PRORATA Final Report – Electronic Version

The report comprises 4 Word files and a number of supporting files containing graphics, charts and tables in Excel, PowerPoint and Adobe Acrobat (PDF) format.

Hidden text in the main text file (frfp-maintext.doc) indicates the point in the report at which each of the supporting files is first referred to.

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EXECUTIVE SUMMARY

1 INTRODUCTION

This is the Executive Summary of the PRORATA project, a research and development study to examine the Profitability of Rail Transport and Adaptability of Railways. The Study commenced in January 1997.

The particular focus of PRORATA is on longer distance, and particularly international, passenger rail transport. The scope of the study covers high speed trains and night trains as well as conventional inter-regional passenger trains. The principal geographical setting is the EU, however issues of relevance to external relations with Central and Eastern Europe - on TEN corridors - and intra-EU movements via Swiss rail corridors will also be addressed.

The principal **goal** of the project is:

> to study and to propose measures to increase the competitiveness of railways in long distance and international traffic.

The essence of the project has been the evaluation of the PRORATA methodology. The methodology is an evolving one, with each Workpackage extending the Study Team's understanding of the issues involved and of the series of analyses and decisions that need to be made in following the method through. Development of the PRORATA has been a largely iterative process, with each Workpackage relying on additional aspects of the work.

A simplified flow-chart of the updated PRORATA methodology is shown in Figure 0.1. see attached file frfp-fig01

2 BENCHMARKING

The starting point for the PRORATA methodology is an assessment of the current situation of the client railway.

A range of performance measures are already likely to be generated by a railway from internal and published accounting data. These measures may vary from railway to railway, being selected to

permit comparison the organisation's performance against both its own performance in earlier years and performance targets that have been set for it by government or a regulatory authority.

A selection of accounting data is also submitted to UIC each year, for inclusion in their annual publication "International Railway Statistics". The same or similar performance measures can be derived for other railways from this data. This will permit the railway's performance to be compared with other railways or against international benchmarks.

Measures can be selected to examine: the railway's overall performance (e.g. cost per Gross Tonne km, cost recovery ratio); or to focus in on a particular aspect of operations. PRORATA presented a sample set of comparative performance measures and has also used absolute measures to test the hypothesis that there is a link between efficiency of operation and a railway's Adaptability Index score.

A well chosen set of performance measures will give an indication of the areas of operational and financial concern in the railway's performance.

3 ADAPTABILITY

In a parallel exercise, the railway's score under the Adaptability Index needs to be estimated. The Adaptability Index can be thought of as a diagnostic tool, giving both:

- an empirical measure of the railway's position in the hierarchy of organisational structures; and

- an indication, via the individual powers contributing to the Power Index score, of the organisational and empowerment weaknesses of the railway.

Further, there is a relationship between a railway's Adaptability and its economic efficiency. Therefore by calculating railway's adaptability index at a point in time, it is possible to highlight potential further operational efficiency savings.

Adaptability has been defined as the product of a railway's Power and Accountability, as follows:

$$A = P*C,$$

where: A = Adaptability;
P = Power; and
C = Accountability

Power Index

The Power Index assesses railway management's freedom to determine its own: costs; scope of operations; tariff rates; and internal organisation, unimpeded by any imposed government duties, for example, social service obligations. A selection of management powers, weighted according to their relative importance, was developed by PRORATA.

Accountability Index

Accountability is a measure of management's incentive to make changes in response to shifts in the market or regulatory environment by virtue of being responsible for elements of the organisation's performance. The PRORATA methodology uses a financial measure of accountability:

$$C = R_c / (R_c + R_s),$$

Where: R_c is the cost of commercial operations; and
R_s is the cost of non-commercial operations.

Economic Efficiency and Adaptability

The study examined the relationship between adaptability and economic efficiency. Based on cost and operations data from "International Railway Statistics" and Adaptability Indices from a limited sample of EU railways.

It concluded that "*profitability and economic efficiency of a railway is strongly dependent on its adaptability*". A relationship was defined, in the form of a regression function:

$$G = 21.821* Ln(A) - 34.865,$$

where: A is Adaptability; and
G is Operating Cost/Gross Tonne Km.

This implies that by increasing a railway's Adaptability it is possible to make efficiency gains. These gains can be achieved by selecting and applying the appropriate concepts.

4 SELECTION OF CONCEPTS

The main stage in the PRORATA methodology is the selection of concepts. Different concepts will be appropriate to enhance profitability and efficiency, depending on the railway's current level of efficiency and Adaptability, and on the political / social / economic context in which it operates.

A railway's point of development, power to change, and the responsibility for its own affairs influence the extent to which any single concept is likely to succeed. Further, given that many concepts could potentially be introduced at the same time, priority should be given to developing an overall strategy into which each of the concepts then fit.

Concepts from existing rail best practice were identified, and those from other modes that might be applicable to rail were catalogued. These concepts were structured into a number of families. Two main groups of concepts have been identified:

- concepts that apply in a generic sense, irrespective of organisational form (classified as "within framework" concepts); and

- concepts relate to strategic issues, involving change in the railway's organisation / regulation / ownership structure (classified as "between framework" concepts).

Generic concepts can be introduced by a railway irrespective of organisational structure or institutional framework. However, while they do not implicitly involve organisational change, they may be more effective under some organisational structures than others.

Examples of Generic concepts include: Right Train; Right Time; Total Quality Management; and Safety Management.

Strategic Concepts involve, or are closely associated with, changes in the way that railway organisations are structured, or in the regulatory framework within which they operate.

As indicated in Sections 2 and 3 above, these concepts are often implemented in response to changes in the market or competitive environment. They are more closely associated with empowering management to make rail a more competitive mode than with operational efficiency.

Powers Index

Powers provide the starting point for identifying potential concept. Many concepts, both generic and strategic, can be associated with particular powers or groups of powers.

Most efficiency gains are associated with the "implementing and operational" powers (i.e. those with which generic concepts can be associated), and that further efficiency gains from subtle changes of ownership are, at present, unproven.

The set of powers contributing to the Powers Index score helps to highlight those concepts that are already being implemented by the host railway. The extent to which they are being implemented, or the degree of success currently being experienced with them, will have a bearing on the need to include them in the package of improvement measures. The absence of a power can also highlight gaps, which need to be filled, e.g. by inclusion of the associated concepts in the package.

Filtering of Concepts

Four analytical methods guide selection of the "right" concepts for a railway in its particular operational, organisational and socio-economic context. There were:

- **Cross Sectional Models.** Effectively looking at the broad range of processes taking place within a railway, then benchmarking railways against each other.

- **Time-Series Analysis.** Reviewing historical performance over time, for example, cost recovery ratios and operational effectiveness.

- **Expert Panels Analysis.** Drawing on the past experience (from former railway managers) to identify the most promising concepts.

- **Case Studies.** Specific examples of how to apply each concept and the precise benefits that may be expected.

5 ROUTES TO CHANGE MANAGEMENT

Having chosen a set of concepts, the final step involves the selection of routes of Change Management. The socio-political context within which the railway operates is important in determining practical routes.

The importance of change management should not be underestimated. Many organisations have embarked on ambitious change programs that have failed because steps have been missed out, or ignored.

6 CASE STUDIES

Finally, the full PRORATA methodology has been tested via three Case Studies of recent changes in EU railways, for: the UK; Germany and Sweden.

This has enabled a detailed run-through of the methodology to be undertaken, identifying:

- the Adaptability of the railway;
- its operating cost and performance;
- the socio-political circumstances in which change was being contemplated;
- the concepts and choices available to the owners (Government, in all three cases) and management of the railways;
- the efficiency gains realised during the period of the case study; and
- the concepts (both within- and between-framework) that were being applied; and
- the Change Management choices that needed to be made.
- All three railways achieved significant efficiency gains (20%+) during the period examined in the case studies by

implementing a selection of concepts which accorded with the PRORATA methodology.

It is considered that even greater gains (up to a further 20%, plus revenue enhancement) may be possible, over a longer time period (allowing the full benefits of the concepts to feed through to the organisation's bottom line) or with the full set of concepts that PRORATA might recommend in each railway's circumstances.

It is, however, often necessary to introduce change slowly, and in simple steps, particularly to large, complex organisations such as national railway networks. The PEST analysis can be particularly useful in identifying potential problems and determining the order in which concepts should be introduced.

Overall, the Case Studies demonstrate the practical applicability of the PRORATA methodology to analysing the current situation of a railway and in selecting an optimal path towards greater commercial relevance in the transport market place, and towards enhanced profitability.

It is notable that those railways (BR, DB AG) that had moved to a Business Sector structure during the period of the Case Study both exhibited unit cost savings of around 20% over a 6 year period. SJ, which was studied over a longer period and through a greater organisational change, achieved a higher efficiency gain, of 32%. The PRORATA methodology predicts higher efficiency gains in all cases, but there is clear evidence of a time-lag between the introduction of change and the full benefit being felt.

1. Introduction

1.1 CONTEXT

1.1.1 Railways are central to the notion of a Europe-wide transport network. They are an ideal mode for passenger travel of between 100 and 700km. Railways provide an attractive alternative to the increasingly congested road and air modes, conferring significant economic, environmental and social benefits.

1.1.2 However, transport by rail to, from and within the Community is in decline. Between 1985 and 1995, freight transport by rail contracted by 20% in absolute terms and decreased in relative terms from 28% to 15% market share. Passenger rail traffic grew by 2.5% in absolute terms in the same period, but market share has declined to 6%.

1.1.3 Instead, the main growth has been in road transport, with a doubling in volume of both freight and passenger transport since 1975. This places increasing pressure upon the infrastructure, leading to unacceptable levels of congestion, not just in urban centres, and to environmental degradation.

1.1.4 The challenge facing Europe's railways is to first halt, then reverse, this long-term trend of falling market share and lost traffic, predominantly to road modes.

1.1.5 The extent of this challenge should not be under-estimated. Whilst there are some signs of rail competing effectively with other modes (e.g.: high speed rail) the general trend is that of continuing poor performance, under-investment and low productivity.

1.1.6 The poor financial performance of the rail sector is a particular concern, as this indicates both an inability to compete effectively in the market place and on unsustainable cost structure. If railways are generally perceived as being inefficient, they will lose the support of passengers and investors alike.

1.1.7 The relationship between financial performance, competitiveness and organisational efficiency is central to the future success of the rail sector. It is also the dominant there in the PRORATA Study. This accepts that long-term competitiveness and profitability are each pre-requisites of a sustainable rail sector. Moreover, they cannot be achieved by piece-meal solutions, but require widespread reform and modernisation across a broad front.

1.1.8 There is some scope for optimism. Railways throughout the world are moving towards an increasingly de-regulated, commercial, operating environment. Within the Union this trend is complemented by EU policy, in particular that represented by Directive 91/440 on open access and other matters designed to reform rail's competitive position. In Britain there has been an almost complete transition to private ownership and operation.

1.1.9 The challenge, and the trends underpinning it, are clear, as are the consequences of failure. It is vital that railways meet this challenge and exploit the growing opportunities to reverse recent declines and develop sustainable, commercial, business operations. This challenge was made explicit in the White Paper on Railways[1] which stressed the critical importance of improved commercial performance and greater private sector initiative and involvement in rail operations. The emerging policy context within Europe provides a clear route to addressing the issues central to rail competitiveness.

Policy Background

1.1.10 The fundamental goals of the Common Transport Policy (CTP) are those of the Treaty on European Union. These were clarified further in the Transport White Paper[2]. The Fourth Framework RTD programme in the field of transport was subsequently focused upon achieving the objectives of the CTP.

1.1.11 The Rail Transport Research Programme comprised ten projects, one of which was PRORATA. The programme and the project supports the development of the CTP in a number of respects, including:

- helping to integrate national rail systems into a commercially effective Community-wide network;

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[1] A Strategy for Revitalising the Community's Railways, European Commission White Paper, Brussels, 1996.

[2] The Future Development of a Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility, European Commission White Paper, Brussels, 1994.

- preparing a commercial basis for the forthcoming open access regime, as laid down by directive 91/440;

- developing rail products which effect a modal shift, thus supporting a more efficient, safe and environmentally sustainable transport system.

1.1.12 Other aspects of European transport policy were also interwoven with the aims and ideals of rail policy. For example, policy statements on pricing[3] and on the Citizen's Network[4] each emphasising the importance of a market for transport free from distortions and of the rights of citizens to choose the most efficient mode for their journeys.

1.1.13 A clear policy hierarchy can thus be identified, beginning with global EU transport strategy and following a chain of policy, goals and objectives to arrive at the research tasks, numbered 51 to 56, falling within the Rail Transport component of the Fourth Framework programme which are covered by PRORATA.

1.2 AIMS AND OBJECTIVES OF THE STUDY

1.2.1 The objective of the PRORATA project was to examine the

"Profitability of Rail Transport and Adaptability of Railways".

The Study commenced in January 1997, and continued for 2 years.

1.2.2 The particular focus of PRORATA was on longer distance, and particularly international, passenger rail transport. The scope of the study covered high-speed trains and night trains as well as conventional inter-regional passenger trains. The principal geographical setting was the EU, however issues of relevance to external relations with Central and Eastern Europe - on TEN corridors - and intra-EU movements via Switzerland were also addressed.

1.2.3 The principal **goal** of the project was:

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[3] Green Paper on Fair and Efficient Pricing, European Commission, Brussels, 1995.
[4] Green Paper on a Citizens Network, European Commission, Brussels, 1995.

to study and to propose measures to increase the competitiveness of railways in long distance and international traffic.

1.2.4 The detailed objectives of the project corresponded with Fourth Framework Programme RTD Research Tasks 51 to 56, as follows:

51 to identify traveller's criteria for the selection of one transport mode before another, through an analysis of the positive and negative factors of rail;

52 to make an inventory of the various marketing and product design concepts being implemented by rail;

53 to analyse the concepts being applied by other modes and to compare these with rail products, with a particular focus upon their potential for effecting a modal shift;

54 to propose new or improved marketing strategies for rail;

55 to identify the specific domains within the rail sector where innovative actions are required and to specify the potential benefits from and constraints upon such actions; and

56 to develop practical action plans (i.e. a business process re-engineering methodology) for implementation, including proposals for pilot studies, along with proposals for further development work.

1.2.5 The emphasis of each objective was to identify and develop innovative ideas and proposals for improving the modal share and general competitive position of international and inter-regional railways.

This Report

1.2.6 The study has been completed successfully, producing a methodology for business process re-engineering within the rail sector. This Report presents that methodology – the PRORATA Methodology - in detail.

1.2.7 The intention is to demonstrate the practical application of the methodology by following the logical process of: problem identification; solution selection; and implementation planning. Examples are given of the actual use of a number of elements of the methodology, and of the resulting impact on rail's efficiency and profitability.

1.3 OVERALL PROJECT METHODODLOGY

1.3.1 A systematic method of research was adopted for the PRORATA project in which each of the six Research Tasks which underlie the project formed the basis for a Workpackage. Figure 1.1 illustrates the flow of ideas and information through the six tasks and some of the more significant sub-tasks.

1.3.2 This overall study programme fell into three distinct phases, each of which needed to be substantially complete before the next could commence, but with considerable overlap and iteration within each. These phases were:

- **Researching** - Data collection and analysis, market research, comparative efficiency analysis, development and application of a competitiveness framework, identification of rail and other mode concepts - Tasks 51-53;

- **Filtering** - Identification of successful concepts and consideration of the practicality of applying them to rail - Tasks 54 and 55; and

- **Recommending** - Development of implementation and change management plans to apply selected new concepts to rail - Task 56.

1.3.3 This Report represents the culmination of the project team's research - the methodology derived as a result of the research. A number of interim reports – Deliverables and Technical Annexes – were presented to the Commission during the course of the study, each covering the team's work on a task or sub-task.

1.3.4 There are a number of areas in which more information on the team's work than can be incorporated in this volume, or detail on the research findings, may be useful. A companion volume of Technical Annexes has therefore been prepared. Copies of this, together with the interim reports, where appropriate, may be obtained from the co-ordinating Partner.

1.3.5 A list of the interim reports is presented in Appendix 1.

1.4 STRUCTURE OF THIS REPORT

1.4.1 Following this introduction, Chapter 2 presents a brief, step-by-step overview of the PRORATA Methodology. Each step is then explained in greater detail in the subsequent sections of this report.

1.4.2 Chapter 3 reviews the analytical tools used by the PRORATA project to examine the positive and negative aspects of rail's current performance, operationally, financially, and in the marketplace.

1.4.3 Chapter 4 introduces the concept of the Adaptability of a railway organisation to change, and posits possible links between this, organisational structure and the regulatory framework within which rail operates in each country.

1.4.4 The final element of the operational environment of rail within which change is being contemplated is the socio-political context. Chapter 5 considers Political, Economic, Social and Technological (PEST) considerations that may need to be taken into account.

1.4.5 The project identified many organisational, product and marketing concepts, both from within existing rail best practice and from other modes, that could be used to improve rail's performance and profitability. Chapter 6 presents these, structured into a number of concept families.

1.4.6 Chapter 7 then reviews the analytical methods developed to help identify which concepts are likely to be the most successful for a railway, given its present operational and institutional circumstances.

1.4.7 Identification of a package of measures to improve profitability will not, of itself, guarantee success. Chapter 8 introduces Change Management theory and techniques to the Method, to enhance the prospects of successful implementation of the concepts.

1.4.8 Chapter 9 then presents a case study of the development of Swedish Railways from 1963 to 1998, illustrating the practical application of the PRORATA Method and the degree to which the efficiency results obtained match those predicted by the Methodology's analytical tools.

1.4.9 Finally, Chapter 10 summarises the findings of this research project, and considers areas for further research and application of the Methodology.

2. Overview of the PRORATA Methodology

2.1 INTRODUCTION

2.1.1 The principal output of the project was a method of approach to enhancing rail competitiveness and profitability: the PRORATA methodology. As a preface to the main body of the report, this Section presents a brief review of the PRORATA Methodology.

2.1.2 A simplified flow-chart showing the steps to be followed in applying the Methodology is presented as Figure 2.1. The how and why of each step is expanded on in the following Sections.

2.2 ANALYSIS OF COMPETITIVENESS

2.2.1 The starting point for the PRORATA methodology is an assessment of the current situation of the client railway. The analysis can, broadly be divided into two, examining the supply side – how efficiently the railway is producing its services – and the demand side – how well it is meeting customer's aspirations.

Benchmarking

2.2.2 Most railways are already likely to be producing a range of performance measures, generated from internal and published management accounting data. These measures may vary from railway to railway, being selected to permit comparison of the organisation's performance against both its own performance in earlier years and performance targets that have been set for it by government or a regulatory authority.

2.2.3 A selection of accounting data is also submitted to UIC each year, for inclusion in their annual publication "International Railway Statistics". The same or similar performance measures can be derived for other railways from this data. This will permit the railway's performance to be compared with other railway's or against international benchmarks.

2.2.4 Measures can be selected to examine: the railway's overall performance (e.g. cost per Gross Tonne km, cost recovery ratio); or to focus in on a particular aspect of operations. PRORATA developed a set of tested and productivity measures that identify the comparative performance of a railway, in relation to other railways. The benchmarking methods developed in PRORATA

quantify the comparative efficiency of a railway, allowing the estimation of the extent to which total costs or unit costs deviate from those indicated by best practice.

2.2.5 A well chosen set of performance measures will give an indication of the areas of operational and financial concern in the railway's performance.

Market Research

2.2.6 Some indication of marketing performance can be obtained from the benchmarking exercise – trends in gross traffic levels, revenue per passenger km, passenger km per car km etc. However, these aggregate measures cannot give insight into local markets, or into why demand is rising or falling.

2.2.7 Market Research can give greater information at a dis-aggregate level:

- analysis of local traffic and revenue data will yield revealed preference findings on passenger's mode choice criteria, but this can only inform about the market perception of existing product;

- stated preference interview techniques and focus group meetings can explore the attitudes of travellers (whether rail customers or not) to rail's current services and to potential products not yet on offer.

2.2.8 As part of the PRORATA project, a number of Focus Groups were convened by the study team. The principal findings were:

- homogeneity of views across Europe and across travel markets;
- dissatisfaction with all modes of travel, but particularly rail; and
- a preference for rail to improve the basic product, and particularly customer care, before investing in high speed and high tech services.

2.2.9 A picture emerged of travellers switching modes frequently, using a particular mode only until they had an unsatisfactory trip on it. In these market conditions, if rail were to improve the "basic" rail product –ordinary inter-city or inter-regional services – mode-switching travellers would stay with rail rather than move on again. Rail's patronage and market share could be increased dramatically.

Adaptability

2.2.10 At the heart of the PRORATA methodology lies the concept of adaptability. This defines the extent to which a rail organisation is able to change, to exploit market opportunities or better manage costs. The concept of adaptability runs through the PRORATA method. Adaptability has been defined as the product of a railway's Power and Accountability, as follows:

$$A = P*C,$$

where: A = Adaptability;
P = Power; and
C = Accountability

Power Index

2.2.11 The Power Index assesses railway management's freedom to determine its own: costs; scope of operations; tariff rates; and internal organisation, unimpeded by any imposed government duties, for example, social service obligations.

2.2.12 For each Power heading, scores are assigned on a scale between 0 and 1, with, for example:

'1' indicating that the Board / Director General / private owner (shareholders) have a complete formal right to make decisions on the issue;

'0' indicating that a non-railway body, e.g. government, makes the decision or approves management's recommendation and has, in effect, a power of veto.

Accountability Index

2.2.13 Accountability is a measure of management's incentive to make changes in response to shifts in the market or regulatory environment by virtue of being responsible for elements of the organisation's performance. The PRORATA methodology uses a financial measure of accountability:

$$C = R_c / (R_c + R_s),$$

Where: R_c is the cost of commercial operations; and
R_s is the cost of non-commercial operations.

Economic Efficiency and Adaptability

2.2.14 A relationship between adaptability and economic efficiency has been established. Based on cost and operations data from "International Railway Statistics" and Adaptability Indices from a limited sample of EU railways, it was concluded that profitability and economic efficiency of a railway is strongly dependent on its adaptability.

2.2.15 A relationship was defined, in the form of a regression function:

$$G = 21.821 * \ln(A) - 34.865,$$

where: A is Adaptability; and
G is Operating Cost/Gross Tonne Km.

2.2.16 This implies that by increasing a railway's Adaptability it is possible to make efficiency gains. These gains can be achieved by selecting and applying the appropriate concepts.

2.3 PEST ANALYSIS

2.3.1 In addition to the foregoing analyses of a railway's performance, powers and organisation, a PEST (Political, Economic, Social and Technological) analysis is useful. This adds an understanding of:

- the external environment in which the railway operates;
- the railway's goals in seeking to change and improve;
- selection criteria when in choosing the optimal set of concepts for the organisation; and
- the best change management path for implementing those concepts.

2.3.2 This introduces the external influences on a railway into the PRORATA method.

2.4 SELECTION OF CONCEPTS

2.4.1 The main stage in the PRORATA Methodology is the identification and selection of suitable organisational, product or marketing concepts for improving the railway's profitability and/or adaptability. Different concepts may be appropriate, depending on the railway's current level of efficiency and Adaptability, and on the political / social / economic context in which it operates.

2.4.2 A railway's point of development, power to change, and the responsibility for its own affairs influence the extent to which any single concept is likely to succeed. Further, given that many concepts could potentially be introduced at the same time, priority should be given to developing an overall strategy into which each of the concepts then fit.

Identification of Concepts

2.4.3 While by no means exclusive, the study team identified and catalogued over 50 concepts.

2.4.4 These were drawn both from existing rail best practice, and from other modes where there was an expectation that they would be easily transferable to rail.

Structuring of Concepts

2.4.5 The concepts were structured into a number of families. Two main groups were identified:

- **Generic concepts** can be introduced by a railway irrespective of organisational structure or institutional framework (i.e. Adaptability) - examples of Generic concepts include: Right Train; Right Time; Total Quality Management; and Safety Management. While they do not implicitly involve organisational change, they may be more effective under some organisational structures than others

- **Strategic Concepts** involve, or are closely associated with, changes in the way the railway organisation is structured, or in the regulatory framework within which it operates, i.e. implementation of the concept itself changes the Adaptability score. These concepts are often implemented in response to changes in the market or competitive environment. They are more closely associated with empowering management to make rail a more competitive mode than with operational efficiency.

Filtering of Concepts

2.4.6 Four analytical methods have been developed to guide selection of the "right" concepts for a railway in its particular operational, organisational and socio-economic context. There are:

- **Cross Sectional Models.** Effectively looking at the broad range of processes taking place within a railway, then benchmarking railways against each other.

- **Time-Series Analysis.** Reviewing historical performance over time, for example, cost recovery ratios and operational effectiveness.

- **Expert Panels Analysis.** Drawing on the past experience (from former railway managers) to identify the most promising concepts.

- **Case Studies.** Specific examples of how to apply each concept and the precise benefits that may be expected.

2.5 ROUTES TO CHANGE MANAGEMENT

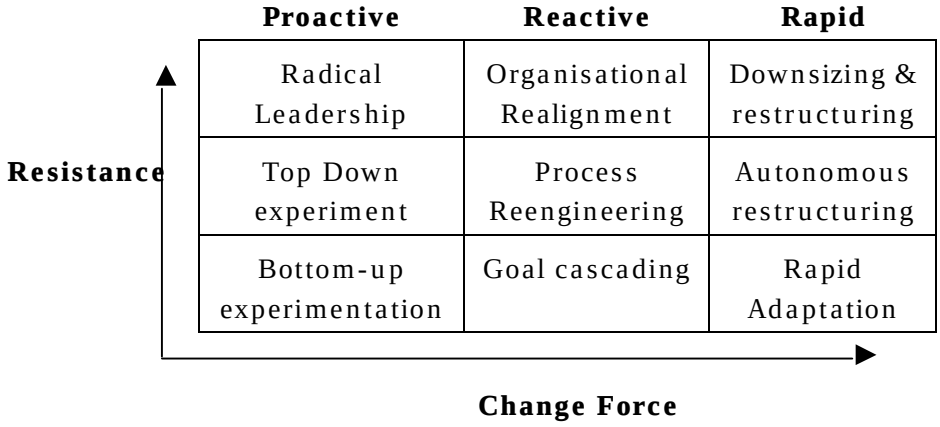
2.5.1 Having chosen a set of concepts, the final step involves the selection of routes of Change Management. The socio-political context within which the railway operates is important in determining practical routes, and Figure 2.1 indicates that the findings of the PEST analysis will influence the selection of change routes as well as concepts.

2.5.2 There are two key tasks:

- Identifying the most appropriate path for change; and
- Practical implementation issues.

2.5.3 The most appropriate path for change can be selected from the matrix shown in Figure 2.2.

Figure 2.2 Matrix of Change Paths



2.5.4 The horizontal axis shows change force, increasing in strength from left to right. The vertical axis shows resistance to change, increasing from bottom to top. In the bottom left hand corner, where both change force and resistance are lowest, an organisation could adopt a "bottom-up experimentation" model. Here, change would begin with front-line staff and gradually work its way upward through the management hierarchy.

2.5.5 Change management is also concerned with practical implementation issues. There are many models. A simple four step model follows:

Pressure of change. Create an agenda or mandate for change. In the case of railways, a poor safety record could create pressure for change;

Shared vision. Managers and employees have the same vision for the organisation;

Capacity for change. The organisation is able to undertake and implement change, in the context of PRORATA, this could involve the organisation being sufficiently empowered to successfully implement the selected concepts; and

Actionable first steps. Employees can see visible signs of change within the organisation early in the change process, giving encouragement for further stages.

2.5.6 The importance of change management should not be underestimated. Many organisations have embarked on ambitious change programs that have failed because steps have been missed out, or ignored.

3. Measurement of Current Performance

3.1 INTRODUCTION

3.1.1 A useful starting point from which to develop an action plan to improve the profitability of rail is an analysis of the existing situation. The annual profit and loss account will give a snapshot of financial profitability, but may conceal the organisation's true profitability – its economic efficiency:

- a well run railway charging low tariffs as part of government's transport policy may attract a high level of custom, yet require a high level of public support and appear non-profitable;

- an inefficient railway whose output is produced to meet Public Service Contracts that cover cost of production may produce low quality services attracting few customers, yet will appear to be profitable.

3.1.2 A deeper analysis of a railway's performance than that given by the profit and loss account is therefore appropriate before determining the priority areas for improvement.

3.1.3 Such an analysis may need to examine both the:

- supply side – how efficiently the railway organisation produces its output relative to other railways or to hypothetical resource utilisation figures calculated on the basis of "best practice"; and

- the demand side – how well the operator meets the needs and aspirations of both existing and potential customers.

3.1.4 A number of analytical and investigative tools were developed and used in the course of the study, summarised below. A more detailed account of the Partnership's research findings is included in the Annex volume. Other tools may be equally appropriate, depending on the particular circumstances in which the Methodology is being applied.

3.2 SUPPLY SIDE – EFFICIENCY OF PRODUCTION AND OPERATION

3.2.1 The PRORATA project opened with an investigation into the comparative efficiency of European railways. The (non-exclusive) issues investigated included:

- the relative performance of European railways;
- the relative strengths and weaknesses of railway companies;
- the key cost drivers for railways;
- the potential scope for cost savings; and
- the key policy implications for improving performance.

3.2.2 Railways are complex organisations, producing multi-dimensional output through the use of many inputs, under different operating environments. This complexity, coupled with the aggregate nature of most rail input, output and financial data, suggested that no single analytical tool would be able to give a clear picture of an organisation's performance. Three analytical methods therefore were used in parallel, each being a check on the utility of the other methods. These were:

- Partial Productivity Analysis;
- Total Factor Productivity Analysis; and
- Cost/Production Frontier Analysis.

Partial Productivity Analysis (PPA)

3.2.3 PPA involves the production of a set of partial factor productivity indicators which are the ratio of one measure of output to one input factor, e.g. passenger km per member of staff. The drawbacks of partial productivity analysis are that:

1 it does not allow for potential trade-offs between individual indicators (e.g. between labour and capital productivity);

2 it is difficult to collate the findings from numerous partial measures into an objective conclusion; and

3 it does not allow for variation in operating environment.

Total Factor Productivity (TFP) Analysis

3.2.4 TFP overcomes the fist two drawbacks of PPA, allowing for potential trade-offs between individual indicators and providing a method for arriving at an objective overall conclusion. TFP digests all the

information gathered from PPA measures to express a measure of output as a ratio to some single measure of total inputs. Given the complexity of rail's production function, several different measures of TFP are possible.

Cost Frontier Analysis (CFA)

3.2.5 CFA addresses the third drawback of PPA measures as well as the first two by allowing the cost implications of factors in each company's operating environment over which even prudent management has no control to be incorporated in the analysis.

3.2.6 Exogenous factors which restrict management's ability to operate in the most efficient manner by imposing particular types of output and cost structures on railway companies vary across the companies sampled, e.g. geographical - type of terrain, or policy related - government specified minimum service requirement or employment practice.

3.2.7 To assess comparative efficiency using CFA, a cost function of the form:

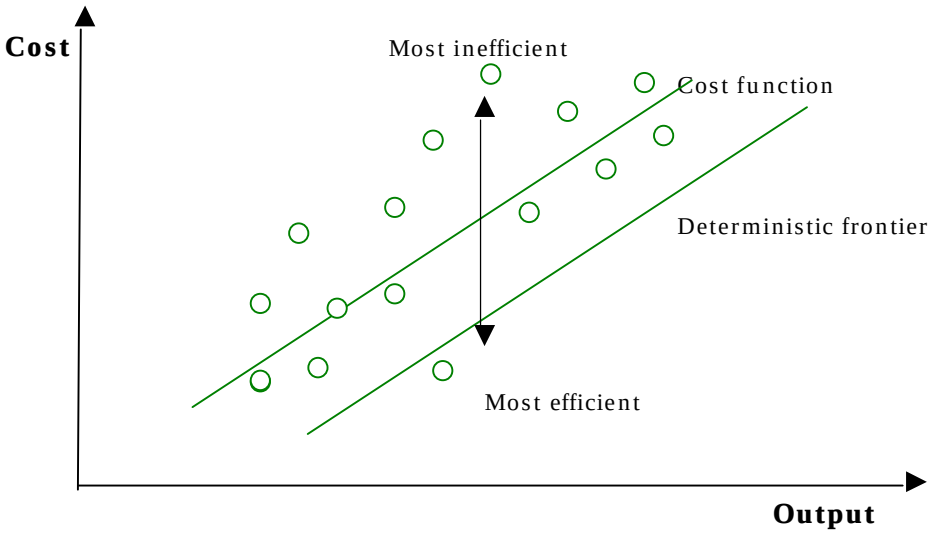
$$C = f(X,Z) + e$$

was assumed, where:

C is the observed level of costs;
X is a vector of outputs,
Z is a vector of factors outside the control of management; and
e is a residual term, interpreted here as variation in efficiency

3.2.8 Two cost frontiers were estimated. In the simple **deterministic** approach, a cost frontier can be obtained by adjusting the estimated cost function until it embraces the most efficient firm(s) only. Taking e as an index of efficiency, large negative values correspond to the most efficient companies. The distance from the cost frontier then provides a measure of inefficiency. This is illustrated in Figure 3.1.

Figure 3.1 Cost Frontier Analysis



3.2.9 A more elaborate approach, **stochastic** frontier analysis, allows for the presence of statistical noise in e. This requires making an assumption about the probability distribution of e and using statistical methods to decompose it into statistical noise and a true efficiency term.

Passenger Railways

3.2.10 The particular interest of PRORATA was to extend the analysis of European railways to the comparative performance of passenger railways, in particular long distance and international passenger railways. However, within the resources and timespan of the study, data availability proved asymmetrical. While almost all data regarding output and (usually) income was suitably disaggregated between freight and passenger, most cost and input data was only available at an aggregate level.

3.2.11 The resulting analysis and its conclusions are therefore applicable to European railways in general, rather than just to the long distance passenger sub-sector.

Data Sources

3.2.12 A database was compiled from a number of sources, including:

- Union Internationale des Chemins de fer (UIC) databases;
- the World Bank railway database;
- Leeds University database;
- Eurostat;
- the UK Department of Transport database; and

- the European Conference of Ministers of Transport (ECMT) database.

3.2.13 Shortcomings emerged in all available data sources, particularly with respect to financial data. Common problems included:

- an inconsistent approach to the treatment of investment capital, cost of capital, depreciation etc.;

- overstatement of profits (return on capital or assets), income and expenditure for the more commercial rail organisations that have been broken down into a number of separate companies (e.g. Sweden, UK) - when database compilers have re-aggregated returns from units still in common ownership, some items have been double counted; and

- difficulty in comparing financial performance indicators for railways which operate under Public Service Contracts (the payment appears as own revenue in UIC data) with those funded via Public Service Obligation type payments (appearing in UIC data as public support).

3.2.14 While its data is not ideal for some aspects of the subsequent analysis, the UIC database proved the most useful source for use in applying the PRORATA Methodology, containing values for a wide range of input, output and financial measures and being easily accessible (it is published annually in three European languages).

3.2.15 Partial and Total measures were constructed using 1995 data (the most recent available at the time). A dynamic element was introduced for some ratios by examining changes in performance since 1990. CFA was applied to a panel of 1990 and 1995 data. Use of panel data increased the number of observations, helping to overcome problems associated with the small number of degrees of freedom inherent in estimating a potentially complex model from a small sample size, and enhancing the robustness of the resultant model.

3.2.16 Data for seventeen European railways was used in the main analysis, these are identified in Appendix 2 of this Report.

Main Findings

3.2.17 The study reached conclusions on both the applicability of the analytical methods to the PRORATA Methodology and on the relative performance of the railways incorporated in the analysis.

3.2.18 All three analytical methods were found to produce output that could be useful in highlighting weaknesses in a rail organisation's production activities, i.e: in identifying areas that could be addressed by an Action plan output by the PRORATA Methodology.

3.2.19 Turning to actual performance, given the concerns noted above it was considered inappropriate to rank railways from 1 to 17. Rather, a ranking is presented by performance quartile, the top 4 companies under each measure being given equal ranking in the 1st Quartile, the worst 4 in the 4th quartile. Figures 3.2 and 3.3 provide a visual summary of the comparative performance of the 17 railways' output during the testing of the PPA, TFP and CFA methods.

Partial (PPA) Measures

3.2.20 The main PPA analysis was undertaken on 1995 data. Three broad groups emerge within the sample:

1. railways which perform well on both labour and capital productivity measures - this group includes BR and SJ;

2. railways which perform poorly on both labour and capital productivity measures - this group includes OSE, CIE, and CP; and

3. railways which show a mixed performance with respect to labour and capital productivity - these countries tend to fall within the 2nd and 3rd performance quartiles, depending on the relative strength of the aspect in which they do better/worse.

3.2.21 Beyond such general observations, partial productivity measures are best used to assess the comparative performance of the companies in greater detail - to identify relative strengths and weaknesses with respect to particular aspects of operational, commercial, and financial performance.

3.2.22 As anticipated, it proved difficult to collate the findings from numerous partial measures into an objective conclusion. The overall picture emerging was somewhat mixed: well utilised

passenger and freight railways exhibited varying levels of capital and labour productivity; a high quality railway was not necessarily a high charging railway; and did not necessarily achieve high capital or labour productivity.

Total Factor Productivity (TFP) Measures

3.2.23 Inconsistent asset valuation across the sample made total cost measures of TFP unreliable. Analysis was therefore carried out using operating expenditure including depreciation (and thus partially responsive to the capital base). While there was also inconsistency in treatment of depreciation, the measure proved reasonably robust. Results of the TFP analysis are shown in Figure 3.3, columns 5-8 and summarised in Table 3.1.

Table 3.1 TFP Performance Quartiles

Quartile	Railways
First	VR, BR, NSB, DB, SJ
Second	CFF, SNCF, RENFE
Third	NS, OBB, CP, DSB
Fourth	BLS, SNCB, FS, OSE, CIE

3.2.24 VR, BR, DB, NSB, and SJ are the most efficient companies on this measure. OSE and CIE, which performed poorly under most PPA measures, are in the least efficient group, but DB and NSB, not amongst the most efficient companies in the PPA indicators, score highly under this measure.

3.2.25 For railways in PPA categories 1 and 2 (i.e. those which perform either well or poorly in terms of both labour and capital productivity), TFP measures show strong correlation with partial productivity measures. However, for railways in the 3rd category the correlation between the total and partial measures is weak.

3.2.26 Spearman's rank correlation analysis was undertaken to compare TFP rankings with PPA rankings. This found a relatively strong overall correlation between total productivity and labour productivity (81%). Correlation with two measures of capital productively: number of coaches, railcars, and trailers per tone Km hauled; and number of locos per tonne Km hauled, were 82% and 52% respectively.

3.2.27 Overall, TFP provides a better yardstick to assess comparative performance than PPA, particularly for companies within the 3rd PPA category. Nevertheless, partial measures help throw light on

potential sources of variation in the TFP measures, and are useful as a check on TFP results.

Cost Frontier Analysis (CFA)

3.2.28 TFP measures (including average operating expenditure) do not allow for the impact of economies of scale and variation in companies' operating environments. These are addressed through CFA.

3.2.29 Furthermore, around 60% of savings would accrue to infrastructure management and 40% to operations.

3.2.30 A simple cost model was developed which expressed operating expenditure as a function of the volume of traffic (i.e. passenger train Km, freight tonne Km), and network sparsity. The equation derived, despite its simplicity, explained around 95% of variation in operating expenditure.

3.2.31 Other factors, e.g. average distance travelled, percentage of line electrified, entered the model with the expected sign**;** but not at the required level of significance - this may be due to the small sample size. Although the analysis was based on panel data, many of the environmental variables within the sample did not show sufficient variation between the two "snap shots", only 5 years apart, and the model also failed to pick them up with the required level of significance.

3.2.32 The estimated cost function points to significant economies of traffic density[5]. Results suggest that if the volume of traffic doubles, total operating expenditure will only increase by around 85%, yielding a saving of 15% in unit costs. PPA and TFP measures, which do not allow for economies of traffic density, will tend to rank low traffic density railways too high and those with high traffic density too low.

3.2.33 The CFA results are summarised in columns 9 and 10 of Figure 3.3. BR and DB continue to be amongst the most efficient firms, with CIE and SNCB amongst the least efficient, repeating the TFP findings. On the other hand CP and SNCF move up to the 1st quartile, from the 3rd and 2nd quartiles respectively, while OBB and SJ fall from the 2nd and 1st quartiles to the 4th and 2nd respectively.

[5] In the railway industry there are three types of returns to scale: economies of traffic density (i.e. volume of traffic), given the network size and average length of haul; economies of length of haul (given the volume of traffic and network size); and economies of network size (given the volume of traffic and average length of haul).

It is notable that the deterministic and stochastic CFA approaches yield very similar performance ranking results.

Potential for Cost Saving

3.2.34 The comparative efficiency analysis was principally undertaken to develop a tool with which to evaluate proposals to improve profitability in subsequent stages of the study. Nevertheless, a number of policy implications emerged even at this early stage of the study.

3.2.35 Deterministic CFA implies that if all firms could achieve best practice, overall cost for the 17 railways in the sample could be reduced by up to Ecu28bn per annum. It should be noted that the deterministic approach does not control for statistical noise, and tends to over-estimate the magnitude of potential savings which could be achieved.

3.2.36 The saving was only Ecu1bn using stochastic CFA but, with a small sample stochastic analysis will tend to attribute an excessive amount of variation in the residual to statistical noise and underestimate the scope for cost savings.

3.2.37 Using the mean of the deterministic and stochastic estimates, the magnitude of potential cost savings would be of the order of ECU 14.5bn per annum, around 20% of total operating expenditure. This is in line with the magnitude of savings achieved during the pre-privatisation process in the UK (1986-1992). As many European railways were not as efficient in 1995 as pre-privatisation BR was in 1986, ECU14.5bn may be a conservative estimate of the potential cost savings.

Sources of Cost Saving

3.2.38 Further statistical analysis to investigate the sources of these potential savings and the likely contribution of each factor of production suggested that, of the total variation in operating expenditure:

57% was attributable to variation in labour cost;
31% to materials; and
12% to depreciation.

3.2.39 The finding for labour cost is largely in line with actual experience in countries such as UK and Sweden, which have recently experienced major institutional reform. The result for depreciation is likely to be an underestimate as differences in accounting

practices across the sample mask the true role of depreciation (as a proxy for capital stock) in overall operating expenditure variation.

3.2.40 Furthermore, around 60% of savings would accrue to infrastructure management and 40% to operations.

Trends Amongst Individual Railways

3.2.41 At a general level, broad agreement exists between all three analyses, PPA, TFP and CFA, on degrees of efficiency amongst European railways. Those railways in which reform has progressed furthest (UK, Sweden, and to a lesser extent Finland and Germany) rank highly, whilst those exhibiting less reform, including Greece, Belgium and Ireland, perform less well.

3.3 DEMAND SIDE – CUSTOMER ASPIRATIONS AND SATISFACTION

3.3.1 In a parallel exercise within the research phase of the study, an extensive Market Research exercise was undertaken: to explore useful sources of information on demand-determining criteria for inclusion in the Methodology; and to inform the study team of these current criteria.

3.3.2 This comprised a mix of:

- Desk Research, aimed at estimating of the current and potential future size of the market for longer distance rail travel in Europe;
- Literature search to identify revealed preference evidence on mode choice criteria; and
- Focus Group meetings, convened to obtain up to the minute information on traveller's perceptions of rail and its products, and of stated preference indications of mode choice criteria.

Estimating Rail's Presence in the Long Distance Travel Market

3.3.3 To assess rail's presence in the market, data on the current and recent historical level of travel by mode, distance travelled and frequency of tripmaking was reviewed. As with the comparative efficiency exercise, it was found that data was only available at a very aggregate level, usually passenger-km. Combining available data with other market research findings, it was possible to draw

some conclusions about rail's overall travel market share and, crucially, its degree of market penetration.

3.3.4 Table 3.2 presents data regarding the distance travelled, in terms of passenger Km, for both the 12 and 15 member EU areas.

Table 3.2 Passenger Rail Transport in EU, 1982-95

(bn pKm)

Year	EU12 countries (excluding former GDR)			EU15 countries (including former GDR)		
	Bn Pass Km.	Index 1982 = 100	% increase p.a. since 1982	Bn Pass Km.	Index 1982 = 100	% increase p.a. since 1982
1982	208	100	---	248	100	---
1984	218	105	+ 2.0%	258	104	+ 2.0%
1987	220	106	+ 1.2%	260	105	+1.0%
1990	233	112	+ 1.4%	275	111	+ 1.3%
1992	241	116	+ 1.5%	268	108	+ 0.8%
1994	247	119	+ 1.5%	265	107	+ 0.9%
1995	235	113	+ 0.9%	263	106	+ 0.5%

Sources: International Comparisons of Transport Statistics
(UK) Department of Transport, 1995
International Railway Statistics 1996 - UIC

3.3.5 The Table indicates a general, though moderate, increase in rail traffic. But the overall travel market was growing much faster, at around 5% p.a., and rail has lost market share, accounting for only 6-8% of passenger km in most EU countries by 1995.

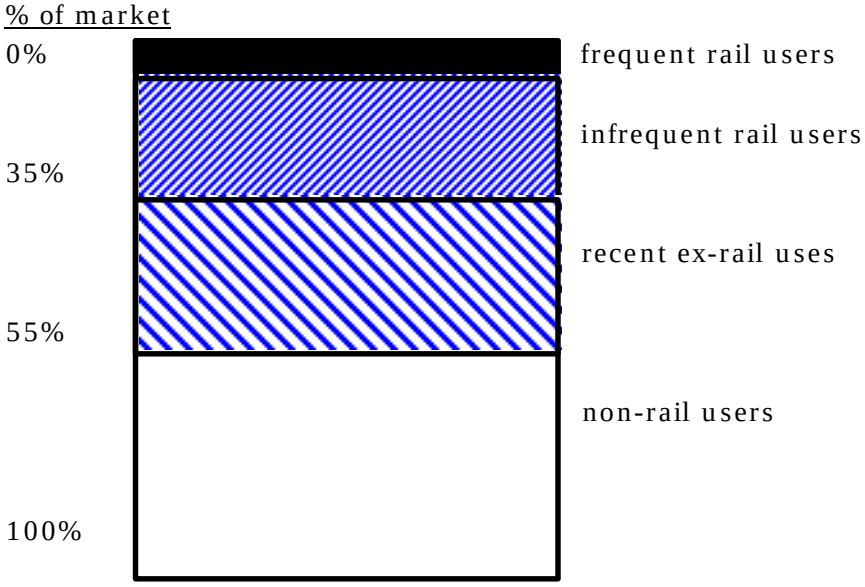
3.3.6 However, evidence from a wide range of transport related market research surveys indicated that the proportion of people with recent experience of longer distance travel by rail was much higher, at around 25-35% in most EU countries.

3.3.7 A market penetration hypothesis emerged of:

- a low number of frequent rail users who, however, represent the bulk of the rail passenger km.;
- a higher number of occasional rail users;
- a high number of recent ex-users (e.g. used rail in the last 3 years); and
- a group who have never made long distance train trips (or not for many years).

This market segmentation is illustrated in Figure 3.4.

Figure 3.4 Rail Penetration in the Long Distance Travel Market



3.3.8 More detailed research may be needed to confirm the split in any country in which the PRORATA Methodology is to be applied. However, this view of market segmentation fits with an observed phenomenon described as traveller's "promiscuity" - the tendency for travellers to use a variety of modes for the same trip purpose or destination in the course of one year.

3.3.9 A similar situation would apply on other modes - travellers use a mode until they have a bad experience, then switch to an alternative. Rail's poor current performance means most travellers float between being low users or ex-users of rail.

3.3.10 While the bulk of rail travel is by a few, frequent, users, most people with recent rail experience travel only once or twice a year, making their perception of rail on these occasions crucial to improving rail's image and promoting customer retention.

3.3.11 This finding has important implications for the design of strategies to:

- attract new rail passengers; and
- retain loyalty amongst existing customers.

Mode Choice criteria - Advantages and Disadvantages of Modes

3.3.12 Table 3.3 summarises current mode choice criteria, culled from desk research, showing the relative strengths of competing modes and the main criteria used in selecting each mode.

Table 3.3 Advantages / Disadvantages of Competing Modes

Travel Mode Characteristics	High speed rail	Classic rail	Air	Coach	Private Car
Service					
Reliability	H	L*	H	H	H
Flexibility	L	M	L	M	H
Frequency	M	M	M	H	H
Comfort	H	L*	H	M	H
Control	H	M	H	M	H
quality – on board facilities (TV, music, magazine, etc.)	H	L*	H	L	M
customer care	H	L*	H	M	N
Catering	H	L*	H	L	N
Pricing					
Integrated ticketing availability	M	L*	H	L	N
Flexibility	M	L	H	L	N
Affordability - travel cost level	L	H	L	H	M
cost management displayed	L	L*	H	M	M
Marketing					
Segmentation	M	L*	H	M	N
customer packages offer	M	M*	H	M	N
volume sales through agents	L	L*	H	M	N
customer knowledge	M	L*	H	M	N
Integration					
door to door	L	L	L	M	H
Technical					
speed	H	M	H	M	M
flexibility	M	L	M	M	H
reliability	H	L*	H	M	H
capacity	M	H	M	M	L
Operational					
hub & spoke organisation	H	M	H	M	N
subcontracting flexibility	L	L*	H	L	N
franchising availability	L	L*	H	L	N
own account operation	L	L*	M	M	H
traffic control capacity	M	M*	H	M	M

Key : H : high, M : medium, L : low
N : non existing
* = potential for improvement to classic rail

3.3.13 Key points are:

- the relatively poor position of classic rail;
- the comparatively strong image of HSR, air and car;
- the extensive potential for improvement in classic rail (denoted by *)

This last point indicates that opportunities for improvement measures do exist and helps to define targets for these.

3.3.14 The literature search indicated that demand elasticities formed the most practical approach to demand forecasting, and a considerable body of reference material exists. However:

- Elasticities are not always transferable to another location and may also change with time; indeed, great caution should be exercised when attempting to apply any elasticity out of context;

- Qualitative criteria are very important in mode choice and should be taken into account in travel demand estimation - most models tend to under-play such influences on demand; and

- the essential travel characteristics - and mode choice criteria - of non (i.e. potential) users of rail are likely to differ from those of users - looking ahead to the formulation of Action Plans, this cautions against market expansion policies predicated on surveys of existing users.

Focus Groups

3.3.15 As part of the research effort, the study team convened a number of Focus Group meetings in four EU Member States. Ten groups comprised users of longer distance transport, four groups comprised transport industry members (tour operators etc.)

3.3.16 The general objective of the meetings was to examine opinions and attitudes of long distance travellers regarding different travel alternatives and long distance rail in particular. More specific objectives were:

- to assist the identification of mode choice criteria;
- to establish travellers' future expectations of rail;
- to establish travellers' current expectations of long distance rail; and

- to assess the current perception of the performance of rail with respect to other modes.

3.3.17 The target membership of the user groups was people with experience of long distance travel in the last 12 months, by rail, car, plane or coach. Potential participants were given a short screening questionnaire to check their travel experience characteristics.

Focus Group Results

3.3.18 The main user group findings are summarised in Tables 3.4 and 3.5. The most striking result was the extraordinarily high level of similarity in the comments made, not only for different user groups in the same country, but also across all four countries. Indeed similarities in comments occurred more frequently than differences.

3.3.19 Negative aspects of rail were raised far more frequently than positive issues, even by frequent users - people who chose to travel by rail whenever it was a feasible option. Despite these negative aspects rail was considered a very popular mode of transport - it was difficult to find and invite true “non users” of rail to the Focus Groups. The most important positive aspects cited were: comfort; space (the ability to walk around, read or work during a trip); sociability; wide territorial coverage of the network; and safety.

3.3.20 Conversely, rail was not generally considered competitive with other modes, being perceived as having low capacity to be a modern mode of transport. The “ideal” mode of transport for all groups was air, although some participants suggested that this was because most people’s experience of air was holiday travel, with the positive aspects of the destination obscuring the “reality” of flight delays and lost luggage. The most practical mode is seen to be car, because of its flexibility and privacy.

3.3.21 There was a concensus that the opportunities to use long distance rail were limited, both physically and socially:

- physically by a less extensive network than road and lack of integration with other modes (even local trains);

- socially by poor quality of performance, limited services, poor personal security, lack of personnel for assistance, availability of tickets, and poor marketing

3.3.22 Discussion of the future of rail revealed a general pessimism about rail, centering on rail's apparent inability to deliver the promised level of service, accentuating a widespread image of rail as "customer unfriendly".

3.3.23 Asked to imagine an hypothetical rail trip of the future, rather than high-tech innovations (seat-back video, tilting trains etc.), group members identified a need for rail to get right aspects of the service that are not working well at present:

- "I want to be treated as a client";
- "Need cleaner coaches";
- "A different relationship between personnel and users";
- "Reliability not only on the main lines, but on the local trains";
- "A normal standard of security in stations".

3.3.24 Investment in high speed rail and premium trains achieved a positive image, but generally limited to the corridors served. Further, these initiatives had no impact on the image of ordinary, "basic", rail in the opinion of Focus Group participants:

"...Pendolino is not the railway!"
"Eurostar is not a train, it is a plane on wheels"

Table 3.4 Analytical Framework of Positive Aspects of Rail

Country	ITALY			U.K.			NETHERLANDS		GREECE
Group typology	PRIVATE	BUSINESS	YOUTH	PRIVATE	BUSINESS	YOUTH	PRIVATE	BUSINESS	PRIVATE / BUSINESS
SOCIAL ISSUES & IMAGE	Comfortable Relax Sociability Safety	Sociability Safety	Comfortable relax Sociability safety	comfortable relax safety	comfortable relax safety	comfortable sociability safety	comfortable relax sociability safety	safety	comfortable relax safety
CONVENIENCE	can move & sleep	Can work "al volo" Last minute	Can move & see "al volo" Last minute	can move & sleep	can work last minute	scenic mode	can move & read easy for children	can work	can move / read / work
ECONOMIC	not expensive	not expensive	not expensive			low cost (<26 yrs)	+ value for 1st class		cheap (common trains)
PERFORMANCE	Capillarity	Destination to City centre Competitive (main lines)	Capillarity		Destination to city centre	fast		destination to city centre	
SERVICE QUALITY				catering	Catering	catering		Thalis luggage compartment	

Table 3.5 Analytical Framework of Negative Aspects of Rail

Country	ITALY			U.K.			NETHERLANDS		GREECE
Group Typology	PRIVATE	BUSINESS	YOUTH	PRIVATE	BUSINESS	YOUTH	PRIVATE	BUSINESS	PRIVATE / BUSINESS
SOCIAL ISSUES & IMAGE	Not secure	not secure Customer unfriendly	not secure customer unfriendly	customer unfriendly + privacy	not secure Customer unfriendly + privacy	not secure customer unfriendly	not secure customer unfriendly + privacy	customer unfriendly + privacy	not secure (stations) customer unfriendly
PERSONNEL ASSISTANCE	+ assistance (inf./security)	+ assistance (inf./ service)		no personnel attention (information / service)			+ contact		
SERVICE QUALITY	+ information Catering Not clean Luggage	+information Catering not clean	+ information catering not clean	better information dirty & noisy luggage purchase of tickets	Better information Dirty & noisy	better information dirty & noisy	better information coffee dirty& noisy luggage	better information catering dirty & noisy	+ information not clean
PERFORMANCE	2 levels of quality (Pendolino & other trains)			2 levels (Intercity, Eurostar &local trains)			2 levels (Intercity, local trains)		2 levels (Intercity & normal)
INTEGRATION	No integration with local trains & other modes			no integration			no integration		+ capillarity
ECONOMIC	Fares flexibility Q/P insufficient			Expensive	+ sensitive Pricing	Costly (+26 yrs.)			Expensive (Intercity)

3.3.25 Rather, they served to emphasise the unsatisfactory image of the more extensive network of lines on which the great majority of rail trips are made, and on which most premium train customers start or end their journeys.

3.3.26 The "ideal model of train" for the future arising from the Focus Groups was thus "basic train"[6]. The current strategy of investing heavily in Premium Products does not appear so persuasive to current and potential future users.

A Potential Product and Marketing Strategy to Improve Profitability

3.3.27 These Focus Group findings gave the study team an early insight into possible strategies for rail's commercial re-vitalisation, at least halting the current decline in market share.

3.3.28 If rail is to be successful, it needs products and strategies capable of at least satisfying the needs of frequent users who, even while choosing rail over other modes, hold negative views of rail which spread to potential users. If this negative image can be overturned, a "virtuous circle" becomes possible, leading to: customer retention; return of ex-users; and attraction of new users. The necessary ingredients for this "virtuous circle" strategy are outlined in Figure 3.5.

3.3.29 While further market research will be needed to confirm the viability of the strategy in any particular country, a unified investment policy which encompasses two product strands to improve the general image and marketability of rail emerges, involving:

- a "Basic Train "strategy; and
- a "Premium Train "strategy

3.3.30 Basic Train strategy has as its goal the improvement of the whole system, investing in service quality: uniformity of product; satisfactory standards; attention to the client; punctuality; cleanliness; security; etc. This will consolidate rail's existing client base via a higher "fidelity" score, more frequent use of rail and attracting back ex-users.

3.3.31 The approach may involve investment in trains and infrastructure, but will mainly involve investment in: personnel; marketing;

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6 The "Basic Train" concept emerged from most focus groups. The term itself was put forward in Italian groups.

customer information systems; and the wider availability and distribution of products and services. Managerial and organisational strengthening will form the principal route to such improvements.

3.3.32 This strategy, creating a base on which a solid customer retention policy can be built, appears to have the greater commercial potential of the two. The wide spread of potential customers for Basic Train - the shaded areas of Figure 3.4 – is critical in establishing a new positive image for rail which they will transfer to the wider travel market.

3.3.33 Premium Train will, increasingly, become the "ideal train" of the future, via a progressive spread of Premium products (TGV, ICE, AVE etc.), throughout the Community, coupled with extension of the High Speed Network and introduction of enhanced commercial services both in stations and on trains. This is a far more capital intensive strategy.

3.4 POSITIVE AND NEGATIVE ASPECTS OF RAIL - SWOT

3.4.1 All avenues explored in the course of the research phase of the Study produced useful insight into factors influencing demand. The findings of this research were structured into positive and negative aspects of rail, listed in Table 3.6.

3.4.2 The information has been defined within the following broad categories:-

- **Supply Side** aspects arising from the comparative efficiency research relating to the provision of the train service products by the European railways, together with output performance issues highlighted by participants in the Focus Group discussions; and

- **Demand Side** those aspects arising from the Focus Group discussions relating to the marketing, product development and overall "commercial" aspects of the train service products.

Table 3.6 Positive and Negative Aspects of Rail Travel

	Positive		Negative	
	Supply	**Demand**	**Supply**	**Demand**
Under Management Control	Frequent, fast, dedicated. Improved terminals, trains, catering and information. Safe and stress-free. Clean, reliable, punctual. Popular high speed services. Technologically innovative. Productive and competitive procurement. Business-led structures. Dedicated staff.	Market-led structures. High speed products. Low price products. Franchising and contracting of ancillary activities.	Unrecognisable product. Customer unfriendly. Stations dirty and run-down. Inconvenient and inflexible. No privacy. Poor reliability of other trains. Poor information and assistance. Fixed and long-run assets. Productivity opportunities not being achieved. Uncompetitive procurement. Poor management information and accountancy. Poor personnel development and training. Lack of incentive.	Poor advertising. Poor product information. High prices and complex ticketing.
Outside Management Control	Comparative advantages. Socially cost-effective. Institutional changes.	Privatisation of railway activities. Contracts with governments.	High fixed costs. No clear objectives. Constrained institutional framework. Government interference.	Sensitive to economic fluctuations. Sensitive to shifts in competitive position. Low perception of rail travel. Periods of peak demand.

3.4.3 In addition, it was recognised that a significant proportion of the issues identified were outside the immediate control of management of majority of European railways. Each of the major categories has been sub-divided to reflect, and the list is divided into 8 sections.

3.4.4 It was not surprising that a number of issues appeared in more than one category although it was difficult to quantify the relative importance. Issues of ownership and organisation, and of the broader economic environment within which railways operate, also have a bearing on both rail's economic performance and on the opportunities to improve it.

3.4.5 These issues were initially taken into account by re-mapping the positive and negative aspects in a SWOT (strengths, weaknesses, opportunities and threats) analysis of European rail, presented in Figure 3.6.

4. Organisational Structure and Adaptability

4.1 INTRODUCTION

4.1.1 In addition to the analysis of rail's current supply- and demand-side performance, the PRORATA Methodology requires an assessment of the organisational structure of the railway and the regulatory framework within which it is operating, in order to gain insight into the organisation's adaptability to change and new concepts.

4.2 ORAGANISATIONAL STRUCTURE

4.2.1 Rail is a heavily regulated mode of transport, with many companies world-wide in Government ownership. To a considerable extent, therefore, the regulatory framework set by Government dictates the way in which the railway industry in a country organises itself.

4.2.2 PRORATA identified a continuum of organisational structures, falling into five broad groups. These are illustrated in Figure 4.1.

4.2.3 The following is a brief explanation of each structure:

- **Traditional Command Structure**: rail is driven completely by Government, sometimes as a branch of the civil service, with a very rigid line of command, objectives based on output statistics, major strategies and policies defined by Government and little freedom given to the railway management to operate outside these tight parameters.

- **Market Orientated Command Structure**: similar, but with some recognition of the market introduced at the lower levels. Objectives incorporate some business targets, within Government strategies and policies, the railway board and management will have some freedom on marketing and delivery activities. There are fewer levels of management, leading to reduced bureaucracy and accelerated decision-making.

- **Business Sector Structure**: the production functions are replaced by business sectors. Government objectives are based on financial and service delivery parameters and will be more closely related to business targets set within the railway organisation.

- **Public/Private Intermediate Business Structure**: may incorporate a mix of public and private sector involvement. Government objectives are based on financial and service parameters and encourage the involvement of the private sector in the full range of primary and secondary railway activities. The remaining publicly owned railway business units and private companies will be working in a very competitive environment.

- **Privatised (Railway) Business Companies**: A free-form structure which is influenced, but not dictated, by a government regulatory regime. Government financial support may be on a contractual basis with targets based on service delivery and quality parameters.

4.2.4 It is re-emphasised that these are five classic organisational structures on a continuum - they do not purport to be inclusive of all possible structures, nor do they fit comfortably on an ordinal scale which can be used in the empirical evaluation of the impact of improvement measures.

4.3 ADAPTABILITY

4.3.1 Interest in an index to measure the adaptability of a railway centres on the hypothesis that adaptability is related to economic efficiency and customer focus / market orientation, and via that to profitability. It was also posited that an Adaptability Index could serve as a quantitative proxy for a railway's place in Figure 4.1.

4.3.2 Any commercial or institutional organisation that manages to stay in business must have evolved a survival strategy. European railways have survived for more than 100 years, their strategy generally involving a monopolistic situation under detailed government control / regulation, compensated for with financial support.

4.3.3 However, competition in the transport market has grown. Customer focus and market orientation, as well as economic efficiency, are part of the survival strategy of most successful enterprises. With increasing use of private (road) transport and the de-regulation / privatisation of airlines and bus companies, most of rail's competitors in the transport market are already in this category. EU transport policy is leading rail in the same direction via regulations such as Directive 91/440 and the 1996 White Paper.

4.3.4 Railways thus need to become market oriented organisations, supplying products designed to optimise the market's willingness to pay the cost of supplying them. Customer focus and market orientation are now necessary conditions for economic efficiency (profitability) and survival.

4.3.5 For PRORATA, 'Adaptability' is used in the restricted sense of 'adaptability to demands of economic efficiency in a competitive market environment'.

Defining an Adaptability Index

4.3.6 The first requirement for an organisation that needs to adapt to changing market conditions is the **power** to do so. An organisation which does not have the power to:

- withdraw from unprofitable market sectors;
- set the price of its products and services;
- change its organisational structure; or
- control its own organisation,

is unlikely to be able to adapt to changed circumstances. One dimension to consider in defining adaptability is thus the set of powers available to the railway's management.

4.3.7 In a well regulated environment, any organisation granted powers to carry out certain activities is held responsible for economic efficiency in those activities. However, this will not ensure economic efficiency if its performance is not measured, targeted and monitored. With responsibility matched by suitable performance measures, an organisation will be **accountable** for its performance. With responsibility for economic efficiency matched by appropriate measures of economic efficiency, it creates an organisation accountable for economic performance.

4.3.8 The hypothesis was thus advanced that:

Adaptability is a function of **Power** and **Accountability**

Both are necessary conditions. An organisation cannot adapt if it does not have the power to do so. But even with sufficient power, it may not adapt unless it has reason to do so, i.e. it is accountable for its performance.

4.3.9 Assuming that 'power' and 'accountability' can be measured, the adaptability index can be defined as:

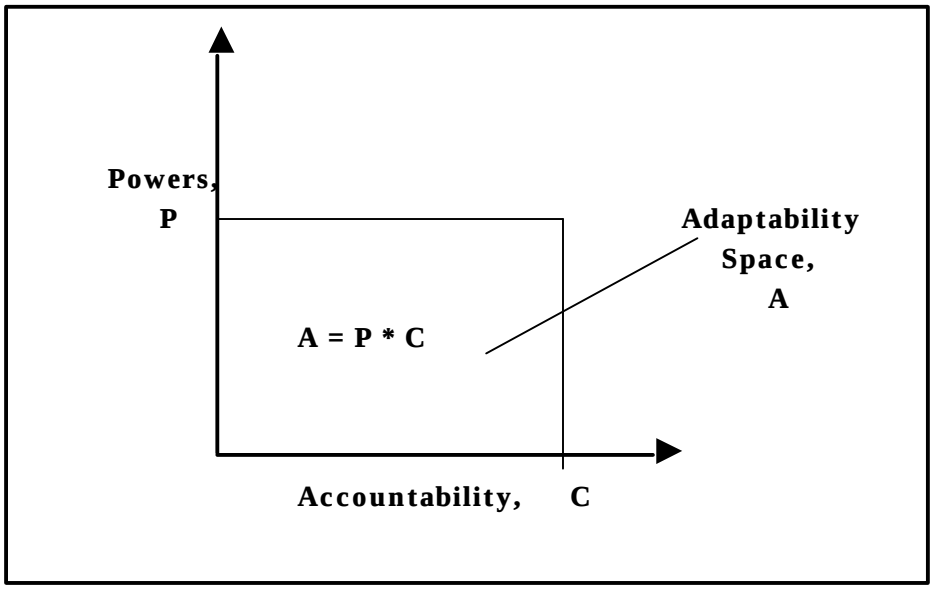
$$A = P * C$$

Where:

A = an index of adaptability
P = an index of power
C = an index of accountability

This concept of two dimensional adaptability space is shown in Figure 4.2.

Figure 4.2 Dimensions of Adaptability Space



4.4 OPERATIONALISATION OF THE ADAPTABILITY INDEX

4.4.1 Calculation of the compound Adaptability Index (A) for use in the PRORATA Methodology requires two indices, representing: powers (P); and accountability (C). If each sub-index is measured on a scale from 0 to 1, the Adaptability Index itself will also have a scale from 0 to 1.

Powers

4.4.2 The powers of a railway organisation are broadly determined by the regulatory framework within which it operates. It is, however, not necessary to incorporate the whole of that regulatory framework in the index, only those parts which have a bearing on adaptability with respect to economic efficiency.

4.4.3 The PRORATA team, together with the study team on the parallel Fourth Framework RTD project LIBERAIL and a panel of European rail experts, developed a list of significant powers appropriate to a Power Index. As powers vary in their importance in determining

management's freedom to act, and thus the degree of adaptability of their organisation, weights were assigned to both main headings and sub-issues.

4.4.4 Table 4.1 shows the components selected for a Power Index, and the weights to be applied to each power to calculating it on a scale from 0 to 1.

Table 4.1 Components and Weights for a Power Index

POWER	Weight Main Heading	sub-Issues	Score
- Appointments:	1.2		
Board		0.15	
Director General		0.25	
Management		0.40	
Staff		0.20	
- Organisational Structure	1.2		
Main		0.40	
Regional/Second Level		0.60	
- Annual Budgets	0.9		
Operational		0.70	
Investment		0.30	
- Long Term Plans	0.6		
Business Plan		0.50	
Investment Plan		0.50	
- Pricing	1.5		
Passenger		*	
Freight		*	
- Finance	1.0		
Borrow/Lend Money		0.35	
Leasing		0.10	
Sell Assets, Keep Profit		0.20	
Go Bankrupt		0.35	
- Competitive Procurement	0.8**		
- Operations	0.8**		
Total	**8.0**		

* Weights in proportion to revenue

**No subclasses are defined

4.4.5 It should be noted that this list of powers was designed to permit the adaptability:efficiency hypothesis to be tested within the timeframe of the PRORATA project. There may be subtle differences between some organisational structures or regulatory frameworks that cannot be expressed using only the categories listed.

4.4.6 For each railway organisation, sub-issues are assigned scores between 0 and 1, where:

- '1' means the Board, Director General, or private owner (shareholders), have a complete formal right to make decisions on the issue;

- '0' indicates that a non-railway body, e.g. government, makes the final decisions on that issue, i.e. has the power of veto.

4.4.7 The contribution to the adaptability index for sub-issue 'k' is then calculated as:

$$C_k = p_k * wh_k * wi_k$$

where:

p_k is the individual sub-issue score;
wh_k the main heading weight; and
wi_k the sub-issue weight.

4.4.8 The Power Index score is the sum of the weighted sub-issue scores divided by the maximum attainable total, 8, to give a score between 0 and 1.

Accountability

4.4.9 Indexation assumes that accountability can be targeted; related to responsibility for performance measures. For PRORATA this was equated to a general responsibility for economic efficiency and measures of economic performance.

4.4.10 The success of a limited company quoted on the stock exchange is measured in terms of dividends paid and/or the growth of its share price, both being related to actual or expected profit. Its responsibility (R) to its shareholders, and the measures / targets (T) by which the stock market judges its performance almost completely coincide. The ratio T/R is thus close to 1.

4.4.11 Most public authorities and publicly owned companies also have economic responsibilities, but these are frequently accompanied by very weak or incomplete measurements of economic performance. Under these circumstances T/R can be very low (but always above 0).

4.4.12 This ratio, T/R, was defined as the degree of accountability, C.

4.4.13 If a railway has total responsibility for its own economic efficiency, e.g. via a requirement to equal or better a specific profit level as

defined in the Profit and Loss account, without any other responsibilities, then its accountability index (C = T/R) will be 1.

4.4.14 However, many rail organisations have non-commercial responsibilities or areas of operation. These can include social service obligations for train operators, or the management of the infrastructure when this is separate from train operations, and is partly or wholly financed by grants (rather than access charges on operators). Under these circumstances the infrastructure agency may be seen as providing a social service to the train operator(s), as is currently the case in Sweden, Denmark and Belgium.

4.4.15 An accountability measure based on train operations only will differ from one for the total railway system. With examples of vertical integration and total separation of operations and infrastructure in the EU, an integrated railway adaptability measure has been adopted to maximise the use of the Methodology.

4.4.16 To incorporate this in the measure, the Responsibility measure is then calculated as :

$$R = Rc + Rs$$

where

Rc = T = The costs of the commercial operations
Rs = The costs of the non-commercial operations

4.4.17 Substituting for T and R, the Accountability Index then becomes:

$$C = Rc / (Rc + Rs),$$

Where social discounts are one of the organisation's obligations, Rs is disaggregated into an operations component, Ro, and the revenue cost of the discount, Rd, i.e.

$$C = Rc / (Rc + Ro + Rd),$$

and the Adaptability Index becomes:

$$A = P * (Rc / (Rc + Ro + Rd))$$

4.4.18 As the practical issues of operationalising the index were addressed, a further hypothesis was made: that a pattern of the number of powers possessed by a railway and the identity of those powers would emerge. Some powers would be assigned to almost all railways, no matter what their institutional hierarchy, while

other powers would be possessed only by those organisations with the greatest number of powers.

4.4.19 This is illustrated in Figure 4.3, a scatter diagram in which the ranking of railways on the vertical axis is determined by the number of powers possessed and the ranking of powers on the horizontal axis is by the number of railways possessing that power. This implies a hierarchical order of powers - as power increases, powers tend to be added in a specific order – and that a specific value of the Power Index represents a specific set of powers. With a minimum bundle of powers and responsibilities associated with each step in the organisation hierarchy, this "double-ranking" would support use of the Adaptability Index to as a quantitative proxy for Institutional Framework.

4.4.20 Gaps within the pattern in Figure 4.3 indicate "missing" powers, suggesting the most essential concepts for that railway to implement. Conversely, powers that fall outside the main block could represent unnecessary powers that a railway possesses but which add little to its operational flexibility because it lacks other, more fundamental, organisational concepts.

Data Collection

4.4.21 To test the hypothesis, the list of Power index components presented in Table 4.1 was developed into a questionnaire to be completed by the PRORATA Partners in consultation with their own country's railway organisation(s). For countries not represented on the PRORATA team, assistance was sought from colleagues on the LIBERAIL team.

4.4.22 Sufficient information was obtained to estimate indices for 9 EU countries. The questionnaire data was augmented (particularly for issues relating to the Accountability Index), checked and cleaned using further data from LIBERAIL country reports.

4.4.23 The result of the data collection exercise is shown in Table 4.2, with the rows and columns arranged in the double-ranked format, on the basis of the un-weighted scores in the column and row totals of the matrix. Railways / countries are identified in this Table only by a number, and not by Member State, as some correspondents requested anonymity for their railways.

Table 4.2 Power, Accountability and Adaptability of Rail in some EU Member States, 1995

Railway has Power to:	Country Observation No.									
	1	2	3	4	5	6	7	8	9	Total
Set Freight Transport Pricing	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**0.5**	8.5
Recruit Staff	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**		8.0
Set Operational Budget	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**		**0.5**	**1.0**	7.5
Appoint Management	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**0.8**	**0.5**		7.3
Sell Assets, Retain Profit	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**			7.0
Lease Assets	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**		**1.0**		7.0
Set Regional Level Organisation	**1.0**	**1.0**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**	**0.5**		7.0
Proccure with Competitive Bidding	**1.0**	**1.0**	**1.0**	**0.8**	**1.0**	**0.5**	**0.4**	**0.5**	**0.5**	6.7
Determine Operations	**1.0**	**1.0**	**0.9**	**1.0**	**0.5**	**0.5**		**0.5**	**0.5**	5.9
Borrow / Lend money	**1.0**	**1.0**	**1.0**	**0.8**	**1.0**	**1.0**				5.8
Set Main Organisation	**1.0**	**1.0**		**1.0**	**1.0**	**1.0**	**0.4**			5.4
Set Passenger Transport Pricing	**1.0**	**1.0**	**0.3**	**1.0**	**0.7**		**0.3**	**0.5**		4.8
Appoint the Director General	**1.0**	**1.0**	**1.0**				**0.9**			3.9
Set Long Term Business Plan	**1.0**	**1.0**	**1.0**	**0.1**				**0.5**		3.6
Set Annual Investment Budget	**1.0**		**1.0**	**0.9**						2.9
Set Long Term Investment Plan	**1.0**	**0.3**	**1.0**							2.3
Go bankrupt	**0.7**	**1.0**	**0.1**							1.8
Board Appointed by Private Owner	**1.0**									1.0
Total	**17.7**	**15.3**	**13.8**	**12.6**	**11.2**	**10.0**	**6.7**	**6.5**	**2.5**	96.4
Unweighted Power Index	0.98	0.85	0.77	0.70	0.62	0.56	0.37	0.36	0.14	
Weighted Power Index	0.96	0.92	0.71	0.79	0.71	0.56	0.37	0.34	0.22	
Accountability	1.00	0.66	0.56	0.80	0.36	0.37	0.58	0.48	0.15	
Adaptability	**0.96**	**0.61**	**0.40**	**0.63**	**0.26**	**0.21**	**0.21**	**0.16**	**0.03**	

4.4.24 There is clear evidence that such a double-ranked pattern does exist:

- all railways in the sample have the power to set their own prices for (at least some) freight transport;
- only one railway organisation – that with the most powers – has its board appointed by private owners;
- only 3 railways – again those with the most powers – have any entitlement to go bankrupt or to set their own long-term plans.

4.4.25 There is also evidence of gaps in the powers possessed by railways. Railway 7, for example, while having some power under 9 of the 18 categories, cannot determine its own operational budget - a power possessed by all other railways in the sample. Conversely railway

9 can set the level of some operations, yet has no power over recruitment.

4.4.26 Entries in Table 4.2 are ranked by un-weighted Power scores. Applying the weights assigned to each Power in Table 4.1 could produce a different ranking of powers and railways, however, the weighted Power Index, shown in the lower section of the Table 4.2, exhibits only a minor difference in ranking. The coefficient of correlation between weighted and un-weighted power indices is 0.98, suggesting that any subjective element the weighting of powers has not had any major distorting effect on the analysis, or the conclusions drawn.

4.4.27 The Table 4.2 also shows the Accountability Index for each country, and the resulting Adaptability Index. The three indices are also shown in Figure 4.4, ranked by Adaptability.

4.4.28 This indicates a strong correlation between Power and Accountability. While it is interesting to observe that railways with low powers tend also to have a low degree of accountability, this would be expected from a-priori reasoning – regulatory authorities should not permit a powerful but un-accountable organisation, and an accountable but powerless organisation would soon founder in a competitive environment.

4.4.29 The coefficient of correlation between power and accountability is 0.74. As Adaptability is the product of Power and Accountability, high correlation of Adaptability with Power and Accountability would also be expected. This is also evident from Figure 4.4 - the coefficient being 0.89 between adaptability and power and 0.93 between adaptability and accountability.

4.4.30 Further analysis, preferably with a broader set of Adaptability Indices, may be needed before firm conclusions can be drawn on the true order of powers in this hierarchy, but the pattern evident in Table 4.2 would seem to support the hypothesis advanced in Figure 4.3. Adaptability, as defined here, was therefore incorporated in the PRORATA Methodology as an empirical measure of organisation.

4.4.31 The Adaptability Index is also an evaluation tool, being used for the Cross-sectional analysis of the impact of concepts in the Selection stage of the Methodology. The results, presented in Section 7, confirm the hypothesis that there is a link between Adaptability and Economic Efficiency.

5. PEST

5.1 CONTEXT

5.1.1 The final element of the PRORATA Methodology used in the selection of suitable concepts, and also in the identification of the optimal implementation plan, is an assessment of the railway's external environment.

5.1.2 As noted in the discussion of Comparative Efficiency indicators, rail, and even the most highly empowered management, cannot control all the factors influencing a railway's performance or organisation.

5.1.3 A PEST (Political, Economic, Social and Technological) analysis of the wider issues affecting the organisation is therefore useful. This adds an understanding of:

- the external environment in which the railway operates;
- the railway's goals in seeking to change and improve;
- selection criteria when choosing the optimal set of concepts for the organisation; and
- the best change management path for implementing those concepts.

5.2 PEST ANALYSIS

5.2.1 The depth of PEST analysis required will be influenced by the circumstances of the railway organisation. Where there is a clear consensus for change both within the organisation and in the regulatory body, for example, political factors will have only limited relevance.

5.2.2 The issues to be examined, and the context within which they are considered, should take into account the external factors considered important by opponents of change as well as those identified by supporters of change.

5.2.3 A very wide range of issues may therefore be appropriate for consideration, with no two railways / Action Plans encountering the same environment. The topics considered below are thus only indicative of the potential scope of this element of the Methodology.

Political Factors.

5.2.4 In addition to the existing regulatory framework, which will be reflected in the Adaptability Index score, wider political factors need to be considered.

5.2.5 These will include the degree of political will behind greater (or less) private sector involvement in the provision of all public services (not just rail, or transport), and the extent to which such services are to be sold to the end consumer at below the cost of production (e.g. subsidised out of general taxation).

5.2.6 Attention may need to be given to the extent of any opposition to change. Where this is associated with an opposition political party, and a change of government seems likely, a rail organisation seeking stability or smooth transition should not adopt policies which it may be pressurised to reverse following an election.

5.2.7 Moves towards the de-regulation of rival modes would also have a bearing on the ideal set of changes for rail. Faced with the competitive threat of the de-regulation of long distance bus services in the early 1980s, managers in BR's new Business Sector structure used their powers to adopt new pricing and marketing strategies which limited the loss of demand and radically improved the public image of inter-city rail travel.

Economic Factors

5.2.8 A strong correlation has been observed between economic activity/growth and the amount of passenger travel in an economy. A need to modernise / expand the system to cope with higher future demand might require one set of responses (e.g. increasing private sector involvement to attract investment capital into the industry). A need to retrench as demand is likely to fall in future would imply a different response.

5.2.9 In particular, given the long planning and implementation cycle for rail investment and the long life of rail assets, analysis of these factors needs to consider all possible future outcomes for the wider macro-economy.

5.2.10 Investment or policies aimed at re-capturing a lost market which, through socio-economic change, no longer exists on any mode should be avoided.

5.2.11 Conversely, failure to anticipate new market opportunities will see these met by modes with a shorter investment cycle. Once other

modes are established in the market, rail may find it hard to recover.

5.2.12 Analysis of economic influences can extend outside the country of the railway. Trends in energy prices and environmental issues. e.g. global warming, could have an influence on longer term investment plans.

Social Factors

5.2.13 In many societies there is a deep-seated public perception of what the country's railway should do, not just among those who use it. While this will, to some extent, be internalised in the regulatory framework or taken into account under Political Factors via competing Parties' manifestos, it may also be a factor in its own right.

5.2.14 A number of socio-economic issues also need to be considered. Demographic trends can be forecast with some accuracy, and will affect the proportions of work and leisure related travel, and the numbers of pensioners or children the railway may be catering for (and thus the level of customer care required).

5.2.15 Likewise, trends in public order and criminality, while not directly affecting the railway, may affect the wider public perception of safety on railway.

Technological Factors

5.2.16 As a highly technical mode, many technological changes are internal to rail – signalling and train control techniques, more efficient motors and regenerative braking, safe single manning via video technology etc.

5.2.17 However, in addition to areas in which there is an interface between rail's choice of technology and economic / environmental factors (e.g. energy source), there are a number of areas in which technological development elsewhere in the wider economy can be relevant to rail's optimal physical and personal investment plans.

5.2.18 Actual and potential changes in comfort / speed / efficiency on rival modes will be relevant – should rail attempt to counter, or, as with the ocean liner and the jet plane, withdraw from the market? Such changes need not be negative for rail.

5.2.19 Growing congestion on inter-urban roads presents rail with an opportunity to win back market share with relatively little effort –

the Focus Groups indicated the potential if rail merely invests in people and gets the "basic" product right.

5.2.20 Conversely, increasing use of Email, fax, tele-working, flexi-time, and job-sharing could have a major impact on working patterns, reducing journey-to-work travel and flattening out commuter peaks. Such technically influenced changes in social organisation may alter the socio-economic function of the passenger railway as well as the economic and financial fundamentals of its operation.

5.2.21 The 1980s, for example, were characterised throughput much of the EU by:

- Change in the political climate, particularly regarding the public ownership of utilities;
- Reduced trade union influence on transport policy in a number of countries;
- Increasing competition in manufacturing industry, particularly from the Far East;
- Rapid changes in technology; and
- Reduction in inflation and interest rates, but no reduction in cyclical economic trends.

6. Identification and Structuring of Concepts

6.1 INTRODUCTION

6.1.1 In order to test the practical applicability of the methodology, the study team drew together a selection of organisational, product and marketing concepts from within rail and from other modes of transport.

6.1.2 As an initial step in the analysis of the most appropriate circumstances for their implementation, these were then structured into a number of families, depending on the way in which they impacting on a railway organisation or the part of the organisation they mainly affect.

6.2 INVENTORY OF RAIL CONCEPTS

6.2.1 Sources of input for the Inventory of Rail Concepts included: the List of Positive and Negative Aspects in Table 3.6; the Comparative Efficiency exercise; and the Mode Choice Criteria review. In each case, a selected concept represents an example of "good practice" in at least one European railway.

6.2.2 These Concepts were initially placed in seven rail-based "families", outlined below.

Structural - Social and Political Environment

6.2.3 These concepts relate to the structure of the railway and its relationship with Government together with matters encompassing the social and political environment within which the railway is operating:-

- Setting railway objectives - financial and service performance.
- Specifying the social role of transport.

Regulatory Environment

6.2.4 This relates to the regulatory regime which may or may not formally exist between the Government and the railway:-

- Review of the Regulatory Environment

Structural - Railway Organisation

6.2.5 These embrace those organisational issues which the railway board and management are generally free to manage, although frequently these are closely related to the social, political and regulatory environment:-

- Reduction in tiers/levels of management
- Refocus on business-led structures
- Creation of specialised long-distance rail passenger companies
- Inter-linked business, operational and engineering objectives
- Development of inter-departmental trading relationships
- Personal objectives and performance management
- Performance regimes
- Total Quality Management
- Empowerment with accountability
- Refocused safety management

Production - Strategy and Policy

6.2.6 General strategy and policy issues associated with the railway operations and engineering activities. Again, management will usually have freedom to manage these issues within parameters defined by Government:-

- Investment development and appraisal processes
- Project risk analysis and value management
- Private sources of investment funding
- Improving project management
- Competitive procurement policy
- Resource, cost and revenue allocation to specific business units
- Business analysis and monitoring
- Effective management information
- Technology of High Speed Services
- Ticket retailing and inspection technology
- Information collection and transmission technology
- Modal integration

Production - Planning and Service Delivery

6.2.7 These detailed planning and delivery concepts are almost wholly within the control of the railway board and management:-

- Manpower productivity
- Asset management
- Key performance indicators

- Personnel recruitment, training and development
- Out-sourcing of services
- Inter-operability
- Infrastructure productivity
- Operational management of infrastructure
- Management of stations
- Quality of service delivery
- Train service reliability

Marketing - Strategy and Policy

6.2.8 General strategy and policy issues associated with railway marketing. The board and management will also be largely free to manage these activities within parameters defined by Government:-

- Market research and analysis
- Product development and pricing

Marketing - Customer Delivery

6.2.9 These relate to the sales and general promotional image of the railway products, which are almost wholly within the control of the railway board and management:

- Promotion and sales
- Value-for-money image

6.2.10 Each concept is described in detail in Section 3 of the Annex volume.

6.3 SUMMARY OF OTHER MODES CONCEPTS

6.3.1 In a parallel exercise a selection of potentially suitable, and transferable, the 'other modes' concepts were identified (i.e. from air, shipping or road modes). These concepts fall naturally into two 'families',: Concepts related to internal organisation and strategy/ objective formulation - **strategic** concepts; and Concepts related to operations - **operational** concepts.

Strategic Concepts

6.3.2 Concepts related to internal organisation and strategy/objective formulation:

- Alliances
  - Global alliances
  - Dominating operations at a hub
  - Alliances with feeders

- Hub and spoke networks
  - Network design
  - Hub determining the brand image
  - Good accessibility of the hub
  - Cross docking
  - Efficient handling systems

- Specialisation and differentiation
  - Value chain
  - Logistical services
  - Niche marketing

- Door-to-door service: interoperability
  - High speed train network
  - Containerisation
  - Information technology

Operational Concepts

6.3.3 Concepts related to operations

- Cost cutting and increasing flexibility
  - Culture of cost-consciousness
  - Rationalisation experience of other industries
  - Liberalisation of business units
  - Time reduction through changes within the network
  - Organisational management
  - Multi-functionality of employees
  - Flexible working hours
  - Leasing
  - Combi transport
  - Flexible fleet size
  - Time reliability

- 'Tailor-made' product
  - A tailor-made product
  - A flying office
  - Yield management
  - Frequent flyer programmes
  - Ticketing
  - Extra service

Extra investments in infrastructure
Price-quality ratio

6.4 CATEGORISATION OF CONCEPTS

6.4.1 To facilitate the identification of successful concepts and give guidance on the optimal implementation strategy, the potentially successful concepts, from existing rail best practice and other modes, have been categorised into a number of concept groups.

Concepts and Adaptability

6.4.2 The developing methodology suggested a multi-tiered categorisation, with the first split being between:

- concepts involving changes in a railway's regulatory regime or organisation; and
- those potentially implementable under any framework.

6.4.3 This is illustrated in Figure 6.1. The Adaptability Index is the scale for the horizontal axis.

6.4.4 All railway organisations have some ability to effect change from within the organisation (i.e. without needing permission from the government or regulatory authority). This is their Zone of Adaptability. Within each zone, adoption of a "best practice" set of within-framework concepts will improve profitability, indicated by the vertical arrows.

6.4.5 Adoption (or imposition) of strategic, framework-changing concepts could affect profit potential in two ways:

- via framework change itself, indicated by the angled solid arrows; and
- by altering both the set of within-framework concepts that can usefully be applied and the quantum of their impact, represented by longer vertical arrows in zones of adaptability towards the right of the Figure.

The angled hollow arrows then show the potential change in profitability with both change of framework and adoption of the optimal set of multi-framework concepts for the new structure.

Transformation of Other Modes Concepts

6.4.6 All concepts were then transformed to a common base. As almost all Other Modes Concepts were closely related to Rail Concepts, either in their organisational basis or their intended route of impact on profitability, the initial rail structuring was used.

6.4.7 Table 6.1 presents this translation. Other Modes concepts are numbered in S(trategic) and O(perational) series. Where no directly comparable Rail concept was identified, the third column describes a probable rail equivalent of the concept (Rail Concept numbering follows that used in Section 3 of the Annex volume).

6.5 CATEGORISATION OF WITHIN FRAMEWORK CONCEPTS

6.5.1 Within-framework concepts were mapped onto a Structuring of Concepts (SoC) matrix, dimensioned by:

- the objective of PRORATA, i.e. the profitability of rail; and
- the activities performed within the railway industry.

Table 6.1 Transformation of Other Modes Concepts to Potential Rail Concepts

Other Modes Concept		Transformation to Rail	Related Rail Concepts
S.1	Global alliances	International (cross-border) alliances between operators, i.e. service and schedule co-ordination	
S.2	Dominating operations at a hub	Co-ordination and integration of on-board and station/ platform service	7.1, 7.2
S.3	Alliances with feeders	Modal integration, interoperability	4.12, 5.6
S.4	Network design	Idem	
S.5	Hub determining the brand image	Integration between stations and railways image, e.g. passenger must experience station as start of train-trip by closed passenger areas	7.1, 7.2
S.6	Good accessibility of the hub	Modal integration, interoperability with local transport, good parking places	4.12
S.7	Cross docking	Efficient passenger transfer planning at stations	5.9
S.8	Efficient handling systems	Efficient passenger transfer planning at stations	5.9
S.9	Value chain	Regulatory framework concept	
S.10	Logistical services	Door-to-door service organisation, information	5.10
S.11	Niche marketing	Regulatory framework concept	
S.12	High speed train network	Modal integration, integration with feeder networks	4.12, 5.6
S.13	Containerisation	Interoperability between operators or service providers, i.e. integration of ticketing, standardisation of service	
S.14	Information technology	Idem	4.10, 4.11
O.1	Culture of cost-consciousness	Performance Management, empowerment with accountability	3.6, 3.9
O.2	Rationalisation experience of other industries	Transferring knowledge through co-operation, private involvement, out-sourcing	4.3, 4.4, 4.5, 5.5
O.3	Liberalisation of business units	Empowerment, personal objectives, resource, cost and revenue allocation to business units	3.6, 3.9, 4.4, 4.6
O.4	Time reduction through changes within the network	Network optimisation	5.2, 5.7, 5.11
O.5	Organisational management	Idem	4.2, 4.4, 4.6
O.6	Multi-functionality of employees	Idem	3.6, 5.4
O.7	Flexible working hours	Idem	3.6, 5.4
O.8	Leasing	Idem	4.3, 4.5, 5.2
O.9	Combi transport	Idem	5.2, 5.7
O.10	Flexible fleet size	Idem	4.3, 4.5
O.11	Time reliability	Idem	5.11
O.12	A tailor-made product	Differentiation and specialisation, idem Value Chain	
O.13	A flying office	Service/price differentiation	6.1, 6.2, 7.1, 7.2
O.14	Yield management	Service/price differentiation	6.1, 6.2, 7.1, 7.2
O.15	Frequent flyer programmes	Frequent traveller programmes	7.1, 7.2
O.16	Ticketing	Idem	4.10, 5.10, 7.1
O.17	Extra service	Service/price differentiation	6.1, 6.2, 7.1, 7.2
O.18	Extra investments in infrastructure	Network optimisation	5.2, 5.7
O.19	Price-quality ratio	Service/price differentiation	7.2

Profitability

6.5.2 Rail can increase profitability by increasing revenue, decreasing cost, or both. Concepts have been structured using these elements of profitability.

6.5.3 Revenue is a product of demand for rail services, and the price they command, either from customers or in social obligation payments from government. Demand depends on the quality of the service as well as the price. Concepts primarily aimed at revenue enhancement, whether via quality or price, were grouped as “revenue concepts”.

6.5.4 Other concepts are primarily aimed at lowering cost, which can broadly be divided into: running cost, related to day-to-day operations; and investment cost, related to the -term provision of capacity for services. There is some inter-play between revenue, running cost and investment cost. Quality improvements imply investment and possibly additional running cost. Investment expenditure will affect not only financing cost but also future running cost. Cost reduction measures may affect the quality of service delivery and thus revenue.

6.5.5 The profitability dimension of the matrix thus has three cells:

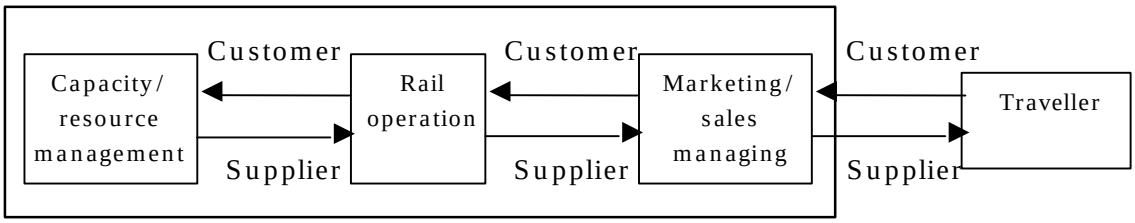
- revenue related measures;
- running cost related measures; and
- investment cost related measures.

Railway Industry Activities

6.5.6 A useful method for differentiating between activities within an industry is the Value Chain method. This assumes that in a deregulated, competitive, industry organisations are valued by their profitability. Rather than attempt to perform all the activities associated with the industry, organisations specialise, focusing on their key strengths.

6.5.7 Other market supply activities are out-sourced to other (competing) service suppliers, and a chain of supplier-customer relations emerges, to provide a service to the ultimate (retail) customer. While the context for a vertically integrated EU railway is different, the structure is helpful in differentiating the activities of an integrated railway organisation. Figure 6.2 shows a simplified value chain for rail public transport services.

Figure 6.2 The Railway Value Chain



6.5.8 Three main differentiated activity blocks within the rail industry are shown, into which within-framework concepts can be broadly structured.:

- Capacity/resource management;
- Rail operation; and
- Marketing/sales,

6.5.9 To be of practical use in PRORATA, the SoC matrix needs to be compatible with the full range of rail organisational structures, e.g.:

- the traditional command structure, where all activities are performed by one centralised organisation;

- the business sector structure, with activities performed in semi-independent business units; and

- a privatised structure, where each activity could be performed by a number of different companies in a competitive environment.

To confirm the value chain's flexibility, the structure was applied to the two extremes of the hierarchy of organisational structures.

6.5.10 A value chain for a traditional command structure is shown in Figure 6.3:

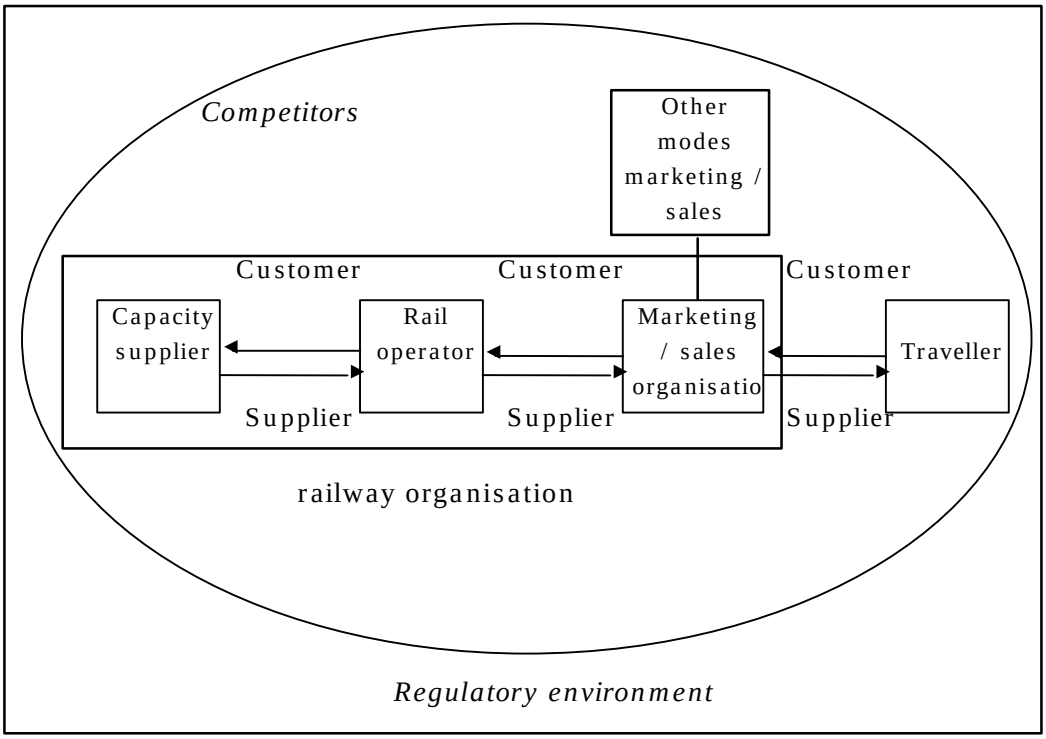
Activities: all activities are performed within one organisation.

Clients: The only client is "external", the traveller.

Competition: the only competition is between the sales organisation of the railway and the sales organisations of other modes. Internal customer-client relations do not experience external competition.

Strategy/market position: the organisation supplies services to all rail passengers, there is no competition with other rail operators and there is no selectivity or focus on a specific market segment.

Figure 6.3 Railway Value Chain for Traditional Command Structure



6.5.11 The value chain for a privatised market structure is shown in Figure 6.4:

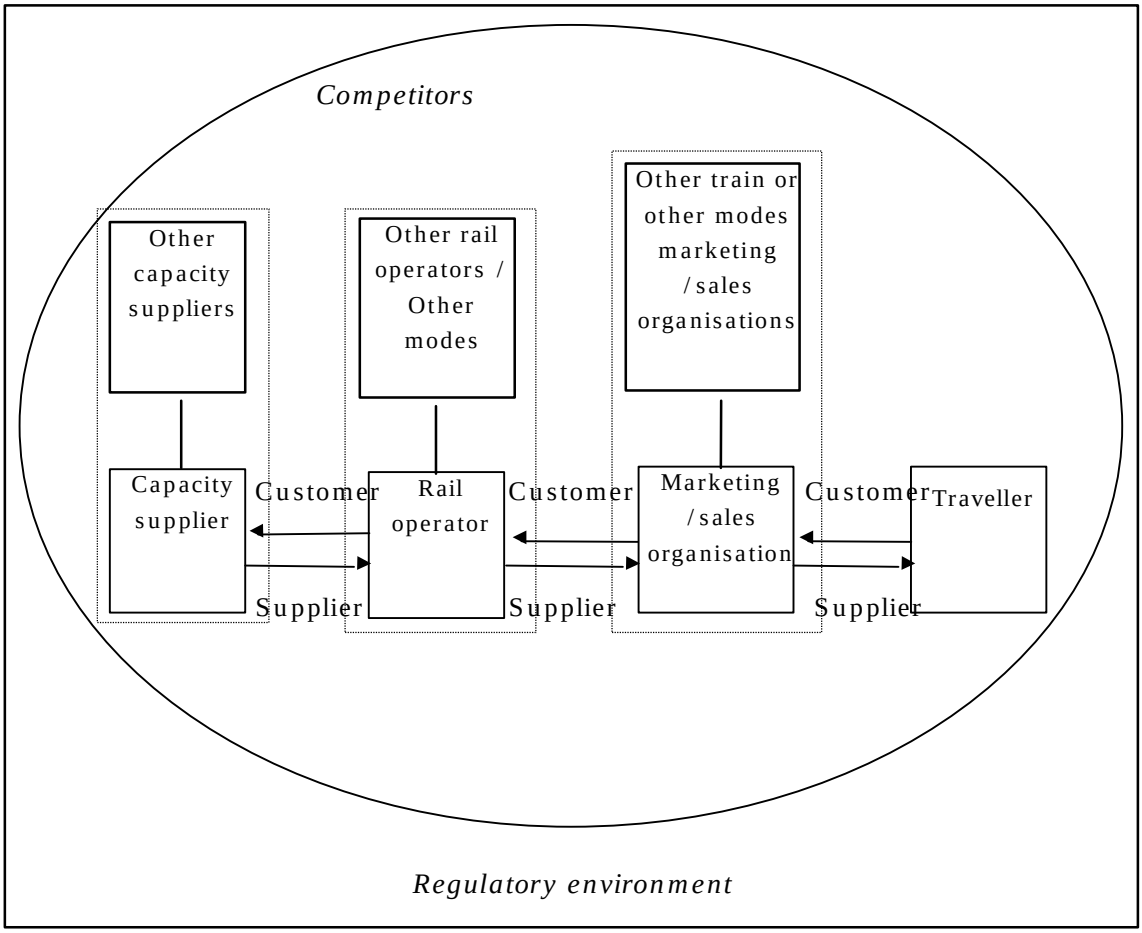
Activities: can be performed by different organisations. All activities in the value chain are in a market environment, whether with competitors, customers, or suppliers.

Clients: privatised railway organisations can perform all activities themselves, but usually have customer-client relations with other organisations on specific activities.

Competition: competition can exist in all segments of the value chain, but will probably increase to the right of the Figure, as the possibilities for service differentiation also increase.

Strategy/market position: a number of companies can supply services in each activity. In this competitive situation companies will position themselves in the market according to their key strengths.

Figure 6.4 Railway Value Chain for Privatised Business Companies



6.5.12 A simple SoC matrix was thus created, with three cells in each of the two dimensions (profitability and Activities). The concepts were loaded onto it according to two criteria:

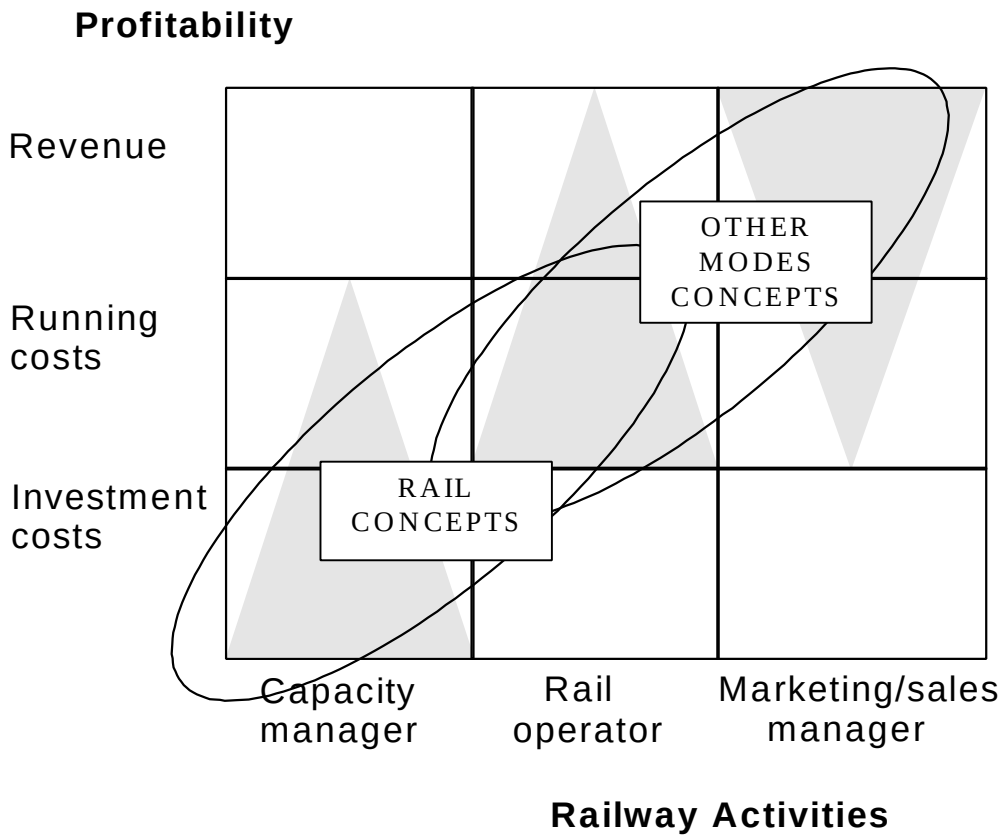
- the railway activity they are related to, e.g. 'competitive procurement policy' is relevant to the capacity/resource management activity (some concepts, such as those relating to personnel are relevant to more than one activity and are assigned to all activities); and

- the route of the main profitability impact, e.g. 'frequent traveller programmes' is aimed at attracting and committing customers, at a higher price for the same service if possible, and is assigned to revenue.

6.5.13 There was a notable difference in the distribution of Rail and Other Modes concepts. Rail concepts were concentrated in the supply side - capacity and operations cost-cutting cells, while Other

Modes concepts were concentrated in the operations cost-cutting and marketing/sales-revenue enhancing cells. This trend is illustrated in Figure 6.5.

Figure 6.5. Clustering of Rail and Other Modes Concepts



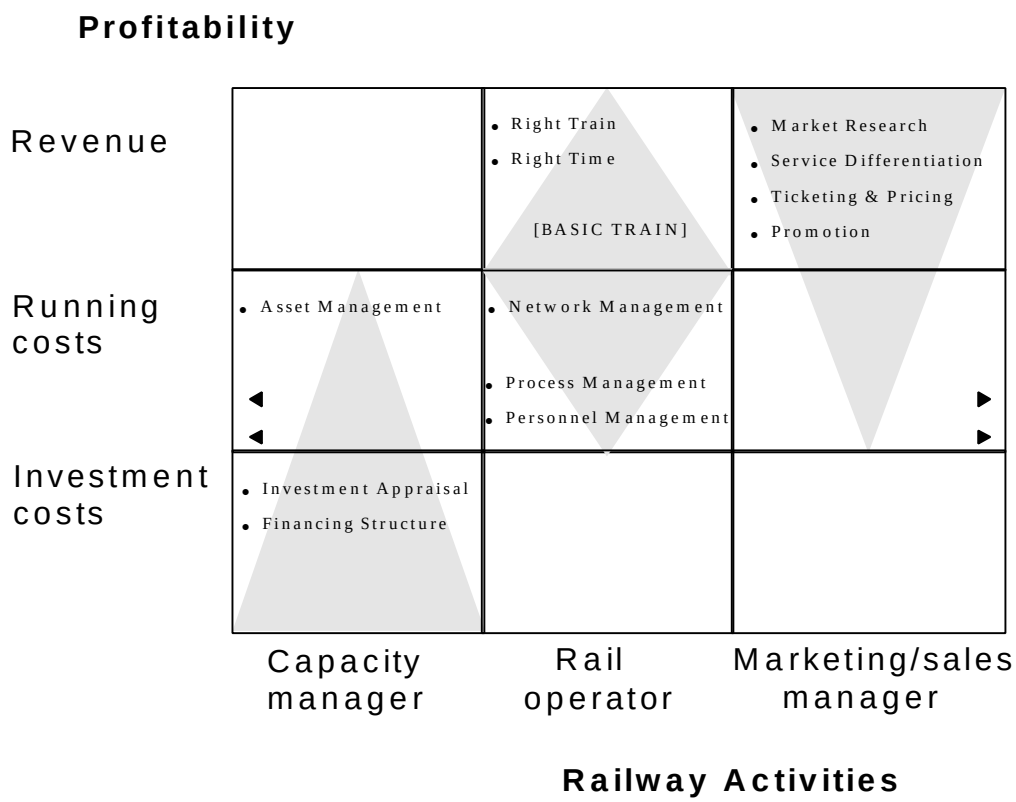
6.5.14 The grouping the concepts in each cell of the matrix helps identify families (categories) of related concepts. These categories can be considered as separate sub-activities within the main railway activity areas. A short description of each of these categories is given in Table 6.2.

Table 6.2 Categories of Concepts

Categories of concepts		
1	Investment appraisal	What infra-, superstructure, rolling-stock capacity to provide
2	Financing structure	How to finance this capacity
3	Asset management	How to manage this capacity
4	Process management	Internal organisation/optimal use of capacity
5	Personnel management	Internal organisation/optimal use of capacity
6	Right train	What train service to provide, train quantity and quality
7	Right time	What train service to provide, time frequency and reliability
8	Network management	Internal organisation/optimal use of capacity
9	Market research	What does the client want (to pay for), price/quality ratio per market segment
10	Service differentiation	Provide what the client demands
11	Ticketing & pricing	Differentiated prices (yield management, price/quality ratio), integrated tickets
12	Promotion	Image building, marketing (information & attraction), customer satisfaction, station management

6.5.15 Finally, these groups of concepts were overlaid on the SoC matrix, as shown in Figure 6.6. It is notable that the concept families reflect many of the initial concepts emerging from the market research phase, Basic Train appears in the families assigned to the Operations-Revenue Enhancement cell.

Figure 6.6. Categories of Concepts Assigned to the SoC Matrix



7. Concept Selection - Measures of Performance

7.1 INTRODUCTION

7.1.1 The central block of the PRORATA methodology is the identification of an optimal set of profitability enhancing concepts for implementation. To aid the process of selection of concepts likely to be the most successful, given the performance, Adaptability and PEST contexts of the rail organisation, a set of measures of performance, is needed.

7.1.2 The appropriate measure of performance for PRORATA is implicit in the title of the Study - the (net) profitability of the railway organisation.

7.1.3 Railways may have other objectives (e.g. implementation of government social policy) which, while not incompatible with a profitability objective, imply the need for a wider range of impact measures. Analysis, of wider social issues is covered in a sister project to this, SONERAIL. Further, profitability can be increased by increasing revenue, decreasing cost, or both, but some concepts that impact on profitability by lowering costs may also lower quality and have a negative revenue effect.

7.1.4 Net profitability alone may not, therefore, be a sufficiently subtle measure of concept performance. It is also necessary to examine the route of profitability impact in order to judge the measure's performance under the full range of potential frameworks, and also to judge how well the concept fits with railways' and governments' non-profit objectives.

7.1.5 Experience (e.g. the Comparative Efficiency Analysis) indicated that incomplete data availability could prevent a single evaluation method from providing conclusive evidence on the suitability of a concept. Four approaches were therefore adopted, in the anticipation that conclusions of each would converge, resulting in robust conclusions. These were:

- Time series analysis;
- Cross sectional analysis;
- Expert panel assessment; and
- Detailed case studies.

The methods were intended to be both complementary and supportive, with each acting as a check on the reliability and outcome of the others.

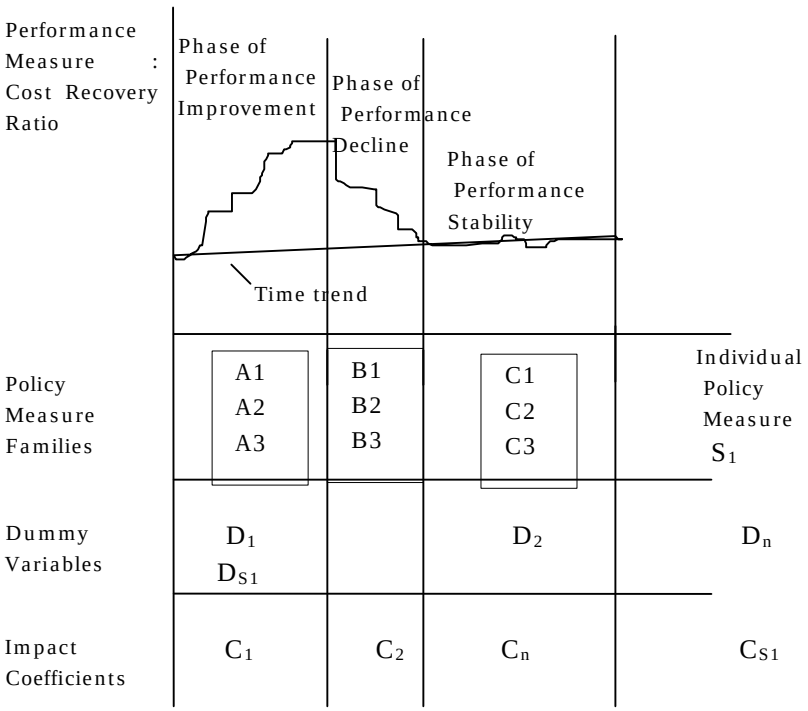
7.1.6 The broad outline of each approach is discussed below, together with the significant findings from the Study team's pilot analyses using the method. The Cross-Sectional analysis, using the Adaptability Index, reached a number of far-reaching conclusions, which are detailed. The Annex volume presents the findings from the Time Series and Expert Panel analysis, together with a selection of Case Studies.

7.2 TIME SERIES ANALYSIS

7.2.1 The basis of this method is that various measures of performance, e.g. unit operating expenditure or cost recovery ratio, can be plotted against time and compared with the time at which specific policy objectives were introduced (or became effective), establishing the existence or otherwise of a relationship between performance and institutional structure or specific policy measures.

7.2.2 Ideally, with sufficiently dis-aggregate data, time series regression could be used as an analytical tool. Figure 7.1 illustrates the principle.

Figure 7.1 Time Series Regression Analysis



Performance Change v. Policy Measures and Institutional Structure

7.2.3 Here, each performance period has seen the introduction or cessation of policy initiatives. Dummy variables, D_1 ... D_n, can be assigned to each family of policies, and regression coefficients derived to measure the impact of policy initiatives / structure on performance. With sufficiently detailed data, or where there have been few changes over time, the impact of an individual policy could be measured via the coefficient, C_{s1}, on the assigned individual policy dummy, S_1 .

7.2.4 Where sufficiently disaggregate data is not available an alternative four step procedure can be applied in conjunction with other approaches:

1. identify the evolutionary pattern of performance of the company;
2. identify the active policy measures in each performance phase;
3. assess the impact of these measures on profitability, subsidy requirement or other suitable performance measure (Expert Panel); and, where possible,
4. assess the impact of major policies individually within each phase (Case Studies).

7.2.5 Whichever method is used, the influence of external factors, e.g. strikes, macro-economic cycle, needs to be taken into account. For example, if economic recession caused traffic to fall by 20%, other things remaining equal, revenue would fall by 20%. However, fixity of some costs and economies of scale in the railway industry mean that cost would by less than traffic / revenue, causing cost recovery ratio performance to decline for reasons outside rail management's control.

7.3 TIME SERIES RESULTS

7.3.1 The success of Time Series Analysis as an evaluation tool depends on whether a robust relationship between cost efficiency and policy / structure changes over time can be detected in the available data. Analyses were undertaken on data from: the UK; Greece; Sweden; and the Netherlands over a minimum of the period 1975 to 1995.

7.3.2 The four countries were found to have had a varied experience of institutional and product changes during that period:

- in the UK organisational structure was radically changed and there were upgrades of rolling stock and service quality on some routes;

- in Greece there were no organisational changes, but there was a significant change in the level of service on main lines;

- Sweden experienced gradual evolution of structure, culminating in the formal division of operations and infrastructure in 1988; and

- the Netherlands exhibited accelerating organisational change.

7.3.3 The Analyses thus considered railways undergoing different changes over the evaluation period, and were able to draw different observations.

7.3.4 The UK analysis gave a strong indication that organisational structure and institutional framework have an influence on profit potential, at least up to the Profit Centre stage. This conclusion is also supported by Sweden and the Netherlands, where improvements in both financial performance and service delivery can be detected as the organisations have moved towards business sector and profit centre structures.

7.3.5 OSE did not undergo any structural changes in the period under review. The Greek data series are free of structural influence and can show the impact of operational and marketing initiatives. The introduction of radically improved main line services appears to have had a dramatic impact on ridership and revenue, halting a long term and serious decline in the cost recovery ratio.

7.3.6 All four analyses also illustrated the importance of external factors:

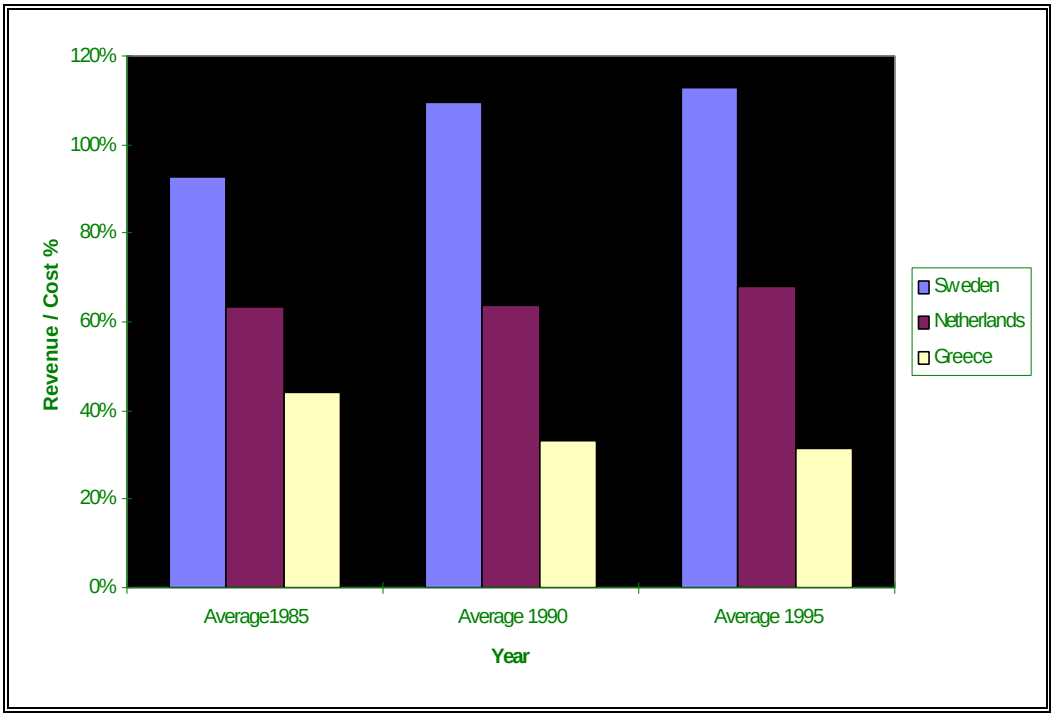
- Subsidy requirement in the UK rose, despite the adoption of a theoretically more profitable structure, in the early 1990s as the country suffered an economic recession and travel demand fell;

- Recent improvement in OSE's financial performance has been reversed by landslides, (non-rail) strikes and war in neighbouring countries.

7.3.7 Figure 7.2 compares the cost recovery ratios for Sweden, Netherlands and Greece, showing the 10 year moving average ratio at 5-year intervals:

- The ratio for Sweden shows strong growth, particularly during the period of rapid organisational re-structuring (1985-1990).
- For Netherlands the growth is less, but again is faster in the period most affected by re-structuring (1990-1995).
- For Greece the trend is negative, but tie decline slows to almost zero in the period affected by improvements in service quality (1990-1995).

Figure 7.2 Cost Recovery Index of Countries Compared



7.3.8 UK data is not included, this was collated by organisational structure period rather than 5-year time period, with four organisational phases:

- Commercialisation (1975 - 1982);
- Business Sectors (1983 - 1989);
- Profit Centres (1990-1994); and
- Privatisation (1994 onwards).

7.3.9 Examination of performance in these periods indicated that financial performance improved significantly.

- During the Commercialisation period:
  - public sector contribution to BR fell by £661m in real terms;
  - average unit cost was 11.5 pence per passenger mile;
  - average revenue was 6.9 pence per passenger mile; and
  - Cost Recovery ratio was 60%.

- During the Sectorisation period:
  - public sector contribution reduced by £1.262 bn in real terms;
  - Average unit cost fell to 11.1 pence per passenger mile;
  - Average revenue increased to 7.3 pence per passenger mile; and
  - Cost Recovery ratio increased to 65%, mainly through initiatives on cost and revenue optimisation.

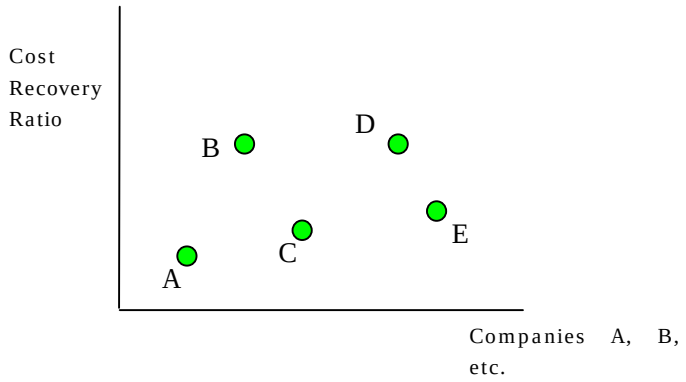
- During the Profit Centre period;
  - subsidy fell by £492m (in real terms);
  - Average revenue increased to 8.1 pence per passenger mile; and
  - Cost Recovery ratio increased to 73%, mainly through revenue measures.

Unfortunately it was not possible to generate similar observations for the privatisation period within the project timescale, changes in accounting practices and structure making it difficult to compare financial data from this period with the previous three.

7.4 CROSS SECTIONAL ANALYSIS

7.4.1 On a simple level, this methodology asks the question “do companies with similar performance have similar institutional backgrounds (or vice-versa)?” i.e., do companies B and D in Figure 7.3 have similar institutional structures?

Figure 7.3 Comparison of Cost Recovery Ratios of Railways



7.4.2 With a large enough sample, the comparative efficiency exercise could be extended using the Adaptability Index as proxy for institutional structure. This would allow relationships between cost efficiency and structure to be explored by introducing adaptability as a right hand side variable in the cost equation and examining the size of its coefficient

7.4.3 With less data availability grouping companies into 'peer groups' according to their institutional characteristics and assigning a dummy variable to each peer group, would allow the impact of institutional factors on performance to be gauged.

7.5 CROSS-SECTIONAL ANALYSIS RESULTS

7.5.1 Adaptability Indices were calculated for rail in 9 EU countries and compared with a number of indicators of economic efficiency, including:

- Total Factor Productivity;
- Cost/Gross Tonne Km (for both freight and passenger);
- Cost/Traffic Unit (assuming 1 tonne km = 1 passenger km); and
- Cost/Train Km, each calculated with respect to total cost, running cost and operating cost,
- Cost Recovery Ratio, calculated with respect to running cost and operating cost; and
- Traffic Units/Member of Staff (i.e. labour productivity).

7.5.2 The initial Cross-Sectional Analysis involved correlating selected efficiency indicators with the: Power Index; Accountability Index;

and Adaptability Index scores from Table 4.2 for the same country / railway.

7.5.3 Attempts were made to fit linear and logarithmic functions to the data sets. Total Factor Productivity and Cost Recovery measures, which can assume both positive and negative values, fitted best to linear functions. The other comparative efficiency measures, which must always be greater than zero, fitted better to logarithmic functions. Figures 7.4 to 7.9 present scatter diagrams showing the Adaptability score for each railway and the six economic efficiency indicators, the fitted regression lines are also shown.

7.5.4 There is a good spread of values of the variables along each axis in each Figure, increasing the level of statistical confidence in the results. Further, with the exception of Labour Productivity (Figure 7.9), the regression lines represent a good fit to the data scatter. Coefficients of correlation (r^2) are shown in Table 7.1 for all the components and variants of the main indices.

Table 7.1 Adaptability, Power and Accountability vs Economic Efficiency

Economic Efficiency Indicator		Adaptability	Power	Accountability
Total Factor Productivity	Total Cost	0.90	0.82	0.89
	Running Cost	0.88	0.81	0.89
	Operating Cost	0.87	0.80	0.87
Cost/Gross tonne Km	Total Cost	-0.81	-0.74	-0.88
	Running Cost	-0.82	-0.75	-0.90
	Operating Cost	-0.82	-0.75	-0.89
Cost/Traffic Unit	Total Cost	-0.62	-0.52	-0.81
	Running Cost	-0.50	-0.40	-0.71
	Operating Cost	-0.45	-0.36	-0.66
Cost/Train Km	Total Cost	-0.56	-0.27	-0.71
	Running Cost	-0.51	-0.18	-0.72
	Operating Cost	-0.49	-0.14	-0.70
Cost Recovery	Running Cost	(0.90)	0.79	(0.84)
	Operating Cost	(0.92)	0.80	(0.87)
Labour Productivity	Traffic Units/ Staff	0.34	0.34	0.46

( ) These results are not statistically significant, see discussion.

7.5.5 The Figures and Table show Total Factor Productivity to be highly correlated with Adaptability, Power and Accountability, irrespective of the cost definition applied. Correlation is highest, at 0.90, for the estimate based on total cost. It can also be seen that Cost (total, running or operating) per Gross Tonne Km is strongly

related to all components of Adaptability, with the expected negative sign, i.e. as Adaptability rises unit costs go down.

7.5.6 Cost per traffic unit is also correlated with Adaptability but not so strongly. This less conclusive result could also be expected as the mix of freight and passenger traffic varies greatly between railways in the sample. The coefficients for regression lines with high r^2 are all statistically significant.

7.5.7 These results suggest that differences in the regulatory framework, as captured by this two-dimensional Adaptability Index, can explain the bulk of differences in productivity between the sample railways.

7.5.8 However, the high correlation of Cost Recovery Ratio with Accountability and Adaptability should be treated with caution, because the definitions of Cost Recovery Ratio and Accountability Index are related:

- Accountability is the ratio of the commercial portion of operations to total operations (commercial and non-commercial); but

- these non-commercial operations represent "costs not recovered" in the calculation of the Cost Recovery Ratio.

7.5.9 This conceptual similarity means that one cannot be used in a scientific way to explain variations in the other. As Adaptability is partially dependent on the Accountability index, this also becomes polluted.

7.5.10 This problem is not present in the Power index, the high correlation between Cost Recovery and Power is statistically valid, indicating a strong dependence. This inter-dependence can be interpreted in two ways:

- the differences of the powers of the studied railways explain a large part of the differences of cost recovery between them; or

- railways with operations largely financed by grants and thus lacking strong indicators of economic performance - i.e. having a low degree of accountability - are not entrusted with strong powers by the regulators.

7.5.11 Given the success of this initial analysis, the proposed regression analysis was attempted. To avoid problems associated with cost measures incorporating interest or depreciation, identified by the

initial comparative efficiency analysis, the further analysis focussed on cost definitions that excluded these elements, e.g. operating cost.

7.5.12 From Table 7.1 it can be seen that Total Factor Productivity and Cost / Gross Tonne Km (GTKm) based on operating cost gave the highest correlation with the Adaptability index. Operating Cost / GTKm is conceptually easier to understand than Total Factor Productivity, and was subjected to detailed analysis of its relation to Adaptability.

7.5.13 A regression function was estimated:

$$G = 21.821 * Ln(A) + 34.865$$

Where:

G = Operating Cost / Gross Tonne Km; and
Ln(A)= The logarithm of the Adaptability index

7.5.14 Using this function, expected unit cost can be calculated for any given Adaptability. Table 7.2 compares observed and simulated unit costs for the 9 railways in the sample.

Table 7.2 Observed and Simulated Unit Costs

Railway	Adaptability	Simulated Unit cost	Observed Unit cost	Difference
1	0.96	36	40	4
2	0.63	45	29	-16
3	0.61	46	43	-3
4	0.40	55	63	8
5	0.26	64	77	13
6	0.21	69	72	3
7	0.21	69	77	8
8	0.16	75	57	-18
9	0.03	111	111	0

7.5.15 The fit between simulated and observed data is quite good, only three railways showing significant differences between observed and simulated unit costs. The possibility that these differences were associated with variation in the mix of passenger and freight traffic was investigated, but no indication was found that this was the case.

Analysis of the Ranking of Powers

7.5.16 As defined, both Power and Accountability are calculated on a scale between 0 and 1. If, on the basis of the observed close correlation between them, the simplifying assumption is made that Accountability and Power scores are equal, Adaptability becomes P^2. Combining this assumption with the regression equation, an estimate of the efficiency gain associated with each power can be made. Table 7.3 shows:

- Powers ranked in the order derived in Table 4.2;
- marginal contribution of each power to the Power Index score;
- cumulative Power Index, expanding powers along the ranking list;
- cumulative Adaptability Index, based on cumulative powers; and
- cumulative (simulated) effect on Operating Cost, in US$/1000 GTkm

7.5.17 It was noted that the upper part of Table 7.3 comprises powers largely related to an "implementing and operational" level of decision making, while those in the lower part of the Table relate to "strategic and ownership" levels of decision making.

7.5.18 The "implementing and operational" powers are associated with a significant reduction in synthesised Operating Cost, from $138 to $45/ 1,000GTkm. However, the "strategic and ownership" powers are only associated with a further $10 decline, to $35/1,000GTkm. Implementing and operational powers thus appear to have a much greater influence on cost, i.e. are essential for a railway to achieve economic efficiency.

7.5.19 The strategic powers (appointment of Board/DG, long-term business plan, annual investment plan, etc.) are concerned more with questions of ownership rather than operation. While it was not possible, with a limited data set, to draw firm empirical conclusions on the impact of delegation of strategic powers to a railway on efficiency, ownership is clearly important. However, unless linked with making the organisation more competitive, these powers would not seem to be as important in reducing the cost per unit of output.

Table 7.3: Powers, Adaptability and Unit Costs, Accumlated

Powers for the Railway (Ranked)	Marginal Power	Cumulative Power	Cumulative Adaptability	Cumulative effect on unit cost (US$/1000GTkm)	Marginal effect on unit cost (US$/1000GTkm)
Implementing and Operating Powers					
Set Freight Transport Pricing	0.09	0.09	0.01	138	
Recruit Staff	0.03	0.12	0.02	126	12
Set Operational Budget	0.08	0.20	0.04	105	21
Appoint Management	0.06	0.26	0.07	93	12
Sell Assets, Retain Profits	0.03	0.29	0.08	89	4
Lease Assets	0.01	0.30	0.09	87	2
Set Regional Level Organisation	0.09	0.39	0.15	76	11
Procure with Competitive Bidding	0.10	0.49	0.24	66	10
Determine Operations	0.10	0.59	0.35	58	8
Borrow / Lend Money	0.04	0.63	0.40	55	3
Set Main Organisation	0.06	0.69	0.48	51	4
Set Passenger Transport Pricing	0.09	0.79	0.62	45	6
Strategic Powers					
Appoint the Director General	0.04	0.83	0.68	43	2
Set Long Term Business Plan	0.04	0.86	0.74	41	2
Set Annual Investment Budget	0.03	0.90	0.80	40	1
Set Long Term Investment Plan	0.04	0.93	0.87	38	2
Go Bankrupt	0.04	0.98	0.96	36	2
Board Appoint by Private Owner	0.02	1.00	1.00	35	1

Valuation of the Concepts to Improve Economic Efficiency

7.5.20 The 12 concept groups from Table 6.2 were cross-referenced to the most appropriate Power group, as shown in Table 7.4. The pattern of mapping suggests 6 larger groups, 3 column based and 3 row based, with the concepts of the group related to the powers of the group.

7.5.21 Further condensing concepts mapped onto the powers to: Set Operational Budget; and Determine Operations, into a single group, 5 clusters of powers and concepts emerge. The re-classification is shown in Table 7.5. This grouping is consistent with the hypothesis of Figure 4.1 that a railway needs certain powers in order to be able to implement certain concepts efficiently.

7.5.22 To give a clearer view, this Concept:Power Matrix was further re-arranged, as shown in Table 7.6. This matrix suggests that most "within-framework" concepts may be closely associated with one or more "between-framework" concepts from the hierarchy of Powers. It can also be seen that there are no within-framework concepts readily associated with the Powers to the right of Table 7.6. It will be noted, from the ranking in Table 4.2, that these Powers are most closely associated with hierarchies 4 (Public-Private) and 5 (Privatisation).

7.5.23 This supports the conclusion from Table 7.3 that most efficiency gains are associated with "implementing and operational" powers (i.e. those with which the groups of concepts can be associated).

7.5.24 This stage of the Cross Sectional Analysis concludes with a quantitative example of the link between Powers, Concepts and efficiency suggested by Tables 7.4-7.6. It is assumed an "average" railway with a Power Index of 0.63 and an Adaptability Index of 0.40, lacks all the powers of one group, e.g. "Operations, operational budget". From the relationships presented in Table 7.3, endowing this railway with these powers will increase Power by 0.18 to 0.81, and Adaptability by 0.26 to 0.66.

7.5.25 Extending the analysis, this increase would be associated with an expected reduction in Operating Cost of $11/1,000GTkm. The railway would be able to achieve this target not by merely possessing the powers, but by being able to successfully apply the concepts classified "1" in Table 7.6.

7.5.26 This exercise was been repeated for all the main concept:power groups, the results are shown in Table 7.7.

7.5.27 These simulations indicate the potential efficiency gains associated with each group of powers and the concepts mapped onto it. E.g., the powers of the group Organisation and Personnel Management will create possibilities for the railway to implement the concepts within group 3. It should then be able to reduce Operating Costs by $14/1,000GTkm.

Quantification of Benefits from Increasing Power and Accountability

7.5.28 The final piece of Cross-Sectional Analysis attempted by the study team attempted a pan-Union estimate of the potential for efficiency gains through greater Adaptability.

7.5.29 While cumulative Adaptability in Table 7.3 is based on an assumption that the Accountability Index equals the Power Index, it is considered possible to increase Accountability close to 1.0 for a railway that has all the implementing and operational powers[7].

7.5.30 Such a railway would have a Power Index of 0.8, and thus an Adaptability of 0.8. This would further promote efficiency and enhance productivity, with a forecast simulated Operating Cost of $40/1,000GTkm8

7.5.31 For this estimate it was assumed that the rail systems of all Member States with average cost exceeding $40/1,000GTkm in 1995 are given all the "operational and implementing" powers in Table 7.3. These railways have average 1995 Operating Cost of $52.5/ 1,000GTkm. This implies an average cost reduction of $12.5/1,000GTkm, or 24% of the original cost.

7.5.32 For the EU railways as a whole, total output in 1995 was about 925 trillion GTkm. If the average cost saving could be achieved by all the Union's railways, the total reduction in Operating Cost (excluding depreciation and interest), would be $11.5bn.

7.5.33 This estimate of potential cost saving and that derived in the Comparative Efficiency analysis (Section 3) are mutually supportive:

- Comparative Efficiency analysis indicated a potential for cost savings of 20% across the sample of railways (which also

[7] E.g. by replacing Public Service Obligation payments with Public Service Contracts, which may be a requirement of potential EC legislation.
8 Such cost levels are achievable – Railway 2 in Table 7.2 has observed costs of only $29/1,000GTkm.

included those of Switzerland and Norway), Adaptability analysis indicates a potential saving of 24% for railways with existing costs above $40/1,000GTkm;

- Cost Frontier Analysis indicated savings of 14.5bn ECU if all railways in that sample were as efficient as the **best**, Adaptability analysis indicates potential savings of $11.5bn (8.8bn ECU) if the EU railways achieved the **average** savings associated with an Adaptability score of 0.8.

7.5.34 Thus, while the Adaptability based estimate appears much lower than the Cost Frontier based estimate, it:

- excludes depreciation and interest;
- is across a smaller sample; and
- only presents savings in achieving a certain level of efficiency – as noted, some railways in the sample already achieve a greater level of efficiency than that projected by the simulation curve.

7.5.35 As the only common element is data from UIC's International Railway Statistics 1995, widely divergent methodologies being followed to derive the estimates, the close comparability of the results lends support to the assumptions made in deriving the estimates.

7.6 ADAPTABILITY AND THE MARKET

7.6.1 The analysis of the relationship between Adaptability and profitability has concentrated on the costs of running a railway – the supply side. A relationship can also be hypothesised between a railway's Adaptability and the attractiveness to potential customers of the services it operates – the demand/revenue side of the profitability equation.

7.6.2 It was not possible to undertake similar empirical analysis on the relationship between revenue and Adaptability. Demand and revenue data, as reported by UIC, is influenced by government policy on tariff structure and issues of commercial confidentiality (particularly for railways with a high degree of private sector involvement).

7.6.3 Nevertheless, revenue/demand:Adaptability relationships, similar to the operating cost /1,000GTKm : Adaptability relationship presented in Figure 7.6 can be postulated.

7.6.4 Figure 7.10 presents a hypothesised relationship between scope for revenue improvement (over and above any growth in demand associated with greater activity in the economy as a whole) and Adaptability. There are notable differences between this curve and Figure 7.6:

- at low levels of Adaptability, a change in Adaptability is associated with quite large changes in cost, but the revenue effect is expected to be quite small, as railway management's ability to make significant changes in the attractiveness of its services is constrained;

- at higher levels of Adaptability, a change in Adaptability has a limited impact on costs, but the revenue effect is expected to be much larger, as at high levels of Adaptability, Accountability will be very high (possibly 1.0), and management will be highly incentivised to pursue opportunities to increase demand and/or revenue

7.7 EXPERT PANEL ASSESSMENT

7.7.1 The first two evaluation methodologies investigated were 'top down' approaches. A potential problem with such methodologies is that they operate on aggregate data, i.e. are insufficiently flexible to provide information on how specific policies or concepts impact at the micro-level. A "bottom-up" approach such as Expert Panel Assessment counteracts these potential deficiencies in the evaluation methodology.

7.7.2 Ex-ante, it was expected that Expert Panels would be an important component of the Methodology, in terms of both ease of implementation and utility of output. Its success depends solely on the identification of panels of experts sufficiently experienced or knowledgeable to assess the likely or actual impact of concepts on an existing railway organisation.

7.7.3 The method seeks the professional judgement of a number of experts on the likely incremental impact on the costs and/or revenue of a given rail organisation of each specific concept / management tool being evaluated. A template was developed for this, seeking opinions not only on the impact range of the concept, but also on the main route of that impact.

7.7.4 Quality issues, importance and ease of implementation were also to be considered. Circumstantial evidence, gained from previous

studies or actual implementation of concepts, to support the judgement expressed in the template was also requested.

7.7.5 At a more advanced level, calculation of net benefits or cost recovery ratio changes might prove possible, helping to identify the most promising performance-enhancing concepts. If quantification is to be achieved, a methodology for converting non-financial benefits into monetary units would be required, e.g. by using established revenue elasticities to form a view of the impact of a measure.

7.8 EXPERT PANEL ANALYSIS RESULTS

7.8.1 The template was completed by experts from the PRORATA partners' countries and, in order to have wider coverage of EU countries, by some of the parallel LIBERAIL project's partners.

7.8.2 Managers and experts with knowledge of the: UK; Hellenic; Italian; Swedish; Danish; Irish; French; Finland; Austrian; and Dutch railways contributed completed templates. The scores they assigned were analysed and a weighted average estimated for each group of concepts (e.g. Investment Appraisal, Financing Structure etc.), derived from the evaluation marks given in the concept sub-categories.

7.8.3 Data was analysed both for the entire set of responses and also for each (relevant) institutional hierarchy. Indicative rankings have been produced for each regulatory system, although it should be noted that some of these are based on a small sample size.

7.8.4 Expert Panel Assessment was found capable of giving both qualitative and quantitative information on the impact of the groups of concepts.

7.8.5 Qualitative information came in the form of an appraisal of the expected route that the impact of the concept would take - cost reduction, revenue enhancement or quality enhancement. Some concepts may impact via all three routes, to varying degrees. "Quality" issues represent less tangible revenue benefits – improved quality should attract more custom at existing prices, or permit price levels to be raised without losing custom.

7.8.6 Quantitative information was provided via an assessment of: the relative importance of each group of concepts; the relative size of its impact on profitability (via all three routes combined); and the practicality of the concept to the particular railway.

7.8.7 The sample set of responses indicate that, overall, the main components of the "Basic Train" proposition, Right Train and Right Time, are the most important and will have the greatest impact on the profitability of a long distance rail organisation. These groups of concepts would impact mainly through the revenue and quality routes.

7.8.8 Asset management, Process management (both largely cost reducing groups of concepts), and Service Differentiation (revenue / quality) are also perceived as being both important and having a significant impact on profitability.

7.8.9 However, of these potentially successful concepts, only Right Time is among those considered relatively easy to implement. Other "easy" concept groups are Market Research and Investment Appraisal, but these were not perceived as having a particularly large impact on profitability.

7.8.10 These findings may be supported by conclusions from the other evaluation tools. Case studies, for example, suggest that Market Research may be easy to implement, but is difficult to implement well.

7.8.11 Expert panel Assessment also gave guidance on differences in the likely routes and, particularly, quantum of impact / ease of implementation of a group of concepts under different institutional structures.

7.8.12 Analysis at the dis-aggregate, institutional structure, level suggests that the same concept can be perceived in a different way by managers, depending on their (institutional) viewpoint. While respondents from the less market focussed structures perceived little cost impact from revenue oriented concepts such as Right Train and Right Time, those from the Public-Private structure perceived a strong impact on capital cost.

7.8.13 There seems to be a negative relationship between institutional structure and anticipated level of impact of a concept, perceptions of Magnitude of Impact being lower among managers of the more market focussed railways. This may, however, be a function of the level of development of their railways – the more concepts are already in place., i.e. the more profitable the railway already is, the lower the expected impact of additional concepts. This finding matches that of the Cross-sectional analysis.

7.8.14 Other patterns across institutional structures are less well defined but, combining findings from the Expert Panel Assessment with observations from the other analytical tools, a hierarchy of those concepts with the greatest potential under each institutional structure can be derived. This is presented in Table 7.8.

Table 7.8 Potentially Successful Concept Groups for each Structure

Group of Concepts	Institutional Structure			
	Command	Business Sector	Public-Private	Privatised
Investment Appraisal	✓	✓		
Financing Structure	✓			
Asset Management	✓	✓	✓	
Process Management	✓	✓	✓	
Personnel Management			✓	✓
Network Management	✓	✓		
Right Train	✓	✓	✓	✓
Right Time	✓	✓	✓	✓
Market Research		✓	✓	
Service Differentiation		✓	✓	✓
Ticketing and Pricing				✓
Promotion				✓

7.9 DETAILED CASE STUDIES

7.9.1 The fourth approach, also "bottom-up" supplements the 'qualitative conclusions' emerging from the other approaches via evidence on the actual costs and benefits associated with the implementation of a sample of successful concepts.

7.9.2 Financial or economic appraisals would be available, e.g. for investment projects, of the anticipated impact(s) on other railways for a number of successful concepts emerging from the other approaches, either:

- a financial appraisal weighing the direct costs and revenue benefits which accrue to the project financier; or

- an economic appraisal considering the incremental cost and benefit accruing to society from each concept - some of these may be non-financial and require conversion into monetary units.

7.9.3 Ideally, follow-up appraisals detailing the actual impacts would also be available, but it is recognised that these are undertaken far less frequently than investment appraisals.

7.9.4 The ultimate output of this evaluation method would be estimates of economic and financial net benefit ratios for each concept addressed.

7.10 CASE STUDIES RESULTS

7.10.1 A number of case studies demonstrating various aspects of real life examples of the application of defined 'rail concept' were reviewed, all of which contained potentially useful information on the impact and implementability of the concept in a range of circumstances. A selection are presented in Section 6 of the Annex volume.

7.10.2 Three major case studies of the applicability of the PRORATA Methodology to EU railways were also undertaken. That for Sweden is summarised in Chapter 9.

8. Change Management

8.1 CONTEXT

8.1.1 Identification of an optimal set of concepts for the current circumstances of a rail organisation will not, of itself, lead to improved profitability or increased adaptability.

8.1.2 The final, crucial, step in using the Methodology is to formulate an Action Plan for Implementation. The Methodology thus requires an understanding of the management issues surrounding practical implementation of change – Change Management Theory.

8.1.3 There are two key tasks:

- Identifying the most appropriate model for change; and
- Practical implementation issues.

8.1.4 The problem of improving an organisation's competitiveness is not unique to railways, but is experienced by industry as a whole. Much of the theory developed for generic business can be usefully abstracted for the purposes of PRORATA and adapted to practical use in the operating environment of European railways.

8.2 CHANGE MANAGEMENT THEORY

8.2.1 There is general agreement among academics and managers that the corporate world of the 1950s and 1960s - one of stability and certainty - has disappeared. That period of stability has been replaced by a business environment of: increasing instability; uncertainty; and rapid change.

8.2.2 Managers therefore need to learn to adapt if they are to survive. Academic analysis of how managers have adapted to this changing environment, and the success or failure of their actions, has provided an understanding of the essential processes within change management.

8.2.3 The catalyst for change can come from numerous sources, including:

- de-regulation;
- privatisation; and
- increasing global competition.

Within the transport industry, many organisations have recently had to cope with both de-regulation and privatisation.

Models of Change

8.2.4 Whatever the impetus for change, to be effective the introduction of new concepts must also be overlaid with a model of change. Such models address the question of implementation, and tend to be generic - capable of being applied in a general sense across any organisation, including vertically integrated railways.

8.2.5 Most models have similar structures. Typical is Kotter's 8 stage model:

- Establish a sense of urgency
- Create the guiding coalition
- Develop a vision and strategy
- Communicate the change vision
- Empower broad based action
- Generate short term wins
- Consolidate gains and produce more change
- Anchor new approaches in the culture

The model is sequential; each stage must be completed before the next can be embarked upon.

8.2.6 The first step of the model focus on creating an understanding within the organisation of the need for change. For example, before change can take place managers need to recognise the need for change.

8.2.7 Step 2 is concerned with creating a guiding coalition for change. This involves getting a majority of senior managers within the organisation to "buy-into" the need for change and also make that change their own personal priority.

8.2.8 Steps 3 and 4 involve creating and leading the change process. Communication and empowerment are key to success in these stages. It is not uncommon, for example, for a new Chief Executive Officer (CEO) to spend the first months of a change program visiting all employees, including front line staff, to gain a deeper understanding of the business.

8.2.9 Steps 5 and 6 are concerned with implementing the change program within the company, empowering employees and

generating “short-term wins”. These are intended to demonstrate to employees (or owners) that the upheaval caused by the change program is producing results.

8.2.10 The final stages deal with consolidation of change, leading to self re-enforcement within the company.

8.2.11 Many of the stages are little more than common sense, but are often ignored. Kotter stresses that omitting a stage by jumping ahead to a later one inevitably leads to a breakdown in the change program.

8.2.12 Change cannot successfully take hold if the need is not recognised:

- Following an earlier service quality improvement program which had started with front-line staff, but failed due to a lack of commitment from senior management, British Rail embarked on a TQM project, “Organising for Quality”. This time the Board appointed a Director of Quality to specifically oversee the project for the Chairman. The next stage in the program involved training all 500 senior managers.

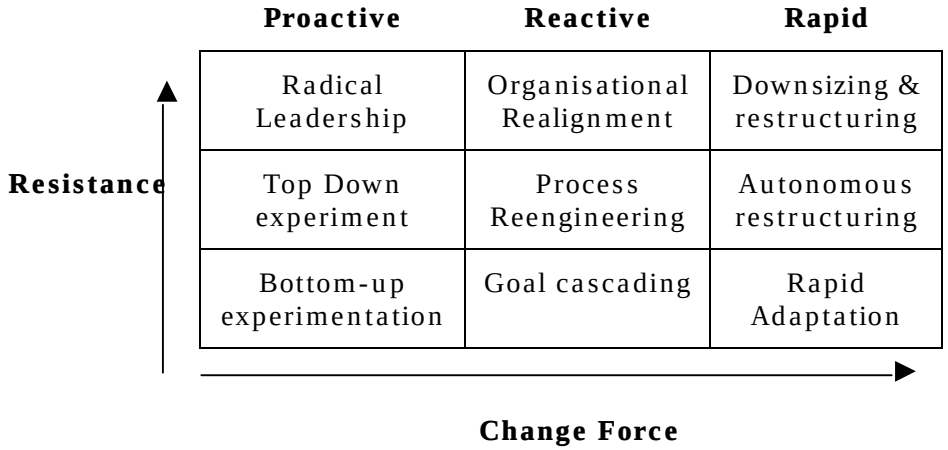
- The transformation of SAS during the 1980s is an example of successful change. The company, facing financial crisis, embarked on an ambitious change management program. New CEO Jan Carlson followed each of the steps in the model, starting with an 18 month tour of all SAS’s businesses. He then set about re-focussing the airline on business travel.

8.2.13 The recently privatised railway companies in the UK have undergone rapid restructuring programs to reduce operating cost in the face of reducing subsidy from Government. In some cases restructuring was done in an arbitrary way, missing steps in the change management model and change has not taken hold properly. Operational performance of many Train Operating Companies has dropped significantly, resulting in fines from the Government and adverse publicity.

8.3 CHANGE MANAGEMENT TOOLS

8.3.1 Figure 8.1 shows a matrix of potential change paths. The horizontal axis is change force, increasing in strength from left to right. The vertical axis is resistance to change, increasing from bottom to top. The paths present alternative routes to achieving change. Selection will depend on the urgency with which change must be achieved.

Figure 8.1 Matrix of Change Paths



8.3.2 In the bottom left hand corner, where both change force and resistance to change are lowest, a "bottom-up experimentation" model could be adopted. Here, change would begin with front-line staff and gradually work its way upward through the management hierarchy. In the top right hand corner, where force and resistance are highest, a more radical tool is required, in this case downsizing and restructuring.

8.3.3 The more urgent the need for change, the more radical the path needs to be. In most cases urgency for change is dictated by financial considerations - a company facing bankruptcy will be more radical than a successful one. Equally a company may try one or more paths before achieving success.

8.4 CHANGE METHODOLOGY IN THE CONTEXT OF PRORATA

8.4.1 Generic Change Management models and tools can be adapted and incorporated into the PRORATA Methodology.

8.4.2 The impetus for change can be via two principle routes:

- enforced - change in the competitive / legislative environment; or
- voluntary - selection of an improvement strategy within the organisation, i.e. within existing institutional constraints.

Either route should involve an assessment of the organisations current performance, via benchmarking and market research.

8.4.3 Effective change can happen only if the organisation has sufficient institutional resources and the capacity to integrate the process -

Adaptability in the context of PRORATA. Further, since many EU railways are national institutions with influences on their host economies extending beyond their immediate transportation function, a wider socio-political consensus for change may need to be present, assessed via a PEST analysis.

8.4.4 To date, most impetus for change in EU railways has been via the "enforced" route, rail needing to respond to:

- changes in general legislation (or legislation relating to other modes) which lead to changes in rail's competitive environment; and

- changes in rail related legislation, either at an EU or national level.

Direct change is normally a political consideration and outside the direct control of the railways, although in some instances the force for political change has come from within the railway rather than from policy makers.

8.4.5 The change process can also be started from within the organisation, with the adoption of some or all of the concepts identified earlier. This approach has the advantage of not requiring a change of framework.

Rail Concepts

8.4.6 Well founded concept selection is not, in itself, a sufficient guarantee of success. Having identified a set of concepts, the next step is the development of practical implementation plans - change management strategies. Consideration needs to be given to the practical problems of implementation within host organisations.

8.4.7 For example, a commitment to adopt Total Quality Management (TQM) techniques to improve quality often requires a radical shake-up of the internal processes of a company. Commitment to such change needs to come from a senior management level. Indeed, implementation of many of the concepts advanced by PRORATA could require a radical shake–up of the host organisation in order to maximise the anticipated benefits.

Adaptability

8.4.8 The Adaptability Index is analogous to a Change Management concept called receptivity. Receptivity attempts to quantify how much an organisation is able to change - there is little point in

attempting an ambitious change management project if the project has little chance of taking root within the company. The more receptive a company is the more likely any change program has of being successful and the more radical the process can be.

Regulatory Structures

8.4.9 Five main organisational structures have been identified:

- Command;
- Market Oriented Command;
- Business Sectors;
- Public-Private Business units; and
- Privatised.

8.4.10 Each represents an organisational form of the business. Change in form can be triggered by different causes. In some cases, e.g. UK, the most recent change in regulatory structure occurred as a direct result of primary legislation, the 1993 Railways Act,with change being rapid and involving a high degree of re-engineering.

8.4.11 This contrasts with the experience of Swedish Railways, which implemented a more limited form of privatisation. Here the change path was one of experimentation and adaptation.

8.4.12 While change can thus be imposed on an operator directly by government, this does not preclude change between regulatory frameworks occurring without the need for legislation. Conceptually many organisational forms (regulatory structures) are possible.

8.4.13 Organisational change can build competitive strategy. Many multinational companies have problems in selecting an appropriate organisational form to manage their businesses. They struggle, as SAS did, to manage large and diversified businesses, with conflicting aims and objectives. Rail engineer ABB created a matrix (sectorised) organisation as their solution, while General Electric (GE) employed a strategic business unit (SBU) form.

8.5 CONCLUSIONS

8.5.1 This Section has introduced the principles of change management to PRORATA. The processes outlined are complex and by their nature iterative. The appropriate concepts for a railway to introduce depend on the strategy it decides to adopt. Strategy is a function of competitive environment. Understanding the linkages between each of these steps is important in comprehending the overall change management process.

8.5.2 Adaptability and PEST are also important, providing signals on which concepts could be implemented in the change process. It should be stressed that identification of a suitable concept, and change tool, does not guarantee success. All case studies stress the importance of following the model of change through to completion.

8.5.3 No matter how good a concept may appear, it will have little chance of successful implementation without the commitment of staff, in particular senior management. The importance of management cannot therefore be overstated.

9. Action Plans and Implementation – a Demonstration Case Study

9.1 INTRODUCTION

9.1.1 The PRORATA Method has been expounded in previous chapters, along with its principal "building blocks" – comparative efficiency analysis, adaptability analysis, concept generation and change management. This chapter tests and illustrates the PRORATA method by reference to recent developments in Swedish railways (SJ). Similar case studies of the management of change in the UK and German rail sectors may be found in Section 7 of the Annex volume.

9.1.2 The chapter has two objectives:

- to compare the evaluation and development of rail organisations with the route proposed by the PRORATA method ie. – gradually increasing levels of adaptability; and

- to demonstrate the method by retrospectively reviewing its effective application in a real rail organisation.

Historic Context

9.1.3 The review starts with a short note on the history of the Swedish Railway system leading up to the review period. This also serves as a partial PEST analysis.

9.1.4 The development of competition from road and sea transport after the Second World War led to a deteriorating financial situation for SJ. Tariffs were raised in 1942, 1946, 1948, 1952, 1955 and 1958, but the difficulties remained. SJ received a subsidy from the State for the first time 1958.

9.1.5 These financial problems induced a discussion on the regulatory framework of the railways, and a Governmental investigation was launched in 1953 to clarify the role of rail in the future transport system. During this investigation Arne Sjöberg , SJ's Director of Finance wrote:

> *"This means in general that the dualism of the goal between business economics and different social and economic considerations, which so far have existed in varying extent for the railways ought to be dismissed. The railways should instead -*

just as their competitors on the transport market - be allowed to function as pure business enterprises. The company policy could then be shaped in a freer and more efficient way than the case is in the present situation. An increased freedom concerning tariffs and services would be of specific importance."

(Järnvägarna i svenskt samhällsliv, 1956)

9.1.6 The investigation team delivered their White Paper in 1962 and the institutional principles for SJ were changed in 1963, granting SJ management more freedom. The new principles were based on spliting the railway into two: a financially profitable network; and a subsidised network. Principles differed between two networks, as shown in Table 9.1.

Table 9.1 Revised Socio-economic Principles for SJ, 1963

The Profitable Network	The Subsidised Network
Free competition, on equal terms, with other modes of transport	Satisfying transport needs throughout the country
Financially profitable	SJ has responsibility for operational costs but State covers the losses
Transport revenue should cover operational cost, including depreciation and interest	Minimum loss at a given operational volume
Increased pricing powers for SJ	The State took responsibility for depreciation and interest
The State granted investments	The State granted investments
Reduced social obligations	

These principles remained unchanged until 1979.

9.2 DEVELOPMENT OF ADAPTABILITY AND ECONOMIC EFFICIENCY DURING THE PERIOD 1975 – 1995

Transport Policy Background

9.2.1 Losses and subsidies continued to grow, by the end of the 70s they added up to around 1bn Skr annually, despite writing off of assets to reduce the financial burdens. A traffic policy decision in 1979 set a goal of offering citizens and industry a satisfactory supply of transport services, at the lowest possible socio-economic cost, throughout the country.

9.2.2 This policy was founded on the progress made during the 70s in the area of socio-economic cost benefit analysis, and the expectations of continuing research efforts both internationally and

in Sweden. Scientifically proven theories and methods for estimating: the value of time savings; accident costs, including human suffering and fatalities; etc. had been developed and theories and methods for valuing environmental costs were in progress. These developments opened the way to approach the concept of "lowest possible socio-economic cost" quantitatively to the extent that it was meaningful to let it form the basis for policy.

9.2.3 During the 80s, a structure for implementing this policy was chosen, containing three elements:

1. Allow different modes of transport to compete on a level playing field.

   A system of charges and taxes would provide the relevant socio-economic marginal cost information to the actors;

2. Adopt consistent investment criteria for infrastructure for all modes of transport.

   A system of socio-economic cost benefit analysis was developed with common inputs for calculation of infrastructure investment for different modes, e.g. the cost for emitting 1kg carbon dioxide should be the same regardless of source (truck, car, aircraft or locomotive). Accident costs should be the same regardless of mode involved and regardless of mode the individual was travelling on.

   A special body - The Institute for Communication Analysis – was established to provide common inputs for the authorities concerned. They produced reports on: air pollution; accidents; noise and vibration; benefit calculations for freight traffic; prices and costs within railway, air and bus traffic; regional structure and balance; infringement and barrier effects; and the value of travel time. A national traffic-forecasting model was developed, used by both the National Road Administration and the National Rail Administration.

3. Further changes to the rail's regulatory framework:

   - to split SJ into a National Rail Administration, BV and an operating company, SJ. This created similar institutions – the new National Rail Administration and the existing National Road Administration –responsible for infrastructure of their respective modes;

- to give rail operators (the new SJ and new operators) a regulatory framework allowing and inducing competition other modes (and to some extent with other train operators) on equal conditions.

The regulatory framework for SJ was changed further during the 80s, so that by 1990 SJ had powers similar to a limited company, and remaining grants from the State were phased out.

Measuring Change 1975 – 1995 Using the Adaptability Index

9.2.4 The importance of changes in the regulatory framework for SJ (SJ + BV after 1988) during this period can be shown by the development of Adaptability. Table 9.2 shows the Power, Accountability and Adaptability Indices for 1975, 1980, 1985, 1990 and 1995.

9.2.5 It can see that Power increased from 0.22 in 1975 to 0.79 in 1995. Indices for 1990 and 1995 are a weighted average for SJ and BV. BV has lower scores, the Power score for SJ alone for 1990 and 1995 is about 0.83.

9.2.6 During the first period (1975-80) the only Power increase concerned pricing of passenger traffic. The main development came in the following period (1980–85), during which the Director General got: Power to chose his own management; design the organisation at both first and second levels; increased control of the investment budget and long term planning;, increased control over tariffs; and the power to borrow money. The index increased from 0.29 to 0.69 during this period.

9.2.7 During the next period, ending 1990, power over the annual budget and long-term plans decreased, but pricing decisions were transferred completely to SJ and power to act in the money market was increased to a level typical of private companies. The scoring shown is only 0.80, however, as BV could not borrow money for infrastructure investments. Powers did not change during the final period.

9.2.8 Counter-intuitively, Accountability goes down from 0.86 to 0.80. While SJ's accountability was 95% in 1990 and 100% by 1995, the de-merged BV is financed entirely by grant and has close to 0% accountability for its economic performance.

9.2.9 The Adaptability index for SJ (SJ + BV after 1988) thus increases from 0.22 in 1975 to 0.63 in 1995. If BV is excluded after 1988, the index for SJ alone increases to 0.79 (1990) and 0.83 (1995).

Comparison of Adaptability and Economic Efficiency

9.2.10 Table 9.3 compares Adaptability and economic efficiency. The cost per GTKm measure used is derived from the annual reports of SJ and BV, rather than the UIC statistics used in the Cross-sectional Analysis, and excludes track renewal costs for consistency across the period. On this basis the operating cost per '000GTKm for 1995 is $21.6 instead of $29.

Table 9.3 Adaptability and Economic Efficiency – Time Series Analyses.

Year	Adaptability		Accountability		Cost/GTkm		Cost reduction
	SJ/BV	SJ*	BV	SJ*	SJ/BV	SJ/BV	SJ/BV
1975	0.19	0.19	N/A	0.86	0.0293		
							2%
1980	0.25	0.25	N/A	0.87	0.0287		
							13%
1985	0.57	0.57	N/A	0.83	0.0251		
							2%
1990	0.59	0.79	~0	0.95	0.0246**	0.0267	
							19%
1995	0.63	0.83	~0	1.00		0.0216	

* Including infrastructure up to 1988 and excluding it after 1988

**The maximum axle load was increased to 22.5 tonnes between 1985 and 1990. This changes the relation between freight tonnes and gross tonnes to such an extent that GTKms decrease while goods tonne kms increase, distorting the efficiency index Operational cost /GTkm. To facilitate a fair comparison between 1985 and 1990, an adjusted value of operational costs / GTkm (0.0246) has been imputed.

9.2.11 Cost reduction from 1975 to 1980 is very modest, only 2 %. During the same period Adaptability rose from 0.19 to 0.25 and Accountability very little, from 0.86 to 0.87.

9.2.12 During the next period, accountability decreases, but Adaptability grows from 0.25 to 0.57, as Powers increased considerably. The cost reduction of 13% seems consistent with the hypothesis concerning Adaptability and economic efficiency, and gives an example of a case where the Power dimension of Adaptability is the effective factor.

9.2.13 With separation of SJ and BV (1988), SJ's Accountability increases but BV's Accountability is close to zero. The cost reduction for SJ/BV for 1985–90 was 2%, and for 1990–95 19%. The main cost reductions took place within SJ. The change of Accountability came at the end of 1988 and there appears to be evidence of a time lag – it takes time to implement procedures necessary to increase efficiency, and there has been little impact of increased Accountability between 1985 and 1990.

9.2.14 SJ's efficiency increases markedly by 1995. Power did not change much after 1985, and thus the Accountability dimension of the Adaptability index appears to be the effective factor in this period.

9.2.15 By entering Adaptability for 1975 and 1995 in the model developed for Cross-sectional analysis (G = 34,865 – 21,821* LN(A)) operating cost (including cost of track renewal) is synthesised, which can be compared with actual cost (adjusted to the same price base, but without cost of track renewal). The result is shown in Table 9.4.

Table 9.4 Comparison of Actual and Simulated Cost Reduction, 1975 – 1995.

(Price level of 1995)

Year	Adaptability	Actual Cost		Simulated Cost	
		$/GTkm, exc. track renewal	Cost reduction	$/GTkm, inc. track renewal	Cost reduction
1975	0.19	0.0293		0.071	
			32%		**37%**
1995	0.63	0.0200*		0.045	

*Imputed figure due to the change of axle load, see above.

9.2.16 This shows actual and simulated cost reductions are encouragingly close, 32% and 37% respectively. The model has explained cost reduction in the Swedish railway system from 1975 to 1995 reasonably well, giving additional support to the model, the hypothesis behind it, and at least one component of the PRORATA Methodlogy.

Conclusions on Adaptability and Economic Efficiency

9.2.17 The 1956 recommendations of Arne Sjöberg -

> *"The railways should instead just as their competitors on the transport market be allowed to function as pure business enterprises. The company policy could then be shaped in a freer and more efficient way than the case is in the present situation."*

were finally realised in 1988. This analysis has shown that during those periods when the regulatory framework was adjusted, becoming more similar to that of the competiton, economic efficiency grew much faster than during other periods.

9.2.18 It took 32 years to find an efficient regulatory model and political consensus. 10 years later the expectations have been realised. The efficiency of the Swedish railway system has been radically improved.

9.3 CONCEPTS TO IMPROVE ECONOMIC EFFICIENCY DURING THE PERIOD 1975 – 1995

9.3.1 The changes of regulatory framework which have been condensed into an Adaptability Index do not, by themselves, improve the economic efficiency of a rail system. The railway has to react by choosing and implementing the changes necessary to improve the economic efficiency.

Major Organisational Change and Divestments

9.3.2 A number of organisational changes and divestments took place during the review period. The most important were:

1.	New Organisation	1983
2.	New system for Cost Accounting	1983
3.	Winding up Part-loads Operation	1986
4.	Separation between SJ and BV	1988
5.	New Organisation	1988
6	Transfer of SJ Bus operations to Swebus AB (Ltd)	1990
7.	Transfer of SJ's Travel Agencies to TGM AB (Ltd)	1990
8.	Transfer of SJ Ferry operations to Sweferry AB (Ltd)	1991
9.	Transfer of Workshops for heavy maintenance to TGOJ (AB)	1991

The development of a new accounting system also started in the late 70s.

9.3.3 Information on Powers, Accountability, organisational change, major divestment, cost/GTKm and labour productivity (traffic units/employee; traffic units = goods tonne km + passenger km) is combined in Table 9.5.

9.3.4 The Power Index increased from 0.29 to 0.69 during the period 1980–85, the important changes being: increased pricing power; full power for the Director General to appoint his managers; and power to choose organisational structure.

9.3.5 With these Powers it was possible to adopt a matrix organisation in 1983, as an instrument to delegate, and thereby increase, managerial capacity. The most important feature was the establishment of: Passenger Traffic; Freight Transport; and Mechanical Engineering Divisions, with separate profit and loss accounts, i.e. they had become profit centres. The Civil Engineering department remained a cost centre only.

9.3.6 This structure made it possible to increase accountability within the organisation, and to delegate Power and responsibility for economic efficiency to the second level. The increase in economic efficiency during this period – a 13% reduction in cost per GTKm, is considered to be an outcome of these changes.

9.3.7 The Power Index increased further, to 0.79, during the period 1985–90. The Director General full control over pricing and the annual operational budget, and increased power over the investment budget.

9.3.8 There was a second reorganisation in 1988. The Civil Engineering Department was divested as BV. Within SJ the matrix organisation was abolished but the divisions remained (augmented with a Real Estate division), as profit centres, endowed with individual profit and loss accounts and balance sheets.

9.3.9 The new SJ thus became a complete profit centre organisation with increased Accountability for economic efficiency at lower levels, increasing the possibility of further delegation of Powers and Responsibilities.

9.3.10 The divestments taking place at the end of this period and the beginning of the next, including divestment of BV, reduced SJ staff by about 15,000. These divestments, and the new organisation of SJ, increased managerial capacity for the retained operations and

thereby prepared the company for increased speed of development of the economic efficiency. Accountability increased to 95%, and Adaptability to 0.75.

9.3.11 The change activity level was high during this period. In 1988 SJ got: a new Director General; an almost completely new top management level, (mainly recruited from private industry); and a new organisational structure. It is thus unsurprising that economic efficiency did not grow very much – only 2% of cost per GTkm – during this period.

9.3.12 During the last period reviewed, 1990–95, SJ reaped the fruits of the new profit centre organisation and the divestments - economic efficiency grew 19%. Table 9.5 also shows the average annual rate of increased labour productivity. For 1975–88 it was 3.1%, but more than doubled to 6.9% over 1988–95. Thus much of the cost reduction was achieved through increased labour productivity.

9.3.13 The strategy to increase managerial capacity available for the core business by choosing a profit centre organisation, and divest non-core businesses, can be considered a success.

Internal Efficiency Work

9.3.14 The assessment of the strategic measures adopted in Sweden can be augmented with an analysis of the operational measures adopted by SJ to improve efficiency, as reported in annual reports for 1975–95.

9.3.15 Table 9.6 presents a summary by five-year period, and by Division (Passenger Traffic, Freight Transports and Mechanical Engineering).

9.3.16 For Passenger Traffic, it can be seen that there were no new initiatives in 1975–80. However, in 1980–85, when SJ got increased Power on passenger traffic pricing, 11 initiatives are indicated, including: product development (service differentiation); ticketing / pricing; and quality improvement (punctuality, passenger information etc.). Arguably, this interest in market oriented activities coincides with the delegation of pricing power to SJ.

9.3.17 Initiatives in other areas, involving labour productivity and development of Management Information Systems, are also reported for the 1990–95 period.

9.3.18 For Freight Transport, Table 9.6 indicates no change in the pattern of activities reported over the 20 years, rather there is a mix of market-oriented and rationalisation activities in all periods. This difference between Passenger Traffic and Freight Transport initiatives may be because SJ already had power to price freight transport in 1975. Important Freight initiatives reported were:

- concentrate marshalling and shunting by increased use of direct trains and dedicated trains, developing the logistics of the total transport chain together with the customer; and

- using IT to support personnel, asset and process management

9.3.19 In the area of Mechanical Engineering only a few initiatives were reported, during 1976–80 and 1991–95.

9.3.20 Anecdotal evidence from managers suggests that work on improving economic efficiency is under-recorded in the annual reports (particularly in the Mechanical Engineering Division) and Table 9.6 does not represent the full development in this area during this period.

Conclusions on Concepts

9.3.21 Differences in the number of new initiatives between the periods seem to be related to management's capacity (Power) to implement concepts. When managerial capacity is high, the speed of development of economic efficiency is high.

9.3.22 While, as noted, there seems to have been an under-reporting of operational concepts in the annual reports, it has been possible to identify a number of PRORATA concepts that have been introduced, and survived for considerable periods, indicating that they have been successful.

9.3.23 Successful Concepts at the Corporate level:

- Introduction of a Profit Centre Organisation. This concept is very useful but only if the railway has the Power of Pricing, of changing the Organisation, of appointing Managers and of Budgeting for operations.
-
- All Social Services shall be produced within a framework of commercial contracts, in order to make Accountability close to 1.
-

- Divestment of Non-core Businesses.

9.3.24 Successful Concepts at the Divisional level, Passenger Traffic:

- Service differentiation (product development)
- Improvement of the pricing system, including peak load pricing
- Improved Ticketing systems, including telephone booking and sales, ticketing machines
- Quality enhancement
- Station development – Travel Centres
- Multiskilling
- Development of management information systems
- Increase of Labour productivity

9.3.25 Successful Concepts at the Divisional level, Freight Transport:

- Concentrate Marshalling and Shunting by increasing the Direct Trains and Dedicated Trains developing the Logistics of the total transport chain together with the customer.
- Introduction of Quality Programmes
- Introduction of IT systems for Personnel, Asset, and Process Management.

9.3.26 Successful Concepts at the Divisional level, Mechanical Engineering:

- Introduction of km based Maintenance
- Optimising the Maintenance Intervals
- Introduction of Split Maintenance

9.3.27 This Case Study of the development of Swedish railways thus illustrates the successful evolution of a rail organisation following the PRORATA Methodology. In particular it identifies how efficiency concepts drive Adaptability to higher levels and hence increase overall competitiveness.

10. Conclusions

10.1 CONCLUSIONS

The PRORATA project has produced a method, the PRORATA method, for applying to railways to improve their profitability and competitiveness. Whilst the project has also produced several other findings of interest, it is the development of this broad method which is the principal output of greatest, long-term, significance.

The detailed conclusions of the project are listed below.

1. A method to improve the competitiveness and profitability of rail has been developed during the Study. This involves the adoption of product, marketing and organisational concepts identified via the PRORATA method;

2. The method recognises the relationship between efficiency and institutional framework (represented by Adaptability), and provides a means for enhancement both within a particular structure and by moving between different institutional levels;

3. The method reflects observed practice within the more developed rail organisations, as illustrated by the Case Studies;

4. The benefits of the PRORATA method are, potentially, great (E10-15bn p.a. in operating costs alone across the EU), i.e. these benefits are quantifiable;

5. Applying the method draws on best practice from across the rail sector and beyond - promoting best practice widely is a key theme;

6. The PRORATA method involves process re-engineering within railways, and includes change management and implementation advice;

7. The PRORATA method is sensitive to the social, political and economic context of each railway - there are no standard solutions;

8. The PRORATA method reflects EU rail policy and could play a critical role in achieving policy goals.

9. The three Case Studies each illustrate aspects of the PRORATA methodology – the link between efficiency and adaptability and the implementation of concepts, and the selection and (successful) application by these railways of concepts that would have been recommended had the PRORATA method been applied to these railways at the start of the periods reviewed.

10. In particular:

- they show how, in addition to efficiency gains achieved through the recent implementation of concepts from the PRORATA "toolkit", further gains could be made by more rigorous application of the PRORATA methodology (UK);

- they show how PRORATA projections of the impact of adaptability changes compare with reality (Germany, Sweden);

- they present a before and after (time series) analysis of the parallel evolution of adaptability and efficiency (Sweden);

- they demonstrate the link between adaptability and efficiency (all three);

- they illustrate how PRORATA fits with the context of an evolving organisation / regulatory structure (UK);

11. It is also interesting to note that the theoretical cost reductions forecast for each railway are all around 40%. The actual cost reductions achieved during the periods under review vary, however. Observed savings are 20% for BR and DBAG but 32-36% (depending on cost measure) for SJ.

12. This may indicate a deeper and more thorough acceptance by Swedish Railways of the opportunities to implement improvement measures with an increase in adaptability, but may also indicate that there is a time lag in the impact of even short term measures – the BR and DBAG efficiency gains were achieved in only 6 years, whereas the SJ analysis spans 20 years.

In addition, the study team have identified a number of areas for further work concerning the refinement of the methodology and the research and analysis underlying it, together with potential applications beyond the long distance passenger railway sector, as follows:

- Update benchmarking (e.g. to 1998/99 UIC data);
- Add econometric analysis of market and revenue benefits from re-structuring;
- Consultation on PRORATA method among Ministries and railways;
- "Live" Case Studies of the PRORATA method;
- Apply PRORATA to CEEC railways;
- Expand adaptability analysis to other sectors (power, telecoms, education etc.);
- Apply the method to freight and urban railways.

The implications of the PRORATA method should provide some optimism about the future of railways in Europe. A process does exist for enhancing competitiveness and has already been demonstrated in a number of states, to varying degrees. Moreover, the benefits from applying this process appear to be considerable.

Nevertheless, the route to achieving these benefits requires some difficult decisions to be taken in the short-term. In many cases, a clear change in direction is needed for railway owners and managers. No-one should under-estimate the challenges posed here.

PRORATA clarifies the process for improving profitability and managing the change associated with this. It also quantifies the benefits from each step towards these improvements. As such, it provides an incentive to achieve further efficiencies in the management of rail organisations, as well as a clear indication of the costs of failing to improve railway competitiveness.

Technical Reports Produced During the PRORATA Study

Deliverable 2 — Mode Choice Criteria – Positive and Negative Aspects of Rail

- Technical Annex 1 — Comparative Efficiency Indicators
- Technical Annex 2 — Market Research - 1st Round - Focus Groups & Desk Research
  - Internal Note — Netherlands Focus Group Results
  - Internal Note — 1st Round UK Focus Group Results

Deliverable 3 — Inventory of Rail Concepts

Deliverable 4 — Cross Mode Comparison

Deliverable 5 — Identification of Successful Concepts

- Internal Note — Time Series Analysis
- Internal Note — Expert panel Analysis

Deliverable 6 — Adaptability of Rail

Deliverable 7 — Action Plans for Implementation

Glossary of Railway Company Abbreviations

BR	British Railways	UK
CFF	Chemins de fer Federaux Suisses	Switzerland
BLS	Berner Alpenbahn-Gesellschaft Bern-Lotschberg-Simplon	Switzerland
CIE	Coras Iompair Eireann	Ireland
CP	Caminhos de Ferro Portugeses	Portugal
DSB	Danske Statsbaner	Denmark
FS	Ferrovie dello Stato	Italy
NS	N.V. Nederlandse Spoorwegen	Netherlands
NSB	Norges Statsbaner	Norway
OBB	Osterreichische Bundesbahnen	Austria
RENFE	Red Nacional de los Ferrocarriles Espagnols	Spain
SJ	Statens Jarnvagar	Sweden
SNCB	Societe Nationale des Chemins de fer Belges	Belgium
SNCF	Societe Nationale des Chemins de fer Francais	France
DB	Deutsche Bahn AG	Germany
OSE	Organismos Sidirodromon Ellados	Greece
VR	VR-Yhtyma Oy	Finland