This book tells a ferry tale, and a bus tale, a tram, train, and metro tale. It tells the tale of public transport and the variety of voices recommending how to organise it, voices coming from many academic disciplines.
Policymakers want to strengthen public transport to improve accessibility and liveability of the metropolis. They hear these different voices and hesitate. The voices point in different directions and often seem contradictory. The voices present our policymaker with a dilemma: narrowing the scope to one offers him a clear but limited perspective, widening the scope to all offers him an ambiguous but more comprehensive perspective.

This book tries to overcome this dilemma, by researching how policymakers use the different disciplines in the organisation of real-life public transport and how this affects its success.
Moreover, the study develops and tests a multidisciplinary approach for organisational improvement. This approach supports our policymaker to understand the different stories and to apply them to his own organisation in a purposeful manner. The approach helps him to cross the gap between theory and practice. By doing so it can help to improve the organisation of metropolitan public transport and as a consequence the way we move.

The author is lecturer Organisation and Management at the Faculty of Technology, Policy and Management of Delft University of Technology, the Netherlands.

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MIND THE GAP

Wijnand Veeneman

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Bridging theories and practice

for the organisation

of metropolitan public transport

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Preface and acknowledgements

This book tells a ferry tale, and a bus tale, a tram, train, and metro tale. It is a story about the many voices telling us how to organise public transport to improve our world. One voice tells us "left at the next corner", a second instructs "straight all the way", a third to go back from where we came. We hesitate to move. This is the story of my journey following these voices in different directions.

It has been a long journey. I want to thank NWO (Netherlands Organization for Scientific Research) for buying me the ticket and TRAIL Research School for inspiring fellow passengers. I am also indebted to all stationmasters that showed me the way in strange cities: professors Maggi and Brändli, Hills and Nash, Jørgenson and Bjørnland. Thanks go to the 61 practitioners from these cities willing to share their insights. Thanks go to the 22 practitioners from Southern Limburg that fuelled my insights and played along. I owe gratitude to AGV Nieuwegein for their effort in creating the gaming environment and thanks to B&A Groep for letting me move on with my journey. I also am grateful to Hans de Bruijn for his generous support of the last leg.

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I owe many, many thanks to Rob van der Heijden. On every station he sent me in the right direction, patiently accepting delays.

Love and thanks go to Apoe and Anjoe, who supported me with the experience of an earlier first-class journey. Big love and many, many thanks go to Marjolein, who earlier saw that sane people should avoid this journey, but still sat next to me all the way.

Voor Marjolein en Maartje

This dissertation has been performed
within the framework of the Delft University of Technology
research program Seamless Multimodal Mobility.

Content

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Departure:
Changing metropolitan public transport

This study starts at the metropolis, where mobility is becoming an increasing problem. Policymakers see these problems and need instruments to overcome them. One of their instruments of choice is public transport.

But how to strengthen the role of public transport remains unclear, as different theories offer different remedies. Bridging these theories in a practical way is the general goal of this study, to help metropolitan policymakers improve the mobility and livability in the city.

This general goal translates in a societal and a scientific goal. The societal goal is aimed at policymakers with a responsibility for public transport. The study is intended to help them improve the performance of public transport, to realise its potential in overcoming a number of mobility related problems. The scientific goal is to understand the way different scientific disciplines can be combined into viable policy options, how the contribution of a variety of disciplinary insight can be assessed, combined, and applied.

The combination of the two goals offers us an institutional focus, on the overall organisation of public transport. The policymaker generally has substantial means to influence the institutional setting. Moreover, the organisation serves as the framework for public transport related actors. These different actors perform specific tasks that are often structured by specialised and disciplinary knowledge. Optimisation of the individual task is well supported within current disciplines. Optimisation over the boundaries of tasks, actors, and disciplines asks for a wider institutional focus.

Consequently, this study aims to improve the overall organisation of metropolitan public transport from a multidisciplinary perspective. To do so it charts the existing knowledge and analyses how this knowledge is used in a number of cities. It tries to develop the successful practices in these cities into an approach, which is tested in a simulation-game.

Because of its specific focus on multidisciplinarity, the study has a number of idiosyncrasies. The study is not rooted in an existing discipline and consequently lacks clear standard for its research strategy. The study tries to follow more general scientific conventions. To help the reader understand, all steps and choices are made explicit in this book; the text closely mirrors these

steps and choices. As a result it contains, among others, five broad descriptions of disciplinary knowledge and four extensive case studies. The advice to the readers is to be selective, unless he or she wants to track the whole scientific cycle. Here, some helpful guidance is given.

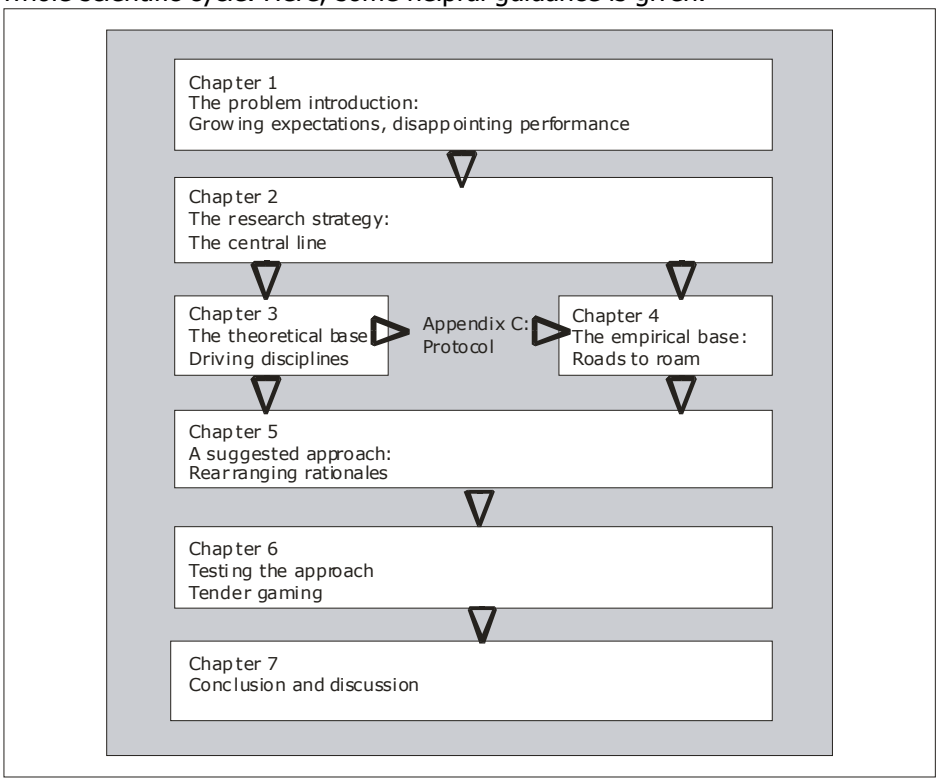

Figure 1
The relations between the chapters

The general content of each chapter is:

- Chapter 1 describes the general background of public transport in a metropolitan setting and the questions the study wants to address,
- Chapter 2 describes the research strategy and the consequences of the multidisciplinary starting point for the study,
- Chapter 3 gives a brief introduction to the five academic disciplines that contribute significantly to public transport,
- Chapter 4 describes the case studies in detail,
- Chapter 5 presents the approach developed,
- Chapter 6 describes the testing of the approach in a simulation game,
- Chapter 7 presents the conclusions and discussion and can also be read as an English summary.

For all readers Chapter 2 present the major starting points of this study.

Readers who want a brief overview of the study can find this in Chapter 7. Dutch readers also have a summary in their own language available in the back of the book.

Policymakers in public transport wanting to learn from foreign cases can find extensive information on four cases in Chapter 4. The case descriptions can give them benchmarks to compare and best practices. Policymakers in public transport wanting to improve their organisation by making it multidisciplinary can focus on the last part of Chapter 4 and the Chapters 5 and 7. Policymakers who want to use simulation gaming to improve their organisation can focus on Chapters 6 and 7.

Academics known to the field of public transport can focus on parts of Chapter 4, (specifically the subsections presenting the lessons learned of each case and the discussion), and the Chapters 5 and 7. Additionally, they might want to familiarise themselves with the other than their primary discipline, as presented in Chapter 3. Academics interested in institutional design can focus on Chapters 5 and 7. Academics interested in issues of interdisciplinarity can focus on Chapter 7. Academics with a primary interest in simulation games can focus on Chapter 6 and 7.

Students who want an introduction to the problems and theory of public transport can focus on Chapter 1, which gives an overview of current issues in public transport, with a focus on the Netherlands.

1 Introduction to the problem: Growing expectations, disappointing performance

Such is the prize you have gained for your championship of man, Prometheus. For, god though you are, you did not fear the wrath of the gods, but you bestowed honours upon mortal creatures beyond their due.

Aeschalus, Prometheus Bound, 30

1.1 Introduction

This dissertation deals with the complex issue of organising metropolitan public transport. The complexity of this issue is growing due to a variety of reasons, among them the increasing and diversifying demand for mobility in general, restricted resources in terms of space (both on and off infrastructure) and funding, institutional and technological changes. The organisation of public transport has to address those dynamic conditions and has to be the platform for attractive public transport services. Metropolitan policymakers expect a great deal from public transport, because they overlook the dynamics that are the result of the popularity of the car.

The automobile has driven us into a car-based society. Everywhere in the world the introduction of the car has had a strong impact on the way we organise our life. This change has brought us much good in some places and many woes in others. In a number of situations it seems we must struggle to cope with the negative aspects of car use without sacrificing the positive aspects.

Self-propelled vehicles became a reality in the 19th century, originally in a form that provided public rather than private transport. Because of the new transport technology, from the 1860s on, public transport grew throughout Europe and the United States, enabling people to adopt a new lifestyle, travelling between home and work and the rest of the continent. These earlier systems of mass transport reshaped our society and opened the way for the individual automotive expansion a century later in the 1960s. During this gradual shift from public to private transport, public transport services became

relatively less attractive. As car ownership and use grew, the city's orientation to public transport faded. Although the emphasis has shifted towards the car, policymakers still regard public transport services as being important for sustained vitality and mobility in urban areas. This implies that public transport will have to reinvent itself, and change from a troubling trailer of automobility to a potent provider of mobility, in a balanced relationship with the automobile.

A variety of disciplines share in the analysis of public transport weaknesses and strengths, and possible ways forward. The elements of the public transport system on which their efforts focus differ. The mechanisms they scrutinise differ. The values they seek in a public transport system differ. As a consequence, the recommendations they offer to policymakers differ. This study recognises these differences as a valuable source of improvement for public transport. It considers how this variety is often overlooked during the original inception of public transport organisation, and studies how successful examples of organisations are improved using this diversity. The ambitious aim of this study is to mobilise the success of these examples for the good of mobility in and vitality in the modern metropolis.

This chapter will evaluate the role of public transport to further the qualities of the metropolis, starting with the power and problem of the car (Section 1.2). In addition, it will discuss earlier efforts by policymakers and operators to reposition public transport in the mobility arena and to improve its efficiency and effectiveness. These efforts are discussed in Section 1.3. Section 1.4 examines the importance of organisational issues and explains how the overall organisation serves as a general framework for the diverse efforts discussed in Section 1.3. Finally, Section 1.5 presents the scientific problem statement for this study and develops it as a set of research questions.

1.2 The car: way ahead

1.2.1 Caring for the automobile

A number of authors have given attention to the merits of the car [Smidt-Relenberg, 1986, pp.121-132; Webber, 1991, pp. 274-284; Rietveld, 1994, p. 23; Gerondeau, 1997, pp. 219-249; Dunn, 1998, p. 2]. They show the car's qualities that match the preferences of most travellers. This fact has triggered the extensive growth of automobility in Western countries, which in turn has established itself as one of the problems of our times. Travellers spend generously on the vehicle, on petrol, on taxes, on tolls, just to keep driving. They accept a less safe mode of transport in order to move fast. They choose a place to live and a place to work with their car as an important factor. Such are the merits of the car.

	Passenger cars in millions of units	*Distance travelled in 1000 million*
1970	*62.5*	1583
1980	*103.2*	2333
1990	*146.1*	3302
2000	*169.7*	3890
**In the 15 European member states of 2000*		

Table 1
Car ownership and use in Europe over the last 30 years (Source: Eurostat, 2000)

The success of the car (Table 1) is not just the success of the vehicle as such. The success is that of a complete system of car-related actors, activities, and artefacts. Moreover, the system is continuously strengthened. Car manufacturers contribute with faster, safer, and more comfortable vehicles. Urban planners develop the urban plain, leaving the cramped inner cities behind in favour of more spacious living on the urban fringes [Steierwald and Kühne, 1994, pp. 3-15]. Transport engineers build and improve the use of an extensive network of motorways, bringing different parts of the country closer together. All these major steps were made after careful consideration led to the conclusion that the benefits outweighed the costs. And we carefully considered moving our jobs and homes to locations that depend on the car system.

As Capello and Gillespie [1993, pp. 45-48] have suggested, the increase of car ownership and use has taken place on the basis of small steps in a wide range of fields, under constant interaction. A complex causal network including technological development, women's emancipation, the rise of economic specialisation, and the rise of the nation state have contributed to this development[1]. A development of this magnitude can only occur through a complex set of changes in a wide range of areas pointing in the same direction: the car has many merits.

1.2.2 Care and concern

Growth of car ownership and use has caused major concern, especially in metropolitan areas [Salomon ea, 1993, p.10; Nijkamp, 1993, p.7; Forschungsverbund Lebensraum Stadt, 1994 a, p.13, Black, 1995, pp. 1-9; Newman and Kenworthy, 1999]. The traffic is denser and it is far more difficult to adapt space. In addition, more people live closer to large road infrastructure, resulting in a larger number of people undergoing the negative

[1] Various authors that have contributed significantly to understanding the range of factors that have influenced car-use are Mumford [1964] and [1980], Wachs and Crawford [1991], and Steg [1995]

effects of car-use. Moreover, though solutions here are most needed, they are difficult to find [OECD, 1995, p.13].

Khisty and Lall [1998, pp. 22-23] like others [Maier and Atzkern, 1992, pp. 212-225; Whitelegg, 1993, 4-146; OECD, 1995, pp.47-70; Kiriazidis, 1994, p.6] give a good overview of all the different problems. An idle running car consumes *energy and space* and produces *exhausts and noise*. That becomes a problem when energy and space are scarce and when the exhaust and noise are harmful. Some of these problems have their immediate effect, like noise and unpleasant smells. Some problems only materialise over long periods of time, like the contribution of car transport to acid rain and global warming [Wee, 1994].

In addition, a car in motion occupies more space on the scarce infrastructure. It consumes more energy and produces more exhausts and noise than when it is running idle. But it also becomes a *dangerous* projectile. When not properly controlled, it can harm and kill. Moreover, a great number of cars on the move amplify the problems mentioned above by multiplication and concentration. And when the number exceeds the threshold of the infrastructure the cars have to slowdown and even stop: this is the problem of *congestion*.

The extent of demand for automobility has led to a significant amount of infrastructure. This infrastructure *fragmented* the landscape, improving accessibility along the infrastructure for the driver, hampering accessibility across the infrastructure for residents.

All direct effects mentioned of course trigger new secondary effects: congestion will influence people's choice of mode [Aarts, 1996], of routes [Verhoef, 1997], choice of their work, their homes [Ommeren, 2000] and their leisure facilities. Congestion also influences companies' choice of location [Veeneman, 1994]. These choices could reduce car-use, but in fact often *spread* car-use and its negative effects over time and in space.

As early as in the late 1970s Thomson stated:

> *If there is one inescapable conclusion from a study of the world's major cities, it is that people everywhere are dissatisfied, often to the point of public protest, with their transport, with the way it is developing and the effect it is having on their cities [1977, p.324].*

As early as 1963 [Ministry of Transport, 1963] public authorities recognised the negative effects that growing car use has had on our society. This Buchanan Report already stated two central problems: new infrastructure tends to attract more traffic rather than mitigate congestion and car traffic is a heavy burden on the urban environment.

To sum up, the success of the car has made it move fast: it gained support and use. But that development is way ahead of many others:

economic, demographic, spatial, technological, and social developments. Automobility has moved ahead. The car is out of step.

1.2.3 Turning traffic around

In their attempts to make metropolitan traffic clean, safe, and moving, governments have developed a number of policy strategies [Plane, 1995, pp. 435-469]. Some of these are directed at the car system itself, others on offering alternative forms of transport [OECD, 1995, p. 76], or on behaviour of the car user [Steg, 1996, p. 41].

Some of the possible courses of action focus on the vehicle technology itself. Filtering systems, catalytic converters, fuel-efficient engines, other propulsive systems using hydrogen, electricity or bio-fuels, they all improve the environmental performance of the car. Moreover, vehicles are designed with more attention to safety and equipped with special safety systems, like airbags, protection bars and safety zones to protect the occupants from human errors [Dunn, 1998]. In addition, the driver can rely on systems that help him prevent problems, ranging from current ABS to future vehicle control systems [Marchau, 2000, p. 50].

Some of the approaches focus on the infrastructure, on developing new, safer or more intelligent infrastructures, or targeting infrastructure for special groups like bus lanes, cycle lanes, pedestrian areas, or car pool centres. But the behaviour of (potential) drivers is targeted directly too. Economic regulation tries to have drivers pay for the external costs they impose on others through fuel tax, tolling, and parking fees. Drivers are stimulated to share their cars or consider alternative working hours.

All these policy strategies focus on the car system: the driver, his[2] vehicle and the road he is driving on. They are directly aimed at limiting car use and its negative effects. But some policy strategies seek solutions outside the car system. They seek ways to further communication over distances as an alternative for travel. They try to steer urban development in less car-friendly directions. Finally, part of the efforts is aimed at strengthening attractive alternative modes of transport in the metropolitan area.

This means that improving public transport is only one of a wide range of policy alternatives that is generally expected to mitigate the negative effects the excessive growth of car use has on metropolitan areas. Like urban development and telecommunications it is an integral solution, in the sense that it provides better safety, less environmental stress, and a relief for congested roads.

[2] The author is a strong believer in equality between women and man. The choice for mainly male pronouns in this thesis has an empirical and no normative origin.

Public transport has proven to have the ability to have an effect in the relative short term. In Hasselt in Belgium ridership rose 381 percent in a year's time after public transport was offered free to all. Of the new bus travellers 16 percent left their car behind [Anonymous, 1999]. However, of the initial strong growth some ground was lost again, from 64000 boardings per month prior to free public transport (December 1996), to 308000 (December 1997), to 291000 (December 1998) [Hasselt, 1999].

The conclusion is that significant improvement of the attractiveness of public transport should be considered as only one of the policy strategies to mitigate the negative effects of the tremendous growth of car-use. Its success is very much dependent on the choices people start making about travel, and location of their home, jobs, and leisure. Examples indicate however that significant change might be attained within a relatively short period of time. Improving the performance of public transport is regarded as a promising policy strategy.

1.3 Public transport: the way forward?

1.3.1 Public transport as a promising avenue

Before the automobile was even invented in 19th century Europe, horse drawn carts and boats, trains and trams provided public transport for those who wanted to travel. Public transport was the start of the growth in mobility in and around the city [Flink, 1988, pp. 1-14]. It provided the necessary support for the growth of the city along the public transport routes [Gray and Hoel, 1992, pp. 3-45; Mills and Hamilton, 1994, pp. 21-30; Khisty and Lall, 1998, pp. 397-403].

It is doubtful that the urban landscape would have developed as swiftly in the latter years of the 19th and the first half of the 20th century without the rise of public transport. In Europe urban planning took control over the growth of the urban fabric outside the city walls. Government investment to support growth of the transport system increased public control over transport service provision. The planned city and public transport grew up together.

And even now, public transport and the city are akin. Many policymakers and academics [e.g., p. 30; Berechman, 1993, p. 1; Stern and Tretvik, 1993, p. 129; Whitelegg, 1993, 158-159; Banister, 1994, p. 214; Nijkamp et al., 1994; Newman and Kenworthy, 1999; Priemus and Koning, 1999; Ministerie van Verkeer en Waterstaat et al., 1999] maintain that strengthening public transport at this point is an important policy strategy for transport problems in the urban areas of European countries. They name a number of reasons for this idea. First of all, public transport on dedicated lanes (rail or bus) can carry a much *higher peak load*. This means more travellers can travel at the same time on the same amount of space than by using a car, especially when

parking space is taken into account. Moreover, when occupied sufficiently, public transport has a *better environmental record* per passenger transported. Public transport does only slightly better on carbon dioxide emissions, which means that lower occupancy rates can tip the balance in favour of the car. On all other environmental indicators, public transport is by far the better choice [CE, 1999]. In addition, public transport has a better *safety record*. For example, every billion kilometres of car travel on Dutch roads led to 10 fatalities in 1995 [CBS Statline, 1998]. Travel by train holds even less risk; every billion kilometres on Dutch rails led to only 0.2 fatalities in the train [Poortvliet, 1998, p. 85]. Finally, *implementation of technological innovations* is less fragmented in public transport, due to the limited number of players, and to government involvement. This means that the environmental performance of buses and rail transport can be significantly improved in the short term. One can think of buses using flywheels, natural gas, hydrogen, and bio-diesel, which are on the streets right now in considerable numbers. There are few private cars available that use these technologies. Electrically powered public transport has been widespread since the 19th century; electric cars still have to find large-scale commercial application.

Public transport is not only a promising policy strategy. It is also a popular policy strategy according to Bonnel [1995, pp. 83-95] and the OECD [1995, p. 78]. Three out of the four most popular strategies to overcome transport related problems in urban areas focus on public transport (development of land-use in accordance with public transport development, railroad development, and lowering fares and improving service). The fourth focuses on designated growth areas and new towns. The quartet mentioned above underlines the importance policymakers give to the interaction between transport planning and urban planning. Both Tyson [1997, p. 115] and Forschungsverbund Lebensraum Stadt [1994 A, p.175] underline that the success of public transport oriented policies is greatly dependent on its integration with other modes and policies with an angle on mobility.

However, this popularity among policymakers is not fully reflected by the trends in the mobility market. Some authors [Bovy, 1990; Simpson, 1994, p. 208] stress that the use of public transport and the car have become different markets and that substitution between the two is arguable. Many travellers in European metropolitan areas still do not see public transport as an attractive option for their mobility. Despite public support, public transport has not been able to keep up with dynamic changes in urban transport developments. So, what went wrong?

1.3.2 Public transport as the rough road

In the Netherlands the car took over in the early sixties as the leading paradigm in urban and transport planning. As in earlier years, cities and

infrastructure were developed in accordance with the possibilities of the prevailing and most promising transport system; the car paradigm came into being. The development of cities and infrastructure has been trailing the demand for automobility since the early 1960s.

The development towards a more car-oriented society has often slowed the development of public transport. *Spatial structure* developed into the urban plane, away from the corridors of dense population where public transport shows its strength. Motorways attracted shopping malls and offices, moving traffic attraction points to the urban fringe, away from the central stations and rail infrastructure [Banister, 1994, p. 3]. The extensive development of *road infrastructure* made it possible to use the car to its full potential. However, when congestion grew on this infrastructure it also troubled the reliability of public transport services on those roads [Gubbins, 1988, p. 221]. *Prosperity and emancipation* gave car ownership a boost. The car became faster than public transport for many people on many trips [Rietveld, 1994, p. 23]. *Travel behaviour* became more erratic [Salomon, 1993, pp. 9-11], both in time and space, something the planned nature of public transport services cannot deal with.

Relative to the car, public transport became less and less attractive. Indeed, even in dense urban areas, the modal split shifted towards the car [Khisty and Lall, 1998, pp. 22-23], despite the fact that urban space was more difficult to adapt to the car and infrastructure more prone to congestion.

How did public transport companies react to this development? They had to adapt to a new market and spatial situation less favourable to their product. Should they opt for a makeover of the product, should they stop providing the transport service altogether?[3]. In the early stages of the growth of car-use, they started to operate at a loss. In the Netherlands from 1962 urban public transport companies had to be supported by the national government to prevent them going bankrupt. Figure 3 on Page 13 shows that the first contributions were to supplement extensive losses, as was the case in other European countries like Italy [Fabri, 1998, p.240]. In the Netherlands in the 1980s a shift was made towards capital subsidies and operational subsidies. Several other countries went along this path [Berechman, 1993, pp. 69-74; Pucher, 1995 B, pp. 219-220]. The operational subsidies in the Netherlands subsequently shifted from lump sum subsidies to performance-based subsidies in the early 1990s [Velde and Veeneman, 1995, pp. 283-302]. This development will be discussed in greater detail from the perspective of involved governments on Page 10.

[3] Or as President Den Besten of Dutch Rail said in one of his companies own magazines: "When put in extremes one could say that we should withdraw from passenger transport. But we are simply a rail company that is good at it, so it is probably what we should keep on doing." [NS, July 1994, p. 9]

Stern and Tretvik [1993, p. 130], Obeng et al. [1997], Winston and Shirley [1998, p.68] and Guess [1990, p. 1] argue that *subsidisation* and public control of public transport services has led to decreasing cost awareness. Berechman, [1993, pp. 168-177] and others [Geelhoed, 1986, p. 348; Obeng et al., 1997 pp. 4-6] argue that, in addition, *public control* has led to a decline of customer orientation by the public transport operator (be it privately or publicly owned). Politics became the new customer, while the traveller came second. Companies under strong governmental surveillance not only lack the means to tweak the product, but also lack incentives to produce efficiently. This effect is regarded as being most pronounced in public service branches [George, et al., 1991, pp. 346-347], but it also holds true for strictly regulated private companies. Moreover, when the regulation includes monopolisation of the market by protecting it from new entries, this adds to the effect. [Carlton and Perloff, 1994, p. 859]. In addition, Jenkins [1988, p. 97] states that *regulation in general* of the public transport sector by national governments contributed to higher costs. On the other hand, it is most likely that without public support the market share of public transport would have plummeted in a great number of cities, as operators would have gone out of business.

The complex process leading to trailing public transport ridership cannot be explained solely by subsidisation. It is only one way in which the three major players interact. In order to understand it fully, we have to include all three general actors and the ways they interact (see Figure 2).

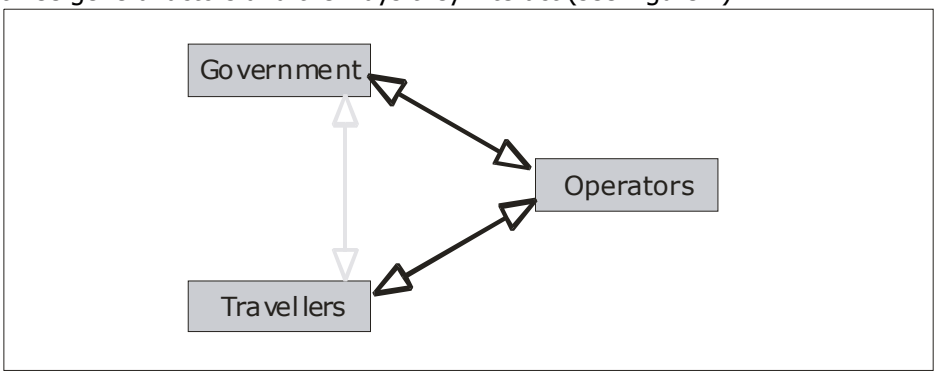

Figure 2
The three actors in public transport

The success or failure of a public transport system is the result of the actions of and interactions between the *traveller*, the actor developing specific transport wishes, the *transport operator*, the actor providing public transport services to cater to those wishes, and *government agencies*, subsidising and regulating the sector. The remainder of this section briefly discusses the role of the different actors in general and their history of involvement in the

Netherlands. Their different roles are assessed in the larger organisational context of metropolitan public transport.

Government

Governments have many ways of influencing both operators and travellers. Here we focus on the way various governments influence operators. Governments influence the kind of service the operator has to provide, what infrastructure will be available, how operators will be financed, etc. Government involvement ranges from keeping the sector alive to setting safety standards for doors.

Government involvement can be justified from a number of perspectives. The provision of basic services for the car-less or captive traveller, affordable mobility in general, mobility for the disabled, equity, and rationalisation of the transport system as a whole, were reasons put forward in the early days [Nakagawa and Matsunaka, 1997, p.17; Mackett and Babalik, 1997]. Later, other arguments were added: the possible mitigation of car-related problems and road congestion, and supplementing the ailing automobile. The involvement of local and national governments is not so much a matter of dispute. It is the manner in which government involvement in public transport has developed which can be scrutinised.

Government intervention in public transport has changed over the past century, with distinctly different timetables for rail and bus transport, for urban and regional transport, and in different parts of the world. But the type, and to some extent sequence of interventions seems to follow the same pattern. The steps that can be identified are:

1. Regulating negative effects of competition between private operators,
2. Providing financial support for insolvent operators,
3. Growing intervention in production,
4. Growing intervention in structure,
5. New systems of subsidisation,
6. Redefining public and private roles in public transport.

Step 1 aims to regulate the *excesses of pure competition*. In the original free market of public transport, competition is often harmful to operators, operator staff, passengers, and those otherwise affected by the operations. As operators fail in that context, government involvement is expanded in step 2, as governments provide *financial support* to public transport in the form of compensation for operating losses. Governments start seeing public transport as a common good deserving support when threatened.

Step 3 is based on the observation that merely subsidising the sector does not help new goals emerge for public transport. Governments try to improve public transport performance with growing *intervention in operations*. National-government intervention ranges from standardisation of buses or service levels, to attempts to fully control service provision. Regional- and

municipal-level intervention may be even more detailed, leading to the fourth step.

Step 4 is intervention in the *organisational structure* of the sector. Governments urge operators to merge in order to establish economies of scale. Governments also acquire operators and bring them into the public sector. Often a slow process, the public transport companies are financially supported, controlled, and eventually taken over. This step often results in the sector being nationalised or "municipalised".

In the various European countries, the application of steps 1 to 4 had a different character and history, but the result by the late 1970s was more or less uniform. Across Europe municipalities owned and controlled the public transport companies in their areas. Other layers of government also had a strong grip on rail services and regional transport. The provision of urban public transport services had become a public task.

In step 5, governments start to subsidise public transport in ways that are *more stimulating for the operator*. Public transport authorities take control over services with little feel for the specific needs of the traveller. They move to financing production (either by public or private operators), rather than production losses, or subsidising on the basis of consumption, rather than on the basis of production. Or they focus their funding on providing a cheap infrastructure rather than on production.

Step 6 is of a more recent nature. All the efforts above blur the lines between the public and the private sector in public transport. National, regional and local governments throughout Europe are trying to bring back the *clear lines of distinction between private and public involvement*, though no standard division of tasks and responsibilities has surfaced yet.

In the Netherlands, we can see these steps surface at different points in time and at differing periods for the various metropolitan and regional transport modes. A brief history of national regulation [Faber, 1989;Velde en Veeneman, 1996; Groenendijk, 1998; Ministerie van Verkeer en Waterstaat, 1948-2001] shows how successive ministers of transport have tried to improve the efficiency and the effectiveness of public transport services. After restricting the possibilities of "wild" bus companies in the 1920s, the national government started to reimburse the company losses of the publicly-owned transport operators in the major Dutch cities in the mid 1960s. But this soon spread to privately owned urban and regional bus operators [see also Nyqvist, 2001].

The national government has tried to improve the efficiency of the sector as a whole in various ways, including by intervening in the structure. In the 1920s, the government merged the existing railway companies into one, looking for economies of scale and integrated services; after World War I government regulation crippled both companies. The national government

intervened in the structure in the regional bus sector three times. First, following concerns in the 1970s about *Dutch Rail*'s (NV Nederlandse Spoorwegen) growing grip on the regional bus sector, the national government prohibited the operator from making further acquisitions [Faber, 1989, pp. 221-230]. Dutch Rail was a national stock ownership at that point in time.

This culminated in the second intervention: the national government bought all shares of Dutch "private" bus operators, including those owned by Dutch Rail. In 1982 the national government set up *NV Aandelenbezit Streekvervoer*. This public limited company was established to serve as a holding company for the national government's shares in regional bus operators, also operating several urban services. The new bus company received a significant capital donation to start with a clean slate. The idea was that a simple stock holding would suffice to improve efficiency and to control the operators, but the stock holding grew ever stronger until it operated as a highly independent and integrated company and renamed itself *VSN Group*.

VSN Group was the subject of the third intervention in its structure when, in 1996, the minister of transport forced the company to split into two separate operators. The idea was to reintroduce competition, enabling public tendering of bus services.

In addition to structural interventions, regulation was aimed at service provision. The national government introduced general standards for services in 1988 in terms of minimum day frequencies. The government also challenged operators to reduce parallel service routes to improve overall public transport efficiency. Furthermore, a national ticketing system was introduced for buses and metropolitan services which had not arisen under private operation. In addition, new forms of public transport were introduced, including demand responsive systems.

Through the years, the financial involvement of the national government in the sector has changed in character. As already stated, financial involvement started by covering the deficits of municipal operators. This method was set aside in 1988, when financing was coupled with specifying service standards, and companies were subsidised for production through the standardised reimbursement of production costs. Only 5 years later this was changed. The new system offered subsidies on the basis of measured ridership, which proved complex. The latest step since is the introduction of tendering, subsidising the best offer for services.

Government financial contributions have been significant in the Netherlands, and annual subsidies and contributions reached more than €3,500 million[4] in 1994 (see Figure 3). These included subsidies for specific target

[4] All financial data is given in Euros. The data presents historic prices at the exchange rate of 1-1-2000. Consequently, the data is not ajusted for inflation of historic

groups, like students and the military, for specific innovative projects, and investments in infrastructure and capital to improve liquidity of the operators.

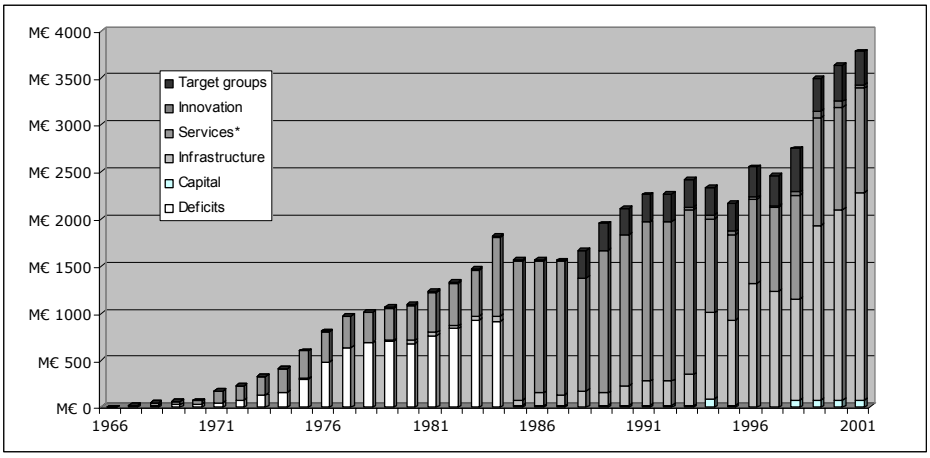

Figure 3
National government contributions to public transport in the Netherlands from 1961 to 2000.
****until 1994 most infrastructure contributions are registered together with operational subsidies***
(Source: Ministerie van Verkeer en Waterstaat, 1966-2002)

Not only the Dutch national government has been regulating the structure of the public transport sector. In the cities, many municipalities have also taken public transport into their own hands at some point in time. Their regulatory efforts were of a more straightforward nature. Full municipal control over public transport operators offered instruments for steering transport development. In the early 1990s nine Dutch municipalities owned public transport companies. In general, the municipality provided a budget, on the basis of which the municipal operator suggested services, generally varying on the existing product. After some bargaining the product was accepted by the municipal executives. The same process holds for 33 other municipalities, which were awarded state funding for their urban public transport. They had to come to an agreement with the regional bus operator in their area.

Local governments in the Netherlands have followed the trends and have rethought the respective roles of public and private actors in metropolitan public transport. As a result, between 1985 and 2001, 7 out of 9 local bus companies have seen some changes in government ownership (see Table 2). In general, the operator changed from a municipal service to a municipal stock ownership at arm's length from local politics.

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currency fluctuations. As these have been limited over the years and countries this study covers, this is regarded to be sufficiently adequate.

Municipality	Municipal operator	Status in 1990	Status in 2002
Amsterdam	GVB	Municipal service	Municipal service*
Arnhem	GVA	Municipal service	National stock ownership*
Den Haag	HTM	Municipal stock ownership	Municipal stock ownership*
Dordrecht	Stadsvervoer	Municipal service	Municipal stock ownership**
Groningen	GVB	Municipal service	Private operator
Maastricht	SBM Groep	Municipal stock ownership	Private operator
Nijmegen	CVD	Municipal service	Municipal stock ownership
Rotterdam	RET	Municipal service	Municipal service*
Utrecht	GVU	Municipal service	Municipal stock ownership
* Considering further steps towards privitisation ** Daughter of HTM			

Table 2
The transformation of Dutch urban operators between 1990 and 2002

The operator

In theory, operators are expected to optimise their profits [Carlton and Perloff, 1994, p. 15] and to ensure continuity. Empirically, an operator's behaviour is hard to understand from the perspective of profit optimisation and continuity. Many mechanisms divert the operator's attention from these simple goals [George et al., 1992, pp. 27-60]. One of the mechanisms is the operators' liaison with the public sector. This is the case not only for those operating as a government service branch, but also for private operators.

The operator is caught between the government steering and traveller demand. The growing intervention by governments discussed before has limited the possibilities for companies to tweak the product to the traveller [Obeng et al., 1997, p. 4]. In many metropolitan areas the operators' main single financial contributor is a government agency, whereas the operator has to tailor its services to the traveller. The main information source for the agency is the operator, creating a situation that distracts attention from the actual traveller. Weigle [1988, p. 53] states that these operators prove to be less flexible and are not able to adapt their services rapidly to changing demand.

The operator has to perform a set of difficult tasks. He has to analyse the variety of the market, define a complex system of services, acquire and run vehicles, employ, deploy and motivate staff throughout his operating area. When he has developed a product, he often has to deliver the same service for a full year. In addition, he has to balance government wishes with company goals and customer needs. He has to deal with limited resources in infrastructure, in the overall availability of which he has little influence.

The operators' main instrument is service execution, generally combined with service definition. The success of public transport is, of course, largely dependent on the type, location, and level of service, forming a balance with

the cost of service provision. In addition, the flexibility of that service to changing demands, tailoring of services to individual demands, adds to the account.

Moreover, the operator can change internal organisational structure or processes. Concentration in the sector, operator- and government-induced, has been a major trend, with operators growing in size. In terms of the processes, job enlargement [Kaspar, 1998, p. 166] has played a role, with the tasks of front-line staff being widened.

In the Netherlands, the efforts of the operators to improve their product and their production have been less well documented then those of the national and local governments. The same holds for the quality of their services, though quality has been lamented throughout the decades. One example is a paper written by a private bus operator as early as 1934 [Marle, 1952], stating that bus operators linked to the nationalised rail operator did not perform very well. A more recent source is the international comparison of the efficiency of bus operators in a number of countries [McKinsey, 1997], showing that, in terms of output, the performance of Dutch public transport operators is well below the average of operators in six other countries. This leads McKinsey [1997, p. 2] to state that …

> *… Relative to the public transportation sectors in other European countries, the Dutch sector is performing poorly.*

Figure 3 on Page 13 can serve as an illustration of the growing dependence of Dutch operators on the national government. Since 1965, subsidies (generally all funding provided by the national government) to public transport have steadily been rising, while ridership has proved to be rising much more slowly.

Municipal service branches in the major cities were the first to get into trouble. From the early 1960s, their municipal owners have applied for help from the national government, which was granted. The operational subsidies rose over the years from €12 million in 1962 to a peak of €1,570 million in 1993. By the new millennium it had decreased to €681 million. Soon after their municipal colleagues received subsidies, the regional bus operators followed. They also brought themselves under the scrutiny of the national government by applying for subsidies. These operational subsidies rose from €3 million in 1969 to €1,030 million in 1985. By 2000, they had remained around that level. However, investments in infrastructure still rose significantly[Ministerie VenW, 1960-2002].

Though some mergers in the Netherlands were induced by the national government, operators also sought each other's company. To improve efficiency the companies grew through acquisition and mergers. From the 1970s, the government stimulated this development, but concentration has

been a major trend over the decades. The number of independent bus operators in the Netherlands in the 1920s is estimated to have been around 200. In 1995, only two groups of bus operators remained, with one major operator of regional buses and 9 urban bus operators. Hence, the average size has grown significantly. The concentration can also be recognised in the centralisation sought by the VSN Group, becoming one of the largest bus operators in Europe. Since the late 1990s, this consolidation has become more and more international. In the late 1990s municipal operators also joined the concentration trend, when their privatisation often meant being acquired by (semi-) private regional bus operators.

This meant that, by the late 1990s, a situation had developed in the Netherlands where there were two large national operators, divided along the lines of technique: Nederlandse Spoorwegen (Dutch Rail) and Connexxion (former VSN Group), both national government stock ownerships. Their respective turnovers from public transport in 2000 were €1180 million and €863 million. In addition, 9 municipal operators were active. Of these, GVB Amsterdam in particular was of substantial size, having a turnover of €330 million in 2000. For comparison, one of the largest European operators, Arriva, had a turnover in that year of €2700 million.

The traveller

Public transport is in essence a collective mode of transport; it is the aggregate of individual travellers' choices that determines its success. To be successful, public transport has to focus on the individual traveller [Schuck-Wesrig, P. and G. Wesrig, 1994, pp. 147-148]. Many authors [e.g. Boer, 1994; Brokx, 1992-1995; McKinsey, 1997] have argued that the vicious circle of less quality, less ridership, less income, less quality will also work the other way to more quality, more ridership, more income and more quality.

How does the traveller influence the success of public transport? Some travellers are in a position to make a daily choice between various transport modes. Their daily choice in favour of public transport can support public transport in the short term. However, others lack this choice. Some travellers choose voluntarily to forfeit this choice. They become the captives of choice for the location of their work, the location of their home, their preferred shopping area, or investment in one or more vehicles. Others, though, are the true captives and involuntarily lack the possibility of making a daily choice of mode of transport.

The car offered a wider variety of possible choices in locations. It has widened the traveller's scope in where to work and live. Emancipation has led to more people exploring the wider scope in job opportunities. Economic growth has given the traveller the possibility of exploring that variety by acquiring a car. It was already shown that many Europeans were willing and

able to pay substantial sums to gain that wider scope in jobs, housing and recreation.

The traveller can adapt his or her behaviour to public transport. But the traveller can also influence public transport to adapt itself to his behaviour, both as a citizen and a consumer. The traveller can elect and object, has voice and choice. As a citizen, the (potential) traveller has the possibility of *electing* governments and *voicing* his preferences towards governments. As a consumer, the traveller has the possibility of *objecting* to operators' performance levels and *choosing* specific operators or changing to other modes [Shaw 1993, p. 201].

	Passenger cars	***Buses and coaches***	***Tram and metro***	***Railway***	***Total***
1970	1583 (75,09)	270 (12,81)	38 (1,80)	217 (10,29)	**2108** **(100)**
1980	2333 (78,47)	347 (11,67)	40 (1,35)	253 (8,51)	**2973** **(100)**
1990	3302 (82,69)	369 (9,24)	48 (1,20)	274 (6,86)	**3993** **(100)**
2000	3890 (83,84)	410 (8,84)	50 (1,08)	290 (6,25)	**4640** **(100)**
**In 1000 million passenger kilometres in the 15 European member states of the European Union. Percentages are given between brackets.*					

Table 3
Car use and public transport ridership in Europe over the last 30 years (Source: Eurostat, 2000)

As a result of the car-orientation of many of the choices, the mobility of the traveller has grown substantially, and the car accounts for most of that growth, as Table 3 shows. In addition, the references regarding transport changed. Transport was expected to be faster, more reliable, more comfortable, and safer, and the traveller expected to be better informed [see also Black, 1995, pp. 294-296; Steg and Kallfs, 2000].

These changes can also be recognised in the Netherlands, though generally they are somewhat less dramatic. While in the whole of Europe there was a modal shift towards the car of 9 percent between 1970 and 2000, in the Netherlands that modal shift was 6 percent. During that period Dutch car ownership grew more slowly than the European average, 88 percent growth against 147 percent growth. [Eurostat, 2000]. But, on the whole, the direction of the changes in the Netherlands has reflected changes elsewhere in Europe, despite the fact that the Dutch government tried to limit growth relatively early, through planning restrictions, taxation, restrictive infrastructure development, and its involvement in public transport, as discussed earlier. As has already been mentioned, the traveller did not change dramatically in some respects, such as the number of trips per day and the time spent travelling.

In most literature the behaviour of the traveller is treated as the dependent variable. This literature does not ask how the traveller can support public transport, but how governments and operators can support public transport by making it more attractive for the traveller. Operators and government basically have the instruments to make public transport a success. This study builds on that notion, as it aims to see how public transport can improve its performance in the wider context of metropolitan transport. In the end, the behaviour of the traveller has a crucial impact on that performance.

In the next section, this research challenge is elaborated in more detail.

1.4 The focus of the research: Combining rationales to organise public transport

The assumption based on the previous discussion is that public transport plays an essential role in supporting the vitality of and mobility in metropolitan areas. Still, the general idea, both from theory and analysis of the performance of public transport operators, is that both the effectiveness and the efficiency of public transport should be improved. To many travellers the services offered are not attractive; the services do not represent an effective means of transport. In addition, the production costs are high. The behaviour of both operators and government agencies are seen as contributors to this lack in performance, the former by the actual operations, the latter by creating an organisational environment that gives the operators no incentive or even possibilities to improve their operational performance.

The behaviour of these actors influences the performance of metropolitan public transport services. Market organisation, urban planning, customer awareness, system integration, solid public policy, business organisation: all contribute to making public transport adapt more easily and effectively to emerging challenges. The focus has long been on isolated issues that might influence the performance of public transport, from low-floor vehicles and optimised network development to customer information systems and subsidy schemes. Their impact on performance has been disappointing.

According to some literature, a more integrated approach towards public transport can contribute positively to its performance. The authors from the Forschungsverbund [1994 a, p. 175] hold that only a combinatory approach will be able to offer a long-lasting change in the attractiveness of public transport in the metropolitan area. More generally, others [Schön, 1983; Rose; 1993] have suggested that a less reductionist and more combinatory approach is useful for tackling complex problems.

A combinatory approach should be based on an analysis of mechanisms influencing performance, from a variety of perspectives. This variety of perspectives is best reflected scientifically in different disciplines relating to

public transport. A combinatory approach should offer analyses and recommendations reflecting that variety. How to attain such a combinatory approach in public transport, though, is largely unknown territory.

A combinatory approach does not adopt the focus of a single (scientific) discipline and try to improve it, neither does it overthrow existing knowledge and replace it by a new paradigm. Rather such an approach aims at understanding the existing rationales, how they relate to one another and to reality, and how that combined knowledge can be used to improve the system as a whole. The approach aims to bridge the variety of disciplines and to elaborate how their combined application can support metropolitan public transport.

A combinatory approach does not focus on a specific task in public transport. A narrow focus on a specific task does not seek wide disciplinary coverage. In contrast, a combinatory approach focuses on organising the whole process of public transport systems development, from transport policy development, through network definition, to operation of services. As such the organisation offers a framework for disciplinary integration.

The term "combinatory" suggests that separate parts exist. This study makes a distinction between rationales and disciplines. The term "rationales" relate to parts of the cognitive construction of public transport. These islands of knowledge focus on specific parts of the reality of public transport. They can be recognised in both science and practice. The different rationales will be specified and further introduced in Chapter 3. These rationales find their origin in wider *disciplines*. Disciplines here are not regarded as public transport specific. They have a larger empirical base and are generally specified by well-known labels such as geography, transport engineering, economics, policy science, etc. In addition, disciplines from our perspective are social systems, rather than cognitive constructs. The term "disciplinary" will be used in this study as an adjective for both rationale and discipline.

This study interprets the question of public transport redevelopment as a matter of organising different tactics and actors together into a solid strategy that supports the quality of the public transport system as a whole. The approach utilises the variety of disciplinary understanding of the whole of public transport related activities: the public transport system. This use of different rationales is intended to be selective and purposeful. The purpose of such an approach would be to improve the efficiency and effectiveness of the services offered. The approach should overcome the gap between the variety of theories and the practice of the organisation of metropolitan public transport.

1.5 Research goal and questions

Public transport is considered to be a major contributor to the mitigation of a multitude of negative effects of increased mobility, more particularly, the excessive growth of car use. In particular, this applies to metropolitan areas, where high densities make car-related problems most pressing. In addition, public transport promises to be one policy option that could be effective in the relatively short term with consideration of the strengths of the existing metropolis.

So far governments and public transport companies have been insufficiently able to convert this promise into reality. In spite of years of attention to improvement, travellers are insufficiently attracted to public transport services. The explanation for this situation can be found in a range of factors, which together form a complex causal network. Consequently, the possible policy actions to improve the performance of metropolitan areas are diverse, many of them having a distinct disciplinary focus. This gives policymakers little grip on how these policy actions relate to each other and how they can be used in a more integral manner.

In reaction to this situation the goal of this research is formulated as follows:

> *The conception of a multidisciplinary approach to support the development of the organisation of metropolitan public transport, focused on the eventual enhancement of the quality and efficiency of Dutch metropolitan public transport services.*

This goal reflects a major hypothesis and primary starting point of the study. This is the idea that the fragmentation into rationales is hampering the improvement of public transport. Although some authors have taken this stand [Lynton, 1985; Klein, 1990; Banister, 1994, p. 218; Teisman, 1997], the concept is difficult to transform into viable policies. As Quinn [1988] asserts, effectiveness lies in the ability of the organisation (here in its traditional sense) to support a variety of competing values. The search for a more multi-disciplinary approach is not mainstream research, especially in a specific field like public transport organisation.

The scientific aim of this study is to explore the possibilities of a combinatory approach. It analyses the use of disciplinary knowledge in the development of public transport. It proposes a theory and a method to improve the public transport system with more consideration for the disciplinarity of knowledge. It intends to evaluate the effect of such a method on the effectiveness and efficiency of metropolitan public transport systems.

When we want to offer a policymaker a perspective on a fruitful combination of different disciplines in his organisation, the following questions have to be answered:

- Which rationales contribute to the range of knowledge on metropolitan public transport?
- What do they contribute to the possible arrangement of activities in the organisational field of public transport?
- The answers to these questions form the theoretical base of the analysis. This is presented in Chapter 3. Further questions are:
- How is disciplinary knowledge used to improve the performance of metropolitan public transport systems?
- What is the effect of the use of disciplinary knowledge within the public transport system on the effectiveness and the efficiency of the system as a whole?

The answers to these questions form the explorative-empirical base of this study. This is presented in Chapter 4.

The next step will be to translate the analysis into a possible approach for the improvement of the organisation of metropolitan public transport systems.

- How can the purposeful application of disciplinary knowledge improve the organisation of metropolitan public transport systems, improving the efficiency and effectiveness of the system?
- What recommendations for policymakers concerned with the organisation of public transport for the metropolis can be deduced?

The approach will be presented in Chapter 5. The approach is tested to answer the following questions:

- Does the approach have the expected result on effectiveness and efficiency?
- How can implementation of these improvements work in a real world organisational setting?

Chapter 6 presents the results of a simulation-game in which the approach was applied.

Finally, Chapter 7 will reflect on the implications of this research for the organisation of public transport and multidisciplinarity in science and practice.

Summarising, this study results in

1. An empirical evaluation of the use of present rationales in the organisation of metropolitan public transport,
2. The development of a theoretical framework of organisational improvement in metropolitan public transport combining the insights of the present rationales,
3. Operationalisation of this framework into a practical combinatory approach,
4. An empirical test of the value of this approach.

First however, Chapter 2 will further clarify the focus of the research and present the research approach and methodological choices.

2 The research strategy: The central line

The more constraints one imposes, the more one frees one's self of the chains that shackle the spirit.... and....the arbitrariness of the constraint serves only to obtain precision of execution.

Igor Stravinsky
In: Poetics of music in the form of six lessons, 1970 (original 1942)

2.1 Introduction

The research questions presented in Chapter 1 indicate three stages of analysis: analysis of existing knowledge, analysis of knowledge application in practice, and analysis of a proposed change to that application. Firstly, the research examines the variety of disciplinary knowledge. Secondly, it examines how it is used in the organisational practice of metropolitan public transport and the relation of that use to effectiveness and efficiency of metropolitan public transport. Thirdly, the research assesses the applicability of an innovative approach based on a more deliberate application of this knowledge. All steps underline that this research has in essence a multi-disciplinary character, which should be reflected in the research design.

In addition, the multi-disciplinarity of the research asks for a clear definition of the key concepts, as the disciplines involved often use concepts in distinctly different ways. Section 2.3 offers this specification and further delimits the research. Next, Section 2.4 presents the methodology that was used to assess the role of different disciplinary knowledge in metropolitan public transport.

Finally, Section 2.5 elaborates on the limitations of the study and how practitioners should interpret the results, based on the methodological choices. But first, because it presents such an important factor in this research, Section 2.2 will elaborate on the importance of multi-disciplinarity in understanding the organisation of metropolitan public transport.

2.2 Multi-disciplinarity

Although in Europe twenty years ago some standard in organising public transport on a metropolitan scale emerged, today the diversity is striking. The way in which metropolitan public transport is organised differs from country to country, from city to city. Tasks and responsibilities are mapped differently to different actors. The processes that lead to buses in the streets and trains on the rails follow different paths. The roles that public and private actors have vary throughout Europe [Grégoire and Maubois, 1994 A and B], suggesting the absence of a shared optimal way to organise public transport or substantial differences in situations in these cities.

A number of research consortia tried to understand those differences between cities and countries [Thomson, 1977; McKinsey, 1997; AVV, 1998; ISOTOPE, 1999; and SESAME, 1999]. In addition, individual researchers have also tried to understand the difference between the organisational framework in countries and cities [Berechman, 1993; Jones, 1993; Pucher, 1995 B; Hendriks, 1996; Groenendijk, 1998; Velde, 1999]. These publications span a wide range of inter-urban, international or intercontinental comparisons. SESAME focuses on gathering performance indicators in 40 different metropolitan areas (with a focus on land use and mobility). Velde, Groenendijk and Berechman aim for a formal analysis and prescription of public transport organisation. Hendriks assesses the informal aspect of policy making in his thorough analysis of the policy culture in two different metropolitan areas. Pucher compares American public transport systems and their organisation with their European counterparts. The approaches of these authors differ, but they share the intention to understand interurban and international differences.

The way in which these researchers touch on organisational matters also differs greatly. For some the organisation is the prime focus, for some only a part of the organisational framework matters, for others it is only one of a larger set of issues under study. Most of the aforementioned authors relate elements of an organisational framework to a set of performance criteria. A great number of authors have taken that approach studying privatisation, decentralisation, subsidisation, contract forms or the introduction of competition into public transport. For examples one can refer to NRC/TRB [1988], Giger [1991], Taylor [1992], Berechman [1993], Pucher [1995], and Hakim et al. [1996]. Some focus on description, while others, [i.e. Ellerman, 1990]; try to model the public parts of the organisation.

In their analysis, researchers of public transport systems have shown themselves to be disciplinary specialists; they chose a "worldview" [Klein, 1990, p. 104] in which light they selectively perceive the problem. Their choice of concepts, empirical mechanisms, and performance indicators comes from a specific discipline. Concepts, empirical mechanisms, and performance

indicators not central to the study are abstracted into models or axioms, or left completely out of the assessment. As a result their analysis of their chosen "worldview" is thorough but narrow.

Science has developed into specialisation, parcelisation and artificial subdivisions of "reality" [Lynton, 1985, pp. 137-152]. This means that both analysis and solutions are based on a partial interpretation and evaluation of real life mechanisms. That might imply that though policy suggestions from academia will work in theory, the real world environment will not treat these suggestions gently [Brewer, 1999]. Von Hayek [1967, in Chisholm, 1989, p. 197] underlines that parcelisation will lead to a delusion that we can reduce complex empirical mechanisms to facts…

> *This often leads to new scientific errors… Such errors are largely due to an arrogation of pretended knowledge, which in fact no one possesses and which even the advances of science will not give us.*

Not just the academic side of society looks at reality as specialists, understanding and evaluating those parts that are well known to them. As Rose [1993, p. 7] rightfully claims, the great majority of policymakers are also specialists, by training or task, by experience or expertise. In addition, this specialisation is subject to trends or fashion. One specialisation is more popular at one moment in time and space than the other. That means that related policy actions will prevail, based on the popular belief among policymakers at that given moment.

This disciplinary specialisation does not do justice to the type of problems we have been discussing. Minx et al. [1994, p. 21] state that the problems mentioned do not occur structured according to disciplines. They add that …

> *... Dass für Problemlösungen notwendiges Wissen häufig in einer Fülle von unverbundenen Einzelstudien in verschiedenen Disziplinen erarbeitet worden ist, so dass es nunmehr vordringlich darum gehen sollte, die vorliegenden Einzelerkenntnisse zusammenzufassen, auszuwerten und hinsichtlich Kongruenz und Widersprüchlichkeit zu prüfen [p. 25].*

Banister [1994, p.126] also pleas for a more holistic view on transport planning as a whole. Such a view includes attention for transport as an integral part of city and for "factors such as organisation, financing, technology and environment".

Klein [1990] and Keyfitz [1995] both show that policymakers acknowledge the importance of multi-disciplinary development of policies.

Klein shows the possibilities, where Keyfitz shows how difficult it is for policymakers to deal with conflicting disciplinary policy recommendations.

In his 1959 treatise on the method of successive limited comparisons, Lindblom [1959, pp. 21-22] viewed discrepancies between scientific literature and practice. Academics focus on single conceptual solutions, being disciplinary. Practitioners focus on an incremental approach to complex problems, with the possibility for a wider analysis of problems and balancing of policy alternatives. Moreover, Lindblom argues that the incremental approach is the only possible way ahead, when it comes to more complex problems.

A great deal of disciplinary knowledge on metropolitan public transport exists on factors that influence its success. Current knowledge is vast, but scattered in disciplines. In addition, current practice has absorbed disciplinary knowledge selectively. Current policymakers are used to and fond of the rather well structured disciplinary world.

This tension between existing disciplinary paradigms and the unexplored promises of a multi-disciplinary approach forms the basis for this study. Or in a single phrase: this research focuses on broadening, rather than to narrowing the theoretical scope on the organisation of metropolitan public transport systems. The goal of this research is to overcome this parcelisation of "reality", though only to a small extent: considering aspects that are influencing the quality of a public transport system and based on the existing "parcels" of reality. That means that the research is not *inter*disciplinary; it does not aim at eradicating the boundaries of different disciplines. It merely relates different disciplines for the purpose of improving the organisation of metropolitan public transport systems.

This challenge yields three steps of scientific endeavour:

- Theoretical analysis:
  By focusing on concepts and performance criteria from a extended range of disciplines,
- Empirical analysis:
  By focusing on the combined functioning of these theoretical mechanisms in real-life,
- Normative analysis:
  By focusing on possible steps of improvement.

The research starts from a multi-disciplinary analysis of the concepts in scientific literature important for the organisation of metropolitan public transport. The relations between these elements of disciplinary knowledge are analysed with a first step of empirical work. In that empirical work we try to draw practical lessons, focusing on the way public transport systems themselves improve performance by adjusting the way in which the system is

organised. Finally, a multi-disciplinary approach is crafted and put through an empirical trial.

2.3 Subject of study

The organisation of metropolitan public transport seems a simple enough concept. It would probably involve a public entity and a number of operators serving the traveller in an urban environment. It would include: a manner of structuring public interest in the services, some way that different operators link up services, and some idea of the individual operator organising the provision of services to their travellers.

To clarify though what the exact subject of this research is we will clarify what will be understood by *public transport*, by *metropolitan areas* and by *organisation*. Finally, we will link it all in a definition of the term public transport system.

2.3.1 Public transport

Many will find the expression "public transport" self-explanatory. Transport means moving people or goods around. Public will mean of the people; either open to everybody or in the hands of government. Here the first ambiguity comes in. Many scientific authors define public transport (or transit in North American countries) based on a legal definition of public transport, often stressing the open character. Groenendijk [1998] takes the Dutch legal definition, including mode types, open access, and a predefined schedule:

> *Voor een ieder openstaand personenvervoer per trein, metro, tram, bus of auto volgens een dienstregeling.*

Many official classifications and definitions of public transport are based on the technique: the vehicles and infrastructure used [APTA Glossary; UN Statistic Division Classification Registry]. Brandli [Giger, 1991, p. 18] takes a slightly different approach, focusing on public transport as a service, the predefined availability in space and time for everyone and the exclusion of driving yourself:

> *Der öffentliche Verkehr ist ein Leistungsangebot mit definierter örtlicher und zeitlicher Verfügbarkeit, das von jedermann aufgrund vorgegebener Beförderungsbestimmungen beansprucht werden kann und den Zwang zum Selbstfahren ausschließt.*

Khisty and Lall [1998, p. 396] also underline the open character of public transport:

> *Public transport systems are modes of passenger transport that are open for public use.*

They add two other characteristics of public transport: the fact that it provides transportation for those not able to have their own private transport and the fact that it is designed to transport large numbers of people between a relatively limited number of locations.

These three definitions offer only a glimpse; many more can be found. All definitions offer some common ground on two aspects:

- Public transport is a transport service for passengers,
- Public transport is open to everyone.

The first aspect implies a number of things. It is a service in which the passenger *is* transported; he does not have to drive. He is either transported by an automated system, a driver is guiding the vehicle, or a combination of the two. This excludes for example car rental as public transport. In addition, the main goal of the service is to transport passengers, not goods. Moreover, public transport is seen as the service. Often people speak of buses as public transport, but the services offered with the vehicle, *that* is public transport. Vehicles and infrastructure are mere prerequisites to offer transport services. Finally, the essence of that service is the transport; this excludes transport offered as a purely recreational service as the boat rides or coach tours.

The second aspect means that the service is accessible for everyone. Of course limitations might apply. One might have to pay, though the example of Hasselt, (Belgium, 65,000 inhabitants) shows public bus services can be free. The system might not be available everywhere and always; network density and operating hours limit availability, but not accessibility. The transport service is there but it is harder to catch. Specific persons might even be expelled from public transport services because of past conduct, but we consider neither their conduct, nor expulsion as a rule. But in general everyone who is willing to go to a stop, or phone in for a service will be able to use public transport.

The fact that public transport is open to everyone means that the individual service is a shared service. During your trip someone else may want to access the service and enter at a (scheduled) stop. This means that taxis are not public transport, though jitneys and other shared systems open to the public are. In addition, it excludes services to designated groups, like handicapped or elderly persons. Services restricted to these groups might be operated by the public transport operators and might receive governments funding. Here, they are not included in the analysis.

The general idea of public transport services is that they are offered on a scheduled basis, either on time, on routes or both. The growing number of services on demand defies this as part of a definition. The growth of demand-dependent services illustrates how public transport is searching for creative ways to expand the types of services, especially when offered in areas or services with limited demand.

In addition, we have some idea of the techniques included. An elevator or an escalator could be seen as public transport, though normally this is not the case. The same is true for aeroplanes and helicopters. It is tempting to only include wheel-based system: either on rail or on the street. But this definition will definitely not hold in the future.

Moreover, we have some idea that public transport is offered by specialist companies. Elevators and escalators are part of the overall infrastructures in airports and shopping centres. But for example in France, public transport companies are part of multi-utilities, companies that are offering many more services than just public transport.

Finally, the word "public" in public transport has invited us in the past to see it as a symbol of governmental involvement in the definition or the operation of the services. Recent developments in the United Kingdom have shown that this is not a defining aspect of public transport. Moreover, public transport started as a service offered by the private sector. Public transport services *can* be offered on pure commercial bases by the private sector, without substantial involvement of the public sector. As a consequence, public involvement is not defining public transport, which leaves us to define public transport as simply as we can: passenger transport services open to everyone.

2.3.2 Metropolitan area

Where do the problems related to growing automobility appear to be the most severe? Where is the promise of public transport the greatest? Where does the fact that this promise does not materialise matter the most? Undoubtedly this is the case for the cityscape: the urban surroundings where space is already scarce, infrastructure is overcrowded, demand for transport is high, people and jobs are concentrated, and economic interests are significant

The term metropolitan area might seem as self-explanatory as the term public transport. However, under close scrutiny both prove to be subject to large differences in interpretation. Again, law in some countries defines metropolitan areas. Urban centres have a role for the surrounding area, providing facilities, services, and jobs for the area. That role is often institutionalised in a jurisdiction, for example to broaden the tax basis for the urban centres, or to provide a basis for joint policy development.

The developed scientific idea of the urban core and surrounding area forming a functional region from a market perspective dates back to early geographers such as Christaller [1933 and 1966] and Lösch [1954]. They focused on central places from the perspective of retail markets, though later work [Beavon, 1977] gave central place theory a focus on other areas. These models centred on (the costs of) transport, and the relation between

passenger transport and urban structure was left untouched. In empirical analyses Knox, [1982, pp. 17-21], Wachs and Crawford [1979], Daniels and Warnes [1980] and many others developed this approach further into the relation between transport and urban form (see also Section 3.6). They show how transport developments have driven the growth of the catchment area of urban centres, linking urban centres to an ever-growing surrounding area.

To understand the role of public transport, the focus has to be on the metropolitan areas as one functional region with an urban centre being the focus of a large part of transport. Jong [1991, pp. 23-29] gives an overview of possible determinations of functional regions, and stresses the relationship between the determination of a functional region and the existing governmental landscape.

Central municipality	Inhabitants	Inhabitants metropolitan area
Amsterdam	734,594	1,168,639
Rotterdam	595,255	1,345,333
Den Haag	442,356	955,243
Utrecht	256,420	1,117997
Maastricht	122,136	647,994

Table 4
Five Dutch metropolitan areas on January 1st 2001

Since this research intends to contribute to decision-making on the organisation of Dutch metropolitan public transport, the focus will be on metropolitan areas outside the Netherlands that are comparable to Dutch metropolitan areas in size and structure. This means that the metropolitan areas considered have a maximum of 2,000,000 inhabitants and a central city ranging in size from 100,000 to 1,000,000 inhabitants. The lower boundary is set, because it is the minimum size for a relatively developed network of public transport services. The higher boundary is set because in the Netherlands no larger city exists. Though some argue that the Randstad should be regarded as a single metropolitan area, it does not function as a functional region, like the larger metropolitan areas of Amsterdam, Rotterdam, Den Haag and Utrecht (Netherlands) do.

2.3.3 Organisation

The term organisation is used for a wide range of concepts and probably evokes the least clear picture of the three central issues of this research. In the literature organisational definitions are often closely related to the structure of a single corporate unit. This research will not use the term organisation in that sense, except when specifically stated in the text.

The focus in this research is not on a single corporate organisation and the design of its structure. Rather, the focus is on the inter-organisational

side of organisation, on how different actors, both private and public, interact to provide public transport services in a given metropolitan area. When the research moves on to prescription, it will focus on inter-organisational design [Nystrom and Starbuck, pp. 385-529], institutional design [Weimer, 1995; Goodin, 1996] or institutional arrangements [Nash, 1982, pp. 72-73] rather than on corporate organisational design. As Thomson [1977, pp. 322-323] states, this is not simply a strategy, but the most important strategy for success. In addition, it is the only way to have a platform for the fruitful combination of different rationales (see Section 1.4).

Public transport is intrinsically an inter-organisational service. First, it has a history of strong public intervention in service provision, combining policy-oriented organisations and production-oriented organisations. This gives it an inter-organisational character, even in situations when a public service branch produces the services.

Second, the services offered by an operator are generally limited, be it in the type of service or in the region in which the services are offered. Travellers often cross these boundaries on a trip when travelling over longer distances. In a single trip their chain may consist of services offered by the local bus operator, the operator of high-speed rail and a tramway operator in the city of destination. Offering an integrated service is one of the challenges of public transport, and making it an intrinsically inter-organisational activity.

So, what does this research regard as *the* organisation of metropolitan public transport? An organisation in its corporate sense has clear marked boundaries. Inter-organisational networks though have not. Many theoretical concepts can provide the limits of the inter-organisation of metropolitan public transport. We could use industrial organisation, with general terms as production process or industry [George et al., 1992, p. 154], or more well-define concepts as value chain [Porter, 1995, pp. 36-52], and inter-organisational networks [Lauman et al., 1978, pp. 455-484]. Most of those focus on private enterprise, while in public transport the connectedness between public and private actors is either an important fact of current life of just around the corner.

A useful concept for this research is that of "purposeful connectedness". The purpose is that of the provision of public transport services, with an environment of public goals and customer needs. The connectedness means that actors are functionally related, interacting on a regular basis, with generally more complex interactions than basic selling and buying. This definition leans most on Dimaggio and Powell's [1983, pp. 147-160] concept of the organisational field or Chisholm's [1989] less strictly defined multi-organisational systems. The term "inter-organisation" [Perrow, 1986, p. 194] also has some appeal but offers a less clear concept for bounding the system.

The purposeful connectedness becomes apparent in interactions. In public transport these are the interactions between the three actors mentioned before: governments, operators, and travellers. To distinguish between them we label these interactions:

- GO-level interactions: Between government and operator,
- OO-level interactions: Between operators,
- OT-level interactions: Between operator and traveller.

GO-level interactions are those interactions that take place between the (private or public) operator and the governmental agency responsible for public transport. They typically involve *infrastructure provision*, *subsidisation* and *commissioning of services*.

OO-level interactions are those interactions that take place between operators. Travellers use a wide variety of public transport services, from local jitney operators to high-speed train operators. Travellers cross the boundaries of operator's regions. A particular public transport operator will not be able to fully service the needs of travellers wanting to travel outside his service range, both type of service and area of service. Operators have to cooperate to offer a full service [Köberlein, 1997, pp. 82-83]. Governmental agencies can have a facilitating role for operator-to-operator interactions. Typically, interactions between operators include *through ticketing*, *co-ordination of products (schedules) and production (vehicles and staff)*, and *integrated information to the customer* [Augustijn, 1988, pp. 41-45].

Finally, OT-level interactions are those between the individual operator and the traveller. Again, a role for governmental agencies can exist. The interactions typically involve *providing the transport service*, *providing information*, and *selling tickets*. Figure 4 gives and overview of the interaction levels.

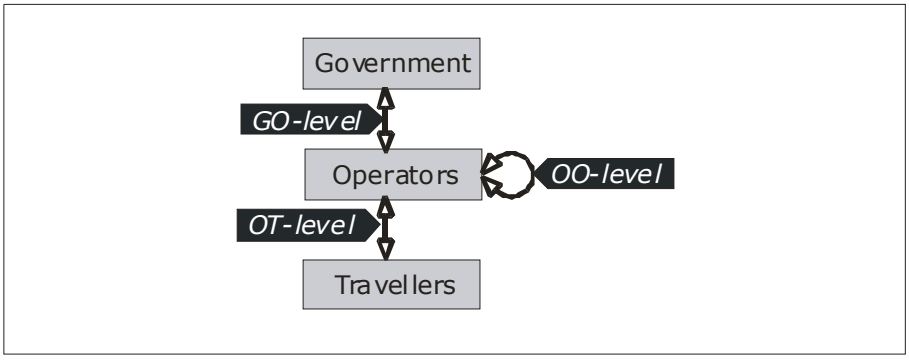

Figure 4
Interaction levels between the three main actors in public transport

Other levels of interaction, like those between government and traveller and between governments, will only be addressed if they have an

influence on the three interactions mentioned. Though for example the provision of travel-vouchers to the traveller might be an interesting way to subsidise public transport, we will analyse this as a tool of government to finance operators, not as a tool to provide cheaper mobility for the traveller. This means that relatively little attention is given to GT-level (government-traveller) interactions, aiming to *push* substantial numbers of travellers into public transport. Most attention will focus on the effort to *pull* of travellers, through more attractive services.

To sum up, three aspects limit the concept of organisation in this study:

- The product: the public transport service as the purpose,
- The actors: those involved in defining, producing, and consuming the product,
- The interactions: representing the connections between the actors to define, produce, consume, and improve the product.

The organisation under study is delimited by the purposeful connectedness of actors. The purpose of these actors is found in the product: public transport services. The connectedness expresses itself in interactions between these actors. Over time, these interactions have been structured into the institutional background, by assigning or reassigning tasks and responsibilities, designing or redesigning structures, processes, and incentives.

Even in an inter-organisational system, the success of the system is of course not solely depending on these interactions between actors, but also on the intra-actions within their actor boundaries. The success is not only dependent on good organisational design and coordination, but also on simple task execution. Less attention is given to the intra-actions. Intra-actions are often task related and based on a shared single rationale. Here, multi-disciplinarity seems less promising. Still, successful interactions between the actors mentioned are an important precondition for the successful intra-actions within these actors.

2.3.4 Public transport system

As a result of our definition, the public transport organisation consists of operators and governments, connected by the purpose of producing public transport services for travellers. The interest of this study is also in the performance of the organisation: the products it produces and the travellers it attracts. That overall subject of the study will be called the "public transport system". The delimitation of public transport system builds on the concept of "organisation" and adds the services which provision is the purpose of the organisation and the travellers who use the services. For the set of services,

sometimes called the public transport system by other, this study will use the term "public transport network".

The input into the public transport system consists of labour, technology, and infrastructure, which can be monetarised. The output is public transport: travellers transported. The actors in the public transport system often share a general view of the performance of the system. Efficiency and effectiveness are regarded as the generic goals. The way these generic goals are explained is probably different in the rationales this study includes.

2.4 Methodology

2.4.1 Introduction

This chapter has posed a goal and a number of questions, stipulated a world-view and a subject of study. The remaining issue is how to answer those questions, while keeping true to the original goal. The questions can be divided into four layers.

First of all, we want to understand what is the role of different disciplinary knowledge in the organisation of metropolitan public transport. For that we have to explore the knowledge available on the functioning of metropolitan public transport systems and their organisation.

Secondly, we have to understand the importance and consequence of that knowledge for the organisation of metropolitan public transport systems. How is that knowledge used, and what is the effect of using specific disciplinary knowledge on the success of the metropolitan public transport system?

Thirdly, we have to translate that understanding into action, focused on the organisation of metropolitan public transport. How can we improve the organisation of current public transport systems in metropolitan areas?

Finally, we will have to assess whether the suggested enhancements work, whether their impact on an existing organisation is beneficial, given the contribution we want to make. These four stages require different approaches. This paragraph clarifies the different steps and how they are tied together.

2.4.2 Literature study: Collecting disciplinary knowledge

To start the research, literature was selected, based on its obvious concern with the organisation of public transport. A tight selection was made on literature that concerned a wide variety of aspects of metropolitan public transport (excluding literature with an obvious focus on long distance public transport and other than public transport). A wider selection was made of

literature on the organisational issues (including literature on the organisation of transport and public involvement in service provision).

This literature was evaluated in terms of four aspects

- Subject
  (the public transport empirical phenomena studied),
- Theory
  (the mechanisms understood between the phenomena),
- Evaluation criteria
  (the indicators used to judge a system's performance),
- Recommendations
  (the ways forward recommended to improve public transport).

These points are further clarified in Chapter 3.

The role of the literature study is to chart the scientific work concerning public transport. Consequently, the literature is sought to represent the established cores, rather than the leading edge. Older publications and standard works receive relatively more attention; journal articles representing the current discussion receive relatively little. Also, this literature is presented as it is, without an appraisal. For such an appraisal a theoretical stance would have to be taken. This is not appropriate, as a multidisciplinary approach does not allow for an a priori disciplinary choice.

As Thompson [1961, see also Rose, 1993, pp. 12-13] clarifies, disciplinary sciences develop their concepts to understand the "real-world". Through a process of induction and deduction, these concepts focus and limit the empirical phenomena included, their exempla or subjects. The literature study presents such applied concepts, within the rationales. In addition, the causal mechanisms that are suggested between the concepts by the different disciplines are chartered. These causal mechanisms suggest how different concepts influence each other and together form the theoretical framework. Thirdly, the literature was examined for the evaluation criteria used by the different disciplines. These criteria represent the operationalisation of goals for the public transport system. Finally, literature was scrutinised on recommendations, the suggestions put forward to improve public transport system performance, on the suggested indicators. These include design variables and a suggested direction to change those variables.

Based on the literature study a protocol is developed for empirical analysis in a number of case studies. The protocol summarises the concepts, suggested causal mechanisms, and different performance indicators from the rationales that have found their way into the literature study. The protocol forms a bridge between the literature study and the case studies and ensures our multi-disciplinary stance in the cases. The protocol can be found in Supplement B, and a summarised account of the literature study is presented in Chapter 3.

2.4.3 Case studies: Understanding the use of disciplinary knowledge

When we want to understand how disciplinary knowledge is used within public transport systems, we have an exploratory question at hand. This is not a perspective with a great deal of past research. We want to understand within a "real-world" context how disciplinary knowledge is used. The aim is not to compare cases, but to do a cross-case analysis of the use of disciplinary knowledge in the organisation of metropolitan public transport. Through the multi-disciplinary nature it is not clear where the boundaries of the area we have to survey lie, even though we have started with a protocol. These are some of the aspects [Yin, 1994, pp. 11-15] of this research that point in the direction of case study research.

For the case study research four cases were selected. A variety of cases is used to have a wider empirical base from which to learn. Case studies are often used to compare a limited number of design and performance variables, seeking cases resembling each other in terms of basic conditions. Again, the goal of the case analysis in this study is to draw lessons from a wide empirical base in how the organisation of metropolitan public transport systems is based on disciplinary notions.

From this perspective, four cases were selected from an original base of 75 metropolitan public transport systems, based on comparability of size (metropolitan area between 100,000 and 1,000,000 inhabitants) and political regime (situated in Western Europe). Moreover, three of the four cases were selected on the basis of their relative success, though the aim was not to select the absolute top performers. This was defined as the part of public transport in the modal split and percentage of the costs of the public transport services paid for by the passengers. The focus on lesson drawing from a wide empirical base means that the cases are not selected on comparability and structural equality, but rather on structural diversity. In interviews with four Dutch policymakers and public transport experts the diversity of the organisation and the possibility to contact the cases were discussed. Eventually three cases were selected from the 10 cases left. A Dutch case was added to these cases for comparison. Supplement D shows the particulars of this step conducted in 1997. Table 12 summarises the selection of the cases.

The four cases represent different types of organisational solutions.

1. The Canton of Zürich, Switzerland
2. Tyne and Wear Metropolitan County in the United Kingdom,
3. The five ambten in the Copenhagen metropolitan area in Denmark,
4. The 21 southern municipalities in the province of Limburg, The Netherlands.

Though the idea of a French case was entertained, it was abandoned. Several efforts over a longer period of time to start such a case failed. This was due to problems contacting both transport operators and responsible authorities in Nancy and St-Etienne.

The interviews showed that the main difference between the cases is found in two variables: distance and dynamics. Distance reflects the height of the boundaries is between the authority and the operator. Dynamics concern the operator, whether the operator is permanent or changing. Our four cases fit a matrix (see Table 5) that describes the basic culture in the organisation. This leans on Ostrom's [1991, pp. 8-28] perspectives on governmental involvement.

	Low boundaries	**High boundaries**
Permanent operators	Hierarchy (Zürich)	Negotiation (Southern Limburg)
Changing operators	Participation (Copenhagen)	Competition (Tyne and Wear)

Table 5
A first glance on organisational differences in the cases

The case research consisted of partly structured interviews with the majority of operators, representatives of all central, and larger municipalities and some smaller municipalities, the governmental agencies concerned with public transport and urban planning, a representative of the national government, and local experts in the field of public transport. In total 85 people were interviewed. The interviews focused on the three types of interactions chosen and the type of information and knowledge that was used setting up and tuning the organisation of public transport in the region. In addition, legal documents were gathered as the representation of formal aspects of the organisation. Also official policy reports were gathered and analysed. In addition newspaper references were researched, for example to understand the local perception of the quality of the public transport services. A description and analysis of the cases will be presented in Chapter 4.

It is important to understand that the role of the cases is **not** to make a detailed comparison on a wide variety of design and performance variables, as they were deduced from the different rationales in Chapter 3. Readers interested in such a comparison can find it in a table in Supplement D. This table is added to present an overview. Rather, the variety of variables is studied **within** each case to understand the role, **within** each case, of the different rationales. The cases are compared on how they use the different rationales in their organisation, **not** on how a wide variety of possible design variables relates to a wide variety of possible performance variables. A comparison of the cases including such a large number of variables without a

developed theoretical framework, does not offer the possibility of a meaningful analysis.

2.4.4 Suggested approach:
Analysis and improvement of the use of disciplinary knowledge.

As Yin [1994, p. 10] states in his work on case studies:

Case studies, like experiments, are generalizable to theoretical propositions, not to populations or universes.

The theoretical proposition cannot be a policy recommendation before it has been tested. But a theoretical proposition cannot be tested before it is formulated as a policy recommendation. Underlining the view that the first formulation is just a theoretical proposition can solve the paradox. The recommendation will focus on the use of disciplinary knowledge to improve the organisation of real metropolitan public transport systems. In Chapter 5 we will clarify our theoretical proposition, however formulated in terms of a recommendation: we will further refer to it as the suggested approach. This formulation of the theoretical proposition allows us to test the approach.

2.4.5 Simulation-game:
Testing the suggested approach

To understand the validity and the operation of our recommendations, we needed to test them. And we needed to test them in a "real-world" situation. This is a complex process for which we needed a toolbox. It contained:

- Performance criteria,
- A way to analyse the existing organisation,
- A way to arrive at organisational recommendations.

No operator or public transport agency would allow a theoretical proposition to be tested on its own, carefully constructed institutions. Over the years they have developed, transformed and tuned the way they organise their public transport very carefully and with great consideration. Therefore, the researcher has to look for an alternative. Simulation-games offer such an alternative environment to test theoretical propositions. Gaming here is not to be confused with game theory, where decision rules are tested in relatively simple situations.

In this research we used simulation-games to create a situation as close to the "real-world" as possible, in which we could evaluate the effect of the approach. Players found themselves in both a standard situation and a changed situation. The effect on the conduct of the players and the differences in performance were evaluated.

For such a simulation-game "real-life" actors were brought together. In addition, a computer system was developed reflecting parts of reality that are not included in the game play and offering the possibility to evaluate the performance, both by the players and for the purpose of this study.

We used three different ways to evaluate the success of the suggested changes. One was based on the generalised performance indicators of efficiency and effectiveness generated by the computer model. This approach gives a less subjective overall analysis of performance, but offers little insight into the detailed functioning of the interventions. The game play remains largely a black box. A second evaluation was based on the opinion of the players. They had to deal with the changes themselves. This evaluation offers a first hand detailed reaction, but limits oversight on how specific interventions influence the overall performance, rather than the specific repercussions of the interventions on the individual players. Finally, we used a third evaluation, by interpreting the minutes and communications of the game play. This is a more subjective approach, but it can offer a more sophisticated view on the functioning of the interventions in the game play by opening up the black box and providing an overview over all players.

An account of the simulation-game is presented in Chapter 6.

2.5 Limitations

One important aspect of this study sets it aside from most others: the fact that it starts from a multidisciplinary perspective. That is the essence of this book. The study takes its cues for that perspective from policy oriented literature underlining the merits of a more interdisciplinary approach in public transport as an instrument to overcome problems related to growing car-use. This has four important consequences:

Firstly, no theoretical frame is available on the combination of disciplinary knowledge. As a consequence the study has an inductive character. Still, it tries to come to a theoretical innovation, make it applicable and test its application, in order to complete a scientific cycle.

Secondly, the study refrains from making a disciplinary choice at the start. Consequently, no theoretical stance is taken. The rationales are evaluated in terms of their mutual positioning in empirical subject, theory, evaluation criteria, and recommendations. Very little attention is given to the scientific debate *within* the rationales. The description focuses on their established cores and the analysis on how these relate to each other.

Thirdly, in the empirical analysis, the cases are assessed on the basis of a checklist of design and evaluation variables from the different rationales. As no theoretical stance is taken, these variables are regarded as of equal importance, though their focus might be on different parts of the overall organisation.

Fourthly, the study wants to develop as far as possible a helpful approach for policymakers in public transport. That means that the theoretical proposition given is a first proposal, even though it is formulated in the form of a recommendation to enable testing. More testing of the hands-on application of the approach is needed to fully evaluate its merits.

Some supplementary comments are necessary on the range of the study. Firstly, the research is focused on the role of disciplinary knowledge in the organisation of metropolitan public transport. Many aspects of the organisation pass by and hopefully the reader will deduce his own valuable lessons from different parts of the study. But those parts are selected to contribute to the overall question; they are the stepping-stones to understanding the organisation of metropolitan public transport from the given perspective. Their aim is not to be complete or inclusive in any other sense.

Secondly, the research takes its theoretical base from North American, European and some Asian literature. However, the empirical base is limited to Western European countries. Moreover, the suggested approach is evaluated in a Dutch region. Though this is not tested, the conclusions relate primarily to Dutch and secondarily to Western European metropolitan areas, both as a theoretical proposition and as policy recommendations. Again, interested American and Asian readers might (and hopefully will) draw their conclusions on the possibilities of multidisciplinary policy design on organisational issues, but the theoretical propositions are based on European empirical data and tested in a Dutch setting.

These points reveal that ultimately this research is aimed at improving Dutch metropolitan public transport, though other metropolitan public transport systems in urban areas ranging in population from 100,000 to 1,000,000 might be able to draw valuable lessons. Also researchers or advisers interested in the design of complex inter-organisational systems or in the possibilities of multi-disciplinary design may find valuable lessons.

This research is aimed at the public policymaker rethinking his organisation of metropolitan public transport. He is constantly in the process of developing, transforming, or tuning his organisation. These changes might be initiated in the region, by national governments [VanMatre-McLoughlin and Wilson, 1988, pp. 58-66], or by the European Union. The latter is [EC, Regulation 1191/69 and EC, COM 2000/7] targeting public commissioning to enable cross-national competition.

At this point in time local governments are the actors that can try to improve the inter-organisational design of metropolitan public transport. Such complex organisational systems have often grown without a great deal of intentionality [Linder and Peters, 1987] or design; they are mostly the result

of evolution. But at this point in time, organisational changes are becoming more and more part of the competence of local governments.

This research has been devised for policymakers, at local level, hoping to give them the tools to improve the organisation of their own public transport system. Those improvements concern both operator and government behaviour, the latter using the tools available to analyse and tune the way their metropolitan public transport system is organised.

Finally, this paragraph wants to take a stand in the epistemological and methodological controversy that reveals itself especially in research which aims to overcome the boundaries of traditional disciplines. As Guba and Lincoln [1994, p. 109] have emphasised, a number of different basic belief systems or paradigms divide the social sciences. The basic question that divides those paradigms is to what extent reality will reveal itself to us.

In its essence, this research utilises the post-positivist model of scientific endeavour. The multi-disciplinary nature of this research makes a positivist perspective unsustainable. Multi-disciplinarity inevitably reveals the different ways in which academics from different disciplines interview and interpret reality and lift their reality from its context. In addition, a strict positivist approach would ask the researcher in a multidisciplinary environment to construct a theoretical proposition that combines or replaces the vast knowledge about public transport and to test this hypothesis. Such a sizable undertaking is not for simple mortals. The epistemological stance is that exploring the vastness of reality inevitably leads to some form of historical, disciplinary, or personal construction.

In addition, this research acknowledges the fact that the community of researchers and policymakers in public transport have strong positivist feelings. Any research wanting to contribute to the success of public transport has to speak their language. That excludes a worldview based on constructivism.

3 The theoretical base: Driving disciplines

To provide for better decisions, we need to find ways to surface the assumptions that constrain our creativity, to "burst bubbles" and go beyond boundaries, rather than remain entrapped within them.

Jonathan Richmond,
In: Transport of Delight, 1991, MIT Thesis, p. 3

3.1 Introduction

The abundance and diversity over disciplinary boundaries of literature on public transport is striking. To illustrate this with just Dutch authors, Waard [1989] shows us the complexities of the traveller's perception of time, while Velde [1998] discusses the complexities of competitive tendering. Egmond [1999] describes the mathematical optimisation of interconnecting timetables, and Hendriks [1996] writes about the democratic quality of administrative culture. Finally, Goedman and Timmerman [1990 pp. 54-66] show us how the development of infrastructure and urban structure in the Dutch Randstad could supplement each other.

All this literature has some importance for the field of public transport. These different rationales[5] have shaped the current world of buses, trains, trams and metros. One should recognise that all of these various rationales were and are fruitful. Ultimately, every single one of them offers a different perspective on the *organisation* of public transport and what should be accounted for when developing, transforming, or tuning the organisation. And all of them are quite right when dealing with their specific subjects. When discussing only the regulatory regime, who will prove the economist wrong? Or when merely discussing service network design strategies, who will question a civil engineer, other, perhaps, than a different civil engineer? And when developing policies in an intelligent way, who will question the knowledge of the researcher of public administration and policy science?

[5] For clarification of the use of the terms "rationale" and "discipline" see Page 19

First, the five uncovered rationales [for a similar approach, see Diaz, 1999] will be dealt with successively in Sections 3.2 to 3.6.

The five are:

- Conceive the customer,
- Manage the market,
- Schedule the service,
- Produce the policy, and
- Maintain the metropolis.

Their roots lie in wider disciplines. Literature that *conceives the customer* can be found in human geography, but also in specific fields of transport economics and engineering. In these disciplines, geographers survey, model and conceptualise travel behaviour. The focus here is on understanding travel behaviour that involves decisions on using public transport services. Literature on *managing the market* can be found in the economic discipline. Industrial organisation and welfare economics both offer analytical and conceptual frameworks to understand the actions of both regulator and regulated. Transport engineers write on the development, optimisation, and *scheduling of services*. Public administration and policy analysis scrutinise how public involvement in public transport is functioning and how to *polish policies* and policy development. Finally, urban planners explore the possibilities for public transport to support urban development and *maintain the metropolis*.

Those five rationales will be discussed here in brief. Consequently, various nuances are left out, thus running the risk of overstatement. Descriptions of rationales serve as an illustration rather than a complete overview. A large number of publications in these disciplines support publications that focus on public transport. The literature presented here focuses on public transport and is supplemented with some core publications in the linked disciplines.

Four different aspects of the disciplines will be discussed:

- Subject
  (the public transport empirical phenomena studied),
- Theory
  (the mechanisms understood between the phenomena),
- Evaluation criteria
  (the indicators used to judge a systems performance),
- Recommendations
  (the ways forward recommended to improve public transport).

The *subject* represents the empirical base of the rationale and how it has translated those empirical phenomena into concepts. It illustrates what is selected from empirical reality to be the object of research. The *theory* describes the relations that the rationale assumes between certain concepts.

The *evaluation criteria* represent the variables on which a rationale judges and optimises a public transport system. Lastly, the *recommendations* are those courses of action a rational proposes, to improve the performance on the given indicators.

Finally, Section 3.7 will analyse the relation between the presented rationales and the organisation of metropolitan public transport.

3.2 Conceive the customer

3.2.1 Introduction

Transport starts with people wanting to travel from one place to another. The earth is not a homogeneous place and man is a social species. This rationale deals with the spatial behaviour of individuals – both their actual trips and their wishes – and is included here as far as it concerns public transport. This rationale explains travel behaviour from the spatial constraints linked to the travellers, their locations and activities. The focus is typically on individuals and their travel patterns. It has a strong emphasis on OT-level (operator-traveller) interactions[6]. Keywords are activity patterns, time-space theory and constraints and domains. Empirical work in this rational includes a wider range of characteristics of the traveller and extends over the boudaries of human geography.

3.2.2 Subjects

In his article "What About People in Regional Science?", published several times in different places, Hägerstrand [1986] laid the theoretical basis for at least part of this rationale. The title clearly shows the importance Hägerstrand gives to the individual in shaping transport patterns by his individual choices within time and space. Hägerstrand points out that "aggregate behaviour cannot escape these facts". He shows clearly what the objects of study are for the rationale: the (potential) traveller.

Time-geography shows how individual behaviour is bound to *capability*, *coupling* and *authority* constraints. These constraints limit human travel patterns either by physical limits, social structures or power relations respectively. These constraints sculpt the *domain* [Hägerstrand, 1986, p. 153], the space a person can travel through on a daily basis.

Dijst [1995] refers to a number of similar concepts used by different authors distinguishing between the *real* domain (activity space, travel field, habitat) and the *potential* domain, closer to Hägerstrand's view (activity area, travel probability field). These constraints, combined with individual choices made within budgets, lead to certain time-space paths: the individual routes

[6] For further clarification see Section 2.3.3

that people choose. These paths are the representation of the presence of individuals in certain places at a certain point in time.

The theory has found its way into transportation services research in different ways. Giddens [1989] draws from an example of Parkes and Thrift [1980, pp. 271-272] which shows the influence of certain coupling and capability constraints on the emergence of a specific pattern of transportation needs around a healthcare centre in New South Wales, Australia. He shows how problems arose because these needs were not met by a tailored supply of transportation services. Giddens [1989, pp.108-109] states that:

> *By studying the time-space paths of a number of workers and clients at the centre, the researchers could pinpoint the origins of these problems. They were also able to suggest positive steps that could be taken to alleviate them by means of a more systematic allocation of resources.*

The focus in this study is on the aggregate effect of the individual constraints on efficient service provision. In fact, it translates these constraints in certain time-space paths and looks at the implications of these paths for the planning of both the resources in the healthcare centre and the need for specific transport services.

In addition to Hägerstrand's approach, which focuses on the constraints, there is the transductive or Chapel Hill perspective, which conceives activities in terms of the individual and his or her psychologically regulated and learned behaviour. Both approaches are complementary, as Fisher [1993, p. 24] asserts that Hägerstrand paid specific attention to understanding the operation of constraints on travel behaviour in space and time, while the Chapel Hill group primarily focused on individuals' preferences. They assessed the relative significance of role and personal factors preconditioning individuals to particular patterns and the relative importance of motivations and other attitudinal factors affecting predisposition to act.

How do individuals make use of public transport services, within the constraints they have to take into account and their personal characteristics? White [1995, pp. 24-44] gives a comprehensive overview of the changes in passenger travel on British public transport in the urban and short distance market over the last few years. He shows how these constraints guide travellers to public transport in urban areas and during peak hours. Factors influencing people's transport behaviour on an individual level, for example whether they will or will not use public transport, have been the subject of a great number of studies.

White also promotes the concept of a trip chain, showing that individuals connect different movements through space to form a chain of

trips, through different modes of transport. The trip chain typically puts the focus on the traveller, away from mono-modal thinking. Veeneman [1997] describes the use of trip chaining in the definition of Dutch and Swiss public transport services.

Great efforts have been made in modelling traveller preferences [for examples see Kitamura, 1988], for example using utility models [Fisher, 1993, pp. 11-24; Kraan, 1996] or conjoint measurement approaches [Molin, 1999]. It has been valuable for understanding the travellller's choice processes between different modes.

3.2.3 Theory

The rationale suggests a number of causal mechanisms at two distinct levels. Firstly, it shows which factors restrict the traveller to specific times and spaces. These explain travel patterns, based on the aggregated constraints of a population. Secondly, it shows which requirements the potential traveller puts upon transport in general and transport services in particular. These preferences account for another part of the explanation given by this rational for general travel patterns.

A number of social institutions bind people to specific times. Working hours, opening hours of shops, school hours and the like provide a strict budget for travel patterns. These social institutions have their own slow dynamics. Though the "24-7" economy is inclined to growing flexibility, the traveller is still very much bound to a common structuring of the time of day. In addition, choices of habitat and workplace have long-lasting effects on people's travel patterns [Ommeren, 1996]. The daily commuters' binding to these constraints offer predictable travel patterns. The commuters travel behaviour is bound to specific times the origins and destinations.

Gwilliam et al. [1991] show that different attributes influence the choice of mode. They distinguish between the attributes of the traveller, his or her location, the trip (purpose and length), as well as the cost and quality attributes of the different modes, including availability, accessibility, reliability, frequency, speed, directness, information, and comfort.

In the various studies, different characteristics are suggested to explain the differences between travellers. Papacostas and Prevedouros [1993, p. 383] bring together these characteristics: household structure, availability and cost of activities, personality and lifestyle, available technology, location patterns, income, social values, and transport system characteristics and policies. These characteristics can make the traveller a captive of a specific transport system. These characteristics *explain* travel behaviour, but a great many of them are influenced neither by regional governments nor by public transport operators.

In order to define a network of public transport services it is important to know how the traveller perceives the quality of public transport. What determines the attractiveness of a particular service for the traveller?

	Prices			
	Bus	**Underground**	**British Rail**	**Non travel**
Bus	- 1.318	0.897	0.193	0.229
Underground	0.356	- 0.688	0.211	0.120

Table 6 Estimated long-run price elasticities (Source: Button, 1993)

One of the important aspects seems to be price [Webster, 1980, p. xviii; Button, 1993, 39-65]. Table 6 shows price elasticities for different modes of transport. Price sensitivity though differs not only by technique, but also by type of traveller. For example commuters to work consider time of travel to be a more important aspect than price. This is also true for connections to other public transport services.

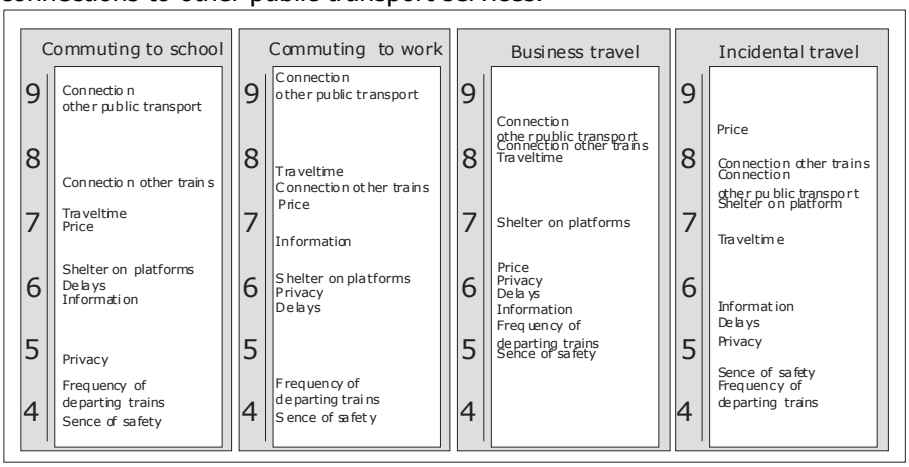

Figure 5
Service attractiveness to the traveller (source: Ooms 1987)

Public transport companies often combine these characteristics into market segmentation. This segmentation is often based on the purpose of the trip, suggesting a causal mechanism between trip purpose and requirements for transport services.

Figure 5 adds to elasticity studies the insight that the different categories of traveller have quite different ideas about the importance of other design indicators. It shows how different groups of travellers grade different service characteristics on a scale of 1 to 10. The first striking aspect is that connections to other types of public transport are considered an important design indicator. This holds especially true for the travellers during

the peak hours, school and work commuters. For these groups in particular the location of the origin and the destination lead to complex transport chains. In these cases public transport only can be offered when different types of service are closely interconnected.

This analysis comes to the same conclusion as research done by Waard [1989, pp. 5.3 – 5.6]. He concludes that the perception of changing time from one mode to another carries a far greater penalty in the eye of the traveller than time used in motion [see also Maarseveen, 1982]. Changing vehicles within modes is also perceived to take a lot of extra time. Button [1993, p. 55] underlines this and presents a more general overview on the valuation of travel time in different modes. The field studying travel time valuation is extensive and an overview is given by Wardman [2001, pp. 85-90].

Solomon [1968, p. 103] cites research carried out in Baltimore in the United States by Brunner and Paine in 1966 and 1967, which was aimed at obtaining the characteristics of an ideal public transport system. This study distinguished between four types of trips based on the purpose of the trip. The four are work, shopping, in-town recreation and out-of-town recreation. On the basis of a factor analysis, Brunner and Paine come to the following list of most important design features of public transport services:

1. Reliability of achieving one's destination. This includes elements of safety and confidence in the vehicle,
2. Convenience and comfort,
3. Travel time, differentiated by trip purposes,
4. Cost,
5. State of the vehicle with cleanliness overshadowing newness,
6. Self esteem and autonomy, i.e. independence rather than self pride,
7. Traffic congestion and crowding in the vehicle,
8. Diversion, e.g. nature of travel companions, availability of radio, and scenery.

Girnau et al. [1976, p.7] chose a hierarchical approach. They distinguish between five primary factors (time, comfort, accessibility, price, and reliability), which translate into a variety of performance indicators for public transport. These are typical evaluation criteria, upon which an alternative public transport system is judged by travellers, and which can serve to evaluate possible alternative policies aimed at attracting more passengers (see Figure 6).

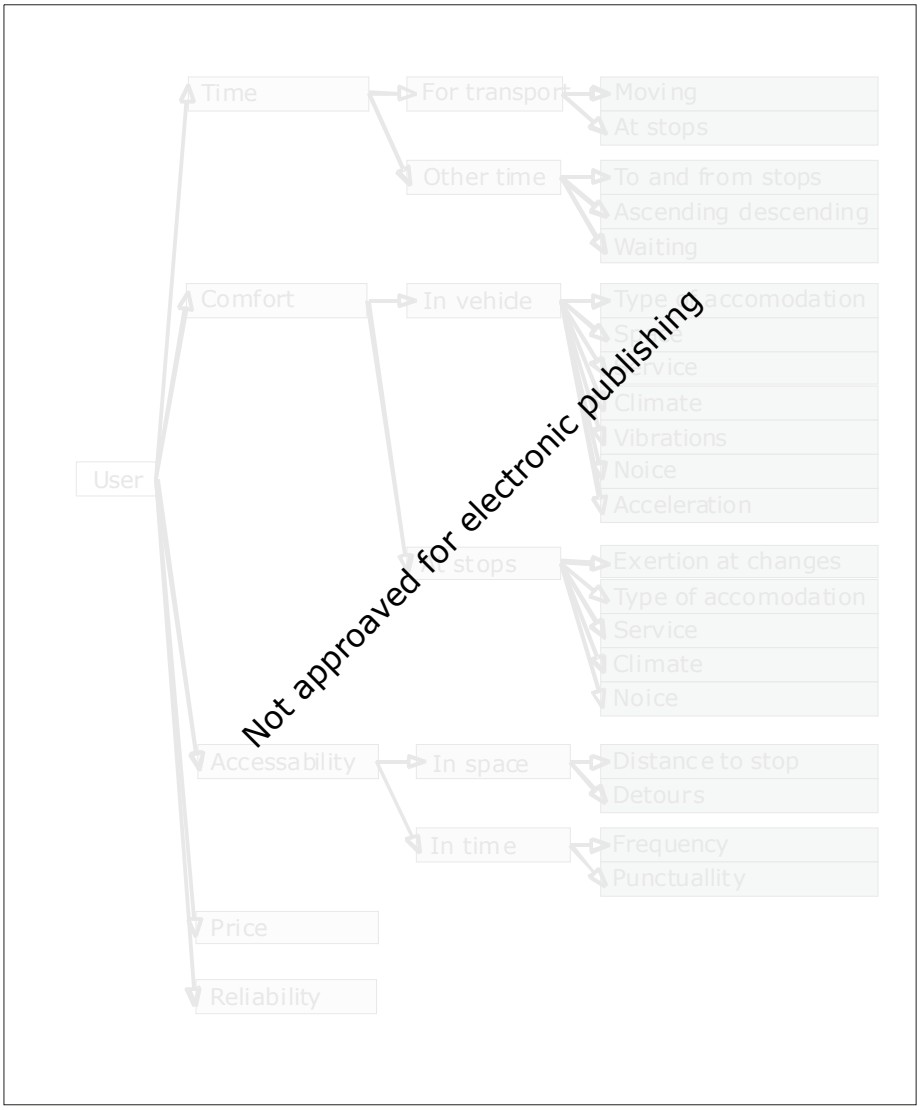

Figure 6
Structure of demands formulated by users of public transport

The importance of these performance indicators not only differs between trip purposes but also between the distances travelled, as was argued by Witsen et al. [1989, p. 5.1-5.11]. They show that speed and comfort become increasingly important when the distance travelled grows, and that accessibility, frequency, and the negative effects of changing mode

or vehicle become less important. Reliability is always regarded of the same high importance.

In conclusion, travellers' preferences consist, unfortunately for those defining metropolitan public transport services, of a multitude of different factors. Two important aspects though come forward. Firstly, public transport services which wish to attract travellers should be tailored as closely as possible to individual preferences. Secondly, the traveller perceives public transport as a complete service. Travelling on different types of service, using different types of public transport, the traveller expects these services to be closely linked in terms of ticketing and information. Either public transport companies or government bodies will have to take this into account when defining public transport services or, for governments alone, when formulating legal or regulatory regimes in which companies must construct an integrated public transport system within a metropolis.

A number of requirements of the traveller have been mentioned. The first mechanism this rationale suggests that public transport services accommodating the variety of demands will attain the highest ridership. Improving the services to match those demands will lead to increased ridership, which in turn can lead to an improved modal split in favour of public transport.

3.2.4 Evaluation criteria

This rationale focuses on understanding the traveller. It shows how several constraints limit travellers' choices. It understands traveller preferences within those constraints on the basis of selected characteristics, of both traveller and trip. To perform well, transport services should reflect these preferences in their characteristics. This proves to be a delicate balance between price and quality, where quality has the components of reliability, travel time, information, and comfort. Different travellers weigh the importance of various characteristics differently. To perform well, public transport needs to be able to aggregate these traveller preferences into matching service characteristics, and subsequently to translate them into appropriate services and service operations.

The focus of this rationale offers a clear performance indicator: the ability to incorporate the preferences of the traveller into the product, retaining the existing travellers and attracting new travellers. How well is the public transport system (through services) able to serve travellers' wishes?

In practice this indicator is often operationalised in terms of the number of travellers, the revenue from travellers, the percentage of possible travellers captured, or the modal split between car and public transport. These operationalisations offer several indicators that show how well the service is meeting the preferences of the traveller.

3.2.5 Recommendations

From this rationale, there are basically two major principles that can structure interactions in the organisation. On the one hand the constraints under which the traveller chooses can be influenced, inclining him towards public transport. Public policy can direct generic traveller determinants to influence the travelers' inclination. On the other hand, public transport services can be influenced. Travellers have specific preferences which are translated into product specifications. This is in the hands of public transport operators.

The former, influencing the constraints (spatial, temporal, etc.) under which the traveller makes a modal choice, receives little attention in this rationale. Temporal organisation of society is treated as an independent variable, showing its own dynamics. Spatial organisation seems to offer more possibilities to influence travel patterns in favour of public transport, but these reside in the realm of another rationale (discussed in Section 3.6). The latter is the focus of this study (see Page 32) and will receive more attention here.

The recommendations which follow from this rationale bear one major thought: tailor public transport services to the preferences of the individual traveller. This rationale has put a great deal of effort into discovering those preferences. Those efforts developed the link between the individual characteristics and their preferences and the characteristics of transport services. Some of those efforts stay close to the individual, describing and understanding his basic transport wishes. Other efforts move away from the individual and take into perspective the constraints of public transport service development. They aggregate individual demands through market segmentation, offering directions for public transport service definition.

Though it offers a perspective on segmentation, it offers little perspective on the possibilities of aggregation. The aggregation of individual travellers preferences into a product (be it infrastructure or a public transport service) is problematic [Ortúzar and Willumsen, 1994, p. 273] to the public transport companies. Individuals have different tastes and appreciations and aggregation to a mass service product, such as public transport, poses a many difficulties. This is in fact true for a number of products, but in public transport the problem is more distinct for three reasons:

Firstly, the service characteristic increases the need for good demand forecasts. Service provision cannot be put on stock and produced in advance. Consumption happens instantly, at the time of production. The inadequacies of the aggregation of individual wishes into a service are magnified by this factor;

Secondly, the complexity of the spatial dispersion of demand contributes to the problems. The complexity of taking into account all travellers, with their different origins, destinations and routes, makes it extremely difficult to aggregate this into a single product, consisting of a

number of services. Demand for transportation services must not only be fulfilled at the right time, the first point, but also between the right places. This shows the high complexity of matching production and demand;

Finally, the translation of preferences into services is further complicated by the inertia of the existing services. The traveller is served by a relatively stable timetable, which brings some inertia to services. In addition, the services are dependent on inert infrastructures. Individuals' wishes may change over such a period, making it hard to keep up with demand changes, and stressing the need for good demand forecasts. Though problems persist, a number of possible ways are available to deal with this aggregation problem, as described by both Small [1992, pp. 22-25] and Ortúzar and Willumsen [1994, pp. 274-284].

From this rationale, some organisational recommendations can be deduced. This rationale stresses the importance of tuning public transport to the needs of the individual traveller. This should be done by translating individual demands into service characteristics, which points to OT-level interactions. Here operators can tune their transport services to an up-to-date perception of (changing) traveller wishes. Both the potential of tuning the service and of evaluating traveller wishes are primarily in the hands of the operator, as he represents the interface with the traveller and often defines the services. In addition, the operator can best develop public transport services with attention to the balance between traveller preferences and possible increases in revenue on the one hand, and operational costs and technical possibilities on the other.

3.3 Manage the market

3.3.1 Introduction

The way in which public transport services are defined and provided depends upon a number of characteristics of the market. On the demand side, traveller spending in public transport is important. The factors that influence this were discussed in Section 3.2.

On the supply side, other aspects play an important role: the interaction with competitors and market intervention by the government. This rationale focuses on this interaction between regulator and regulated and competitors, which indicates the focus is on GO-level and OO-level interactions (see Section 2.3.3). The rationale attaches great importance to the governmental role on the for GO-level, and has studied the relation between the governmental principal and the operating agent in detail. As a consequence, government efforts to manage the sector are largely based on this rationale.

3.3.2 Subjects

Though the general discipline pays much attention to the way competing companies interact, the rationale focuses more on the interaction between operator and government. The discipline has gained momentum in public transport, and market regulation has become a major issue to policymakers.

Within this rationale, attention is paid to the amount, subject and structure of regulation. Although different authors describe other issues that should be regulated, all agree on the necessity of entrepreneurship in public transport to ensure that services stay in touch with changing demand. Authors disagree on the level of government intervention [Gwilliam et al., 1985], from anti-trust and cartel rules down to the governmental provision of specific services at specific times and at specific fares.

The rationale studies operator *performance* at sector level under different regulational regimes. It deduces a number of regulational aspects that influence performance. On the basis of these deductions, the rationale designs "optimised" interactions between government and operator that improve service provision and welfare in general.

The rationale distinguishes between two distinct types of regulation. The first type concerns intervention directly at operator level: his products, production and prices. The second regulation type concerns intervention at a higher level: the organisation of public intervention, and market structure.

In many European countries' regional public authorities regulate the product: they define public transport services either for tendering or delegation [Groenendijk, 1998, 236-238]. The motive for product regulation is the securing of a coherent experience for the traveller by providing standardised information, pricing and ticketing. Production can be regulated to prevent (harmful) competition between different public transport operators [Nash, 1982, p.70] or even services. Regulation of production is often dealing with safety standards [Nash, 1982, p.70], the negative external effects of transport [Baum, 1993, 169] and protection of the labour force.

The issue of regulated pricing is considered to be important. The invisible hand of the market does not always provide the right price. Train [1992, p. 115] gives an overview of the considerations involved in pricing public transport services. The rationale provides two perspectives on the issue of pricing. The first takes the operator's perspective: the complexities of cost allocation in public transport [for example Jansson, 1984]. Different types of service use the same infrastructure, and the infrastructure is (partly) financed by public funds [a comprehensive overview is found in Nagakawa and Matsunaka, 1997]. The second takes the government's perspective: looking at optimal and second best pricing structures [Button, 1993, p. 122; Nash, 1982, p. 50]. The optimisations look at price as a means of regulating the modal split or improving the efficiency of the sector.

Country	*Regulatory regime*						*Revenue -cost ratio in %*
	Complete regulation		*Regulation with tendering*	*Partial deregulation*	*Full deregulation*	*Subsidy type*	
	Public owned monopoly	*Licensed monopoly*					
Denmark	X		x			N/R	55
Belgium	X					N	30-40
Finland		X		X		N	50-65
France	X		X			N	30-80
Greece	X					N	40-50
Ireland		X				N	80-95
Netherlands	X					N	30-40
Israel		X				N	65
Italy	X					N	25-30
Norway		X	X			N/R	55-60
Portugal		X		X		N/R	65
Spain	X		X			N	50-60
Sweden		X	X			N/R	30-40
Switzerland		X	X			N	55-80
Turkey	X			X		N	NA
Utd Kingdom			X	X	X	R	NA
Germany		X				N	55
Yugoslavia	X					N	NA
United States	X		X		X	N	30-40
Australia			X		X	R	NA
New Zealand			X			R	NA
N= network based subsidies, R= route based subsidies. NA= not available							

Table 7
Regulatory regimes in 21 countries
(Source: Berechman, 1993)

Government intervention in public transport operations takes many sizes and shapes, from public ownership, through centralised public planning, to traveller subsidisation [see Table 7 for an overview]. Gwilliam et al. [1985, pp. 105-132], in their discussion with Beesley and Glaister [1985, pp. 133-142], come up with a number of different reasons for public involvement in the bus sector. First, they challenge the possibility of competition in public transport markets by arguing that transit markets, particularly urban ones with stage bus services, do not provide adequate incentives for entry to ensure competition and restrain monopolistic prices and output. Moreover,

they argue that social welfare maximisation requires that the sector be subsidised and regulated. In addition, they regard cross-subsidisation as an important means of financing service provision during off-peak periods. Finally, they underline the benefits of the provision of integrated services, which can be obtained only if the fares and services in an area are planned jointly.

On the other hand Beesley and Glaister argue that central planning has apparently not been able to define public transport services appropriately, nor to establish appropriate fare structures. They also state that entering the bus market is not very difficult in theory, and conclud that contestability and competition can be guaranteed. Their point on cross-subsidisation is a more fundamental one. They claim that cross-subsidisation is only used to subsidise non-viable services with little demand, using the revenues of profitable services. They argue that it would be preferable to use these for improving services on lines where there is high demand.

Sleuwehaegen [1994, pp. 29-38] distinguishes between two approaches, the French school and the Anglo-Saxon school. The French school, whose main representative is Lafont [1994, 507-537], models the attainment of the goals of the regulating government in a principle-agent relationship. His analysis offers an optimal system of tendering public transport services. Important prerequisites are that the resources should be available to all potential producers, against competition prices. Moreover, the cost of collusion by the different potential competitors should be high enough to ensure competitive bidding.

The Anglo-Saxon school, with its representatives Baumol and Sidak [1994], introduces contestability as a possible optimal regulation. Prerequisites are that there is easy access to the market, that all technologies are available to (possible) competitors, and that leaving the market does not imply high costs, i.e. by the presence of only limited sunk costs. A contestable market ensures that companies can make the same amount of profit as in the case of competition, but not more. Inefficient companies have to leave the market, cross-subsidisation cannot be sustained, and prices will be equal to economically efficient prices [Oostroom and Renes, 1993, pp. 886].

Market entry has often been regulated by the creation of regional monopolies. This has been one of the ways of protecting public transport companies from wasteful competition. In the long run, this monopolistic situation has not provided enough stimuli to ensure an innovative and efficient public transport sector. A liberalisation of market entry has led to growing regulation on the issue of market entry, preventing companies from creating private regional monopolies. Liberalisation of public transport markets is now seen in different European countries as one of the ways in which these stimuli can be brought back.

But, as suggested above and as underlined by Sleuwehaegen [1994, pp. 29], detailed elaboration of this deregulation is extremely important for the success of this policy. The design of public involvement in a regulatory regime depends on a number of variables. First of all, the matter of non-competitive markets, for example as a consequence of a natural monopoly, is of utmost importance. Though the public transport market has long been regarded as a natural monopoly, veering towards a single operator, [compare Mills, 1980; Mills and Hamilton, 1994], that view has been under scrutiny [Groenendijk, 1998, pp. 45]. A second matter is the ever-present information asymmetry; detailed understanding and knowledge of the production process, more specificly of the cost structure, is available to the operator but not to the regulator. Other important points are the availability of capital goods and labour.

Public involvement in the sector is not restricted to operations but can also focus on infrastructure investments. Payson and Steckler [1996] show a variety of ways to distribute public and private involvement in the development of infrastructure. Another overview can be found at Kessides [1993].

3.3.3 Theory

This rationale relates performance on the sector level with the regulation of that sector. Firstly, the (organisation of) governmental involvement with public transport is regarded to have major effects on its effectiveness and its efficiency. Secondly, market structure is an important determinant of the efficiency of the system.

Winston and Shirley [1998, pp.68] formulate one of the causal mechanisms linking government involvement with performance. They assert that government involvement with operators creates inefficiencies. They come to the conclusion that [pp. 89]…

> *… As long as transit prices and services are determined by the public sector, it is hard to see how the current welfare costs – primarily caused by government subsidies, policy entities and transportation constituents – could be significantly reduced.*

Of course there are authors who are see more room for public transport policymakers and agencies [Gwilliam et al., 1985]. But within the rationale there is a general understanding about the relationship between government and operator. This relationship gives operators mixed incentives and distracts the operator from his own goals and from focusing on the traveller.

These requirements of governments (or rather governmental agencies) are clearer than the complex and changing demands of many different

travellers. Also the gains of fulfilling the requirements of governments are far more straightforward than are the gains of trying to attract more passengers. This gives the operator an incentive to focus on government requirements rather than traveller satisfaction. The relationship between governments and operators provides a clear example of principal-agent relation where the goals of the government and the operator differ, and the government has less relevant information than the operator [George, et al., 1992, pp. 348].

This decreasing interest of the operator in the details of traveller preferences lead him to provide services that are not tuned to the preferences of that traveller. The traveller induced innovations of services suffers. As a result, growing numbers of travellers look elsewhere for their transport. In addition, subsidies provide some slack; efficient production is less crucial. Subsidies based on ridership or production costs try to overcome these problems, but their effectiveness suffers from the imbalance of information between the government and the operator.

This asymmetric information is considered to be an important reason for the failure of government intervention. Baron [1992, pp. 1347-1447] states that…

> *… Incomplete information and limited observability create opportunities for strategic behaviour on the part of both the regulator and the regulated.*

In the field of industrial organisation, a multitude of studies is carried out on this subject, analysing the theoretically expected behaviour within a specific regulational setting of both parties. Carlton and Perloff [1994, pp. 854-855] show how operators value regulation: governments often consolidate the existing situation, creating favourable circumstances for the incumbents and less favourable for others. The asymmetry in information allows the incumbent to highlight the positive effects of regulation to the regulator, while downplaying the negative effects.

In addition to government intervention, market structure also has an important influence of the performance of an operator. Monopolistic markets are considered to hamper the revelation of the market price [Bishop et al. 1994, 12]. When the monopolist is not pressed to sell his product at market price, he will be able to raise the price, increasing revenue without the risk of losing many travellers.

Monopolies in public transport come in different forms [for a more complete overview see Velde et al., 1996, pp.37]. Public transport has long been regarded to be a natural monopoly. This occurs when competition is impossible (as infrastructure can prohibit multiple users) [Groenendijk 1998, pp. 44] or there are unbound economies of scale [Carlton and Perloff, 1994,

pp. 151]. Moreover, governments can protect sectors under threat by setting up entry barriers, thereby creating a monopoly [Ooststroom, 1999, pp.55].

In describing the causal mechanism between sector performance and government intervention and market structure, the rationale makes a number of assumptions. Travellers' preferences are supposed to be dynamic, which requires the constant tailoring of services to travellers' preferences. The exact nature of these preferences is left untouched. Other areas of economics do make more extensive analyses of travellers' behaviour in the sphere of public transport [for an overview see Ooststroom, 1999, pp. 13-26, or for a more extensive look, Fisher, 1993, pp. 6-32]. They were briefly discussed in Section 3.2. In addition, assumptions are made about the origins of operators' behaviour. Their behaviour is regarded as static: operators are expected to react foreseeably to incentives, rather than strategically changing their reaction. Also the focus on market structure and governmental intervention leaves a number of aspects of institutional structure and policy processes untouched. These will receive more attention in Section 3.5.

3.3.4 Evaluation criteria

The above-mentioned causal mechanisms relate government intervention and market structures to a number of different performance indicators on the operations of public transport. Those performance indicators are biased towards efficiency and are often monitarised [McKinsey, 1997; Yu, 1982]. Generally, they represent composites of cost and revenue indicators [Berechman, 1993]. The three main indicators that are used are production costs, fare-box revenue, and government subsidies. These three together form the basis of many analyses of the performance of public transport systems within this rationale.

Production efficiency is generally operationalised in a revenue-cost ratio, representing the share of cost that is covered by revenue from the fare-box. This is the performance indicator that is the most widely used [Berechman, 1993]. Theoretical elaboration of the causal mechanisms has lead to a number of other possible performance indicators which aim to illuminate more complex relations. An important example is consumer surplus, which represents the total (monitarised) gain consumers perceive from the availability of public transport [Stiglitz, 1988, pp. 260-261; Button, 1998]. Efficiency of service provision can be operationalised on a number of different levels. Already published are an analysis of the efficiency of a single operator [Globerson, 1985], of all operators in the sector [McKinsey, 1997] and even of the entire public transport system, including government efficiency [Savas, 1987]. When assessing the performance of public transport systems many authors come to the conclusion that public transport performance is lagging behind other sectors [McKinsey, 1997].

3.3.5 Recommendations

The recommendations of this rationale focus on the design of the government role in regulating and commissioning public transport services. The recommendatory focus is on optimal regulation, rather than optimal products, production and process. The discussions between Gwilliam et al., on the one hand, and Beesley and Glaister, on the other (see Page 55), show that not all authors share the same idea. An example was given on price setting. Price setting in a deregulated market might not always see the optimal price from a welfare standpoint, due to market disturbances. Here governments can choose either to step in to regulate prices, or to focus on eliminating the market disturbance. Small [1992, pp. 129] gives an overview of possible pricing solutions.

There is agreement over the fact that efficiency in service production and innovative behaviour can be stimulated through competition in or for the market. A number of important conditions should be created to make a market contestable and to enable easy entry. There should be little or no sunk costs, infrastructure access should be easy, and labour, vehicles and maintenance garages should be easily available. Some authors [De Rus Mendoza, 1993, pp. 245] consider market entry relatively simply, allowing for this tendering of management and operations to the same or different operators. In order to keep the market contestable in this situation, the length of the franchising period should not exceed five years and will preferably be three in the bus market.

An important question is what institutional arrangements should be taken to ensure these issues. As Velde [1992, pp. 296-318] states, the keywords for choosing a particular type should be incentives for efficiency and clear goals for both companies and governments. A possibility is the tendering of the market. Here, governments actively introduce contestability through competition for the market. Important choices are whether tendering should include operations and/or management. Easy market entry in a contestable market could imply the tendering only of management.

Berechman [1993, pp. 311] gives an overview of what he considers to be recommended public transport policy regimes (see Table 8). For larger metropolitan areas (indicated as a large central city, where the population exceeds 100,000 to 150,000 inhabitants) he recommends regulation with public agency production. He argues that tendering the whole network will lead to local franchise monopolies, loss of network economies, and the high costs associated with establishing a comprehensive tendering scheme. Complete deregulation will only lead to the undesirable result of an unregulated private monopoly market structure. This is due to the high network economies of this specific market, which are the economies of the operation of larger parts of the network.

	Public transport markets				
Policy regime	Large central city	Small city	Metropolitan	Rural	Intercity
Public agency regulation	Yes Tendering of auxiliary services*	No	No	No	No
Partial deregulation	No	Yes Tendering of social services	Yes Tendering of social services	Yes Tendering of social services	No
Full deregulation	No	No	No	No	Yes No tendering
* these include demand responsive, express and special purpose services					

Table 8
Recommended transportation policy regimes (Source: Berechman, 1993)

Weiß [1999] stresses the complexities of combining competition with co-ordination. Velde and Veeneman [1995, pp. 283-302] add that the final institutional design of regulation, within a regional setting, should take the asymmetry of information into account. Information about production costs should be available to the regulator, be it to ensure reasonable bidding in a tendering situation, or to make the right pricing possible. In a tendering situation additional information about the market should be made available to potential bidding companies. Sleuwehaegen [1994, pp. 32] underlines that the prescriptions of economic theory should serve as a reference, simplifying the design of regulatory regimes, and should not be mistaken for the actual design itself.

Though controversy exists, the general feeling is that government control over the sector has exceeded its merits in many European countries. A swing to more competition is regarded as beneficial for the performance of the sector. The controversy is over the exact roles of public agencies and the operator. Deregulation, liberalisation, privatisation and protection of the market form four propagated changes to current institutional setting of most European public transport systems.

3.4 Schedule the service

3.4.1 Introduction

In order to attract people to public transport, a (more or less) appealing public transport network has to be developed and communicated. This rationale studies public transport service definition in all its aspects. It looks at different public transport techniques (bus, tram, underground, train, etc.) and their attributes as a resource to build a public transport network, and the

optimisation of these. The techniques and attributes are depicted here as far as they are relevant to the development of a metropolitan public transport system. The rationale has links with maintain the metropolis and conceive the customer but its main proponents can be found in transport engineering. Keywords are (public transport) network definition, optimisation, integration of modes and transportation technique innovations.

3.4.2 Subjects

This rationale is primarily engaged in the optimisation of public transport networks (networks being a number of specific services offered) given a certain demand. This rationale looks at demand in a far cruder manner than the rationale presented in Section 3.2. Demand is defined at an aggregate level, focusing primarily on the origins of possible travellers and possible destinations, rather than on their individual preferences. This aggregate demand is the basis for the optimisation of public transport networks, with various transport techniques, schedules, routes, stops, vehicles, and fare structures. As a contrast to its perspective on demand, the rationale's view on possible service networks is very rich and developed.

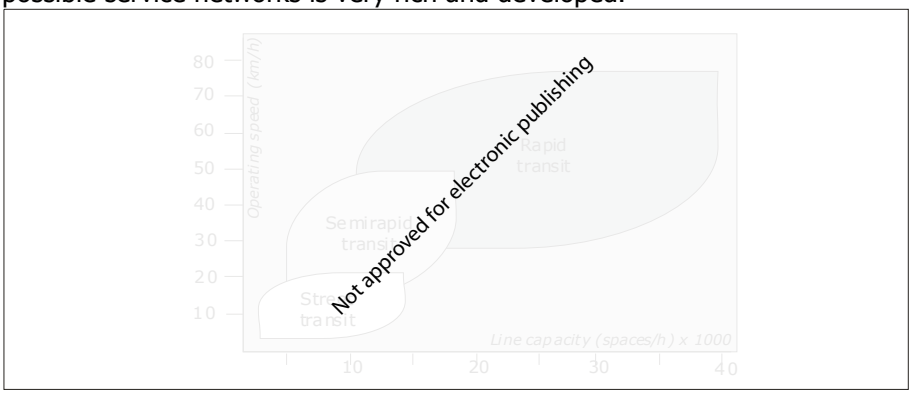

Figure 7
Line capacities and operating speeds on different modes (Source: Vuchic, 1981)

Krug [1987] divides the choices to be made when developing a service network into two main concepts: the net concept and the service concept. The latter encompasses choices for timetables, vehicles, and ticketing and pricing. The former encompasses choices on infrastructure, routes, and number and location of stops. Egeter et al. structure the wide variety of net concepts [1989, pp. 21-29] by distinguishing between systems that open up areas and make public transport accessible on the one hand, and systems that connect areas on the other. Vuchic [1981] distinguishes between three

types of services, based on line capacities and operating speeds (see Figure 7).

Most autors combine infrastructure and route choices in a network design: the topology of the infrastructure and service network. The challenge is to optimise network topology to serve demand best [Nes 2000]. Hutchinson [1974, pp. 177] determines a typology of five types of travel demand, to which (public) transportation networks can be tailored. These five are: radial towards and from a metropolitan centre, circumferential around that centre (from suburb to suburb), short trips within residential areas, short trips within central business districts, and finally, travel to major activities, not situated in the metropolitan centre.

A similar typology can be found at Levinson [1992, pp. 149], when he distinguishes between:

1. Radial routes,
2. Circumferential routes,
3. Cross-town routes,
4. Feeder routes,
5. Shuttle routes.

He already relates route types (demand) with the provision of specific public transport services (supply). His typology tries to directly link types of services to the types of spatial demand for transportation put forward by Hutchinson. Not only should the type of route be considered but also the distance between routes, within the urban space. Bonz [1994, 500-501] also shows a number of theoretical concepts of networks, translating these into public transport networks.

Together with infrastructure and routes, the location of stops [White, 1995, pp. 88-92; Nes, 2000] on the routes is a third aspect of the net concept. Every transport technique has specific characteristics regarding speed and capacity. To utilise the strength of every technique at its best the spacing of the stops should be a balance between the time the (average) traveller needs to get to a stop and the extra time the stop costs for travellers in a vehicle. Several mathematical models [Egeter and den Heuvel, 1992, pp. 375-390; White, 1995, pp. 103-104] have been used to define the optimal distance between stops. For bus services a general figure of 600 metres [White, 1995, pp. 89] is given.

The net concept primarily depends on the spatial distribution of public transport demand. When this is established, the quantity of demand on these lines at different times of the day can be optimised into a schedule. This is the first aspect of the service concept. In addition, the schedule can be based on the need for integrating a particular service into the network of services, demanding the synchronisation [Egeter 1989, pp. 58] of lines at transfer points. Other considerations can be the clarity and predictability of the

schedule and the creation of an orderly schedule extending to hours of low demand.

A second aspect of the service concept is the design of vehicles [Vuchic, 1981, pp. 193-240 and pp. 314-365]. The design plays a part in determining the quality of the public transport service for the passenger. Preliminary choices on the type of vehicle are made when a technique is chosen; other details will have to be decided later. The choices range from the size of the vehicle (depending on demand and infrastructure) to the colours and the upholstery of the seats (depending on local tastes and cleaning requirements).

A third aspect of the service concept is the definition of the pricing and ticketing system. Generally, four types of pricing are available. Firstly, fares [Levinson, 1992, pp. 157] can be uniform: the price of a trip offered by a specific provider is the same for all trips offered. Secondly, fares can be calculated according to zone – the price within a zone is uniform, but crossing a boundary between zones incurs an additional charge. A third type is fares calculated on the basis of the distance covered by the trip. Finally, free public transport can be offered, where no price is attached to the service. Bonz et al. [1994, p. 481] stress the need for integrated fares, where a ticketing system is valid not only within a given technique in a metropolitan area, but in all techniques and in a wider area.

Some literature crosses the borders of net and service concepts by focusing on techniques, being the combination of vehicle and infrastructure types. Techniques are commonly subdivided [Levinson, 1992, pp. 131] between buses, tram or light rail, semi-rapid transit, rapid transit (including subways), automated systems and commuter rail (like the German *S-bahn*), which are specific in the infrastructure used, their speed in operation and their capacities. Vuchic [1981, pp. 86-104] adds paratransit, public transport techniques which are demand driven rather than schedule driven. He also adds the concept of dedicated services, not open to the general public, as is commuter transit.

3.4.3 Theory

This rationale relates aggregate traveller demand quantities with the public transport service. It explores this relation in both directions, one predicting demand quantities based on a given service, the other prescribing a service based on given demand quantities. The former predicts the number of travellers a specific service will attract. The latter prescribes the best services to attract travellers.

For both directions, an important independent variable is the spatial dispersion of possible travellers and attractive destinations in the urban structure. The first direction, prescribing services, deduces an optimised

network of services from the urban structure. It prescribes service changes within an existing network, adding to or tuning the network. The direction proposes the selection of a net concept and a service concept on the basis of the urban structure, and possibly additional variables such as existing services, ridership history or traveller preferences.

The second direction predicts expected ridership or revenue, based on the analysis of the urban structure and the proposed service. Additional variables might also be taken into account here. This analysis is shared with the rationale in Section 3.6. What the two directions presented here and the rationale in Section 3.6 share, is that they relate urban structure, public transport services, and ridership. The three differ on the dependent variable: the service, ridership, and the urban structure respectively.

This rationale often uses modelling to relate the many variables of the service(s) with the limited variables of the travellers dispersed over a wide variety of locations. Gravity-based models [Fisher, 1993] still form an important basis for describing this relation. Those models offer aggregate data on trips, giving an expected number of trips from grid cell to grid cell. As has already been stated, more advanced approaches include some generalized traveller preferences.

An important aspect sets this rationale apart from the rationale in Section 3.2. The rationale sees traveller preferences as a limited set of quantitative variables. The qualitative aspects of demand play a secondary role. Travellers' preferences are treated as a black box, depending for the most part on location. In addition, supply is described in the same way: quantitative variables with a strong emphasis on location. This means that the rationale offers only indirect ways to analyse the effect of *qualitative* improvements of public transport services. On the other hand, the rationale offers direct ways to design the *quantitative* aspects of public transport services and their qualitative effects. An integrated analysis with equal treatment of both qualitative and quantitative aspects is not available.

This orientation towards quantitative analysis and definition of public transport services underlines the focus of this rationale on quantitative variables, more specifically, the capacity of vehicles, infrastructures, and public transport services. Capacity in transport depends on both size (of vehicle and infrastructure) and speed. Though the causal mechanism studied is relatively simple in concept, the design question of the rationale is a complex one. The wide variety of design variables in public transport services and the wide variety of origins and destinations are the main causes of that complexity.

3.4.4 Evaluation criteria

The prime performance indicator for this rationale is the "right" capacity, tuning the quantity of supply of services to the quantity of demand. Consequently, in-vehicle seat occupancy is an important aspect by which this rationale judges a service. Low seat occupancy means high costs for the operator. Seat occupancy which is too high means low quality for the traveller. On the level of infrastructure, the same performance indicator has a different guise. Here the infrastructure has to be tuned to the number of vehicles, which gives a different performance indicator: slot occupancy.

This rationale considers speed to be another important quality aspect of the transport service. As a consequence, speed is an important performance indicator. Design aspects influencing the speed of a specific service include infrastructure speed (the topology of the infrastructure and the uniformity of traffic), vehicle speed (acceleration and cruising speed), and the distance between stops (or stations). At the level of the individual, service speed is balanced by accessibility: the higher the speed, the fewer stops. High-speed public transport techniques, like high-speed trains, have a limited number of access points. Low-speed techniques, like urban bus services, have good access but limited service speed.

Speed is an important performance indicator for the service network. In a network, the speed of the overall service depends heavily on the smart combination of different techniques, both slower techniques, which make public transport accessible to specific areas, and faster techniques, which connect these areas. An integrated service can offer the traveller high access and high speed. The aggregated trip speed can offer a good perspective on the quality of the network; how fast the traveller can go using the available services. High accessibility reduces speed at the service level (given a specific service frequency) due to regular stopping, but improves the speed during the trip due to swift access. The further the traveller has to walk to the access point, the longer his overall travel-time is and the lower his trip speed is.

At network level, speed depends on the operating speed of the individual services and on the integration and co-ordination of the services [see also Simpson, 1994, pp. 174-177]. Travel time can be minimised by reducing waiting times between services, either through high service frequencies or through interconnection between services. Frequent services minimise waiting time at the entry of the system, enabling a higher average speed for the trip. Interconnection of services minimises waiting time when transferring to a different service, enabling higher average travel speeds.

Network development and service development focus on design variables like speed and capacity and their effects on dependent variables like cost or income as a derivative of ridership. This rationale pays secondary

attention to other aspects of a service valued by the traveller, such as price, comfort (other than technique specification), and ease of use. For the traveller, comfort and ease of use depend on more aspects than the technical definition of a public transport technique. These aspects, like clarity of the schedule and friendliness of the staff, occasionally find their way into this rationale, but do not form its core.

3.4.5 Recommendations

This rationale optimises the technical features of different vehicles and infrastructure types as a service for a specific urban structure. To handle the variety of possible vehicle and infrastructure variables, this rationale defines typologies of techniques. It relates typologies, as given by Hutchinson [1974] and Khisty and Lall [1998], to concepts for public transport services within a network, as given by Levinson [1992] and Vuchic [1981]. Table 9 shows only one example of a wide range of recommendations linking urban structure and population size to public transport tasks in the network and techniques.

Areas		**10-50,000**	**50-250,000**	**250-750,000**	**750-2,000,000**	**2,000,000 +**
Suburb coln	*Satel-lite*	Vanpooling	Subscription buses	Subscription and express buses	Express buses	Commuter rail
	Low density	Taxi, vanpool	Dial-a-bus, van, taxi	Dial-a-bus, small bus	Dial-a-bus, fixed route feeder	Dial-a-bus, fixed route feeder
	Medium density		Dial-a-bus, fixed route feeder, integrated network	Dial-a-bus, fixed route feeder, integrated network	Fixed route feeder, integrated network	Integrated network
Line haul services		Dial-a-bus, fixed route bus, van or taxi	Fixed route bus, express	Fixed route bus, bus ways, light rail	Fixed route bus, bus ways, light rail	
Downtown distribution			Overlapping routes	Overlapping routes, separate system	Overlapping routes, separate system	Central terminal, through routes, separate system

Table 9
Public transport techniques (adapted from Khisty and Lall, 1998)

The rationale offers a perspective on the process of technical design to cope with its inherent complexity. Many choices are made in this process of public transport design and planning. In order to gain insight into the set of choices, Levinson [1992, p. 377] distinguishes between four types of public transport planning:

> *It includes* strategic planning*, which takes a broad global look at how a (transport) agency might function in its surrounding environment;* long-range system planning*, which generally relates to major facility development (...),* short-range planning*, which traditionally produces a transit development plan; and* service or operations planning*, which looks at service changes on a continuing basis.*

Krug [1987, p. 3] also underlines the role of planning of public transport services in the overall process of traffic and transportation planning:

> *Es wird deutlich, dass der Prozess städtischer Verkehrsplanung weder als statisches System der reinen Angebotsplanung noch als isoliertes Problem eines Verkehrsbereich auf zu fassen ist. Vielmehr muss von einem dynamischen Prozess im Rahmen einer Gesamtverkehrsplanung gesprochen werden.*

When he describes the process of public transport design, Krug [1987, p. 99] shows how public transport network models can be used to formulate measures. He stresses the incremental changes, because of investments in transport techniques and infrastructure. Bonz et al. [1994, pp. 481-543], when defining a process for designing public transport systems, stress the importance of system goals for the (re)development of the system.

Different actors suggest different ways of coupling demand with services. A first approach is of a linear type [Hutchinson, 1974] with a number of steps between the problem formulation, the generation and selection of alternatives and implementation. A second approach can be called iterative [Shunk, 1992], which is comparable to the linear approach, but with feedbacks build into the process. A final type can be called incremental [Smith and Taylor, 1994], when, given the existing situation, improvements are constantly implemented and enhanced.

Most authors above place the public transport planning process in a wider process of metropolitan transport planning. Levinson [1992, pp. 123-174] stresses the need for a strategic viewpoint on the level of transport planning on a metropolitan level as a basis for public transport prerequisites. This process should be aimed at a specific time-horizon reaching contemporary policy goals. In his prescriptions for the process of urban transport systems planning, Hutchinson [1974, pp. 372-373] states that, due to the sequential nature of investments in transport facilities and services, and, moreover, the uncertainties involved, it would be better to choose a sequential approach; in his example using decision trees.

At the level of designing a network of services (Levinson's *short-range planning*), Egeter et al. [1989, pp. 53-58] describe four steps. The first is the *choice of nodes*, based on the typology of origins and destinations. The

second step is the *designation of links*, based on the existing infrastructure and the requested speed for that link. The third step is the choice of an appropriate *technique and a route*, based on demand, managerial aspects, desired quality of the product, environmental considerations and the interconnection with existing networks. Finally, in the last step services are defined with *schedules and headways*.

To predict ridership, the literature [Hutchinson, 1974, pp. 31-148; Bayliss, 1992, pp. 24-25; Button 1993, pp. 210-211; Fisher, 1993, pp. 7-11; Black, 1995, pp. 183-184] suggests a process, aimed at modelling demand for the sake of service development. They describe the classical four-stage modelling process of:

- Trip generation,
- Trip distribution,
- Modal split, and
- Route assignment.

The conversion of traffic demand into a specific set of operations (operational design) using a fixed number of vehicles and personnel is covered in more detail by Krug [1987, pp. 51-98] (operations derived from a computer modelling exercise), and in more general terms for buses by Levinson [1992, pp. 399-403] and for metropolitan rail networks by Knibbe [1991, pp 213-227].

Bayliss [1992, pp. 6] and Nes [1999] underline the importance of planning services in a co-ordinated fashion [see also Köberlein, 1997, pp. 82-83]. Public transport consists of many different services offered with many different techniques, each with its own task in the public transport network [Baggaley, 1998]. The rationale regards co-ordination between all these services as a prerequisite for high quality public transport. Co-ordination at that level requires a central planning agency for public transport, which is self-evident in this rationale. This is in sharp contrast with the discussions presented in Section 3.3.

As can be observed from the concise literature overview above, this rationale is closely related to the rationale in Section 3.6. The expected demand for public transport services is calculated on the bases of land-use patterns, or a more general distribution of population and workplaces.

3.5 Produce the policy

3.5.1 Introduction

Governments at the national, regional and local levels are closely involved in public transport. The reasons for this interest were discussed in Section 1.3.2. Governments undertake all kinds of action to create a public transport system which best fulfils its wishes. Growing concern over the quality of public

involvement in public transport has led to a growing debate over the possibilities for improving government involvement in public transport. This is reflected in the Netherlands by a host of policy reports on the subject [Boer, 1994; Brokx, 1991, 1992A, 1992B, 1992C, 1992D, 1993A, 1993B, 1994, 1995; Ministerie van Verkeer en Waterstaat (VenW), 1981, 1982, 1996]. In other countries, too, [Guess, 1990; Cerwenka and Meyers-Rühle, 1991, pp. 194-228; Lewis and Williams, 1999] the organisation of this process of interaction between governments and companies has come under scruteny. In Europe an important impetus for this change was been given by European Commission interest in lowering the cross national boundaries by rearranging the existing control of public transport by the public sector [EC, Regulation 1191-69, Directive 92-50-EEC].

This rationale analyses public involvement and suggests how this can be shaped. It relates the organisation of the public sector to the behaviour and performance of public transport. Like the other rationales, this one is not homogeneous. When discussing a decision-oriented approach on transport planning in general, Meyer and Miller [1984, pp. 87-95] distinguish between five different conceptual models of decision-making used throughout the literature. The five are:

1. The rational actor approach,
2. The satisficing actor approach,
3. The incrementalist approach,
4. The organisational process approach,
5. The political bargaining approach.

The first approach assumes that those involved optimise their behaviour to best fulfil their needs. The second relaxes the axiom of full optimisation; actors would pursue their needs to the level of satisfaction. In both cases actor behaviour is mostly predictable.

The latter three approaches find their basis in criticism of the rational models of policy development and decision-making processes. Some question the rationality of problem definition in traditional processes [Cohen, 1972], some examine the way possible solutions are found and linked to problems [Kingdon, 1984], some scrutinise the limited attention for the learning regulated actor [In 't Veld, 1989, pp. 20-25], and others query the emphasis on modelling as a source of improving public transport [Lewis and Williams, 1999, p. 23]. Ostrom [1994] asserts that for understanding policy processes …

> *… Bounded rationality is a more appealing assumption. In these settings, individuals do not appear to perform a complete analysis of all future moves and then decide – once and for all – on a strategy of how to play the entire game facing them.*

Instead, they make shortcuts or even detours to arrive at their actual play.

The latter three approaches answer the relaxed ideas of rationality in three different ways and are gaining importance in this rationale. The first focuses on the incrementally adapting public involvement, adjusting it to new developed situations. The second looks at the process design to develop and implement policies. The third points to bargaining between actors, finding more complex solutions, including different aspects of the problem, which are satisfactory to the greater number of the actors involved.

For the purpose of brevity, a further distinction is made only between the combined first two and the combined latter three approaches: rational decision-making and relativist steering. The first focuses on goal setting, analysis and choice of policy. The second assumes policymakers to have far less possibilities for steering as a consequence of bounded rationality, the inertia of existing institutions, and the strategic behaviour of all parties involved. Rational decision-making will receive less attention, as it is mainly the application of knowledge from other rationales. More attention will be given to relativist steering, since this view is more complementary to the other rationales presented in this chapter.

This section first pays attention to this rationale's focus on process and structure. Some general prescriptions on the process will be discussed in Section 3.5.5. Keywords are actor, policy, process, and steering.

3.5.2 Subjects

The paradigms of rational decision-making and relativist steering have somewhat different subjects. The first has a relatively strong focus on the *analytical* process of policy development. In this process the analyst produces possible policy alternatives, and solves complex policy puzzles, through analysis. It has a strong normative character and makes substantial use of modelling.

Relativist steering focuses more on the *actor* process of policy development and steering. In this process the policymaker probes the actors involved, organising their contributions in an intelligent way to further public interests. It has a strong empirical character.

For both rational decision-making and relativist steering, the process is an important aspect to deal with complexity, both analytical or political. Meyer and Miller [1984, p. 85] conclude from a multitude of different studies in the field of urban transport system design that…

... Planning and design of transport systems are as much a political process as they are a technical one.

The design of a metropolitan public transport system is a political process in which different actors initiate, participate, deliberate, and effectuate actions. This process characteristic plays a central part in this section. The central issue in this rationale is the streamlining of processes on both policy definition and on policy execution. There are different ways of streamlining the process, which aim at different goals. These processes are concerned with transport policy in general, and more specifically on the provision of public transport services.

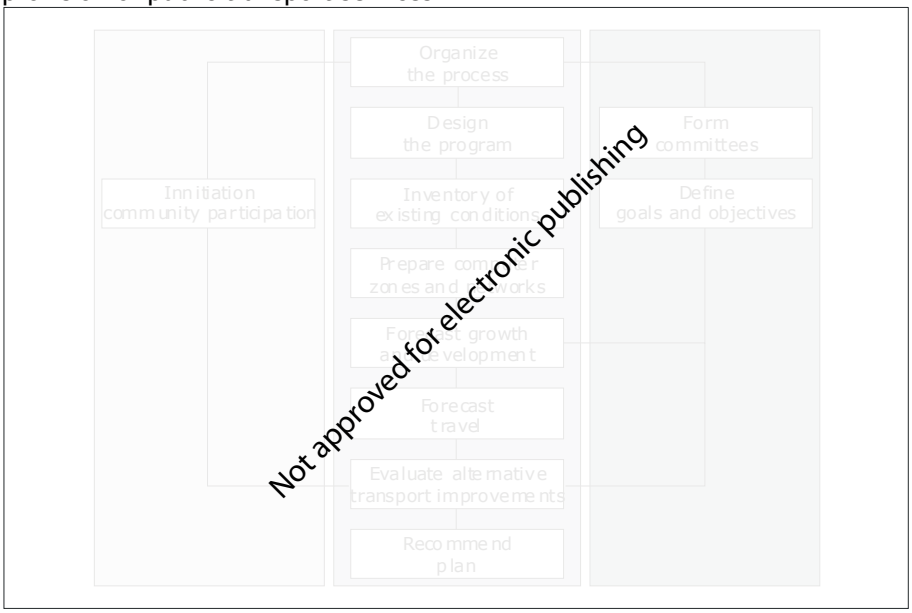

Figure 8
The transportation planning process (Source: Shunk, 1992)

Shunk [1992, pp. 88-122] shows an example of such a process (see Figure 8). He involves actors and audiences in the process. He stresses, as do Bonz et al. [1994, pp. 481-543], the need for a clear set of goals, and he involves not only abstract numbers on population and the distribution of workplaces in the technical planning process, but also a survey to gain a more qualitative insight into travellers' needs and wishes. This distinguishes this rationale from that in Section 3.4.

A scan of policy-science-orientated publications concerning transport and public transport in particular shows a strong focus on these processes and the actors involved. The public transport system, especially the process of public decision-making on public transport, is understood in terms of the actors involved and their actions. In general, little attention is paid to the

operational side of public transport service provision. A great deal of attention goes to the way in which decisions and policies are developed.

Hutchinson [1974, p. 297] cites Meyerson and Banfield in a typology of possible ways in which governments can interact with other actors, distinguishing between co-operation, contention, accommodation and dictation. With co-operation, objectives are shared, and ways are sought to solve problems, based on these mutual objectives. In a contention situation, actors endeavour to make their objectives prevail over the other. With accommodation, one of the actors freely chooses to adopt the objectives of the other. Finally, when dictation is in order, one actor states the terms of the settlement and compels the other to accept them.

As well as attention to the process, attention is also paid to the structure of the public organisation [Weimer, 1995 pp. 1-16]. Increasing effort is put into the conscious design of public organisations both defining and implementing policies. Chisholm [1989] has produced one of the most intriguing researches in his discussion of informal aspects of organisations, based on the empirical analysis of the Bay Area Rapid Transit in San Francisco.

The question of structure in public transport has been revolving around the matters of regionalisation and decentralisation [Jong, 1991; Huizinga, 1991; Witbreuk and Guilhéry, 1999]. This stems from the idea of contingency: a problem should be dealt with at the governmental level closest to where the problems occur. To give governments the possibility of reacting swiftly and flexibly to new developments, problem level and governmental level should be attuned [Brokx, 1992, pp. 12-13; Boer, 1994, pp. 31-39]. Not only in the Netherlands, but also in Germany [Cerwenka and Meyers-Rühle, 1991; Girnau, 1994; Knieps, 1995], Switzerland [Giger, 1991], the United States [Judycki and Berman, 1992] and France [Velde, 1992], much attention has been paid to this issue, generally pleading for increased responsibilities for public transport at the regional level. Another important topic in the matter of structure has been the subject of balance between public and private control over different activities.

An important additional issue is the financing system for metropolitan public transport [NRC/TRB, 1988; Guess, 1990]. Government involvement often results in subsidies to public transport. This rationale relates the way of financing to actor behaviour. It looks at the possibility of earmarked taxes instead of funding from general taxes [Velde and Veeneman, 1995], budgeting issues, democratic control over public spending, and the choice of elected or more business-orientated public transport authorities. These subjects touch on managing the market, as discussed in Section 3.3. But the analysis takes a different turn when it focuses on microanalysis of actor behaviour, rather than on macroanalysis of the sector.

3.5.3 Theory

The paradigms of rational decision-making and relativist steering have a different source for the mechanisms they analyse. The first borrows its mechanisms largely from the theory of other rationales in this chapter and adds a set of tools to deal with the complexities of this combination of mechanisms given a certain problem.

A wide range of design variables is addressed by different authors. For example, Wulkan [1990] addresses the matter of elected or appointed executives of transport agencies. Taylor [1992, pp.151-179] addresses the quality of public control. Giger [1991] gives a perspective on the distribution of tasks for different levels of government, as does Cohen [1990]. Kish [1990], Walther [1990], Olson and Brown [1990], Fielding and Lee [1990], and Lynch and Campbell [1990] give an overview on financing and budgeting matters. Globerson [1985], finally, gives a perspective on incentive systems, embedding improved performance within an organisational structure.

The paradigm of relativist steering develops its own mechanisms from empirical analysis of the policy process. It shows how the bounded rationality of a single decision-maker leads to limitations in problem analysis, possible solutions, and commitment. The policy-makers' problem definition is not "complete". He singles out, constructs, and colours problems so as to match existing institutions and knowledge. This means that problem definitions reflect as much the organisational view of reality as they reflect the societal perspective [Schön, 1983, p. 40]. Possible alternatives have the same limitations, as Weimer [1993, p. 112] states …

> *… (An) initial problem definition already points towards a set of proto-alternatives.*

In addition, the range of possible solutions, the solution domain, is very limited. A number of basic solutions is reinvented, retuned, and reprocessed for new problem definitions. Both mechanisms are known as foreclosure [Perrow, 1986, pp. 192-194]. Richmond [1991] shows decision-makers generally overestimate the quality and success of rail services. This leaves a picture of problems and solutions "bumping into each other" along the dynamics of organisations in so-called policy windows [Kingdon, 1984].

The policy process has a number of limitations that block major changes. For example Wildavski [2000, ch. 3] shows how incrementalism is built in to the careful budgeting of public spending. In addition, Taylor shows [1992, p. 153] how existing operational financing schemes for public transport form the basis for new infrastructural investment. Also Lindblom and Woodhouse [1993] assert that incrementalism is not only built into budgetary systems but is also the best way to come to political decision-making and policy analysis, as do Lewis and Williams [1999, p. 20].

Finally, the regulated actor does not abide to the "stay-as-you-are" rule [Veld, 1989]. Regulation, in any form, is based on some premise of the reaction of the regulated to support the spirit of the regulation, following past perceptions by the regulator. But regulation proves to have many more dimensions to the regulated actor than anticipated by the regulator, offering a wide palette of unforeseen reactions to the regulation. The regulated actor will use that palette to adjust to the regulation in such a manner that it supports his own goals best. He will learn and adapt to the regulation.

This means that the notion of hierarchy does not aptly describe the relation between the public transport authority or general government on the one hand and the operator on the other [Chisholm, 1989]. And as Bruijn and Ten Heuvelhof [1995, p. 162] show, the clear distinction between the public and the private sector has blurred, which has mystified the roles of regulator and regulated.

3.5.4 Evaluation criteria

Hood [1991] gives a number of core values in public management that can also be applied to the organisation of metropolitan public transport. This section will use Hood's typology for the sake of structure. Table 10 summarises the three different value systems under which public authorities (can) operate.

	Sigma-type values **Keep it lean and purposeful**	***Theta-type values*** **Keep it honest and fair**	***Lambda-type values*** **Keep it robust and resilient**
Standard of success	**Frugality** (matching of resources to tasks for given goals)	**Rectitude** (achievement of fairness, mutuality, the proper discharge of duties)	**Resilience** (achievement of reliability, adaptivity, robustness)
Standard of failure	**Waste** (muddle, confusion, inefficiency)	**Malversation** (unfairness, bias, abuse of office)	**Catastrophe** (risk, breakdown, collapse)
Currency of success and failure	Money and time	Trust and entitlements	Security and survival
Control emphasis	Output	Process	Input/Process
Slack	Low	Medium	High
Goals	Single	Incompatible	Multiple

Table 10
Core values of public management (Source: Hood, 1991 pp. 11)

These value-types incorporate different performance indicators for policy processes and for organisational structures. For sigma-type values, an often-used indicator is efficiency. The public involvement in public transport

should be aimed efficiently attaining a preset goal. Performance is indicated by the efficiency of goal attainment, asking for quantitative and measurable goals, for example a level of modal split.

Other value-types influencing public involvement bring other performance indicators. Theta-type values require openness in processes, enabling for example democratic control and offering equal chances for all citizens. Public involvement should not be aimed at the attainment of a preset goal, but at development of policies that support mutual different goals. To do so, travellers and operators should be involved in a meaningful way in defining public transport. Performance should be measured from the contentment of traveller, operator, and authority.

Finally, lambda-type values offer performance indicators aimed at minimising risk and maximising reliability. The organisation of public transport should ensure that public transport is a safe and reliable mode of transport. In addition, processes, like the commissioning of public transport services, should be aimed at securing the provision of public transport to those who need it.

No single value-type is paramount, though some are dominant at certain points in time. Generally performance indicators which belong to different value-types are in a dynamic state of balance. Processes in the public domain leading to, for example, a new public transport infrastructure should be efficient and purposeful, should balance the needs of public transport travellers and the residents along the infrastructure, and should be dependable in terms of reaching some solution. The public organisation concerned with offering services should be aimed at efficiency in the provision of services, should be open to democratic control, and should ensure continuous service provision.

Note that the performance indicators in this rationale are directed at the organisation and processes for public transport, rather that on the infrastructure and services themselves. When more travellers use public transport, the rational in Section 3.2 values the shift. This rationale values it only when activities in the policy process were aimed at that shift.

3.5.5 Recommendations

The distinction between rational decision-making and relativist steering, is also found at the normative side of this rationale [see also Linder and Peters, 1987]. On the one hand the assumption prevails of the necessity of structured decision-making processes. On the other hand the acknowledged problems in doing so are central [Perrow, 1986, pp. 258-278; Baum, 1993, pp. 152-188]. Some authors present conceptual structuring examples of decision-making processes [Hurwitz, 1996, pp. 269-284], while others stress

the importance of learning and adapting within current processes [Schön, 1983, pp. 21-69; Rose, 1993, p. 135].

From the perspective of rational decision-making unilateral decision-making is the starting point, where a single actor is leading the process. From the perspective of relativist steering generally starts the shrinking importance of unilaterality and stresses the growing importance of multilateral decision-making; actors co-operate to reach both shared and individual goals. The former is poised towards large-scale solutions. The latter is more prone towards incrementalism. The former will be referred to as rationalist, the latter as incrementalist.

Rationalist literature [Egeter, 1989; Black, 1995, pp. 179-182; Khisty and Lall, 1998, pp. 427-436; Mackett and Babalik, 1998] requires a cycle of clear setting of goals, development of alternative policies, pre-evaluation of alternatives on goal attainment, establishing an alternative of choice, implementation of the alternative of choice, and post-evaluation of goal attainment. This process still reflects the Chicago 1962 planning process [Meyer and Miller, 1984, pp. 78-79]. Further developments of this process of transport policy development are used to assess alternative infrastructure options, alternative service options or contracting and procurement procedures [Hurwitz, 1996, pp. 269-284]. As a reaction to the conceptual and long-range perspective, alternatives were developed for short-range decision-making [Khisty and Lall, 1998, pp. 599-631].

The rationalist literature often comprises complexity in a model. The rationalists' analysis for policy-making has a tendency to grow and incorporate growing parts of the transport system. To do so, it uses modelling of complex behaviour of travellers and operators. As Bayliss [1992, p. 45] shows, the assumptions behind the model should be clear, as well as for non-technical policymakers.

The relativists' literature [Lindblom, 1972; Rose, 1993; Schön, 1982] prescriptions focus on the exchange of rich information between actors, rather than on analytical structuring by a single actor. Hendriks' (1996, pp. 280-300) analysis of policy development in public transport shows that plurality is needed in a decision making process. He argues that a political system must also hear and incorporate individual opinions which do not run smoothly in the political system and do not reflect the political majority.

To attain a productive exchange, processes should be aimed at optimising the search for solutions from a multilateral perspective. Foreclosure in the process, for example by unilateral problem definition, should be minimised. The process should offer room to graze the full solution domain, with all relevant actors. The process should aim for a supported solution, both outside and inside the public sector.

In the literature on the design of organisational structures a number of design variables take the floor. On the one hand, rationalists focus on distribution of tasks over different actors [Taylor, 1985; Globerson, 1985], while others show the importance of informal organisation [Chisholm, 1989]. An important question is that of the distribution of tasks between public and private actors [Savas, 1987; Hakim et al., 1996; Groenendijk, 1998] A shift towards more private execution of tasks is argued, not only from the perspective of efficiency, but also from the perspective of improved democratic control.

As the rationale shifts towards the paradigm of relativist steering, the general inference is that a government has limited possibilities to steer actors in a specific direction. The image of government controlling public transport is substituted by an image of a mutually dependency between government and governed [Bruijn and Ten Heuvelhof, 1995, p. 10]. Andersson and Strömquist [1989, pp. 29-36] have observed such a development in the organisation of transport networks. Or, in the terms of Meyer and Miller [1984], the policymaker has lost much of the power to dictate and has to probe other actors to produce viable policies.

3.6 Maintain the metropolis

3.6.1 Introduction

This rationale focuses on the relation between urban-geographical developments and public transport. Public transport is considered because it plays a specific role in an urban system. The rationale relates public transport and the city in two reverse ways. Firstly, it shows what effect different urban structures have on the possibility of developing a successful public transport network. Secondly, it shows the requirements of a public transport system to attain certain goals in spatial development. The rationale is somewhat different from the others presented here. The other rationales converge on the provision of public transport itself. This rationale though stresses the importance of urban structure in the functioning of public transport and the importance of public transport in the functioning of the modern metropolis. This relates directly to the problem definition in Chapter 1.

Like others, Goedman and Timmerman [1990, pp. 54-69] and Webster [1988, pp.3-4] point to the strong interrelation between land-use and public transport, which justifies inclusion of the rationale in this study. Some keywords are transport planning, land use policy, urban planning, all of course with respect to their prescriptions and descriptions on public transport.

3.6.2 Subjects

Urban or spatial planning is the activity aimed at influencing spatial dynamics in such a way that government goals can be reached. These goals can have a spatial character themselves, but planning activities are mostly connected to other goals (The green lungs of London to secure fresh air for the city or the Hausmann design for Paris to improve the flow of traffic or complicate rioting). Urban or spatial planning finds its origin in the regulation and control of town development [Goodal, 1987, p. 353]. The subjects of this rationale are urban structure and the way it is developed on the one hand, and the role of transport in general on the other.

In the Netherlands, as in other Western European countries, there exists a permanent need for the development of new housing. The search for space is conditioned by a number of demands, for example retaining large areas of "green" space, making new homes accessible with public transport, supporting the existing city centres, and similar. These goals have triggered a specific choice, which has been expressed in white papers on spatial planning [Ministerie van Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu (VROM), 1993; Ministerie van VROM, 2001]. The typical choice has been for new building sites close to the existing urban centres, making it possible to concentrate developments, link up to existing public transport systems, and strengthening the existing urban economic structure.

Even on a national level, transport is very much a part of spatial planning practice. From 1945 onwards the role transport has played in spatial planning has been constantly changing. When considering the link between spatial planning and transport in West Germany, Steierwald and Kühne [1994, pp. 3-15] distinguish four different phases. The developments they describe also can be recognised in other European countries like the Netherlands and the United Kingdom, though sometimes later or earlier. The phases are:

Time to build (1945 until 1960)

This phase finds its roots in the era of growth following the second world war. Public transport is considered to be declining irreversibly. Banister marks it as the era of predict-and-provide [1994, p. 25], predicting the growth of car use, and constructing a car infrastructure. In England the M1 is constructed as the first motorway; in West Germany the limited network of *Autobahnen* is expanded with new links. But it is not only intercity networks which are being developed. On a metropolitan scale, the road is also paved for the car. In West-Germany *Stadtautobahnen* and *Stadtschellbahnen* into city centres are introduced.

Time to think (1960 until 1970)

Following the *Autophase* there comes a period in which the facilitating growth of car use is becoming less inherent. More attention is given to an integrated approach to public transport and to the diminishing importance of the

automobile in town and country planning. This is reflected in the United Kingdom by the publication of the Buchanan Report: Traffic in Towns [Ministry of Transport, 1963]. This report had a major impact and reflected general views in this era. It raises two important issues [Banister, 1994, p. 25]: First, infrastructure development for the car tends to attract more traffic, and is, as a consequence, often not the best alternative to fight congestion. In addition, the burden of the immense growth of car-use on the urban environment is extensive.

More attention to public transport is seen as the only solution for transport problems in larger urban areas. In Germany, the same problem is observed and the construction of large urban motorways is drastically reduced. Instead of leading traffic into city centres, the new car infrastructure will direct cars around the urban cores.

Time to change (1970 until 1985)

Cammen and Clerck [1986, pp. 271-318], Banister [1994, pp. 39-40], and Steierwald and Kühne [1994] regard the introduction of public negotiations into transport policy in general as a striking feature of this period. Contributions from the public are considered to be essential to ensuring a successful planning process. It is regarded as an integral part of that process.

Banister [1994, pp. 35] describes a similar development in the United Kingdom. He argues that the acknowledgement that the inner cities of large urban areas could survive neither without a strong public transport system nor without a strong road network led to a reconsideration of investment in urban transport. In transport planning, it is the rise of *Verkehrberuhigung* (traffic calming), *Engstellen* (bottlenecks), and *Flachendeckenden Tempo-30-zonen* (reduced speed areas), all revisiting the Buchanan report. A large number of grand car infrastructure projects are either scaled down or terminated.

Despite this growing attention to public transport, in practice the car still plays a large role in structuring urban planning. The reconstruction of urban public transport is undertaken against a background of low growth or even decline in both population and economic importance of urban centres. Growth is expected on the outskirts, where planning for the car still prevails as the dominant factor in urban planning.

Time to review (1985 until 1995)

During this period, awareness is growing that urban problems are not easy to solve, including transport problems. Approaches from the past prove to have their own specific disadvantages and only pose new problems. Integral planning is considered a powerful instrument in the battle for the consolidation of urban centres and against urban congestion [Hakkesteegt, 1992]. In the Netherlands, the new marriage between transport planning and urban planning results in a number of developments. More attention is given

to public transport and the bicycle. In addition, spatial planning is used to favour specific beneficial developments from a transport planning perspective. Transport is becoming an increasingly important issue in general urban planning.

Moreover, the private sector is increasingly involved in planning decisions and projects. In addition to public participation, companies now get involved in planning, be it in financing or in influencing the direction of planning policies to ensure that developments favour the bearers of economic growth. The two main issues in which private financing is introduced are inner city revitalisation and infrastructure development. Governments seek new ways to finance large projects to attain ambitiously-set goals. Banister [1994, pp. 49-50] describes the paradox that follows on this development in the United Kingdom in the late 1980s: in urban planning strategic goals are set; in practice short-term profits are negotiated.

Different countries in Europe show different orientations in terms of the interdependence of public transport and urban planning. This in turn leads to a different role for public transport in the urban structure, and to various degrees of success in public transport acting as a strong competitor to the car. But, some general lines of thought can be distinguished. The recognition that urban city centres will not be able to survive in a car society is widespread. The complexity of policies that try to improve the chances for public transport by spatial planning has also become apparent over the last 10 years. New developments tend to incorporate the strength of the car system into public-transport- orientated planning by aligning urban structure to multi-modal nodes and trips.

In certain relations in space, public transport cannot beat the car. Intra-urban public transport is a good idea, but in relations to and from the edges of a metropolis and tangential trips through the metropolis the car is, in the main, the attractive proposition. The combination of car and public transport offers possibilities to support growing metropoles with growing hinterlands.

3.6.3 Theory

The rationale emphasises the need to support existing metropoles. This policy choice is the basis for this rationale. Growing mobility has proved to be undeniable and hard to regulate. It sees a number of causal mechanisms that threaten the metropolis. Even though negative effects become apparent, the growth of mobility has been steady and is expected to continue. Growing car-use threatens the current metropoles in two ways:

Firstly, the car supports deconcentration of habitation and economic activity. The spreading of homes and jobs is possible thanks to the mobility the car offers. This deconcentration puts pressure on the peripheral

environments of the metropolis; open space is lost to the urban sprawl. In addition, it leads to a decline of economic activity in the centre of the metropolis and devaluation of existing investments there. Support for the existing concentration conserves both the green metropolitan fringes and the red metropolitan cores.

Secondly, growing car use threatens the quality of life within the metropolis. Facilitating high-density car traffic means growing pollution of the ecological environment. In addition, massive expansion of infrastructure, facilitating growing demand for transport by car, would dramatically reduce the aesthetics of the metropolitan centre. In addition, the infrastructure, both for driving and parking the car would use up more valuable space. High-capacity supply of infrastructure threatens the quality of life by polluting the ecological and cultural environment.

This means that growing car use threatens the metropolis both in its existence and its functioning. Given the fact that mobility and the demand for space will grow, alternatives will have to be developed. They will have to take into account the fact that the car is very strong both outside and inside the metropolis. Public transport can offer capacity for urban areas with high-density traffic demand without a massive spatial claim.

3.6.4 Evaluation criteria

The most important performance indicator in this rationale is the extent to which public transport is able to facilitate growing mobility, at the same time relieving pressure on both the urban fringe and at the urban core. In order to do so, public transport has to attract travellers and be efficient in its use of urban space. How travellers should be attracted by public transport services has little relevance to this rationale, neither has the elaboration of the kind of techniques used in public transport service provision.

Modal *shift* has long been the main performance indicator in the rationale, claiming that a shift from auto mobility to public transport mobility would better support metropolitan urban structure. But as spatial deconcentration continued, public transport proved to be no viable alternative on its own. More attention has recently been given to interconnectivity between public transport, the automobile and other modes, chaining car, taxi, jitney, bicycle, rental cars, and public transport techniques into an integrated transport concept for the city. This means that the modal shift as a performance indicator is less compatible with current ideas of coupling transport systems to urban systems. The performance indicator is extended with factors of space, time or relations, for example the modal split in rush hour traffic to urban centres.

In addition, the performance of alternative combinations of urban structures and more complex transport systems are assessed in a productive

way through modelling exercises [Lee, 1973, pp. 9-10; Sheppard, 1995, pp. 100-128]. Alternatives are weighed by their contribution to the mitigation of the original problems, congestion and environmental pollution. Examples could be the contribution of chained services to the reduction of toxins, noise, and congestion, through sizeable models. Modelling provides a way of calculating the performance of far more complex relations between the suggested solution (transport services) in a specific context (the urban structure) and its performance (the reduction of toxins, noise and congestion) [see also Webster et al., 1988; SESAME, 1999]. Modelling has become an intrinsic part of this rationale, despite scepticism [Lee, 1973; Batty, 1976, pp. 163-178; Fisher, 1993, pp. 7-11].

The original evaluation criterium of modal *shift* has changed into more composite indicators. But, as stated before, the rationale also focuses on urban planning. It sports indicators of the performance of spatial development supporting public transport. And indeed, here modal *split* is firmly established as a performance indicator. Spatial structures supporting and stimulating public transport ridership are highly valued. Modal split is generally defined as the part of transport realised using public transport services. This can be measured in different ways, for instance either in kilometres or trips, and can either be based on census data, or on traffic counting (network-wide or on specific routes).

3.6.5 Recommendations

The interaction between (public) transport and urban development is a complex one. Following the analysis, recommendations work two ways, adapting the urban fabric to public transport and designing public transport to support the existing urban fabric.

As in other rationales, the prescriptions of urban or physical planning partly take the form of a process. These process recommendations structure the analysis for programmes or plans of urban redevelopment. In essence this process should be regarded as cyclical [McLoughlin, 1969, pp. 92-103]. Different authors have described the process in different ways. For example Steierwald and Kühne [1994, p. 10], when approaching urban traffic planning from an urban planning view, describe the process as represented in Figure 9. In general the process consists of a problem-formulating and a goal-formulating phase, a phase in which a model (either conceptual or mathematical) of the urban system under study is developed, a phase in which alternative development strategies are developed and are tested against this model with set goals, and finally a phase in which a decision is made between the different strategies, after which implementation is carried out. Though most approaches follow this frame, they vary in their details [Lichfield, 1981, p. 4; Pas, 1995, pp. 58-77].

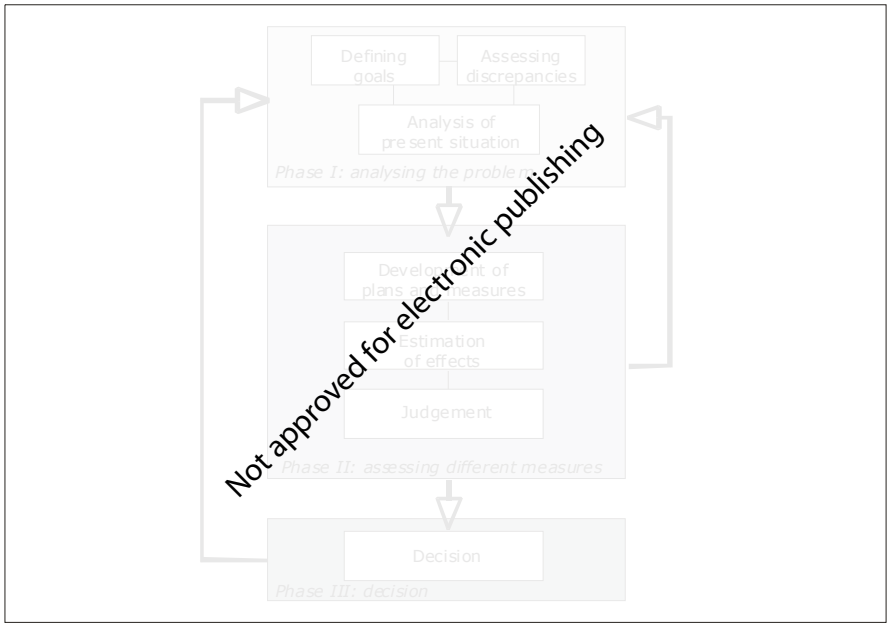

Figure 9
The traffic planning process
(Source: Steierwald and Kühne, 1994)

The process should be aimed at a comprehensive and integrated approach in the field of transport planning within a metropole, including public transport policy. Himanen et al. [1993, p. 281] cite Hanson [1985] and Wärnhjelm [1990] when they assert that, within metropolitan areas, a co-ordinated approach is needed in transport planning in four areas: public transport, infrastructure networks, parking in the city centre, and the development of pedestrian zones in city centres. They add that such an integrated approach is a more successful strategy.

> *Wärnhjelm (1990) has investigated transport problems, measures and results in 25 European cities. According to his material it is obvious that the cities that have a broad approach, have been able to avoid congestion and environmental problems much better than other cities.*

In terms of adjusting the urban structure to public transport a number of strategies are suggested. First of all, *building in corridors* gives an urban structure that is far better suited to the linear supply of fast public transport services. A second suggested approach is *developing existing nodes of public transport* with economic activity that generate high volumes of traffic. The

development of office space in the neighbourhood of intercity stations is an example.

Other suggestions of this rationale work on transport solutions that adapt to urban sprawl, but still try to support existing metropolitan centres. An example is the development of extensive park-and-ride facilities around metropolitan areas, so called *transferia* [Bos, 2000, pp. 2.1-2.14]. These protect the urban centre from being flooded by cars, while still allowing the traveller to use his car in its natural suburban environment. Frieling [1999] shares this goal and advocates further integration of different modes of transport. But recommendations vary: others [Priemus and Konings, 1999] still support the idea that solid *public transport* per se is the key to sustained urban vitality.

3.7 Discussion: Lessons from the rationales

Before continuing, a major lapse in the literature should be underlined. The literature was selected from several Dutch university libraries on specific analysis and prescriptions in the field of public transport – the primary literature. It was supplemented with secondary literature, which the authors of the primary literature quoted. Secondary literature often had a wider perspective, often focusing on transport in general or general organisational or policy matters. This search algorithm only brought a very limited amount of literature on the managerial aspect of public transport operations [two very dissimilar examples were found at White, 1995 and Kaspar, 2000]. The public transport literature found had a strong focus on the aspect of service pricing. Other literature dedicated to questions of managing public transport operations was not found. Recently, literature on managing the operation has received more attention, for example in the field of the specifics of human resource management in the sector. Two examples are the extensive transit cooperative research program started o the subject at TRB [TRB, 2001] and the work of Reisner [2001].

Having explored a variety of perspectives, the question arises of what the importance is of these rationales for the organisation of metropolitan public transport. What is their place in an integrated approach? Some lessons can be drawn.

First of all, the timeliness of rationales should be underlined. Different rationales have more attention in the literature during specific periods [Goodin, 1996, p. 36]. The interest in specific subjects shifts. These shifts are significant, resembling Kuhnian paradigm shifts, putting reality in a new light. These shifts follow changes of the interests of policymakers, operators and academia. This is recognised in the literature as the problem of mandated science [Robinson, 1992, pp. 237-254].

In the 1970s a great deal of attention was paid to the optimisation and development of public transport systems and the use of models to support this approach. Public transport should provide mobility for *all* citizens alike. The dimension of the services provided depended only on the size and structure of the urban areas. Growing population meant more public transport, provided by national and regional governments.

The 1980s saw a shift in the role of public transport. Growing deficits led governments to question their role as providers of general mobility. Public transport became a normal policy instrument, used especially in combination with urban planning. The literature shifted from a technical approach to a functional one, from public transport development to the role of public transport.

In the early 1990s the awareness grew of the influence of organisation on costs and quality. A number of policies were undertaken to improve efficiency and the effectiveness of the system. The successes were only marginal. In the 1990s, the primary focus turned further away from the optimisationism of the 1970s and the instrumentalism of the 1980s to organisationalism and institutionalism. The government slowly retreated further from its role as the provider of general mobility. The focus of the literature shifted to managing the organisation of public transport as an instrument with growing attention for the role of private enterprise.

The shift in emphasis prompts a second observation. The rationales differ in the subjects under study and the evaluation criteria. Obviously, they disagree on the resulting theory and recommendations. Over the years, public transport has been evaluated using different criteria and different recommendations followed. Even though the rationales study problems and remedies that are adjacent and interrelated, we have to agree with Klein and Richmond: the rationales' analyses and recommendations are very much bound together [Klein, 1990, p. 104], and they all simply put their own criteria first [Richmond, 1991, p. 169]. Some rationales are more open to xenogamy than others, but all reside in their own private niche.

Let us look at the subjects, theory, evaluation criteria, and recommendations successively. Strong specialisation in one *subject* excludes others. When conceiving the customer, the human geographer has little eye for production efficiency or technical restrictions; they are treated as a black box. The economist managing the market can claim efficiency gains by optimal regulation, but has little eye for the complexities of policy development, implementation and reaction by the regulated actor. The engineer calculating the capacity has little eye for the subtle distinctions of customer needs, as they are generally understood in terms of spatial patterns. The policy analyst understands very well the limitations that steering instruments have, but has little consideration for the technical and

commercial dimensions of public transport provision. Finally, the urban planner sees the need for public transport supporting the existing metropolis, but needs the other four to make public transport work. In our case, five different boxes are opened by five different rationales, leaving possible others undiscovered. These five boxes all have some bearing on the success of public transport. The different *theories* have no clear answers about the way these boxes relate to each other.

The *evaluation criteria* differ, but share a common basis: effectiveness and efficiency. Effectiveness refers to the relation between the public transport network and the volume of passengers it actually transports. It shows how well the services are tuned to transport demand. Its focus is more on revenue. Efficiency refers to the relationship between the public transport network and the amount of resources required to provide it. It tells how well scarce resources are deployed for the services. Its focus is more on costs. In the different rationales, efficiency and effectiveness battle for attention. When managing the market, efficiency leads effectiveness. When maintaining the metropolis, effectiveness leads efficiency. In addition, the different rationales use different operationalisations of both efficiency and effectiveness. Effectiveness might be defined in terms of modal split, which puts public transport's success diametrically opposite to that of the car. Another option is to operationalise effectiveness in terms of the environmental record of new systems. This opens up solutions, including both car and public transport. Or effectiveness might be operationalised as capacity or speed, triggering a focus on public transport vehicles and infrastructure.

When subjects and evaluation criteria differ, it is no surprise that the *recommendations* of the rationales differ. Weimer [1989, p. 447] underlines how rationales deduce recommendations from their own bounded subject. These recommendations are likely to fail in the unbounded and undisciplinary reality of the real world.

Recommendations are directly related to the part of reality that they describe, but often also try to include that world outside their primary focus. They can only do that by including rudimentary assumptions about parts of reality studied in much greater depth in other rationales. *Managing the market* is about government regulatory actions based on assumptions of operator behaviour, both in the operational and strategic senses. *Schedule the service* prescribes the way in which operators should set up and schedule services. The locations of the travellers' origin and possible destinations are seen as the predominant determants for the travellers' behaviour. *Conceive the customer* has a less normative tone, which can be summarised by tuning public transport to the individual needs of customers, assuming that public transport is able to do so. *Maintaining the metropolis* provides normative theory for urban planning, which relies heavily on assumptions about policy

implementation, traveller behaviour, and public transport operations, assuming government is able to control urban development, travellers use public transport as provided and that the services needed can be run efficiently. Finally, *producing the policy* provides normative theory in distinct flavours based on assumptions about the possibilities of strategically steering behaviour by operators and travellers, with some downplaying the possibility of steering, and others emphasising the improvement of existing instruments and possibilities of steering.

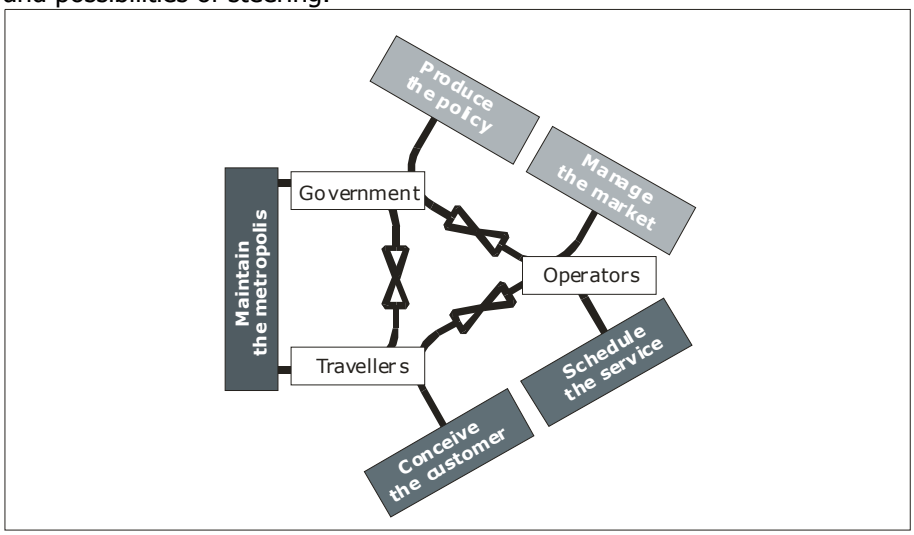

Figure 10
Disciplinary focuses in the overall organisation

Recommendations are also directly related to the evaluation criteria. Modal split as a primary criterion of effectiveness requires measures that push travellers out of their cars. Speed as a primary criterion of effectiveness requires measures that integrate the car into public transport with typical car relations. The first rationale would recommend increased fuel taxes, the second would recommend improved kiss-and-ride facilities. The choice of evaluation criterion directly influences the recommendations made to improve public transport. The rationales' focus on specific parts of reality [Klein, 1990, pp. 82-83] does not imply that they coexist without interference, as Figure 10 shows.

	Conceive the customer	Manage the market	Schedule the service	Produce the policy	Maintan the metropolis
Subject	Traveller characteristics and preferences	Market structures and behaviour	Service development and service types	Policy development and effectuation	Metropolis structure and transport
Theory	Understanding traveller preferences in a variety of segmentations	Understanding operator behaviour under a variety of market regimes	Understanding service suitability in a variety of (primarily spatial) conditions	Understanding the effectiveness of policies and policy processes	Understanding the implication of urban planning on public transport and vice versa
Evaluation	Are traveller preferences reflected in the services? Primarily effectiveness	Are markets triggering productive operator behaviour? Efficiency and effectiveness	Are services attracting travellers and can they be produced efficiently? Effectiveness and efficiency	Are policies reflecting the dynamics and variety of the actors involved? Primarily effectiveness	Is both vitality and mobility supported by metropolitan public transport? Primarily effectiveness
Recommentation	Include the variety of traveller preferences in service design and delivery	Include regulation focusing on market structure and operation.	Include a co-ordinated system of services, related a variety of local conditions	Include policies reflecting the variety and responsive to the dynamics of the actors involved	Include public transport policy in an intergrated set of policies supporting mobility and vitality

Table 11
Concise overview of the rationales

It summarises the focus of analysis and recommendations of the rationales. Producing the policy studies of the constraints of government to recommend government develop policies to steer operators and to a smaller extent travellers. Schedule the service studies the constraints to the operation to recommend operators how to develop a service to the traveller. Manage the market studies operator behaviour to come to recommendations to governments regulating the sector. Conceive the customer studies traveller behaviour to come to recommendations for operators designing the service. Finally, maintain the metropolis studies the constraints to the traveller and the city to come to recommendations to government how to influence the relation between the traveller and the city in both directions.

Because of the different focuses, recommendations by different rationales often conflict. For example, extensive co-ordination of public

transport services is without doubt a highly recommendable policy from a technical perspective. Normative descriptions of such co-ordination by engineers assume some form of monopolised control, a single designer for the entire system. This leaves little room for competition between operators fighting for the interests of the traveller. This is a highly recommendable policy from an economic perspective. These are the conflicts a policymaker has to understand in order to deal with the variety of rationales offering him advice on the organisation of metropolitan public transport. Table 11 gives an overview of rationales.

The policymaker can use the recommendations to improve organisation, to see his options, and to understand the constraints he has to deal with. These constraints are best described as inert aspects of the public transport system. Spatial constraints lie in the current build up of the urban fabric. Institutional constraints are given by the current structures and processes of decision-making, both in a public and in a private context. Technical constraints rest in the existing technologies, both in infrastructure and in vehicles. The remaining part of this study will focus on understanding the meaning of the rationales for the organisation of public transport as a whole.

4 The empirical base: Roads to roam

Truth implies experience.

Emmanuel Levinas
La philosophie et l'idée de l'infini
In: Revue Philosophique de la France et de l'Etranger 1957, 7/9, pp. 241-253

4.1 Introduction

Around us we see a variety of ways to organise metropolitan public transport. Every specimen of organisation is the result of years of accumulated actions by those involved, forming, shaping, and changing elements of that organisation. All actions, large and small, take the organisation in a specific direction. That direction can be understood from a number of angles. The angle of importance to this study is the role of different rationales in the development of organisation. Any empirically-driven research project tries to understand how a number of variables relate in a number of cases. Because the project's limited resources, it can only handle a limited number of variables, relations, and cases. The multidisciplinary character of this research increases the number of variables and relations under study. Chapter 3 has shown the variety of variables over the rationales and the fact that the rationales do not always agree on the direction of causality in the relations. As a consequence the number of cases has to be limited.

The variety of variables and their mutual relations can only be described in a rich picture of a limited number of cases. The large number of variables and the uncertainty about the direction of causality offers us an extended but simple research protocol: a checklist (see Supplement C). The protocol aligns the different empirical phenomena discussed in Chapter 3 without a priori establishing the relations or hierarchy between the variables. Variables which were taken into analysis come from all rationales. They incorporate all relations between actors and include basic population data, regulatory regimes, services on offer, institutionalised interaction processes between the different actors, and urban structures.

Studying the empirical interactions between rationales in the organisation of public transport excludes a research strategy treating large parts of the system as a black box. It requires an open approach to a wide variety of variables and causal mechanisms. This also inhibits a traditional cross-case comparison: side-by-side comparison of preselected "independent" and "dependent" variables (see Supplement F), limiting the differences between the cases to these variables. In a multidisciplinairy context, the number of variables is simply too large and the relationships between them uncertain. Instead, this chapter will assess the cases separately and present the lessons learned within each case. These lessons come from the experience of those directly involved in the organisation of public transport, and from local observers in the media and academia. The focus here is on the local problems and the solutions sought to correct or mitigate those problems.

The case descriptions for the selected cases will track the following path: Firstly, an introduction is given, presenting the area including population data, public transport services, and urban structure. Secondly, a short description of the organisation of public transport within the region is given, including the regulatory regime, interaction processes, and financial streams. A distinction can be made in all cases between the traditional set up, the restructured organisation, and the reflection and tuning of its operation from the restructured organisation. Thirdly, the performance of the systems is presented, using local indicators of efficiency and effectiveness. A wider analysis of the qualities of the system is added, based on the perceptions of those involved in the system. Fourthly, the lessons learned are summarised. The aim is to understand the contribution of different rationales to the solving of empirical problems, and to understand the effect of rationale-biased solutions. Assesments given in these sections reflect the opinions of the interviewees and the literature. Fifthly, an analysis of the roles of different rationales in the organisation and their effects on the performance is presented. The aim is to understand the contribution of different rationales to the solving of empirical problems, and to understand the effect of rationale-biased solutions.

This chapter explores four cases of metropolitan public transport organisation. The selection is presented more extensively in Supplement D. Three of the four cases were selected from 75 possible cases in Western Europe. Firstly, they were selected on the basis of their comparability to Dutch cases. Secondly, 20 of the 75 possible cases were selected on the basis of two general measures of success. These measures were effectiveness in attracting travellers and efficiency in delivering public transport to the area, and the variety in their organisation. Modal split was regarded to be a indicator of the effectiveness of public transport on a policy level, under the assumption that policy makers would desire public transport to mitigate the

effects of car use. Cost recovery is regarded to be a general indicator of efficiency of the system as a whole on a policy level. It optimises the amount of public transport offered, given a specific amount of subsidy under the assumption that prices and number of travellers are constant[7]. These specific operationalisations of performance indicators where used to select cases and later will be used for the simulation game. They do not represent the specific operationalisation this study want to use for performance indicators. Different rationales offer different operationalisations of efficiency and effectiveness. A priori excluding other operationalisations than those presented here would harm the multidisciplinary character of the study. In addition, the selection did not seek the best cases, but rather good examples of a variety of organisational forms, on which bases 10 of the 20 possible cases were selected. Contact was made to universities in these regions to support the research, which enabled the selection of three of the 10 possible cases. One final Dutch case was added as a comparative case in a Dutch setting.

Step	Criterion	Source	Cases
0	Western European public transport systems in metropolitan areas	Bushell [1994]	75
	Selected metropolitan areas are situated in Western Europe		
1	Comparable to Dutch metropolitan areas in size	Bushell [1994]	42
	Selected metropolitan areas have between 100.000 en 1.000.000 inhabitants		
2	Systems relatively outperforming others - Modal split - Cost recovery	Bushell [1994] Survey 1997	20
	Selected metropolitan areas have relatively high modal split and low percentage of subsidies		
3	Diversity of organisational forms	Survey 1997	10
	Selected metropolitan areas show a diversity in organisational forms		
4	Possibility to do extensive research	Inter-views	3
	Selected regions reflect divers organisational forms and offer possibilities to do research		
5	Additional Dutch case	Inter-views	4
	Willingness to participate		

Table 12
Procedure of case selection

[7] On operator level a preferable performance indicator of efficiency would be cost per vehicle kilometre or seat kilometre, but this indicators seeks to represent efficiency for the whole organisation and from the generalised policy perspective.

For each case about 20 people were interviewed, from government and operators (a complete list of those interviewed is available in Supplement E. In addition, extensive desk research was undertaken, including policy and company reports, legislation, news and scientific articles, passenger counts, and timetables. This study does not offer enough room for a complete description of each case. Each analysis here is based on a more detailed and extended case report.

It is important to understand that the role of the cases is **not** to make a detailed comparison on a wide variety of design and performance variables, as they were deduced from the different rationales in Chapter 3. Readers interested in such a comparison can find it in a table in Supplement D. This table is added to present a general overview. Rather, the variety of variables is studied **within** each case to understand the role, **within** each case, of the different rationales. The cases are compared on how they use the different rationales in their organisation, **not** on how a wide variety of possible design variables relates to a wide variety of possible performance variables. A comparison of the cases including such a large number of variables without an theoretical framework, does not offer the possibility of a meaningful analysis.

This means that the reader is presented with a wide variety of design and performance variables in the cases, without a great deal of interpretation. This enables the reader to evaluate the analysis at the end of every case of the use of rationales. It also enables the reader to look at the details of the cases, for example for comparison to his or her own organisation. The reader will discover that in the cases a variety of performance measures is used. This would hamper a case comparison on these specific performance indicators, but it helps understand how different rationales are used within the cases, as the operationalisation of performance also varies between rationales.

4.2 Canton Zürich: Government allocation

4.2.1 Introduction

The canton of Zürich is situated in the central northern part of the federal state of Switzerland. The canton covers an area of around 1,700 square kilometres and is inhabited by 1.2 million people. This means the average population density is about 700 inhabitants per square kilometre. Of these people, about 343,000 live in the city of Zürich (92 km^2); the remaining inhabitants are scattered over 170 other *Kommunen* (municipalities or communes) in the canton. The city of Zürich is clearly the centre of the region. Within the canton only Winterthur (87,000 inhabitants) is a major urban centre. All other urban centres have fewer then 30,000 inhabitants.

The area is relatively mountainous. Together with Lake Zürich, the mountains shape the urban structure into corridors. The most important traffic routes for both rail and road follow the banks of the lake and the valleys. The core of the urban structure lies on the northern shores of Lake Zürich, along the two lobes of the shores that stretch south. To the northwest, the wide Limmat valley contains the major part of urban Zürich. Due to the restrictive nature of the landscape, urban densities are relatively high. Moving in the north-eastern direction, the built-up area stretches out to Winterthur. Major expansions of the city stretch out further along this corridor.

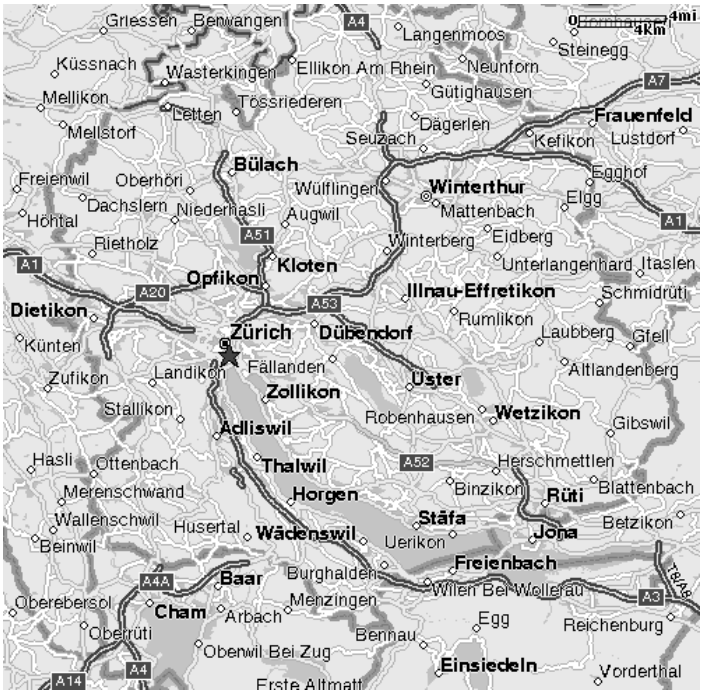

Figure 11
A map of the canton of Zürich

Of course both canton and communes develop plans for both urban development and traffic infrastructure. In these plans public transport plays a major role. An example on parking is the limitation and pricing of parking space throughout Zürich city centre. An example on traffic flow is the development of single-lane tram stops. These bottlenecks in the main roads in the city of Zürich limit car speed and improve public transport passenger safety at tram stops. An example of urban planning is public investment in

the development of station areas. Strict parking policies are in force within the city of Zürich.

Public transport in the area is of a high standard, especially within the corridors. An extensive network of *S-Bahn* (metropolitan rail) services spreads out over the canton and beyond. In the urban environments extensive tram, trolley and bus services complement the S-Bahn. Regional bus services in the rural areas are well integrated to the S-Bahn system. Apart from the SBB S-bahn services and urban and regional bus services, other public transport services in the canton are ferries, funiculars, and night buses.

In the Zürich case, governmental control of public transport is significant. A government-controlled authority defines the services, which are operated by public services or limited companies. This section is based on a more comprehensive case study of the Zürich case. It describes the Zürich case as observed in March and April 1996. Later changes are only part of this analysis when explicitly mentioned.

First, the organisation of cantonal public transport is discussed. The focus will be on the structure and the processes of GO-level, OO-level and OT-level interactions, where G stands for government, O for operator and T for traveller (see also page 32). When discussing the structure, actors, tasks and financial arrangements will be considered. Second, the performance of the system will come under scrutiny. Third, the lessons that the actors involved have learned themselves will be discussed, followed by an analysis of the organisation in terms of rationales and interaction levels.

4.2.2 Organisation of public transport

The organisation will be discussed in the following items: actors involved and their relations, the regulatory basis for operations, the process of definition of services, and financial arrangements. The actors involved in the provision of public transport within the canton are:

- The Swiss confederation,
- The canton of Zürich,
- The 177 communes (municipalities) within the canton,
- The Zürcher Verkehrsverbund (ZVV),
- The 42 local operators of train, bus, tram, funicular, and ferry services
- The national railway operator *Sweizeriche Bundesbahn* (SBB).

These operators work under different regulatory and subsiditory regimes, depending on the type of service they offer and their organisational status. Three types of ownership exist:

- Federal services,
- Municipal services, and
- Shared municipal and private stockownership.

Schweizerische Bundesbahn (SBB) and *Postauto* are federal service branchess. The *Verkehrsbetrieben Zürich* (VBZ) and *Winterthurer Verkehrsbetriebe* (WV) are municipal services. The other companies are limited companies with stocks mostly held by public entities, either the canton or municipalities.

Public control of public transport is strong, ranging from control of market entry to service development. All operators except SBB are *konzessionierten Transportunternehmen* (KTU). Entry is granted by the canton, through the provision of a concession. Entry to the market is limited; the concessions are monopolistic and lasting. The confederation grants the entry to the long distance and regional rail market, in which SBB is the most important operator.

The ZVV plays a major role in the further control of public transport. The ZVV is the central actor in public transport within the canton. The ZVV is the agency that controls the operators. The operators themselves are represented in the ZVV in *Fachkommissionen* (subject committees). An overview of the tasks and responsibilities concerning the provision of public transport in the canton is given in Figure 12. The light gray shows public tasks, the dark gray the tasks of private operators.

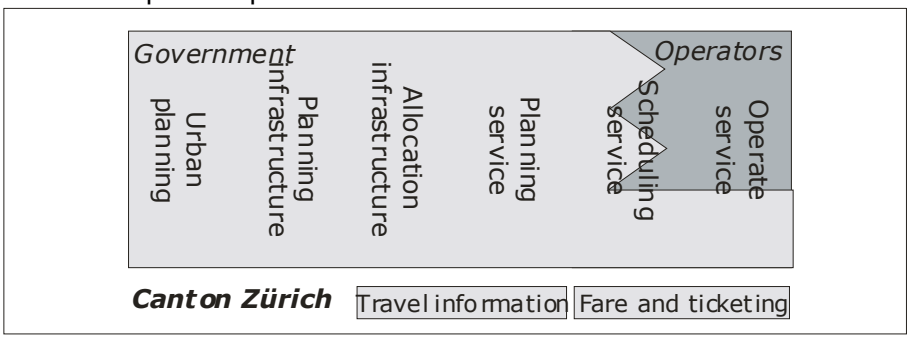

Figure 12
Distribution of tasks concerning public transport in the canton of Zürich

The controlling body of the ZVV is the *Verkehrsrat* (transport board). The cantonal government exerts a strong influence on public transport services in the region, through its central role in the Verkehrsrat. The Verkehrsrat further holds representatives from the confederation and different municipalities.

As the public transport authority, the ZVV plays a central role in the processes through which public transport services are defined. The canton develops general policies on strategic changes, supply of services, and pricing. The municipalities have the right to be heard during these processes.

Based on these policies, the ZVV plans most services in co-operation with SBB. During planning, other actors are heard at the *Verkehrskonferenz*

(transport convention). In the *Lokalverkehr* (the larger part of bus services), concession holders operate services under gross cost contracts and are reimbursed for their costs. An exception is made for large urban operators whch plan their own services in co-operation with the ZVV, also under gross cost contracts.

The Swiss governmental system makes wide use of the instruments of direct democracy. Extensive changes to the public transport system can be subject to referendum. This was the case with the introduction of the ZVV. In addition, citizens may start their own referendum, either presenting their case to the government or contesting a government decision.

S-Bahn services are financed under the regime of the *Regionalverkehr*. SBB regional management develops its own schedules in negotiation with the ZVV. SBB Kreis 3 partly operates under the regulatory and financial regime of the *Regionalverkehr* and receives funding from both ZVV (canton and communes) and the confederation for income lost due to the integrated ticketing. Their normal fares are higher than the integrated fare, for which they receive compensation.

The federation determines cantonal contributions to the *Regionalverkehr* every two years in the *Verordnung über die Anteile der Kantone an die Abgeltungen und Finanzhilfe im Regionalverkehr*. This directive sets the percentage every canton has to contribute to regional transport is based primarily on the *Steuerkraft*, which means all revenues on the basis of local or regional income tax. For 1996, the contribution for Zürich canton was set at 33 percent of the total budget. In addition, SBB receives funding directly from the ZVV, for income lost due to the influence of the ZVV on the schedule.

The contributions of the canton and communes to the *Lokalverkehr* (the bulk of services in the canton) are also budgeted every two years, in the so-called *Rahmenkredit*; the canton and combined communes contribute 50 percent each. The distribution of the communal 50 percent over the different communes is based on an index of service levels in the commune (80 percent) and the tax revenue of the commune (20 percent). Contributions to the *Lokalverkehr* are paid for out of the property taxes of both the communes and the canton. The ZVV plays a central role in this redistribution of funds. It also collects the fare-box revenues. An overview of financial flows concerning the provision of public transport in the canton is given in Figure 13. The rectangles show the parties involved. The arrows show the flow of funds and the basis of the amount.

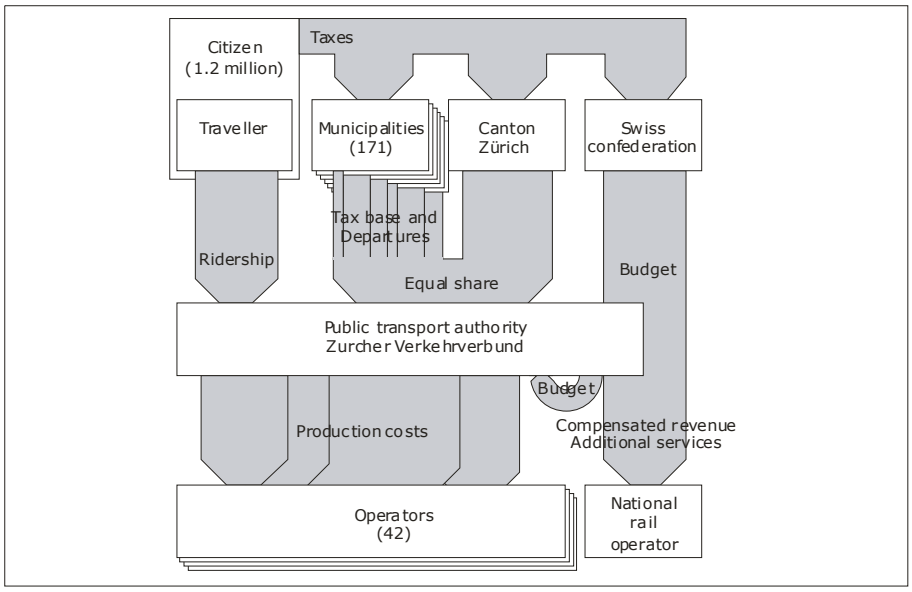

Figure 13
Financial streams and their basis in the canton of Zürich

The canton and the ZVV were confronted with a number of weaknesses in this approach, which will be discussed in Section 4.2.4. In the early 1990s a limited form of benchmark competition was introduced. The ZVV transferred some small concessions of inefficient operators to more efficient neigbouring operators. But the makeover of the organisation took a more dramatic turn in 1997. A distinction was made among the operators. The eight largest operators became the *marktverantwortliche Transportunternehmen* (MTU) and each one held of one of the eight concessions: six regional concessions, a rail concession and a shipping concession. The responsibility for scheduling and marketing in the concessions was decentralised to the MTU's. The execution of services could be tendered to other operators – the remaining of the KTU's. In addition, revenue would not go to the ZVV, but to the MTU's. The changes were a move away from centrally planned services, including the centralised finance system. The importance of the ZVV was drastically reduced from a public transport planning authority to a holding company for the 8 largest operators.

This is the way ZVV has been working since. An important effect was a siginificant consolidation among the KTU's. Of the more than 40 KTU's in the early 1990's only 12 were still offering services in 2002, along side the 8 MTU's. During those years of competition between operators and consolidation the cost effectiveness of the whole system was improved significantly, from 47 in 1996 percent to 58 percent in 2001. In the same

period the number of travellers was also growing slowly, with about 1 percent per year

4.2.3 Performance of public transport

Centralised planning ensured full integration throughout the canton at all levels. This section assesses the level of quality offered to the traveller and how the efficiency of the public transport services. The total number of boardings in the canton topped 350 million in 1996, which is, on average, 322 boardings per inhabitant. First, the focus is on the different performance indices concerning effectiveness. In the second part of this section the focus will be on performance indices concerning the efficiency of the system.

Most interviewees considered the quality to be relatively high, compared to other European systems, especially after the introduction of co-ordination through the ZVV. Speed is an important aspect of that perceived quality. On longer distances, the average speed is standard, with the backbone of the S-Bahn reaching all major origins and destinations. The average fastest travel time between 8 and 9 a.m. on a normal working day travelling to Zürich Hauptbahnhof from three selected nodes (Wadenswil, Winterthur and Baden) is 19 minutes, using SBB fast trains. Travel times vary greatly between the lines and services: for S-Bahn services the average is 33 minutes. On the Baden line, an intercity service offers a travel time of 16 minutes. Travel-time from Baden can reach as much as 37 minutes using the S-Bahn. Intracity speed in the city of Zürich is considered high, but is relatively slow. The average travel-time of three main tramlines on a 10-kilometre trip to the centre is 34 minutes.

Travel time consists of time to access the system, driving, waiting time (entering and connecting), and to leave the system at the destination. Frequencies are high, so are the reliability and predictability of the services. At a metropolitan level, basic frequencies on the S-bahn lines are 1 (S1) every hour to 4 (S18) every hour. Because lines are bundled into the city, frequencies closer to Zürich are doubled, tripled and sometimes even quadrupled. Also frequencies are higher during peak hours. The basic frequency of tram services within Zürich during the main operating hours is 10 times every hour; outside these hours frequencies can drop to 8 or 6 every hour. Again, bundling leads to higher frequencies closer to the city centre. These bundles split again when they pass the centre, to provide direct access to the various parts of the centre.

Though the need to transfer is built into the system and transfers are frequent, waiting times are low; typically, peripheral changes from bus to S-Bahn and vice versa take less than 5 minutes. Outside the city centres, waiting times are kept low by scheduled connections. Services in urban areas

have relatively high frequencies, also leading to low average waiting times. Waiting times do not vary substantially between peak and non-peak.

	Prices	*April 96*
Type of ticket	*Euros*	*Hamburger Std.*
Single trip within centre	1.20	0.34
Day card within city centre	4.08	1.15
Day card for whole region	16.32	4.61
Travelling into city centre (10 kilometres)	2.43	0.69
Travelling into city centre (20 kilometres)	5.10	1.44

Table 13
Prices of selected trips in the canton Zürich

The interviewees regarded public transport in Zürich to be relatively expensive to use. The canton is divided into 46 zones. The price for intra-zonal trips, valid for half an hour, is €1,33. Urban trips are priced higher. Single tickets can be upgraded to be valid 24 hours at double the price. Prices do not vary in time: one price system is in use throughout the day. Table 13 shows the selected prices for the Zürich case.

The "travelling into the city from 10 kilometres" price represents the mean of three prices between the city centre of Zürich and three major nodes at approximately 10 kilometres distance in different directions (Regensdorf, Zollikon, and Opfikon) at peak hours. The "travelling into the city from 20 kilometres" price represents the same average between the city centre of Zürich and three major nodes at approximately 20 kilometres distance in different directions (Wädenswill, Winterthur and Baden). The corrected prices show a simple way of cost-of-living correction using the Hamburger Standard[8] prices to correct for general price level.

In general, travellers are quite content with the level of service offered by public transport companies in Zürich. Research shows that the majority is content with the services. The value of public transport to the population of Zürich is reflected in the modal split numbers discussed below. To underline the difference between the old, pre-ZVV quality of services and ZVV services, it has to be said that public transport ridership rose dramatically. Following the new integrated timetable and ticketing system, demand grew 20 percent on average; though demand within the city of Zürich dropped slightly. S-Bahn or suburban heavy rail ridership rose 40 percent. Of course, this massive growth is the result not only of an integrated network of services, but also of

[8] The Hamburger Standard or Big Mac Index was introduced by *The Economist* and is regarded a simple and effective means of correcting prices for price level. It is based upon the 'Purchasing Power Parity' (PPP) theory. The PPP argues that, in the long run, the exchange rate between two currencies should move towards the rate that would equalise the prices of an identical basket of goods and services in the two countries.

the totally new S-Bahn system (though heavy rail services were offered before the introduction of the ZVV), massive investments in infrastructure, a clear and well-communicated network, and growing congestion on the roads.

The above shows that the effectiveness of the system as perceived by the interviewees is relatively high, though prices are high. The relatively high fares though do not render subsidies superfluous. The efficiency of the system is considered to be a problem. Centralised planning achieves some efficiency gains through synergy. On the other hand, it excludes the possibilities for tuning services to local situations and customer needs.

The quality of the services leads travellers to choose public transport relatively often, even though prices are relatively high. Table 14 shows the modal split of commuters travelling in and out of Zürich. The modal share for public transport in general in Switzerland in trips in 1996 was 23 percent. The modal share for Switzerland as a whole and in kilometres is 21 percent [Litra Verkehrszahlen, 2000]

1990	*Public transport*	*Individual motorised transport*
City of Zürich	78	22
City of Winterthur	59	41
Rest of the canton	18	72
Canton of Zürich	62	38
Switzerland	21	79
Percentage of active members of the workforce commuting within the region to and from work using public transport and individual motorised transport		

Table 14
Modal split in trips in the city and canton of Zürich, (Source: ZVV, 1995)

The total subsidy for 1996 amounted to €270 million for all services in the canton, which is €225 per inhabitant. The income from travellers in 1995 covered for 47 percent of the total cost of the public transport system. Additional income came from advertising and covered 9 percent of the total cost. The remainder (44 percent) was covered by subsidies from the confederation, canton and communes. These numbers focus on public transport services operated within the ZVV framework and exclude SBB services other than the S-Bahn.

4.2.4 Lessons learned

The case of the canton of Zürich teaches us a number of lessons. These lessons were learned and formulated by the operators, confederation, and the ZVV. They signalled a number of problems. First of all, operators occasionally rejected timetables compiled by the ZVV. On specific routes and stations, some operators simply denied that it was possible to operate according to ZVV calculations. The integrated schedules required top-down development of

the schedules. The operators pleaded for a more bottom-up development of services, taking into account traveller demand and traffic situations. The organisational boundary, the negotiating relationship and the asymmetric information between the planner and the operator proved to be an obstacle to the integrated balancing of the two.

Because of the unchallenged monopolies of the operators, the relation between the ZVV and the operators is largely based on negotiation. In addition, the asymmetric information between planner and operator means these negotiations were not conducted on equal terms. The ZVV knew little about the real (im)possibility of its schedules.

A second problem the ZVV indicated was related to the efficiency of the operators. The ZVV regarded the efficiency of service provision to be substandard. The ZVV was partly able to control the performance of the individual operator through benchmarking. The ZVV informally compared the efficiency of the different operators and urged them to improve when they performed under par. Though not an absolute incentive for efficiency, this gave the ZVV some leverage over the companies. But still it left the ZVV unsatisfied about the efficiency of the system.

A third problem signalled by the confederation occurred through matching financial and influential regimes for public transport that did not match. Two different financial regimes worked side by side, for the Regionalverkehr and Lokalverkehr. For service definition, though, only one system existed. Communes did not contribute financially to Regionalverkehr (i.e. the S-Bahn), but through the Verkehrskonferenz they could demand S-Bahn services. This led to shifting demands from the communes towards more railway services, away from bus services.

A fourth problem signalled by the ZVV was the rigidity of the schedules. Full integration of services led to problems both at the operational level and at the tactical level. At the operational level, disruption of the S-Bahn service could mean the disintegration of large parts of the public transport network in the canton. At the tactical level, small changes to the schedule on a specific line had consequences for the entire system. Tight coupling of services led to rigidity in the schedules. The strict ZVV control on planning the services reduced the creativity of the operator to tune services to localised needs or situations.

These problems demonstrate a number of issues. First of all, they show the limits of co-ordination. These limits were reached in the Zürich case. Co-ordinated scheduling of public transport services is impossible without extensive modelling. Modelling serves the purpose of understanding the complexity of the integrated schedules and making them manageable in the design process. But the implementation of calculated schedules has proved to be a culprit.

In addition, not only are the co-ordinated schedules hard to implement, but to some extent full co-ordination itself hampers the lasting quality of the overall service. Tightly coupled services reduce the flexibility of operation and planning. Though co-ordination offered a clear and lasting product to the customer, this rigidity made it very hard to respond at the operational level to service disruption, and at the tactical level to shifting demands.

Finally, the case shows the distorting effect a financial system can have on the performance of a system. Both the relationship between the communes and the ZVV and the relationship between the ZVV and the operators suffered under this distortion. The nature of the communes' financial contributions by different governments to the ZVV caused growing demands by the municipality for rail services rather than bus services. ZVV regarded the operators as relatively inefficient, when compensated for their production costs by the ZVV. This underlines that the choice of financial relationships is an integral part of the whole organisation.

The decentralisation of scheduling, financial responsibility and commissioning that took place in the late 1990s targeted many of these issues. It uncoupled scheduling in the different regions, which improved flexibility. It brought responsibility for fare-box revenue to operators, giving them the incentive and the chance to tune services to travellers' wishes. It brought planning to the operator, reducing the asymmetric information between planner and operator. It introduced competition, which indeed improved efficiency, without losing travellers.

The case teaches us that full integration of services does not necessarily fit into the unruly real world; it provides little adaptability to both changing traveller preferences and disorder of the road. Integration reflects the scheduler's perspective on the traveller; it offers speed and coverage to services. It can provide an attractive, clear product, but at high costs: inflexibility and inefficiency. The case shows the complexity of reaching the right balance between clear concept and changing individual traveller preferences.

4.2.5 Evaluation: Rationales and interaction levels

The Zürich case is a typical example of centralised co-ordination and planning of public transport services in the way the Section 3.4 service scheduler would prefer. The case shows that centralised co-ordination at the scale presented is highly dependent on the model-based development of schedules and strong public control. This approach offers a number of advantages. Centralised planning gives immense possibilities for planned integration of different services. A single planning agency, in this case the ZVV, is able to reach synergy through combined planning of services using different

transport techniques. Planning the interconnection of services is based on hierarchical steering, operator responsibility, and the ability to put into effect that responsibility.

The organisational design focuses on OO-level interactions, in which operators optimise their services between different transport techniques. The role of the ZVV is to give a hierarchical basis for these optimisations. Interactions between operators are placed within a formal organisational framework in which the ZVV represents the integrative linchpin between the commissioners of transport services (the confederation, canton, and communes) and the operators of those services.

The problems presented in Section 4.2.4 can be understood from the strong focus of the system on OO-level interactions. This focus on OO-level interactions did draw attention away from design questions concerning GO-level and OT-level interactions. Both subtler arrangements for commissioning services and the subtler tuning of services towards differentiated groups of travellers were ruled out by the centralised operations.

Co-ordinated ticketing was implemented using the centralised collection of fare-box revenues. For ease of implementation the operators received gross cost contracts, which meant revenues and subsidies were redistributed to the operators on the basis of production cost, rather than on the basis of performance. This meant operators did not receive any extra income for extra customers, and marginal profits were non-existent. As a consequence, the role of travellers in allocation choices by the operators and the ZVV was significantly reduced. In addition, integrated ticketing required centralised pricing, leaving little room for local or special prices, for example peak-hour pricing which might improve the efficiency and quality of services by levelling out demand.

Co-ordinated scheduling was implemented with considerable organisational distance between the planner and the operator of the service. The ZVV enforced its calculated reality on the operators, which left little room for real-life public transport operations. The manoeuvrability of the operators was minimised, either to increase efficiency or to improve effectiveness by tuning services to localised situations or needs. In addition, it limited the manoeuvrability of the ZVV itself for tuning services to changing demand.

Finally, *co-ordinated planning* forced the integration of transport techniques under different regulatory regimes. At the national level, the regulatory regimes did not match the organisational structure under which the ZVV, the canton, and the communes operated. The balance between clear financial relations and integrated planning was lost, leading to strategic demands by the communes.

After 1996, the ZVV introduced two changes to mitigate these problems, borrowing from other rationales. To improve efficiency, the ZVV

decided to bring in elements of competition; smaller operators would have to compete for concessions. This change does justice to design questions at GO-level interactions. Competition is a possible incentive to efficiency and, perhaps, to effectiveness. In addition, decentralisation of planning and scheduling to the larger operators mitigated the conflicts between the ZVV's and the operators' realities. This change also does justice to design questions at OT-level interactions, offering more possibilities to the operator to tune services to local situations and demands.

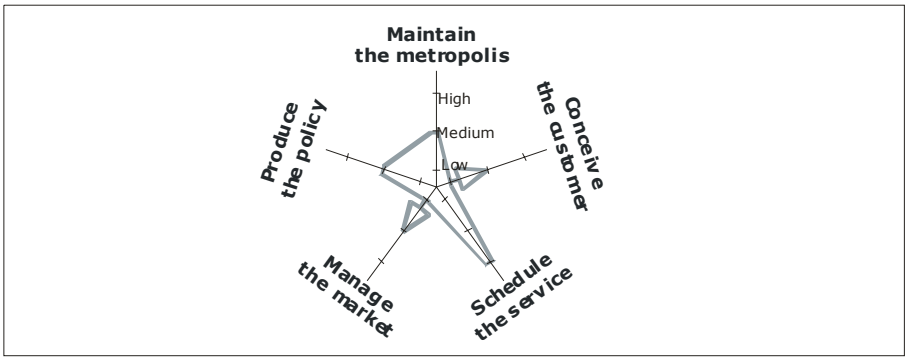

Figure 14
Interpretation of the importance of the rationales in the organisation of public transport in the canton of Zürich

Prior to the 1996 change, one could have argued that one rationale dominated the organisation in Zürich: scheduling the service. Co-ordination of services has been the leading concept for both the centralised task of the ZVV and the financial and organisational systems that made that centralised form possible. Other important rationales could be found in maintaining the metropolis and producing the policy. The coupling of the urban structure and public transport in Zürich, however, was only partly designed into the organisation. The fact that the landscape itself restricted urban development to corridors played an important role. The strong focus on public transport followed from natural conditions, rather that from policy prescription or organisatoional design. The monopolistic operators had long term relations with the authorities, providing an environment for productive interactions and co-operation, and complex and sizable innovations. Figure 14 interprets the design rationale of the organisation in a single picture. The line shows the how the different rationales were present in the primary design.The arrows show the rationales that drove the secondary organisational changes.

The changes after 1996 added competition, in an attempt to better manage the market. The ZVV tried to find an organisation combining the co-ordinative strength of centralised planning of the larger operators with the efficiency gains through competition between the smaller operators. They

also included a new incentive to conceive the customer, remunerating the larger operators for their efforts by paying them for performance rather than for cost.

4.3 Tyne and Wear County: Free market allocation

4.3.1 Introduction

Tyne and Wear County is situated on the northeastern shores of England. The area is divided into three zones by its name givers: the rivers Tyne and Wear, which both flow eastward. The infrastructure has a typical radial structure, focusing on Newcastle-upon-Tyne. Only the coast and the rivers disturb this radial structure. Centrally located in the region are the cities of Newcastle-upon-Tyne and Gateshead. Car ownership in the county is relatively low compared to the rest of England, as a result of lagging economic development in the 1980s.

The area covers four metropolitan districts (North Tyneside, South Tyneside, Gateshead, and Sunderland) and one city council district (Newcastle-upon-Tyne). The number of inhabitants goes up to 1.1 million over nearly 600 square kilometres, giving an average population density of around 2000 inhabitants per square kilometre. The city of Newcastle is the economic centre (260,000 inhabitants), but economic activity is spread out over the area. Gateshead, south of the river Tyne has around 200,000 inhabitants, North Tyneside around 190,000 inhabitants, South Tyneside around 155,000 inhabitants, and the coastal city of Sunderland around 290,000 inhabitants. The relatively high population density is the result of a close fit between the territorial boundaries and the urban area in the region.

The county is multi-centred. An example is found in the pattern of shopping centres, including central Newcastle and Gateshead, and MetroCentre, a very large peripheral shopping mall. This multi-centred character also typifies job locations, which are relatively industrial and located in large production plants outside city centres.

Figure 15
Map of Tyne and Wear County

Public transport in the region consists of regional train services on two lines (Whickham to Sunderland and Durham to Cramlington), a regional metro service, and a large variety of bus services. These different types of service have little integration in terms of ticketing. Techniques coexist or compete for market share. Apart from rail, metro, and bus services, public transport in the area also comprises express buses, demand-responsive buses and night buses.

In the Tyne and Wear case, allocation of resources is mainly in the hands of private operators under limited government control. Primarily services are based considerations of the individual operator with hardly any interference from governmental actors, though the autority might consider adding services to the market. The presentation here is based on a more comprehensive case report and represents the situation as it was in September and October 1996. Though further changes might have occurred, they are presented only briefly.

Firstly, the organisation of county public transport is discussed. The focus will be on the structures and processes of GO-level, OO-level and OT-level interactions, where G stands for government, O for operator and T for traveller (see also page 32). When discussing the structure, actors, tasks and

financial arrangements will be considered. Secondly, the performance of the system will come under scrutiny. Thirdly, the lessons which the actors involved have learned themselves will be discussed, followed by an analysis of the organisation in terms of rationales and interaction levels.

4.3.2 Organisation of public transport

The organisation of public transport in the county changed dramatically in October 1986, from subsidised government services to completely private operators in a free market. This change fragmented service provision. The provision of public transport services is the result of a number of relatively disjointed processes. A number of actors play roles in these processes:

- The English government,
- The five councils in the region,
- The Passenger Transport Executive (PTE/Nexus), and
- The 23 private operators.

The *English government* plays an important though distant role. As in other countries, the national government sets general regulations for the sector. Important for the organisation of public transport in Tyne and Wear is the 1985 Transport Act that opened up the English bus services market outside London and eliminated government control, based either on ownership or on the provision of concessions. Some regulation still applies to the public transport operators. Operators of public bus services first have to obtain a licence to run so-called public service vehicles (PSV's). In addition, they have to register changes in their timetables or new services 42 days in advance. The national government has two more bodies regulating the market. The Office of Fair Trading (OFT) regulates market behaviour, and the Monopolies and Mergers Commission (MMC) regulates market structure. Apart from limited regulation, the national government subsidised public transport through a fuel duty rebate in 1996.

At the *regional level*, government tasks in public transport are brought together in the Passenger Transport Executive (PTE), an authority operating under the name of Nexus. Nexus combines the different government tasks in public transport for the different councils in the county. Those tasks include:

- Operating Tyne and Wear Metro and the Shields Ferries,
- Tendering for 'socially necessary' bus services in Tyne and Wear,
- Subsidising the Sunderland - Newcastle railway line,
- Administering the Tyne and Wear Concessionary Travel Scheme,
- Providing public transport information,
- Giving transport policy advice to the PTA and district councils.

The Passenger Transport Authority (PTA) controls the execution of tasks by the PTE. The PTA consists of a group of fifteen elected local councillors, who are nominated to serve in the PTA by the five district councils

in Tyne and Wear. The fifteen positions are allocated on the basis of size of population in the District Councils: Newcastle (4), Sunderland (4), Gateshead (3), North Tyneside (2), and South Tyneside (2). In addition, the councils contribute financially to the PTE on the basis of the number of inhabitants.

Figure 16 shows an overview of the division of tasks in the Tyne and Wear County. The light gray shows public tasks, the dark gray the tasks of private operators.

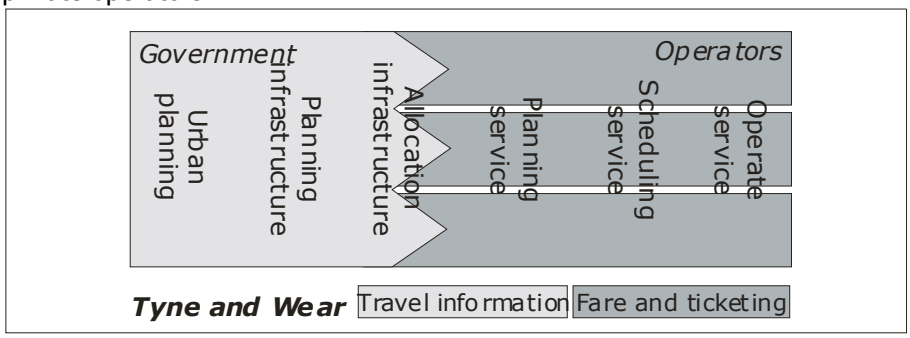

Figure 16
Distribution of tasks concerning public transport in the Tyne and Wear County

Private companies run all bus lines, of which 88 percent are wholly developed and funded by the operators. The operators set prices, mostly on a kilometre basis. The prices for bus services are not regulated. Changes to schedules are also at the discretion of the operator, although the process is regulated. Operators have to announce changes to their services 42 days in advance to the national traffic commissioner for the region. The commissioner informs the PTE of the changes. British Rail Regional Lines runs regional train services in the region. The PTE runs the Metro services and the Shields Ferries under full public control.

Although the autonomy of the operators is high, a number of interactions exist between the PTE and the operators, adding to the basic services. Of the remainder (12 percent) of the bus lines, 9.8 million bus kilometres are secured through tendering by the PTE under its task of upholding socially-necessary bus services. The PTE can tender additional services on established bus lines or tender the provision of a complete service. Suggestions for tendering are made by local councils or the PTE. Eventually, the PTA approves the tender.

In addition, the PTE provides facilities for all operators by providing travel information to the traveller. These facilities include the publication of comprehensive travel information, 10 travel centres, and a telephone inquiry service. The district councils also provide facilities in terms of bus stops and stations. Bus stations are operated by the PTE or tendered to a bus operator,

under rules of stop allocation to different operators. Operators pay departure charges for the use of the facilities.

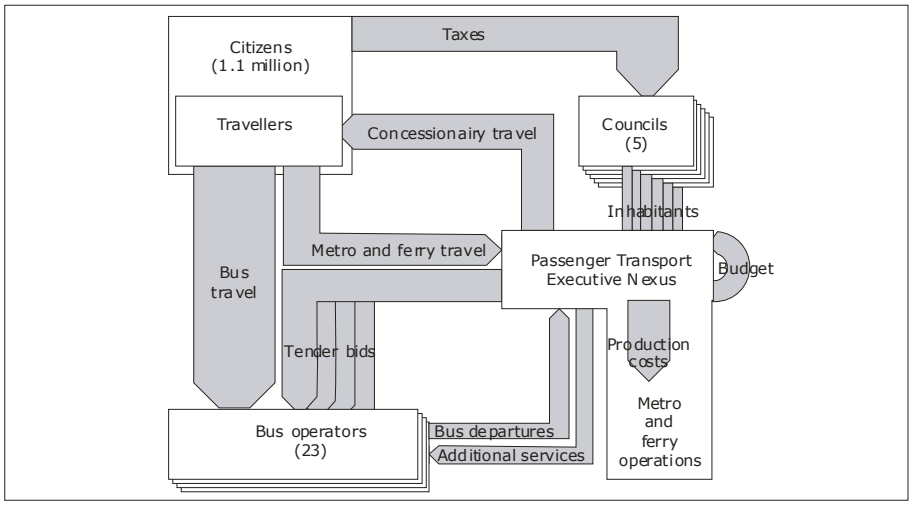

Figure 17
Financial streams concerning public transport in the Tyne and Wear County

Furthermore, operators and the PTE have agreed on two types of ticket integration. Firstly, a basic system of network tickets is in place. The tickets are valid for a week, a month or a year, are valid for specific zones or the entire network, and differentiate between peak and off-peak hours. Pricing is based on a zonal ticketing scheme. Income from network travel tickets is redistributed amongst the operators. Secondly, 90 percent of bus services offer simple ticket integration with the Metro system under the Transfare scheme. Single tickets can be used on a single journey using a connecting bus and Metro service. Redistribution of revenue through Transfare is considered to be negligible. The systems works under the premise of averaging out between inbound (bus-metro) and outbound (metro-bus) singles and is settled without payments. Moreover, the PTE administers the concessionary travel scheme. The PTA provides cheaper rates for the registered elderly and handicapped. The operators are compensated for loss of revenue. In terms of financial contributions, this is by far the most important interaction between governments and operators. Finally, the Newcastle council stimulates public transport in its development plan. The 1994 development plan states that bus access to the centre must be improved in the city, with a possibility for introducing bus priority access on road in the city centre.

The development of services is in mixed hands, though it is fair to say that commercial development of bus services is the major force. Metro and ferry service development are in the hands of the PTE; bus service development is for largely in the hands of private operators. Their view of market developments steers the development of services. The PTE follows that development and adds to the commercially developed services.

The leading role of the private operator implies that the structure of the market is as important as the formal structure of the organisation. Of the 23 operators, nine are part of to three large public transport groups. Together these nine operators run 86 percent of the bus lines and an even larger part of the bus transport market in the region. This means that, in effect, three groups hold almost 90 percent of the market. These groups mostly operate within a specific area. The daughters of Cowie operate mainly in the northwest, those of Go Ahead Northern in the southwest, and those of Stagecoach in the central and eastern parts.

Since 1997 the national government recognised that the role of the authorities in public transport should be strengthened. The have developed two new types of interaction between the authorities and the operators: Quality Partnerships and Quality Contracts. A Quality Partnership is a voluntary cooperation between operators and authorities. An example in the region was the Durham Road Superroute, an extensive program of service and infrastructure improvements between Durham and Sunderland was developed by local operators, councils and authority. The Transport Acts of 2000 introduced new powers to the authorities, including the Quality Contract. This Quality Contract offers to the authority the possibility to designate a specific area as a concession. The local authority has apply at the national government to use this instrument. The national government has set a number of conditions, including the failing of Quality Partnerships, local market power, and to the goal to provide connections between techniques.

4.3.3 Performance of public transport

Due to the competitive character of most public transport operations in the county, no comprehensive numbers are available about fare-box revenue in the region. The PTE makes yearly estimations about public transport boardings in Tyne and Wear County. For 1996 the PTE has estimated 230 million boardings in the county, which amounts to 209 boardings per inhabitant.

Interviewees from the public sector considered the quality of the system to be poor, though bus operators disagree. A Go-Ahead Northern customer survey shows that 80 percent of travellers were satisfied with the services. Again, the interviewees underlined the importance of travel speed, which bus operators try to attain through direct services. The bus operators

try to improve their service by offering direct services between all major destinations. This is a move away from the system of interconnecting bus and metro in operation prior tooperations which existed until 1985. Prior to the 1985 deregulation of the bus sector, the Tyne and Wear public transport system was set up with the metro system as the backbone, with bus services operating to and from metro stations. Since deregulation however the private operators have partially left this system of co-ordinated schedule development. In addition, no fully-integrated ticketing and pricing system is in place. The Transfare scheme offers integration for single tickets between regional rail, metro and 89 percent of the bus lines.

Travel speed over short distances is at the standard level. The average travel time from three urban concentrations (Tynemouth, Washington, Cramlington) at approximately 10 kilometres from Newcastle into the city centre using a bus service is 30 minutes. The average travel times into Newcastle over longer distances (20 kilometres from Sunderland and Durham) are also at the standard level: 19 minutes. The high speed is the result of Sunderland's direct rail link into Newcastle city centre every 20 minutes, which on average takes 20 minutes between 8 and 9 in the morning. During the same period there is one train from Durham to Newcastle, which takes 18 minutes. The number of bus vehicle-kilometres, however, has risen significantly in the last ten years, partly through smaller buses and more frequent services.

Other aspects of the quality of service which are regarded as poor by public authorities are the vehicles and the reliability of service. The PTE regards vehicle access to be an important aspect of the quality of service. The number of low-floor vehicles in Tyne and Wear is considered to be relatively low. The reliability of services depends on the service running on schedule and the customer knowing and understanding the schedule. Within their licences, bus operators are allowed to change times by 5 minutes from the original schedule on any given day. For larger changes they have to announce them 42 days in advance. In 1996, operators changed bus services 900 times, which several interviewees regarded to be undesirable.

Interviewees agree on the fact that prices of public transport services in the county are low. They regard prices to be amongst the lowest in Britain. Though all operators are free to set their own prices, most operators use a kilometre rate for the first 5 kilometres, followed by a zonal system of prices. Prices of single trips are not widely published, but a price for a single short distance trip is around €0.70. Competition has not been prohibitive for an integrated ticketing system; Transfare offers integrated ticketing for single trips with transfers between metro and bus and Network Ticketing for network-wide season tickets (both peak and off-peak). Table 15 shows peak prices.

	Prices	August 1996
Type of ticket	Euros	Hamburger Std.
Single trip within centre	0.70	0.33
Day card within city centre	1.60	0.76
Day card for the whole region	3.48	1.66
Travelling into city centre (10 kilometres)	1.55	0.73
Travelling into city centre (20 kilometres)	4.10	1.95

Table 15
Prices of selected trips in the Tyne and Wear County

Though bus operators are free to set their prices, the PTE feels they indirectly influence bus service prices through PTE's pricing of competing metro services. The PTE feels that its control over metro prices has kept prices low, due to price competition. In addition, the PTE has control over prices for the elderly and handicapped under the concessionary scheme.

Model split figures in the Newcastle area were last measured in a 1991 census. On average, 27 percent of all motorised journeys to work were undertaken using rail (6.4 percent) or bus (20.6 percent). This is a relatively high number for the United Kingdom, which can be contributed to a relatively low car ownership in the region.

1991	*Public transport*	*Motorised individual transport*	*Other*
Gateshead	29.3	53.6	17.1
Newcastle	31.2	49.5	19.3
North Tyneside	25.3	55.1	19.7
South Tyneside	24.9	52.7	21.4
Sunderland	23.4	58.1	18.5
Tyne and Wear	27.0	54.0	19.0
United Kingdom	15.7	60.8	27.6
Percentage of active members of the workforce commuting to and from work using public transport of all modes, excluding bicycle and moped			

Table 16
Modal split in trips in the Tyne and Wear, (Source: Lawson and Davies, 1996)

Because information on the fare-box revenues of commercial bus operators is not available, no overall picture can be given of the balance between fare-box revenues and subsidies. The total subsidies for tendered bus services amounted to €5.3 million in 1996. In addition, fuel taxes for the bus operators were forfeited. The total amount of forfeited fuel taxes to Tyne and Wear operators remains undisclosed. Moreover, concessionary passengers were subsidised. In total, subsidies on the concessionary travel amounts to €28 million in the year 1996.

Rail services received an additional operational subsidy of €5.6 million in 1996. The Shields Ferry received an operational subsidy of €0.4 million.

The metro was run with a subsidy of €6.1 million in the same year. In that year, the total cost of running the metro was €50.8 million, giving a revenue-cost ratio of 88 percent.

In addition, the PTE provided integrated information to the traveller. Though this does not represent a direct subsidy to the operators, it gives operators the possibility of cutting costs in their own information provision and marketing. The PTE spent to €3.2 million in 1996 on providing integrated information.

Finally, the fuel duty rebate in 1996 was €0.29 per litre [Ministry of the Environment, Transport and the Regions, 1995], and the estimated distance covered in the area using public transport in 1996 was 390 million kilometres [Shields, 1989 and PTE, 1996]. This means that, at an average fuel consumption of 1 litre for every 3 kilometres [Meijkamp, 2000, pp. 188], the total fuel duty rebate can be estimated to be €2 million for all oprators in the region.

Total subsidies (including the cost of providing information and excluding fuel tax rebates) for the year 1996 add up to €53.2 million, which is €48 per inhabitant. This means a reduction of over 40 percent as compared to 1985, prior to deregulation.

4.3.4 Lessons learned

The most important feature of the organisation of public transport in the county is the disjointed character of many of the processes, and the distance between the actors. The interviewees acknowledged this, although they characterised it as less disjointed than in other parts of Britain. The interactions between operators and the PTE are formalised through tendering procedures. The main interactions between competing operators occur on the street.

This disjointed character especially influenced those aspects where actors have to depend on each other to offer a good public transport product. Examples have been found of a deadlock situation in both service development and infrastructure development. In infrastructure, private enterprises waited for the PTE to develop the infrastructure before setting up services, and the PTE was unwilling to invest when service provision was not certain. The PTE waited for the operators to develop services before tendering a subsidised service, which contributed to the problem. In the development of new housing and industrial estates the reaction of private operators could be described as awaiting rather than creating a market. Problems in co-ordination occurred frequently. A positive lesson learned is that the free market is not at all prohibitive for simple forms of integrated pricing and ticketing.

Moreover, competition led the operators to focus on cost reduction and geographical market share. The free market did not bring innovative products, even if there was room for them in the market. Only after intervention of the PTE did operators discover the potential of low-floor buses to attract more passengers and they stimulated their use.

In addition, it was expected that the operators would evolve in a constant state of competition. But the market consolidated rapidly. The small operators where either taken over or pushed out of the market. Three main operator groups controlled the market. No institutionalised barriers to entry were present, but fierce local competition led to new barriers. Only the larger operator groups could sponsor that competition through cross-subsidisation. Not only did a concentration take place to three major operator groups, but these groups also divided the market in the county through a process of collusion.

To some extent this consolidation was welcomed by the interviewees. The constant competition led to ongoing changes in public transport schedules, confusing the customer. At some stage more than 1200 significant timetable changes occurred per annum. Some interviewees regarded this to be the worst effect of the introduction of the free market.

A final problem that the interviewees signalled was the huge influx of buses into Newcastle city centre. Prior to the free market, bus services fed passengers into the metro, which transported the traveller to Newcastle city centre. Their competition for market share and their conception of traveller service led the operators to offer direct bus services to Newcastle city centre. In addition, there was a general tendency for operators to move away from large buses towards doubling the frequency with minibuses. This increased congestion and pollution in the urban area. The council had little possibility of regulating the number of buses coming into the urban shopping centre.

Apart from their existing role in facilitating and subsidising private operators, councils and the PTE are seeking a more active role in public transport. They try to stimulate the use of clean and accessible vehicles (through subsidised leases), influence price levels (through metro prices), and influence bus congestion (through traffic regulation). The council developed a control policy that limits the total capacity in the city centre and favours environmentally-friendly and accessible buses.

These problems illustrate a number of issues. Firstly, the focus on the free market has made it hard for public and private actors to co-operate. Public entities are obligated by strict rules to ensure the facilitation of all private initiatives on the basis of equality. This mechanism leads to a rather passive public role in public transport provision. Interaction between public transport and spatial development is generally weak. In that institutional culture, the PTE took some initiatives to improve the provision of public

transport services. Some of these could have been challenged due to market disruption. Still they can be seen as contributing to the relative success of public transport in the county.

Secondly, co-ordination between operators at the level of scheduling becomes focused on individual market share rather than on collective market coverage. Their mutual interaction within the market seems to be aimed at the forceful attainment of market share and consolidation. The case shows that the free market was not prohibitive towards co-ordination of ticketing. Through-ticketing (Transfare) and network ticketing were introduced in combination with the free market principle of free prices. The PTE sees its role in stabilising and directing bus pricing through competitive metro prices as an important prerequisite for the success of both schemes.

Thirdly, qualitative product innovation is not indubitably bound to freeing up the market. Risk aversion and market control can limit the operators' customer orientation. Examples can be found in an aging fleet and the numerous changes to the timetables. On the other hand, simple innovations which are both low-risk and customer-friendly are implemented swiftly. Public actors can use this mechanism by participating in investment and thus reducing the risk for the operator. This was the case when the PTE co-financed the first low-floor buses in the region. When this proved to be a success other operators followed without intervention by the PTE. This and other lessons have found their way into the Transport Act 2000 [anonymous, 2000], which gives local authorities more possibilities to improve the quality of services.

Fourthly, a free bus market does not guarantee a competitive bus market. Operators find their own niche in their search for market share and cost reduction. They find their own local niche, either by offering a specialised product, or by concentrating their activities within a specific area. The combined effort of the operators in the region led to what resembles local monopolies. Regulating and controlling the market conduct have proved insufficient to counter this development.

Fifthly, the existence of a government-controlled metro system has offered the possibility of regulating prices without direct control over the operators. The metro both competed with as well as added to the bus services. Though a "fremdkorper" within the free market, it has served very well in balancing the negative side effects of the free market.

4.3.5 Evaluation: Rationales and interaction levels

The Tyne and Wear case is a typical example of free market allocation in the planning of public transport services. Managing the market was the primary issue when making choices about organisation. The case shows how freedom

for the operator was forced through national law limiting the possibilities for local authorities to influence public transport service development. This approach has some clear advantages. The case shows the immense efficiency gains that this organisational design can bring. The different operators can search the market to develop new possible services. The equilibrium between demand for services and their supply is constituted through constant balancing of what the service is worth to the customer and what it is costing the operator. It is this process of trial and error of a diversity of competing operators that innovates both product and production.

The organisational design in Tyne and Wear opens up possibilities for public transport operators to define services for the passenger, which fosters the diversity of competing operators. The overall organisational design from 1986 is focused on the GO-level. The design tries to significantly reduce government influence on service provision. This should maximise the operators' freedom to define services for the traveller, balancing what the traveller is willing to pay. Thus the design focus is on the GO-level to change operator behaviour at OT-level interactions. As a result, the operator should deliver the most attractive services for the traveller at the right price. In addition, it focuses on managing the market. Interaction between public authorities and operators (GO-level interactions) are limited to a minimum and formalised for the sake of fair competition and a level playing field for all operators. Integration between operators (the OO-level) is left to the discretion of the operators, with a facilitating role for the PTE.

This organisational design has induced a number of problems. The formalised character of interactions between operator and public authorities has prohibited more complex arrangements, linking public transport and urban development or public transport and infrastructure development. The limited degrees of freedom hamper tailoring arrangements which promote the quality of public transport. As a result, deadlock situations have occurred in processes improving public transport quality. In addition, the new regulation was based on a premise of operator behaviour under the new regime. But the diversity of operators, realised at the moment of deregulation, soon subsided as operators consolidated. At the same time, freeing the market left the public authority few possibilities to reintroduce and maintain that diversity. In other words, the broken public monopolies evolved into private monopolies.

These problems can be understood from the strong focus on the GO-level interactions on the design from the perspective of managing the market. The analysis prior to deregulation, privatisation and liberalisation (for the whole of the United Kingdom) was that these GO-level interactions distracted the attention of the operator away from travellers' needs. Reducing those interactions required the restraining of public authorities, which had initiated growing subsidisation and control. The premise behind privatisation,

deregulation, and liberalisation of public transport was that both efficiency and customer satisfaction would improve. The analysis however showed that the involvement of public authorities in some issues still was desirable. Formalisation of those interactions gave a very strict institutional framework. The public role had to follow market development, both in commissioning additional services and facilitating the operators with infrastructure.

Formalising tendering procedures created a considerable and insurmountable distance between the public authorities and the operator to combine urban planning, infrastructure development and public transport development. Disruption of the free market had to be kept to a minimum, and public authorities had to wait and see what operators would come up with. The attention of authorities shifted towards the car, due to uncertainty about the behaviour of the operators. As a result, the car received growing attention in urban and infrastructure development, following growing uncertainty about public transport service development and use of a specialised public transport infrastructure.

Formalising the other interactions between public authorities and operators hampered the ability to further public goals related to public transport, i.e. congestion reduction and basic mobility. The Newcastle city centre and its bridges suffered from growing congestion by bus traffic, even though a graded metro infrastructure was available for public transport. In addition, general bus services were largely not adapted to the needs of the less mobile, even though the elderly made up a large part of the customers. In addition, the strict *formalisation of the public role* in public transport gave the PTE little room to act when operators did not react to the deregulation, privatisation and liberalisation as expected. The certainty of costs and the uncertainty of revenues brought operators to focus on cost reduction and geographical market share, more so than on significant product innovation.

Though the new regulation did not provide an institutional basis for OO-level interactions, the PTE was able to sustain a certain level of co-ordination between operators in the field of ticketing, with the Transfare and network ticketing schemes. In addition, the PTE found ways to induce greater use of low-floor buses, despite of criticism of operators which were not initially involved and despite the fact that it operated on the fringe of what was possible within the rationality behind the organisation. On the whole the PTE was successful in introducing small mitigations of the possible negative effects of the liberalised market. The PTE has retained some influence over pricing. They have been successful in maintaining a level of integrated ticketing. They have been unsuccessful in maintaining some level of co-ordinated planning of services.

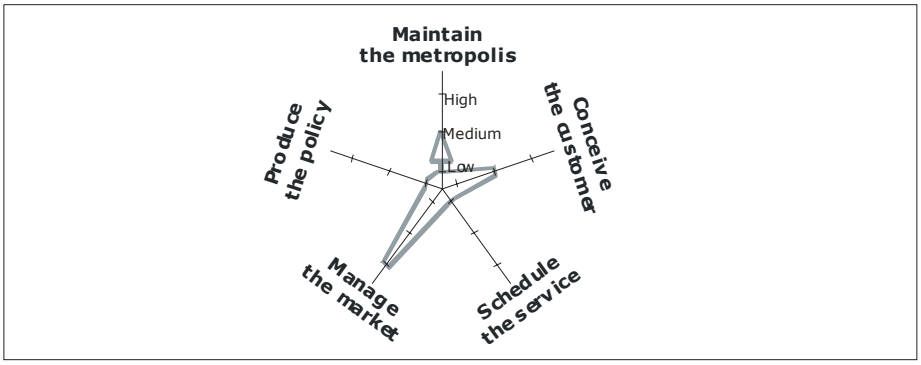

Figure 18
Interpretation of the importance of the rationales in the organisation of public transport in Tyne and Wear County

Following the introduction of the 1985 Transport Act, one rationale clearly dominated the organisation in Tyne and Wear County: managing the market. Though the organisation contained possibilities for maintaining metropolis through additional tendering, rules based on the main rationale hampered the possibilities of the authorities to do so. Service coordination was expected to be develop for as far it was useful for the operators, but no specific arrangements were made to coordinate the scheduling and execution of services. The full dependency on farebox revenues was expected to stimulate the operators to conceive the customer. As a result, the organisation leaned heavy on the market as provider of coordination and efficiency. Interaction between operators and between operators and authorities became formal and limited, hampering large innovations build on public private partnerships. In addition, the strict rules of the free market hampered the functioning of tendering of additional services. Figure 18 interprets the design rationale of the organisation in a single picture. The line shows the how the different rationales were present in the primary design.The arrows show the rationales that drove the secondary organisational changes.

Within the constraints of the national Act, the regional authority tried to use their hold on the metro to uphold integrated ticketing and influence pricing. In addition, the authority set up lease contracts to co-develop innovative low-floor services. Local councils used traffic regulation to manage inner city bus traffic and bring it into line with other policy goals and concessionairy schemes to subsidies target groups. Through these policies both the authority and local councils found ways to try to include other rationales in the organisation.

4.4 Northern Sjealand: Public tendering

4.4.1 Introduction

This city of Copenhagen lies in the northern part of the largest island of the Danish archipelago (Sjealand). A population of 1.6 million people lives in the area around the city. This metropolitan area covers around 2800 square kilometres. The average population density is 570 inhabitants per square kilometre. Copenhagen is the main urban centre and is located in the southeastern corner of the area. The city has 600,000 inhabitants and consists of three *amtskommuner*: Copenhagen, Frederiksborg, and Roskilde and two *kommuner:* Copenhagen and Frederiksberg, which will hereinafter be referred to as communes. These communes further consist of up to 20 municipalities.

Town and country planning has secured a lobe structure for the city of Copenhagen (see Figure 19). The concept of "the finger city" has been an important planning guide since 1949. The urban area stretches out like the fingers of a hand following the metropolitan rail system, the S-tog. Since 1995, the concept has been expanded by adding an extra finger at the Amager island corridor extending both the built up area and constructing new rail links.

Public transport in the region consists of five lines of S-tog metropolitan rail services converging on Copenhagen in the south east. Between those lines, a number of S-buses offer fast tangential services, while numerous other bus services also interconnect with the rail services. All services are offered on a single ticketing system, valid for the whole area. Apart from S-tog and standard bus services, HT offers a number of special services including express buses, night buses, demand-responsive services (Telebus), and services for schoolchildren, the elderly and the handicapped.

The growing importance of the car has led to mounting pressure on the intermediate open areas. But still, car ownership is relatively low and public transport relatively successful. Although the trend of urban development is eroding the finger city concept, both the city centre and its fingers still represent the urban cores, both in the location of offices, industry, and habitation.

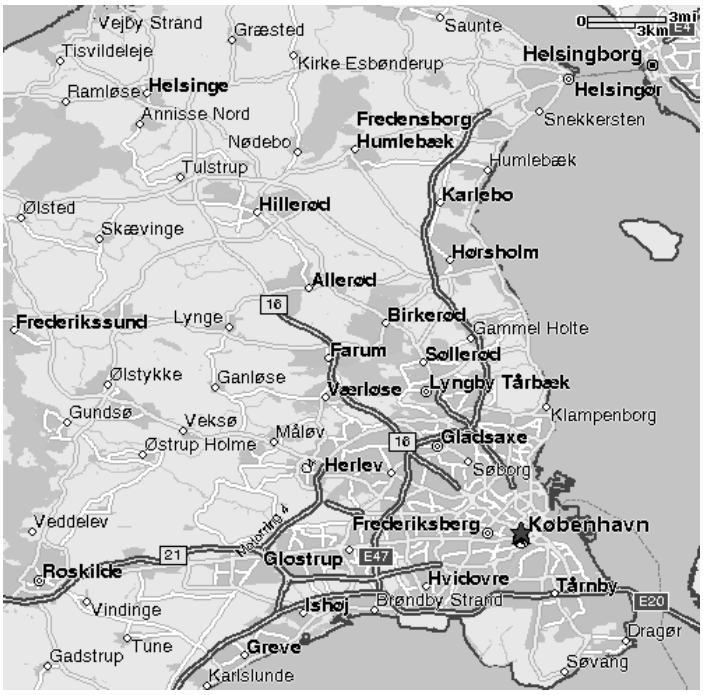

Figure 19
Map of Northern Sjealand

In the Northern Sjealand case, the allocation of resources is split amongst the operators and the public authority. The role of the government authority is relatively important. Services are devised by the public authority and tendered out (in terms of bus-hours) to the private operators. Operators compete against each other for concessions and the choice is made using a standardised public tendering procedure. Services are allocated by *Hovedstadsområdets Trafikselskab* (HT); resources – how to offer the services – are allocated by the operators. This section is based on a fairly comprehensive case report and represents the situation as it was in January and February 1997. Further changes have occurred since, but these are discussed only very briefly.

4.4.2 Organisation of public transport

A number of actors are present in the organisation of public transport in Copenhagen and its surroundings:

- The Danish national government,
- The five communes,
- The *Hovedstadsområdets Trafikselskab* (HT),

- The 16 private bus operators,
- The national rail operator *Danske Statsbaner* (DSB), and
- The five local rial operators *Privatbaner*.

The role of the national government is limited. First, the *Trafikministeriet* (Ministry of Transport) subsidises DSB for the operation of rail services, including S-tog and regional rail services operations, and puts the infrastructure at the disposition of the operators. Also, the national government pays 70 percent of the subsidies to the *privatbanen* (private rail operators) in the area. Moreover, the national government is responsible for DSB, which is a government service. In addition, the national government sets the organisational framework for public transport. In 1989 the national parliament passed a bill for the Copenhagen area that created the legal framework for public transport development in the area, the *Lov om hovedstadsområdets kollektive personstrafik*. It abolished general regional government and concentrated tasks in the field of public transport to a regional agency. This bill specified the new role for HT and defined the role of the communes in controlling the activities of HT. Because no regional government consistent with the HT area exists, the influence of the councils is organised in a board with members from the five communes. In addition, the communes have the possibility of specifying their wishes to HT in terms of the services they want. Figure 20 shows the division of tasks in Northern Sjealand. The light gray shows public tasks, the dark gray the tasks of private operators.

As a consequence of the concentration of tasks in the HT organisation, its role is pivotal when it comes to bus services. HT has a number of tasks.

- Analysis of public transport demand,
- Definition of bus services,
- Tendering out of bus capacity,
- Controlling the execution of services,
- Organisation of marketing and sales,
- Provision of travel information, and
- Provision of facilities.

HT defines bus services, analyses the number of bus-hours needed to execute these services, and tenders out the capacity needed from private operators. Bus service definition is fully in the hands of HT, from the tactical network and product development to the schedule at every individual bus stop. In addition, HT defines a wide range of standards for the execution of services by the operators to include in the contracts. These concern a wide variety of issues including the interiors and exteriors of buses. Moreover, HT organises sales and the marketing of public transport services in general. It organises the integration of ticketing and pricing. Finally, HT controls the execution of bus services by the operators.

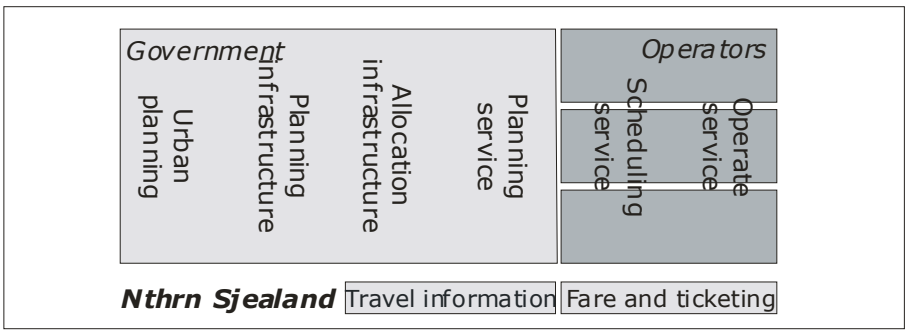

Figure 20
Distribution of tasks concerning public transport in Northern Sjealand

While the role of HT is central when it comes to bus services, DSB has the lead in the development of rail services. In contrast with HT, DSB both develops and operates the rail services, with far more independence from local government than HT. DSB offers both local (S-tog) and regional and intercity services, though different DSB divisions offer the services. In the near future, DSB will place S-tog activities in a separate company. Five private rail operators are active in the area on separate lines, with shares held by the state, communes and private holders. In the future, an additional private operator will execute Amager rail services when they came into service in 2000. To facilitate the integration of the different schedules, the DSB planning process goes ahead of HT, allowing HT to define interconnecting bus services at stations.

Together, DSB and HT have committed themselves to strengthening the existing spatial structure with their services. This is also reflected in the combined urban and public transport development on the island of Amager, co-ordinated with the urban development of the area. Until 1986 the regional government, the Hovedstadsområdet, was an important actor in both policy fields. The Hovedstadsområdet used its influence to maintain the aligned development of the two. This meant that the influence of regional government on public transport and urban planning was significant. In 1986, this administrative level was discontinued. In 2000, however, HT was integrated in the Hovedstadens Udviklingsråd (HUR) which integrated several tasks on a metropolitan level, including planning and public transport.

The growing importance of the car has led to mounting pressure on the intermediate open areas. But still, car ownership is relatively low and public transport relatively successful. Although the trend of urban development is eroding the finger city concept, both the city centre and its fingers still represent the urban cores, both in the location of offices, industry, and habitation.

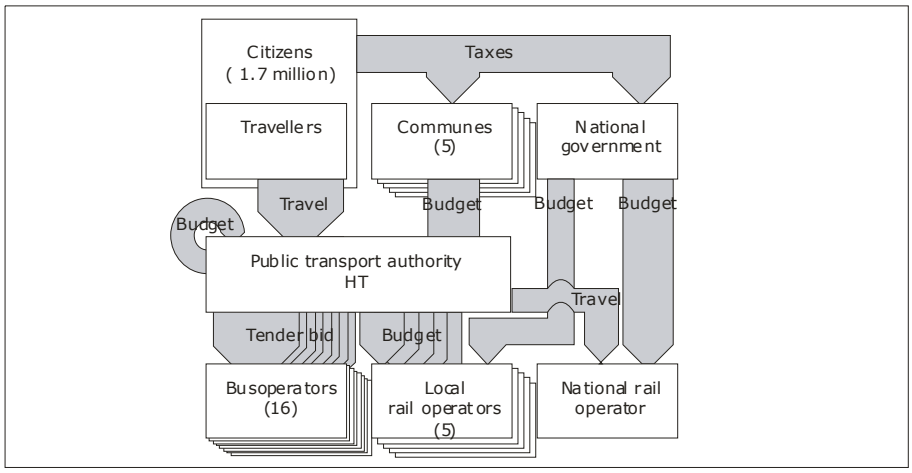

Figure 21
Financial streams concerning public transport in Northern Sjealand

The financial contributions of the different communes are negotiated between the communes and HT as lump sums (see Figure 21). DSB also receives additional funding from the national government through a negotiated lump sum. Other income (fare-box, advertising on shelters) goes to HT. HT sets prices after negotiating with councils and the rail operators. HT collects the fare-box revenue and redistributes it between HT, DSB and Privatbaner on the basis of a transport performance model based on passenger counts. This allocation is subject to additional negotiations. Bus operators do not receive a share of the fare-box revenues. Contracts are set in a lump sum for the execution of the contract. Bus operators can receive premiums when their performances are above standard and penalties when they are substandard, in line with the criteria in their contracts with HT. A new concessionaire has to keep the bus drivers of the existing concessionaire.

The HT was tendering out bus-hours on the basis of a gross cost contract. The main evaluation criterion between the different bids was price, but additional degrees of freedom were offered to the bidders. These degrees of freedom concerned the vehicle typology and environmental performance. The operators' bids were evaluated after the combination of the monitarised optional degrees of freedom and price for the bus-hours.

HT found itself confronted with a weakness of the tendering procedure and the contract it had chosen. The gross cost contract meant that operators did not receive any income from the traveller but a lump sum to compensate for production costs. Once in operation, operators proved very creative in cutting costs. This sometimes negatively affected the general quality of the service while staying within the constraints of the contract. Reacting to that,

HT has been adding standards for execution of the bus services to the contract. After growing discontent with the discrepancies between HT conception of the bus services and the services offered by the operators, HT has chosen a different path. A small percentage of the total contract sum is set aside, to be redistributed among operators on the basis of their general performance quality. The maximal bonus reserved for performance incentives has been rising from 1 percent in 1997 to 2.5 percent in 2001.

A second weakness was the limited contact HT had with the operators both. In 2001 HUR has introduced a number of platforms for discussing operations with both management and drivers of the operators. Interactions between government and operators were introduced both during the tendering and the concession period. From 1996 to 2002 perceived quality rose significantly from 83 percent to 87 percent satisfied travellers. In that period, average bus hour tendering prices rose from € 53 per bus hour to € 62, as the market consolidated. This rise followed a decline from € 70 in the first two years of tendering in 1992.

Although tendering put pressure on the relationship between HT and the operators, it relieved pressure in the relationship between HT and the communes. Tendering public transport led to diminishing costs. HT invested most of them into new public transport services and was able to do so without demanding new subsidies.

4.4.3 Performance of public transport

Public transport in the region has traditionally been very successful. Building on its strong presence, bus and rail services are still attracting travellers. Privatising operators has increased the efficiency of service execution. The efficiency gains were used to develop new services, including fast tangential bus services, and to improve the quality of services by making higher demands of the operators. In addition, a permanent system of market research is in place. This has led to a slight increase in passenger numbers between 1992 and 1997 after a steady slow decline since 1985. The total number of boardings in 1995 was 247 million, which amounts to 145 boardings per inhabitant.

Most of the interviewees saw the quality of public transport in the region as above standard. Though improvements still are sought, especially in new infrastructural developments, the existing services are of a high standard. The backbone of the S-tog and the integration with bus services offer relatively short travel times, while integration of the scheduling of both adds to the quality. Integration of ticketing and pricing is complete. In addition, the system was seen as transparent in concept, adding to the overall quality of the system.

The backbone of the system, the S-tog, uses a standard frequency throughout the day on weekdays, with lower frequencies at weekends and additional trains during rush hours on few selected lines. Bundling lines together closer to the urban core doubles or even triples frequencies at stations closer to the city centre. Frequencies average around 9 every hour from the selected stations at ten kilometres from the city. Travel times between 8 and 9 a.m. average 14 minutes from those stations.

From the selected stations further away (around 20 kilometres), the average travel time is relatively short: 22 minutes, with a frequency of 6 every hour. For shorter distances within the city, speed is at the standard level. The tight integration of schedules should provide little loss of travel time due to waiting for connecting transport. Even though no shared traffic control system ensures dynamic integration of bus and rail services, delays are not common, ensuring fast transfers. Investments in station infrastructure aim to make transfers more convenient. The trips used to analyse travel speeds and prices are from Lyngby, Brønby and Bellerup (about 10 kilometres from Copenhagen Hovedbanegården) and from Greve, Tastrup, Ballerup and Holte (about 20 kilometres to Copenhagen Hovedbanegården).

Most interviewees regard the prices to be at the standard level. Public transport uses a zonal ticketing system in concurrence with the integrated ticketing system. The system uses 95 zones, which are concentrically clustered into seven price levels from the zone of origin. The basic price for trips within the zone of origin and its adjacent zone is €1.43. No off-peak prices are available, but cheaper season tickets are offered. Table 17 shows prices for selected trips in the HT area. Again trips are used from the already mentioned origins to average trip prices.

	Prices	January 1997
Type of ticket	Euros	Hamburger Std.
Single trip within centre	1.43	0.43
Day card within city centre	9.10	2.72
Day card for the whole region	9.10	2.72
Travelling into city centre (10 kilometres)	2.86	0.85
Travelling into city centre (20 kilometres)	4.16	1.24

Table 17
Prices of selected trips in Northern Sjealand

To monitor the quality of the service offered by private operators, HT has a permanent hotline for complaints. In addition, HT has employed 200 inspectors to assess the activities of the operators in their compliance with the contracts. Moreover, HT uses a customer panel. Though some problems have been identified, service quality is considered to be relatively high. Punctuality is seen as an important criterion. One percent of the buses were more than five minutes late, while two percent departed too early. Of all bus

departures, 97 percent showed a delay of less than five minutes. Passengers indicate that quality has improved over the last five years.

Another indicator for this positive indication of the quality is given by the reversal of the downward trend in ridership since 1991. The modal share of public transport is relatively high, though this is hardly surprising, due to the urbanized character of the area. The bicycle is a strong competitor with many of facilities. Parking policies are relatively strict and car taxes relatively high, favouring public transport. Public transport, though, has lost some of its modal share to rapid growing car ownership and use.

1990	Public transport	Bicycle	Car
Hovedstadsområdet	20	20	60
Percentage of travellers within the region using public transport, bicycle, and individual motorised transport on an average day			

Table 18
Modal split in trips in Northern Sjealand, (Source: HT and DSB, 1992)

In 1995 HT spent a total of €123 million of subsidies, which it spent on various bus services and Privatbaner. An additional €34.5 million was spent on special services for the handicapped and elderly. The largest part of that subsidy was received from the five communes. DSB received a total subsidy of €93 million for all its operations and €131 million for the management, maintenance and development of its entire infrastructure.

The amount of DSB subsidies that can be attributed to S-tog must be estimated. In the year 2000, 18 percent of all DSB subsidies for operations went to S-tog services. Between 1995 and 2000, the proportions of train kilometres between S-tog and other DSB passenger services remained almost identical. If 1995 subsidy allocations are proportional to the 2000 subsidy allocation, S-tog received an estimated €17.1 million for operations in 1995.

In addition, infrastructure subsidies have to be allocated to the S-tog to arrive at subsidies aiding the operation of the S-tog. In 1995, total subsidies from the state to the whole of DSB for infrastructure maintenance and management amounted to €131.0 million. The proportion of the total network for S-tog amounted 12.2 percent. Also, the percentage of the total railway usage tax attributed to S-tog A/S in 1999 amounted 11.6 percent. Thus, in 1995 an estimated 12 percent of €131.0 million can be attributed as subsidises for the maintenance and management of the S-tog infrastructure, being €15.7 million.

Finally, state subsidies to the Privatbaner amounted to €4.6 million in total, €2.0 million from HT and €2.6 million from the state. For its own operations, HT needed another €21.1 million. This leads to an estimated total public spending on the operation and maintenance of metropolitan public transport in Northern Sjealand in 1995 of €216.0 million. This is €127 per inhabitant.

The income from travellers in the same year amounted €129.4 million for HT, €100.1 million for DSB, and an estimated €3.0 million for the Privatbaner. The total income from travellers amounts to €229.5 million. Income from travellers covered an estimated 51 percent of the total cost of the operation and maintenance of metropolitan public transport of Northern Sjealand in 1995.

4.4.4 Lessons learned

The case of Northern Sjealand shows us a number of lessons. Changing from a traditional government service in the late 1980s into a public transport authority in the 1990s raised a number of issues that had to be resolved in order to come to successful tendering of public transport operations. The lessons mentioned here are those that interviewees from the operators, authorities and government have put forward. For the most part, they represent the issues which are targeted in the ongoing process of the adaptation of the existing organisation to ever- changing circumstances.

Because of tendering procedures, HT has to define clearly what it expects from the operators. In terms of services, this is based on thorough market research. The tender describes in detail what HT is expecting from its operators, what possible degrees of freedom they have apart from price, and how different bids on these degrees of freedom are weighted. This ensures transparency in policy choices and bid choices and is advisable from the perspective of the tendering process. In terms of policy choices, the tender shows how much HT is willing to pay for cleaner engines, lower floors etc. This should lead to better allocations of funds, because operators will only bring lower floors into their bids if the government contribution exceeds the most efficient way of delivering low floors. This should lead to the transparent and efficient application of public funds for specific quality aspects of public transport. In terms of bid choices, the formal method of choices makes the choice of a certain bid on price and number of degrees of freedom repeatable and controllable.

The first lesson that HT learnt was that operators could and often would neglect the quality aspects of the service that were not mentioned in the tender. If cleanliness the inside the vehicle was part of the tender, with either a bonus for compliance with or a malus for violation of the norm, operators would neglect the cleanliness on the outside of the vehicle, not mentioned in the tender. This led to a process of tenders growing in size, with more and more demands of service operators. To move away from a constant process of definition and evasion of quality demands, HT decided to introduce quality incentives into the contract.

To implement this strategy, HT created a fund amounting to one percent of the total tendering funds. This fund is set aside and redistributed

among operators on the basis of their relative quality performance. That performance is measured 20 percent by the authority's assessment of quality and 80 percent by a general survey of travellers' perceptions of quality. This gives an incentive to the operators not to focus solely on the quality aspects mentioned in the contract but also to focus on travellers' needs and wishes. The one percent part of total tendering funds is under evaluation and expected to be increased.

Another lesson on quality preservation concerned the actual magnitude of the effort to check the execution of services by the operators. HT employs more than fourty inspectors who manage and check the execution of the services by the operators. In addition, some interviewees expressed concern with the size of HT. On the other hand, other interviewees expressed concern with the growing size of the operators and the risk of collusion and rising prices.

Further lessons were drawn concerning the ease of entry and exit for bus operators to ensure competition. One of the aspects that could hinder entry and exit was the availability of vehicles and drivers. In contracts, HT arranged that drivers could transfer when concessions changed operator. A problem which was mentioned by the operators was that changing concessions meant drivers were changing employers at the end of concession period, every five or six years. The operators found it hard to keep the drivers committed to the operators, which hindered the operator's effort to uphold the quality of the service. HT also signalled this problem.

Another barrier is the ability to acquire buses which fit the demands of HT. Procurement of buses would take longer than the period of preparation for operation of the concession. Moreover, the concession period is far shorter (five or six years) than the official depreciation period of the buses. In addition, authorities throughout Denmark laid down specific and diverse demands on vehicles. Operators reacted by leasing buses, which in effect created a pool of vehicles that can be leased by the operators. This pool is open to all possible operators, effectively taking away the barrier of entry and ensuring the possibility of successful tendering.

A further lesson concerned integrating HT- defined bus services and DSB S-tog services, both in integrated scheduling and ticketing. In terms of scheduling, HT and DSB agreed on a process arrangement for integrating the schedules of S-tog and bus services. The arrangement was based on the so-called top-down approach. DSB would define S-tog services 2 years in advance, after which HT could define connecting bus services and tender them out. Problems occurred if DSB fine-tuned its services when bus service execution was already tendered out. HT would not be able to maintain an integrated service, because it had no leverage over DSB, and the contract with the operator hampered the regular changing of bus services.

Furthermore, DSB and HT integrated ticketing caused some problems. A complex model should aid DSB and HT in determining what proportion of fare-box revenue should go to HT and what proportion to DSB. But model calculations only acted as a basis for further negotiations, which were seen by some interviewees as unhelpful and unnecessary.

4.4.5 Evaluation: Rationales and interaction levels

The Northern Sjealand case provides a fairly typical example of tendering public transport services. It shows the subtle balancing act that tendering authorities have to perform between three important factors: *control*, *flexibility,* and *attractiveness*. Control of the tendering is needed for transparency and democratic control of the activities of HT. Flexibility is needed to ensure that operations are tuned to a changing operating environment, especially demand and infrastructure. These two have to be balanced with attractiveness for operators, because the success of the tendering procedure also depends on the number of operators that are attracted to bidding for the tender.

The relationship between the three is complex. The balancing of control, flexibility, and attractiveness surfaced at every interaction between government and operator, before, during, and after the tendering procedure. The HT model chooses for control, as transparency is seen as an important feature of public policy. To ensure transparency of the choice for a specific bid in the tendering procedure, the evaluation of bids has to be straightforward. To achieve this, HT strictly *controlled the possible degrees of freedom* in the bid for the operators. These were limited to price and a number of pre-specified options. In this way HT controlled bid complexity, although it also reduced the flexibility, and to some extent the attractiveness for the operator.

To ensure that counties and their civilians were getting their money's-worth, HT strictly *controlled vehicle type, equipment, and appearance*. Their hold on these issues grew over time, reacting to operators' behaviour. This limited the flexibility of the operators to deploy vehicles in a way that suited the customer. In addition, it limited the possibility for entry, because the initial costs reduced the attractiveness of the tender.

From the start of tendering, HT *controlled labour availability, ticketing*, and *service integration*. In all these aspects, HT either put binding conditions in the contracts for the operators, or took matters into their own hands. Before tendering, of course, HT had even greater control, because all operations were also part of the HT organisation. With DSB and HT having no mutual controlling power, co-ordination between the two had to be attained without hierarchy. Redistribution of fare-box revenues to DSB and the

coupling of the schedules of bus operators and DSB S-tog have proved complex.

The subtlety of the balancing act can be described with an example. Tendering offered HT a way to balance *public control*, *operation flexibility,* and *operator attractiveness*. By tendering out bus- hours, the actual tendering contracts were simple in terms of what had to be delivered and on what points the operators could bid. Tendering bus-hours still offered HT the possibility of being flexible in planning services. Market entry was facilitated, which attracted operators. But the gains where balanced by losses. To realise the gains, HT had to control service development, the translation of general demand into services, a task which is better suited to the operator.

On another issue, the operators tried to simplify the balancing act. By setting up their own bus pool between them, they were more flexible when bidding, despite strict government regulation of the definition of vehicle types. The strict control of vehicle type did not impair market entry, but made operators seek alternative arrangements for providing their buses, thus increasing their own flexibility.

Finally, HT decided to relax their control over the operators. A more general incentive system should make operators take more note of the traveller. The different aspects of service quality would not be individually set in the contract. Operators would have the choice of investing in certain aspects of service quality, making the total allocative choice the sum of HT priorities and the operators' priorities. Those priorities would be steered by a general appreciation of the service by the traveller and a number of pre-fixed items set by HT. One percent of the total contract sum was set aside and allocated to the operators which performed best. The idea was that operators would evaluate their choice by the importance travellers gave to different quality aspects and the amount of money HT was ready to spend on quality aspects in general.

When looking at the attention given to the different levels of interaction, one has to conclude that much attention is given to the interaction between the operators and HT, GO-level interactions. The need for formal, transparent commissioning of services has led to a tendering system that puts the government largely in the chair of the operator. A transparent relationship led to a controlling relationship.

This control has enabled integration as far as operations were in the hands of a single authority. HT enabled strong integration between bus services. But where different governmental levels subsidised and controlled different techniques, things become more complicated. Railways were controlled in general terms by the state, with a lot of freedom for the operator. HT controlled buses strictly on the authority of the five counties. This meant OO-level interactions were smoothly built into the organisation

when it came to bus services, but the organisation was not fully tuned to bus-rail interactions. This integration however was a spin-off of the strong focus on GO-level interaction values.

So, this focus on GO-level interactions has brought some successes at OO-level interactions. However, it caused a number of problems when it came to OT-level interactions. The quality of service for the traveller had to be safeguarded through quality control mechanisms in the contracts between government and operator. Operators no longer showed much consideration for their travellers. The choice was to reduce the stronghold of GO-level interaction values and give room to operators by steering with goal-driven incentives.

Finally, when looking at the importance of the five rationales, the image is rather clear. The balance between the different rationales is much stronger than in earlier cases. The market is managed through competition, co-ordination is secured in the scheduling of services, and strong coupling with other policies, including spatial policies, is realised. Tendering has to some extent aided the reconciliation of rationales of scheduling the service, maintaining the metropolis, and managing the market. Its formal structure though has done little for the co-operative and interactive development of services by operators and government authorities.

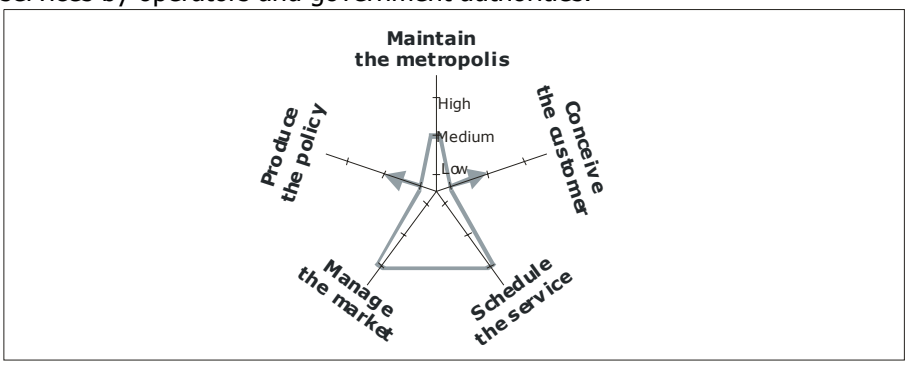

Figure 22
Interpretation of the importance of the rationales in the organisation of public transport in Northern Sjealand

The tendering in the region reflected a wider variety of rationales than the cases presented earlier. The organisational form utilized mechanisms like competition and co-ordination and secured a strong relationship with other policy areas. Two rationales were less well represented. Producing the policy underlines the strength of co- production based on productive interaction. The formal tendering procedure and development by HT left little room for such co- production. In addition, the focus was not on the varied demands of the traveller. Financial remuneration for both the service developer and

operator can give an incentive to do so. This was not built into the organisation. Figure 22 interprets the design rationale of the organisation in a single picture. The line shows the how the different rationales were present in the primary design.The arrows show the rationales that drove the secondary organisational changes.

As already described, HT recognised the second flaw. Operators showed more interest in the conditions of contract than in the preferences of the traveller. There was no incentive to conceive the customer. HT decided to include remuneration into the contract with operators on the basis of perceived service quality by the traveller.

4.5 Southern Limburg: Co-arrangements

4.5.1 Introduction

Southern Limburg consists of the 23 southern-most municipalities of the Netherlands. The area forms a Dutch peninsula between Belgium to the west and south, and Germany to the east. In total 660,000 people inhabit the region. The area covers around 700 square kilometres. This means the average population density of the area reaches 932 inhabitants per square kilometre. Southern Limburg contains a triangle of three conurbations. The first in the north-western part consists of the cities of Sittard, Geleen and Stein (totalling 168,000 inhabitants), the second in the east comprises the cities Heerlen, Kerkrade, Landgraaf, and Brunssum (269,528 inhabitants), and the third is the cities of Maastricht and Meersen in the south (210,830 inhabitants). Just over the border to the east lies Aachen, a major German city with 254,054 inhabitants.

The three urban centres form a horseshoe-shaped enclosure of a relatively open, hilly landscape. Maastricht is a typical compact city, where the enclosing infrastructure, river and a national frontier enforce the relatively high densities. The other two urbanisations form a more scattered urban texture with a multi-centred character. This texture is the result of a number of cities and villages growing together (see Figure 23).

Public transport in the region consists of a triangular rail network of regional and intercity trains. In addition, three conurbations in the area have local urban bus networks. Throughout the area a series of regional bus services is run through the open country linking most cities and villages. Integrated ticketing is available between all bus services and is nationwide. Two national ticketing systems are in place, one for railway services and one for bus, metro, and tram services, the so-called *Nationaal Tariefsysteem (NTS)*. This national pricing system is valid for a limited number of rail

services, including a small route going south from Maastricht. Also, bus and rail services cross the border to major cities in Belgium and Germany.

Figure 23
Map of Southern Limburg

A planning guidance directs development of labour and traffic intensive offices to locations close to large public transport nodes such as intercity stations. Parking capacity at these locations is limited. In addition, new urban developments are planned in or on the existing urban fabric.

In the Southern Limburg case, allocation is split up amongst the operator and the government, with a relatively important role for the operator. The operator develops and executes services based on general standards, and in negotiation with the responsible government. The government levels involved are national, which provides subsidies and standards to rail and regional bus operators, and the municipalities of Maastricht, Geleen and Heerlen, which commission service provision and provide subsidies for urban services in their areas. All but one operator are government stockownerships, with the exception of Vancom. All operators operate exclusive concessions. The presentation here is based on a comprehensive case report and represents the situation as it was in August and September 1997. Although the region has been preparing for competitive tendering in the region since, this is only discussed briefly.

4.5.2 Organisation of public transport

This section addresses the following aspects of the organisation: the actors involved and their relationships, the regulatory basis for operation, and financial arrangements. In the region the following actors are involved in the organisation of public transport:

- The Dutch national government,
- The Maastricht municipality commissioning services and owning an operator,
- The municipalities of Sittard and Heerlen commissioning services,
- The national rail operator NV Nederlandse Spoorwegen (NS),
- The municipal bus operator Stadsbus Maastricht (SBM),
- 2 Regional bus operators, Hermes and Vancom.

The operators operate under two national juridical regimes, one for rail transport and one for bus services. Stemming from the *Spoorwegenwet*, *Nederlandse Spoorwegen* (NS) holds the exclusive right to execute rail services in the region and beyond. It runs the trains, and maintains and allocates the infrastructure of specific services. There is some control by the national government on the prices at the national level, but in general, regulatory control is limited. The initiative for service development is in the hands of NS.

The juridical basis for bus operation is found in the *Wet Personenvervoer*, the law on transport of persons. Bus operators receive the exclusive right to operate bus services in a specific region. Regional bus services are run formally under the control of the national government, under general rules of service standards. That standard is at least three bus departures a day within a 1250 metre range of every locality, attracting at least 12 travellers per day. But the initiative for service development is in the hands of the operators. Operators of regional bus services receive funding directly from the national government. The three larger municipalities are commissioning their urban bus services.

A similar approach is taken for urban bus services, though here three municipalities commission public transport services. They receive funding from the national government, which, in turn, they use in annual negotiations with the monopoly operator. Control by these municipalities of the bus services in their region is significantly greater than control by the national governmental of regional bus services and rail services. Nevertheless, a lot of freedom is left to the operators. Again, the initiative for service development is in the hands of the operators, in this case a private company with stocks held by either national- or municipal-government actors.

Hermes runs the bulk of bus services, both urban and regional. Hermes is the regional daughter company of the national regional bus operator VSN Groep, running services in the provinces of Limburg, Noord-Brabant, and

Gelderland. The national Ministry of Transport, Water Management, and Public Works holds all VSN Groep shares. Hermes develops its own services. These services have to be submitted to the Dutch Minister of Transport, Water Management and Public Works for approval 6 months prior to their coming into effect. Vancom is the other regional bus operator and is privately held. Vancom runs six regional services in the south of the region as a result of a tendering experiment by the national government. Vancom runs services that were part of experimental public tendering. Stadsbus Maastricht (SBM) runs the buses commissioned by the Maastricht municipality in that city, though SBM has the initiative in developing the services. The freedom of Hermes and NS in defining and executing services is large, especially in regional and rail services.

Municipalities and the province have set up a *Regionaal Mobiliteitsoverleg*, which is a regional mobility consultation. These consultations move ahead of major changes to the organisation. The main task of the consultation is to short-circuit planning, financing and integration issues of public transport and other transport projects. Figure 24 gives an overview of the overall distribution of tasks in the region. The light gray shows public tasks, the dark gray the tasks of private operators.

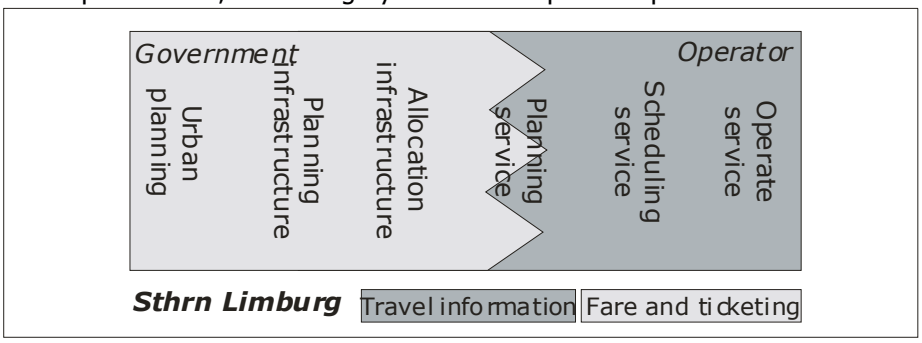

Figure 24
Distribution of tasks concerning public transport in Southern Limburg

Rail services are subsidised through a yearly lump sum subsidy to NS on a national level, though this subsidy will further be reduced and terminated in the near future. In addition, NS receives a national grant for running services on 31 lines that NS has designated as unprofitable. In the longer run the province will have to publicly tender out these services. Bus services are also subsidised from a nationally budgeted fund, which is redistributed over all urban and regional operators on the basis of a yearly passenger count. The national government receives all revenue from the integrated national ticket system for all regional and urban public transport services. This revenue is redistributed over the different operators on the

basis of local sales of national tickets and a survey of the number of traveller-kilometres of the operator's services. This means the redistribution of subsidies and fare-box revenues to the operators is generally based on local sales and a survey of the number of traveller-kilometres, but urban areas receive a relatively larger proportion. Figure 21 gives an overview of the financial streams to and in the region.

The overall approach is one of negotiated arrangements between operators and governments at different levels. These negotiated arrangements are most explicit at the level of local municipalities, where local demands to the operator can be specific, but always subject to negotiation. At the regional level the arrangements are less explicit, but they allow the national government to formulate demands to the operators in terms of maximum price level, minimum service level, etc. It gave the national government the opportunity to change the basis for distribution of subsidies twice in the mid-1980s, changing the basis for subsidies from cost-based to production-based (1985) to consumption-based (1987).

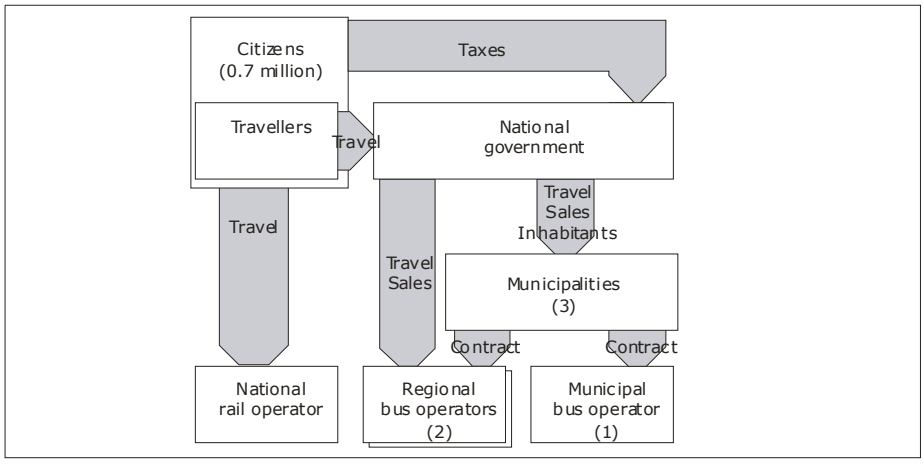

Figure 25
Financial streams concerning public transport in Southern Limburg

The Dutch national government has been re-evaluating the organisation, and an experiment has been undertaken with tendering services in the region. From the year 2000, NS operates rail services on the intercity network under a performance contract between the national government and NS. Under new regulations, the province will be responsible for all other public transport in the region, except urban bus services in Maastricht. It will commission rail services outside the intercity network and regional and urban bus services, progressively in public tendering. Also, the province will generally tender local bus services out, although Maastricht will keep the

responsibility for their own public transport services, like other major municipalities in the country. These municipalities will over time also be obliged to tender these services. At the moment of analysis though, the local authorities had little opportunity to influence both the organisation and operation of public transport in the region.

4.5.3 Performance of public transport

The co-arrangements used to develop public transport have led to a balance of public wishes and commercial considerations in the service development by the operators. The services in Limburg attracted an estimated total number of boardings of 41 million in 1997. This amounts to a total of 36.5 boardings per inhabitant. The interviewees had mixed views on the quality of public transport in the Southern Limburg region. The operators were content with the quality of the system, given the resources, though improvement of the quality was regarded as desirable. This is in line with the general view among the public authorities. A majority of them assert that the quality of public transport in the region could be better and also that the efficiency of the system is lagging. In a survey, passengers rated the Hermes services above the average of all regional services in the country. Vancom services rated even better than Hermes service provision.

Speed has to be considered, as it is one of the important aspects of quality. Along two branches of the national intercity rail network that stretch into the region, service speeds are relatively high. Frequencies, though, are somewhat lower than in the rest of the network, due to the forking of the lines at the periphery of the network. The fastest travelling time between 8 and 9 a.m. into Maastricht, averaged from three origins about 20 kilometres away, is 23 minutes. This means that the travelling speed is relatively fast. Travel times differ greatly, from 15 minutes using the intercity train service from Sittard, to 24 minutes using the fast train from Heerlen, to 30 minutes on the interliner express bus service from Vaals. Integration of the timetables of bus and rail services is limited, especially between the services of different operators.

Public transport within the cities of Maastricht, Heerlen and Sittard depends solely on bus services. Because of the deconcentrated urban structure of the region, the radius of the urban centres is generally less than 10 kilometres. Intracity speeds in Maastricht are relatively low. A 10-kilometre trip using a bus service from opposite city boundaries to the centre of Maastricht means a journey time of 34 minutes. Intracity trips in the Heerlen conurbation have comparable average speeds. Some major origins at 10 kilometres offer a rail service into the city, bringing travel speeds up; travel time from these origins averages 12 minutes. There are a number of call-a-ride services.

Interviewees generally viewed the price of public transport to be somewhat lower than average. Although the example of free public transport in nearby Hasselt (Belgium) appeals to some, it is not seen as a viable option because of the relatively high fare-box recovery ratio of public transport in the region. The extra subsidy for free public transport is simply too large a step. A single-trip ticket within an urban zone costs €0.68 and is valid for 1 hour on all public transport except rail services (see Table 19). Tickets bought on board are more expensive. Lower fares are available for children and the elderly. Students have commendatory travel pass, giving them free public transport throughout the country. No off-peak pricing is available for bus services. Off-peak pricing is available for rail services starting later than 9 a.m. Table 19 gives an overview of prices within the Southern Limburg region. In the analysis of the price levels, trips are made from Margraten, Valkenburg and Beek into Maastricht (travelling 10 kilometres to the city centre), and Sittard, Heerlen and Aachen (travelling 20 kilometres to the city centre) into Maastricht. The price used starts at Vaals, making it a 22-kilometre trip.

	Prices	September 1997
Type of ticket	Euros	Hamburger Std.
Single trip within centre	0.68	0.28
Day card within city centre*	5.79	2.36
Day card for the whole region*	5.79	2.36
Travelling to city centre (10 kilometres)	1.80	0.73
Travelling to city centre (20 kilometres)	3.26	1.33
*Only available for bus trips		

Table 19
Prices of selected trips in Southern Limburg

Travellers in the region had mixed feelings about the level of quality of the services. In a survey, average ratings for different quality aspects ranged from 6.5 to 7.9 on a scale of 1 to 10. The survey also shows that the travellers' assessments of the quality showed a positive inclination. This positive score does not translate into high ridership. The modal share for public transport in the region is low; only 12 percent of all traveller-kilometres are covered using public transport (see Table 20). In terms of trips, the modal share of public transport is 25 percent. This is in line with a downward trend that has been slow but steady over the last 25 years.

All subsidies originated from the national government. Operating subsidies for rail services were directly assigned to NS for operating train services in general and on specific lines. Subsidies on the basis of passengers transported were directly assigned to Hermes. Subsidies to SBM were assigned by the national government to the municipality that could negotiate with SBM over the services they would offer to the travellers. Finally, the

national government had a contract with all Dutch operators for the transport of students and defence staff. Attribution of subsidies to the region under study has proved complex and the numbers quoted here have to be understood as crude estimates.

1996	Public transport	Bicycle	Car
Limburg	12	9	79
Percentage of *traveller-kilometres* within the region using public transport, bicycle, and individual motorised transport on an average day			
Limburg	25	5	70
Percentage of *trips* within the region using public transport, bicycle, and individual motorised transport on an average day			

Table 20
Modal split in trips in Limburg (Source: CBS, 2002)

In 1997, Dutch railway services received an operating grant of €30 million in general funds and €70 million aiding all services on 31 specific lines, including one Southern Limburg line. How these funds were attributed within NS is unclear. When we redistribute these subsidies based on the number of inhabitants served, they amount to an estimated €7 per inhabitant or €4.5 million in total for Southern Limburg.

In 1997, Hermes received an operating subsidy of €26 million for regional bus service operations throughout the province of Limburg. On the basis of the number of inhabitants, we might attribute 48 percent of that to Southern Limburg, leaving an estimated total operating service of €12.5 million for Southern Limburg for Hermes services. In addition, Hermes received €2.3 million of subsidies for urban services in Sittard and Heerlen. Vancom received an operating subsidy in the region of €1.5 million, while SBM received €6.8 million.

Moreover, students and defence staff received travel cards for public transport throughout the country. The total contract sum is attributed to the different operators on the basis of expected loss of income. This contribution of €6 million can partly be seen as a subsidy. Based on an average fare-box return rate for the region of 32 percent, 68 percent could be seen as a subsidy, which amounted to €4 million in 1997.

The above leads to the conclusion that operating subsidies in the region for 1997 can be estimated to be €31.6 million. This means that the subsidy was €47 per inhabitant. Total fare-box revenue attributed to the region was €19 million. This excludes fare-box revenue for NS, which can be estimated at €27 million. Total expenditure for public transport services per inhabitant can be estimated to be €70.

4.5.4 Lessons learned

An important organisational aspect of public transport provision in Southern Limburg is the significant role of the national government. The paradox is that rather strict regulation by the national government has given the operators a lot of freedom. National regulation proved to be unable to effectively steer the operator, the distance of scope between regulation and operation is simply too large. No public transport authority filled this gap between national regulation and service operation in Southern Limburg, though some municipalities have roles that resemble that of small-scale public transport authorities.

The important role for the national government also gave rise to a national integrated ticketing system. Surprisingly, though, two systems exist side by side, a ticketing system for train services and one for all other public transport, the *NTS*. This division was chosen despite the fact that transfers between train services on the one hand and bus, tram, and metro services on the other were far more common than transfers between bus, tram, and metro. In addition, it is valid in the whole country, though most nationwide travel depends on train services not included in the ticketing system. Only in some instances was the national government able to persuade NS to accept the *NTS* and drive towards a regional integrated system, as on the Maastricht-Randwyck line. The unwillingness of NS to accept the *NTS* was based on the lower fare per kilometre of the *NTS*, compared to NS's own fare system.

Also, some interviewees did cast doubt on the effectiveness of the operators. An explanation was sought in the financial system (WROOV+) that redistributed fare-box revenues and subsidies to the operators. This system redistributed both *NTS* revenues and subsidies on the basis of travellers transported. Interviewees regarded it as unwieldy. The financial effects of the small scale tuning of the services were uncertain to the operator, unlike the effects of cost cutting. This seduced operators to focus on efficient operations rather than on effective services. The uncertainty was the result of a complex redistribution model, exacerbated by the imperfect counting of passengers and local sales. The effect of the uncertainty was considered to be three-fold. Firstly, it hampered accurate evaluation of travellers' reactions to innovations. Secondly, it muffled the (possible) financial gains for the operator following innovations, because the specific effects got lost in the generic redistribution of revenues. Thirdly, it partly postponed the (possible) financial gains to a later date. Though a fixed percentage of growing local sales went directly to the operators as revenue, the result of increasing use was only after the following survey of travellers.

It was, however, not only the operators' orientation towards the traveller which was questioned. The role of the municipalities also came

under the scrutiny of some interviewees. They claimed that the larger municipalities often lacked a firm policy basis for the way this role was brought into effect, resulting in indiscriminate changes of course. This distracted the operators from focusing on the traveller.

These lessons were not so much drawn by a regional authority, critically assessing its own organisation. Such a regional authority simply did not exist. Rather they represent the general dissatisfaction with the organisation ayt the national level. This dissatisfaction was the basis for organisational changes through decentralisation and tendering, strengthened by European legislation on governmental procurement of services, including public transport.

These lessons show a number of things. Firstly, the financial system (WROOV+) was set up together with the *NTS* to combine incentives for efficiency and effectiveness for the operator together with an integrated ticketing system. In the end it proved to be able to redistribute revenue and subsidies satisfactorily, including some incentives for operational efficiency. But it did not succeed in giving sufficient incentives to the operator to develop effective services, nor did it succeed in aiding the mass of travellers' transfers between train services and other public transport and vice versa. Some interviewees stated that the promise of a national ticketing system never materialised, despite the enormous effort to set up the system.

Secondly, the dominant role of the national government was helpful in providing national solutions, but these solutions did not always match the regional or local character of mobility problems. Although three municipalities exerted some influence upon urban service provision, the possibilities were limited because of an inability to change the organisational setting. The municipalities were bound to national service standards for regional public transport, the national rail operator, the national ticketing system, the nationally protected monopoly of the local operator, the national subsidisation scheme for public transport, and national funding. Neither municipalities nor the province were able to intelligently associate policies on urban planning, parking and the disabled and elderly on the one hand to public transport provision on the other, either through direct service definition or through organisational tuning.

The lack of influence municipalities had on the organisational conditions lead to an emphasis from their side on the specifics of certain public transport services, the sole aspect they could (rather inadequately) influence. The picture painted by some interviewees showed municipalities with ad hoc demands battling uphill with better-informed operators. This would have been no problem if strong incentives were built into the organisation to motivate the operator to be efficient and to support both public and private goals in a

balanced way. These incentives were missing, however, as has already been asserted.

The national government also signalled these problems. First of all, a process of decentralisation was started: in the late 1980s towards functional regions with transport authorities, called a *vervoerregio*, and in early 1990s towards a more active role for the province in transport. That decentralisation was realised in 1998, when responsibility for regional public transport was transferred to the provinces. Also, the smaller municipalities with responsibilities for urban public transport (Sittard and Heerlen in Southern Limburg) lost this responsibility to the province in a process of centralisation. Only the larger municipalities (Maastricht in Southern Limburg) still held their role in urban public transport, together with the province.

In addition, the monopoly of the operators was weakened. From 2001, provinces were obliged to tender out parts of their public transport network. The part of the network that should be tendered would rise over the following years. The provinces are given a great deal of freedom over the conditions put to the operators.

Not only institutional changes were sought. Technology should also offer more flexibility to the system of revenue collection and redistribution. In the mid-1990s the chip card was hailed for easier integration of different ticketing systems, enabling greater regional freedom in ticketing systems, retaining transparent ticket integration for the traveller. In fact the chip card is expected to enable the uncoupling of fare integration and ticket integration. Implementation of the chip card, however, was still not realised in 2001.

4.5.5 Evaluation: Rationales and interaction levels

The Southern Limburg case clearly shows how co-arrangements between a monopolistic operator and local governments can support a specific type of public transport service. In addition, the case shows the limitations of such an approach when the local or regional governments lack degrees of freedom to fill their side of the bargain. When they have nothing to trade, either relieving their control of and penalties to an operator or increasing their support for the operator, operators give nothing back. In that case local and regional government authorities have to fight for every single step forward, even though public transport is largely publicly funded. The case shows the mass of national transformation processes such as the case of decentralisation, the introduction of the chip card, and financial organisation. This impedes small, local or regional scale changes that fit both organisation and services to local needs. The distance between national regulation, regional interpretation, and local operation gave the operators three different customers, local travellers, regional governments and their voters, and national governments.

The strong position of the national government also hampered the success of interactions on all of the three interaction levels. Though room was built into the organisation for GO-level, OO-level, and OT-level interactions, the interactions are generally too detached, distant, and delayed. Often solutions come from a national level and are detached from local policy processes and their rationales. These solutions are distant from the problems they try to mitigate. Finally, the solutions are often sizable and implementation is slow, because implementation has to fit the entire country, rather than the region.

A common denominator for the problems can be found in the *oversizing of solutions*, when it comes to tackling local mobility problems. The *NTS is oversized* in terms of its national coverage, banking heavily on the possibility for it to be flexible in financial arrangements with different operators in different regions and not providing a solution for many transfers. The *WROOV+ is oversized* in its effort to provide incentives to the operators. Because incentives are delayed and diffused, the effects are limited. These oversized solutions immediately crossed the borders of the problems they were supposed to mitigate to create other problems that are beyond the scope of an analysis based on a single rationale. Decentralisation and freedom for provinces in tendering seem to break with this tendency of oversizing, but still have to stand the test.

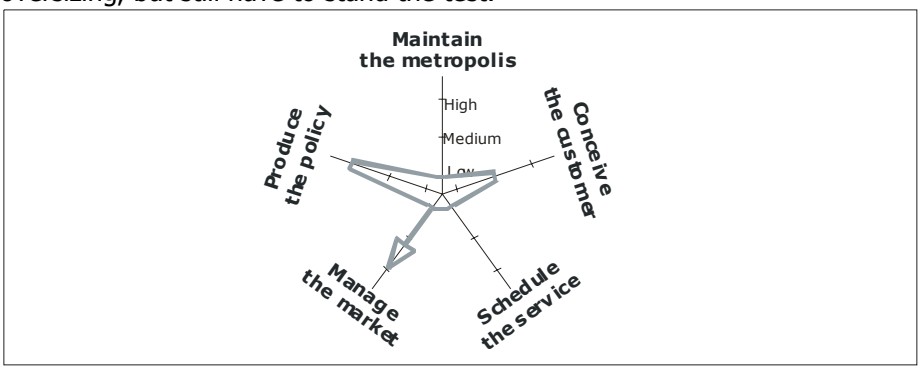

Figure 26
Interpretation of the importance of the rationales in the organisation of public transport in Southern Limburg

The organisation of public transport in the region lacked a wide disciplinary coverage. The financial system (WROOV+) did try to give incentives to conceive the customer, and an integrated ticketing system was in place for all but rail services. But the combined implementation did not relate the incentives to solving local mobility problem as they were set on a national level. The incentives to operators were diminished and delayed and travellers transferring between bus and train were not helped. In addition,

both co-ordination in service development and competition between service operators were little developed. Finally, producing productive policies at a national level left most local actors uninvolved, with the exception of the few larger municipal authorities that were given the possibility of developing policies. Figure 26 interprets the design rationale of the organisation in a single picture. The line shows the how the different rationales were present in the primary design.The arrows show the rationales that drove the secondary organisational changes.

The national government saw the weaknesses of the organisation and started two processes of major change: decentralisation (in line with problem-related production of policy) and public tendering (in line with both improved possibilities for a competitively managed market). In the region an experiment with tendering of services was carried out to introduce competition and better manage the market.

4.6 Discussion: Lessons from the cases

4.6.1 Introduction

The brief presentations of four cases in the previous sections show the relative importance of the five rationales in the cases for the organisation of metropolitan public transport. The exploratory nature of the analysis and the lack of a pre-defined theoretical framework present a number of limitations when drawing lessons. These will first be discussed in Section 4.6.2. Secondly, in Section 4.6.3, lessons will be discussed referring to the organisation of public transport in general. Finally, in Section 4.6.4, the lessons will be presented that can be drawn from the analysis of the way disciplinary knowledge is used.

4.6.2 Limitations in lesson drawing

Cases like those presented here might tempt one to compare them on their basic inputs and outputs, generalising them into a principal causal relation between aggregated variables of organisation and performance. Supplement F shows a table that might be the basis of such a comparison. Though this comparison might be fruitful in some ways, it does not contribute to understanding the ways of using different rationales in organising public transport. In fact, the case descriptions, as well as Supplement F, show that reducing organisation and performance to a single aggregate variable might enable organisational and performance variables to be compared, but it does not teach us much about the real strengths and weaknesses of the organisations involved.

When comparing cases on these generalised variables, we learn about the variables in their generalised state. This is fruitful in disciplinary science concerned with those variables and might show us which generalised organisation offers the finest generalised performance.

Any scientist wanting to understand parts of reality has to relate phenomena in that reality and map those relationships. Within a specific discipline, those phenomena are part of its theoretical base. Though often this selection is based on prior scientific endeavours, it always misses some points of other disciplines. When studying the relationships between the use of disciplinary knowledge and the success of an organisation of metropolitan public transport, the selection of phenomena spans all five rationales simutaneously. In addition, Chapter 4 showed that occasionally the direction of causality differs between rationales and that the rationales use different evaluation criteria to define success.

The selection of phenomena and their evaluation criteria is a disciplinary process. Firstly, theory determines which variables define an organisation and which define performance. Secondly, theory establishes which variables are more important than others. Thirdly, theory states how these variables interact. It is through a multidisciplinary analysis that the limitations of this approach become apparent. Though a theoretical framework can in itself be relatively comprehensive through logical boundaries, the cases showed several examples of how a theory in practice is incomplete through ambiguous and dynamic boundaries. The Zürich case showed this most clearly, when public transport operators were not able to operate services carefully calculated by the public transport authority for specific routes and locations. The difference between theory and practice becomes most apparent in practice.

The multidisciplinary analysis presented here does of course suffer from similar drawbacks; variables from all rationales cannot be meaningfully and decisively related to each other. This section crosses the boundaries of the monorationale in two distinct ways. Firstly, the inclusion of many variables and relations in the analysis removes the natural boundary of monorationale's theory. Secondly, the analysis tries to stay as close as possible to the lessons of those interviewed and to establish whether these lessons show a pattern in the application of different rationales.

4.6.3 Lessons on organisation: Tasks and dichotomies

The organisational forms in three of the four cases in the 1980s showed great resemblance to one another. These cases had a traditional set up: a regional government producing its own public transport as services. In contrast, Dutch public transport has always leaned more on private operators to develop

service, more so in regional that in urban public transport. All cases have undergone or are undergoing a major organisational change since the 1980s, based on the perception of flawed organisation.

In the late 1990s the institutional designs differed greatly. But uniformity was found on the way in which a number of tasks were distributed. Some are regarded as typically governmental. Governments are *guarding competition*, though their idea of the ideal competitive market changes. This means that they guard competition sometimes by containment and sometimes by stimulation. In addition, local and regional governments can *co-ordinate their own policies* in different policy areas, such as parking, infrastructure development and urban planning. Moreover, government authorities play an active role in *inter-operator co-ordination*. None of the cases provided an example of non-governmental co-ordination in scheduling (static and dynamic) or ticketing (marketing, sales and prices). Apparently, in the cases there was the need for a government actor to incite, facilitate or even take over the collaboration of operators. But the cases have also shown that governmental actors often find it hard to balance the benefits of co-ordination with its costs. Finally, governments seem to have an important role when it comes to *high-risk innovations*. Operators are averse to risks, where risk presents the combined effect of the size of the investment and the uncertainty of the return. So, larger investments (for example in infrastructure) or investments that the operators do not expect to benefit from (like low floor buses in Tyne and Wear) need some public incentive, or are left to the public sector altogether. Sometimes public involvement simply reduces the risk by being a neutral partner in the process.

Two other tasks are typically considered to be the operator's. First of all the *production of services*, which of course in its essence defines the operator. The task involves allocation at a relatively low level, ensuring that the services in fact are carried out as planned. In addition, the operator is the actor which organises *traveller involvement*. This is not the same as traveller analysis or a complaints desk. The operator is the face of the operation and can use revealed traveller behaviour and preferences to improve day-to-day operations.

In the remainder of the institutional design (both the distribution of remaining tasks and other aspects of the organisation), less uniformity and conformity were found, despite efforts by the European Union. Choices of the remaining design parameters seem to revolve around three dichotomies:

- Co-ordination versus competition,
- Public versus private,
- Grand design versus incrementalism.

The different cases have shown how co-ordination and competition are important issues in the practice of metropolitan public transport. In

theoretical analyses, co-ordination often demands specific institutional designs that preclude competition, because co-ordination is best left to a single actor. The claim is that institutional designs supporting co-ordination do not need to support competition because co-ordinated services are efficient in their own right. On the other hand, others demand competition and state that a free market situation will automatically reach the right level of co-ordination. The cases seem to refute the suggested relations. Rather, they illustrate the need for institutionalising both competition and co-ordination, and that there are possibilities to do so. They show the compatibility of (different types) of competition with co-ordinative institutional designs through small-scale institutional changes that introduce competition and co-ordination simutaneously. The cases show how the organisation of public transport can support both competition and co-ordination. On the other hand it denies the monodisciplinary claims that full competition will offer an environment in which co-ordination will thrive and that full co-ordination offers inevitably efficient service provision.

When reinventing the organisational framework of metropolitan public transport, the public actors in the cases reassessed their own role or the role of different public actors. That assessment included a reflection on the responsibility for tasks, being either reserved for the public or the public sector. Often that reflection has prompted the transferring of tasks which solidified in institutional designs for operator ownership (publification or privatisation) or operator relations (partnering or formalising), changes in product-related laws (regulation or deregulation) or market-related laws (protection or liberalisation), changes in contract content (government-defined or operator-developed) or contract conditions to the operator (government control or operator responsibility). The cases show that the organisation of public transport does not have a given size, which has to be divided between public and private sectors. Rather, they show that institutional designs can be abundant (or deficient) in both, with strong (or weak) roles for both public and private actors.

This leads to a third dichotomy that can be observed between the cases on the one hand and theory on the other, and which is also reflected in some variation between the cases. And that is the dichotomy between grand design and incrementalism. Here the cases also show a differentiated view. The Zürich case presented an example of grand design, but rather centred on integrated services through hierarchical co-ordination from the operators by the ZVV authority. The case of Copenhagen presents an example were the grand design left a great deal of room for experimenting with and tuning the organisation.

The organisation of Tyne and Wear and Southern Limburg had in common the fact that national governments heavily controlled the

organisational form. In Tyne and Wear, public transport was very much the result of the grand design of the 1980s, introducing deregulation, privatisation, and liberalisation. But the public transport authorities in the area were able to preserve co-ordination through small-scale institutional intervention. The grand design of the organisation in Southern Limburg also was set up by the national government, with little eye for the local idiosyncrasies of the Southern Limburg area. The limited instruments of local governments and the absence of a public transport authority hampered tuning even more than in Tyne and Wear.

The most important lesson from the cases was that in the cases outside the Netherlands grand design and incrementalism were cleverly combined at regional level. A good organisation seems to include co-ordination as well as competition, and should combine strong features of the public sector with strong features of the private sector.

The public transport authorities in the three cases have seen major grand design processes occur in their organisation. Following those major changes, the cases show a continuous process of organisational reflection and tuning. The authorities were very much tracking the flaws of the existing organisation and were taking small steps to tune their organisation to mitigate or overcome its flaws. These cases were the ones selected because of their relative success, which was partly explained by an authority able to tune the organisation. The cases also showed that this process of organisational improvement had a disciplinary side. The grand design is based on an analysis with a limited disciplinary coverage. The tuning increases that coverage. This process will be discussed further in the next section.

4.6.4 Lessons on disciplinarity

Primary and secondary processes of organisational change

The case descriptions gave an analysis of the disciplinary focus of each organisation. Zürich and Tyne and Wear showed a strong disciplinary monomania, respectively focusing on scheduling the service and managing the market. The organisation in Copenhagen showed a somewhat wider disciplinary coverage, as did Southern Limburg. A clear difference was found between the Danish and the Dutch case. The organisation in Copenhagen showed the transparent decentralised implementation of different disciplinary arrangements, whereas the organisation in Southern Limburg showed the oversized implementation of arrangements at the national level. The relatively low disciplinary coverage of different organisations was the result of a process of large-scale organisational change. That low coverage in the cases seemed to favour scheduling the service and/or managing the market as leading rationales.

In all three cases outside the Netherlands, that process had taken place, in the Dutch case it was underway. Because of the size of the organisational change, it presents a great deal of complexity. In order to be able to reduce this complexity, those initiating the organisational change leaned heavily on disciplinary knowledge to develop the new organisational form. In essence, the process of organisational change was directed at large scale changes and the perceived optimisation of the organisation for a number of (rationale related) variables. We will call this the *primary process of organisational change*. The result of this process is a template: organisational form with limited disciplinary coverage.

The three cases outside the Netherlands showed how the process of tuning the organisation followed a major change in the primary process. This tuning was often aimed at goals other than those of the primary and major change. The secondary processes extended the disciplinary coverage of the organisation. The changes of the organisation were much smaller during these secondary changes, but were arguably more important for the success of the organisation than the primary process of organisational change. We will call this the *secondary process of organisational change*. Despite its importance, as illustrated in the cases, the secondary process receives far less attention, both in practice and theory. It is this secondary process of tuning that gives the successful cases in this chapter their multidisciplinary characters, on top of their monodisciplinary bases.

Zürich (Hierarchy)	**Arrangement type**	**Interactions**
Existing organisation 1995	Co-ordination	GO-level
	Policy integration	GO-level
	Interaction	GO-level
Arrangements added 1996	Competition	OO-level
	Remuneration	OT-level

Table 21
Tuning in Zürich

How did the actors involved in the individual cases draw their lessons? The organisation of public transport in the Zürich canton revolved round the Zurcher Verkehrsverbund, the ZVV. This governmental public transport authority had contracts with all operators, which provided a platform for tuning the organisation. ZVV negotiated with larger operators like the national railway service for co-ordination on ticketing and scheduling. Integration with other policy areas was built in through regular meetings with government representatives from all layers of government in the canton. The ZVV tried to uphold the wishes of these governments in the negotiations with the operators. In addition, the ZVV presented itself as the centre point of public transport in the canton, stimulating and organising interactions with

travellers, governments and operators. ZVV actively tuned the organisation (see Table 21).

In 1996, the ZVV decided to add competition between smaller operators and remuneration for larger operators, because it lacked the tools to improve the efficiency of the operators. Instead of reimbursement of production costs, the eight largest operators received remuneration for on their performance in attracting travellers. These eight operators were also able to schedule their own services, though the ZVV protected integration. Competition was brought in by offering these large operators the possibility of tendering services out to any of the smaller operators in the canton.

Before 1996, ZVV had reached a level of organisation that should be able to realise the full integration of scheduling, ticketing, and marketing in the primary process. The ZVV learned that operators were not able to execute services in the way that the integrated centralised planning had forecast. In addition, it learned that the intended level of integration was costly and inflexible. Part of that inflexibility reduced the quality of the product to the traveller. It concluded that service development was over integrated. The ZVV reacted in the secondary process by condensing its own organisation to less a quarter, bringing in limited competition between operators and assigning service development to operators, who could balance operational costs against possible traveller revenue.

The introduction of a free market in the Tyne and Wear area was a typical primary process of organisational change. It introduced and attempted to safeguard remuneration for the operators and competition It left the local PTE limited instruments to influence public transport provision. The 1985 Transport Law took many of those away and introduced formal procedures of involvement to protect the free market. This posed a problem when bus traffic in the shopping district of Newcastle and Tyne bridges rose to unwanted levels. It also proved cumbersome when the PTE wanted to help raise vehicle standards in the area.

The law gave PTE the strictly regulated opportunity to tender services and provide disabled and elderly with cheaper tickets. The PTE lacked direct instruments for implementation of innovations (like low floor buses), price control, ticket integration, and a tight coupling between urban development and public transport development. After 1995 the Tyne and Wear PTE, now called Nexus, had found ways to improve policy integration (see Table 22). Within this situation of formalisation, Nexus proved very creative in the secondary process to overcome the problems they were confronted with, containing bus traffic, keeping prices low, maintaining ticket integration, and introducing low floor buses. These were implemented on Nexus initiative without many instruments and with safeguarding impartiality between the competing operators. Nexus was less successful in integrating planning

policies on industrial and office estates with public transport development, though the need was felt.

The Copenhagen public transport authority, HT, was battling to retain the quality of public transport services. After introduction of competition through public tendering in a primary process or organisational change, HT had full control over public transport service provision. This was a strong bases for coupling public transport development to other policy areas and co-ordinated scheduling and ticketing. The strict rules of the tendering procedure left little room for interaction between operators and HT. This meant the tendering conditions in the contract dominated the mutual interactions.

Tyne and Wear (Competition)	**Arrangement type**	**Interactions**
Existing organisation 1995	Remuneration	OT-level
	Competition	OT-level
Arrangements added 1997	Policy integration (social, safety)	GO-level

Table 22
Tuning in Tyne and Wear

HT had little instruments to ensure the quality of bus operations. The tendering contracts gave the operator a clear incentive to cut costs, rather than to provide higher quality services. The contract form chosen left quality definition and control to HT. In the battle to uphold the quality of services, the amount of contract conditions grew, as operators continuously found new ways to cut costs within the conditions, often reducing service quality. In the secondary process HT fought the urge to further control of the operators. HT chose to give incentives to the operator to improve service quality in general, trading in control for incentives. This gave room to operators to balance quality aspects and gave HT the ability to name a price they were ready to pay for improved quality of public transport services in Copenhagen (see Table 23).

Copenhagen (Participation)	**Arrangement type**	**Interactions**
Existing organisation 1995	Competition	GO-level
	Co-ordination	GO-level
	Policy integration	GO-level
Arrangements added 1998	Remuneration	GO-level

Table 23
Tuning in Copenhagen

In Southern Limburg, before the introduction of tendering, there was little development of the organisation of public transport. In Southern Limburg no actor could directly influence, let alone tune, the organisational framework. An exception was municipality of Maastricht, which had a contract with its own operator. The general framework though was developed at a

national level and tuned to national problems. In addition, the national government held most of the stocks of the regional operator. This national control was over-sized when it came to local problems.

This left the municipalities with public transport responsibility no other instrument than negotiating specific services. This reduced the influence of the existing remuneration arrangement on the effectiveness of the services because more attention was given to ad hoc service demands of local authorities. It did not reduce the influence of remuneration on the efficiency of service production, which remained high.

Southern Limburg (Negotiation)	**Arrangement type**	**Interactions**
Existing organisation 1985	Interaction	GO-level
Arrangements added 1987	Remuneration	GO-level and OT-level

Table 24
Tuning in Southern Limburg

The arrangement of remuneration had not always been in place. In the early 1990s the national government added it to a financial model that was introduced to make the Strippenkaart possible. The model first redistributed income and subsidies based on production, based on the number of seat-kilometres, but after 1993 that was changed to consumption, based on passenger-kilometres.

The full introduction of tendering in the national Wet Personenvervoer 2000 (Law on person transport 2000) tried to overcome this by giving provinces and large municipalities much freedom on when and how they will tender public transport services. How the Limburg province will use that freedom to tune the basic framework will reveal itself in the coming years.

This chapter showed a variety in the ways metropolitan public transport is organised. It is very likely that European metropoles represent an even greater variety in the details in which public transport is organised. There seem to be many ways to the Rome to improve the efficiency and effectiveness of public transport. This chapter tried to understand how those actors responsible for the organisation are on a journey discovering the route to improve their system. The question was whether they are choosing their next stop on that journey with care. Though only four main roads to organise metropolitan public transport were described, the landscape along those roads proved very divers. The next step of this study will try to apply the lessons from the different landscapes in a journey to better public transport.

Is it possible to anticipate and avert the problems that arose after the primary process of implementing large-scale change to the organisational framework? Can lessons be drawn in an earlier stage? Is it possible to implement large-scale change and make arrangements in advance before problems grow out of hand? And if there is, what is the role for

multidisciplinarity? Where lies the balance between particularity and generalisability? Is it possible to transfer the learning points, both general and more specific, from one place to the other? How can we come from tracing the individual cases to trading solutions between places? These are the questions that will be addressed in the next chapter.

5 A suggested approach: Rearranging rationales

We must not be satisfied with retaining the beautiful formulas of our illustrious predecessors… Time and reflection modify little by little our vision, and at last comprehension comes to us.

Paul Cézanne,
from a letter to Èmile Bernard, 1905

5.1 Introduction

Chapter 1 presented the problem of urban mobility. The chapter expressed how an organisation of public transport based on a multidisciplinary approach could contribute to the mitigation of the problem. Chapter 2 showed that organisation consists of three major groups of actors: travellers, operators and government. Chapter 3 described how these actors all have varying disciplinary focuses: their views are represented by different rationales, focusing on distinct aspects of the public transport system. These rationales hold axioms tailored to the needs those distinct actors, supporting their analyses. These rationales require organisational conditions to make their prescriptions work. These conditions have a bearing on other actors and hamper the implementation of their rationales, causing conflicting prescriptions from the different rationales. Chapter 4 showed that an organisational template with a strong disciplinary focus has a blind eye for other rationales, the related actors, their specific tasks, and the related values. (see Figure 10 on page 88).

The cases showed how policymakers deal with this problem and the conflicting prescriptions. The cases presented large changes of the organisation founded on a mono-discipline, in what was called the *primary process of organisational change*. Here the perspective of one actor becomes the centre of the organisational redesign. The primary process of organisational change is both a fundamental redesign overthrowing the existing organisation and is inspired by a single rationale. The result is an organisational template.

An organisational template represents a set of arrangements bearing a strong internal consistency, based on a single rationale. Though supported by solid disciplinary analysis and offering attractive recommendations, reality proves unruly to the template. Actors and aspects, values and tasks not central to the leading rationale prove to be misrepresented and goals for the organisational change are not met.

In a *secondary process of organisational change* the template is tuned to overcome the problems raised by the primary process. Tuning the organisation often defies the consistency of the template, bringing other values to the organisation than those represented in the template. Chapter 4 illustrated the relative success of the secondary process. Tuning the organisation builds on day-to-day learning and incrementally applying these insights. The success cases supplemented template organisations with out-of-template small-scale solutions going against the primary rationale of the organisation.

The cases depicted four different primary processes of large-scale organisational change, the introduction of the *Zürcher Verkehrsverbund*, the liberalisation of the English bus market, and the introduction of competitive tendering in Copenhagen and Southern Limburg. All cases described numerous examples of secondary processes of organisational change. The ZVV introduced competition into the co-ordinative structure in Zürich. In Tyne and Wear, Nexus introduced subsidised leases to stimulate the use of low-floor buses. HT introduced generalised quality incentives in competitively-tendered contracts. The Dutch national government changed the basis for payment to the operators from capacity to ridership. This process proved beneficial; tuning the organisation was an essential part of the cases that reported solid efficiency and effectiveness, through both a wider disciplinary basis of the analysis and a wider array of organisational solutions.

The cases have illustrated how this application of multidisciplinarity is generally hidden. Though the cases underlined its importance, the literature on public transport has paid little attention to the support of this secondary process. Some parallels might be drawn with Lindblom's [1959, pp. 239-249 and 1971, pp. 517-526] analysis of the disjoint incrementalism in policy processes, Weimer's [1993, pp. 110-120] analysis of tinkering with the design of policy options, or [Etzioni, 1988, pp. 130-135] mixed scanning. In addition, there are some parallels with the perspective of Rose [1993] and Schön [1982] on lesson drawing by the reflective practitioner. Although secondary processes have received some attention in the sidelines, the specifics of such an approach for the organisation of metropolitan public transport remains uncharted territory.

The more widely-orientated literature offers three approaches to broaden the disciplinary scope of the analysis and solutions: widening the

analysis, widening the range of actors involved in a case, or widening the empirical basis from which lessons are taken.

Firstly, some literature is available on the combination and integration of (scientific) analyses [Klein, 1990, Brewer and Lövgren, 1999, Brewer, 1999, Roy 2000, and Feller, 2000]. These authors claim that complex problems require a more integrated approach from science. They assert that scientific analysis should be more problem- driven, rather than discipline-focused. They propose changes to the design of university and project organisations and funding.

Secondly, scientific literature describes how participation of different actors (including academia) in a process of (organisational) change can ensure a wider scope for rationales, thus securing improved robustness in the real world and a higher chance of success. Robinson [1992, p. 251] recommends using science in a more interactive way, with a focus on …

> *… mutual learning among scientists, policymakers and the public that would occur in such a context. The underlying view here is that public policy will be improved, not by the presentation of more and better science, but by the mutual learning among scientists, policymakers and the public that would occur in such a context.*

De Bruijn et al. [1998] suggest it might be fruitful to bring actors related to a perceived problem together in a highly designed process. Actors within the sector already represent a variety of views on the reality of public transport. The inclusion of their views can lead to a more robust and more supported approach. In addition, the inclusion of a variety of actors also enlarges the range of solutions. This approach requires the processes to intelligently organised. Although this could work to widen disciplinary coverage, it could also evolve to strengthen vested interests, rather than solve apparent problems.

Bridging the gap between public-transport-related academia and practisioners on the one hand and our policymaker on the other can be useful. The former support a widening of the analysis, the latter support disclosing more problems and opportunities. But the efforts of the academics and practisioners are not always helpful to our policymaker[9]. They compete with each other, and as a result let their rationales compete. Our policymaker could be helped more with a coordinated application of rationales to support policy goals.

Thirdly, Rose [1993] and Jong [1999] do not focus on the variety of actors' views of one case, but rather on one actor's view of a variety of cases.

[9] This thesis will hereinafter refer to regional and local policymakers who are capable of tuning the organisation of public transport as "our policymaker".

Jong calls this approach *institutional transplantation*. Here, not the actors are brought together in an intelligent way. Rather the policymaker develops ways forward based on the analysis of other cases. He tries to understand the way other authorities operate and he transplants those lessons to his own situation. These lessons involve the contingencies of different organisational tuning strategies, in processes, structures, and arrangements.

This chapter will present a fourth approach to improve the multidisciplinarity of the organisation, building on the third. It aims to support and forward the secondary process of organisational change. It aims to provide the policymaker with a way to interrogate and combine recommendations of a variety of scientific rationales, based on lessons on how they were implemented in different cases. It aims to support our policymaker to ask himself questions about the success of the organisational form, define the issue at hand, and introduce other rationales. This results in a continuous process of small-scale assessments and changes. This chapter is a first attempt at supporting the incremental amelioration of public transport organisation through the structured use of different rationales.

This chapter has four remaining parts to describe a multidisciplinary approach to organisational design. Section 5.2 describes the arrangement types put forward in the different rationales to strengthen the disciplinary coverage of the organisation. Section 5.3 describes how these arrangement types, together with other tools presented in this study, can be used to tune the organisation. Section 5.4 further clarifies the approach by giving three limited examples of the first steps of the approach. Finally, Section 5.5 discusses the possibilities and limitations of a multidisciplinary approach to organisational design in metropolitan public transport.

5.2 The building blocks: Disciplinary knowledge and the organisation

5.2.1 Introduction

From the perspective of a single rationale, organisational design[10] should develop an organisational form supporting the rationales' evaluation criteria based on the rationales' theories. Consequently it is frequently a monodisciplinary exercise. The result is often an organisational template to be implemented in a primary process of organisational change.

[10] On Page 30 the concept of "the organisation" for this thesis was defined as purposefully-connected actors providing public transport in a metropolitan area. The organisational design consists of the arrangements structuring the connections or interactions between these actors.

The cases illustrated how a secondary process of organisational change made the template work with arrangements from other than the primary rationale. These added arrangements are the building blocks for the construction of an organisation with a wider disciplinary coverage. The cases showed five general types of arrangements related to the different rationales:

- **Remuneration**
  supporting values of *conceive the customer*,
- **Competition**
  supporting values of *managing the market*,
- **Co-ordination**
  supporting values of *schedule the service*,
- **Interaction**
  supporting values of *produce the policy*, and
- **Policy integration**
  supporting values of *maintain the metropolis*.
  These will be discussed here in greater detail.

The discussion will follow the same pattern for all five building blocks, related to the five rationales presented in Chapter 3. Firstly, each section gives a general description of the building block and explains which values the arrangement supports or secures. These values are related to the basic goals of public transport: effectiveness and efficiency. Subsequently, each section shows what organisational design threatens the functioning of the arrangement type. Finally, each section illustrates the difference between a monodisciplinary organisation based on the specific arrangement type and how the arrangement type can be added to an organisation: each section sketches an organisation based solely on this arrangement type (the template) and redraws how this arrangement was used to tune the organisations in the cases.

5.2.2 Remuneration: Getting even

Remuneration in the organisation supports the drive to understand the traveller by coupling performance (in the eye of the traveller) and reward (from the hand of the traveller). The traveller rewards service aspects that are to his or her liking, letting the operator reflect on the importance and design of these different service aspects. These positive ridership incentives should strengthen the feedback between a wide variety of ever-changing service demands by travellers and the design and execution of the services. Incentives generally have a financial character and are based on ridership, simply through the fare box revenue or allocation of income and subsidies to the operator. Other allocation systems can include the perceived quality of the services.

The main value of this arrangement is effectiveness, in different forms. It promises adaptability and customer orientation in public transport. Public transport leaves the standardised clockwork regime and is tuned to the wishes of a variety of customers. This should appeal to the traveller and increase ridership. It also contributes to efficiency, as services without travellers lack the positive feedback and planners redirect resources to services with better revenues.

These incentives target both the execution of services (by management and frontline staff) and definition of services (by planners). Generally, they structure the relation between traveller and operator (OT-level interactions). But in two of our cases (Zürich and Copenhagen), public authorities planned the services. Here, the incentive would structure the interactions between the public authority planner and the traveller. Remuneration to the authority can also depend on the number of travellers or their evaluation of the service. Generally, feedback should reward all actors, whether private or public, for their contribution to the system.

The main threat arises when the traveller and the customer are two different actors. Public agencies performed a role in all cases in commissioning and paying for public transport services. This means that the traveller is only paying partially for the service, and often that service planner's and executor's incomes are not coupled to the performance of planning and execution. The subsidising actor in that case becomes the important customer, deviating the attention of planner and executor from traveller's wishes.

A template merely based on this arrangement is devoid of subsidies and makes operators fully dependent on traveller satisfaction. Because subsidisation of public transport for infrastructure and operational costs is often vital, subsidies are generally an undeniable reality. Of course subsidies can be used to strengthen this mechanism, although vouchers (a personal public transport budget for every possible traveller) or multipliers (for every euro from the traveller, an additional subsidy). Even without subsidies, cost orientation and market positioning can distract attention away from the traveller.

Two small-scale implementations of this arrangement type are found in the Copenhagen case. The income of the authority (HT) was dependent on fare box revenue, resulting in extensive market research in planning services in Copenhagen. Also, HT introduced contracts with the operators that made their income more dependent on the quality of service execution. In the Zürich case, the new financing structure with *marktverantwortliche Transport-unternemungen* embraced this arrangement. The Dutch case also showed the redistribution of fare-box revenue and subsidies over operators based on ridership. The Dutch case underlined that in order to be successful, the

incentive has to be direct and accurate: revenue should be redistibuted to swiftly and based on performance.

5.2.3 Competition: Getting ahead

Competition in the organisation supports the drive to innovate both production and product. Incentives are not necessarily formulated in financial terms. They can also be formulated primarily in terms of market share. Winning or losing a piece of the market is considered to be an important incentive to public transport operators. It can be introduced either through autonomous competition (free market, OT-level interactions) or controlled competition (tendering, GO-level interactions). Organised competition can be either formal like the English and Danish tendering systems, or far more informal, like the competition organised in the early days of the Swiss ZVV.

In the cases the main value of competition has proved to be the amelioration of efficiency through the innovation of production. For example, operators in Tyne and Wear changed from two person double-decker operation to one person minibus operation, thus doubling the frequencies. In addition, it could also improve effectiveness when the traveller (or a good representative of the traveller) makes the choice between competing operators. Implementation of competition in the Tyne and Wear and Copenhagen cases showed dramatic increases in cost effectiveness, but only moderate changes in effectiveness (ridership or modal split numbers). In Copenhagen, reinvestment of efficiency gains in new public transport services should account for the moderate positive changes in ridership that arose in the region after competitive tendering.

Competition can be applied to different interactions in the overall organisation. The main focus is on operators competing for travellers, but competition is also organised for other tasks like competitive development or procurement of services, vehicles or facilities. In the case studies, competition was limited to the operators, but one might also consider competition for the role of public transport authorities by specialised companies. The cases have shown that competition can be established between operators for travellers (the Tyne and Wear free market, OT-level interactions), between operators for transport authorities (the tendering in the Copenhagen case, GO-level interactions) or between subcontracting operators for other operators (the tendering in the Zürich case OO-level interactions).

Two important aspects seem to impede the prospect of improving the effectiveness of the system through competition. Aggregating customer wishes into a service concept has proved difficult. Consequently, competing companies can more easily compete against each other on costs than on quality. This means competition only leads to improved customer orientation

in specific situations where the importance of costs is underplayed, or cost savings are used to improve quality. A second aspect is that in some of the competition models mentioned, the traveller cannot choose a specific operator on a day-to-day basis, but the choice is made for him or her through a tendering procedure.

Competition, like the other arrangement types mentioned here, is not self-sustaining. Over time it will change character, away from the principles it was based on. Like the other arrangements, a potent actor has to uphold the arrangement, possibly tuning the arrangement itself to strengthen it. The challenge is to combine the role of that regulator of the market and the role of the traveller, as one can easily obscures the other.

The template of this arrangement is the free market, in which the operators compete freely for the customer and all operators can easily enter the market. But the cases showed the flaws of the template. In Tyne and Wear, introduction of the free market led to competition between the major operators in the early years. But the market consolidated and the different operators colluded into monopolistic regions. Competition was upheld between the large operators on the one side and niche players and small new entrants on the other. Consolidation also occurred in competitive tendering in Copenhagen.

The implementation of a free market in Tyne and Wear left some room for the transport authority to tender out additional services. This option though was hampered by strict rules, set to defend the free market. In Copenhagen the authority had far more degrees of freedom in tuning the tendering procedure. This led to strict tendering on price, with incentives for the operators to focus on travellers' demands. Tendering is of course an alternative implementation, providing competition between operators and co-ordination by the public transport authority.

5.2.4 Co-ordination: Getting in line

Co-ordination in the organisation supports the drive to co-operate in production and on product. Metropolitan public transport always consists of services, which together define the overall service quality for the traveller. These services are fragmented into subsystems because of their variety in region, technique, service type, operating company, or a combination of the four. Different actors are responsible. To offer full coverage of services to travellers, these subsystems have to be co-ordinated. In the first place this co-ordination is directed at the interaction between the traveller and the operator (OT-level interactions): the co-ordination of the product. This involves the definition and operation of the transport service, of fares, sales, information provision, etc.

The main value of a co-ordinated product for the traveller is effectiveness; it enables the traveller to use the different services with as little a barrier between them as possible, both in time as well as in effort. This provides an effective service to the traveller and should attract people to public transport.

In addition, operators might not only co-ordinate their efforts towards the traveller, they might also co-ordinate mutual production processes. Co-ordinated production between operators offers substantial efficiency gains by smoothing out capacity fluctuations. Logistics of personnel, vehicles, facilities, and infrastructure can also suffer from fragmentation between regions, services or operators. The Copenhagen case offered an example: bus operators could fall back on a shared pool of buses, provided by a private leasing company. The Danish and Dutch case presented an example in the tendering rules. In both cases transferring a concession between operators included the transfer of drivers, in effect creating a pool of personnel.

Co-ordination is aimed at overcoming fragmentation, in product and production. But sometimes that fragmentation serves a purpose, for example in the cases of specialisation, decomposition or competition. Specialisation provides a way to excel in a specific task, more so than a non-specialised actor. Decomposition provides smaller problem perspectives, which makes problems easier to handle. Competition provides incentives and benchmarks for the different actors to improve their own performance. Here over-co-ordination can hamper both effectiveness and efficiency. This means that effective co-ordination in a specific situation has a specific level and is focused on specific aspects of the overall organisation. Over-co-ordination has no regard for the gains of fragmentation, only for the gains of co-ordination. This leads to loss of incentives for efficiency and effectiveness, and flexibility.

The template (the organisation with exclusive attention to the co-ordination arrangement type) can be operationalised in terms of a structure of a single authority designing and directing all services, crossing the borders of regions, services and possibly operators. Moreover, the authority would maintain the complete pool of vehicles, personnel and infrastructure. In the Zürich case, co-ordination went a long way to full co-ordination. The case clearly showed the weakness of such an approach; the authority recognized it was managing too rigid a system and the organisation lacked incentives for efficiency and customer orientation. In addition, the co-ordinated services the authority was developing proved very hard to implement, leading to paper co-ordination, rather than a really co-ordinated product. The cases of Zürich and Copenhagen presented fully integrated ticketing systems. In the Southern Limburg case, a co-ordinated ticketing system was set up for all bus services, but fragmentation remained between rail services and bus services in the region.

All cases present alternative implementations on a smaller scale. Co-ordination was available in ticketing between Metro and bus in Tyne and Wear, in a simple arrangement between Metro and bus operators accepting each others' single tickets with closed purses. Examples of co-ordination in developing schedules were found. Though bus and S-tog (metro) services in Copenhagen were not in the same hands, a process was set up to co-ordinate between the timetables of S-tog (services designed and executed by the national railway operator) and bus services (designed by the public transport authority and executed by bus operators). A similar process was used in Zürich. In addition, in Copenhagen a commercial leasing firm provided a co-ordinated bus pool, available for all operators in the region. The Copenhagen contracts in effect organised a pool of bus drivers, through the mandatory transfer of personnel when contracts were transfered between operators. These present examples of co-ordination without a hierarchical organisational structure.

Co-ordination had different themes in the various cases. Ticketing and the development of timetables are obviously important. But all interfaces, on the edges of regions, techniques, service types, and operators, require some kind of co-ordination if the traveller is to enjoy using public transport. Many such interfaces exist. A strong focus on one or two might underplay the importance of others. The Southern Limburg case clearly showed how focusing on integrating bus ticketing hampered integration with train ticketing.

5.2.5 Interaction: Getting together

Actors in public transport communicate, of course, but interaction with the exchange of rich information is not standard. Exchanging rich information is not about data transfer, but rather about understanding and supporting the role of other parties in the organisation. It is necessary to exchange rich information for two reasons. Firstly, information becomes available in the organisation to actors other than those who can use it. Secondly, the solution to the problem of one actor is often in the hands of another, due to the interlaced activities of different actors. No actor has a full overview of information availability and needs, of problems and solutions. Moreover these change over time, making continuous interactions a necessity.

Two examples might clarify this. Frontline staff interacts with travellers and might receive helpful travellers' responses first hand. These reactions are valuable to the service scheduler, either to the operator or to the public authority. Interaction arrangements can support the flow of that rich information between driver and planner. On the other hand, government might have some idea of the role of public transport for disabled. Eventually,

drivers and wardens have to implement that policy, preferably in the spirit of the policy, rather than the letter. In both cases, an rich exchange of information has to be built into the organisation between frontline staff and other actors.

The organisational form can, to some extent, secure or hamper these interactions. For example, strict tendering procedures severely limit the possibilities for rich exchanges of information between the commissioning authority and the tendering operator, additional to the specifications and after allocation of the tender. The design of an organisational form should contribute to the quality of interactions. This can focus on several aspects, both the design of the process of interaction itself and incentives for the actors to interact productively.

The quality of interaction becomes more important in a dynamic environment. They represent the relation between the changes and the appropriate response. When traveller preferences change, the frontline staff will have the first opportunity to notice this. Interactions between the different actors will be necessary for achieving the appropriate reaction. Because travellers' wishes, the labour market, public transport technology, policy considerations, etc., constantly change, public transport actors might need to adjust the product, production, or organisation.

But it is not only the environment which is dynamic. The way in which actors operate within an organisational form also changes, as was most apparent in the cases in Tyne and Wear and Copenhagen. A positive response to a specific organisational change can fade over time, due to changing goals or behaviour.

Public transport services are offered in an environment that has persistent dynamics, inside and outside its organisation. Any organisational solution will meet a shifting problem, policy goals, and transport wishes. The organisation should be aware of changing conditions under which a solution can work. A policymaker should be able to evaluate and retune the organisation to meet the new challenges. That evaluation is only possible with a proper perspective on the system and based on productive interactions with the actors involved.

The main value good interaction gives the organisation of public transport is effectiveness: a closer match between travellers' wishes and the product. Through rich interaction, travellers' preferences and the possibilities of the existing staff, fleet, and infrastructure become known in a rich and contextualised form throughout the organisation. When more actors involved have a rich picture of these aspects, the process of product innovation will find a closer match between demand and resources, a more effective product. In addition, innovation of resources (vehicles, infrastructure, and their management systems) will be more related to travellers' preferences

and the resources that are already available. The improved information symmetry increases both the range of solutions and the overall rationality of the implemented solutions.

Of course rich interaction can also support synergetic efficiency. In that case, interaction arrangements resemble co-ordination arrangements, but they lack the hierarchical aspect found in co-ordination arrangements. Interaction arrangements support hands-off co-ordination, rather than the hands-on co-ordination.

Two main threats can be distinguished. The first is simply overstating the importance of rich interactions, either by both parties or one of the parties involved. Interactions can become non-selective in the information that is exchanged, without regard for relevancy. For example, the information that operators had to provide to the Copenhagen authority rose dramatically over the years, as did the workforce processing and checking the information. A second threat is that strong interaction between two actors effectively reduces the interaction with other parties in the organisation. In the Southern Limburg case public authorities drew much attention from operators, leading to an under-appreciation of travellers' preferences in the product.

In the template merely based on this arrangement type, all actors fully share all their information. No case came close to this. All cases showed strong barriers within the organisation, though the height of the barriers differed between different actors. Fragmentation between actors was strongest in Copenhagen and Tyne and Wear, where strict rules limited the interactions between operator and authority. Far less strong was the fragmentation between operators and authorities in Southern Limburg and Zürich, leading to a richer interaction about wishes and possibilities and more creative solutions.

An interesting example can be found in Zürich. Here, the transport authority had regular meetings with all operators on general issues. These meetings were also used to discuss the implementation of the schedules as designed by the authority. During these meetings, the authority recognised the problems this posed the operators. Eventually, this led to the complete abolition of scheduling by the authority, transferring that task to large operators. On the other hand, these meetings were a platform for informal benchmarking between different operators, and a springboard for small-scale competition between the operators.

Interactions can concentrate on specific interaction levels. In Zürich the structuring of the interaction between operators has been a paradigm for the design of the organisation, while in Tyne and Wear the interaction between government and operator was the main focal point of the restructuring of the organisation in the mid-1980s. In Copenhagen and Southern Limburg, the organisation seemed to be directed at structuring more interaction levels.

5.2.6 Policy integration: Getting support

In Section 5.2.5 above, arrangements are discussed that structure interactions inside public transport. But the success of public transport, both its efficiency and its effectiveness, depends very much on developments outside the organisation. The policymaker tuning public transport can arrange other policies in a way which supports public transport. Vice versa, the success of other policies can depend heavily on public transport. A number of examples can be given. Roundabouts improve traffic flow and safety, but hamper bus speed in Southern Limburg. Numerous buses in Newcastle-upon-Tyne shopping area compromise pedestrian safety. Strict Zürich parking policies in the inner city support a model shift. High taxes on cars and petrol in Copenhagen support public transport ridership. Large housing, office, and industrial development schemes in all cases require additional public transport services to be developed. Dedicated services or service adaptations for specific groups, like the elderly, children, and the disabled, supporting social and educational policies are found in all cases.

The examples reflect five main areas:

- Social policy (bilaterally interdependent: generally supporting and getting support from public transport),
- Urban planning (bilaterally interdependent: generally supporting and getting support from and public transport),
- Environmental policy (unilaterally dependent: generally supporting public transport as the preferred transport solution),
- Economic development (unilaterlly dependent: generally supporting public transport as a transport solution), and
- Traffic safety (unilaterly dependent: generally hampering efficiency of public transport service execution on the road).

Public authorities relate general transport policy to the above-mentioned policies. Such relations are structured by arrangements. For example, the development of traffic calming should involve drivers and planners in the process. The development of new housing, office or industrial estates requires some involvement of planners of services. Subsidies for the disabled should be included alongside general subsidisation, as is the case with subsidies for environmentally friendly engines. Consequently a wide range of arrangements relates other goals to the provision of public transport.

Public transport has a strong foothold in the public sector through (a history of) subsidisation. That subsidisation was generally accompanied by detailed demands from public agencies, generally unable to represent the wide variety travellers' preferences. Some integration in policy development is desirable and attractive. But the regulation and subsidisation that comes with policy integration carry a significant threat. Operators and authorities focusing

on that regulation and subsidisation can be distracted from efficiently providing a desirable service to travellers in general. Public transport has its own market. That market is not always easy to discover. It becomes even more difficult when public transport is focused on supporting other goals too. In such cases, public transport services tend to become more a public service and less a transport service. The organisation has to strike a balance between the general public demands and the demands of the general public. The implementation of policy integration has to reflect that balance in its arrangement. The development of public transport is hampered by its fixed relationship with other policies, of regional, national, or transnational governments.

In the template, public transport is just an instrument of a single or wide range of public policies. Subsidies and regulation are the basis of public transport operation. Subsidies and regulation can hamper efficiency and effectiveness, because they cannot incorporate the details of both travellers' preferences and transport operation.

Alternative implementations were found in all cases. In Tyne and Wear and Copenhagen, specific services existed for disabled, supplementary to the general services. Though no synergies were achieved between general services and those for the disabled, both types of service were better tailored for the specific target group, improving their effectiveness. Another possible alternative implementation is subsidising through the general traveller. When he is remunerated for his performance, the actor designing the services will listen more closely to the travellers' wishes. Rather than distracting the operator from the traveller's demands, the subsidy amplifies the voice of the traveller.

5.2.7 Discussion

The sections above depict a variety of arrangement types relevant to the organisation of public transport. They assert that good organisation of public transport is based on operators and authorities trying to be the best, serving the traveller with a co-ordinated product, while co-ordinating production and resources. The organisation is constantly tuned by the actors to overcome problems perceived by any actor, including the traveller. Public transport is supported by other public policies and in return delivers quality services to existing and new, captive and non-captive markets.

A number of conflicts arise combining the rationales into an organisation through these arrangement types. First, conceptually the combination of *arrangement types* can seem contradictory. For example, public transport aiming to support other policy goals without subsidies of any kind seems unlikely. Or competition with hierarchical co-ordination also seems implausible.

Also at a later stage, when the arrangement types have been developed into *arrangements* for implementation, conflits arise. For example, subsidies for an innovative operator could conflict with regulations securing a free market. Or the decision to further negotiate a tender with the winning operator could conflict with strict tendering procedures. Every organisation contains a wide variety of arrangements at all interaction levels. By the sheer number of arrangements it becomes even harder to prevent conflicts between arrangements. Consequently, when the decision comes to add other arrangements, implementation is painful.

More conflicts might occur after implementation. The cases showed how implementation of combined arrangements can not only be painful, but it is also difficult to determine their success. When arrangements are added, their influence on the interactions is countered by arrangements introduced to favour other values and changing behaviours. In concept, the *arrangement type* favours a specific value, but after implementation of the *arrangement* it is hard to discern its effect on that value.

Still, policymakers in the different cases were able to combine these arrangement types for the good of public transport. Moreover, this combination of arrangement types helped the cases to be successful. The types were used to tune the organisation and spread its disciplinary coverage at the different interaction levels.

The building blocks presented offer a starting point for the widening of the disciplinary coverage of a variety of organisations. They are not developed in further detail here. Their basic description serves allow further definition, aligned with a wider variety of existing organisations. Of course application of the arrangement types requires a translation from arrangement type to functioning arrangement fitting the organisation in which it will find its place. The added arrangement and the existing organisation have to form a functional, though possibly diverse entirety. In addition, the arrangement has to target the problems perceived. The next section will present a chart to come to such a translation from arrangement type to arrangement.

5.3 Reconstruction: Towards a multidisciplinary organisation

5.3.1 Introduction

This section explains how policymakers might manage the secondary process of organisational change. It develops the main lesson from the cases: part of the success of the cases outside the Netherlands can be found in the application of a secondary process of organisational change. This secondary process was multidisciplinary in its essence. The organisational changes in this process aimed at resolving the conflicting recommendations not by

choosing a single rationale, but by side-by-side application of rationales at the level of arrangement types. This offered a wider set of incentives to the actors involved. It combined incentives that direct the operators to the preferences of the traveller, while still providing subsidies. It directed operators to compete while using the co-ordinative strength of government intervention.

The success of adding arrangements (and organisational changes in general) depends on the context. Whether a new arrangement will have the desired effect depends highly on the other arrangements (the organisation as it was) and the way actors allow the old and new arrangements to structure their interactions. These vary greatly through space and time.

To balance the existing organisation, new arrangements have to be based on an empirical assessment of the existing arrangements and how the actors react to them. Understanding the existing context is a prerequisite for developing the arrangement types into a useful configuration of arrangement types. This context varies even under a common institutional regime, such as the one in the Netherlands. It depends on a variety of aspects, from current operator to urban structure, from specific contracts to available modes. The whole public transport system defines the playing field on which authorities can try to tune their organisation. Moreover, as the context is dynamic, effective arrangements will be different through time. In such a context the combined rationales do not offer a single answer, but the cases did provide a lesson this section further develops. Organisational design in a multidisciplinary perspective offers no grand design, but is does offer incrementalism as an alternative.

The building blocks from Section 5.2 form the construction material to incrementally balance an organisation with arrangements related to different rationales. The remaining question is: how can these building blocks be utilised to redesign the organisation of metropolitan public transport? The answer to that question has to be found in a process that structures the incrementalism in a way that capitalises on its multidisciplinary potential.

The approach helps our policymaker widen the possible definition of the problem, the analysis, and the range of possible solutions. Table 25 shows how the multidisciplinary approach differs from a more traditional monodisciplinary approach. Some differences are apparent beforehand. The multidisciplinary approach aims to widen the understanding of the issue, rather than narrowing it down to a strict problem definition. In addition, it focuses on mobilising the theoretical mechanisms defined by more rationales in the right direction, rather than restricting the issue to a single theoretical mechanism. Moreover, its recommendations are aimed at organisational changes, as the organisation is the construction linking the different actors, tasks, values and rationales.

	Monodisciplinary	Multidisciplinary
1	*Narrow down the problem*: Develop one clear definition of the issue from the first problem inception	*Widen the issue*: Develop a variety of possible issue definitions from the first problem inception, using the rationales and interactions levels
2	*Understand the mechanisms*: Select a rationale describing the problem consistent with current rationale	*Mobilise the mechanisms*: Select all arrangement types that can help address the variety of issues, using the building blocks
3	*Formulate solutions*: Select from that rationale possible solutions	*Formulate arrangements*: Create arrangements based on the variety of arrangement types that align with current organisation
4	*Select solution*: Decide on a promising solution based on an analysis from the current rationale	*Dismiss arrangements*: Decide on the arrangements that can be left out because they or similar arrangements are already incorporated in the organisation or they cannot be fitted with other arrangements
5	*Implement solution*: The result of the above approach is a way forward in line with the current rationale	*Implement new arrangements*: The result of the above approach is a number of arrangements that can address the issue and widen the disciplinary coverage of the organisation concerning the issue
6	*Evaluate effect solution:* Measure quantified effect of the implemented solution	*Evaluate working of organisation:* As effects of the different arrangements are hard to discern, the evaluative focus is on the organisation as a whole, rather than on the single arrangements

Table 25
Multidisciplinary versus monodisciplinary approach

5.3.2 Widen the issue

The first step clarifies the issue at hand. In a *monodisciplinary* approach of organisational change our policymaker defines problems in a framed manner. The problem is delimited at an early stage, either by its first manifestation or by the first interpretation of our policymaker. This framing incorporates a choice for a specific rationale: the analytical rationale. When travellers are frustrated by the lack of quality, this can be framed as: "ridership slips because of a lack of competition". The analysis then shows that the market is not functioning properly and, as a consequence, the operator is not trying hard enough. The analytical rationale is not necessarily the existing organisational rationale. It might be that an analytical rationale is chosen countering the existing organisational rationale, which possibly is the overture of a new primary process of organisational change.

In a *multidisciplinary* approach, problems are defined in a wider, more ambiguous way. Travellers' complaints, negative media coverage, or a talk

with an operator can trigger our policymaker to reassess its perception of the quality of the organisation. Quantifying can play a role, but our policymaker should incorporate other ways to let "problems" surface. When other actors involved perceive a problem rooted in the overall organisation, our policymaker can adopt it. An urban planner not able to support urban development with public transport services points out a problem. An operator perceiving that he cannot adapt services to demand also has a problem too.

Applying a multidisciplinary approach implies that a single problem is translated into a multifaceted issue not limiting it to a single cause and solution but expanding it to a variety of causes and solutions. This step is not aimed to find the "right" problem but rather to find a number of possible mechanisms that influence the problem.

The interaction levels and rationales presented in this study offer the possibility of translating the first problem perception to a wider issue definition. For example, passenger counts might show ridership is slipping. At first this seems a problem at the OT-level: the operator is not providing the traveller with an attractive service. However, the travellers might in fact appriciate the services of individual operators, but service perception overall is low because of a lack of co-ordination between operators at the OO-level of interaction. Or government regulation of the operators (the GO-level of interaction) might hampering co-ordination between operators. Moreover, it is quite likely that ridership is influenced negatively on all three levels.

Subsequently the issue can be widened by further exploring how different rationales interpret these problems. For example, growing government regulation can have disturbed the market (manage the market), making it harder to technically optimise operations (schedule the service), leading to higher prices and dropping ridership (conceive the customer). Again, it is likely that all these mechanisms work together to negatively influence ridership.

Should the policymaker act when he perceives his organisation as a monodisciplinary construct, but perceives no problems within the organisation? This is an arbitrary question as a template is prone to problems. Problems will occur in a template, which can be used to come to an issue definition. The question is less arbitrary when the policymaker wants to start a primary process of organisational change, altering the organisation fundamentally. Section 6.4 will evaluate the possibilities for improving the multidisciplinarity of a template before implementation.

5.3.3 Mobilise the mechanisms

The next step in a *monodisciplinary* approach aims to understand the mechanisms that triggered the problem. In essence, this is a highly disciplinary exercise. The different rationales provide different mechanisms

which all can influence the problem. A traditional problem analysis provides no fertile basis for combining of these mechanisms in a single evaluation. Understanding a problem requires clear causal relations, which is something a multidisciplinary framework does not easily provide.

Problem definition is a selective process; it tries to pinpoint the origin of the problem. In its selectivity, it also limits the possible ways forward. The *multidisciplinary* approach does not select a single problem, but widens the problem. Still, there is a need to go forward, to develop actions that can help address the issue. These actions should be directed at the organisation as the linking structure for actors, tasks, and consequently rationales. The building blocks in this chapter serve this purpose, as they provide a bridge between the wider issue definition and the right *arrangement type.*

Our policymaker has to realise that a variety of arrangement types dealing with the same issue works better than a single arrangement type, even when these arrangements types seem contradictory. In our example of slipping ridership, a problem analysis might pinpoint a lack of co-ordination between operators to be the origin of the problem. Competition is often seen as a reason for operators to focus on internal processes, reducing their co-ordinative effort. Taking away competition might improve co-ordination, but can have negative effects on efficiency of the operators. A multidisciplinary approach tries to combine both competitive and co-ordinative arrangements, as this provides the possibility of fostering the benefits of both arrangement types. These various arrangement types can trigger mechanisms from different rationales directing the organisation along various paths in the same direction: more travellers.

5.3.4 Formulate arrangements

Based on an understanding of the problem, step 3 in a *monodisciplinary* approach develops a solution that targets the perceived origin of the problem. As the analysis has a disciplinary bias, the solutions inevitably show that bias too. Solutions in this step align with the recommendations of the analytical rationale as they were presented in Chapter 3.

A *multidisciplinary* approach translates the arrangement types from step 2 into arrangements that address the issue, all in their own manner. The arrangement types have to be translated into real arrangements: organisational structures, processes, or incentives. For example, the slipping ridership seems to be the result of operators not working together. At the OT-level, remuneration can help operators focus on travellers' demands for co-ordinated services. At the OO-level, a co-ordinative top-down scheduling process (intercity, regional, local) can structure targeting the interdependencies of the schedules and facilitate co-ordination of the timetables. Finally, at the GO-level of interaction, the government might only

provide a concession to competing operators if they join a combined traffic control centre. Other arrangements might not target weak co-ordination, but values put forward by other rationales. For example, our policy maker might contribute sliding ridership to regulation putting too many constraints on the scheduling process. An arrangement can limit government intervention in the scheduling, as well as allow government facilitating the process of scheduling.

These arrangements present small changes to the overall organisation. In addition, they are varied rather than coherent. One arrangement selectively strengthens government intervention on one aspect, while the other weakens it on an other. The incentives often seem contradictory, but only in a theoretical context. In reality they balance the behaviour of actors at different interaction levels and are aimed at effectiveness with a need for efficiency: optimising better service while leaving costs in the balance.

The exact arrangement is very much dependent on the existing context of organisation, demand, sector, and technology. For example, when the operator only executes services that are developed by public authorities, full remuneration to the operator is no viable option. How can an operator be held responsible for services he does not develop? Still, remunerative incentives can help the operator focus on the customer, but the actor developing the services obviously has to take most of the financial remuneration. Or when there are no alternative operators interested, implementation of competition between operators may prove counterproductive. Or the combination of remuneration and co-ordination might be simple in a situation where travellers are used to a chip card. No single theory can oversee this contextuality; it is up to our policymaker to select the context variables he considers important and take these into account. Chapter 3 supports this selection.

The smaller arrangements offer our policymaker the opportunity to be more flexible. He has multiple arrangements at hand, which makes it less problematic if one fails. The arrangements are smaller, which makes it easier to change or withdraw them. As the context is also dynamic, the flexibility allows the alignment of the organisation to respond to changing conditions. In the dynamic context of reality, incentives need to balance each other in an effective way.

5.3.5 Eliminate existing and ill-fitting arrangements

The next step in a *monodisciplinary* approach selects a single solution for implementation from the limited array of solutions. Implementation of this single solution is both critical and complex. The *multidisciplinary* approach offers a variety of arrangements. This variety may contain arrangements that already have a place in the organisation, perhaps in a slightly different form.

This makes it necessary for our policymaker to evaluate to what extent the existing organisation contains arrangements that already secure specific arrangement types for this issue. These arrangement need not to be implemented as they are already available. They might need some tuning though, to strengthen structures, processes, or incentives that support the current issue. For example, if a contract with an operator contains financial incentives to co-ordinate services with other operators, new contracts can simply raise the financial bonus. The remaining arrangements can be implemented. Also, arrangemets can be rejected because they cannot be combined with other new arrangements or simply cannot be positioned in the existing organisation.

5.3.6 Implement new arrangements

In a *monodisciplinary* approach the result of steps 1 to 4 is a solution that is the best way forward for this issue from the perspective of a single rationale. Whether implementation is possible remains to be seen. The constraints the existing organisation puts on implementation, might require alteration of the solution, further challenging its effectiveness.

The result of steps 1 to 4 in a *multidisciplinary* approach is a set of arrangements already aligned with the existing organisation, though possibly based on different rationales. In addition, the arrangements are relatively small changes to the existing organisation. Both aspects facilitate implementation.

For implementation, a distinction can be made between two situations: the implementation can be direct or indirect, depending on how the existing arrangements structure government involvement. In a free market with strict national control, direct involvement of local authorities in public transport is limited. Government involvement is much greater when services are tendered out: the concession procedures and contracts offer a solid framework to add or remove arrangements. In all cases, however, local authorities hold some restrictive (concessions to operators, traffic regulations), and supportive (ticket sales, infrastructure, subsidies) instruments they can use to build additional arrangements on. For example, to improve sliding ridership the local authority can invest in bus lanes and bus priority schemes to improve the average speed of the services offered. Moreover, the authority could restrict the use of bus lanes to low-emission engines or low-floor buses, to reduce emmissions and improve accessibilty. Here the authority becomes indirectly involved in the interaction between the operator and the vehicle provider.

Because of the ease of implementation, our policymaker is presented with a pitfall: when adding arrangements is easy, adding regulation is easy too. Adding arrangements does not necessarily mean adding regulation and

steering. A new arrangement can replace parts of the existing organisation. Moreover, the new arrangement itself can leave more room for operators to focus on the traveller or co-operate with each other. This is important because no public authority can represent the variety of (potential) travellers in public transport. Consequently, implementation can imply the choice for a hands-off arrangement. An example is subsidising public transport by means of travellers' subsidies. Here, the policymaker gives the traveller the possibility of controlling the operator, rather than taking public control.

5.3.7 Evaluate the working organisation

A *monodisciplinary* evaluation distinguishes the effects of the implemented solution from the other dynamics in organisation and performance. As with the other steps, only a monodisciplinary lens provides enough focus on specific mechanisms to provide such an evaluation. An assessment based on "managing the market" can answer the question of whether competition led to lower costs. When more rationales are included in the assessment, the picture easily becomes unclear. A multidisciplinary assessment could show that the effect was (partly) the result of other mechanisms, for example reduced demands by governments, innovation by operators, or service levels.

Evaluation in a *multidisciplinary* approach is very complex, as it lacks the focus of a single rationale. From a *multidisciplinary* prespective, our policymaker understands that many different mechanisms influence the effectiveness and efficiency of public transport provision. From a *multidisciplinary* prespective, the effect of a single arrangement is hard to quantify. As a consequence, the evaluation of the changes is directed at the entire organisation, rather than at a specific change. The evaluation makes the process iterative as it is a renewed step one. It will again bring issues to the surface, which in turn will trigger the remaining steps and result in the tuning of existing arrangements, the replacement of existing arrangements by new arrangements, or the addition of the arrangements.

The success of the approach depends on solid and adaptive implementation, not on the pureness of implementation of the building block: competition, co-ordination, interaction, etc. On the other hand, an arrangement built on the strengths of competition will not ensure competition, an arrangement built on the strengths of co-ordination will not ensure co-ordination, an arrangement built on the strengths of interaction will not ensure interaction, etc. Our policymaker will have to critically assess on a day-to-day basis whether the arrangement still reflects its building block or whether further tuning is needed to improve the organisation of public transport in his metropole.

5.4 Tuning templates: Three partial examples

The multidisciplinary approach described in the previous section underlines its dependency on the context. This is an obstacle to a more detailed conceptual description of the steps. This section takes the first steps out of that approach and clarifies them by describing them for three archetypical types of public transport organisation: a government service branch, a free market, and a tendering process. The limited descriptions lack context, the examples are only given as an illustration. Chapter 6 provides a more detailed application of the multidisciplinary approach.

One of the quintessential templates is that of the *government service branch*. It is heavily dependent on the arrangements of interaction and policy integration at the GO-level. Co-ordination can play an important role when the template is applied to all techniques in a specific region, i.e. when the government service branch offers all services in the region. This is generally not the case, because non-local operators offer intercity services that enter the region. In addition, the arrangement offers the possibility of internal co-ordination, but this still has to be implemented.

Government service branch	**Arrangement**	**Interactions**
Existing in template	Interaction	GO-level
	Policy integration	GO-level
Arrangements to be added	Co-ordination	OO-level
	Remuneration	GO-level and OT-level
	Competition	GO-level

Table 26
Tuning a government service branch at different levels of interaction

When co-ordination of schedules lacks, a special arrangement has to be added to co-ordinate these services, for example a top-down process of scheduling. In such a process, intercity service changes are planned at least two years in advance, so other services can adapt to those changes. Similarly, co-ordination at the level of ticketing can be implemented easily for local services, but additional arrangements will have to be made for interchanges from local services to important regional and national services.

Generally, this template does not include remuneration. But implementation is possible and can shift attention back to the OT-level. The basis is, of course, that fare-box revenue has to be awarded to the municipal operator, rather than to general public funds, and the operator should receive a large amount of freedom to develop services. Remuneration can be less effective because the service branch, management, staff, and frontliners, will always feel it can fall back on government subsidies. Strict and transparent rules for additional subsidies and adhering to these rules though will have to

be used to implement remuneration in a government service branch. Figure 27 gives an overview of the arrangement types in the template and the directions to tune.

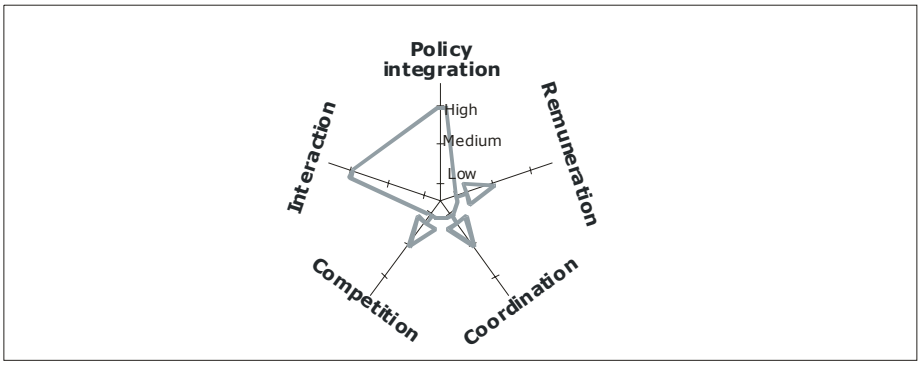

Figure 27
Arrangement types and tuning possibilities in a government service branch

Often the idea is that this template completely excludes any form of competition. This is not true though. Tendering out management is an established way of adding competition to the template of the governmental service branch. In such cases only the (top) management of the service branch is hired from the private sector, through a process of tendering out at regular time intervals. The choice for a specific tender can be tuned, like more extensive tendering, to the needs of the moment. Of course, internal competition, within the operator, through benchmarking services, districts, or teams is also a way of implementing competition within a governmental service branch.

Free market	**Arrangement**	**Interactions**
Existing in template	Competition	OT-level
	Remuneration	OT-level
Arrangements to be added	Policy integration	GO-level
	Co-ordination	OO-level
	Interaction	All levels

Table 27
Tuning a free market at different levels of interaction

Another characteristic template is the *free market*. It is heavily based on the arrangements of competition and remuneration and has a strong focus on the OT-level. Often co-ordination is expected to arise consequentially, due to the templates' expected focus on the traveller. But operators have trouble combining the role of competitor with that of a colleague. Management attention tends to favour the real and private benefits of improved market-share over the uncertain and shared benefits of co-ordination. Figure 28 gives

an overview of the arrangement types in the template and the directions to tune.

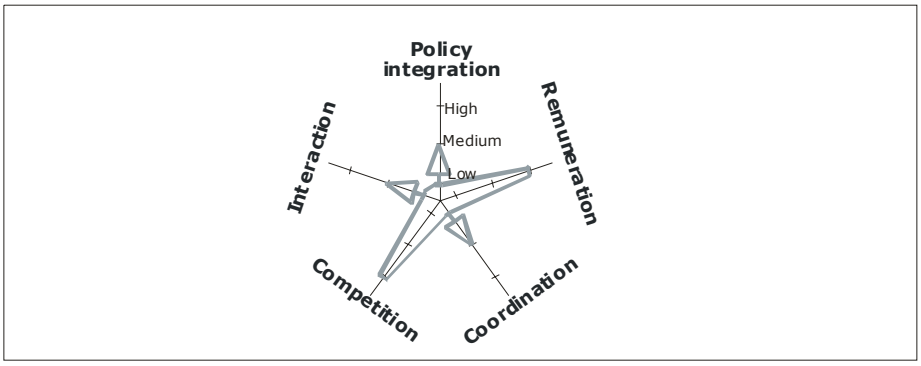

Figure 28
Arrangement types and tuning possibilities in a free market

That means that co-ordination needs a specific arrangement. That can be implemented at the OO-level. An example is the acceptance of mutual tickets in a situation were this will not influence the distribution of income over the operators. When redistribution is expected, chip card technology might be able to indisputably trace this effect and an arrangement can be made to redistribute income over all participating operators. Public authorities may support this redistribution. Scheduling is more complex to co-ordinate in such cases, but public authorities can contribute by setting up a platform for scheduling between the operators of different techniques.

Policy integration and interaction also need attention. The template tends focus operators away from other operators and travellers. In addition, counter-intuitively, operators are not always so open to travellers' wishes, either. Costs and travellers' wishes have to compete for attention, again, costs being the more controllable. Local authorities can improve the interaction with travellers by encouraging them to publicly evaluate the services offered by publishing benchmarks, which will raise the collective awareness of service quality. Policy integration can be improved by allowing for tendered services alongside the free market services and by inviting and involving operators when new developments are planned.

A final remark is in order here. The strict rules of this template make it especially hard to add arrangements. That means that the potential of the added arrangements is there but is hard to realize. Adding policy integration, co-ordination, and interaction, and shifting the balance to the OO-level and the GO-level will need some creative tuning by local authorities.

Tendering process	Arrangement	Level
Existing in template	Competition	GO-level
	Policy integration	GO-level
Arrangements to be added	Co-ordination	OO-level
	Interaction	OT-level and OO-level
	Remuneration	OT-level

Table 28
Tuning a tendering process at different levels of interaction

Finally, a general template in use is the *tendering of services*. The public authority defines the service (needs) and operators compete for the execution of the services. The public authority has a lot of freedom to integrate public transport development with the development of other policies. In addition, it uses competition between operators to keep the execution of services efficient. This template is based on the combination of policy integration and competition. Figure 29 gives an overview of the arrangement types in the template and the directions to tune.

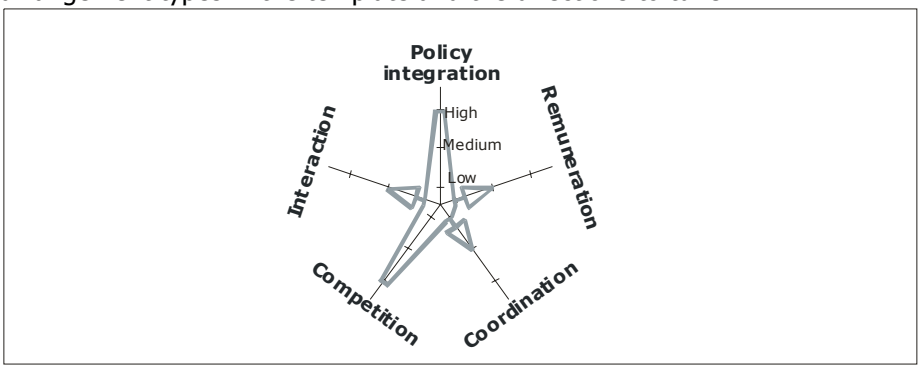

Figure 29
Arrangement types and tuning possibilities in a tendering process

In the scheduling of services, the public authority can build in some form of co-ordination, either by scheduling the services themselves, or by demanding interconnection from tendering operators. As in the government service branch, co-ordination at the level of ticketing is relatively easy to implement at a metropolitan level, as is co-ordination between the services planned by the authority. Additional arrangements have to be made for co-ordination with other services.

The template is biased towards the GO-level. The public authority could balance that by keeping a constant eye on travellers' wishes, for example through focus groups, market research, or an active complaints desk. In addition, the template often lacks interaction between public authority and operator, hampering the policy integration over the longer term. Communication is generally one-way, from the commissioning authority to the

executing operator. Finally, the template needs a form of remuneration. The operator has to be aware of the fact that his income depends on how well he serves the travellers. That can be done by awarding the operators with the fare-box revenues or by adding incentives to the contract to uphold the quality of service provision. This also balances the template more towards the OT-level interactions.

5.5 Discussion

This chapter has not provided our policymaker with an ultimate destination: it does not describe the optimal organisation of metropolitan public transport. It offers a multidisciplinary route aimed at continuous improvement of the organisation. This way forward has no clear organisational destiny, but it has a clear goal in terms of performance improvement. Tuning the organisation as we suggested is in line with the idea of contextuality: every existing organisation is unique and requires a unique approach. Our policymaker has a great deal of knowledge about the present organisation, which he can mobilise to improve it. Combined with the presented knowledge about the wide range of possible arrangements he can tune the organisation's performance to a higher standard.

Of course this approach has its pitfalls. Tuning the organisation should not be confused with simply adding arrangements. When arrangements are simply added, the organisation runs the risk of entanglement. This represents the opposite of the template. In a template, the incentives an actor receives point in one direction. This disables the actor's possibilities to balance values in his organisation and increases his urge to evade the incentives. In an entanglement all incentives are non-directional. The organisation fails in its role of directing actors, because the incentives are blurring each other. A balanced organisation can be multidirectional, giving clear and balanced incentives to the actors.

The suggested approach has some implications for the primary process of organisational change. Firstly, one could argue that large-scale organisational change is less required when the organisation is continuously tuned. An organisation which adapts incrementally does not need a complete overhaul. Secondly, the primary process of organisational change often starts out when the responsible actor is confronted with ongoing problems, either by his own perception or by reception from other actors. One could also argue that the primary process would be helped if the actor responsible took a wide disciplinary view. Thirdly, tuning an organisation is only possible if the primary design of the organisation leaves room for such an activity. A primary design which locks responsibilities and instruments away for those who can judge the detailed functioning of the organisation excludes opportunities for organisational tuning. But the ramifications of this chapter for the primary

process are left to the creativity of the reader. Here, the focus will be on the secondary process of organisational change, tuning the existing organisation to the perceptions of the major actors involved.

How does the approach endorse multidisciplinarity? It does this in two different ways. Firstly, by balancing interactions between actors in the standing organisation; the rationales of a greater variety of actors is involved in the organisation. That means that an organisation should balance interactions over the GO-, OO- and OT-levels. Secondly, that variety can be reflected by the variety of arrangements used.

Does this work? It is too early to say, but the next chapter presents the results of testing the approach in a simulated real-world: a simulation game.

6 Testing the approach: Tender gaming

It's hard to make improvements without changing anything.

Mikhail Gorbachev
Address to the Supreme Soviet Congress, February 1986

6.1 Introduction

Chapter 5 suggested that the organisation of metropolitan public transport can be improved by balancing different types of arrangement. Balancing implies the combined implementation of complementary types. Five arrangement types were mentioned:

- Remuneration,
- Competition,
- Co-ordination,
- Interaction, and
- Policy integration.

These arrangement types find their roots in different rationales. They aim to balance the interactions between the different actors. Simultaneously applying these arrangement types can improve multidisciplinarity in the organisation. Three levels of interaction between different actors were quoted:

- GO-level, between government and operators
- OO-level, between operators, and
- OT-level, between the operator and the traveller.

A balanced application of the arrangement types at the different interaction levels should improve the multidisciplinarity of the organisation, mobilising more empirical mechanisms linking empirical phenomena to performance, and improving the overall effectiveness and efficiency of the service. Simply put, this approach mobilises the complete potential of organisational improvements, as seen by geographers, economics, engineers, policy scientists, and urban planners.

The approach follows from an analysis of the behaviour of policymakers in four cases. But is it beneficial and feasible? Does this approach offer our

policymaker a way forward to improve the performance of the organisation? A policy exercise was set up to assess this question. A policy exercise is a simulation game in which a group of individuals is put in different real-life situations to evaluate their performance. Here, actors involved in public transport in Southern Limburg in the Netherlands were set in two different organisational forms: a tendering process which was developed by the policymaker in the region and a tendering process with new arrangements to overcome the weaknesses of the template tendering procedure. This chapter describes the outcome of that policy exercise, analyses the performance of the actors in both situations, and reflects on the performance of the suggested approach.

A simulation game is a way of learning about actor behaviour in complex situations. It is often used to provide the participants with a learning experience. They are confronted with a pre-set situation, upon which they act and later reflect on their behaviour in the situation. It provides a low-risk environment for the participants to learn how to operate in an unknown setting. In addition, it can be used to understand participant behaviour and, as such, provides a learning experience for the observers of the simulation. In such cases observer and player can learn valuable lessons. Simulation games can be used for other purposes [see also Becker and Goudappel, 1972]. Corsini [1961], Duke [1974], Shubik [1975], Ståhl [1983], Wentzler, [1993], Caluwé [1996], Holsbrink-Engels [1997] and many others present useful overviews and design guidelines on simulation games.

Simulation games generally consist of two parts. There is a part that mimics the outside reality: the support environment. This is generally modelled using computers, but other paraphernalia can also be used. There is also a part that mimics actor interactions: the game-play. Simulation games are distinguished from (computer) simulations by the added game-play. Real people re-enact parts of reality of social interaction, supported by models simulating physical systems or social systems outside the game-play.

Duke [1974], Shubik [1975], and Ståhl, [1983], and all distinguish between different types of simulation game. Marshev et al. [1983] combine these views and present three main areas of application:

- The educational area,
- The research area, and
- The operational area.

In the *educational area*, the simulation game imparts a pre-set lesson to its players. The organisers set up a game to impart a specific lesson to the players. A well-known example is the beer game, developed by Stafford Beer to show students the complexities of logistical systems in situations of flexible demand. In the *research area*, there is no ex-ante lesson for the player. There is just an ex-post lesson about how the players behaved in a specific

situation, generally testing a hypothesis about expected actor behaviour. The organisers focus on (re)creating a specific situation and recording and interpreting what happens. Research in game theory uses this approach, for example to understand how people act in a prisoners-dilemma situation. Finally, simulation games are applied in the *operational area*. Here, too, the focus is on testing, not of neutral hypotheses, but rather of the expected improvements of a system. The organiser's focus is on tuning the simulated system, rather than on understanding player behaviour in the simulation. Examples can be found in disaster management, where different actors enact their respective roles to investigate how their organisation can be improved to deal with the reality of disasters.

Shubik [1975] and Ståhl [1983] present a number of simulation games which cross between areas with different purposes. In fact our game also has a triple focus. Firstly, it helps the players understand how tendering public transport services can work. Secondly, it gives the provincial government the opportunity to tune the tendering approach to be implemented. Thirdly, it gives us the possibility of testing the suggested approach developed in Chapter 5. The latter goal is the primary focus and is the basis for the design of the simulation game.

The aforementioned authors distinguish between simulation games based on their purpose. A distinction can also be made between simulation games that seek to reduce reality to a single mechanism (for example a prisoners dilemma or a chicken game) and simulation games that seek to come as close to reality as possible. The first type has a more theoretical focus, with randomly selected participants in a simplified situation. The second type is more empirically-orientated. Generally the simulation game imitates reality as close as it can and the players' roles reflect their daily activities. The simulation game presented in this chapter takes the latter approach. It does not aim to understand general player behaviour in abstract situations, but rather it seeks to understand and support policymakers in redesigning the organisation of (Dutch) metropolitan public transport.

Reality is distorted in all simulation games, partly because of temporal and spatial concentration, partly because of exclusion of elements of reality. Time is sped up, space is cramped, direct contact between players is easier, daily distractions are left out, and the supporting models are limited abstractions of a part of reality. But simulation games are the closest we can get to the richness of reality and the most real situation under which we can test significant organisational changes without jeopardising the performance of the real organisation.

Section 6.2 describes the simulation game developed in this study: the players involved, the set up, the game play. It also describes how the suggested approach was applied and four different methods used to evaluate

the results. Section 6.4 discusses the results and how the simulation game and the suggested approach together offer a unique possibility for improving the disciplinary coverage of the organisation of metropolitan public transport.

6.2 The simulation game setup

6.2.1 Introduction

Twenty-two representatives of national, provincial and municipal governments and managers and planners of bus operators were gathered to simulate four years of tendering public transport in Southern Limburg[11] at the "Gouvernement" in Maastricht, the Netherlands, on June 18th and 19th 1998. The Southern Limburg region had little experience with competition or tendering. In one tendering experiment in 1994 a limited concession was awarded to Vancom Southern Limburg, taking the concession from Hermes, the local incumbent.

For the simulation game, the provincial government put up three different networks for tender: *Oostelijke Mijnstreek* (a network of urban bus services in the east of the region), and *Westelijke Mijnstreek* and *Heuvelland* (two networks of regional bus services). In addition, the municipality of Maastricht had the possibility of tendering out the complete network of urban bus services in and around the city of *Maastricht*.

6.2.2 The players

The game play represented the interaction between governmental actors and operators. The players were divided into seven different actors.[12]

1. Vancom Zuid-Limburg,
   (daughter company of Vancom, an international transport company operating regional bus services),
2. Hermes,
   (daughter company of national stockownership VSN-Groep, operating regional bus services),
3. Stadsbus Maastricht,
   (Maastricht municipal-stockownership, operating urban bus services in and directly surrounding the city of Maastricht)
4. Nederlandse Spoorwegen Reizigers13,
   (national stockownership operating the vast majority of regional and intercity rail services in the Netherlands),

[11] For a more detailed description of the region and its public transport see Section 4.5.

[12] The description represents the 1998 situation. The exact list of participants can be found in Supplement E.

5. The province of Limburg,
   (the government of the province, public transport authority for regional services throughout the province and urban services in the region outside Maastricht),
6. The municipality of Maastricht,
   (the government of the municipality of Maastricht, public transport authority for urban services in and directly surrounding the city of Maastricht)
7. Other municipalities,
   (seven of the 21 municipalities in the region, no public transport authorities but dependent on regional or urban bus services)

Two quantitative models represented other parts of simulated reality. A first model simulated the interaction between operators and travellers. The model simulated bus and rail service operation based on data on service provision entered by the players, attributed travellers to the services and calculated income for the service operation. A second model calculated operator's expenditure based on the same data entered by the players. Players interacted with this simulated part of reality through actor-specific personal computers with a custom-made interface, which were linked to a central database. This support system was developed in co-operation with AGV-Nieuwegein.

The computer interface provided the operators with the possibility of changing the frequencies, stop density, operating times, vehicle type, number of vehicles and frontline staff deployed, and the route of bus services in the region. The interface also provided the players with the opportunity of developing any measure they found necessary, of which the game leaders estimated cost and revenue. In addition, the interface structured the process by providing a running calendar and by announcing networks that were up for tender. Moreover, every cycle the interface provided feedback to the different actors on their performance. Operators were provided with information on production costs, fare-box revenue and ridership on a per line basis. Government actors received information on ridership at the concession level. Also, the interface provided the possibility of sending mail to other players and sending tender specifications and tenders back and forth. The different actors communicated using the computer-based mailing system. In addition, players could arrange meetings in which they could meet face to face, but they were asked to use the software for approaching the other players and

[13] NV Nederlandse Spoorwegen declined to participate. A representative of Rijkswaterstaat, the national transport executive, and familiar with local passenger rail transport, agreed to take up the role. Because of the limited role of national rail services on a metropolitan level this was regarded to be acceptable.

more formal communications. This reflected the real-life distance that existed between the different actors.

The game leaders (i.e. Delft University of Technology and AGV-Nieuwegein) represented the rest of the outside world: the national government, consultancy firms, the media, etc. In those roles, they provided feedback to the players in terms of juridical advice, research results, newsflashes, etc.

6.2.3 The cycles

Four cycles simulated public transport tendering in the years from 1998 to 2002. The first two cycles, representing 1998 and 1999, were played in a tendering procedure corresponding with the provincial plans at that time. The next two cycles, representing 2000 and 2001 were played with interventions based on the suggested approach in Chapter 5.

Every cycle represented one year and in that year the tendering process passed through four steps:

- Preparation of tender specifications for a specific concession by one of the transport authorities,
- Preparation of a tender for that concession by all interested operators,
- Choosing between tenders by tendering government,
- Implementation of the chosen tender by the operator.

Before the first two cycles, a brief introduction was given on the process and rules of the simulation game. The participants were given time to accustom themselves with the computer software and with the process of tendering as it was proposed by the province. To do so a dummy cycle was played. Four assistants actively supported the players during all cycles in the use of the computer software and made minutes of the game play.

In 1998 the province was in the process of developing a tendering procedure[14]. The province planned to invite operators to tender for all bus services in four designated concession areas. The operator has some freedom to develop the service in the tender, within the constraints in the tendering specifications. To judge the tenders, the province uses a multi-criterion approach with an emphasis on price. When a concession changes hands, personnel directly linked to services in that concession also transfer to the new concession holder.

The concessions are held for two to three years. Although the "real" concession period is six years, this is reduced to have at least one tendering

[14] Based on communications with M. Onnen, Head of the Mobility Unit of the Provincie Limburg: a letter dated January 28th 1998, a fax dated April 23th 1998, and several interviews between November 1997 and July 1998. In 1998 the province was still developing its views on tendering concessions and it does not necessarily represent the way in which Limburg actually tenders its services.

procedure each cycle. During the concession period it is the responsibility of the concession holder to attract travellers; fare-box revenues from the concession go to the operator. Limitations apply to additional income to the operator from on-vehicle and in-vehicle advertising etc.

	Day 1		***Day 2***	
Cycle	***1***	***2***	***3***	***4***
Year	***1998***	***1999***	***2000***	***2001***
Heuvelland			Tendered	
Maastricht	Tendered		Tendered	
Oostelijke Mijnstreek	Tendered			Tendered
Westelijke Mijnstreek		Tendered		Tendered
The light gray area represents cycles without interventions, the dark grey area represent cycles with organisational interventions based on the suggested approach				

Table 29
Tendered networks in the different cycles

In brief, the game developed as follows. In the cycle representing 1998, the authorities, the province of Limburg and the Maastricht municipality tender their urban services in the Oostelijke Mijnstreek and Maastricht. At the province's invitation to tender for urban services in Oostelijke Mijnstreek, two operators produce a tender: Hermes and Vancom. At the municipality's invitation to tender for urban services in Maastricht, three operators submit a tender: Hermes, Arriva, and Stadsbus Maastricht. Both governments award the concessions to the incumbent, respectively Hermes and Stadsbus Maastricht.

In the cycle representing 1999, only one tendering procedure is planned. The province tenders out the regional services of the Westelijke Mijnstreek. Hermes and Arriva prove to be the contenders in the regional market. Both submit a tender. Again the incumbent holds the concession and Hermes continues running the virtual buses of the Westelijke Mijnstreek.

For the third and the fourth cycle representing 2000 and 2001, game leaders introduced interventions. Changes are made to tendering procedures and communications, based on the analysis of the first two cycles. Arrangements are added for interactions between operators and government. For a detailed description about the arrangements added, see Section 6.3.2. The province tenders out the services of Heuvelland and the municipality of Maastricht again tenders out the urban services in the city.

In this cycle urban services in Maastricht change hands. The municipality chooses the proposal entered by Vancom in favour of the proposal of the incumbent Stadsbus Maastricht. In the same cycle Vancom suffers an important loss, it forgoes its concession of Heuvelland by not submitting a tender. Nederlandse Spoorwegen Reizigers, who have started bus services, takes the concession.

The last cycle represents 2001. In that cycle the services of the Oostelijke Mijnstreek and Westelijke Mijnstreek networks are tendered out. In both instances the existing operators, Hermes and Vancom respectively, retain the concession.

Simulation-games are social experiments. The two situations in the experimental design are hardly ever the same, except for the intervention itself. When the same people are playing in both situations, they have learned the second time around. When different people are playing the second time, well, they are different and thus the situations are different. Generally, researchers overcome this problem by using different groups in repeated tests in large random samples to even out differences.

In our simulation-game this problem is apparent and we lack the sizable population. Our empirical population, delimited in Section 2.3, is far too small for a full experimental set-up: public transport organisations in European metropolitan areas. Our targeted population even smaller: public transport organisations in Dutch metropolitan areas. And not all are willing to participate, reducing the population even further. Our population leaves no room for an ideal experimental set-up. Our game was only performed once with practitioners in their own environment; the same participants played the situation without and with interventions.

6.3 The simulation-game played

The nexts sections will describe the simulation-game as it unfolded. First, Section 6.3.1 describes the first two cycles in which the players played autonomously without intervention of the game leaders. Second, Section 6.3.2 describes the analysis of the first two cycles and the suggested interventions based on the approach in Chapter 5. Finally, Section 6.3.3 describes the effect of the interventions in the last two cycles and gives the evaluation of the players.

6.3.1 Gameplay in cycles 1 and 2: Observed starting situation without intervention

The tendering as it was implemented in the first cycles of the simulation game was already rich in *arrangements*. The approach contained an arrangement for remuneration. Authorities received income from national subsidies (around 40 percent) and fare-box revenues (around 60 percent). All authorities decided to allocate fare-box revenues to the concession holder. The remaining subsidies were allocated on the basis of a fixed lump sum price in the tender specifications. Some authorities evaluated the possibility of linking subsidies to performance, through vouchers (a personal public transport budget for every possible traveller), for example, or multipliers (for

every euro from the traveller, an additional subsidy), but the idea was abandoned.

The allocation of subsidies did not play a role in remuneration, but it did play a role in the arrangement for competition; competitive tendering with a fixed price meant that operators competed on stated service quality, rather than on price. The lump sum reduced their perceived risk and increased the interest of possible contenders. More operators contending for a tender would improve competition and service quality.

Although a financial arrangement was in place to improve competition, entry was hampered by limited information on the networks, even for other regional operators, and the relationships between authorities and operators. The tender specifications contained little information for new entries in the market; NS was not able to compete in bidding for the Oostelijke Mijnstreek in the 1998 cycle. After the first tendering, the operator of the Maastricht network discovered a yearly deficit of €0.9 million. The operator proposed to the authority that it tender out the service anew or agree on reducing service levels. Instead, the municipality raised its contribution, leading to legal protests by other operators, which were ruled in favour of the plaintiffs, the other operators. Following this ruling, the municipality put the concession forward for renewed tendering. Furthermore, the transparency of choice in the competitive tendering was hampered. Although authorities asked for tenders with a limited number of variables, they found it hard to choose between the tenders in an unquestionable manner.

The tendering approach also provided for an arrangement to co-ordinate the product. The tender specifications were used to secure a single ticketing system and, in some cases, or synchronise at major transfer points services of different techniques in the network, for example stations. National law provided a simple arrangement for the co-ordination of production. Front-line staff were required by national law to change to the new operator when the concession changed hands. During the game play, the operators did not try to develop co-ordination of production further. No developments were found in the game towards production pools such as bus leasing, garage sharing, off-peak mode switches, or staff pooling.

The players themselves did not develop arrangements for interaction during game play. Though interactions between operators and authorities were numerous, no arrangements were in place to structure the roles of different actors, authorities, operators (current and new) and travellers (current and new). A number of examples can be given. The authorities did not introduce any monitoring systems, either through travellers (a complaints desk, benchmarking), or through authorities (control of service execution), during the concession. In addition, no arrangements were made in the tender

specifications or in the tenders about possible changes to services during the concession.

As a result, interaction between the operator and the authority stopped after the concession was awarded, leaving no room for changing transport policies or additional policy interactions. In addition, the operators were not fully encouraged to interact with the traveller.

Rich interaction between authorities and operators was also limited during the tendering procedure, as it was developed for the simulation game by the province. The players introduced no process arrangements. The procedure chosen did not provide any possibility of transferring rich information between the operators and authorities before preparing the tender. This created distinct problems: it limited the creativity of the operator (who was forced to tender services to the letter of the specification) and it limited the quality of policy integration (creative service development by the operator without intelligent policy integration and co-ordination). Operators were seeking to develop a rich service concept, based on limited tender specifications and unclear evaluation criteria. The operators reveived little information on how to align their offerings to policies and governmental preferences. In addition, the possibilities for asking for clarification were very limited due to tendering procedures. In addition, complaints about the poor quality of tender specifications never reached the governmental players.

In the first cycles the success of the policy integration arrangement was mixed. The authorities had some difficulty translating their policy needs into general demands on which the operators could develop their services. Policy needs were operationalised into public transport services, rather than into tender conditions. The authorities tended to overspecify their demands on the operators. In addition, policy integration with other governmental bodies was poor. The tendering governments seemed to be absorbed with the process itself, rather than with securing the role of other governmental actors. Little interaction was built in at first with municipalities that were not authorities themselves.

The organisation provided some balance in the first two cycles between the *levels of interaction*. Remuneration focused the operators' eyes on the traveller, the tendering procedure on the authority; both GO-level and OT-level interactions found a place. The operators could translate their interaction with the travellers into service changes as they had some freedom to tune services during the concession period. The operators received a great deal of freedom to develop the services and the contract included incentives for the operators to focus on travellers, while inter-operator co-ordination was built into the tender specifications. The barriers between the operators proved to be high, leading to less well-developed OO-level interactions.

6.3.2 Between cycle 2 and 3: Analysis of cycles 1 and 2 and definition of interventions

The game leaders developed new arrangements to be added in cycles 3 and 4 based on the analysis of cycles 1 and 2. The arrangements resulted from the application of the approach presented in Section 5.3. Cycles 1 and 2 described above reflect several examples of a *first problem inception* as they were found in the minutes. During and after the first two cycles, operators complained that it was very difficult to develop a service concept based on the tender specifications they received from the authorities. According to the operators, the specifications lacked crucial information on current service supply and demand and provided unclear guidelines. The operators had to compose an offer solely on the verbatim information in the tender specifications. The authorities on their part complained about the apparent inability of the operators to provide adequate tenders. Their task in evaluating the tenders was hampered by incomparable tenders and very general descriptions of service concepts.

In addition, the municipalities, other than Maastricht, aired complaints about the interaction with the public transport authorities. The interaction between the two authorities (the municipality of Maastricht and the province) and other municipalities was limited in the first cycles. The strict tendering procedure absorbed most of the authorities' attention.

To *widen the issue,* the initial problem inception was related to several rationales. From the perspective of *conceiving the customer*, one could argue that the lack of remuneration focused the operators very much on the authority. From the perspective of *managing the market*, competition was hampered by the asymmetry of information between operators. The incumbents could more easily supplement the limited specifications with their current knowledge of both supply and demand and government preferences.

From the perspective of *scheduling the service*, it became clear that the tender specification offered no sound platform for service development, let alone service co-ordination. The uncertainty about the tender specifications drew much attention to the bidding operator, consequently limiting attention to a sound service concept. Their efforts were very much directed at getting additional information, within the strict rules of tendering in the procedure developed for the simulation game by the province.

From the perspective of *producing the policy* the lack of rich interactions between possible bidders and the authority caught the eye. The tendering process did not provide for rich information exchange. Moreover, the tender specifications contained no demands on the sustained exchange of information between operator and authority during the concession period. The exchanges that occurred were driven by mutual complaints.

From the perspective of *maintaining the metropolis*, it became clear that the current spatial and social policy choices provided a limited basis for tender specifications. The policy plans available were formulated in terms of general choices in favour of public transport, but left a major gap from general policy description to precise tendering specifications.

Problems could be traced to formal communications between governments and operators in the tendering process. It became apparent that the authorities did not include in the tender specifications those aspects that were needed by the operators to define a tender that came close to the authorities' wishes. After the first cycle, operators vented complaints about the omission of essential information from the tender specifications. They approved the freedom to schedule services themselves, but lacked critical information in the tendering specifications to supply accurate tenders.

The five possible arrangement types offered a way to improve the situation by *mobilising the mechanisms* from different rationales.

We the game leaders evaluated remuneration: built-in financial incentives for the operator holding the concession to provide information to possible new entrants and to focus service development on the traveller. In addition, remuneration arrangements were evaluated to urge the authority to develop a sound tender specification. Secondly, the game leaders evaluated competition. Competition could be improved. The limited focus of the tender on its specifications made it unclear to the operators on which aspects to compete. These competitive elements could be made more explicit, without prescribing narrowing the possibilities for on what services to offer. Moreover, the authority could include a stricter set of rules for participating in the eventual choice, by precluding operators that do not relate their tenders to the specifications. This would provide the operators with an ultimate incentive to understand the authorities' standpoints. To further improve competition, the game leaders evalueated the possibility to obligate all operators holding a concession to provide a large set of data and obligate the authority to enclose this information in the tender specification. New operators wanting to bid could use this data to narrow the competitive advantage of the current concession holder. Thirdly, the game leaders evaluated co-ordination. Obviously, the authority had an important coordinative role. Ticketing was already coordinated. We developed process arrangements that would structure schedule coordination by the authority prior to tender specification. An alternative arrangement structured schedule coordination by the operator when defining its services, winning the concession. We entertained the possibility of obliging all operators holding a concession to provide a large set of data needed by operators wanting to bid for a concession and let the authorities enclose this information in the specification. Fourthly, the game leaders looked at interaction. The tendering procedure was very formalised,

leaving little room for rich interactions. We considered providing a forum in which all bidding operators could comment on the specifications and in which the authority could provide additional information, equally available to all. Finally, the game leaders looked at policy integration. One focus was on horizontal integration, integrating the needs of different municipalities in the process of defining a tender specification. In addition, policy integration could be improved vertically, by developing public transport policy programmes aiming at tendering rather than general policy conditions.

From these general types we *formulated arrangements*, mostly focusing on GO-level interactions that would fit the existing organisation. Arrangements ranged from competition for the role of authority, to closer co-operation between authority and operators in the tendering process, and from workshops open to all that would have to develop tender specifications to making operator income dependent on ridership.

We *eliminated arrangements* on the grounds that they were already available or would not fit the existing organisation. For example, we saw little opportunity to improve competition for the role of authority, as a means to improve tender specification quality. In addition, the incumbents would not provide detailed information on demand and the existing arrangement did not offer the possibility to do so. We saw little possibility to monitor information quality provided by the current holder of the concession. As a consequence, the information that they had to provide was limited to essential data, of which the quality could be monitored. Moreover, free interaction between operators and authorities in the tendering procedure was rejected, as the need for a level playing field for all competitors demands strict procedures. These limited the possibilities for information exchange and negotiations between an operator and the authority, both before and after allocation of the tender.

Finally, three *arrangements were implemented* for cycles 3 and 4. They were introduced after the second cycle, to be operative in the third and fourth cycles. First, public pre-bid meetings were introduced, which offered operators the opportunity of making enquiries to the authority about the specifications without favouring a single operator. In addition, the tender specifications were pre-structured, based on the information needs expressed by the operators. To improve the information available to new and current operators, the authorities were asked to include in their tender specifications:

- Selected data on current service, ridership, and profitability of the network,
- An explicit definition of the social function of public transport in the concession,
- Explicit and elaborated criteria on which the tenders would be chosen, and

- An explicit procedural paragraph,

Moreover, the new contracts explicitly stated which information should be communicated to the authority at what time during the concession. Penalties were added for not complying and for supplying incorrect information. Finally, in the procedure leading to the tender specifications was changed, a moment was added to include consultation of the smaller municipalities.

The arrangements implemented did not present radical new input in the organisation as tuning the organisation is not about radical changes; it is about the right arrangement to solve a perceived problem and about being able to see a problem before it occurs, on the basis of an analysis of the arrangements that are present. The arrangements introduced were generally in line with the arrangements mentioned to mitigate the negative aspects of strict tendering procedures mentioned on Page 182. Many of these arrangements have already found their way into tendering procedures, but the province has not incorporated them yet.

6.3.3 Gameplay in cycles 3 and 4: The impact of the interventions

To investigate the impact of the interventions, one needs an experimental design. The experimental design created two similar situations in the first two and the latter two cycles. These situation differed primairily on the application of the intervention. Several performance indicators were measured in all four cycles.

Our population leaves no room for an ideal experimental set-up. Our game was only performed once; the same participants are in the two different situations. To make our testing meaningful, the evaluation is not just aimed at the relation between the interventions and the performance indicators, with a black-boxed organisation in between. Rather we used two alternative evaluation strategies to indicate the quality of the suggested approach, trying to understand more about the functioning of the added interventions, rather then simply rating them.

As the simulation game was played only once with practisioners in their own environment, multiple evaluation strategies were used:

- Evaluation of model scores,
- Evaluation by the players,
- Evaluation of the minutes and communications.

The *model scores* present the first elementary data about the development of general performance indicators in the simulation game, still very much treating the game play as a black box. To open the black box the two other evaluation strategies assess the success of the interventions, based on an understanding of how a more multidisciplinary organisation influences

actor behaviour. The *evaluation by the players* is based on an ex-post evaluation with selected players of the situations with and without the interventions. This was performed in a group discussion immediately following on the simulation game.The *evaluation of the minutes* presents the most detailed information on the simulation game. It paints a rich picture of participant behaviour before and after the interventions. It is based on the analysis of all communications between players and on minutes provided by assistants on both days of the simulation game.

Model scores

After the interventions, a picture of the effectiveness and efficiency of the system was generated. The computer models calculated overall improvements in both ridership and cost-recovery after interventions in the organization, based on changes of the player's behaviour in the respective cycles.

The models provided data for the "ridership" indicator. Equation 1 gives the calculation of ridership in the different cycles[15]. Ridership was calculated using a traditional transport demand model. The model was calibrated on ridership data from the early 1990s. Firstly, the area was divided into 240 cells and their potential trip generation and attraction was calculated. Secondly, public transport trips were calculated in the relations between all cells. The calculation was based on the number of inhabitants and jobs in the respective cells**, travel time using public transport on a link between two cells (based on average road speed on a route** and the possible application of traffic light management systems*), and waiting time using public transport on that link (based on frequency of the service*).

$$T = \sum_{Links} \left(\left(-f \times \log(R) \right)^2 \times P_o \times P_d \times c \right)$$

T	=	*Number of trips*
R	=	*Travel and waiting time */*****
P_o	=	*Trip generation potential on origins***
P_d	=	*Trip attraction potential of destination***
f	=	*Parameter****
c	=	*Parameter****

Equation 1
Number of trips generated on public transport (source: AGV transport model)

The model distributed the total public transport trips generated between cells over different route segments of every bus line on the basis of the relative closeness of the route segment to the different origins and destinations**, and the frequency of the bus line on the route segment*.

[15] For all variables mentioned are based on:
* game play, **pre-set data, *** model calibrations, **** model calculations.

Some trips were attributed to Interliner and rail services on the basis of proximity to a station. This resulted in the number of trips on the different route segments. Equation 2 shows how trips over the different routes were finally multiplied by the length of the different routes** to obtain the number of traveller-kilometres per route segment and summed over route segments of all lines to offer the total number of traveller-kilometres. Equation 2 presents the formula for the calculation of the total distance travelled on public transport.

$$D = \sum_{Lines} \sum_{Routesegments} T_{Routesegment} \times L_{Routesegment}$$

D = *Total distance travelled on public transport*
T = *Trips allocated to route*****
L = *Length of routesegments***

Equation 2
Total distance travelled on public transport

Table 30 shows the ridership through the different cycles calculated according to the model. Note that the interventions in the organisation were in effect in the cycles representing 2000 and 2001. The number of traveller-kilometres slipped in the years 1998 and 1999, but after introduction of the interventions, it rose slightly in every cycle. The total number of traveller-kilometres, however, never reached the level of its base number in 1997.

		Day 1		***Day 2***	
Cycle		***1***	***2***	***3***	***4***
Year	***1997****	***1998***	***1999***	***2000***	***2001***
Ridership in 10^6 kilometres	223	199	204	205	218
Ridership (1997=100%)	*100%*	*89%*	*92%*	*92%*	*98%*

* 1997 is the base year
The light gray area represents cycles without interventions, the dark grey area represent cycles with organisational interventions based on the suggested approach

Table 30
Ridership in millions of kilometres in the different cycles

Figure 30 shows that ridership in all networks shares a common drop in the first cycle. In the second cycle, ridership generally recovers slightly or remains at the same level. After that, ridership of the regional services, Heuvelland and Westelijke Mijnstreek, rises significantly, the first after tendering, the second without tendering. Ridership in the urban networks also rises, but only slightly. A direct relationship is not apparent between model data on ridership and the tendering cycles of the networks.

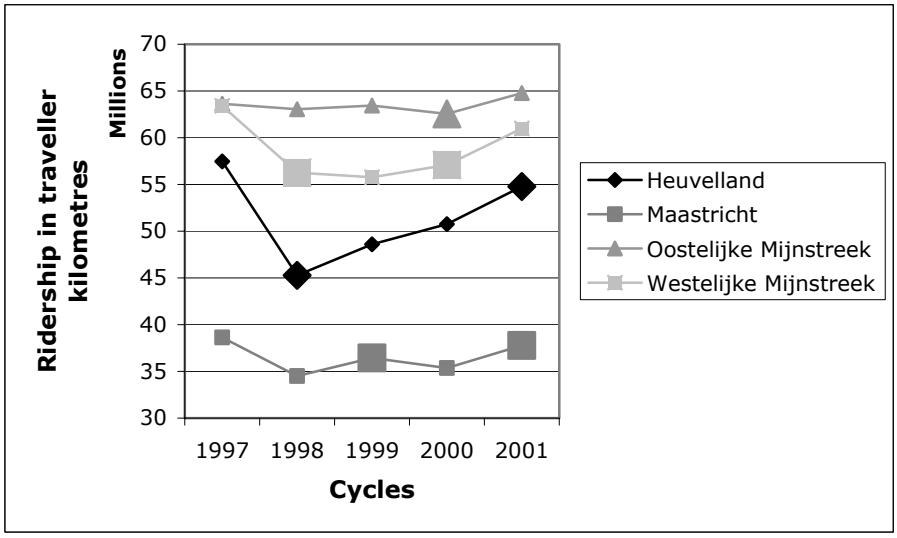

Figure 30
Ridership in kilometres in the different cycles per network with 1997 as base year (larger icons represent years of tendering)

Equation 3 presents the formula to calculate the cost-recovery for every cycle. Pure fare-box revenue defined income, which was the number of traveller-kilometres*** multiplied by the fare per kilometre*. Costs were calculated for personnel and vehicles. Operators set the operating hours, the number of vehicles and the number of staff for a specific line. The latter two were checked for consistency with the frequency and operating hours of the service offered.

$$E = \frac{\sum_{Lines} D \times F}{\sum_{Lines}\left(S \times \overline{C}s \times H\right) + \sum_{Lines}\left(V \times Vs \times Cv \times H\right)}$$

E	=	*Cost-recovery*
D	=	*Traveller-kilometres* ***
F	=	*Fare per kilometre* *
S	=	*Number of staff deployed* *
Cs	=	*Cost per hour per staff* **
H	=	*Operating hours* *
V	=	*Number of vehicles deployed* *
Cv	=	*Cost per kilometre per vehicle* */**
Vs	=	*Vehicle speed* ****

Equation 3
Cost-recovery in public transport (source: AGV cost models)

In the pre-1999 cycles, cost-recovery of the overall services dropped significantly. After intervention, the cost-recovery rose slightly but continuously, to surpass the cost-recovery of the base year in the cycle representing 2001. Table 31 summarises the overall cost-recovery.

			Day 1		***Day 2***
Cycle		***1***	***2***	***3***	***4***
Year	***1997****	***1998***	***1999***	***2000***	***2001***
Cost-recovery	0,44	0,38	0,38	0,41	0,45
Cost-recovery (1997=100%)	*100%*	*87%*	*86%*	*94%*	*103%*

* 1997 is the base year
The light gray area represents cycles without interventions, the dark grey area represent cycles with organisational interventions based on the suggested approach

Table 31
Cost-recovery in the different cycles

Figure 31 shows the development through the cycles of the cost-recovery of the system for the different networks. The cost-recovery differed significantly over the different networks. This might be attributed to the relative performance of the respective operators and authorities. Other possible explanations might be the type of services offered or the location of the networks. Another important issue might be the cycle of tendering, as not all networks were tendered out in all cycles. The analysis did not provide a single clear answer.

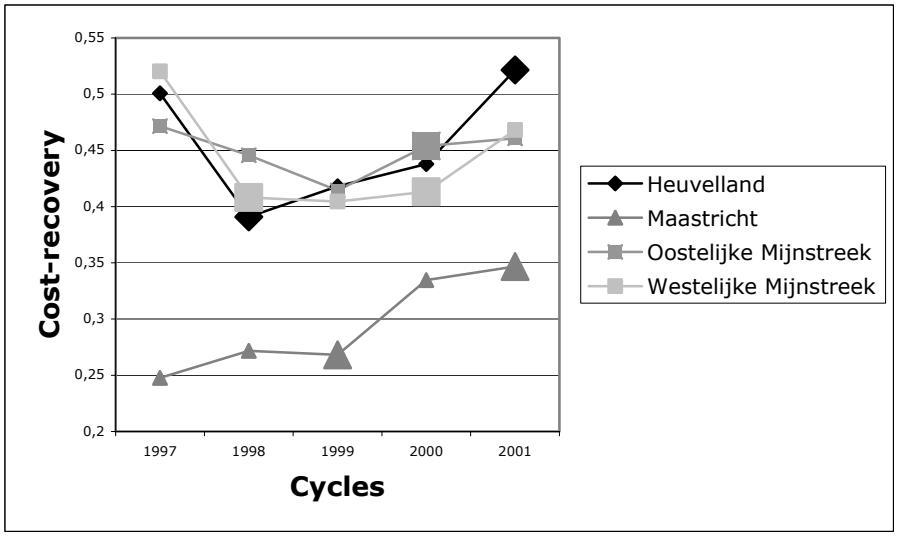

Figure 31
Cost-recovery in the different cycles per network with 1997 as base year (larger icons represent years of tendering)

Improvements in cost-recovery differed not only between networks but also between operators. At one extreme, an operator doubled its overall cost-recovery through the four cycles. At the other extreme, an operator attained a cost-recovery equal to that at the start, after two cycles of far worse performance.

The figures presented here give a general overview of the model outcomes for the different networks and operators during the different cycles. The primary goal of the models was to provide plausible data to the players, not "true" data. The models contributed by creating a lifelike experience for the players. This means that the analysis above gives us little insight in the effects of the interventions on the way the players participated in the game play.

It is also important to note that players probably learned to play the game. They improved their dexterity with the interface, with the setting, with the other players, and with tendering in general. The two following strategies for analysing the results arguably present better ways to answer the question of how the interventions influenced player behaviour.

Evaluation by the players

The outcome was evaluated after the simulation game with the participants in an intensive discussion recorded by observers. In general, the participants were positive towards the overall game. Most players were confident that the simulation game had contributed positively to the implementation of tendering in the region. Contrary to their expectations, the game play had a lifelike feel to it. The players acknowledged that the models provided plausible data and the procedures and rules of the gaming simulation also brought in enough realism.

The set up of tendering was also discussed with the players prior to the simulation game. During that first discussion, the players expressed many reservations towards tendering procedures in general. The operators agreed that the exact distribution of tasks and responsibilities between the authorities and the operators was still imprecise. In the first discussion this led to a debate between operators and authorities about the distribution of certain tasks within the organisation. Both groups claimed specific tasks, especially related to the development of the services.

Though government players were sceptical about leaving scheduling to the operators, in the evaluation they were satisfied about how it had worked out. The players agreed that the uncertainties in task and responsibility distribution had vanished during game play. During game play, the roles of the different players emerged in a very sophisticated manner. The tasks and responsibilities were taken up by the operator and the authority based on the players' willingness and ability, rather than a conceptual optimum. The roles of authority and operator took different forms in different issues (allocation of

infrastructure, sales, marketing, designation of major transfer nodes, frequencies, routes, and exact times). The overview of the distribution of tasks and responsibilities regarding service development was varied, resembling co-operation rather then strict commissioning at first glance. At second sight, though, the relationship between operator and authority was still formal, but shaped differently on different issues. After the simulation game the players regarded the exact a priori distribution of tasks in service development as an issue of far less importance.

In terms of the contributions made to the game in the last rounds, opinions were mixed. Almost all players agreed the tendering procedure improved after the introduction of the changes. The players found it hard, however, to indicate how the interventions had influenced their behaviour and whether they had generated better results. A small group was sceptical about the changes, not because they did not value the interventions, but because they found the additions to be basic elements of the tendering.

Opinions were mixed on the specific interventions. The tendering authorities welcomed the standardised template for the tender specifications. In addition, the operators saw improvements in the tender specifications and found it easier to tune their tenders to the wishes of the authorities. In addition, the pre-bid meetings also were welcomed by both groups of players, though some operators were not impressed with the information the authorities provided at these meetings. But mostly they wondered why these meetings were not part of the original set up.

Giving the smaller municipalities an explicit role in the tendering process was considered a welcome change. Though these municipalities already had contacted the authorities in the earlier cycles, their more formal participation was valued. The suggestion that authorities or operators should improve interaction with travellers by setting a monitoring system was neglected by the players and subsequently did not lead to any changes in actor behaviour.

Evaluation of the minutes and communications

The minutes, together with all recorded written communications, tender specifications and tenders, give a very valuable perspective on developments in the simulation game. A number of questions were put regarding these data:

- Did the interventions have an observable effect on the overall behaviour of the players?
- Did this change in player behaviour have a positive effect on the overall performance of the organisation?

The minutes confirm that the interventions improved interaction quantity and quality between the players. For some interventions, like the pre-bid meeting, this improvement in the quantity of interactions is very

obvious. The pre-bid meeting did directly introduce a greater number of interactions in the tendering procedure. But it was not only the number of interactions between operators and authorities which rose. The interactions were fruitful and answers to questions posed at these meetings clearly found there way into tenders. To that extent the interactions reduced the ambiguity of the demands of the authorities to the operators. These interactions did lead to better tenders. Not only did both authorities confirm this, but also the coverage of the tender specifications by the tenders improved and the disruptions in the tendering procedure were significantly reduced after the interventions. For example, before the interventions, the tendering of the Maastricht network failed, resulting in a request by the municipality to re-tender the network. No such failure occurred after the interventions were introduced. Apparently operators and authorities felt less need to side step the procedure, due to better information in the procedure.

The improved interactions also had a beneficial effect on the functioning of other types of arrangements. For example, the playing field on which the operators competed levelled out because of the growing contact between new operators and the authorities. Prior to the interventions, one of the authorities generally neglected communications from other operators than the incumbent. The incumbent was even asked to write the first tender specifications, as the municipality did not regard itself competent to do so. Other operators were not able to develop a tender on the specifications, and against tender specifications, they tried to compete on price. The structured rich interactions in the tendering process offered the different operators the possibility of delivering tenders tuned to the wishes of the authorities.

In addition, the improved interactions partly restored the damaged trust between the operator and the authority. The distance created between operators and authorities by formal procedures and a lack of transparency significantly reduced trust between the different players. The intesified and less informal interactions reduced the distance between all actors, while maintaining a transparent procedure. Competition was maintained and a more co-ordinated approach to service development and operation was enabled.

Following the interventions, the quality of policy integration also improved, both between policy sectors as well as between actors. Game leaders offered a number of changes in the game in order to gauge the response. Examples were the breaking news of the development of a new industrial estate in Borgharen (a Maastricht satellite) and the reduction the frequencies of local trains. Also in the earlier cycles, the authorities reacted with additional subsidies and tendering of services to the estate. In later cycles they developed more integrated approaches.

The interface explicitly invited the players to put forward measures for implementation that were not pre-defined. The players, mostly the operators, defined nineteen measures covering a wide range: from infrastructure development to pricing policies, from marketing efforts to parking regimes. The minutes show that after intervention, interaction between the authorities, operators and other municipalities did indeed increase. Before the interventions, the suggested measures were very much aimed at solving the problems of the individual players. Operators pursued straightforward measures, aimed at higher income and lower cost, by proposing smaller zones and prioritised traffic control systems. They paid little attention to the effect on overall transport policy. Authorities pursued simple quality measures, without much understanding of the costs of these measures, absolute higher frequencies and lower floors.

The measures implemented by the players after the interventions showed a wider consideration for mutual goals and the instruments: fare differentiation temporally (between peak and off-peak, season and off-season) and geographically (more differentiation in zone size) rather than a generic fare increase, marketing efforts, parking policies supported by additional public transport, bicycle shelters at bus stops, and improving public transport circulation by developing bus lanes. All these measures combine the possible goals and instruments of the different actors.

The analysis presented above suggests some improvement of the quality of behaviour by the players due to the interventions. The players found it easier to follow procedures and the quality of tenders rose; interactions and policy integration improved. The relation between improved interactions and improved policy integration on the one hand, and the performance of the system on the other was harder to establish.

The minutes and the communication plausibly confirm a positive relationship between the arrangements and the players' behaviour. But the relationship between players' behaviour and the performance indicators is far less straightforward. In the simulation game, models represented this relationship. Though the players confirmed the face validity of the models, the simulation game still does not provide for real, empirical testing of this assumed relationship.

A general appraisal of the processes shows a clearer transformation during the simulation game than the analysis of the behaviour of the players presented above. In the earlier cycles, players found it hard to move away from existing relations outside the simulation game and into tendering relations. As was described in Section 4.5, public transport in the region was carried out by regional monopolist Stadsbus Maastricht and Hermes. In the first cycle, the authorities relied heavily on "their" operator for the

development of tender specifications, giving the operator a decisive advantage in the tendering.

The discussion between the players changed character during the simulation game. In the discussion prior to the simulation game and in meta-discussions in the early cycles, the players recurrently discussed the roles of authorities and operators in the tendering procedure in general terms. In the course of the simulation game the meta-discussion moved away from general terms to the more intricate design of the procedure. The meta-discussion seemed to move from a conceptual level to a practical level. The operators pointed out the omissions in the procedure to the authorities, who developed a clear sense of their own role in the procedures, and tasks were divided between operator and authority creatively on the go.

Moreover, in the later cycles, the authorities moved away from the inclination towards growing governmental control and passed financial risks on to the operator. They chose strict control of certain issues and incorporated this in the tender specifications; on other issues they started to rely on the operators' creativity under the incentive system. In addition, in the earlier cycles operators were reluctant to take financial risks, but in later cycles, they submitted tenders that showed a more generous and innovative attitude. Apparently game play offered an answer to some of the apprehension that existed towards specific aspects of tendering and some of the rigid views on the role of public and private actors.

The game play showed a continuous refinement of the players' insights on tendering and on intelligent solutions to occuring problems. The emerging insights were so self-evident that the players do not consciously see the lessons presented and the way these lessons influence their behaviour. The game play simply presented the lessons to them and they acted upon them. The game play helped to overcome many of the existing reservations about tendering and helped more clearly specify and solve emerging dilemmas.

6.4 Discussion

In the world of public transport, a vast array of arrangements is available. Moreover, arrangements are used in other sectors that can serve a purpose in public transport. Together, these arrangements can tune the organisation of metropolitan public transport to function better. The approach proposed in the previous chapters aims to diversify the focus of arrangements in template organisations of metropolitan public transport, trying to improve their disciplinary coverage.

Our approach was developed to support a policymaker in the process of tuning the organisation. It should help him to broaden his horizon in terms of the possible arrangements that can and should be given a place in the organisation. To represent the width of arrangements and help the

policymaker bridge the gap between disciplinary analysis and implemented arrangements, five arrangement types were developed:

- Remuneration, supporting the drive to understand the traveller,
- Competition, supporting the drive to innovate in production and product,
- Co-ordination, supporting the drive to create synergies in production and product,
- Interaction, securing actor interactions,
- Policy integration, securing policy interactions.

During the first cycles of the simulation game, a number of loopholes surfaced in the original Limburg implementation of tendering through the analysis of the game's original organisation and the game play in the first two cycles. The game leaders intervened by adding arrangements to the original organisation; these alterations were in general followed by positive changes in player behaviour.

The model scores showed an improvement of selected performance criteria (traveller-kilometres and cost-recovery), but did little to make us understand how the interventions influenced player behaviour. Evaluation by the player and evaluation of the minutes and communications showed more clearly how the added arrangements functioned within the overall balancing of the organisation. But questions still remain.

A single simulation game can not conclusively establish the success or failure of the suggested approach. It can only hint at the potential of such an approach and the more and less intelligent ways of deploying it. To that extent, our simulation game has provided some indication of the usefulness of the approach when tuning an organisation beforehand rather than during its operation. For a priori tuning of the organisation, the playing of the simulation game itself might have had a significant influence, possibly as important as the implemented approach.

The simulation game presented us with a paradoxical situation. During the game play, players developed their tendering skills, with or without the interventions. Whether their performance developed more, better or faster in the last cycles than in the first is very hard to distinguish. This continuous learning of the players clouded the testing of the success of the interventions.

On the other hand, the game play showed the kind of tuning the suggested approach wants to support: tuning of the organisation prior to implementation of organisational changes. This might well lead to the conclusion that simulation games may be less well suited to *testing* the suggested approach. When an approach aims to cause incremental, continuous and long-term improvement, how well can it be judged from a single increment. When the approach aims at small-scale changes, what would be the effect of one such change? What would have been the outcome

if the players had agreed to simulate 20 years in two weeks, rather than four years in two days? That question remains, as no more real-life players were found to help answer it at this point.

An important conclusion is that a simulation game can very well *support* the suggested approach, rather than test it. Our policymaker can use simulation games to try the arrangements he wants to add before implementing them. This is especially useful in more substantial changes. In such a primary process of organisational change, the necessity of the policymaker tuning the organisation is greater. The simulation game, by its nature, is an example of combining different rationales, as different actorsmeet to evaluate the functioning of a potential form of organisation. It can be an additional tool to the suggested approach in widening the disciplinary coverage of the organisation.

In our simulation game, a number of secondary tuning arrangements could be added. This helped develop the organisation before the implementation of the primary change, the implementation of the tendering procedure in Limburg. The lessons learned could very well improve the performance of the organisation at implementation.

Some players regarded the interventions not as widening the disciplinary coverage of the organisation, rather as a solid implementation of the tendering. We could not agree more. The new arrangements clearly fitted in the holes of the first implementation of tendering, but these solutions were not included in thefirts inception of tendering procedures by the province. Apparently thinking up tendering procedures leaves questions unasked and unanswered. The combination of the approach and the gaming asked the questions and provided several answers. More generally, designing a template leaves many questions; simulating a new organisation raises even more questions but also gives answers. The suggested approach does the same; it asks questions by widening the issues at hand and provides a direction to answers through the arrangement types. Both in the simulation game and in the suggested approach, these answers can be found in broadening the arrangements, in this case adding arrangements for interaction.

Concluding, this application of the suggested approach in a simulation game improved the coverage of arrangements by introducing interaction arrangements, but it proved less apt in balancing the interaction levels, away from the GO-level (more specifically between the authority and the operator) towards the OT-level (more specifically between the designer of services and the operator).

7 Conclusion and discussion

And I gave my heart to know wisdom … I perceived that this also is vexation of spirit. For in much wisdom is much grief: and he that increaseth knowledge increaseth sorrow.

Qhelet 1, verses 17 and 18.

7.1 Introduction

Looking at modern mobility, a picture emerges of the car doing very well, urging public transport to improve its relative performance. This study looked at what might be done from an organisational point of view in public transport to make it better. But it has not given a decisive picture of what "better" means. Better efficiency and effectiveness proved to be different issues for different rationales and actors, and in different countries. And indeed ways forward differed between countries, actors, and rationales.

Though the ways forward to improve the organisation differed, the cases showed a common pattern in terms of disciplinarity. In processes of radical change, the old organisation is replaced by a new template. The new template is build up from scratch, incorporating the ideas of one or maybe two rationales. Design demands transparent concepts that can steer development.

After implementation, however, the template proves to be flawed. The analysis on which the organisational template was designed focused on specific empirical mechanisms, excluding or undervaluing others. Traveller, operator, and government behaviour had been simplified. In reality, other empirical mechanisms surface and problems arise. Strong integration in Zürich proved to be uncontrollable. Strong competition in Tyne and Wear proved to be unsupportive. Both public tendering in Copenhagen and co-arrangements in Southern Limburg proved more multidisciplinary. In Copenhagen, continuous tuning kept improving the quality of the organisation. The case in Southern Limburg showed little evidence of tuning the organisation on a regional level, though tuning was perceived on a national level.

As the flaws of the template surface, the template is tuned by adding different types of arrangements. This adding of arrangements mitigates the weaknesses of the template.

How can the policymaker achieve the promise of the multidisciplinary organisation? This study aimed to better support multidisciplinarity and concluded that tuning the organisation by the policymaker was the essence of multidisciplinarity in the organisation of metropolitan public transport. Section 1.5 presented the questions this study was intending to answer. They were answered in detail in the previous chapters; Section 7.2 gives a brief summary.

The remainder of this chapter puts this research in a wider context. This chapter extends the analysis beyond the boundary of the primary questions. Section 7.3 reflects on the respective roles of different actors in the multidisciplinary version of the organisation. Finally, Section 7.4 looks beyond this study, at future research further probing the benefits of multidisciplinarity in improving metropolitan public transport and other services.

7.2 Conclusion: Questions answered

This study started with a number of questions. The questions have been addressed in the previous chapters, and the conclusions are brought together here.

7.2.1 Question 1: Which rationales contribute to the knowledge on public transport?

An extensive and wide-ranging literature study has revealed five disciplines with a substantial coverage of metropolitan public transport. These disciplines find their roots in human geography, economics, civil engineering, policy science, and urban planning. The term rationale was introduced for those parts of these disciplines that focus on public transport. The rationales were referred to as:

- Conceive the customer,
- Manage the market,
- Schedule the service,
- Produce the policy, and
- Maintain the metropolis.

Internally, all rationales show their own dynamics, with an established core and ongoing debates. The established core was of most importance to this study, as we wanted to determine how these relate to each other and to the empirical context of metropolitan public transport. Externally, the

rationales have some relations with each other. For example, conceive the customer and schedule the services shared a common interest in a subject: the relation between traveller characteristics and service development, what was called the OT-level of interaction. The main difference between the two is the focus of the former on the various traveller preferences, and the latter on the conditions for specific service concepts.

Other rationales have different subjects, but share a field of recommendations. For example, *manage the market* offers primary recommendations on the regulatory regime and the interactions between governments and operators (GO-level interactions). These recommendations structure operator interactions (OO-level interactions) and make a case for competition as an organisational arrangement. Competition offers choice for the customer (either traveller or authority) and incentives to the operator, with apparent gains in efficiency and effectiveness.

On the other hand, *schedule the service* offers primary recommendations on service design and the interactions between operator and traveller (OT-level of interaction). These recommendations also structure operator interactions (OO-level interactions), but make a case for coordination as an organisational arrangement. A hierarchical coordinative structure between operators improves the possibility of coordinating both product and production, with apparent gains in efficiency and effectiveness.

The recommendations on the OO-level of interactions theoretically conflict. The hierarchical coordinative structure very much restricts the freedom of competitive operators. On the other hand, the competition appears to focus the operator on their own performance improvement, rather than on coordinative performance improvement. Both rationales claim efficiency and effectiveness gains through organisational arrangements that seem contradictory.

In general terms the rationales agree that efficiency and effectiveness are good performance indicators. But further operationalisation differs. Effectiveness can be measured in a variety of indicators like ridership, modal split, or emission reduction. Efficiency can focus on the level of subsidies, or cost per traveller kilometre or vehicle kilometre. In addition, the weight different rationales give to efficiency and effectiveness is not equal. *Conceiving the customer* and *maintaining the metropolis* primarily focus on effectiveness. *Managing the market* and *scheduling the services* incorporate both, with a small bias of the former on efficiency and of the latter on effectiveness. *Producing the policy* has no clear performance indicators, as it derives these indicators from the actors involved in the policy process.

The rationales relate to each other in many other ways. They all have their own niche as was shown in Figure 10, but they are still connected through the overall organisation, the group of actors purposefully connected

to provide public transport. When the rationales are combined, it is not hard to perceive the theoretical conflicts. The theory itself does not offer a way to deal with these conflicts. In addition, no meta-theory explains how to deal with these conflicts. Empirical analysis might offer insight in the way that practitioners overcome these conflicts, leading us to the next question.

7.2.2 Question 2: How are the rationales used in current organisations?

The four case studies showed that the use of this disciplinary knowledge followed a clear pattern in the successful cases studied, a pattern that was absent in the less successful Dutch case. All four cases showed occasional major changes of the overall organisation. The three success cases showed on top of that a constant process of smaller changes. The study introduced the terms *primary process of organisational change* for intermittent major changes and *secondary process of organisational change* for the continuous small changes. The primary process receives most of the attention both in academia and from policymakers, but the cases showed how the secondary process improves the performance of metropolitan public transport systems. They simply solve small problems.

Both processes showed a clear disciplinary side. The primary process leads to organisational forms based on a single rationale. A clear theoretical foundation in a single rationale offers a solid basis for a complete redesign of the organisation. When more rationales are combined, the appropriate organisational form becomes less evident. For organisational forms based on a single rationale, this study introduced the term *organisational template*.

The secondary process is more problem-driven than the primary process, which is more theory-driven. In the secondary process, problems occur and arrangements are sought to overcome these problems. These arrangements represent small changes and do not receive as much attention as the primary processes. But the cases show that they are also very important in improving the performance of the metropolitan public transport system.

The secondary process in the case studies also has a clear disciplinary side. The new arrangements find their roots in other rationales than the primary rationale of the organisation. An organisation with a strong focus on managing the market was amended with arrangements seeking improved coordination in operating and scheduling the services. An organisation with a strong focus on coordinated scheduling of services was amended with arrangements that manage the market towards competition. An organisation that already incorporated both coordinative and competitive arrangements in competitive tendering was amended with remunerative arrangements to

compel the operator to better conceive the customer. And the case studies yielded many more examples.

It is hard to quantify what is the exact effect of an organisation with broader disciplinary coverage. First, multidisciplinary analysis shows that the organisational form is only one of many aspects influencing performance. A multidisciplinary perspective on metropolitan public transport clearly shows that causes and effects are very hard to distinguish when no a priori theoretical stance is taken. Second, a multidisciplinary analysis offers a variety of performance indicators as dependent variables, related via many mechanisms to many independent variables. A choice for specific indicators of mechanisms has a disciplinary bias.

The effect has to be understood in terms of improving the scores for a wider variety of performance indicators. In the Tyne and Wear case, a primary process aimed at managing the market and as a result reduced the disciplinary coverage of the organisation. The process offered gains in the efficiency of the services; cost effectiveness went up significantly and subsidies went down. The local authority felt the need to promote other values that had suffered: traffic safety, vehicle innovation, ticket integration, and price control. In the Zürich case the primary process aimed to coordinate the scheduling and operation of services. The process offered gains in the effectiveness of the services: public transport took a relatively large share of the modal split. The local authority felt the need to forward other values that had suffered: lower costs, flexibility, traveller awareness.

The analysis from the cases was that organisations with a multidisciplinary character cover more mechanisms influencing the success of metropolitan public transport and directs these mechanisms in a desirable direction. As a multidisciplinary organisation covers more parts of reality, it not only performs better on more generic performance indicators, but also has a higher tolerance for change. A multidisciplinary organisation performs better overall, but it might well perform worse on specific performance indicators.

7.2.3 Question 3:
What approach improves the use of disciplinary knowledge?

The combination of theory and practice showed that the five rationales all favour specific values, which in turn are supported by specific arrangement types. *Conceiving the customer* is supported by remuneration: income dependence on the traveller offers a clear incentive to understand the traveller's preferences and to translate these into an appropriate product. The *market manager* is aware of the negative effects of monopolisation or collusion on performance. Arrangements based on competition support efficient allocation. The *service scheduler* is well aware of the fact that public

transport consists of services using a variety of techniques, which can only offer a full mobility service when properly combined. The quality of that combination depends on strong coordination in service development and operation. The *producers of policy* are well aware of the variety and dynamics of both the regulating and the regulated actors. As preferences and behaviour change, the actors will have to reiterate and recalibrate themselves for successful operation and cooperation. This is only possible through interaction. Finally, *maintaining the metropolis* requires more than just public transport. Furthering public transport is one of the many policies that support the metropolis. In addition, many policies may help or hamper public transport. The integration of these policies is a prerequisite for successful public transport in the metropolis.

In addition, five arrangement types were distinguished supporting the values of the rationales:

- Remuneration,
- Competition,
- Coordination,
- Interaction, and
- Policy integration.

The arrangement types presented here are the primary organisational recommendations from the different rationales. They represent the first set of choices. However, all rationales show a level of understanding for the values and primary arrangement types of other rationales. For example, market managers support competition as an organisational arrangement, but underline that a properly functioning competitive market should trigger coordination. Competition is presented as the primary arrangement type, while the attention to coordination recognises the values of those scheduling the service.

Two aspects form the basis for the purposeful application of multidisciplinarity through a proposed approach. First, rationales support specific values through specific arrangement types. A multidisciplinary organisation contains a variety of these arrangement types. The purposeful application of the arrangement types can enhance the quality of the organisation from a multidisciplinary perspective. Second, multidisciplinarity is best applied in a secondary process of organisational change, the incremental tuning of the organisation. These two observations from theory and practice were combined in a suggested approach for the policymaker managing the organisation. A summarised version of the approach is presented here. A more detailed description of the steps can be found in Section 5.3.

First, the policymaker is recommended to widen the issue (step 1). Often the current organisational rationale shapes the first problem inception, either by rejecting the current rationale ("competition is the problem, we

need to go back to a more coordinated organisation") or strengthening the current rationale ("we need to better implement competition"). In that case the issue rejects or follows the most prominent one. Consequently, solutions will also fully reject or strengthen the current rationale, both leading to new organisational templates. The policymaker should widen the issue to incorporate rationales. The set of arrangement types is a basis for possible organisational improvements by the other rationales.

Second, the policymaker should fit these arrangement types to the existing organisation and formulate arrangements accordingly (step 2 and 3). He can select several arrangement types on the basis of their primary values as the basis of possible arrangements. At first glance, arrangements might be incompatible with an existing organisational template. However, the cases showed many examples of arrangement types being introduced from other than the primary rationale. This results in a wide set of possible arrangements, based on a variety of arrangement types.

Third, the policymaker is recommended to seek implementation of this wide set of arrangements (step 4 and 5). He could consider not implementing proposed arrangements that resemble existing arrangements, but rather altering the existing arrangement. He could also consider dropping the proposed arrangement altogether, as existing arrangements. Other proposed arrangements might be dropped in the process of implementation, following opposition or incompatibility revealed in the process of implementation. When a wider set is available, some arrangements can be lost in the process.

Finally, the approach recommends that the policymaker monitors constantly and receptively for problem definitions by others (step 6). Incrementally improving the organisation is a continuous process, rather than a temporary project. In addition, improvements should not only support the perspective of the authority, but also the perspective of other actors involved.

7.2.4 Question 4: What is the success of such an approach?

We have already concluded that a quantitative evaluation of success and failure in a multidisciplinary study is difficult. Still, we wanted to have a meaningful assessment of the merits and flaws of the theoretical innovation and the approach's application. The choice was made to choose the application of the approach, as this enabled the evaluation of the validity of both the theoretical innovation and suggested approach.

A second choice was whether the evaluation would use a real-life application or a condensed application in a simulation-game. The availability of possible cases and time for a real-world application pointed to a simulation-game. An evaluation of the effects of an incremental improvement of the organisation with a control group is a promising exercise. However, such

evaluation would take up to a decade. In addition, in 1999 Dutch public transport authorities were not ready to implement the untested approach. There was, however, interest in testing it in the protected environment of a simulation-game. And such a simulation-game offers the opportunity to condense several years of public transport operation and organisation into a number of days, though, of course, with limitations.

The suggested approach was tested in a simulation-game. The application of the approach was evaluated using both quantitative (ridership and cost effectiveness) computer models and qualitative analysis. Interviews with the players and the minutes of the simulation-game formed the basis of the qualitative analysis.

Four cycles of the simulation-game represented, in total, four years of public tendering of public transport services in Southern Limburg. These four cycles were played in two days with all the real-life actors (operators and governments) in the region playing their proper role. Two cycles were played organising public transport following Southern Limburg and Maastricht plans for future tendering of public transport. This represented a partial organisational template, primarily based on the rationales managing the market and scheduling the service. Two additional cycles were played according to the suggested approach, implementing a secondary process of organisational change.

As expected, the quantitative evaluation offered no clear answer to value the approach. The small size of the organisational changes did not trigger extreme changes in behaviour, and effects on the modelled parameters were positive but ambiguous. The effects in the qualitative evaluation were clearer, as players generally valued the added arrangements, and the minutes showed the positive effect of the arrangements on interactions between governments and operators and between different governments.

The simulation-game showed that application is possible and promising. In addition, it showed that the approach together with a simulation-game offers the possibility of tuning an organisational form prior to its implementation. This is valuable in a primary process of organisational change, as it offers the ability to significantly alter the organisation, with a priori mitigation of the flaws of an organisational template.

7.2.5 Reflection: Looking behind the answers

This study has made a distinction between two types of organisational forms: the template, which very much leans on a single rationale, and tuned organisational forms, including more perspectives on reality. The template tries to structure interactions based on the perspective of a single rationale,

which gives it the advantage of analytical clarity. The empirical analysis showed that in time the template reveals its flaws and additional rationales are brought into mitigate the template into a more mature organisational form. The organisational template must be tuned.

The weakness of the template can be found in three mechanisms: interpretation, inertia, and instability. A monodisciplinary theoretical recommendation has to be reinterpreted for implementation. That *interpretation* of the theory is a prerequisite for implementation, pure theory simply can not be implemented. This interpretation generally stays implicit, a more explicit interpretation would include a wider disciplinary analysis. The introduction of a free market in the Tyne and Wear is an example of near-concept implementation. However, the authority's control on Metro prices, low-floor bus leasing subsidies, and many other small arrangements allowed the organisation to function relatively well. The cases seem to argue that those details largely part determine the success of the organisation.

In addition, implementation of a template will have to deal with the existing context. Though the organisation changes dramatically, no template can eradicate existing institutions and cultures. This will evoke the need for the template to be tuned to incorporate the old institutions and cultures. This *inertia* will, in the shorter run, threaten the success of the organisational change. The Southern Limburg case is exemplary, showing a very slow process of implementation of tendering.

Finally, implementation of a template occurs in a dynamic world. This is a world where policy goals can dramatically change after four or five years, technology is constantly on the move, and actors adapt to further their own goals, altering in their path the relation between organisation and performance on which the new organisational template was based. This *instability* of the surrounding world will threaten the success of the template on the longer run. This is clear in the Tyne and Wear case, where national political change in 1997 changed priorities, leaving an organisational form not suited for the new priorities.

Interpretation, inertia, and instability stop templates from working without additional tuning. The need to tune the template will present itself during and after the implementation process, as it did in these cases. A multidisciplinary focus on organisational change might be able to mitigate the weakness of the template by introducing a wider empirical base into the total implementation formula.

Our policymaker was shown that in the long run the tuned organisational form has better overall performance than the template. First, based on its wider empirical base, the tuned form is likely to have fewer unforeseen negative side effects. The tuned form is based on an analysis with a wider scope, though the analysis is fragmented among actors and

rationales. That scope is likely to incorporate more possible effects, of which negative effects are explored and mitigated during the process. Second, the tuned form mobilises more possible mechanisms to improve public transport. It applies a wider range of tools to couple and direct actors to improve performance. Tuning the organisation was called the secondary process of organisational change, as opposed to the primary process, which introduces a new template.

In the practice of our policymaker, this tuning often takes the shape of subsequently adding arrangements the template lacks: remuneration, competition, coordination, interaction, and policy integration. That practice could help the policymaker when trying to design a multidisciplinary organisational form without starting of with a flawed template. To the extent to which this was tested, it proved to be a viable hypothesis and a possible tool for improving the organisation of metropolitan public transport.

How does the secondary process offer performance improvements? The simple answer is that it solves problems. Not many problems at the same time, and not large problems. In addition, it defends a variety of values, creating a more robust organisation. This robustness offers sustained performance when actors involved change behaviour or preferences. The tuned organisation is better able to respond to these unavoidable dynamics.

On the other hand it offers a more complex and potentially less transparent organisation. The variety of values and incentives confuses the general direction in which public transport should develop. But in the details of policy development, planning, and operation, those purposefully connected to offer metropolitan public transport can balance their efforts to be efficient and effective.

7.3 Discussion: Disciplinarity in metropolitan public transport

7.3.1 Introduction

This study has focused its recommendations on the public transport authority; that part of local or regional government which is responsible for public transport and, more importantly, its organisational form. However, the improvement of the effectiveness and efficiency of public transport in the modern metropolis is characterised by high interdependency between the different actors. The three main actors depend on each other.

The organisation of metropolitan public transport structures these interdependencies through arrangements. A ticket with a lower price stimulates the traveller to travel in the off-peak period to reduce the costs of the operator. A contract which gives the operator the fare box revenues stimulates that operator to try to attract travellers. A competitive bidding

procedure can help governments get their money's worth from the operators, etc. Pricing policies, subsidy schemes, consultation procedures, these are all examples of arrangements trying to couple individual interests into mutual interdependencies.

We have tried to cater for our policymaker by giving him tools to improve the multidisciplinarity of the organisation through introducing new arrangements. But his success depends on other actors to support him in his effort to improve the quality of the organisation. This leads us to the question for this discussion: what is the role of the different actors to improve the multidisciplinarity of the organisation of metropolitan public transport?

7.3.2 Academics

What is the role of academia in extending the disciplinary coverage of the organisation of metropolitan public transport? Other authors [Lynton, 1985; Klein, 1990; Banister, 1994] have argued that policy-oriented scientist should break the disciplinary boundaries and take a problem orientation rather then a disciplinary orientation. To some extent we would agree on the basis of this study. The discussions within the rationales do not always have a direct bearing on the needs of policymakers.

On the other hand, the dynamics of the rationales lead to advanced knowledge on specific issues. Who can neglect the combined efforts of economists, psychologists and geographers when conceiving the behaviour and needs of the customer? Who will prove the economist wrong when designing a way of managing the market? Who will doubt the civil engineer when services need to be scheduled? Who can neglect the advice of the policy scientist when trying to produce effective policies? Who will prove the urban planner wrong when designing public-transport-oriented city to maintain the metropolis?

Analytical fragmentation is the basis for academic endeavour. As every rationale selects and emphasises other mechanisms, they create a wide and specific understanding of public transport in general. The variety of analyses offers a variety of recommendations, though often not obviously relevant to the policymaker. The quality of these analyses needs delimitation and specialisation in order to be intelligent. In academics this fragmentation is fruitful and not conflicting.

Conflicts arise only when the recommendations are given an organisational form (an arrangement) to be implemented. In that case recommendations have to function next to recommendations from other rationales and in uncharted areas of reality. In real-world public transport travellers, markets, policies, services, and cities are not closed analytical fields; they interact.

It is at implementation that disciplinary fragmentation loses its attraction of narrow and deep analysis. Here the truth of the public administrator competes with that of the economist, the geographers' reality with civil engineers' reality, with that of the urban planner. For example, as those *maintaining metropolis* may ask for free public transport, *market managers* may ask for market prices or at least cost-related pricing. As *market managers* may support competition, *services schedulers* may ask for hierarchical coordination. Analytic fragmentation lets us understand parts of reality. At implementation fragmentation becomes a liability rather than an asset.

Should scientists be more reserved about their recommendations? This study underlines the plea of Linder and Peters [1987, pp. 472] for

> *… Sciences to deal more systematically with the normative implications of their work. As is evident in the implementation literature, there is a tendency to quickly translate empirical observations into implicit ideal types, and to then extract evaluative statements from that ideal.*

The challenge for scientists is to keep their specialisations aligned with the organisational reality of public transport. They can do this by shifting their own specialisation and through cross-over.

Shifting the specialisation is the simpler of the two, as it does not break through the existing disciplinary structure of science. Academics could improve the relevance of their analysis by incorporating developments in organisation. They can bring their specialisation closer to the policy reality. For example, coordinated and centralised organisation asks for different mathematical optimisations of scheduling than a free and open market.

Cross-overs between different sciences can be a fruitful idea, but are harder to realise within the disciplinary structure of science. It is hard to overcome the boundaries, when language, conferences, faculties, empirical mechanisms studied and performance indicators are so different. The different rationales are simply too specialised. The way in which travellers' preferences are reflected in schedules and policies is generally not convincing to those conceiving the customer. The market managers' condensed perspective on government and operators' interactions does not satisfy the producers of policies. In this context, multidisciplinary research will not thrive, but it is an important challenge.

7.3.3 Supranational and national governments

At the time of the case studies, the English and Dutch national governments showed little awareness by some (supra) national governments of the small merit and sizable malice of monodisciplinarity in the organisation of public

transport. Strict regulation severely hampered tuning by the authorities in the Tyne and Wear and Southern Limburg cases. Rather, the national governments saw this as unwelcome modifications from their original organisational template. In addition, European rules have also proved to limit the possibilities for local governments to tune the organisation. However, in the cases of Zürich and Copenhagen, the national governments explicitly left a lot of room for the local governments to organise public transport. Increased interest in decentralisation in The Netherlands and the United Kingdom suggests that the conditions for tuning will improve.

National governments could support the further strengthening of multidisciplinarity in public transport by decentralising, and offering authorities room to develop their organisation. This enables their organisation to be tuned to the problems that occur in that specific situation. In addition, (supra) national governments have the benefit of multiple cases and could organise lessons to be exchanged between local governments and authorities as another way of overcoming fragmentation. The contingencies of tuning can spread faster through local governments, improving the intelligence of arrangements and the way they are applied. As with scientists, they, too, should not overestimate the applicability of the lessons they draw from these cases, but rather leave that to our local policymaker.

7.3.4 Regional and local governments and public transport authorities

This actor was the primary focus in this study. For the regional or local policymaker this study developed an approach as a first step in a process of furthering the multidisciplinarity of public transport. But the approach is only a small step in that process. This last section shows how dependent local governments and authorities are on other for their success. What else can local governments and authorities do to manage the disciplinarity of their organisation and improve performance?

Some clear conditions have to be met to allow for tuning the organisation. Tuning has to be based on the values the government seeks in public transport and a perspective on how performance should develop. Regional and local governments should be very upfront about the values they seek and the performance they expect from public transport, and to support policymakers in their efforts to tune the organisation to support that development. This does not imply that these values have to be static; goals and performance can be tuned to changing demands and conditions over the years.

In addition, they can and should include the perspectives of other actors, including travellers and operators. This means that multiple values might be sought through public transport. For example, arrangements

brought in by the local governments to reduce costs should not exclude profit for the operator.

A second condition is a knowledgeable public transport authority. They can form an intermediary between operator and policymaker that can bring both perspectives together. Generally such an organisation is set up for the purpose of executing the public transport policies set by a number of local governments. Over the years they become a centre of competence, and can develop the freedom to tune the organisation, naturally under normal democratic control mechanisms.

In the cases in the Zürich and Copenhagen, and to a lesser extent in Tyne and Wear, public transport authorities handled a large part of the role of the local government. The cases illustrated the important role of public transport agencies such as ZVV, HT, and Nexus. The authorities served as knowledge centres in the relation between organisation, quality and efficiency of service provision. All the authorities mentioned use that knowledge to tune the organisation in a hands-on manner. The Zürich and Copenhagen authorities had more freedom to tune their organisation than the Tyne and Wear authority. The local governments in Southern Limburg lacked a public transport authority at the time of the case studies. Organisational changes were initiated by the national government and were not geared to local problems.

This study regularly mentioned "our policymaker" as the person to support in the secondary process of organisational change. The natural position for this policymaker is in the public transport authority. The authority forms a permanent institution to tune the organisation as a whole in an ongoing process. Without a relatively knowledgeable and independent public transport authority organisational tuning is unfeasible.

Finally, multidisciplinarity can be an asset for an organisation when it is used to continuously tune the organisation to changing priorities of our policymaker or changing behaviour of other actors jeopardising our policymakers' current priorities. Multidisciplinarity improves the general performance of the organisation, though on specific performance indicators, template organisations can do better. Multidisciplinary organisations do better in terms of robustness and flexibility.

However, there are limits to the merits of multidisciplinarity and tuning. *Over-tuning* can pose a problem. The success of the tuning is based on adding balanced, recognisable, and distinguishable incentives to support the overall performance of the organisation. When the organisation becomes a tangled jumble the functioning of arrangements might be misunderstood. Actors might use this ambiguity to reinstate fragmentation and strategically use the jumble to their advantage. Problems will resurface and express themselves in the need for cleaning up. This will lead to a long-term process

of introducing templates, tuning them over time, and finally discarding them in favour of a new template.

7.3.5 Operators

All actors have a bias towards specific parts of reality, and a tendency to prefer specific types of arrangements and specific organisational templates. However, their bias is not static. Rationales struggle for dominance in the operator, as they do in science and government. The outcome of this struggle seems to be largely dependent on the arrangements under which the he operates. And the outcome of that struggle within the operator determines which problems in the operation he notices and tackles first. Through this mechanism, arrangements influence the development of operation and services. They also influence which part of the organisation gets the most attention, as different types of problems do not occur uniformly in the operator's organisation. That direction of the organisational focus is the role of the arrangements in the overall organisation of public transport.

This continuous struggle between rationales, inspired by the tuned organisation, is an asset; it comprises the flexibility of the sector. This flexibility depends on managers, planners, and frontliners balancing different rationales between them and amongst them. The manager has to balance his focus on costs and revenue, innovation and operation. The planner has to balance his focus on speed and access, and the internal and external coherence of services. The frontliner has to balance his focus on courtesy and authority, loyalty to the traveller and to the manager.

The success of the tuned organisation depends on the ability of managers, planners, and frontliners to listen close to the composite incentives they receive from the tuned organisation. They have to open their ears, sometimes deafened by years of commanding templates, to the fairytales of the tuned organisational form. All three, manager, planner, and frontliner, have to develop a fine ear for the composite message the tuned organisational form is trying to get across, and to develop a feel for the arrangements under which they operate. When they do so, careful tuning of the organisation can result in better public transport.

7.3.6 Travellers

Better public transport is there for the traveller to enjoy. In organisations of public transport the traveller is often seen as the outsider. Consequently complexities of demand are often jostled by the complexities of supply and government. Service planning and policy development are complex issues with a tendency to impose simplification in their perspectives on demand.

One of the suggested arrangement types furthers the understanding of the travellers' preferences throughout the organisation through remuneration.

Remuneration works through a small incentive in large numbers. Every ticket sold can be a small incentive to the operator and the authority to focus on that type of traveller. Remuneration is a dynamic coupling of the travellers' preferences with the parts of the organisation. Travellers come in a great variety and their preferences shift. Remuneration can help a balanced incorporation of that variety in the public transport services.

Remuneration is based on aggregation, but travellers also use representation to make themselves heard by governments and operators. Representation is less successful in reflecting the variety of travellers. Consumer organisations will find it hard to represent the traveller, operators will find it hard to find representative panels. Still, the representative role is important to aggregate travellers' preferences on service characteristics that all travellers share.

Consumer organisations should promote arrangements that shift attention away from technical or cost optimisations and towards service and revenue optimisations. The shift means that tuning should be the focus of the consumer organisations, rather than asking for a new template. Travellers hardly ever witness a secondary process of organisational change, whereas primary processes receive a great deal of public attention. They might conclude that the quality of metropolitan public transport depends on the introduction of a whole new organisational template. A consumer organisation might propose organisations fully based on remuneration, focusing the organisation on the needs of the traveller, or coordination, focusing the organisation on a unified service to the traveller. An intelligent way would be to see how the current organisations might be strengthened by specific arrangements based on the arrangement types that can help further the quality of metropolitan public transport. This attitude would simplify their inclusion in a secondary process organisational change.

7.4 Beyond this study: Questions unanswered

This study asserts that organisations for public transport with a wider disciplinary coverage perform better than organisations with a narrower disciplinary coverage. Local authorities themselves draw lessons and implement arrangements to improve their organisation. These lessons can be interpreted as widening the disciplinary coverage of the organisation, moving away from a template based on one or two rationales toward a tuned organisation. The four cases offered evidence in this direction.

This study has offered some understanding of the mechanisms that support this assertion, but further empirical analysis is needed on a larger empirical base. This could be done by replicating the case study approach. Alternatively a survey or longitudinal study could further focus on the relation

between disciplinary coverage and performance in a larger number of metropolitan public transport organisations.

Both the survey and longitudinal study require two issues to be resolved. The first issue is the least complex. A further operationalisation is needed of disciplinary coverage. How can we recognise whether an organisation is a template or whether it has been extensively tuned to meet the local situation? A first step could assess the presence of a public transport authority, as a prerequisite for a secondary process of organisational change and tuning. A second step could look at the extent to which organisational changes are overturning the existing organisation.

The second issue is far more complex. How to assess performance in such an analysis? First, this study showed that different rationales offer different operationalisations of performance indicators. Second, it showed that in different places and times the ways to measure similar performance indicators differed significantly. Third, it showed that different actors support different performance indicators. As rationales disagree, cases disagree, and actors disagree, there is no single answer to what performance is in a multidisciplinary perspective. Any indicator that might be used should at least involve efficiency and effectiveness factors, which would point to a composite index. In addition, it should be quantifiable. Moreover, in the case studies it should be available for all cases. Finally, it should not be biased towards a specific rationale. The first major step of such a research would be the development of such a performance indicator.

Further research could also focus on the suggested approach. It was developed and tested once in a simulation-game. However, further testing of the suggested approach is needed to refine and improve it. How well does it support public transport authorities recognising the need to widen the disciplinary coverage of their organisation? Here two approaches can be useful. The first is a detailed study of local authorities willing to implement the approach. A second would use simulation-gaming. The simulation-game would be developed primarily with the aim of understanding how authorities use the approach, and secondly to evaluate the performance of the approach. Here evaluation of performance is simpler. As the authorities involved use the approach, either in a real-world or in a simulation-game application, their assessment of the usefulness of the approach gives a useful basis for refinement and improvement.

Finally, this study focused on the role of public transport to help the modern metropolis improve its vitality and mobility in the face of growing car-use. It gives the public transport authority some direction on how to improve the organisation of public transport. However, newspapers present many other areas like education, healthcare, and utilities, where governments, together with professionals, provide a service to users. A single organisational

form should balance the demands of all these groups and offer them room to make the right choices. Replicating this study in other sectors might help understand how interdisciplinarity in general can help overcome the negative effects of fragmentation. It might provide ways to learn from others to further improve public transport for the future of the modern metropolis.

Samenvatting

Mind the gap, een brug tussen theorie en praktijk van stadsgewestelijk openbaar vervoer. Dit boek is de afspiegeling van een langlopend promotieonderzoek naar het openbaar vervoer in stadsgewesten. Het vormt een aanzet voor een betere organisatie. Niet vanuit één discipline, maar vanuit verschillende.

Wetenschappers hebben nuttige ideeën over een beter openbaar vervoer. Die ideeën liggen op veel terreinen. Van het type bus tot de plek van nieuwe kantoren en woonwijken. Of van de opzet van de dienstregeling tot de ordening van de markt. Op al die terreinen zijn specialisten actief, ieder met z'n eigen competentie. De verkeerskundige denkt na over de opzet van een dienstregeling en de econoom over de ordening van de markt; andersom zou improductief zijn. Deze specialisten hebben schatten aan kennis, maar kennen ook zo hun beroepsmatige voorkeuren. Op die manier vormen ze disciplines: eilanden van inzichten. Over de effecten van het combineren van die versnipperde kennis voor een beter openbaar vervoer weten we nog weinig. Sterker nog: sommige aanbevelingen van de verschillende disciplines botsen op het eerste gezicht met andere. Daarom is een aanpak vanuit verschillende disciplines gewenst.

Logische vragen om zo'n multidisciplinaire aanpak te onderbouwen zijn:

1. Welke disciplines leveren een zinvolle bijdrage aan de organisatie van stadsgewestelijk openbaar vervoer?
2. Hoe wordt kennis vanuit losse disciplines in de praktijk gebruikt?
3. Welke combinatie van disciplines leidt tot beter stadsgewestelijk openbaar vervoer?
4. Wat is het succes van zo'n multidisciplinaire aanpak?

Deze antwoorden op deze vier vragen staan in de hoofdstukken 3, 4, 5 en 6 van dit boek. Hieronder een samenvatting.

Vraag 1: welke disciplines leveren een zinvolle bijdrage?

Een uitgebreide literatuurstudie levert vijf disciplines op die over het openbaar vervoer gaan:

- Kennen van de klant
  Onderzoek en aanbevelingen uit vooral de sociaal-geografische discipline gericht op verplaatsingsgedrag en wensen van openbaar-vervoerreizigers.
- Managen van de markt
  Onderzoek en aanbevelingen uit de economische discipline gericht op het ordenen van de openbaar-vervoermarkt.
- Rekenen aan ritten
  Onderzoek en aanbevelingen uit de verkeerskundige discipline gericht op het opzetten van openbaar-vervoerdiensten.
- Beter besturen
  Onderzoek en aanbevelingen uit de bestuurskundige discipline gericht op overheidsrollen- en taken in het openbaar vervoer.
- Sterken van de stad
  Onderzoek en aanbevelingen uit de ruimtelijke discipline gericht op de relatie tussen stedelijke bebouwing en openbaar vervoer.

Deze vijf disciplines hebben een eigen praktijkbasis, onderscheiden verschillende causale mechanismen, kennen eigen prestatie-indicatoren en komen dan ook tot verschillende aanbevelingen. Die aanbevelingen hebben bijna altijd gevolgen voor de organisatie, maar die gevolgen zijn niet altijd duidelijk of direct.

Lang niet alle kennis binnen de vijf disciplines gaat over het openbaar vervoer. De samenhang binnen elke discipline is sterker dan de relatie met andere disciplines. Omdat de disciplines rond het openbaar vervoer niet de complete wetenschappelijke discipline dekken, hebben ze in dit boek een eigen naam gekregen.

Vraag 2.
Hoe wordt kennis vanuit losse disciplines in de praktijk gebruikt?

Om te onderzoeken hoe de verschillende disciplines in de praktijk worden gebruikt, zijn vier Europese casussen geselecteerd: drie praktijkvoorbeelden buiten Nederland en één binnen Nederland. Bij de Europese casussen is geput uit 75 succesvolle regio's met de hoogste kostendekking en het hoogste openbaar-vervoeraandeel in de totale

mobiliteit. Gekozen is voor drie praktijkvoorbeelden met grote organisatorische verschillen:

- het kanton Zürich in Zwitserland
- het stadsgewest Tyne and Wear rond de stad Newcastle upon Tyne in het Verenigd Koninkrijk en
- het stadsgewest Noordelijk Sjealand rond de stad Kopenhagen in Denemarken.

Als aanvullende Nederlandse casus is gekozen voor Zuid-Limburg, een gebied dat qua dichtheid van de bevolking te vergelijken is met de stadsgewesten Amsterdam, Rotterdam en Utrecht. Zuid-Limburg vergroot de variëteit in organisaties, maar behoort niet tot de succesvolle voorbeelden in Europa.

De literatuurstudie leverde een beeld van de belangrijkste variabelen van de verschillende disciplines. Een lijst met die variabelen is gebruikt bij het bestuderen en analyseren van de casussen. Deze lijst staat in bijlage C. Aan de hand van de variabelen is gezocht naar het gebruik van de verschillende disciplines in de drie regio's. In elke regio zijn ongeveer twintig interviews gehouden: met managers en planners van regionale vervoerbedrijven en de regionale openbaar-vervoerautoriteit, met ambtenaren van de regionale en nationale overheid en met wetenschappers uit het betreffende land die interesse hebben in openbaar vervoer. Om het beeld te completeren is aanvullende informatie verzameld uit beleidsstukken, media, nota's, rapporten en statistieken.

Bij alle buitenlandse casussen is de organisatie flink veranderd om het openbaar vervoer te kunnen verbeteren, maar steeds op een andere manier. In Zürich stond een gecoördineerde opbouw van openbaar-vervoerdiensten centraal, in lijn van het rekenen aan ritten. In Tyne and Wear draaide het om de introductie van concurrentie, in lijn met het managen van de markt. In Kopenhagen stond de introductie van aanbesteding centraal, met zowel concurrentie als de afstemming met het beleid van de overheid. De organisaties werden grondig verbouwd. Ze hadden een of meer disciplines als leidend principe. Zo'n organisatievorm, leunend op een discipline, noemen we een sjabloon.

Openbaar-vervoerautoriteiten gingen bewust om met de problemen na de introductie van zo'n sjabloon. Alle drie – het Zwitserse ZVV in Zürich, het Britse Nexus in Tyne and Wear en het Deense HT in Kopenhagen – zochten vrij snel na de introductie van de nieuwe organisatie naar verfijningen. Problemen kregen een vertaling in organisatorische aanpassingen. Veelal voegde de openbaar-vervoerautoriteit arrangementen toe gebaseerd op andere disciplines dan de leidende. De organisaties die concurrentie invoerden, hadden behoefte aan meer afstemming.

Als een organisatie een sjabloon hanteert, dan geldt: het een of het ander. Een organisatie met een goede afstemming met het beleid kan minder inspelen op de wensen van de reiziger. En een organisatie met veel samenwerking tussen de vervoerders kent weer weinig concurrentie tussen die bedrijven, et cetera. HT, ZVV en in mindere mate Nexus waren in staat de voordelen vanuit verschillende disciplines toe te voegen aan hun bestaande organisatie. Zo'n organisatie bestaat uit een stelsel van afspraken en arrangementen die kunnen worden aangepast en toegevoegd. Arrangementen vanuit verschillende disciplines versterkten de organisatie.

De vier casussen laten steeds twee processen zien. Enerzijds zijn er primaire processen van organisatorische veranderingen. Die richten zich op grootschalige aanpassingen van de organisatie: een nieuwe structuur, nieuwe processen en een nieuwe verdeling van taken en verantwoordelijkheden. Een voorbeeld is de invoering van aanbestedingen in Nederland. Vaak gaat het om invullingen die sterk zijn gestoeld op theorie of leunen op één discipline, zoals een vrije markt, coördinatie door de overheid of een transparante aanbesteding. Vaak vergen deze grootschalige veranderingen veel voorbereiding en betekent de invoering ervan voor alle partijen een flinke ommezwaai.

Anderzijds zijn er secundaire processen. Die richten zich op het oplossen van problemen na de grootschalige aanpassing van de organisatie. Dit is een taak die de Nederlandse openbaar-vervoerautoriteiten nog staat de wachten. Vaak zijn het sterk probleemgedreven en oplossingsgerichte invullingen: een extra prikkel inbouwen in een contract, een andere procedure om inschrijvers uit te nodigen, een lichte verschuiving van verantwoordelijkheden. Het oplossen van relatief kleine problemen kan vaak redelijk snel. Het leidt ertoe dat de organisatie op meer disciplines leunt. De organisatie wordt dan omgebouwd van monodisciplinair naar multidisciplinair.

Vraag 3:
Welke combinatie van disciplines leidt tot beter stadsgewestelijk openbaar vervoer?

De analyse van de praktijk leert dat een monodisciplinaire organisatie (sjabloon) onherroepelijk tegen problemen oploopt. Zo'n sjabloon botst tijdens de invoering namelijk op onvermoede mechanismen: het rationele model komt niet overeen met werkelijkheid. Maar waar komen de oplossingen vandaan? Ook in de succesvolle casussen blijkt het vaak moeilijk de discipline van een organisatie te doorbreken. Invoering van een sjabloon heeft het gedachtegoed gekleurd. De leidende discipline heeft zich verankerd in regels van de organisatie. Die regels bemoeilijken vaak aanvullingen met arrangementen uit andere disciplines. Een oplossing vanuit een andere discipline is dan ook niet snel gevonden en nog moeilijker door te voeren. Als

een andere discipline wel een kans krijgt, dan is dat veelal een radicale verwerping van de bestaande discipline en organisatie. Een nieuw primair proces om de organisatie te veranderen treedt dan in werking en een nieuw sjabloon vervangt het oude, met andere ongewenste gevolgen.

De centrale les is dat de secundaire veranderingen van de organisatie belangrijk zijn voor het succes. Die veranderingen vloeien vaak voort uit de leidende discipline. Zo werkte de vrije markt goed omdat regulering en overheidsbemoeienis de scherpe kantjes eraf haalden. En coördinatie tussen overheid en vervoerders werkte goed omdat een zekere vorm van marktwerking de bijwerkingen van coördinatie afzwakte. Juist de casussen die dit principe toepassen presteren goed op verscheidene fronten. Dat is begrijpelijk: een organisatie met meer disciplines dekt meer aspecten van het openbaar vervoer en functioneert dus beter.

Deze gedachte is de basis van de multidisciplinaire aanpak. Eerst is bezien of arrangementen zijn te onderscheiden langs de lijnen van specifieke disciplines. Als er arrangementen zijn toegevoegd die oorspronkelijk uit een andere discipline komen, hoe zijn die dan te herkennen? Casussen plus theorie leidden tot deze typering:

- Arrangementen voor vereffening
  stimuleren van klantgerichtheid
- Arrangementen voor concurrentie
  stimuleren van innovatie in product en productie
- Arrangementen voor coördinatie
  stimuleren van meerwaarde in product en productie
- Arrangementen voor interactie
  zekerstellen van afstemming tussen partijen
- Arrangementen voor samenhang
  zekerstellen van afstemming tussen beleidsterreinen.

Zes stappen rond het toevoegen van arrangementen kunnen de beleidsmaker helpen de organisatie van het openbaar vervoer te verfijnen. In tabel 24 op pagina 173 staat hoe de multidisciplinaire aanpak zich verhoudt tot een aanpak vanuit één discipline.

1. Vergroot het vraagstuk
   De eerste omschrijving van een (beleids)probleem geeft vaak al de oorzaak aan. Zo'n oorzaak claimt het probleem meestal vanuit één discipline. Treinen rijden bijvoorbeeld niet op tijd omdat er volgens de ene een tekort is aan materieel of volgens de andere aan concurrentie. Door vanuit andere disciplines te kijken, krijgt het probleem meer kleuren en daardoor ook meer mogelijke oplossingen.

2. Mobiliseer de mechanismen
   Als de eerste omschrijving van het probleem is gekleurd vanuit één discipline, dan raken mogelijke oplossingen voor het onderliggende probleem vanuit andere disciplines of andere niveaus van interactie buiten beeld. De verschillende 'kleuren' van het probleem vragen om verschillende arrangementen. Zo koppel je de vijf typen arrangementen aan de verschillende formuleringen van het vraagstuk.
3. Formuleer arrangementen
   De vijf typen arrangementen kunnen een plaats krijgen in de organisatie. Marktwerking kan werken in elke organisatie, maar de invulling zal verschillen. Om arrangementen te laten werken, is het van belang de context te kennen: zowel de organisatie als het gedrag van partijen. Zo combineer je context, vraagstuk en typen arrangement tot een passend arrangement.
4. Versterk bestaande arrangementen
   Met sommige van de arrangementen uit stap 3 werkt de organisatie al min of meer. De prikkels van deze arrangementen kunnen eventueel worden versterkt.
5. Voer nieuwe arrangementen in
   Uit stap 3 volgen verscheidene arrangementen die zijn gebaseerd op verschillende interpretaties van hetzelfde probleem. Arrangementen waarmee de organisatie nog niet werkt kunnen worden ingevoerd. Daarbij zijn moeilijkheden bij de invoering minder erg omdat OV-autoriteiten kunnen inzetten op verschillende arrangementen met hetzelfde effect.
6. Evalueer hoe de organisatie functioneert,
   In een multidisciplinaire analyse van de organisatie is het lastig het effect te meten van een enkel arrangement, want arrangementen kunnen elkaar versterken of juist afzwakken. Of elkaar in evenwicht brengen of juist uitdoven. Evaluatie dient zich daarom te richten op de resultaten van de hele organisatie.

Deze zes stappen helpen de openbaar-vervoerautoriteit hun organisatie bij te stellen en vergroten de dekking met verschillende disciplines. Ze vormen een cyclus in een proces van stap voor stap veranderen. In de praktijk kunnen stappen parallel of door elkaar lopen. Dit permanente proces is nooit afgelopen.

De multidisciplinaire aanpak verschilt in een aantal opzichten van de traditionele aanpak. De multidisciplinaire aanpak verbreedt het probleem eerst, terwijl een monodisciplinaire aanpak de omschrijving van het probleem al snel verengt. De multidisciplinaire aanpak zoekt niet naar aanscherping van de verklarende mechanismen, maar gebruikt de verklarende mechanismen

om het probleem aan te pakken. Tenslotte beperkt de multidisciplinaire aanpak zich tot aanpassing van de organisatie: de verbanden tussen verschillende partijen, taken, waarden en disciplines.

Vraag 4.
Wat is het succes van zo'n multidisciplinaire aanpak?

De multidisciplinaire aanpak is getoetst in een spelsimulatie van twee dagen in 1998. Vrijwel alle partijen in het openbaar vervoer in Zuid-Limburg deden daaraan mee. Zij speelden aanbestedingen van openbaar vervoer: eerst zoals de openbaar-vervoerautoriteiten (provincie Limburg en gemeente Maastricht) de aanbesteding voor ogen hadden. Daarna speelden de partijen aanbestedingen met veranderde en nieuwe arrangementen gebaseerd op de multidisciplinaire aanpak. In totaal zijn er vier ronden gespeeld.

Nieuwe arrangementen speelden in op klachten van verschillende partijen. Zo hadden de vervoerders bij de eerste gesimuleerde aanbestedingen geklaagd over het gebrekkige programma van eisen en een gebrek aan gegevens. En de openbaar-vervoerautoriteiten hadden geklaagd over de kwaliteit van de ingediende offertes en ook over een gebrek aan gegevens. Andere overheden (zoals aangrenzende gemeenten) hadden geklaagd dat ze niet waren betrokken bij het opstellen van het programma van eisen. De aanbestedingsprocedure was strikt. Dat uitte zich in gebrekkige terugkoppelingen en gebrekkige communicatie tussen de overheden en vervoerders. Vanuit een aantal disciplines is gezocht naar arrangementen die deze klachten konden verhelpen en die pasten bij de organisatie.

Het doorlopen van de zes stappen leidde tot drie wijzigingen. Eerst introduceerde de spelleiding openbare pre-bid bijeenkomsten. Daarin konden potentiële inschrijvers vragen stellen aan de openbaar-vervoerautoriteiten. Ten tweede kregen andere overheden meer inspraak in het programma van eisen en konden openbaar-vervoerautoriteiten en vervoerders meer informatie uitwisselen. Tenslotte legde de concessie de communicatie en levering van informatie vast tussen de openbaar-vervoerautoriteit en de winnende vervoerder. Al deze aanpassingen versterken de interactie. De spelleiding verwierp aanpassingen voor een betere afwikkeling van kosten en opbrengsten omdat dat niet paste in de spelsimulatie.

De resultaten van de aanbestedingen zonder het doorlopen van de zes stappen en met het doorlopen van de zes stappen zijn op drie manieren vergeleken. Ten eerste op de uitkomsten. Om de spelers tijdens het spel informatie te geven, berekenden twee computermodellen inkomsten (efficiëntie) en aantallen reizigers (effectiviteit) op basis van gegevens die de spelers leverden. Gekeken is of inkomsten en aantal reizigers veranderden

door de aanpassingen in de organisatie. Op basis van de modellen viel die conclusie niet te trekken.

Ten tweede is aan de spelers gevraagd of de extra arrangementen in de tweede ronde waardevol waren. De spelers concludeerden dat die enkele beperkingen van de eerste ronde wegnamen. Enkele spelers stelden terecht dat een aantal extra arrangementen, zoals een pre-bid bijeenkomst, gewoon bij een aanbesteding horen en dus al in eerdere ronden hadden moeten zitten. Hoewel de aanbesteding er niet van afhangt, zijn extra arrangementen wel nodig voor een goede aanbesteding. Voor de provincie Limburg en de gemeente Maastricht spraken de extra arrangementen niet vanzelf: ze waren niet gepland voor de eerste aanbestedingen. Zonder de spelsimulatie en de zes stappen waren ze daar niet zelf achtergekomen.

Tenslotte is gekeken naar de notulen van het spel. Hieruit kwam duidelijk naar voren dat het doorlopen van de zes stappen tot een beter resultaat leidt. Observanten notuleerden klachten van vervoerders over de kwaliteit van het programma van eisen. Zij moesten de letterlijke teksten van de programma's interpreteren. Ook waren de afwegingscriteria van de openbaar-vervoerautoriteiten niet helder. Dat uitte zich in 'briefwisselingen' en verzoeken om informatie, maar overheden hoorden ook hoe zij het programma van eisen konden verbeteren. De observanten notuleerden ook klachten van de overheden over het bij de zittende vervoerder inwinnen van informatie die nodig was voor eventuele nieuwe vervoerders. Verder signaleerden ze teleurstelling bij de overheden over de kwaliteit van de ingediende offertes.

Het bleek moeilijk om een helder beeld te krijgen van de exacte invloed van de aanpassing op de effectiviteit en efficiëntie. De effecten van nieuwe inzichten van de partijen zijn zowel in een spel als in het echt nauwelijks te ontwarren van de effecten van aanvullende arrangementen. Tevens richt het gesimuleerd doorlopen van de zes stappen zich op het voortdurend en langdurig verfijnen van de organisatie. Dan mag je niet verwachten dat je van een enkele stap effect ziet op effectiviteit en efficiëntie. De evaluaties van de spelers en de notulen zijn daarom van wezenlijk belang voor het begrijpen van de effecten van de aanpak. De spelers zagen oplossingen voor een aantal problemen. Het is aannemelijk dat deze problemen zonder de multidisciplinaire aanpak niet of later waren opgelost, aangezien de problemen nooit verder waren gekomen dan de partij die ze opmerkte. Communicatie was tenslotte een van de belangrijke aandachtspunten.

In hoeverre is de multidisciplinaire aanpak nu succesvol? Deze aanpak is in elk geval veelbelovend. Veel ambtenaren en vervoerders denken in sjablonen: monodisciplinaire organisatievormen met duidelijke beloften voor het oplossen van grote problemen. In de praktijk zijn ze vaak ongestructureerd bezig met het oplossen van kleine problemen. Deze studie

overbrugt dit gat tussen theorie en praktijk. Het daagt de beleidsmaker uit kleine problemen breder te bezien en gestructureerd aan te pakken. Uit die aanpak volgt een organisatie die niet is gestoeld op kennis van een enkele discipline, maar op de kennis van vijf disciplines en de praktijk daarvan in drie succesvolle buitenlandse casussen.

Conclusie en discussie

Verschillende auteurs hebben hoge verwachtingen van multidisciplinair onderzoek op het gebied van complexe problemen, zoals mobiliteit. Deze studie ontwikkelde zo'n multidisciplinaire aanpak voor een specifiek probleem: de organisatie van stadsgewestelijk openbaar vervoer. Duidelijk is geworden dat multidisciplinariteit tegennatuurlijk is in de wetenschap. De scherpte in analyses, die je van wetenschappers mag verwachten, komt voort uit een selectieve aandacht voor de werkelijkheid: meestal zien ze maar een deel van het probleem en de oplossingen.

Multidisciplinair wetenschappelijk onderzoek spreekt dan ook niet vanzelf. Wetenschap is er niet op ingericht. Faculteiten, congressen, taal: allemaal eilanden waartussen het lastig bruggen slaan is. De eilanden hebben vaak ook zo'n massa dat zij slechts traag de praktijkontwikkelingen kunnen volgen bij het opnieuw formuleren van hun kernvragen. Voor wetenschappers liggen er twee uitdagingen. Om hun aanbevelingen te laten aansluiten bij de praktijk, moeten hun vraagstellingen die praktijk ook weerspiegelen. Daarnaast ligt er een uitdaging om vaker de overstap te maken en samen met andere disciplines het beeld van de werkelijkheid aan te scherpen. Maar het startpunt dient altijd gedegen disciplinaire kennis te zijn.

Voor mannen en vrouwen van de openbaar-vervoerpraktijk geldt iets soortgelijks. Ook zij moeten altijd hun vak beheersen tot in de details en erin excelleren. De organisatie waarin ze werken verbindt hun handelen. Die organisatie moet ruimte bieden aan het scala aan waarden van deze praktijkmensen. Dat lukt niet wanneer een enkele partij de organisatie grondvest op één discipline. Slechts wanneer de organisatie 'getuned' wordt op de problemen en wensen van de verschillende partijen kan het openbaar vervoer helpen voldoen aan de mobiliteitsvraag van metropolen.

Wijnand Veeneman, juni 2002

References

Aarts, H. [1996]
Habit and decision making; the case of travel mode choice, (diss.), Nijmegen, NL;

Adviesdienst Verkeer en Vervoer (AVV) [1998]
Werkt marktwerking; ervaring uit het openbaar vervoer in tien Europese steden (in Dutch "Does the markt function, experiences in ten European cities"), Adviesdienst Verkeer en Vervoer, Rotterdam, NL;

Andersson, A.E., and U. Strömquist [1989]
The emerging C-society, in: D.F. Batten, and R. Thord (Eds.), *Transportation for the future*, Springer Verlag, Berlin, D, pp. 29-39;

anonymous [1985]
Transport Act, The Stationery Office Limited, London, UK;

anonymous [1989]
Lov om hovedstadsområdets kollektive personstrafik (in Danish "Law on public transport Copenhagen") , Folketinget, Copenhagen, DK;

anonymous [1994]
Le transport public, acteur social, in: *Transport public* (in French "Public transport, social actor") , 6, Paris, FR;

anonymous [1999]
Gratis bus Hasselt slaat vleugels uit, in: *Verkeerskunde* (in Dutch "Free bus is Hasselt expands"), 6, ANWB, Den Haag, NL, pp. 19-20;

anonymous [2000]
Transport Act, The Stationery Office Limited, London, UK;

anonymous [2000]
Wet Personenvervoer (in Dutch "Law on passenger transport"), Staatsdrukkerij, Den Haag, NL;

Augustijn, M.J. [1988]
Samenwerking openbaar vervoer; onderling en met de overheden (in Dutch "cooperation public transport: operators and authorities"), Technische Universiteit Delft / Civil Engineering, Delft, NL;

Banister, D. [1994]
Transport planning; an international appreasal, E & FN Spon, London, UK;

Batty, M. [1976]
Urban modelling; algorithms, calibrations and predictions, Cambridge University Press, Cambridge, US;
Baum, H. [1993]
Government and transport markets, in: J. Polak, and A. Heertje (Eds.), *European transport economics*, Blackwell, Oxford, UK, pp. 152-188;
Baumol, W.J., and J.G. Sidak [1994]
Towards competition in local telephony, AEI Press, Washington DC, US;
Bayliss, B. [1992]
Transport policy and planning; an integrated analytical approach, World Bank, Washington DC, US;
Beavon, K. [1977]
Central place theory; a reinterpretation, Longman, London, UK;
Becker, H.A., and H.M. Goudappel (eds.) [1972]
Developments in simulation and gaming, Boom, Meppel, NL;
Beesley, M.E., and S. Glaister [1985]
Deregulation in the busindustry in Britain, a respons, in: *Transport reviews*, London, UK, pp. 133-142;
Berechman, J. [1993]
Public transit economics an deregulation policy, Elsevier, Amsterdam, NL;
Berechman, J., et al.(eds.) [1996]
Transport and land-use, Edward Elgar, Cheltenham, UK;
Bishop, M., et al.[1994]
Privitization and economic performance, Oxford University Press, Oxford, UK;
Black, A. [1995]
Urban mass transportation planning, McGraw-Hill, New York, US;
Boer, E. de (ed.) [1986]
Transport sociology; social aspects of transport planning, Pergamon Press, Oxford, UK;
Bonnell, P. [1995]
Urban car policy in Europe, in: *Transport policy*, 2, Oxford, UK, pp. 83-96;

Bonz, M., et al.[1994]
Öffentliche Verkehr, in: G. Steierwald, and H.D. Kühne (Eds.), *Stadtverkehrsplanung; Grundlagen, Methoden, Ziele* (in German "Public transport") , Springer Verlag, Berlin, D, pp. 481-543;
Bovy, P., et al.[1990]
Hoe kan dat nou? De discussie over de substitutiemogelijkheden tussen auto en openbaar vervoer (in Dutch "How is that possible? Discussion on subsititution between car and public transport"), Adviesdienst Verkeer en Vervoer, Rotterdam, NL;
Bruijn, J.A. de, and E.F. ten Heuvelhof [1991]
Sturingsinstrumenten voor de overheid; over complexe netwerken en een tweede generatie sturingsinstrumenten (in Dutch "Steering instrument for government"), Stenfert Kroese, Houten, NL;
Bruijn, J.A. de, and E.F. ten Heuvelhof [1995]
Netwerkmanagement, strategieën, instrumenten en normen (in Dutch "Managing networks: strategies, instruments and values"), Lemma, Utrecht, NL;
Bruijn, J.A. de, et al.[1998]
Procesmanagement: over procesontwerp en besluitvorming (in Dutch "Process management: on process design and desicion-making"), Academic Service, Schoonhoven, NL;
Bushell, C. [1994]
Jane's urban transport systems, Jane's Information Group, Coulsdon, UK;
Button, K.J. [1993]
Transport economics, Edward Elgar, Cheltenham, UK;
Button, K.J., and R. Stough (eds.) [1998]
Transport policy, Edward Elgar, Cheltenham, UK;
Caluwé, L., et al.[1996]
Gaming; organisatieverandering met spelsimulaties (in Dutch "Gaming: organisational change through simulation games"), Delwel, 's-Gravenhage, NL;
Cammen, H. van der, and L.A. de Clerck [1986]
Ruimtelijke ordening; van plannen komen plannen (in Dutch "Planning: plans make plans), Het Spectrum, Utrecht, NL;
Capello, R., and A. Gillespie [1993]
Transport, communications and spatial organisation; conceptual framework and future trends, in: P. Nijkamp (Eds.), *Europe on the move; recent developments in European communications and transport activity research*, Avebury, Aldershot, UK, pp. 45-48;

Carlstein, T., et al.(eds.) [1978]
Timing space and spacing time I; Making sense of time, Edward Arnold, London, UK;
Carlton, D.W., and J.M. Perloff [1994]
Modern industrial organization, HarperCollins, New York, US;
Centrum voor Energiebesparing en Schone Technologie (CE) [1997]
Energy and emmision profiles of aircraft and other modes of passenger transport over European distances, CE, Delft, NL;
Cerwenka, P., and O. Meyer-Rühle [1991]
Sondierung einer für Berlin geeigneten ÖPNV-Kooperationsform aus einem internationalen Vergleich, in: *Verkehr und Technik* (in German "Probing a form for cooperation in Berlin's public transport") , 1, D, pp. 194-228;
Chisholm, D. [1989]
Co-ordination without hierarchy; informational structures in multiorganizational systems, University of California Press, Berkeley, US;
Christaller, W. [1933]
Die zentrale Orte in Süddeutschland; eine ökonomisch-geographische Untersuchung über die Gesetzmässigkeit der Verbreitung und Entwicklung der Siedlungen mit städtischen Functionen (in German "Central place theory in southern Germany") , Gustav Fisher, Jena, D;
Christaller, W. [1966]
Central place theory in southern Germany, Prentice Hall, Englewood Cliffs, US;
Cohen, M.D., et al.[1972]
A garbage can model of organizational choice, in: *Administrative Science Quarterly*, 17, US, pp. 1-25;
Commissie De Boer [1994]
Naar een vitaal en betaalbaar openbaar vervoer; advies aan de minister van Verkeer en Waterstaat uitgebracht door de auditcommissie stads- en streekvervoer (in Dutch "Towards healthy and sound public transport"), Commissie De Boer, 's-Gravenhage, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1992 A]
Openbaar vervoer en regionaal bestuur (in Dutch "Public transport and regional government"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1992 B]
Openbaar vervoer in beweging (in Dutch "Public transport on the move"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);

Commissie Openbaar Vervoer Brokx [1993 A]
Ontvlechting en verzakelijking (in Dutch "Less tangled and more professional"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1994]
Achtergrondstudie marktwerking in het openbaar vervoer (in Dutch "The functioning of the market"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1991]
Openbaar vervoer in het Verre Oosten (in Dutch "Public transport in the Far East"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1992 C]
Tariefvrijheid en tariefdifferentiatie; mogelijkheden op korte termijn (in Dutch "Possibilities for freedom and differentiation of pricing"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1993 B]
Personenvervoer op maat (in Dutch "Tailormade passenger transport"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Commissie Openbaar Vervoer Brokx [1995]
Marktwerking in het openbaar vervoer (in Dutch "A better market in public transport"), Commissie Brokx Openbaar Vervoer, Utrecht, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Daniels, P.W., and A.M. Warnes [1980]
Movement in cities; spatial perspectives on urban transport and travel, Methuen, London, UK;
Danske Statsbanen (DSB) [1992]
Koreplan (in Danish "Time table") , DSB, Kobenhavn, DK;
De Rus Mendoza, G. [1993]
Optimal policies in the provision of public transport in Europe, in: P. Nijkamp (Eds.), *Europe on the move; recent developments in European communications and transport activity research*, Avebury, Aldershot, UK, pp. 231-251;
Denzin, N.K, and Y.S. Lincoln (eds.) [1994]
Handbook of qualitative research, Sage Publications, Newbury Park, US;

Dijst, M. [1995]
Actieruimte als integrale maat voor bereik en mobiliteit, in: H.J. Meurs, and E.J. Verroen (Eds.), *Colloquium verkeersplanologisch speurwerk III* (in Dutch "Actionspace as integral measure for access and mobility"), C.V.S., Delft, NL, pp. 553-573;
Dimaggio, P.J., and W.W. Powell [1983]
The iron cage revisited; institutional isomorphism and collective rationality in organisational fields, in: *American Sociological Review*, 48, US, pp. 147-160;
Duke, R.D. [1974]
Gaming; the future's language, Sage Publications, Newbury Park, US;
Dunn Jr., J.A. [1998]
Driving forces, Brookings Institution, Washington D.C., US;
Edwards, J.D. (ed.) [1992]
Transport planning handbook, Prentice Hall, Englewood Cliffs, US;
Egeter, B., et al.[1989]
Stelselmatig beter, structuurschets regionaal openbaar vervoer voor Zuid-Holland (in Dutch "Regional public transport for Zuid-Holland"), Technische Universiteit Delft / Civil Engineering, Delft, NL;
Egmond, R.J. van[1999]
Railway capacity assessment; an algebraic approach, TRAIL, Delft, NL;
Ellerman, D. [1990]
Modeling policy outcomes; decision making at local transit agencies, VSP, Utrecht, NL;
Etzioni, A. [1988]
The moral dimension: toward a new economics, Free Press, New York, US;
European Commission (EC) [1969]
Regulation 1191/69, European Commission, Bruxelles, B;
European Commission (EC) [1991]
Regulation 1893/91, European Commission, Bruxelles, B;
European Commission (EC) [1992]
Directive 92-50-EEC, European Commission, Bruxelles, B;
European Commission (EC) [2000]
Com 2000/7, European Commission, Bruxelles, B;
European Conference of Ministers of Transport (ECMT) [1990]
Round table 82; promoting regional transport, ECMT, Paris, FR;
European Conference of Ministers of Transport (ECMT) [1993]
Round table 75; research relevant to trends in transport over the coming decade, ECMT, Paris, FR;

Faber, J.A. (ed.) [1989]
Het spoor; 150 jaar spoorwegen in Nederland (in Dutch "Tracks: 150 years of railways in the Netherlands"), Meulenhoff Informatief, Amsterdam, NL;
Fielding, G.J., and T. G. Lee [1990]
Financial forecasting and annual budgeting, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 131-142;
Flink, J.J. [1988]
The automobile age, MIT Press, Cambridge, US;
Forschungsverbund Lebensraum Stadt (ed.) [1994 A]
Faktoren des Verkehrsverhandelns; Berichte aus den Teilprojecten (in German "Aspects of mobility") , Ernst & Sohn, Berlin, D;
Forschungsverbund Lebensraum Stadt (ed.) [1994 B]
Mobilität und Kommunikation in den Agglomerationen von heute und morgen; ein Überblick (in German "Mobility and communication in the metropoles of today and tomorrow") , Ernst & Sohn, Berlin, D;
Frieling (ed.) [1999]
Personenvervoer in de Deltametropool (in Dutch "Passenger transport in the Deltametropole"), Deltametropool, Delft, NL;
Frieling, D.H. [1999]
Deltanet, in: Frieling (Eds.), *Personenvervoer in de Deltametropool* (in Dutch), Deltametropool, Delft, NL;
Geelhoed, L.A. [1986]
Deregulering in de vervoersector, in: *Tijdschrift Vervoerwetenschap* (in Dutch "Deregulation in transport"), 4, Rotterdam, NL, pp. 345-361;
George, K.D., et al.[1992]
Industrial organisation; competition growth and structural change, Routledge, London, UK;
Gerondeau, C. [1997]
Transport in Europe, Artech House, Norwood, US;
Giddens, A. [1993]
Sociology, Blackwell, Oxford, UK;
Giger, M. [1991]
Die Regionalisierung des öffentlichen Verkehrs (in German "The regionalisation of public transport") , Haupt, Bern, CH;
Girnau, G. (ed.) [1976]
Anforderungen der Fahrgäste an der öffentlichen Nahverkehr (in German "Preferences of travellers in public transport") , Alba Verlag, Düsseldorf, D;

Girnau, G., and F. Blennemann [1970]
Verknüpfung von Nahverkehrssystemen (in German "Integration in public transport") , Alba Verlag, Düsseldorf, D;
Globerson, S. [1985]
Performance criteria and incentive systems, Elsevier, Amsterdam, NL;
Goedman, J., and F. Timmerman [1990]
Openbaar vervoer en verstedelijkingspatronen, in: *Tijdschrift Vervoerwetenschap* (in Dutch "Public transport and urban structure"), Rotterdam, NL, pp. 54-67;
Goodal, B. [1987]
Dictionary of human geography, Penguin, Harmondswoth, UK;
Goodin, R.E. [1996]
The theory of institutional design, Cambridge University Press, Cambridge, US;
Gray, G.E., and L.A. Hoel (eds.) [1992]
Public transportation, Prentice Hall, Englewood Cliffs, US;
Grégoire, B., and R. Maubois [1994]
Organisation et financement de transport urbain; Europe, terre de contrastes, in: *Transport public* (in French "Organising and financing urban public transport: European contrasts") , 1, Paris, FR, pp. 40-46;
Grégoire, B., and R. Maubois [1994]
Organisation et financement de transport urbain; Europe, terre de contrastes 2, in: *Transport public* (in French) , 2, Paris, FR, pp. 34-39;
Groenendijk, J. [1998]
Overheidsinvloed in het openbaar vervoer; een vergelijkend onderzoek naar deregulering, privatisering en verzelfstandiging in Europa (in Dutch "Government influence in public transport: a European comparison of deregulation and privitisation"), Thesis publishers (diss.), Amsterdam, NL;
Guba, E.G., and Y.S. Lincoln [1994]
Competing paradigms in qualitative research, in: N.K Denzin, and Y.S. Lincoln (Eds.), *Handbook of qualitative research*, Sage Publications, Newbury Park, US, pp. 105-117;
Gubbins, E.J. [1988]
Managing transport operations, Kogan Page Ltd, London, UK;
Guess, G.M. (ed.) [1990]
Public policy and transit system management, Greenwood Press, New York, US;
Guess, G.M. [1990]
Introduction; federal transit assistance, management, deregulation, and local mobility needs, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 1-24;

Gwilliam, K.M., et al.(eds.) [1991]
Factors influencing mode choice, EUR / RTC, Rotterdam, NL;
Gwilliam, K.M., et al.[1985]
Deregulation in the busindustry in Britain, the case against, in: *Transport reviews*, London, UK, pp. 105-132;
Hakim, S., et al.(eds.) [1996]
Privatizing transportation systems, Preager Publishers, Westport, US;
Hakkesteegt, P. [1992]
Ruimtelijke infrastructuur, in: *Planologische Discussiebijdragen* (in Dutch "Spatial infrastructure"), Delft, NL, pp. 1-41;
Hanson, S. (ed.) [1995]
The geography of urban transportation, Guilford Press, New York, US;
Hendriks, F. [1996]
Beleid, cultuur en instituties; het verhaal van twee steden (in Dutch "Policy, culture and institution: a tale of two cities"), DSWO, Leiden, NL;
Hermes [1997]
Busboekje Zuid Limburg (in Dutch "Time table"), Hermes, Weert, NL;
Hey, K., and J. Sheldrake (eds.) [1997]
Urban Transport, Ashgate, Aldershot, UK;
Himanen, V., et al.[1993]
Transport, mobility, spatial accessibility, and environmental sustainability, in: P. Nijkamp (Eds.), *Europe on the move; recent developments in European communications and transport activity research*, Avebury, Aldershot, UK, pp. 269-287;
Holsbrink-Engels, G.A [1997]
Computer-based role-playing for interpersonal skills training, in: *Simulation and Gaming*, 2, New York, US, pp. 164-180;
Hovedstadsområdets Trafikselskab (HT) [1996]
Koreplan Busse og tog (in Danish "Time table") , Hovedstadsområdets Trafikselskab, Kopenhagen, DK (Available from Dutch Ministerie van Verkeer en Waterstaat);
Huizinga, L. [1991]
Vervoerregio als trekker van regionaal bestuur, in: *Tijdschrift Nederlandse Gemeenten* (in Dutch "Transport regions the start of regional government"), 37, Den Haag, NL, pp. 10-11;
Hutchinson, B.G. [1974]
Principles of urban transport systems planning, Scripta Book Company, Washington DC, US;
In 't Veld, R.J [1989]
De verguisde staat (in Dutch "The maligned state"), VUGA, 's-Gravenhage, NL;

Jansson, J.O. [1984]
Transport system optimization and pricing, John Wiley, Chichester, UK;
Jenkins, H.C. [1988]
Case study of transit in small and medium sized cities, in: National Research Council / Transportation Research Board (NRC/TRB) (Eds.), *New organizational responses to the changing transit environment*, Transportation Research Board, Washington DC, US, pp. 97-105;
Jones, P. [1993]
Study of policies in overseas cities for traffic and transport; final report, University of Westminster, London, UK;
Jong, M.A. de [1991]
Vervoerregio; is de oplossing een probleem (in Dutch "Transport regions: is the solution a problem"), TNO-INRO, Delft, NL;
Jong, W.M. [1999]
Institutional transplantation; how to adopt good transport infrastructure decision-making ideas from other countries, Eburon, Delft, NL;
Judycki, D.C., and W. Berman [1992]
Transport system management, in: G.E. Gray, and L.A. Hoel (Eds.), *Public transportation*, Prentice Hall, Englewood Cliffs, US, pp. 342-345;
Kaspar, C. [1998]
Management der Verkehrsunternehmungen (in German "Managing transport companies") , Oldenbourg Verlag, München, D;
Kellerman, A. [1981]
Tiime-space approaches and regional study, in: *Tijdschrift voor Economische en Sociale Geografie*, 1, NL;
Kersbergen, B. [1991]
De overstap van bus op trein door de ogen van openbaar-vervoerreizigers (in Dutch "The transfer from bus to train through travellers eyes"), Katholieke Universiteit Nijmegen, Nijmegen, NL;
Kessides, C. [1993]
Institutional options for the provision of infrastructure, Worldbank, Washington DC, US;
Keyfitz, N. [1995]
Interdisciplinary contradictions and the influence on policy, in: *Policy Sciences*, 28, Kluwer Academic Press, Dordrecht, NL, pp. 21-38;
Khisty, C.J., and B. Lall [1998]
Transport engineering, an introduction, Prentice Hall, Upper Saddle River, US;
Kingdon, J.W. [1984]
Agendas. Alternatives and public policies, Little, Brown and Company, Boston, US;

Kiriazidis, T. [1994]
European transport; problems and policies, Avebury, Aldershot, UK;
Kish, S.J. [1990]
Local government financing of public transportation; a case study of Georgia transit systems, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 38-68;
Kitamura, R. [1988]
An evaluation of activity-based travel analysis, in: *Transportation*, Kluwer Academic Press, Dordrecht, NL, pp. 15-34;
Kitamura, R. [1988]
Life-style and travel demand, in: National Research Council / Transportation Research Board (NRC/TRB) (Eds.), *New organizational responses to the changing transit environment*, Transportation Research Board, Washington DC, US, pp. 149-189;
Klein, J.T. [1990]
Interdisciplinairity; history, theory and practice, Wayne State University Press, Detroit, US;
Knibbe, J.E. [1991]
Rationeel op de rails; kansen voor wiskundige optimalisering in het stedelijk openbaar vervoer, in: A. Volgenant, and C.W. Duin (Eds.), *Caleidoscoop van de levende besliskunde; budel bij het afscheid van G. de Leve* (in Dutch "Mathematical optimisation in urban public transport"), Instituut voor Actuariaat en Econometrie, Amsterdam, NL, pp. 213-227;
Knieps, G. [1995]
Regionalisierung, Privatisierung un Deregulierung im Nahverkehr; neue Instutitionen und neue Lösungsansatze (in German "Regionalisation, privitisation and deregulation in public transport") , Albert Ludwig Universität, Freiburg, D;
Köberlein, C. [1997]
Kompendium der Verkehrspolitik (in German "Handbook transport policy") , Oldenbourg Verlag, München, D;
Kraan, M. [1996]
Time to travel, (diss.), Enschede, NL;
Krug, S. [1987]
Ein interaktives Programmsystem zur angebotsplanung fur den liniengebundenen OPNV (in German "Interactive planning software for public transport services") , (diss.), Braunschweig, D;
Lafont, J.J. [1994]
The new economics of ten years after, in: *Econometria*, pp. 507-537;

Lauman, E.O., et al.[1978]
Community structure and interorganizational linkage, in: *Annual Review of Sociology*, 4, pp. 455-484;
Lawson, P., and J. Davies [1996]
Trends and statistics report, Planning Department, Newcastle, UK;
Lee, C. (ed.) [1973]
Models in planning, an introduction to the use of quantitative models in planning, Pergamon Press, Oxford, UK;
Levinson, H.S. [1992]
System and service planning, in: G.E. Gray, and L.A. Hoel (Eds.), *Public transportation*, Prentice Hall, Englewood Cliffs, US, pp. 375-377;
Levinson, H.S. [1992]
Urban mass transit systems, in: J.D. Edwards (Ed.), *Transport planning handbook*, Prentice Hall, Englewood Cliffs, US, pp. 157-169;
Lewis, D., and F. Williams [1999]
Policy and planning as public choice; mass transit in the United States, Ashgate, Aldershot, UK;
Lichfield, N. [1981]
Transportation and land-use planning, in: *Traffic, Transportation and Land-use Planning*, pp. 1-14;
Lindblom, C.E. [1959]
The science of "muddling through", in: *Public Administration Review*, 1, US, pp. 239-249;
Lindblom, C.E. [1971]
Still muddling, not yet through, in: *Public Administration Review*, 6, US, pp. 517-526;
Lindblom, C.E., and E.J. Woodhouse [1993]
The policy-making process, Prentice Hall, London, UK;
Linder, S.H., and G. Peters [1987]
A design perspective on policy implementation; the fallacies of misplaced prescription, in: *Policy Studies Review*, 3, pp. 459-474;
Lösch, A. [1954]
The economics of location, Yale University press, New Haven, US;
Lynch, T.D., and K.A. Campbell [1990]
Mass transit budgeting, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 143-164;
Lynton, E. [1985]
Interdisciplinarity; rationale and criteria of assessment, in: L. Levin, and I. Lind (Eds.), *Interdisciplinarity revisited; reassessing the concept in the light of institutional experience*, OECD / CIRN, Linkoping, S, pp. 137-152;

Maarseveen, M.F.A.M. van[1982]
Onderzoek naar de gewichten van weerstandscomponenten van openbaar-vervoerverplaatsingen (in Dutch "The relative importance of different resitors in public transport trips"), PB IVVS, Delft, NL;
Mackett, R., and E. Babalik [1998]
Increasing the effectiveness of new urban transport systems, in: *Proceedings of WCTR*, B, WCTR, Antwerpen, BE, pp. 1-20;
Mackie, P., et al.[1995]
Bus deregulation; ten years on, in: *Transport reviews*, London, UK, pp. 229-251;
Marchau, V.A.W.J. [2000]
Technology assessment of automated vehicle guidance; prospects for automated driving implementation, Delft University Press, Delft, NL;
Marks, G.V., and B. Lall (eds.) [1985]
Organisation and management of public transport projects, American Society of Civil Engineers, New York, US;
Marle, Th. van [1952]
Het binnenlands vervoer na de bevrijding 1944-1945 (in Dutch "Inland transport after the second world war"), Nederlands Verkeersinstituut, Den Haag, NL;
McKinsey [1997]
Boosting Dutch economic performance, McKinsey global institute, Amsterdam, NL;
McLoughlin, J.B. [1969]
Urban and regional planning, a systems approach, Faber, London, UK;
Meersman, H., et al.(eds.) [1999]
World transport research; transport policy, Pergamon Press, Amsterdam, NL;
Meijkamp, R. [2000]
Changing consumer behaviour through ecoefficient services; an empirical study on car-sharing in the Netherlands, DfS, Delft, NL;
Meurs, H.J., and E.J. Verroen (eds.) [1995]
Colloquium verkeersplanologisch speurwerk III (in Dutch "Colloquium on transport and land-use"), C.V.S., Delft, NL;
Meyer, M.D., and E.J. Miller [1984]
Urban transportation planning; a decision oriented approach, McGraw-Hill, New York, US;
Meyerson, M., and E. C. Banfield [1988]
Politics, planning and the public interest, Free Press, Glencoe, US;
Mills, E. [1980]
Urban economics, Scott Foresman and Company, Glenview, US;

Mills, E.S., and B.W. Hamilton [1994]
Urban economics, HarperCollins, New York, US;
Ministerie van V en W [1966 -2002]
Vaststelling van de begroting van de uitgaven en de ontvangsten van het ministerie van Verkeer en Waterstaat (XII) voor het jaar 1966-2000 (in Dutch "Budget for the ministry of Transport, Water Management and Public Works"), SDU, Den Haag, NL;
Ministerie van V en W [1981]
Verkenningen; alternatieven organisatie openbaar vervoer (in Dutch "Alternative forms of organising public transport"), Ministerie van Verkeer en Waterstaat, 's-Gravenhage, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Ministerie van V en W [1982]
Op weg naar nieuwe bestuurlijke verhoudingen in stads- en streekvervoer (in Dutch "Towards new relations in regional transport"), Ministerie van Verkeer en Waterstaat, 's-Gravenhage, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Ministerie van V en W [1996]
Marktwerking in het regionaal openbaar vervoer; implementatienota (in Dutch "A better market in regional pubic transport"), Ministerie van Verkeer en Waterstaat, Den Haag, NL (Available from Dutch Ministerie van Verkeer en Waterstaat);
Ministerie van V en W, and Ministerie van VROM [1990]
Tweede structuurschema verkeer en vervoer; regeringsbeslissing (in Dutch "Whitepaper on transport"), SDU, Den Haag, NL;
Ministerie van V en W, et al.[1999]
Perspectievennota verkeer en vervoer (in Dutch "Whitepaper on transport"), Ministerie van Verkeer en Waterstaat, Den Haag, NL;
Ministerie van VROM [1991]
Vierde nota ruimtelijke ordening (in Dutch "Whitepaper on town and country planning"), Ministerie van VROM, 's-Gravenhage, NL (Available from Dutch Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer);
Ministerie van VROM [1993]
Vierde nota ruimtelijke ordening extra (in Dutch "Whitepaper on town and country planning"), Ministerie van VROM, 's-Gravenhage, NL (Available from Dutch Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer);
Ministerie van VROM [2001]
Vijfde nota ruimtelijke ordening (in Dutch "Whitepaper on town and country planning"), Ministerie van VROM, Den Haag, NL (Available from Dutch Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer);

Ministry of Transport [1963]
Traffic in towns, Ministry of Transport, London, UK (Available from English Department of Transport, Local Government and the Regions);
Minx, E., et al. [1994]
Zu Ansatz und Methode im interdisziplinairen Forschungsverbund Lebensraum Stadt, in: Forschungsverbund Lebensraum Stadt (Eds.), *Faktoren des Verkehrsverhandelns; Berichte aus den Teilprojecten* (in German "A methode for the interdisciplinary research forum on the urban space") , Ernst & Sohn, Berlin, D, pp. 19-41;
Molin, E. [1999]
Conjoint modeling approaches for residential group preferences, Technische Universiteit Eindhoven (diss.), Eindhoven, NL;
Mumford, L. [1964]
The highway and the city, Secker and Warburg, London, UK;
Mumford, L. [1980]
Mythos der Machine; Kultur, Technik und Macht (in German "Myth of the machine: culture, technology and power") , Fisher, Frankfurt, D;
Myers, B. [1992]
Designing in car-oriented cities; an argument for episodic urban congestion, in: B.D. Taylor (Eds.), *When finance leads planning; the influence of public finance on transportation planning and policy in California*, UMI Dissertation services, Berkeley, US, pp. 254-273;
Nakagawa, D., and R. Matsunaka [1997]
Funding transport systems; a comparison among developed coutries, Pergamon Press, Amsterdam, NL;
Nash, C.A. [1982]
Economics of public transportation, Longman, New York, US;
National Academy of Sciences (ed.) [1982]
Future directions of urban public transportation, National Academy of Sciences, Washington DC, US;
Nes, R. van [2000]
Optimal stop and line spacing for urban transport networks; analysis of objectives an implications for planning practice, TRAIL, Delft, Nl;
Nes, R. van[1999]
Design of multimodal transport systems; setting the scene: review of literature and basic concepts, TRAIL, Delft, NL;
Newman, P., and J. Kenworthy [1999]
Sustainability and cities; overcoming automibile dependence, Island Press, Washington DC, US;

Nijkamp, P. (eds.) [1993]
Europe on the move; recent developments in European communications and transport activity research, Avebury, Aldershot, UK;
Nijkamp, P. [1993]
Challenges to European transport policy analysis, in: P. Nijkamp (Eds.), *Europe on the move; recent developments in European communications and transport activity research*, Avebury, Aldershot, UK, pp. 1-16;
Nijkamp, P. [1994]
Global environmental change; management under long-range uncertainty, in: *Contingencies and Crisis Management*, pp. 1-9;
Nijkamp, P., et al.[1994]
Hoogwaardig openbaar vervoer in Europese metropolen; gedwongen alternatief of strategische optie, in: *Tijdschrift Vervoerwetenschap* (in Dutch "Quality public transport for the European metropoles"), 1, Rotterdam, NL, pp. 27-43;
NRC/TRB (eds.) [1988 A]
A look ahead; year 2020, National Research Council, Washington DC, US;
NRC/TRB (eds.) [1988 B]
New organizational responses to the changing transit environment, Transportation Research Board, Washington DC, US;
Nyqvist, C.J. [2001]
Mobiliteit in het geding; een onderzoek naar de doeltreffendheid van openbaar vervoer beleid (in Dutch "Mobility questioned: a study of effectiveness of public transport policy"), (diss.), Utrecht, NL;
Nystrom, P.C., and W.H. Starbuck (eds.) [1981]
Handbook of organizational design; volume 1 Adapting organizations to their environments, Oxford University Press, New York, US;
Obeng, K., et al.[1997]
Modeling economic inefficiency caused by public transit subsidies, Preager Publishers, Westport, US;
OECD [1980]
Urban public transport; evaluation of performance, OECD, Paris, FR;
OECD [1985]
Co-ordinated urban transport pricing, OECD, Paris, FR;
OECD [1990]
Healthcare systems in transition, OECD, Paris, FR;
OECD [1992]
Market and government failures in environmental management; the case of transport, OECD, Paris, FR;

OECD [1993]
Managing with market-type mechanisms, OECD, Paris, FR;
OECD [1995]
Urban travel and sustainable development, OECD, Paris, FR;
Olson, C., and S. Brown [1990]
Paying for public transportation; the problem of operation deficits at MARTA, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 113-130;
Ommeren, J. van [1996]
Commuting and relocation of jobs and residences, Thesis publishers (diss.), Amsterdam, NL;
Ommeren, J. van [2000]
Commuting and relocation of jobs and residences, Aldershot, Ashgate, UK;
Ooms, A. [1987]
Potentiele treinreizigers; reisgedrag en perceptie (in Dutch "Potential train travellers: travel behaviour and perception"), NV Nederlandse Spoorwegen, Utrecht, NL;
Ooststroom, H.P.C. van [1999]
Marktwerking en regulering bij de spoorwegen; theorie, empirie en beleid (in Dutch "Regulation in railways: theory, practice, and policy"), (diss.), Rotterdam, NL;
Ooststroom, H.P.C. van, and G. Renes [1993]
De economie van de spoorwegen, in: *Economisch Statistische Berichten* (in Dutch "The economics of the railways"), pp. 886-898;
Ortúzar, J.de D., and L.G. Willumsen [1994]
Modelling transport, Wiley, Chichester, UK;
Ostrom, E. [1991]
Governing the commons: the evolution of institutions for collective action., Cambridge University Press, New York, US;
Ostrom, E., et al.[1994]
Rules, games, and common-pool resources, University of Michigan Press, Ann Arbor, US;
Papacostas, C.S., and P.D. Prevedouros [1993]
Transportation engineering and planning, Prentice Hall, Englewood Cliffs, US;
Parkes, D., and N. Thrift [1980]
Time, spaces and places, Wiley, Chichester, UK;
Pas, E.I. [1995]
The urban transportation planning process, in: S. Hanson (Eds.), *The geography of urban transportation*, Guilford Press, New York, US, pp. 53-77;

Payson, W.H., and S.A. Steckler [1996]
Developing public-private partnerships in infrastructure, in: S. Hakim, et al.(Eds.), *Privatizing transportation systems*, Preager Publishers, Westport, US, pp. 33-53;
Perrow, C. [1986]
Complex organizations; a critical essay, Random House, New York, US;
Plane, D. A. [1995]
Urban transportation; policy alternatives, in: S. Hanson (Eds.), *The geography of urban transportation*, Guilford Press, New York, US, pp. 435-469;
Polak, J., and A. Heertje (eds.) [1993]
European transport economics, Blackwell, Oxford, UK;
Poortvliet, A. van [1998]
Risks, disasters and management;a comparitive study of three passenger transport systems, Eburon, Delft, NL;
Porter, A.L., et al.[1991]
Forecasting and management of technology, John Wiley, New York, US;
Porter, M.E. [1995]
Competitive advantage; creating and sustaining superior performance, Free Press, New York, US;
Priemus, H., and P. Nijkamp (eds.) [1994]
Beheersing van de automobiliteit; feit of fictie (in Dutch "Controlling automobility: fact or fiction"), Delft University Press, Delft, NL;
Priemus, H., and R. Konings [1999]
Stadsgewestelijk openbaar vervoer; sleutel tot stedelijke vitaliteit (in Dutch "Metropolitan public transport: key to urban vitality"), Technische Universiteit Delft / OTB, Delft, NL;
Public Transport Executives Group (PTEG) [1996]
Legislating for better busses, PTEG, Halifax, Uk;
Pucher, J. [1995]
Urban passenger transport in the US and Europe; a comparative anaysis of public policies; part 1, in: *Transport reviews*, 2, London, UK, pp. 99-117;
Pucher, J. [1995]
Urban passenger transport in the US and Europe; a comparative anaysis of public policies; part 2, in: *Transport reviews*, 3, London, UK, pp. 211-227;
Quinn, R.E. [1988]
Beyond rational management; Mastering the paradoxes and competing demands of high performance, Jossey-Bass Publ., San Fransisco, US;

Reijs, Th. A. M., and P.T. Tanja (eds.) [1992]
Colloquium Verkeersplanologisch Speurwerk (in Dutch), C.V.S., Delft, NL;
Reisner, E. [2001]
Work / family spillover; a qualitative of public transportation operators, Boston University (diss.), Boston, US;
Richmond, J.R.D. [1991]
Transport of delight; the mythical conception of rail transit in Los Angeles, MIT Press (diss.), Boston, US;
Rietveld, P. [1994]
Autobezit en autogebruik, in: H. Priemus, and P. Nijkamp (Eds.), *Beheersing van de automobiliteit; feit of fictie* (in Dutch "Car ownership and car use"), Delft University Press, Delft, NL, pp. 23-34;
Robinson, J.B. [1992]
Risks, prediction and other optical illusions; rethinking the use of science in social decision-making, in: *Policy Sciences*, 25, Kluwer Academic Press, Dordrecht, NL, pp. 237-254;
Rose, R. [1993]
Lesson drawing in public policy, Chatham House, Chatham, US;
Salomon, I., et al.(eds.) [1993]
A billion trips a day; tradition and transition in European travel patterns, Kluwer, Dordrecht, NL;
Savas, E.S. [1987]
Privatization; the key to better government, Chatham house publishers, Chatham, US;
Schmalensee, R., and R.D. Willig (eds.) [1992]
Handbook of industrial organization. Vol. 1., North-Holland, Amsterdam, NL;
Schmalensee, R., and R.D. Willig (eds.) [1992]
Handbook of industrial organization. Vol. 2., North-Holland, Amsterdam, NL;
Schön, D.A. [1983]
The reflective practisioner, how professionals think in action, Arena, London, UK;
Schuck-Wersig, P., and G. Wersig [1994 B]
Flexibilisierung des Handelns als Hintergrund der Prognose der Mobilitätsentwicklung, in: Forschungsverbund Lebensraum Stadt (Eds.), *Mobilität und Kommunikation in den Agglomerationen von heute und morgen; ein Überblick* (in German "The prognosis of mobility in a context of growing flexibility in behaviour") , Ernst & Sohn, Berlin, D, pp. 147-148;

SESAME consortium [1999]
Final report for publication, SESAME, Delft, NL;
Shaw, S.J. [1993]
Transport, strategy and policy, Blackwell, Oxford, US;
Sheppard, E. [1995]
Modeling and predicting aggregate flows, in: S. Hanson (Eds.), *The geography of urban transportation*, Guilford Press, New York, US, pp. 100-128;
Shields, C.R. [1989]
Measurement of passengers' attitudes to bus deregulation; a case study in Newcastle city centre, University of Newcastle / Civil Engineering, Newcastle upon Tyne, UK;
Shubik, M. [1975]
The uses and methods of gaming, Elsevier, Amsterdam, NL;
Simpson, B.J. [1994]
Urban public transport today, E & FN Spon, London, UK;
Small, K.A. [1992]
Urban Transport Economics, Harwood, Chur, CH;
Smidt-Relenberg, N. [1986]
On the sociology of car traffic in towns, in: E. De Boer (Eds.), *Transport sociology; social aspects of transport planning*, Pergamon Press, Oxford, UK, pp. 121-132;
Smith, P.N., and C.J. Taylor [1994]
A method for the rationalisation of a suburban railway network, in: *Transportation Research A*, 28 A, Kluwer Academic Press, Dordrecht, NL, pp. 93-107;
Solomon, K.M., et al.[1968]
Passenger psychological dynamics, American society of civil engineers, New York, US;
Stadsbus Maastricht [1997]
Dienstregeling openbaar vervoer Maastricht (in Dutch "Time table"), Stadsbus Maastricht, Maastricht, NL;
Ståhl, I. (ed.) [1983]
Operational gaming, Pergamon Press, Oxford, UK;
Starkie, D.N.M. [1976]
Transportation planning policy and analysis, Pergamon Press, Oxford, UK;
Steg, E.M. [1996]
Gedragsverandering ter vermindering van het autogebruik (in Dutch "Behavioural change to reduce car use"), Thesis publishers (diss.), Groningen, NL;

Steg, E.M., and N. Kalfs [2000]
Altijd weer die auto! (in Dutch "That car again"), SCP, Den Haag, NL;
Steierwald, G., and H.D. Kühne (eds.) [1994]
Stadtverkehrsplanung; Grundlagen, Methoden, Ziele (in German "Urban transport planning: basis, methodes and purposes") , Springer Verlag, Berlin, D;
Stern, E., and T. Tretvik [1993]
Public transport in Europe; requiem or revival?, in: I. Salomon, et al.(Eds.), *A billion trips a day; tradition and transition in European travel patterns*, Kluwer, Dordrecht, NL, pp. 129-148;
Stiglitz, J.E. [1988]
Economics of the public sector, Norton & Company, Ney York, US;
Taylor, B.D. [1992]
When finance leads planning; the influence of public finance on transportation planning and policy in California, UMI Dissertation services (diss), Berkeley, US;
Taylor, J.L. [1971]
Instructional planning systems; a gaming-simulation approach to urban problems, University Press, Cambridge, UK;
Taylor, P.C. [1985]
Organization for construction of a rail transit project, in: G.V. Marks, and B. Lall (Eds.), *Organisation and management of public transport projects*, American Society of Civil Engineers, New York, US, pp. 183-209;
Teisman, G.R. [1997]
Sturen via creatieve concurrentie; een innovatie-planologisch perspectief op ruimtelijke investeringsprojecten (in Dutch "Creative competition"), Katholieke Universiteit Nijmegen, Nijmegen, NL;
Thompson, G. [1961]
The inspiration of science, Oxford University Press, London, UK;
Thomson, J.M. [1977]
Great cities and their traffic, Golancz, London, UK;
Train, K.E. [1992]
Optimal regulation; the economic theory of natural monopoly, MIT Press, Cambridge, US;
Tuite, M., et al.(eds.) [1972]
Interorganisational decision making, Aldine Publishing Company, Chicago, US;
Tyne and Wear Passenger Transport Executive (PTE) [1996 A]
Local public transport guide ST, Tyne and Wear Passenger Transport Executive, Newcastle, UK;

Tyne and Wear Passenger Transport Executive (PTE) [1996 B]
Local public transport guide N, Tyne and Wear Passenger Transport Executive, Newcastle, UK;
Tyne and Wear Passenger Transport Executive (PTE) [1996 C]
Local public transport guide G, Tyne and Wear Passenger Transport Executive, Newcastle, UK;
Tyne and Wear Passenger Transport Executive (PTE) [1996 D]
Local public transport guide S, Tyne and Wear Passenger Transport Executive, Newcastle, UK;
Tyson, W. [1997]
Metropolitan transport policy in the 20th and 21th centuries, in: K. Hey, and J. Sheldrake (Eds.), *Urban Transport*, Ashgate, Aldershot, UK, pp. 104-117;
VanMatre-McLaughlin, P., and N.H.M. Wilson [1988]
Strategies for coping; the range of options, in: National Research Council / Transportation Research Board (NRC/TRB) (Eds.), *New organizational responses to the changing transit environment*, Transportation Research Board, Washington DC, US, pp. 56-66;
Veeneman, W.W. [1993]
Congestie en vervoersintegratie; mogelijkheden in het openbaar vervoer, in: *Planologische Discussiebijdragen* (in Dutch "Congestion and service integration; opportunities for public transport"), Delft, NL, pp. 483-492;
Veeneman, W.W. [1996]
Ruimtelijke planning en openbaar vervoer; een verschuivende relatie, in: *Planologische Discussiebijdragen* (in Dutch "Planning and public transport; a changing relation"), Delft, NL, pp. 433-442;
Veeneman, W.W. [1998]
A process approach to public transport design, in: *Proceedings of WCTR*, F, WCTR, Antwerpen, BE, pp. 1-13;
Veeneman, W.W., and J. Baggen [1997]
Collectief vervoer als instrument in de ruimtelijke ordening, in: *Planologische Discussiebijdragen* (in Dutch "Public transport as an instrument for spatial planning"), Delft, NL, pp. 439-438;
Veeneman, W.W., and R.E.C.M van der Heijden [1994]
Gewogen wegen; infrastructuurvernieuwing in West-Brabant; motieven, percepties en effecten (in Dutch "Rated roads; infrastructure renewal in West-Brabant"), Technische Universiteit Delft / TBM, Delft, NL;

Velde, D.M. van de [1992]
Naar een betere organisatie van het openbaar vervoer in Nederland; wat kunnen we leren van het buitenland?, in: *Tijdschrift Vervoerwetenschap* (in Dutch "Lessons from abroad for a better organisation of Dutch public transport"), Rotterdam, NL, pp. 296-318;
Velde, D.M. van de, and P.A. van Reeven [1996]
Perspectief op aanbesteding in het openbaar vervoer (in Dutch "Perspective on tendering public transport"), ECTAL, Rotterdam, NL;
Velde, D.M. van de, and W.W. Veeneman [1995]
Beste Burgemeester, waar gaat deze lijn heen?, in: H.J. Meurs, and E.J. Verroen (Eds.), *Colloquium verkeersplanologisch speurwerk III* (in Dutch "Dear mayor; whereto now?"), C.V.S., Delft, NL, pp. 283-302;
Verhoef, E.T. [1996]
The regulation of road transport externalities, Thesis publishers (diss.), Amsterdam, NL;
Volgenant, A., and C.W. Duin (eds.) [1991]
Caleidoscoop van de levende besliskunde; bundel bij het afscheid van G. de Leve (in Dutch "Overview of current operations research"), Instituut voor Actuariaat en Econometrie, Amsterdam, NL;
Von Hayek, A.F. [1967]
Studies in philosophy, politics, and economics, Routledge, London, UK;
Vuchic, V.R. [1981]
Urban public transportation; systems and technology, Prentice Hall, Englewood Cliffs, US;
Waard, J. van der [1989]
Onderzoek weging tijdelementen, deelrapport 4 (in Dutch "Study time perception in transport"), Technische Universiteit Delft / Civil Engineering, Delft, NL;
Waard, J. van der[1989]
Onderzoek weging tijdelementen, deelrapport 5 (in Dutch "Study time perception in transport"), Technische Universiteit Delft / Civil Engineering, Delft, NL;
Wachs, M., and M. Crawford (eds.) [1991]
The car and the city; the automobile, the built environment, and daily urban life, University of Michigan Press, Ann Arbor, US;
Walther, E.S. [1990]
Transit financing; the case of California, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 69-88;
Wardman, M. and W.G. Waters II [2001]
Advances in valuation of travel time savings, in: *Transportation Research E*, 37 A, Kluwer Academic Press, Dordrecht, NL, pp. 85-90;

Webber, M.M. [1991]
The joys of automobility, in: M. Wachs, and M. Crawford (Eds.), *The car and the city; the automobile, the built environment, and daily urban life*, University of Michigan Press, Ann Arbor, US, pp. 274-284;
Webster, F.V., et al.[1980]
The demand for public transport, Transport and Road Research Laboratory, Crowthorne, US;
Webster, F.V., et al.[1988]
Urban land-use and transport interaction; policies and models, Gower, Aldershot, UK;
Wee, G.P. van [1994]
Ontwikkelingen autogebruik in milieuperspectief, in: H. Priemus, and P. Nijkamp (Eds.), *Beheersing van de automobiliteit; feit of fictie* (in Dutch "Developments of car use from a environmental perspective"), Delft University Press, Delft, NL, pp. 5-23;
Weigle, T.G. [1988]
Causes of change; internal and external pressure, in: National Research Council / Transportation Research Board (NRC/TRB) (Eds.), *New organizational responses to the changing transit environment*, Transportation Research Board, Washington DC, US, pp. 37-55;
Weimer, D.L. (ed.) [1995]
Institutional design, Kluwer, Boston, US;
Weimer, D.L. [1992]
Claiming races, broiler contracts, heresthetics, and habits; ten concepts for policy design, in: *Policy Sciences*, 25, Kluwer Academic Press, Dordrecht, NL, pp. 135-159;
Weimer, D.L. [1993]
The current state of design craft; borrowing, tinkering, and problem solving, in: *Public Administration Review*, 2, US, pp. 110-120;
Weimer, D.L. [1995]
Institutional design; an overview, in: D.L. Weimer (Eds.), *Institutional design*, Kluwer, Boston, US, pp. 1-16;
Weimer, D.L., and A.R. Vining [1989]
Policy analysis; concepts and practice, Prentice Hall, Englewood Cliffs, US;
Weiß, H.J. [1999]
ÖPNV-Kooperationen im Wettbewerb; ein disaggregierter Ansatz zur Lösung des Koordinationsproblems im öffentlichen Personennahverkehr (in German "Public transport in competition; a disaggregate method for co-ordination in public transport") , Nomos Verlagsgesellschaft, Baden-Baden, D;

Wenzler, I. [1993]
Policy exercises; a new apporach to policy development, Instituut voor Toegepaste Sociale Wetenschappen, Nijmegen, NL;
Werner, J. [1998]
Nach der Regionalisierung; der Nahverkehr im Wettbewerb (in German "Public transport in competition") , Dortmunder Vertrieb für Bau- und Planungsliteratur, Dortmund, D;
White, P. [1995]
Public transport, its planning, management and operation, UCL Press, London, UK;
Whitehead, A. [1984]
Planning the unplanned environment; the Transport Act 1985 and municipal bus operators, in: J.O. Jansson (Eds.), *Transport system optimization and pricing*, John Wiley, Chichester, UK, pp. 77-95;
Whitelegg, J. [1993]
Transport for a sustainable future; the case for Europe, John Wiley, Chichester, UK;
Wildavski, A. [1996]
The new politics of the budgetary process, Addison-Wesley Publishers, Reading, US;
Wildavski, A., and N. Caiden [2000]
The new politics of the budgetary process, Addison Wesley Publishers, Reading, US;
Winston, C., and C. Shirley [1998]
Alternate route; toward efficient urban transportation, Brookings institution, Washington DC, US;
Witbreuk, M. [1997]
Het regionale verkeersnetwerk als common pool resource (in Dutch "the regional transport network as common pool resource"), Van Marle, Hengelo, NL;
Witbreuk, M., and L. Guilhéry [1999]
Fiscal federalism and regionalisation of transport policy in Europe, in: H. Meersman, et al.(Eds.), *World transport research; transport policy*, Pergamon Press, Amsterdam, NL, pp. 445-459;
Witsen, M. van, et al.[1989]
Openbaar vervoervoorzieningen (in Dutch "Public transport services"), Technische Universiteit Delft / Civil Engineering, Delft, NL;
Wulkan, A.C. [1990]
Elected versus appointed boards and transit management effectiveness, in: G.M. Guess (Eds.), *Public policy and transit system management*, Greenwood Press, New York, US, pp. 25-38;

Yin, R.K. [1994]
Case study research; design and methods, Sage publications, Newbury Park, US;
Yu, J. [1982]
Transportation engineering, Elsevier, Amsterdam, NL;
Zurcher Verkehrsverbund (ZVV) [1995]
Fahrplan 95 -96 (in German) , Zurcher Verkehrsverbund, Zurich, CH;

Web pages visited

APTA, [28-1-2002]
http://www.apta.com/info/define/general.htm
CBS, [7-1-2002]
http://www.cbs.nl/nl/statline/index.htm
DETR, [14-4-2000]
http://www.local-transport.detr.gov.uk/response/tbs/index.htm
Diaz, R., [10-1-2000]
http://www.designacademy.nl/publictransport/index.html
Eurostat, [14-5-2001]
http://europa.eu.int/comm/eurostat/
Hasselt, [26-4-2000]
http://www.hasselt.be/
Isotope, [14-5-2001]
http://www.cordis.lu/transport/src/isotope.htm
Litra Verkehrszalen, [28-3-2000]
http://www.litra.ch/Ausw_D/Vadem/fr_vademd.htm
OANDA, [20-4-2000]
http://oanda.com/converter/classic
TRB [12-12-2001]
http://www4.trb.org/trb/crp.nsf/All+Projects/TCRP+F-01
UNSD , [28-1-2002]
http://www.un.org/depts/unsd/class/class1.htm

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Supplement A Glossary

This glossary provide an overview of how terms are used in this study.

Science	
Discipline	Established scientific fields with a common theoretical background and empirical focus. Examples are geography, economics, transport engineering, policy science and urban planning.
Rationale	Cognitive constructions of parts of the reality of public transport. They find their basis in wider disciplines in terms of their theoretical focus, but their empirical focus is limited to public transport.

Transport	**The moving from one place to the other using**
Mode	Private or public transport
Service	Offering of transport

Public transport	**Public transport are those transport services for passengers, open to everyone**
Technique	Combination of vehicle type and infrastructure type
Infrastructure	Set of fixed objects that support and guide transport processes for public transport
Vehicle	Propelled container designed and used to offer public transport services
Service	Offering of public transport on a specified route or in a specified region using a specific technique
Network	Set of interconnected public transport services
Facility	Edifice to support public transport service operation, like garage, station, stops
Actors	Group of individuals bound by a common task in a public transport system
Traveller	The actor using the public transport service, being transported
Authority	The actor commissioning the scheduled public transport service
Operator	The actor offering the scheduled public transport service
System	Combination of all activities of all actors directly and purposely involved in the offering of public transport services within a region
Organisation	Type of structuring of public transport tasks among actors in an organisational field
Field	The actors purposely connected to provide public transport services
Template	Type of organisation of public transport structured primairily on one or two rationales

Tuning	Consciously and iteratively restructuring the organisation on a small scale
Arrangement	Part of the organisational structuring the interactions between different actors, like
Task	Activities supporting the purpose of the organisation as a whole: suitable public transport services related to infrastructure, facilities, vehicles, or services
Provision	Making infrastructure, facilities, vehicles, or services available to others to provide public transport services
Management	Allocating resources on infrastructure, facilities, vehicles, or services to specific users
Exploitation	Using infrastructure, facilities, vehicles, or services to provide public transport services
Commissioning	Having infrastructure, facilities, vehicles, or services constructed to provide public transport services
Subsidising	Financing the public transport serviceswithout using the services
Developing	The design and locating of new infrastructure, facilities, vehicles, or services
Scheduling	The planning of timetables for the availability of infrastructure, facilities, vehicles, or services
Planning	The allocation of resources to provide infrastructure, facilities, vehicles, or services
Selling	Receiving financial remuneration for use of infrastructure, facilities, vehicles, or services
Paying	Offering financial remuneration for use of infrastructure, facilities, vehicles, or services
Informing	Providing information to the (potential) user on possibilities of infrastructure, facilities, vehicles, or services
Using	The public transport services

Supplement B Abbreviations

ABS	Antilock Brake System
APTA	American Public Transportation Association
AVV	Adviesdienst Verkeer en Vervoer (Dutch Transport Research Centre for the Ministry of Transport, Watermanagement and Public Works)
CE	Centrum voor Energiebesparing en Schone Technologie
EC	European Commission,
DETR	Department of Transport and the Regions (UK),
DSB	Danske Statsbanen (national railways in Danmark),
GO	Interactions between a governmental agency and public transport operators,
HT	Hovedstadsområdets Trafikselskab (regional transport authority of the Copenhagen region),
KTU	Konzessionierten Transportunternehmen (concession holding operators),
MMC	Monopolies and Mergers Commission (regulator in the United Kingdom),
MTU	Marktverantwortliche Transportunternehmen (return-responsible operators),
NRC	National Research Council
NS	Nederlandse Spoorwegen (national railways in Nederland),
OECD	Organisation for Economic Co-Operation and Development
OFT	Office of Fair Trading (regulator in United Kingdom),
OO	Interactions amongst public transport operators,
OT	Interactions between a public transport operator and the traveller,
PSV	Public Service Vehicle,
PTA	Passenger Transport Authority,
PTE	Passenger Transport Executive,
PTE	Public Transport Executive
SBB	Schweizerische Bundesbahnen (national railway Switzerland),
SBM	Stadsbus Maastricht (local bus operator in Maastricht),
TRB	Tranportation research Board
UNSD	United Nations Statistics Division.
VBZ	Verkehrsbetrieben Zürich (local bus operator in Zürich),

VenW	Ministerie van Verkeer en Waterstaat (Dutch Ministry of Transport, Watermanagement and Public Works)
VROM	Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer (Dutch Ministry of Housing, Spatial Planning and Environment)
WROOV	Wettelijke regeling opbrengstenverdeling openbaar vervoer (Dutch system of subsidisation and fare-box revenue redistribution in public transport),
WV	Winterthurer Verkehrsbetriebe (local bus operator in Winterthur),
ZVV	Zürcher Verkehrverbund (regional transport authority)

Supplement C Case protocol

GO-level INTERACTIONS
1. National
1.1 Goals
1.1.1 What goals are set for public transport on a national level?
1.2 Responsibilities
1.2.1 What are in general the responsibilities that lie at national level?
1.3 Regulation
1.3.1 How is public transport regulated?
1.3.1.1 Short overview
1.3.1.2 History
1.3.1.3 Future
1.3.2 What is the regulation on:
1.3.2.1 Entry
1.3.2.2 Price
1.3.2.3 Infrastructure
1.3.2.4 Personnel
1.3.2.5 Vehicles
1.3.2.6 Network
1.3.2.7 Schedules
1.3.2.8 Subsidies
1.3.3 Where to find the exact regulatory rules?
1.4 Direct interactions
1.4.1 How was regulation developed?
1.4.1.1 Process (short)
1.4.2 Which actors were involved?
1.4.2.1 What was the role of European guidelines?
1.4.2.2 What was the role of regional governments?
1.4.2.3 What was the role of local governments?
1.4.2.4 What was the role of companies in the development?
1.4.2.5 What was the role of travellers?
1.4.3 What processes lie behind this regulation?
1.5 Other policies directly aimed at public transport?
1.6 On a national OT-levelher indirect policies to influence ridership ?
1.6.1 On infrastructure
1.6.1.1 Public transport
1.6.1.2 Roads
1.6.1.3 Other
1.6.2 On tax measures
1.6.3 On spatial planning
1.6.4 Other
1.7 Is the case studied typical for the country?
2. Metropolitan
2.1 Goals
2.1.1 What goals are set for public transport on a metropolitan level?
2.2 Responsibilities
2.2.1 What are in general the responsibilities at metropolitan level?
2.3 Metropolitan policies on public transport?
2.3.1 What are specific metropolitan policies on public transport
2.3.1.1 Short overview,
2.3.1.2 History
2.3.1.3 Future
2.3.2 Policies on:
2.3.2.1 Subsidies
2.3.2.2 Infrastructure
2.3.2.3 Price
2.3.2.4 Personnel
2.3.2.5 Vehicles
2.3.2.6 Network
2.3.2.7 Year to year improvements
2.3.2.8 Strategic developments
2.3.2.9 Schedules
2.3.3 Where to find the exact policies, in what reports?
2.4 What other policies to influence ridership?
2.4.1 On infrastructure
2.4.1.1 Public transport
2.4.1.2 Parking
2.4.1.3 Roads
2.4.1.4 Other
2.4.2 On tax measures
2.4.3 On spatial planning
2.4.4 Other
2.5 Direct interactions with other actors?
2.5.1 How are policies developed?
2.5.1.1 Process
2.5.2 Which actors were involved?
2.5.2.1 What was the role of companies in the development?
2.5.2.2 What was the role of travellers?
2.5.3 Why does it look the way it looks?
2.6 How are the deals structured and monitored?
2.7 Survey of the quality of the product?
3. Local
3.1 Goals
3.1.1 What goals are set for public transport on a local level?
3.2 Responsibilities
3.2.1 What are in general the responsibilities that lie at local level?
3.3 See regional
OO-level INTERACTIONS
4. Goals
4.1 What are the stated goals of the co-operative platform?
4.2 How are these related to governmental goals for public transport?
4.3 How are these related to goals of individual companies?
5. Responsibility
5.1 What responsibilities are given to the co-operation?
5.2 Is it clear what the task of the different actors involved is
5.3 What tasks do the different actors have
6. Influence on regulation
6.1 How is the relation with the governmental bodies?
6.2 Is the influence stronger from the co-operation platform or form individual companies?
7. Interpretation of regulation
7.1 What freedom is left to the companies to co-operate?

7.2 How much of that freedom is taken and for what reason?
8. Co-operation
8.1 How was the co-operation set-up?
8.2 Form of co-operation
8.2.1 One Company
8.2.2 Special metropolitan organisation
8.2.3 Co-operation platform
8.2.4 Regular meetings
8.2.5 Ad hoc meetings
8.3 How is power organised within the set-up?
8.4 How is the co-operation controlled?
8.4.1 companies
8.4.2 governments
9. Role of different players
9.1 Role government in co-operation?
Which governmental partners are involved as:
9.1.1 Initiator
9.1.2 Financier
9.1.3 Stimulator
9.1.4 Forcer
9.2 Role of the different companies
Which companies are involved:
9.2.1 In the process
9.2.1.1 Following the process
9.2.1.2 Directing the process
9.2.1.3 Initiating the process
9.2.2 Special attention of the different actors on:
9.2.2.1 Organisation
9.2.2.2 Network improvements
9.2.2.3 Cost reduction
9.2.2.4 Ridership improvement
9.2.3 Freedom of companies after deals in co-operation
9.2.3.1 High degree
9.2.3.2 Low degree
9.2.4 Type of co-operation
9.2.4.1 Bargaining
9.2.4.2 Hierarchical
9.2.4.3 Functional
9.2.5 Typology of network of actors and possibilities for steering
9.2.5.1 Pluriformity
9.2.5.2 Closedness
9.2.5.3 Interdependence
9.3 Graph of the network of all actors.
9.3.1 What actor do you have the most contact with?
9.3.1.1 Formal
9.3.1.2 Informal
9.3.2 What actors do you feel the most closely linked to?
10. Cost of the co-operation
10.1 Could you give an estimation of the cost concerned with the co-operation?
10.1.1 Where do the costs occur?
10.2 Could you give an estimation of the benefits of with the co-operation?
10.2.1 Where do benefits occur?
10.3 What procedures where chosen do reallocate funds?
11. Innovative and learning capabilities
11.1 Do you think there is room enough for innovation of the network in the way the co-operation is organised?
11.2 What are the bottlenecks for you?
12. Survey of the quality of the product?
12.1 What is your own interpretation of the influence of the co-operation on the quality of the product?
12.2 Could you give a crude estimate of the influence of the co-operation on ridership?
13. Would it be possible to talk to a transport planner in your company?
OT-level INTERACTIONS
14. Goals
14.1 What is seen as the goals for this public transport company?
15. Responsibilities
15.1 What are the responsibilities/task within the system of the transport company?
15.2 What are the responsibilities/task of the planner to reach this?
16. What freedom is there to divert from co-operative or regulatory rules?
17. How is the every year design of the network structured?
17.1 Where do changes come from?
17.2 Who initiates changes?
17.3 What process leads to the effectuation of these changes?
17.4 How long do the different steps of the process take?
17.5 What is the role of agreements on meso level?
17.6 What other inputs are there in this process?
18. Special subject on which changes might occur?
18.1 In co-operation with others
18.1.1 Interconnections
18.1.2 Lines
18.1.3 Prices
18.1.4 Fare structure
18.2 Own network of services
18.2.1 Lines
18.2.2 Routes
18.2.3 Stops
18.2.4 Schedule
18.3 Ticketing system
18.3.1 Prices
18.3.2 Fare structure
18.4 Marketing strategy
19. Are there set targets for the company?
19.1 How are targets formulated?
19.1.1 Cost efficiency
19.1.2 Schedules
19.1.3 Modal split
19.1.4 Number of travellers
19.2 How is the feedback from these targets organised?
20. Information used in the process
20.1.1 What information is sought from the customer?
20.1.2 How is it used to change the above mentioned designs?
20.1.3 What other information is used?
20.1.3.1 Market survey
20.1.3.2 Models
20.1.3.3 Scenarios
20.1.3.4 Expert knowledge
20.1.3.5 Planning policies for future developments
20.1.4 Where is the information aquired?
21. What direct influence des the person use from regulatory rules?
22. Rentability
22.1 What is the rentability of the companies?
22.2 How is it measured and controlled?
PRODUCT
23. Price using hamburger standard
23.1 Peak hours (07.00-10.00)
23.1.1 Single trip
23.1.2 Day card within the central city
23.1.3 Travelling into central city 10 kilometres
23.1.4 Travelling into central city 20 kilometres (the three node example)
23.2 Non-peak hours (14.00-17.00)
23.2.1 Single trip
23.2.2 Day card within the central city
23.2.3 Travelling into central city 10 kilometres
23.2.4 Travelling into central city 20 kilometres (the three node example)
24. Speed
24.1 Average speed at peak hours
24.1.1 On a trip from three important nodes at 20 kilometres from the centre to the centre
24.1.2 On a trip of 10 kilometres through the centre

24.2 Average speed at non-peak hours
24.2.1 On a trip from three important nodes at 20 kilometres from the centre to the centre
24.2.2 On a trip of 10 kilometres through the centre
25. Frequencies
25.1 Peak hours (07.00-10.00)
25.1.1 Basic frequencies on lines in and out city at central point
25.2 Non-peak hours (14.00-17.00)
25.2.1 Basic frequencies on lines in and out city at a central point
26. Interconnections
26.1 Peak hours (07.00-10.00)
26.1.1 Percentage of travel time spend waiting on trips from three important nodes at 20 kilometres from the centre
26.2 Non-peak hours (14.00-17.00)
26.2.1 Percentage of travel time spend waiting on trips from three important nodes at 20 kilometres from the centre
27. Value to inhabitants
27.1 Modal split (excluding non-motorised traffic)
27.1.1 Trips
27.1.2 Kilometres
27.2 Modal split (including non-motorised traffic)
27.2.1 Trips
27.2.2 Kilometres
27.3 Evaluation surveys of quality
27.3.1 Governments
27.3.2 Companies
27.4 Newspaper analysis
27.5 Companies own view of their quality
27.6 Governmental view on quality offered

INDIRECT FACTORS

28. Additional policies on mobility
28.1 Parking
28.2 Infrastructure
28.3 Location policies
29. Spatial structure
29.1 Size
29.1.2 Number of inhabitants,
29.1.3 Size of the area,
29.1.4 Distance to secondary nodes
29.2 Borders (lakes, sea, country, mountainous terrain)
29.3 Structure
29.3.1 Lob (as positive to public transport operations)
29.3.2 Nodal (as negative to public transport operations)
30. Culture
30.1 Importance of bike
30.2 Importance of public transport in history
30.3 Growth of car use over history
31. Government
31.1 What governmental levels are involved?
31.2 What are their different tasks?
32. Companies
32.1 How is the division of responsibilities between companies?
32.2 Are their stronger and weaker companies?
32.3 Is there a power relation, how does it work?

Supplement D Case selection

Step	Criterion	Source	Cases
1	Western European public transport systems in metropolitan areas	Bushell [1994]	75
	Selected metropolitan areas are situated in Western Europe		
2	Comparable to Dutch metropolitan areas in size	Bushell [1994]	42
	Selected metropolitan areas have between 100.000 en 1.000.000 inhabitants		
3	Systems relatively outperforming others - Modal split - Cost recovery	Bushell [1994] Survey 1997	20
	Selected metropolitan areas have relatively high modal split and low percentage of subsidies		
4	Diversity of organisational forms	Survey 1997	10
	Selected metropolitan areas show a diversity in organisational forms		
5	Possibility to do extensive research	Interviews	3
	Selected metropolitan areas reflect divers organisational forms and offer possibilities to do research		
6	Additional Dutch case	Interviews	4
	Willingness to participate		

Step I

	Country	City
1	België	Antwerpen
2	België/Belgique	Brussel/Bruxelles
3	Belgique	Charleroi
4	België	Gent
5	Belgique	Liège
6	Danmark	Aarhus
7	Danmark	Copenhagen
8	Deutschland	Aachen
9	Deutschland	Augsburg
10	Deutschland	Berlin
11	Deutschland	Bielefeld
12	Deutschland	Düsseldorf
13	Deutschland	Frankfurt am Main
14	Deutschland	Hamburg
15	Deutschland	Hannover
16	Deutschland	Köln
17	Deutschland	Mannheim-Ludwigshafen

18	Deutschland	München
19	Deutschland	Nürnberg
20	Deutschland	Rhein-Ruhr
21	Deutschland	Stuttgart
22	Deutschland	Wuppertal
23	España	Barcelona
24	España	Madrid
25	France	Grenoble
26	France	Lille
27	France	Lyon
28	France	Marseille
29	France	Nancy
30	France	Nantes
31	France	Nice
32	France	Paris
33	France	Rennes
34	France	St. Etienne
35	France	Strasbourg
36	France	Toulouse
37	Hellas	Athens
38	Italia	Milano
39	Italia	Napoli
40	Italia	Roma
41	Italia	Torino
42	Norge	Bergen
43	Norge	Oslo
44	Östenreich	Graz
45	Östenreich	Linz
46	Östenreich	Wien
47	Portugal	Lisboa
48	Schweiz	Basel
49	Schweiz	Bern
50	Suisse	Lausanne
51	Schweiz	Zürich
52	Suomi	Helsinki
53	Sverige	Göteborg
54	Sverige	Malmö
55	Sverige	Stockholm
56	United Kingdom	Birmingham
57	United Kingdom	Aberdeen
58	United Kingdom	Birmingham
59	United Kingdom	Bristol
60	United Kingdom	Cardiff
61	United Kingdom	Dublin
62	United Kingdom	Edinburgh
63	United Kingdom	Glasgow
64	United Kingdom	Hull
65	United Kingdom	Leeds-Bradford
66	United Kingdom	Leicester
67	United Kingdom	Liverpool
68	United Kingdom	London
69	United Kingdom	Manchester
70	United Kingdom	Teesside
71	United Kingdom	Tyne and Wear
72	United Kingdom	Nottingham
73	United Kingdom	Sheffield
74	United Kingdom	Southampton
75	United Kingdom	Stoke-on-Trent

Step 2

	Country	**City**
1	België	Antwerpen
2	Belgique	Charleroi
3	België	Gent
4	Belgique	Liège
5	Danmark	Aarhus
6	Danmark	Copenhagen
7	Deutschland	Aachen
8	Deutschland	Augsburg
9	Deutschland	Bielefeld
10	Deutschland	Bremen
11	Deutschland	Duisburg
12	Deutschland	Karlsruhe
13	Deutschland	Wiesbaden
14	Deutschland	Wuppertal
15	France	Grenoble
16	France	Marseille
17	France	Nancy
18	France	Nantes
19	France	Nice

20	France	Rennes
21	France	St. Etienne
22	France	Strasbourg
23	Norge	Bergen
24	Norge	Oslo
25	Östenreich	Graz
26	Östenreich	Linz
27	Schweiz	Basel
28	Schweiz	Bern
29	Suisse	Lausanne
30	Schweiz	Zürich
31	Suomi	Helsinki
32	Sverige	Göteborg
33	Sverige	Malmö
34	United Kingdom	Birmingham
35	United Kingdom	Aberdeen
36	United Kingdom	Bristol
37	United Kingdom	Edinburgh
38	United Kingdom	Hull
39	United Kingdom	Leicester
40	United Kingdom	Southampton
41	United Kingdom	Stoke-on-rent
42	United Kingdom	Tyne and Wear

Step 3

	Country	City
1	België	Antwerpen
2	België	Gent
3	Danmark	Copenhagen
4	Deutschland	Aachen
5	Deutschland	Augsburg
6	Deutschland	Bielefeld
7	Deutschland	Duisburg
8	France	Nancy
9	France	Nice
10	France	St. Etienne
11	France	Strasbourg
12	Norge	Bergen
13	Östenreich	Graz
14	Schweiz	Zürich
15	Schweiz	Basel
16	Suomi	Helsinki
17	United Kingdom	Southampton
18	United Kingdom	Tyne and Wear
19	United Kingdom	Edinburgh
20	United Kingdom	Bristol

Step 4

	Country	City
1	België	Antwerpen
2	Danmark	Copenhagen
3	Deutschland	Aachen
4	Deutschland	Bielefeld
5	France	Nancy
6	France	St. Etienne
7	Norge	Bergen
8	Schweiz	Zürich
9	United Kingdom	Tyne and Wear
10	United Kingdom	Bristol

Step 5

	Country	City
1	Danmark	Copenhagen
2	Schweiz	Zürich
3	United Kingdom	Tyne and Wear

Step 6

	Country	City
1	Danmark	Copenhagen
2	Schweiz	Zürich
3	United Kingdom	Tyne and Wear
4	Nederland	Southern Limburg

Supplement E Case sources

Kanton Zürich	
Bundesamt fur Verkehr	M. Giger
Eidgenössische Technische Hochschule / Verkehrsplanung	H. Brandli, Prof fur Verkehrsingenieurwesen
Eidgenössische Technische Hochschule / Verkehrsplanung	R. Schilling, Dipl. Geograph
Eidgenössische Technische Hochschule / Verkehrsplanung	U. Wust, Researcher
Kanton Zürich	W. Diener, Stabstelle offentliche Verkehr
Postauto	H. Sprenger, Direktor
Postauto	S. Raugosch, Netzentwicklung
SBB Regional Zürich	R. Mattenberger, Regional Director
SBB Regional Zürich	G. Feuer, S-Bahn plannung
SihltalZürichUetlibergbahn	C. Weibel, Direktorin
Universität Zürich / Socialöconomisch Instutut	R. Maggi, Senior Lecturer
Universität Zürich / Socialöconomisch Instutut	P. Prione, Researcher
Universität Zürich / Socialöconomisch Instutut	M. Fillippini, Professor
Universität Zürich / Socialöconomisch Instutut	K. Muller, Reseracher
VBZ	R. Künzle, Director
VBZ	P. Stirnemann, Netzentwicklung
Verband öffentliche Verkehr	F. Lüdi, Vizedirektor
Winterthurer Verkehrsbetriebe	U. Huber
Zurcher Verkehrsverbund	G. Elser, Regional Direktor

Tyne and Wear Metropolitan Area	
Go Ahead Northern	C. Matthews, General manager
Go Ahead Northern	A. Tyldsley, Commercial manager
Metropolitan Borough Council Gateshead	T. Arkless, Engineer
Metropolitan Borough Council Gateshead	I. Shipley
Monash University / Institute for Transport Studies	G. Rose, Senior lecturer
Newcastle City Council / Planning and Transportation	A. Smith, Head of planning department
Newcastle City Council / Planning and Transportation	G. Robinson
Nexus	B. Scott, Business Development Manager

Nexus	B. Garner, Head of Planning and Development
Nexus	M. Parker
Northumbria Motor Services	D. Monoghan, General manager
OK Motors	W. Emerson, General manager
Open University	M. Enoch, Researcher
Stagecoach Busways	P. Nash, Commercial director
University of Leeds / Institute for Transport Studies	C. Nash, Professor of Transport Economics
University of Newcastle upon Tyne / Transport Operations Research Group	P. Hills, Professor
University of Newcastle upon Tyne / Transport Operations Research Group	J. Nelson, Head of Transport Engineering
University of Newcastle upon Tyne / Transport Operations Research Group	P. Blythe, Senior lecturer
University of Newcastle upon Tyne / Transport Operations Research Group	R. Hibbert, Lecturer
Welcome Passenger Travel Service	H. Stuart, General manager

Kobenhavn Hovedstadsområdets / Northern Sjealand	
Bus Danmark	E. Koop, Director
Bus Danmark	M. Lund Larsen, Chefoconom
Bus Danmark	R. Gisselman, Marketing director
Danmarks Tekniske Universitet / Trafikstudier	N. Jørgensen, Professor
Danmarks Tekniske Universitet / Trafikstudier	T. Rallis, Associate professor
DSB S-tog	E. Seest, Strategic planner
DSB S-tog	N. Welledorf
DSB S-tog	M. Haas
Handelshøjskolen i Copenhagen / Institut for Logistik og Transport	D. Bjørnland, Professor
Hovedstadsområdets Trafikselskab	L. Jensby, Assitent head of section
Hovedstadsområdets Trafikselskab	T. Vexø
Hovedstadsområdets Trafikselskab	B. Nielsen, Contractchef
Hovedstadsområdets Trafikselskab	K. Meulengracht
Hovedstadsområdets Trafikselskab	P. Als, Viceadministrerende direktør
Copenhagens Kommune / Vejafdelingen	J. Knoop
Copenhagens Kommune / Vejafdelingen	S. Ellen
Copenhagens Kommune / Planning	B. Jørgenson
Copenhagens Kommune / Stadsingeniørenoffice	B. Eir
Trafikministeriet	I. Schiøtz, Advisor
Unibus Gruppen	J. Bigom, General manager

Dutch case selection	
Bestuur Regio Utrecht	T. Sleurink
Gemeente Almere	A. Erkens
Gemeente Dordrecht	A. Akkies
Gemeente Haarlem	R. Fabel

Gemeente Leiden	M. Fleer
Gemeente Maastricht	S. Jansen
Gemeente Tilburg	L. Trip
Knooppunt Arnhem Nijmegen	P. Meyboom
Knooppunt Arnhem Nijmegen	B. Harmsen
Provincie Drenthe	M. Vries
Provincie Friesland	R. Duvergé
Provincie Groningen	D. Platvoet
Provincie Groningen	D. Bressers
Provincie Limburg	M. Onnen
Provincie Limburg	H. Hamakers
Provincie Overijssel	M. Koeman
Regio Twente	R. Olde Kalter
Samenwerkingsverband Regio Eindhoven	S. Runsink
Samenwerkingsverband Regio Eindhoven	A. Wolthuis
Stadsgewest Haaglanden	D. ten Grotenhuis

Southern Limburg case	
Gemeente Geleen	R. Dolmans
Gemeente Kerkrade	T. Kleynen, Sector stad
Gemeente Sittard	G. Schrijnemakers, Civiele techniek
Gemeente Sittard	P. van Noppen, Financiën
Gemeente Heerlen	R. Schmeitz, Voorbereiding en toezicht
Gemeente Heerlen	G. Nievelstein, Planning en control
Gemeente Valkenburg	A. Houberigs
Gemeente Maastricht	W. Meijs, Stadsontwikkeling en grondzaken
Gemeente Landgraaf	H. Engelen
Gemeente Brunssum	M. Wierts, Hoofd afdeling O.W.G.
Gemeenten Maastricht, Heerlen en Sittard	P. Janssen, Vervoerscoördinator
Hermes	G.J. van Zoelen, Algemeen directeur
Hermes	G. van Wouw, Markering directeur
Hermes	B. Sijstermans, BU-manager
Provincie Limburg / Unit Mobiliteit	M. Onnen, Unit mobiliteit
Provincie Limburg / Unit Mobiliteit	H. Hamakers, Unit mobiliteit
Rijkswaterstaat Limburg	H. Winten, IVV
SBM Groep	M. Vermaas, Algemeen directeur
SBM Groep	M. Thehu
SBM Groep	L. Wijnants
Vancom	S. Minses, Manager
NV Nederlandse Spoorwegen	G. Essers

Supplement F Case comparison

In 1997	*Canton Zürich*	*Tyne and Wear*	*Copenhagen*	*Zuid-Limburg*
Government organisation				
Metropolitan administration	Y	N	N	N
Influence of municipalities	Y	Y	Y	Y
Public transport authority	Y	Y	Y	N
Services				
Government commissioning	Full	Limited	Full	Limited
Government definition	Full	Limited	Full	Limited
Government execution	Limited	None	None	Limited
Contracts				
Part of the market in trips	100	20	100	100
Allocation	Grandfather rights	Tendering	Tendering	Grandfather rights
Financing	Production costs	Lump sum	Lump sum	Revenue
Efficiency incentives	None	Full	Full	Limited
Effectiveness incentives	None	Full	Limited	Limited
Operator organisation				
Government ownership	Y	Y	Y	Y
Rail	Service	Shareholder	Shareholder	Shareholder
Metropolitan rail	Service	Service	Shareholder	Shareholder
Regional bus	Service and shareholder	None	Shareholder and none	Shareholder
Urban bus	Shareholder	None	Shareholder and none	Service
Number of operators	42	23	17	4
Percentage market 5 largest operators	80	90	50	100
Percentage active nation wide	60	20	80	80
Market entry	Closed	Open	Open	Closed
Performance				
Total subsidy (M€)	270	53	216	32
Subsidy per inh. (€)	225.00	48.18	127.06	48.48
Subsidy per square km. (€)	0.16	0.09	0.08	0.05

Subsidy per veh.km. (€)	N.a.	N.a.	N.a.	11.28
Subsidy per pass.km. (€)	N.a.	N.a.	N.a.	0.184
Pass.kilom. per inh.	N.a.	N.a.	N.a.	262
Average speed D (kph)	18	20	26	36
Average speed E(kph)	62	63	83	52
Modal pass.km. split (%)	62	27	20	12
Modal pass.trips split (%)	N.a.	N.a.	N.a.	25
Prices*				
Euros				
A	1.20	0.70	1.43	0.68
B	4.08	1.60	9.10	5.79
C	16.32	3.48	9.10	5.79
D	2.43	1.55	2.86	1.80
E	5.10	4.10	4.16	3.26
Hamburger Std.				
A	0.34	0.33	0.43	0.28
B	1.15	0.76	2.72	2.36
C	4.61	1.66	2.72	2.36
D	0.69	0.73	0.85	0.73
E	1.44	1.95	1.24	1.33
Basics				
Inhabitants central city	343,000	260,000	600,000	210,000
Inhabitants metro area	1,200,000	1,100,000	1,700,000	660,000
Square kilometres	1,700	600	2,800	700
Density	705	1833	607	942
Passenger kilometres (M)	N.a.	N.a.	N.a.	173
Passenger trips	N.a.	N.a.	220,000,000	N.a.
Vehicle kilometres (M)	N.a.	N.a.	N.a.	25

*Trips
A Single trip within centre
B Day card within central city
C Day card for the whole region
D Travelling into central city between 8 and 9 AM (10 kilometres)
E Travelling into central city between 8 and 9 AM (20 kilometres)

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Subiono, *On Classes of Min-max-plus Systems and their Applications*, T2000/2, June 2000, TRAIL Thesis Series, Delft University Press, The Netherlands

Meer, J.R., van, *Operational Control of Internal Transport*, T2000/5, September 2000, TRAIL Thesis Series, Delft University Press, The Netherlands

Bliemer, M.C.J., *Analytical Dynamic Traffic Assignment with Interacting User-Classes: Theoretical Advances and Applications using a Variational Inequality Approach,* T2001/1, January 2001, TRAIL Thesis Series, Delft University Press, The Netherlands

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Willems, J.K.C.A.S., *Bundeling van infrastructuur, theoretische en praktische waarde van een ruimtelijk inrichtingsconcept*, T2001/4, June 2001, TRAIL Thesis Series, Delft University Press, The Netherlands

Binsbergen, A.J., van, J.G.S.N. Visser, *Innovation Steps towards Efficient Goods Distribution Systems for Urban Areas,* T2001/5, May 2001, TRAIL Thesis Series, Delft University Press, The Netherlands

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Bockstael-Blok, W., *Chains and Networks in Multimodal Passenger Transport. Exploring a design approach*, T2001/8, December 2001, TRAIL Thesis Series, Delft University Press, The Netherlands

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Koppius, O.R., *Information Architecture and Electronic Market Performance,* T2002/3, May 2002, TRAIL Thesis Series, The Netherlands

About the author

Wijnand Veeneman was born in the town of Apeldoorn (the Netherlands) on February 1st 1968. After graduation from the "Johannes Calvijn Lyceum" in Kampen in 1986 he studied Human Geography at the University of Groningen, specialising in transport geography.

In 1992 he completed his Master's thesis as part of an internship at the NV Nederlandse Spoorwegen (Dutch Rail). The thesis assessed the possible role of the railway company in the further integration of public transport services and the possible gains for the company and its customers.

In 1993 and 1994 he worked at Delft University of Technology (Faculty of Systems Engineering, Policy Analysis, and Management) as research assistant on a study assessing the influence of infrastructure development on the logistic decisions of companies. From 1994 focussed on this dissertation at the Transport Policy and Logistics organisation Group of the Faculty. In 1999 Wijnand Veeneman has been working as a senior advisor in the field of transport and policy at B&A Groep in Den Haag (the Netherlands).

He participated in a many applied research projects for several Dutch ministries and parliament, public transport operators and authorities.

Since 2000 he is lecturer in organisation and management at the Faculty of Technology, Policy, and Management of Delft University of Technology. He specialises is management questions and organisational issues in infrastructure construction and service operation in transport, with a focus on public transport.