volume, intensity and output will differ between organisations.



Data from 2011; all cost converted by purchasing power parities

Figure 28: Asset management expenditure

The comparison in the figure above shows that expenditure related to network size differs significantly among the peers. Asset management represents more than one third of total support functions at the two peers with the highest expenditure per track-kilometre.

There are two factors to be considered that might explain the large spread in cost levels: economies of scale and outsourcing. A large network size has a direct 'positive' effect on the unit cost per kilometre. In addition a large

organisation is expected to achieve some benefits as activities such as strategy and business improvement are more or less independent from network size. Other activities such as research and development or system solutions might be fully outsourced to the industry. In such cases, this support expenditure would only be visible on the invoices of the contractors, most probably as capital expenditure on infrastructure assets.

However the study was not able to obtain clarity on the volume of each activity or the depth and quality to which the activities were performed. A much better understanding is needed in order to draw any formal conclusions on the efficiency of the railways included in the study.

The analysis would benefit from a more detailed breakdown both by staff numbers and by costs. A functional structure should be disaggregated into key activities on which infrastructure managers spend the majority of their budgets. This could be analysed through guiding questions such as:

- Development of asset strategies and policies: What is strategically most important and why?
- Innovation and research, development of design standards: What needs to be 'invented' internally, or what does already exist and can simply be copied?
- Asset information planning and controlling: Which information is needed and finally used to optimise asset life cycle costs?
- Decision support tools and modelling: Which models and tools are applied, are those standard applications, what can be outsourced?

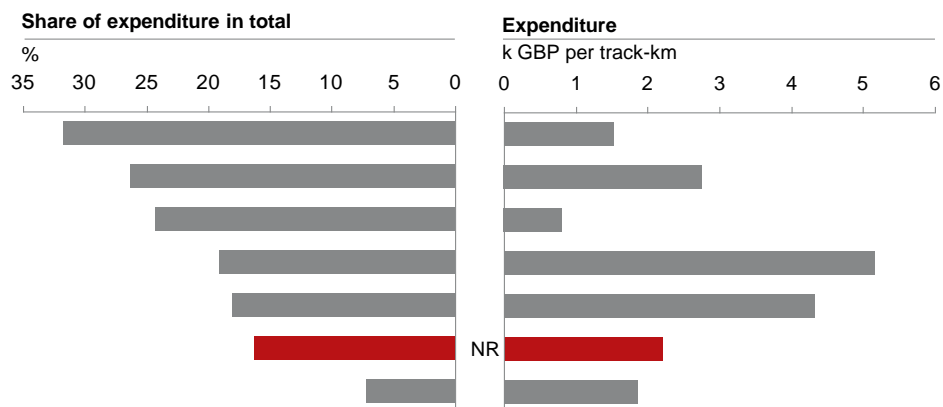
A multilateral Asset Management Club Project carried out by the consultants of civity with seven European national railway infrastructure managers, including Network Rail, between 2008 and 2010 identified different philosophies as well as various maturity grades in some of those areas. A further in-depth analysis should look at the degree of outsourcing as well as on intensity, complexity and quality of internal activities and outputs. This will help to understand the amount of resources (manpower and money) assigned to each activity and to identify manageable cost drivers within asset management.

A maturity assessment of Network Rail's Asset Management capability⁶ identified room for improvement in areas such as asset knowledge & data, the evaluation of opex and the rationalisation & disposal of assets.

Network Rail aims to achieve 17% efficiency improvement in CP5 (i.e. opex costs in FY 13/14 and FY 18/19) for asset management services.

4.3 Information management

This function covers services such as testing new technology, user helpdesk, managing relationships with internal customers, provision, operation, support of IT infrastructure and applications. IT related directly to railway operations (e.g. for traffic control) is not covered in this study. The costs here only include operations expenditure but not capital expenditure such as depreciation of hardware and software.



Data from 2011; all cost converted by purchasing power parities

Figure 29: Information management expenditure

The diagram on the left shows that expenditure for information management is more pronounced at most of the comparators. Compared to the total size of the network (right diagram), Network Rail's expenditure on information management is in the middle of the peer group. Expenditure has also been related to the number of IT accounts as this is expected to be a key driver of information management.

⁶ 2011 AMEM Assessment, Asset Management Consulting Limited (AMCL)

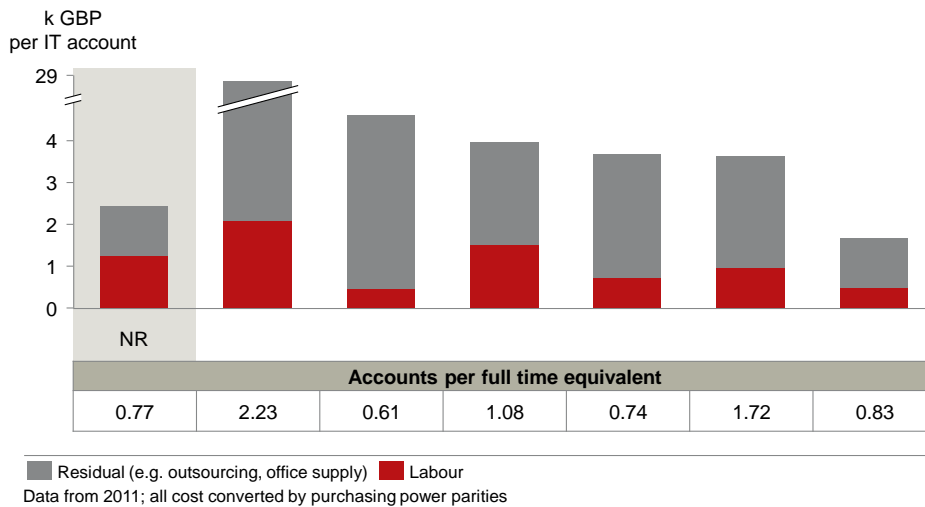


Figure 30: Composition of information management expenditure

According to figure 30, the cost of information management per IT account is low compared to the comparator railways. Although it should be noted that the number of IT accounts per staff full time equivalent is very high for two of the comparator railways.

Total expenditure is also driven by external IT projects, which is the case for the outlier in the graph above. The red bar indicates the share of own labour in total information management expenditure, which shows that Network Rail has the largest share.

As with the support functions discussed earlier, information management needs to be analysed in more detail in order to understand what kind of services and activities are behind the figures. As with workplace management, a comparison with other UK located organisations might be more meaningful as railway related hardware and software applications are not considered here.

A more comprehensive analysis should also consider capital costs that were excluded from this benchmarking. Subjects to be analysed include:

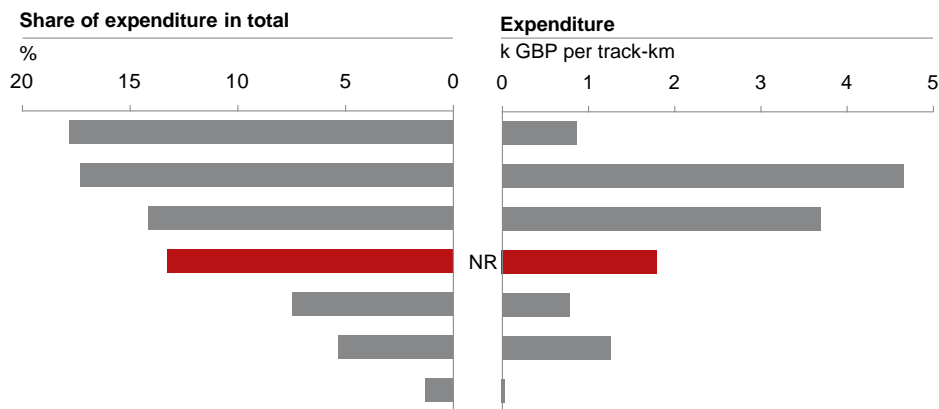
- Strategy and scope of information management: What kind of hardware and office software is needed? What is really needed to support decision making, or what is 'just generating data graveyards'? What are the trends, where are the priorities?
- Outsourcing: What services need to be delivered internally, what could be purchased on demand?

- Internal project management: Time management, cost and budget controlling, functionality, quality assurance, definition of standards, critical assessment of availability of systems and support staff etc.

A next step in further work should consider cost drivers like the number of users and software licenses, data volume, status of technology, reaction rates of the helpdesk etc.

4.4 Human resources

Human resources cover classical functions such as personnel management, recruiting services, training or external agencies.



Data from 2011; all cost converted by purchasing power parities

Figure 31: Human resources expenditure

The diagram on the left shows that with a share of 10% or above human resources is a large cost driver for most peers. Network Rail's expenditure for human resources in relation to the network size is in the middle of the peer group as indicated by the right diagram.

The graph below shows the total number of staff, on average, that each staff member in the human resource department is responsible for.

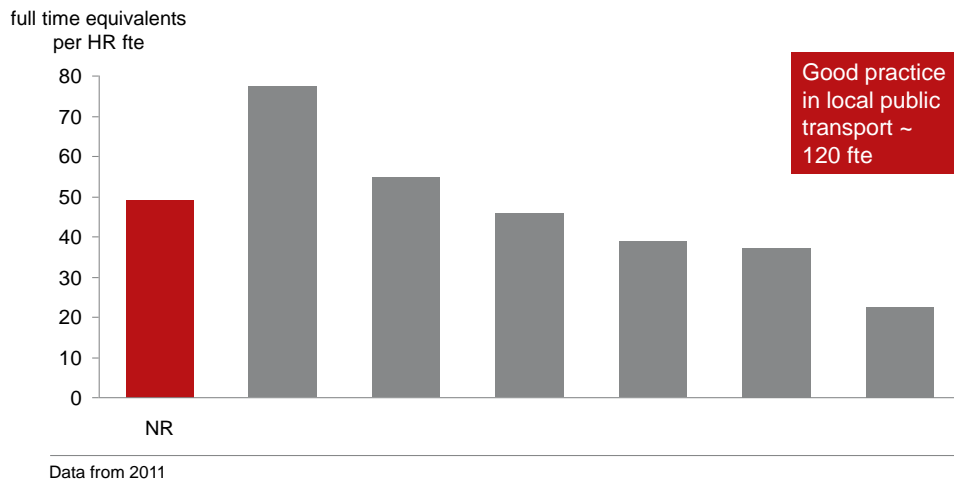


Figure 32: Human resources staff care

The comparison shows that Network Rail's HR 'productivity' – measured in full time equivalents per HR employee – is slightly higher than average. Nevertheless, good practice (e.g. in local public transport companies⁷) is much higher.

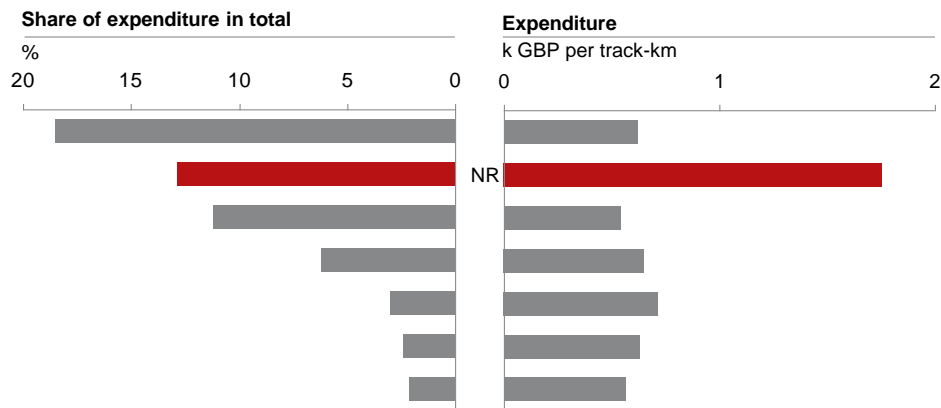
Again, further work is needed to disaggregate the activities within the HR function which are carried out by the railway's own staff. In addition, sub-contracted services, e.g. recruiting, could be measured by a success rate such as cost per applicant. Further cost differences could result from the intensity and quality of activities such as recruiting activities, training and education or legal issues.

Network Rail aims to achieve 22% efficiency improvement in CP5 (i.e. opex costs in FY 13/14 and FY 18/19) for human resources.

⁷ Based on research by civity in the German public transport industry

4.5 Procurement

Procurement covers functions such as sourcing and category management, supplier development, or cost claim management.



Data from 2011; all cost converted by purchasing power parities

Figure 33: Procurement expenditure

Whereas the share of procurement expenditure shows a large bandwidth between 2% and 20%, the expenditure related to the network size is relatively close between peers, except for Network Rail spending about twice as much per track kilometre as peers spend on average.

Besides network size, there are of course other cost drivers such as the degree of outsourcing or the budgets available for investments which can lead to very different spending levels. The financial value of goods and services purchased per employee in the procurement department was chosen as a metric to give an indication on each comparator's productivity. Network Rail's procurement staff generates comparatively low procurement volumes (see figure 34).

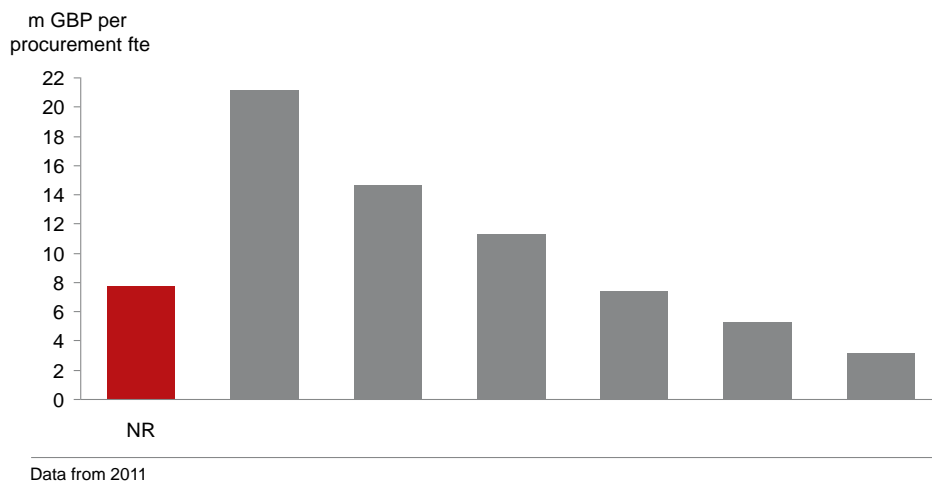


Figure 34: Procurement purchase volume

A railway with a high degree of outsourcing does not necessarily need many resources for material management, if this is already done by their contractor. In addition, economies of scale can drive up this productivity parameter by an optimised strategic investment planning. This could lead to more planning stability by avoiding investment peaks and troughs, allowing a relatively constant utilisation of internal resources.

Over the last few years, efficiency has been benchmarked, by Network Rail, for all procurement units and they have started to reduce costs and headcount significantly⁸. In CP5, Network Rail aims to achieve 28% efficiency improvement (i.e. opex costs in FY 13/14 and FY 18/19) for contracts & procurement.

⁸ Review of Network Rail's Supply Chain Management, civity, May 2012

4.6 Finance

Finance covers all accounting activities such as internal or external audit, annual financial accounts, controlling, or reporting of costs and KPIs.

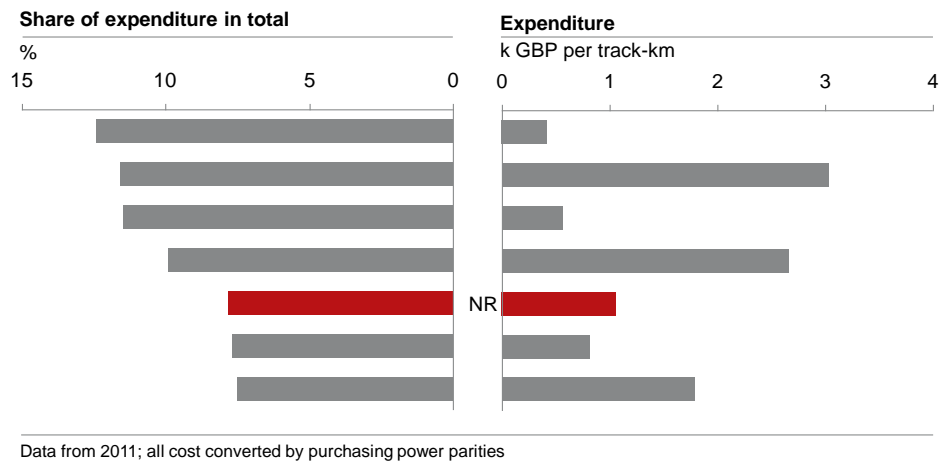


Figure 35: Finance expenditure

Finance represents approximately 10% of all support functions expenditure among the international peer group as illustrated in the diagram on the left. Network Rail's expenditure on finance on a per track-kilometre basis is at a relatively low level, see also diagram on the right. The total annual expenditure of an organisation is seen as a key driver for the size of the finance function. As spend increases, financial transactions and controlling activities increase as well, resulting in more resources needed in this function.

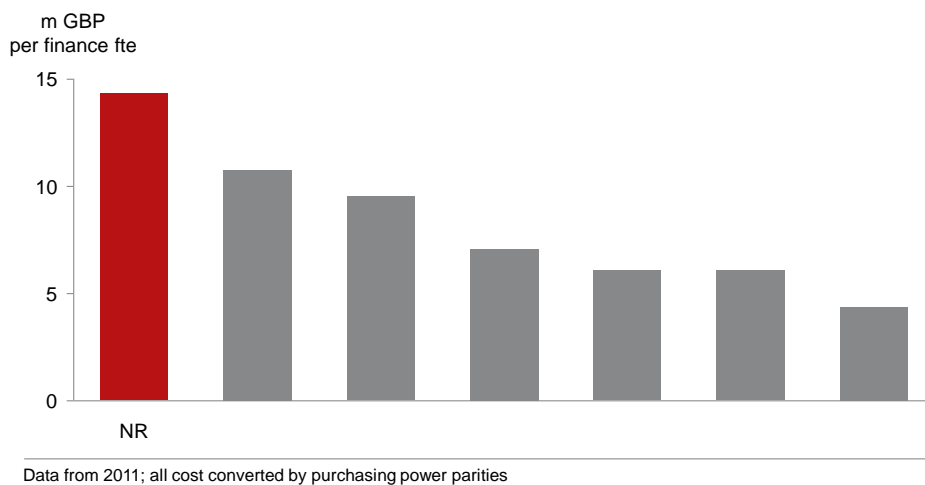


Figure 36: Total infrastructure expenditure

Total infrastructure expenditure covers all costs for infrastructure maintenance, renewals, enhancement, operations, support and – where applicable – the appropriate share of the holding. This figure was related to the number of employees in the finance department. The comparison shows Network Rail in the highest position.

Again, the figures available do not allow us to draw any conclusions on finance efficiency, as the total expenditure volume can be driven by several factors including infrastructure condition or budget availability.

For example, Network Rail is currently spending more than in previous years in order to renew and modernise the UK rail network, which could be another driver for high expenditure per full time equivalent. Further work could be carried out to disaggregate costs and headcounts into activities and analyse performance indicators such as the total number of bookings, time per booking, number of invoices, number of payrolls, or the intensity of reporting. Further cost differences could be found in the intensity and quality of activities such as internal and external audits, cash management, invoicing, financial planning and budgeting processes.

Network Rail aims to achieve 16% efficiency improvement in CP5 (i.e. opex costs in FY 13/14 and FY 18/19) for finance.

4.7 Conclusions

This benchmarking provides a very high level comparison of support functions for railway infrastructure managers. The positioning of Network Rail in relation to its peers is based on total expenditure, staff size, and labour costs only. The level of Network Rail's total support functions expenditure (representing 8% of the total annual expenditure), in relation to the network size, is in the middle of the peer group. This is also true for each of the individual functions, except for procurement where Network Rail's share is at the higher end of the peer group.

Nevertheless, the cost of some of those support functions (e.g. human resources, information management) is strongly influenced by the local non-rail market cost of specific skills. In addition, all functional costs are aggregated from a number of sub-functions, which were not analysed in the course of this study. Thus, the current positioning cannot be used to draw reliable conclusions on Network Rail's efficiency. In order to get additional value from this analysis, it would be necessary to disaggregate these costs.

The main limitation of this analysis is that it has not been possible to quantify fully the outputs of each of the support functions. Whilst it is quite possible to compare the unit costs of the inputs (i.e. cost per full time equivalent), this does not take account of the number of tasks undertaken by these staff or the effectiveness or quality to which they are delivered.

Furthermore we would recommend a focus on the quality of the outputs of the support functions, in order to derive robust efficiency assumptions.

Appendix

Interviews

Railway	Function	Date
Banedanmark	Operations, Support	28 September 2012
SNCF Infra	Support	18 October 2012 7 November 2012
Finnish Transport Agency	Operations, Support	19 October 2012
ProRail	Operations, Support	25 October 2012
BLS Netz	Operations, Support	1 November 2012
Infrabel	Operations, Support	9 November 2012
Network Rail	Operations, Support	22 November 2012

Table 1: Peer interviews

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