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DOI
10.4233/uuid:431ffda5-275c-4670-bf32-43d863261ec2

Publication date
2020

Document Version
Final published version

Citation (APA)
Hirschhorn, F. (2020). *En Route to Better Performance: Tackling the Complexities of Public Transport Governance*. [Dissertation (TU Delft), Delft University of Technology]. https://doi.org/10.4233/uuid:431ffda5-275c-4670-bf32-43d863261ec2

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Tackling the Complexities of Public Transport Governance

Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology
by the authority of the Rector Magnificus, Prof.dr.ir. T.H.J.J. van der Hagen
chair of the Board for Doctorates
to be defended publicly on
Tuesday 31, March 2020 at 12:30 o'clock

by

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ISBN 978-94-6384-122-1

Layout and printing: Optima Grafische Communicatie, Rotterdam, The Netherlands

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Acknowledgements

In 2014 I started to contemplate doing a PhD. At that point I was living in Washington DC and working with urban transport projects at the World Bank. For many reasons I felt it was time to pursue other interests, move to a new place. Mostly, I wanted to dive deep into understanding more about the topic I was working with, and use that knowledge in a different way. Coincidentally, in August that year I had to organise a workshop related to concession models and contracting in public transport. It was then, by preparing the event, reading the work of potential participants, as well as other related papers, that for the first time I got in touch with literature from two researchers at Delft University of Technology that struck me as very interesting. I 'found out' that public transport governance was my field of study; my PhD journey had just started. I wrote an email to Wijnand Veeneman and asked if we could meet in a few months when I would be visiting Europe, since I wanted to discuss the possibility of doing a PhD under his and Didier van de Velde's supervision.

Fast forward through one and half years of preparations (especially searching for funding options), and just a few days before the end of 2015 I landed in Delft. From then on, it is the usual PhD story that most of you are familiar with: blood, toil, tears and sweat of course, but new friends, trips, laughs and learning too. As I reach the end of this chapter, I can say that nothing happened as expected. Nonetheless, I had a memorable experience and it is time to look back and express my gratitude to those whose participation made it possible.

Wijnand and Didier, thank you for the inspiration, for opening the doors of TU Delft to me, and for your resolute confidence in my work. I would also like to thank Ernst for the always valuable advice and for the sincere interest in both the quality of my dissertation and my personal well-being. Thank you also to all my other colleagues from the O&G section; I appreciate your disposition to help me since my arrival in Delft. In particular Bram, for navigating the complex seas of University and HR policies to guarantee that I could continue my research, in addition to being ready to listen and offer advice on how to manage the PhD hurdles. Also Haiko, Mark, Martijn, Qasim, and Kees who kindly assisted in the final steps before the defence. Gerdien and Joyce, for so many fun chats during lunch. Another special mention to the O&G ladies – Elisabeth, Eva, Femke, Maria, Shannon, and Toyah – for all the *gezelligheid*, especially during our weekend getaway.

I also found extraordinary people outside my research group. Maria, who every two years shows me that engineers can be sweet people too. Ben and Vladimir, friends who I never get tired of giving a strong hug, and Christine, on whom I could truly rely for anything, during good or bad times. Thank you very much. Barbara, Fernando, Julio, and Luana, thank you for always reminding me of how Brazil can be light, cheerful, and

flavourful. My gratitude also goes to Tonzé, for the unexpected and yet indispensable friendship.

Finally, my family. I am moved to remember my grandparents, who went through hardship to eventually settle in Brazil and create the conditions for me to live only for the pursuit of my dreams. Ghitta and Martin, Mimi (my dushka) and Anjel (my sladur), you are in my thoughts. Raya, Julio, and Gabriel, parents and brother who I deeply admire. You are a source of inspiration and a safe haven. If anything I achieved so far has any value, it is because we always walk side-by-side.

Summary

The Call for better Public Transport

Travelling in most cities today is time consuming, uncomfortable, and unsafe. Excessive traffic congestion significantly restricts people's access to basic services and opportunities, and ultimately impacts individuals' fundamental right to freedom of movement. Moreover, increased emissions from vehicles are at the root of the global climate emergency, affecting not only the entire urban population, but also jeopardising future generations. It is imperative to change this trajectory and drive cities towards more sustainable mobility. A modal shift away from cars, with increased usage of public transport (hereafter PT), is key for this.

The Governance Challenge

Decision-makers struggle with the complexities involved in the design and implementation of policies to address wicked problems like congestion, the global climate crisis, and transport inequality. PT policy design and implementation requires the management of increasingly complex formal and informal interactions between a multitude of actors (with varying interests and incentives) in collective decision-making processes, and aimed at reaching diverse societal goals such as sustainability, cost-effectiveness, and accessibility. Understanding how these governance processes can influence PT outcomes is central in the search for more sustainable metropolitan mobility.

In this dissertation, I tackle the governance challenge in PT. *The overall aim is to identify and explain key mechanisms by which governance can influence PT performance, supporting a modal shift away from cars and ultimately leading to the broader goal of more sustainable metropolitan mobility*.

To this end, the dissertation identifies and addresses two critical gaps in the current understanding of governance in PT: the '*what*' and the *'how*' gaps. The first gap is related to the search for improved institutional design of PT, and concerns the well-established debate around the influence of organisational form on performance. In this literature, the prevailing approach is incremental, and authors isolate the effects that the introduction or reform of a formal organisational element – like legislation, policies, contract forms, or ownership nature of actors – has on a type of performance. This dissertation, instead, proposes a complexity-oriented view, and analyse performance as the result of the interplay between multiple organisational elements. The second gap, in turn, is concerned with understanding how policies are created and established as they are, recognising that there might be important discrepancies between institutional design and practices. Whilst mainstream PT research traditionally shows a narrow understanding of governance and analyses only how formal organisational elements

influence performance, this dissertation goes beyond and investigates the role of informal institutions, policy steering, and individuals' agency in influencing PT outcomes.

Research Design

The dissertation is constituted of a collection of self-contained papers that, yet, are substantively coherent and weave together a critical investigation of the PT governance challenge. A general introduction (Chapter 1) details the societal problem and scientific gaps tackled by the research, spelling-out key questions and the outline of the dissertation. Subsequently, four chapters effectively tackle the governance challenge in PT: Chapters 2 and 3 form Part I of the dissertation and address the '*what* gap', whereas Chapters 4 and 5 form Part II of the dissertation and address the '*how* gap'. The dissertation continues with a general conclusion containing reflections on the implications of overall findings, as well as considerations on the methods used and future research directions (Chapter 6). Finally, an addendum offers methodological considerations specific to the study presented in Chapter 2.

This dissertation employs a variety of theoretical frameworks and methods, using qualitative and quantitative data and analyses. The chapters apply the Delphi method, Qualitative Comparative Analysis, causal process tracing and in-depth longitudinal case studies. They also draw on concepts and analytical frameworks provided by governance theories, new institutionalism, and socio-technical transitions theories. Furthermore, each chapter builds on findings from previous studies, either by taking the conclusions from preceding chapters as a starting point of investigation or by further scrutinising cases that were analysed before. This mixed-method approach within a nested design ensures that the different chapters, jointly, tackle the PT governance challenge in a systematic manner.

Results

In Part I, two chapters address the '*what* gap'. Chapter 2 employs the Delphi method to elicit the opinions of experts from academia, industry, and public sector organisations to identify and rate the most critical (i) PT performance indicators, and (ii) PT organisational elements influencing performance. The survey reveals the key analytical variables that should be taken into account to inform the discussion about the relationship between organisational form and performance. Chapter 3 follows-upon these findings by employing the most highly rated indicators and organisational elements in the Delphi to develop a systematic cross-case comparison between selected metropolitan areas in order to understand how those variables interact in a real-world context.

Main findings from Part I show that the experts consulted in the Delphi survey prefer, as key performance indicators, those metrics that offer system-wide view on PT and are linked to ridership objectives (those achieved by increasing PT usage), such as

user satisfaction, cost-recovery, and modal split. Integration as a coordination mechanism, in turn, emerges as the central governance dimension according to consulted experts; policy integration between public transport and other policy areas, a single integrated planning authority at the regional/metropolitan level, as well as ticket and fare integration were highly rated. Furthermore, the case comparison shows that the attractiveness of PT (measured through modal split ratios) is strongly connected to good coordination based on (i) integration between policy areas – especially land-use and transport – and (ii) integration in public transport planning through an authority with regional/metropolitan jurisdiction over multiple public transport modes. The financial sustainability of PT (measured through cost-recovery levels), instead, appears to be associated to the way in which (i) agency (decision) over funding at the regional/metropolitan level and (ii) contractual risk allocation strategies work together to shape incentives for cost savings and/or revenue generation by authorities and operators.

In Part II, two additional chapter address the '*how* gap'. Chapter 4 presents an in-depth longitudinal investigation of the PT systems in Oslo and Amsterdam. Following-up on findings from Chapter 3, this chapter uses causal process tracing and draws on institutional theories to analyse how the interplay between formal frameworks, informal institutions, and individuals' agency – manifested, e.g., in political leadership or outstanding know-how of civil servants – can contribute to making PT more attractive in relation to other transport modes. Chapter 5, in turn, looks into the future of mobility and examines governance responses to mobility as a service (MaaS), which promises to help increase the use of PT. This analysis focuses on the interactions between PT systems and MaaS developments in Amsterdam, Birmingham, and Helsinki, and case comparison is informed by the multilevel perspective on socio-technical transitions as well as by the literature on meta-governance of networks.

Main findings in Part II show that the dynamic interaction between key actors, formal, and informal institutions are also critical to performance outcomes; they co-exist and interact in complementary, substitutive, and accommodating manner. These interactions facilitate collective decision-making on issues like integration between land use and transport, the decision on where to provide public transport services, policy implementation capacity, and coordination within budget constraints. Furthermore, Chapter 4 reveals a positive loop between good performance and good governance, indicating that the relationship between governance and performance is not unidirectional; they affect and are affected by each other in a complex dynamic interplay – positive performance outcomes strengthen the legitimacy of and trust in institutions and actors, increasing their effectiveness. Additionally, Part II also emphasises the importance of the policy steering dimension of governance, and conceptualises governance approaches being adopted by public sector actors in relation to MaaS. These strategies range from hands-on strong intervention (direct intervention on the

MaaS development niche with actual participation on the production of outputs) to information collection efforts (distant and hands-off measures to maintain awareness and build knowledge on MaaS). The identified approaches show that public sector actors tend to reproduce, in relation to MaaS, their institutionalised practices used in the governance of mainstream PT, seeking to control the apparent disruptive potential of MaaS by incrementally absorbing innovations in the current PT system.

Implications

Important societal and policy implications arise from these findings. First, if governance is the outcome of social, economic, and political developments, and good performance can enhance the effectiveness of governance in multiple dimensions (increasing the legitimacy of and trust in formal frameworks and individuals), it is clear that the relationship between governance and performance is highly contextual-dependent. Thus, decision-makers should be cautious with advertised policy success formulae or silver bullets. So-called international best practices and benchmarking should be seen as potential leads to action, but never as final answers. The importance of context – and thus of informal institutions and individual actors – also underscores that harnessing broadly shared understandings and consensus can be pivotal for achieving better PT performance. In this way, decision-makers must be aware and support broader stakeholder engagement in governance processes; involving a wider set of interests in decision-making processes is possibly more cumbersome, representing a measure with high transaction costs, but whose gains compensate the effort.

Second, considering the importance of the debates about optimal coordination mechanisms, decision-makers should be open to experiment innovative forms of governance. To increase the efficiency, effectiveness, and legitimacy of policy-making and policies, they must combine existing and new practices, foster collaboration with a more diverse set of actors that possess various backgrounds and espouse new and competing ideas, deliberately leave aside existing beliefs and practices to promote the development of new ones that can represent a qualitative step change despite the associated risks, and show tolerance toward complexity.

Third, moving PT production to high-demand areas at the expense of less dense locations is insufficient, *per se*, to achieve sustainability ambitions attached to PT; this policy must be coupled with the expansion of complementary transportation options for first and last mile trips, in order to mitigate the risks of increasing reliance on cars by suburban populations. In this sense, a word of caution is necessary in relation to the still common bias in favour of easy technological fixes. The enthusiasm with emerging mobility services needs to be critically assessed and it is too early to expect that at this stage MaaS could represent a complete mobility complement to PT and decisively influence decisions about car ownership and mode choice.

This dissertation combines multiple sources of leverage and bridges qualitative and quantitative approaches to propose a critical understanding of PT policy-making. This work highlights that, at this moment, financial interests are the main policy driver in PT, whereas the environmental and social dimensions of sustainability assume secondary importance. By tackling the governance challenge to understand how we actually 'do' PT, comprehending the disparities between policy design and implementation, this dissertation helps equipping decision-makers and citizens in general to critically assess current policy directions, making current value trade-offs more transparent, and allowing more effective interventions to fix today's wicked mobility issues.

Samenvatting

De roep om beter openbaar vervoer

Tegenwoordig is reizen in de meeste steden tijdrovend, ongemakkelijk, en onveilig. Overmatige verkeersopstopping beperkt het dagelijks leven aanzienlijk, waaronder de toegang tot basisvoorzieningen. Uiteindelijk heeft dit invloed op het recht van vrij verkeer van personen. Bovendien ligt de toegenomen uitstoot van uitlaatgassen door voertuigen aan de basis van de wereldwijde klimaatcrisis, die niet alleen de hele stedelijke bevolking treft, maar ook toekomstige generaties in gevaar brengt. Het is daarom belangrijk om steden aan te zetten tot meer duurzame vormen van mobiliteit. Hierbij ligt een belangrijke sleutel in de verschuiving van minder gebruik van auto's en naar verhoogd gebruik van het openbaar vervoer (hierna OV).

De *governance*-uitdaging

Besluitvormers die werken aan vraagstukken zoals verkeersopstopping, de wereldwijde klimaatcrisis, en ongelijkheid op vervoersgebied, worstelen met de complexiteit van deze vraagstukken wanneer zij beleid ontwerpen en uitvoeren.

Om verschillende maatschappelijke doelen te bereiken vereisen het ontwerp en de uitvoering van OV-beleid de omgang met een veelheid aan actoren (met uiteenlopende belangen en prikkels) in collectieve besluitvormingsprocessen, die beïnvloed worden door formele en informele instituties. Het is daarom belangrijk om te begrijpen hoe deze processen OV-prestaties beïnvloeden en duurzamere vormen van mobiliteit stimuleren. Dit staat dan ook centraal in het onderzoek naar de verbetering van grootstedelijke mobiliteit.

Dit proefschrift richt zich op deze *governance*-uitdaging in het OV. Het doel is om belangrijke mechanismen te identificeren en te verklaren hoe bestuurlijke (*governance*) processen OV-prestaties kunnen beïnvloeden, en hoe zij een verschuiving van auto's naar OV kunnen ondersteunen en daarmee leiden tot het bredere doel van duurzamere grootstedelijke mobiliteit.

In het proefschrift worden twee kritieke kennisvragen in ons huidige begrip van *governance* in OV geïdentificeerd: de 'wat' en de 'hoe' vraag. De eerste vraag houdt verband met het vinden van een verbeterd institutioneel ontwerp van OV, en heeft betrekking op het huidige debat over de invloed van organisatievormen op prestaties. In de relevante literatuur is de heersende benadering 'incrementeel', waarbij auteurs de effecten isoleren die invloed hebben op de prestatie van de introductie of hervorming van een formeel organisatorisch element – zoals wetgeving, beleid, contractvormen of eigendom van actoren. Dit onderzoek, daarentegen, neemt een op complexiteit gestoeld beeld en analyseert de prestaties van het OV als het resultaat van de wisselwerking tussen meerdere organisatorische elementen. De tweede vraag gaat verder in

op het begrijpen van hoe beleid wordt gemaakt en vastgesteld, daarbij rekening houdend met het feit dat er belangrijke verschillen kunnen ontstaan tussen institutioneel ontwerp en realiteit. Terwijl het reguliere (mainstream) OV-onderzoek dikwijls een beperkt begrip van *governance*-processen geeft en vaak alleen analyseert hoe formele organisatie-elementen de prestaties beïnvloeden, gaat dit proefschrift een stap verder en onderzoekt het de rol van informele instituties, beleidssturing, en de agency (potentieel tot handelen) van individuen, die allemaal de OV-resultaten kunnen beïnvloeden.

Onderzoeksopzet

Het proefschrift bestaat voornamelijk uit een collectie artikelen die inhoudelijk samenhangen en als geheel een kritisch onderzoek naar de uitdagingen van OV-*governance*. Een algemene inleiding (hoofdstuk 1) beschrijft het maatschappelijke probleem en de wetenschappelijke vragen die ten grondslag liggen aan het onderzoek en de hoofdlijnen van het proefschrift. Vervolgens wordt in de daaropvolgende vier hoofdstukken ingegaan op de verschillende *governance*-uitdagingen in het OV: hoofdstuk 2 en 3 vormen deel I van het proefschrift en gaan in op de 'wat' vraag, terwijl hoofdstuk 4 en 5 deel II van het proefschrift vormen en de 'hoe' vraag behandelen. In hoofdstuk 6 worden de algemene conclusie getrokken, reflecties op de implicaties van de bevindingen beschreven, evenals overwegingen over de gebruikte methoden en toekomstige onderzoeksrichtingen. Ten slotte biedt een addendum methodologische overwegingen die specifiek zijn voor hoofdstuk 2.

Dit proefschrift maakt gebruik van verschillende theoretische kaders en methoden, alsmede kwalitatieve en kwantitatieve gegevens en analyses. In het proefschrift worden de Delphi method, de Qualitative Compartive Analysis, en de causal process tracing toegepast, evenals worden er diepgaande longitudinale analyses van verschillende casussen gemaakt. Daarnaast worden theoretische concepten en analytische kaders gebruikt vanuit *governance*, new institutionalism, en socio-technical transitions theorieën. Verder bouwt elk hoofdstuk voort op bevindingen uit eerdere studies, hetzij door de conclusies uit voorgaande hoofdstukken als uitgangspunt voor onderzoek te nemen of door gevallen die eerder werden geanalyseerd, nader te onderzoeken. Door het gebruik van zowel kwalitatieve als kwantitatieve methods (mixed method) kunnen binnen een genest onderzoeksontwerp de verschillende hoofdstukken gezamenlijk de uitdagingen van OV-*governance* op een systematische manier aanpakken.

Resultaten

In deel I gaan twee hoofdstukken in op de 'wat' vraag. Hoofdstuk 2 maakt gebruik van de Delphi-methode om de meningen van experts uit de wetenschap, het bedrijfsleven, en de publieke sector te achterhalen om (i) de belangrijkste OV prestatie-indicatoren te identificeren en te beoordelen, en om (ii) de OV organisatorische elementen die de

prestaties beïnvloeden te identificeren. Resultaten van de enquête geven een beeld van de belangrijkste analytische variabelen en indicatoren over de relatie tussen organisatievorm en prestaties. Hoofdstuk 3 gebruikt vervolgens de belangrijkste indicatoren en organisatie-elementen om een systematische casusvergelijking tussen verschillende geselecteerde grootstedelijke gebieden te doen. Hiermee kunnen we begrijpen hoe de verschillende variabelen in de realiteit op elkaar inwerken.

De belangrijkste bevindingen uit deel I laten zien dat de experts die in de Delphi-enquête zijn geraadpleegd, als belangrijkste prestatie-indicatoren de voorkeur geven aan indicatoren die een systeembrede kijk op OV bieden en direct gekoppeld zijn aan doelstellingen voor OV-gebruik (die bereikt worden door het OV-gebruik te maximaliseren), zoals gebruikerstevredenheid, kostenherstel en modal split (keuze van vervoerswijze). Integratie, een vorm van coördinatie, komt volgens de geraadpleegde deskundigen naar voren als de centrale bestuurlijke dimensie; de beleidsintegratie tussen OV en andere beleidsterreinen, een geïntegreerde planningsautoriteit op regionaal of grootstedelijk niveau, en een ticket- en tariefintegratie werden hooggewaardeerd. Bovendien laat de casusvergelijking zien dat de aantrekkelijkheid van OV (gemeten aan de hand van modal split ratio's) sterk verbonden is met goede coördinatie op basis van (i) integratie tussen beleidsgebieden – met name landgebruik en vervoer – en de (ii) integratie in de planning van het OV via een autoriteit met regionale of grootstedelijke jurisdictie over meerdere openbaarvervoermiddelen. De financiële houdbaarheid van het OV (gemeten aan de hand van kostenherstelniveaus) lijkt daarentegen verband te houden met (i) handelingsvrijheid (agency) in financiële beslissingen op regionaal of grootstedelijk niveau, en (ii) de manier waarop contractuele risicotoewijzingsstrategieën samen prikkels voor kostenbesparingen opleveren en / of inkomsten genereren voor autoriteiten en exploitanten.

In deel II wordt in twee extra hoofdstukken de 'hoe' vraag besproken. Hoofdstuk 4 presenteert een diepgaand longitudinaal onderzoek van de OV-systemen in Oslo en Amsterdam. In navolging van bevindingen uit hoofdstuk 3, gebruikt dit hoofdstuk causal process tracing en maakt het gebruik van institutionele theorieën om te analyseren hoe de wisselwerking tussen formele kaders, informele instituties, en de agency van individuen ertoe bij kunnen dragen om het OV aantrekkelijker te maken ten opzichte van andere vervoersmiddelen.

Hoofdstuk 5 onderzoekt de toekomst van mobiliteit en kijkt specifiek naar de acties van de overheid op het gebied van Mobility as a Service (MaaS, mobiliteit als een dienst), wat belooft het gebruik en bereik van OV te kunnen vergroten. De analyse richt zich op de interacties tussen OV-systemen en MaaS-ontwikkelingen in Amsterdam, Birmingham en Helsinki. De case-vergelijking gebruikt een zogenaamd gelaagd (multi-level) perspectief op sociaal-technische transities, een analyse op meerdere niveaus, en is geïnformeerd door literatuur over de meta-governance van netwerken.

De belangrijkste bevindingen in deel II laten zien dat de dynamische interacties tussen belangrijke actoren, formele en informele instituties, van cruciaal belang zijn voor de prestaties; ze bestaan naast elkaar en werken op complementaire en substitutieve wijze samen. Deze samenwerking vergemakkelijkt collectieve besluitvorming over kwesties zoals integratie tussen landgebruik en vervoer, de beslissing over waar OV-diensten mogen worden geleverd, capaciteit voor beleidsuitvoering, en coördinatie binnen budgettaire beperkingen. Verder laat hoofdstuk 4 een positieve relatie tussen goede prestaties en goed bestuur zien, waarbij de relatie tussen bestuur en prestaties niet eenzijdig is; bestuur en prestaties beïnvloeden elkaar in een complex dynamisch samenspel. Positieve resultaten verbeteren de legitimiteit van het vertrouwen in instituties en actoren, waardoor effectiviteit toeneemt. Bovendien benadrukt deel II ook het belang van de beleidsturende kant van *governance*, en identificeert het conceptuele *governance*-benaderingen die door actoren in de publieke sector worden gebruikt in relatie tot MaaS. Deze strategieën variëren van hands-on directe interventie (interventie op de MaaS-ontwikkelingsniche met daadwerkelijke participatie bij de productie van output), tot inspanningen voor het verzamelen van informatie (maatregelen op afstand en hands-off methoden om bewustzijn te behouden en kennis op te bouwen over MaaS). De geïdentificeerde benaderingen laten zien dat actoren in de publieke sector geneigd zijn om hun geïnstitutionaliseerde werkwijzen, die zijn gevormd in het bestuur van het reguliere OV, te reproduceren in relatie tot MaaS. Het verstorende potentieel van MaaS wordt beheerst door innovaties in het huidige OV-systeem stapsgewijs te introduceren.

Implicaties

Uit de bevindingen van dit proefschrift vloeien belangrijke maatschappelijke en beleidsimplicaties voort. Ten eerste, als *governance* het resultaat is van sociale, economische en politieke ontwikkelingen, en goede prestaties de effectiviteit van *governance* in meerdere dimensies kunnen vergroten (het vergroten van de legitimiteit van en vertrouwen in formele kaders en individuen), dan volgt dat de relatie tussen *governance* en prestaties sterk contextueel afhankelijk zijn. Daarom moeten besluitvormers voorzichtig zijn met het stimuleren van beleidssuccesformules of wondermiddelen. Zogenaamde internationale best practices en benchmarking moeten worden gezien als potentiële aanknopingspunten, maar nooit als hapklare oplossingen. Het belang van contextuele factoren – en dus van informele instituties en individuele actoren – onderstreept ook dat het voortbouwen op breed gedeelde opvattingen en consensus cruciaal kunnen zijn voor het bereiken van betere OV-prestaties. Op deze manier moeten besluitvormers een bredere betrokkenheid van belanghebbenden bestuursprocessen ondersteunen. Hoewel het betrekken van een groter aantal belanghebbenden bij besluitvormingsprocessen mogelijk omslachtig lijkt, omdat het hoge transactiekosten met zich meebrengt, laat dit proefschrift zien dat de voordelen opwegen tegen de inspanning.

Ten tweede moeten besluitvormers openstaan voor het experimenteren met innovatieve vormen van *governance*. Om de efficiëntie, effectiviteit, en legitimiteit van beleidsvorming en beleid te vergroten, moeten besluitvormers bestaande en nieuwe werkwijzen combineren, samenwerking bevorderen met een meer diverse verzameling actoren om verschillende achtergronden en nieuwe en concurrerende ideeën te omarmen, bestaande overtuigingen loslaten en omstandigheden creëren om de ontwikkeling van nieuwe ideeën te bevorderen zodat ondanks de bijbehorende risico's een stapsgewijze verandering kan plaatsvinden waarbij de complexiteit van het vraagstuk wordt gerespecteerd.

Ten derde is het verplaatsen van OV-faciliteiten naar gebieden met een hoge vraag ten koste van minder dichtbevolkte locaties op zichzelf onvoldoende om duurzaamheidsambities te bereiken. Beleid moet gepaard gaan met de uitbreiding van het aantal vervoersopties voor het reizen van de eerste en de laatste kilometers. Hiermee kunnen risico's verminderd worden op een toenemende afhankelijkheid van auto's door bewoners van voorsteden. We moeten voorzichtig zijn in het kiezen voor eenvoudige technologische oplossingen. Het enthousiasme waarmee opkomende mobiliteitsdiensten zoals MaaS worden ontvangen moet kritisch worden beoordeeld. Het is nog te vroeg om te concluderen dat MaaS in dit stadium een volledige aanvulling op het OV kan zijn en daadwerkelijk invloed heeft op beslissingen over autobezit en vervoerswijzen

Dit proefschrift biedt meerdere aangrijppunten voor en gebruikt kwalitatieve en kwantitatieve analyses om een kritische kijk op beleidsvorming van OV te stimuleren. De studie laat zien dat op dit moment financiële belangen de belangrijkste drijfveer zijn in OV-beleid, terwijl de ecologische en sociale dimensies van duurzaamheid veelal van ondergeschikt belang zijn. Door de *governance*-uitdaging aan te gaan en te begrijpen hoe we OV daadwerkelijk kunnen uitvoeren, alsmede de verschillen tussen beleidsontwerp en -uitvoering te begrijpen, helpt dit proefschrift besluitvormers en burgers om kritisch te reflecteren op de huidige beleidsrichtingen. Hierdoor worden de huidige waarde-afwegingen transparanter en ontstaat er ruimte voor effectievere interventies om de huidige mobiliteitsproblemen op te lossen.

Chapter 1

General Introduction

Urban areas today are shaped by decades of car-centred decision-making (see e.g. Caro, 1975; Jacobs, 1992), producing a "system of automobility" (Urry, 2004). The predominance of cars is upheld and stabilised by a series of lock-in mechanisms, ranging from sunk investments in road infrastructure, to vested interests from influential players such as car manufacturers and the oil industry, or even cultural values and the preference for the feeling of freedom promoted by car ownership and individual transportation (Sheller, 2004; Sheller & Urry, 2000). This has spurred a series of societal challenges and wicked policy problems (as conceptualised by Rittel and Webber 1973), most notably the externalities caused by increasing traffic congestion. Globally, the transport sector accounts for a quarter of total emissions; the road sub-sector is the largest contributor in terms of volume (International Energy Agency, 2018) and is thus one of the main drivers of the climate crisis. The problem is more acute in urban areas, as climate change and the urban heat island effect produce higher temperatures than those in the surrounding countryside (Kolbe, 2019). Additionally, urban dwellers increasingly suffer from health hazards and premature deaths caused by air pollution (European Environment Agency, 2018). Longer commuting times caused by congestion also reduce the productivity of the labour force, generating immense financial losses (Centre for Economic and Business Research, 2014). Last, but not least, congestion significantly impairs peoples' freedom of movement and ability to access employment, educational and cultural opportunities (Suzuki, Cervero, & Iuchi, 2013; UN-Habitat, 2013). It is imperative to change this situation and improve mobility patterns in metropolitan areas, shifting cities' trajectories to a more sustainable path.

The sustainable development of urban areas and their transportation systems, comprising environmental, social, and economic dimensions, has been a top political priority for decades (WCED, 1987). A key component of more sustainable mobility is greater multimodality, i.e. the development of transportation systems that are less reliant on private cars. Bertolini and le Clerq (2003) suggest that for urban areas to overcome the current challenges of mobility, they must develop conditions to support environmentally friendly transport modes that will replace cars, whilst at the same time maintaining or even increasing levels of accessibility to job opportunities, and to education and health services, within reasonable travel times. Banister (2008) proposes the sustainable mobility paradigm, built upon elements such as modal shift away from cars, acceptance of reasonable travel time rather than travel time minimisation, decrease in the need to travel (e.g. through home working), greater energy efficiency, higher vehicle occupancy, and demand management measures. Therefore, improving the attractiveness of public transport (hereafter PT)[1], i.e. its ability to represent an effective

[1] The term public transport refers to all collective modes of land passenger transport services available to the general public within a metropolitan area, and linking it to its direct environment. There is no distinction based on ownership or control; these services can be either publicly or privately operated.

transportation option for commuters vis-à-vis the automobile, can effect a modal shift to collective modes of transport, and can also encourage more walking and cycling (Cervero, 2013; Hickman, Hall, & Banister, 2013).

Whilst historically there has been a bias towards technological innovation as the easy fix for mobility problems this conception has proved to be misleading. The potential benefits attributed to the introduction of new technologies are unclear (Kemp, Geels, & Dudley, 2012; Wadud, MacKenzie, & Leiby, 2016), and other challenges pose more significant barriers to more attractive PT; it is perhaps the policy-making and governance of PT that constitute the most complex of them (Stough & Rietveld, 1997; UN-Habitat, 2013). With the emergence of global wicked problems, the nature and dimension of the issues to be tackled by elected politicians, public officials, operators' management, and academics (in other words, decision-makers broadly conceived) has profoundly changed in all policy areas. These actors are faced with the need to understand and conduct increasingly complex collective prioritisation and decision-making processes to design and implement policies and regulatory frameworks that can respond to a multitude of (many times conflicting) societal goals. In PT this challenge is particularly daunting, as the sector is increasingly characterised by horizontal and vertical fragmentation across distinct agencies and government levels, what creates difficulties for integration within PT policies and across connected areas such as land use planning and public health. Furthermore, the emergence of new technologies (e.g. automated vehicles) or service models (e.g. mobility as a service) increases the number of actors and interests in the sector, turning the overall policy-making landscape more complex.

This dissertation addresses this governance challenge in PT. *Its overall aim is to identify and explain key mechanisms by which governance can influence PT performance, supporting a modal shift away from cars, ultimately leading to the broader goal of more sustainable metropolitan mobility*. To this end, the dissertation puts forward a collection of papers combining a variety of theoretical frameworks and methods, using qualitative and quantitative data, to examine the governance of PT comprehensively and systematically. It thus responds to calls for more mixed-method research in the field of PT, and greater dialogue with other disciplines in the social sciences (Banister, Schwanen, & Anable, 2012; Marsden & Reardon, 2017).

In this introductory chapter, Section 1.1 establishes the starting points for this dissertation: it briefly reviews the current state of the art in studies concerning the influence of governance on PT performance – the literature on which the dissertation builds upon. Afterwards, Section 1.2 identifies some of the shortcomings of said literature, which create new research opportunities – the knowledge gaps addressed by the dissertation. Section 1.3 specifies the key questions that this dissertation uses to achieve its aim, explaining the overall research design. Section 1.4 provides an overview of the dissertation's chapters.

1.1 Background review: the influence of governance on public transport performance

For many years, researchers have recognised that governance elements of PT systems can shape performance outcomes, enabling or hampering different political objectives attached to mobility such as accessibility, cost-efficiency and sustainability. This body of work dates back to at least the nineteenth century (Chadwick, 1859), but it has gained significant traction in more recent decades, after the systematic deregulation experience in the UK in the 1980s and the introduction of numerous regulatory reforms in the sector targeting greater cost-efficiency (Banister, 1985; Evans, 1988; Wong & Hensher, 2018). The premise is that the introduction or reform of policies and regulatory frameworks can affect performance, measured via indicators such as emissions, operational costs, ridership, and modal split levels. This dissertation expands on the existing literature, taking some of its foundational concepts and overall analytical insights as starting points. These are discussed in the remainder of this section.

1.1.1 Performance, the 'dependent variable'

The concept of performance and the various ways of assessing it have been extensively discussed in PT literature over recent decades, and various authors have proposed frameworks to guide the overall evaluation of PT performance. Dajani and Gilbert (1978), for instance, propose a classification that divides the systems' performance in three levels: efficiency (use of resources needed for the production of PT services, the technical relationships between inputs and outputs); effectiveness (the degree to which PT service achieves individual and community mobility goals); and impact measures (indirect, beneficial or negative, intended or unintended impacts on social well-being, economic development, and environmental quality). Similar frameworks are developed in Fielding et al. (1978) and Fielding (1992). Based on these works it is possible to analytically distinguish two dimensions in the discussion of performance in PT. A first dimension concerns the wider societal value that policy interventions can provide in view of the expected impacts of these policies; consequently, this first dimension has a largely *ex-ante* goal orientation. A second dimension considers the operationalisation, quantification, and measurement of those broader values; it is primarily characterised by an *ex-post* goal evaluation based on performance indicators. These dimensions are further examined below.

Concerning the first performance dimension, van Gestel et al. (2008) propose that broad public values can be seen in the three ways: (i) the classical perspective, which considers public values as general and abstract principles defining government's responsibilities and rights, along with the obligations of citizens regarding different policy areas (Jørgensen & Bozeman, 2007); (ii) the stakeholders approach, according to

which public values constitute the actual purposes of stakeholders and their networks, such as government, private companies, interest groups, citizens, experts or executive agencies, and where the precise formulation of a public value varies according to these stakeholders' perspective and interests, existing problems, and policy arenas (de Bruijn & Dicke, 2006); (iii) the institutional theory perspective, which proposes that the institutional environment (formal and informal rules) restricts or promotes certain actions and perceptions by stakeholders – i.e. particular institutional settings influence stakeholders' definitions of public values and the way these stakeholders approach the trade-offs between their values (Scott, 2001).

The dissertation emphasises public values as the representation of the varying goals and expectations of diverse stakeholders in relation to government in a policy area (de Bruijn & Dicke, 2006, Koppenjan et al., 2008). Concretely in PT, these goals might include, for example, sustainability, cost-efficiency, and accessibility. They translate, broadly speaking, into two often opposing types of objectives: those that are achieved by increasing PT usage and those that are achieved by increasing the spatial availability of PT services, despite low usage (Faivre d'Arcier, 2014; Walker, 2008). Literature also approaches the discussion of the variety of broad goals in PT by distinguishing paradigm shifts. Banister (2008) and Marshall (2001), for instance, identify the emergence of a 'sustainable mobility paradigm' replacing the 'predict and provide' approach to transport planning. The latter emphasises efficiency and utility – mobility is seen as a derived demand – whereas the 'sustainable mobility paradigm' acknowledges social and environmental perspectives as well, encouraging sustainable transport patterns. Other authors identify the rise of the accessibility paradigm, supplementing a mobility-centred view and giving more prominence to issues of spatial and social inequality (Farrington, 2007).

The second dimension of performance relates to the measures through which broad goals can be quantitatively translated – the performance indicators. The choice of indicator or set of indicators to measure each performance aim varies, and consensus around best metrics is challenging (Fielding, 1992). Firstly, the range of options is vast: Geerlings et. al (2006) report a literature review identifying over 400 indicators in PT; moreover indicators continue to be developed, generating additional quantitative and qualitative assessment tools (K. Lucas, van Wee, & Maat, 2016; van Wee, Hagoort, & Annema, 2001). Preferences across indicators may vary according to the particular objectives of the policy implemented or analysis undertaken, the type and amount of data available, or the methodology employed for their measurement. Taking the measurement of efficiency as an example, Veeneman (2002) chooses to assess it based on cost-recovery ratio (the ratio between the revenues obtained with tariffs and the operational costs). Fielding (1992), in turn, when proposing efficiency metrics to be adopted by PT agencies in the USA, suggests 5 different indicators: revenue vehicle

hours per dollar of operating expense; vehicle miles per peak vehicle; vehicle hours per employee; vehicle miles per maintenance employee; vehicle miles per accident. Jain et al. (2008) employ data envelopment analysis to compare technical efficiency in 15 PT systems measuring the number of vehicle kilometres and passenger trips.

To conclude, the key point in this section is that the definition of broad values to be achieved in and via PT, as well as the prioritisation across them, can vary over time and according to stakeholders' interests and incentives. Furthermore, public values may also conflict and compete with each other (Stewart, 2006; Thacher & Rein, 2004). In other words, PT goals are multi-dimensional, and their accomplishment depends on a complex series of trade-offs often managed by decision-makers with limited information and driven by a multitude of spatially and temporally dynamic interests. This also makes defining performance indicators difficult.

1.1.2 Governance, the 'independent variable'

Governance is possibly one of the most used and least understood concepts in the political sciences literature (Bevir & Rhodes, 2016; Hufty, 2011a). Broadly speaking, theories of governance are concerned with creating and examining the conditions for ordered rule and collective action – the decision-making processes that take place whenever collective stakes lead to competition and cooperation (Hufty, 2011a; Stoker, 1998). In this dissertation, governance concerns the ways in which societies create and uphold rules and order in social processes in the pursuit of collective interests, i.e. the formal and informal interactions for collective decision-making involving public and private actors, through which they coordinate practices to achieve predefined goals (Bevir, 2013; Hufty, 2011b; E. Sørensen & Torfing, 2009). The concept thus encompasses the governance of policy processes; this includes the formulation and implementation of policies as well as the method of political steering, from hierarchical imposition to sheer information measures (Héritier, 2002). Analytically, the notion of governance can be broken down into three dimensions: politics (concerning the actor constellation, i.e. range and nature of actors involved in the process of policy-making); polity (concerning the institutional landscape in which these actors operate); and policy (concerning political steering, i.e. the nature and character of steering instruments being used) (Treib, Bähr, & Falkner, 2007). Whilst these three dimensions are empirically intertwined, the analytical distinction is useful to clarify the application of the notion of governance.

Indeed, in PT studies the understanding of governance is not straightforward. Although frequently used in this literature, the term is defined loosely if at all, and it is often plagued by terminological confusion, depending on professional jargon and national contexts. Recently though, there has been greater interest in conceptualising governance more explicitly in this field. Paulsson et al. (2017), for instance, offer a brief review of governance definitions proposed by political scientists and highlight the

variety of concepts and diversity of analytical perspectives around the term. Eventually, though, the authors conclude their review with a relatively vague reference to governance as a theme concerned with *"...the understanding of how societal affairs are organised."* (Paulsson et al., 2017, p. 3). Hrelja et al. (2017, p. 612) explicitly define governance "*as an analytical concept that opens up for a critical exploration of various 'modes' of steering that depends on institutional properties, actor constellations and/or policy instruments.*" Their conceptualisation refers to the work of Treib et. al (2007) mentioned above, but ultimately remains broad and difficult to grasp. Veeneman, finally, defines governance of public transport as the *"set of institutions providing actors with agency (the power to act) and funding (the means to act), structuring their actions towards a public transport system, with the expected result to attain specific public values."* (2018, p. 227). Whilst useful in the context of the author's paper, this definition is limited because it restricts the concept to actors' agency and funding.

This dissertation does not aim to provide a comprehensive overview of the concept of governance, its origin, or its varied definitions and uses.[2] Yet, it represents an important progress in relation to the studies mentioned in the previous paragraph – and for PT research as a whole. Using empirical studies this dissertation directly confronts some of the complexities around the notion of governance to engage with aspects of this concept that are seldom tackled in the field. The claim made here is that to understand the implications of governance for PT performance and contribute to policy and decision-making, there is value in further pursuing this research path. In other words, better understanding the governance of policy-making processes comprises investigating both *what* to do in terms of transportation policy development and the realities of policy formulation and implementation, i.e. the processes that explain *how* policies in place are the way they are in real-world settings (Marsden & Reardon, 2017).

1.1.3 The link between governance and performance in PT

A sizable literature has developed exploring the hypothesis that the governance setup of PT systems can influence their performance outcomes. As highlighted above, whilst long-established, much of this literature has developed in the wake of liberalising measures during the 1980s and 1990s – usually under the New Public Management label – that attempted to reform public services by using practices typical of the private sector to achieve greater efficiency and reduce public expenditures (Hood, 1991). In this context, several countries introduced reforms in PT regulation trusting that cost minimisation could come from measures such as the establishment of free market entry to operators (deregulation), competition for the market via tendering procedures, and separation between infrastructure ownership and service provision (Evans, 1988;

[2] For such an overview, please refer e.g. to Bevir (2013) and Hufty (2011a).

Fernández & Muñoz, 2007; van de Velde et al., 2012). In addition to efficiency, PT's ability to attract passengers (and thus revenues) has been a focus of these works too.

A useful way to map this literature is to examine it through the lens of the strategic, tactical, and operational levels of PT planning and control (hereafter STO) (van de Velde, 1999).[3] This is, one could consider how the allocation of tasks pertaining to each level across different stakeholders might be conducive to distinct performance results.

The literature analysing elements at the strategic level evaluates potential impacts on ridership or user satisfaction in PT systems adopting open market entry for any operator interested in providing services (deregulation), as opposed to systems in which the state retains the right of initiating services, directly or via third parties engaged for that. Cowie (2014), for instance, examines the UK (outside London) and concludes that deregulation did not produce expected economically efficient bus services. In an analysis of the European PT regulatory environment, van de Velde (2014) discusses and compares the dissemination of market initiative regimes in countries such as Germany, Sweden, and Italy, noticing the difficulties to integrate PT policies and services in this institutional contexts. Another strategic aspect discussed by some authors is the importance of long-term strategic planning frameworks, arguing that they can promote the stability of transport strategies and high quality service, thus making PT more attractive (Gwilliam, 2003; May, 2004).

Analyses of elements at the tactical level indicate that integrating planning tasks within an overarching organisation, with authority over multiple modes in an area corresponding to major commuter patterns (a regional public transport planning authority, or PTA), can make policy implementation more coherent and avoid harmful competition between modes (Kumar & Agarwal, 2013; Pemberton, 2000). At this same level of analysis, studies also look into the potential impacts on passengers and ridership levels resulting from the adoption of different awarding mechanisms. Mouwen and Rietveld (2013), for instance, analyse the first ten years of competitive tendering of PT in The Netherlands and conclude that average trip satisfaction of passengers in areas using tendering increased only marginally more than satisfaction of passengers in areas that did not implement the tendering procedure. Mees (2005), in turn, highlights the disappointing effects resulting from the use of varied contractual regimes between authorities and operators in Australia. The performance benefits brought by ticketing and fare integration are also an important part of this literature (Buehler, Pucher, & Dümmler, 2019; Sharaby & Shiftan, 2012).

[3] The 'strategic level' refers to deciding on public transport 'aims' such as policy goals in terms of accessibility and modal share. The 'tactical level' refers to service design (routes, frequencies, fares, vehicle design, etc.), i.e. determination of 'means'. The 'operational level' refers to operational management, e.g. crew and vehicle rostering or facility and vehicle maintenance.

At the operational level, studies are less numerous, but still revealing of the overall approach in this field. Eboli and Mazzulla (2007) develop a structural equation model to explore the relationship between global customer satisfaction and service quality attributes such as bus stop furniture (shelter and benches), bus cleanliness and overcrowding. Similarly, Zhang et al. (2016), Fiorio, et al. (2013), and Jain et al. (2008) examine the causal connection between the ownership nature of operators, or even the number of operators in a given market, and user satisfaction levels.

1.2 Knowledge gaps

Despite the valuable insights produced by the literature described above, there is still limited understanding of organisational design issues and, more broadly, governance questions in public transport (Marsden & Reardon, 2017; C. H. Sørensen & Longva, 2011; Stough & Rietveld, 1997). This dissertation claims that such shortcomings stem from an overly narrow consideration of the notion of governance and its multiple facets. Two of these limitations are identified and addressed.

First, as exemplified in the literature described in the previous section, most of the existing work often takes an incremental view; that is, it attempts to isolate the impacts that the introduction or reform of a single element of PT governance has on a type of performance. Performance, then, is assessed as the outcome of a summation of separate interventions, rather than the result of the interplay between multiple systemic elements as well as their context. PT and its governance, however, cannot be reduced to stable and deterministic relationships between variables (Macmillen, 2013). PT is a complex socio-technical system, made up of diverse interdependent elements of different nature (including technology, infrastructures, and finance) and featuring actors with disparate values and preferences. Unfortunately, current studies seldom recognise this complex and systemic character. Whilst this may be less problematic for analyses of the short-term impacts of specific governance reforms, there is a need for PT research to take a complexity-informed view of PT governance, acknowledging its wicked nature. Thus, PT governance analyses can benefit from a configurational perspective that recognises its systemic character, as well as the importance of the volatile interplay between different governance elements. Decision-makers dealing with PT policy-making should be aware of these more complex relations in order to better identify *what* measures to take; for instance, they must know which formal elements to consider, in combination, for a better design of PT systems. This includes organisational elements such as legislation, policies, contract forms, and ownership nature of actors. Therefore, the first knowledge gap concerns the need for a more comprehensive and complexity-oriented approach to the '*what* gap'.

Second, mainstream analyses are restricted to examining how the organisational elements of PT systems may influence performance outcomes. This is an overly narrow view of governance – a concept that includes multiple dimensions beyond the formal institutional environment (Treib et al., 2007). Thus most existing work only partially addresses governance dimensions, and emphasises this phenomena as design only, often neglecting governance as a political process; this approach disregards issues such as the role of informal institutions, political steering, actors' agency, power relations and framing. These are relevant because decision-makers dealing with PT governance must understand not only what institutions to design and implement, but also *how* policies, regulations, and formal institutions are designed and implemented the way they are (Marsden & Reardon, 2017). Frequently, if not always, there are important discrepancies between institutional design and actual implementation; institutions constrain actors by facilitating or hampering certain actions and outcomes, but can also be shaped according to how individuals interpret and enact them. Grappling with these complex governance questions could benefit PT policy-making and implementation. Therefore, the second knowledge gap concerns the need to expand the view of governance and engage with policy in practice, moving PT research beyond the analysis of formal institutions to better grasp the '*how* gap'.

1.3 Research approach

The dissertation helps to fill these gaps in order to identify and explain key mechanisms by which governance can influence PT performance, supporting a modal shift away from cars, ultimately leading to the broader goal of more sustainable metropolitan mobility. To this end, the dissertation is divided into two parts.

Part I addresses the '*what* gap', introducing a novel way to identify what institutional designs can promote better PT performance. In contrast to the incremental approach often adopted in mainstream studies, this part of the dissertation examines how the interplay between multiple organisational elements can improve PT performance, thus potentially contributing to sustainable mobility initiatives. Two key research questions are investigated in Chapters 2 and 3 respectively:

RQ1. Considering the existing body of knowledge in academia, industry, and public sector organisations, what are the most critical (i) PT performance indicators, and (ii) PT organisational elements influencing performance?

RQ2. How does the dynamic interplay between some of the most critical organisational elements of public transport systems influence key performance indicators? What combination(s) of said organisational elements drive successful performance across different PT systems?

Part II of the dissertation turns to the '*how* gap' and examines dimensions of governance still understudied in PT research. In doing so, the dissertation joins a recent and growing strand of literature interested in understanding governance as a complex political process of policy design and implementation, and not only as a formal institutional setup. This view acknowledges the importance for PT performance of issues such as informal institutions, policy steering, and individuals' agency. To this end, two key research questions are investigated in Chapters 4 and 5 respectively:

RQ3. How do informal institutions and key individuals' agency influence PT performance, and play a role in promoting more attractive PT?

RQ4. How do public sector actors steer the implementation of new technologies and service models in the mobility ecosystem, e.g. mobility as a service (MaaS), that promise to enhance the attractiveness and use of PT?

To address these four key research questions, the dissertation employs a multi-method design and in which subsequent chapters build on and further investigate previous findings and cases. Methodologically, case studies are the core of this dissertation. All the same, it responds to authoritative calls for more qualitative and mixed-method research in public transport, as well as for increased interdisciplinary dialogue with the social sciences, as opposed to the traditional emphasis on a few disciplines such as engineering and economics (Banister et al., 2012; Marsden & Reardon, 2017). This dissertation introduces innovative approaches, and combines qualitative and quantitative data, employing a variety of methods to complement or enhance case analyses. For instance, it uses the Delphi method and qualitative comparative analysis to help address the '*what* gap' and identify institutional designs that can promote better PT performance. Additionally, the dissertation draws on different theoretical frameworks from the social sciences, including governance theories, institutional analysis, and transitions in socio-technical systems. This interdisciplinary dialogue is particularly important in addressing the '*how* gap', which requires scrutinising the reality of policy-making and implementation, moving beyond institutional design. Finally, the dissertation has a strong fact-finding character: all chapters produce new data and findings that also serve as input for future research.

1.4 Overview of the dissertation

After this introductory chapter, Chapters 2 and 3 tackle the '*what* gap' and Chapters 4 and 5 address the '*how* gap'. A general conclusion reflecting on overall findings, the methods used, and future research directions is presented in Chapter 6. Finally, an addendum offers specific methodological considerations based on the study presented in Chapter 2. Whilst the chapters provide self-contained analyses, they are also closely

interconnected; each one either takes conclusions from preceding chapters as a starting point of investigation or further scrutinises cases that were analysed earlier in the dissertation. This structure ensures that the chapters, jointly, tackle the PT governance challenge in a comprehensive and systematic manner.

Figure 1.1 presents a schematic outline of the dissertation. A brief description of the content of each chapter follows.

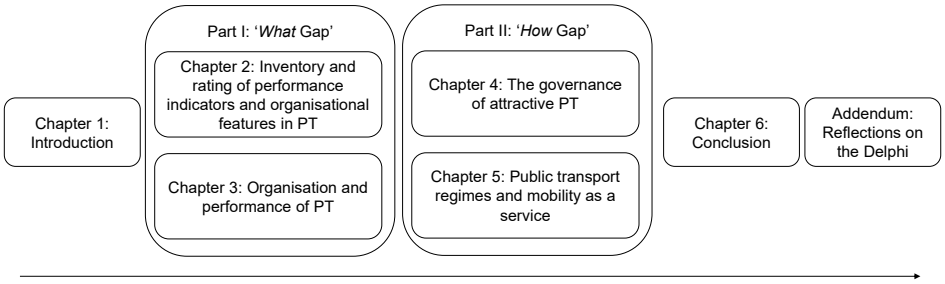

Figure 1.1: Overview of the dissertation

Chapter 2. Inventory and rating of performance indicators and organisational features in metropolitan public transport: A worldwide Delphi survey

Building on state-of-the-art knowledge and the opinions of experts, Chapter 2 identifies key analytical variables in the discussion of the relationship between governance and performance. This is done via an international Delphi survey (Dalkey & Helmer, 1963). The Delphi method constitutes a participatory process to elicit the opinions of experts, originally developed to build authoritative consensus and forecasts using a series of questionnaires interspersed with controlled feedback. This way, the method is well-suited to answer research question number one, presenting a series of advantages in relation to alternative methods, especially a traditional literature review. The Delphi provides a powerful research tool to increase access to the valuable, and many times difficult to reach, opinion of experts. Furthermore, the opinions taken into account in a Delphi are not limited to those of academics; with a Delphi it is possible to elicit the views of and structure a dialogue between academics and practitioners, both in private and public settings, with varied technical expertise and regional background knowledge, thus contributing to unveil a more diverse, comprehensive, and current view on the issue being analysed. The survey presented in Chapter 2 elicits views from PT specialists across academia, industry, and government in eighteen countries worldwide. After a three-stage iterative process including anonymous questionnaires and feedback, the survey builds authoritative inventories and ratings of core performance indicators and organisational features in PT.

Chapter 3. Organisation and performance of public transport: A systematic cross-case comparison of metropolitan areas in Europe, Australia, and Canada

The third chapter builds on the Delphi results from Chapter 2. The most strategic performance indicators and most strategic features of the organisational setting of PT as defined by the Delphi study are used as key analytical variables for a medium-n systematic cross-case comparison between PT systems in metropolitan areas worldwide. Chapter 3 employs qualitative comparative analysis (QCA) (Ragin, 2008). QCA is suited for small and medium-n comparative research and it occupies a central position in the dissertation. First, because of the method's ability to account for conjunctural causation and equifinality, recognising that it is usually the interplay of several factors that leads to an outcome and that different combinations of factors may lead to the same outcome. In other words, QCA can directly address the '*what* gap', offering a robust alternative to the incremental approach usually adopted in mainstream literature described in Section 1.2 above. QCA works by systematically comparing cases to identify set-relations between (combinations of) independent variable(s) – conditions – and the dependent variable – outcome – under study. The output of a QCA study is the identification of causal pathways indicating the (combination of) condition(s) that are sufficient or necessary to produce the studied outcome. Therefore, an additional advantage of QCA is that, by using set-theory and Boolean algebra, the method can employ both qualitative and quantitative data as input, which suits the dissertation's intention to adopt a mixed-method research approach as a tool to develop a more comprehensive understanding of the relationship between governance and performance, as opposed to relying solely on qualitative or quantitative data (Creswell & Clark, 2017). In sum, by using qualitative and quantitative data the chapter develops a systematic comparison of detailed contextual case information and reveals patterns across cases highlighting combinations of organisational elements that are conducive to better performance.

Chapter 4. The governance of attractive public transport: Informal institutions, institutional entrepreneurship, and problem-solving know-how in Oslo and Amsterdam

Chapter 4 builds on the leads produced in the previous chapter. Following a nested design (Toshkov, 2016), Oslo and Amsterdam, two of the cases studied in Chapter 3, are carefully scrutinised to reveal the factors that drive variations in their PT modal split ratios. The chapter's aim is to investigate instances of informal institutions and key individuals' agency that can also be crucial for driving better performance in PT. In-depth investigation of context-dependent information is needed, and this underpins the choice for a qualitative case study research design (Flyvbjerg, 2006). The chapter employs process tracing in particular, because this approach, as its name implies, offers a way to trace the processes that, over time, may have led to an outcome, thus identify-

ing (or at least narrowing) the list of its potential causes, i.e. process tracing can be used to develop case analyses that uncover sequences of events that allow making inferences about causal explanations (George & Bennett, 2005). This choice of approach is also adequate in this chapter because process tracing allows mediating between structure and agency, investigating the institutional context and the motivations and information of individuals. One further advantage of choosing process tracing at this stage of the research is that with it, Chapter 4 introduces the longitudinal dimension into the dissertation's analyses, not fully addressed in previous chapters. Theoretically, and to complement process tracing, the analysis in this chapter builds on theories of governance and of institutional analysis. This choice is consistent with the theoretical approach of the dissertation, and adequate to address the '*how* gap'. Drawing on concepts and frameworks established by these theories, the chapter can systematically select and interpret empirical information, to (i) identify instances of informal institutions and key individuals' agency, and (ii) explain how they interact alongside formal frameworks to drive the performance of PT.

Chapter 5. Public transport regimes and mobility as a service: Governance approaches in Amsterdam, Birmingham, and Helsinki

Chapter 5 analyses the emergence of new mobility services that promise to contribute to increase the usage of PT and drive greater sustainability. In particular, it examines governance responses from public sector actors to the development of mobility as a service (MaaS). The chapter once more follows a nested design and further investigates cases that were studied in previous parts of the dissertation: Amsterdam, Birmingham, and Helsinki. Once again the chapter uses an in-depth case-study design, given the nature of the proposed research question and the consequent need to unveil and analyse detailed context-dependent information. Given the infancy of the development and implementation of MaaS, it is beneficial to seek examples and lessons from more than a single case, so that there is more evidence to build general (even if initial) insights about this service model. Thus in Chapter 5 a comparative design is selected, using the structured focused comparison method (George & Bennett, 2005), which is appropriate to the aim of the chapter of in-depth analysis of very particular case phenomena. The method is structured as the researcher asks the same questions of each case under study to guide and standardise data collection, thereby making systematic comparison and accumulation of the findings of the cases possible. It is focused as the method deals only with certain aspects of the cases examined. To support the comparative design, this chapter employs a widely used framework to address the adoption, diffusion or rejection of new technologies (Sovacool & Hess, 2017), the multilevel perspective in socio-technical transitions (Geels, 2002). This framework is chosen because it offers heuristic lens to structure the comparative design across cases (into a structured and

focused manner), and also proposes analytical tools to understand processes of change in socio-technical systems. Finally, governance theories are also part of the analytical toolkit used in this chapter; in particular theories of meta-governance and the role of meta-governors, which discuss precisely the role of government in managing collective decision-making processes and thus are suited to help in the chapter's aim to conceptualise and classify governance strategies towards MaaS. Based on these methodological and analytical foundations, the chapter considers the mutual influence between (on one side) the institutional setting and existing logics of action in PT, and (on the other) the emerging steering approaches adopted towards MaaS, revealing the extent to which the former shape the latter in the three studied cases.

Chapter 6. Conclusion
This chapter reviews the chief findings of the dissertation and the answers to the key research questions listed in Section 1.3. It also presents substantive and methodological reflections, along with their societal and scientific implications, derived from the dissertation.

Methodological addendum to Chapter 2. Reflections on the application of the Delphi method: lessons from a case in public transport research
This addendum discusses some methodological insights obtained after conducting the Delphi survey presented in Chapter 2. To complement the methodological considerations addressed in the Conclusion, this addendum offers insights that can support other researchers or practitioners preparing to apply the Delphi method. It discusses aspects such as the choice of method, selection of experts, design of questionnaires, interaction between survey coordinator and participants, and analysis of experts' responses. Furthermore, it reflects on some novel practices introduced in the survey presented in Chapter 2, which can help overcome some typical pitfalls of the Delphi. These practices are a dedicated blog supporting the survey as an additional communication channel with panellists, safety-net questions to prevent discarding of responses, and a constant-sum type question employed to generate a series of statistical measures to assess the survey's results.

Part I

Tackling the '*What* Gap'

In Part I of this dissertation, I address the first knowledge gap identified in public transport governance research. The aim is to examine the relationship between governance and performance through a complexity-oriented perspective. I advance that rather than the sum of effects from independent measures, public transport policy outcomes are better understood as the result of the dynamic interplay between multiple governance elements. Therefore, instead of investigating how the introduction or reform of a single element of PT governance influences one type of performance, in the first part of the dissertation, I identify how a combination of elements of public transport governance can lead to more successful performance. This is done in a two-step process.

In Chapter 2, I employ the Delphi method to develop an international survey eliciting the views of public transport experts across academia, industry, and governments. After a three-stage iterative process, interspersing questionnaires and controlled feedback, the survey produces two authoritative inventories and ratings of (i) core performance indicators and (ii) key formal elements of governance driving performance in public transport – such as legislation, policies, contract forms, or ownership nature of actors. These ratings based on experts' opinions constitute novel data and evidence that add to the literature discussing the relationship between organisational form and performance in public transport. In addition, in the broader context of the dissertation, these ratings define key variables used to inform the cross-case comparison developed in Chapter 3.

In Chapter 3, I develop a systematic cross-case comparison of metropolitan areas in Western high-income countries. Building on the findings from Chapter 2, my objective in this analysis is to observe the real-world functioning of the relationship between the key performance indicators and formal elements of governance highlighted in the results of the Delphi survey. The chapter investigates how the interplay between six formal governance elements of public transport systems influences two key performance indicators. Specifically, how the combined presence of (i) integration of planning responsibilities within an authority at the regional/metropolitan level; (ii) land-use and transport integration; (iii) long-term metropolitan public transport planning; (iv) agency over funding; (v) fare integration, and (vi) allocation of risks between government and operators affect the levels of modal split and cost-recovery. Methodologically, I employ qualitative comparative analysis (QCA). QCA can perform case comparisons handling a combination of multiple explanatory conditions, framing the relationship between the variables under examination in terms of necessity and sufficiency. The method is well suited for the goal of my analysis in Part I, since it recognises that, most often, it is the interplay of several conditions that leads to an outcome, and that multiple combinations of conditions may lead to the same outcome. The systematic comparison using QCA is able to identify cross-case patterns and, as a result, reveal different combinations of conditions conducive to higher levels of modal split and cost-recovery.

These results offer decision-makers new practical policy insights. Furthermore, in the context of the dissertation, the solution pathways found in Chapter 3 represent leads for continued more in-depth investigation, which I do in Part II of this research.

Chapter 2

Inventory and Rating of Performance Indicators and Organisational Features in Metropolitan Public Transport: A Worldwide Delphi Survey*

* The content of this chapter has been published as Hirschhorn, F., Veeneman, W., van de Velde, D., 2018. Inventory and rating of performance indicators and organisational features in metropolitan public transport: A worldwide Delphi survey. Research in Transportation Economics 69, 144–156. The final publication is available at https://doi.org/10.1016/j.retrec.2018.02.003.

Abstract

This chapter contributes to the discussion on the ways organisational form may influence the performance of public transport systems. A worldwide Delphi survey with experts in the field is presented. After a three-stage iterative process interspersing questionnaires and controlled feedback, the survey produces authoritative inventories and ratings of performance indicators and organisational features in public transport. In relation to performance indicators, system-wide metrics such as user satisfaction, cost-recovery, and modal split are selected by experts as preferred measures for a strategic assessment of public transport. Concerning features of organisational form driving performance outcomes, integration emerges as the central dimension: policy integration between public transport and other sectors, single integrated planning authority, as well as ticket and fare integration were highly rated by Delphi experts.

2.1 Introduction

The connection between organisational form and performance in metropolitan public transport (PT) has been under analysis for over a century (Chadwick, 1859) and remains at the top of the academic agenda (Docherty, Shaw, & Gather, 2004; Faivre d'Arcier, 2014; Hensher & Wallis, 2005). These analyses indicate that some organisational features (market deregulation, competitive tendering, etc.) might be important for achieving goals attached to PT (such as efficiency and accessibility). However, unravelling this relationship is not simple, and studies many times have mixed or inconclusive results (Roy & Yvrande-Billon, 2007; van de Velde & Wallis, 2013). Reasons for these difficulties are manifold. The first challenge is the identification of performance and organisational variables to be examined.

Concerning performance, two levels of analysis exist: the first refers to broad PT aims (e.g. efficiency and accessibility). Complexities emerge as the definition and prioritisation of broad aims change over time and according to the varied (and sometimes conflicting), expectations actors have in relation to PT. The second level of analysis is related to the translation of those broad aims into quantitative metrics – performance indicators (for example vehicle hour per employee, population living within 500m to frequent PT service). The choice of the best indicator or set of indicators to measure broad aims varies substantially and consensus is a challenge (Fielding, 1992). Features of organisational form normally have an eminently contextual character. As a result, their study requires in-depth case knowledge and the generalisation of conclusions about their influence over performance is arduous.

In view of this complexity, most studies connecting organisation and performance tend to assess the impacts of one single policy creating or reforming a feature of PT organisation on one type of performance. For instance, the potential cost impacts stemming from the use of competitive tendering in bus markets (Beck, 2011). When framed this way, these analyses tend to simplify reality by only examining a direct and simple relationship between isolated organisational features and performance indicators. A more comprehensive approach looking at combined effect of multiple variables and their dependencies might have the potential to unravel new insights on key mechanisms connecting organisation and performance in PT. A first step, therefore, is to identify variables that might enable an analysis of PT not driven by the assessment of a single policy, but rather one that considers the interplay of different elements. For this purpose, this chapter aims at defining *what performance metrics are suitable to measure strategic PT outcomes and what organisational features might drive strategic outcomes.*

The Delphi method (Dalkey & Helmer, 1963; Linstone & Turoff, 2002) is a possible tool to help with such task. This methodology consists in a participatory process to elicit and articulate the opinion of experts in a field, allowing them to expose diverse

views on complex matters. Whilst the method was initially devised as a tool for consensus reaching, variants emerged, enabling researchers to produce different sorts of outcomes. The Delphi method can have an important role in highlighting multiple perspectives on one issue, clarifying policy problems and assisting problem-resolution. In this chapter, a Global Delphi in Public Transport (hereafter GDPT) gathering PT experts across the world is presented. After an iterative three-stage process, the GDPT produced authoritative inventories and ratings of core performance indicators and organisational features driving performance in PT.

The chapter moves on by reviewing literature on PT performance and organisational form, to then outline the suggested alternative analytical approach in Section 2.2. In continuation, the GDPT is described in Section 2.3. Results are discussed in Section 2.4, followed by conclusions in Section 2.5.

2.2 Background

2.2.1 Performance

To disentangle the topic of PT performance, two levels of analysis can be distinguished: one involving performance aims – associated to an *ex-ante* focus on policy design and interventions; and another related to performance indicators – which have an *ex-post* focus on policy outcomes. The first level is tied to broad public values, and the second refers to the way these broad values are translated into quantitative metrics.

Public values can be described as general abstract principles defining government responsibilities and rights, and obligations of citizens (Jørgensen & Bozeman, 2007). More concretely, public values represent the varying goals and expectations of stakeholders in relation to government in a policy area (de Bruijn & Dicke, 2006). As such, values are constrained by the surrounding institutional setting, and their definition and prioritisation vary in context. Furthermore, values may conflict and compete with each other (Thacher & Rein, 2004). In PT, these values can be efficiency, accessibility, and safety, for example. The importance attributed to each of them may change in time, according to actors' interests, and depending on context. This is reflected in literature that describes paradigm shifts in PT. Banister (2008) and Marshall (2001) identify the emergence of a 'sustainable mobility paradigm' replacing a conventional approach to transport planning ('neoclassic' or 'predict and provide'). The latter emphasises efficiency and utility: mobility is seen as a derived demand. The 'sustainable mobility paradigm', differently, acknowledges social and environmental perspectives too, and encourages sustainable transport patterns. Similarly, authors identify the rise of the accessibility paradigm supplementing a mobility-centred view, giving more prominence to issues of spatial and social inequality (Farrington, 2007).

Additionally, broad PT aims may also compete with each other. Buehler & Pucher exemplify this: *"In general, more frequent, higher quality, and financially efficient public transport also helps achieve social sustainability. However, in some circumstances financial efficiency and social equity might not be fully compatible (BBR, 2002; Topp, 2006; Werner, 2006)."* (2011, p. 135). Walker distinguishes between patronage goals (those achieved by the extent people use PT) and coverage goals (concerned with availability of PT regardless of its use), and asserts: *"Public transport must serve the competing demands of patronage and coverage, because the two values push service design in opposite directions"* (2008, p. 442).

The second level of analysis of performance relates to the quantitative measures through which broad aims can be translated – the performance indicators. The choice of indicator or set of indicators to measure each performance aim varies, and consensus is a challenge (Fielding, 1992). Firstly, the range of options is vast: Geerlings et al. (2006) report literature review identifying over 400 indicators in PT. Furthermore, choices may vary due to particular objectives of the analysis undertaken, type and amount of data available, or methodology employed. Taking efficiency as an example: Veeneman (2002) justifies his choice to measure efficiency with cost-recovery ratios based on his interest in a metric for the whole public transport organisation and from a general policy perspective. Fielding (1992), proposing efficiency metrics to be adopted by PT agencies in the USA, suggests 5 indicators: revenue vehicle hours per dollar of operating expense; vehicle miles per peak vehicle; vehicle hours per employee; vehicle miles per maintenance employee; vehicle miles per accident. Jain et al. (2008) employ Data Envelopment Analysis to compare technical efficiency in 15 PT systems measuring the number of vehicle kilometres and passenger trips (supply and demand-oriented metrics).

2.2.2 Organisational form

Several authors describe the organisational structure of PT systems (e.g. Barter, 2008; van de Velde, 1999). Based on these models, it is possible to identify some important organisational features in the sector: existence of a governmental prerogative to set-up public transport services or to authorise others to do so – as opposed to deregulated regimes with autonomous market entry; division of regulatory powers between government tiers; ownership structure of operating companies; or varied awarding mechanisms. The individual impact of these and other organisational features over performance is scrutinised in literature.

The contrast between markets with open entry to autonomous players and markets where the public sector holds a 'legal monopoly' to initiate PT services constitutes an important research track in PT. Authors examine both deregulation experiences (Cowie, 2014; Paredes-Molina & Baytelman, 1996) and systems adopting regulated

entry (Gómez-Lobo, 2007; Zhang, Juan, & Xiao, 2015). Particular elements of 'regulated' markets are also evaluated: different awarding mechanisms or the varied contractual regimes (risk allocation and incentives) governing the relationship between authorities and operating companies (Kavanagh, 2016; Stanley & Hensher, 2008). Authors also examine how ownership issues affect PT performance, both at the market level – integration or separation between infrastructure management and service delivery (van de Velde et al., 2012) – and at operating company level (Albalate, Bel, & Calzada, 2012). Analyses also study how having different tiers of government responsible for PT may influence performance. Likewise, the role of different key stakeholders and the ways they interact are studied (Buehler & Pucher, 2011; Finn & Mulley, 2011). Finally, the performance implications of funding frameworks (Veeneman et al., 2015) and of service characteristics (J. R. Brown & Thompson, 2008) are also analysed in PT literature.

2.2.3 A proposed approach to expand existing research

PT is a complex multifarious socio-technical system where technical elements and actors with diverse and conflicting values coexist. Whilst the analyses described above offer important insights about the connection between organisational form and performance, they do so by examining variables in an isolated manner. Thus, they might be unable to capture a more nuanced view of the complexities of PT systems. Literature may be overlooking relevant mechanisms linking organisation and performance. This echoes Hale (2011) who searches for new approaches to assess urban transport, as *"Most transport assessment is generally based on incremental analysis of individual projects with pre-existing planning and political support."* (p. 173).

It is important to acknowledge the complexity in PT systems and search for ways that allow addressing the relationship between organisation and performance in a more comprehensive way, rather than looking at policy processes as the sum of isolated interventions. The connection between organisational form and performance can be better understood from a configurational perspective. Variables interact, affecting and being affected by each other, and thus conjunctural causation processes can occur (Ostrom, 2010; Ragin, 1987). It is plausible to expect that PT performance outcomes result from the effects of a combination (configuration) of different organisational variables. Moreover, more than one combination of organisational variables may lead to the same outcome.

A necessary step to pursue such an original analytical approach is to find metrics that can help measuring strategically important transport initiatives or projects. These metrics should be able to identify *"…which kind of options and interventions are more able to deliver substantial and hence strategically important improvements to overall urban transport outcomes."* (Hale, 2011, p. 175). This article aims at defining *what performance metrics are suitable to measure strategic PT outcomes and what organisational features might drive strategic outcomes*. The Delphi method is employed for this.

2.3 Global Delphi in public transport

2.3.1 The Delphi Method

The Delphi method consists in a participatory process for consensus building. It elicits the opinions of experts through a series of questionnaires interspersed with controlled feedback to build authoritative forecasts in relation to the occurrence of events or trends (Dalkey & Helmer, 1963). After responding to the first questionnaire, and preceding new rounds, participants have access to and can reflect on other experts' opinions through anonymous feedback organised by the survey's coordinator.

The Delphi can help articulate different views and estimations on complex matters and allows the confrontation of perspectives to generate ideas and shed light on alternative directions for clarifying and solving problems. It constitutes an important tool for answering complex issues that cannot rely on the knowledge of a single expert or single group of stakeholders. The anonymity of the process supports free expression of opinion and prevents that a more vocal individual or group control the discussion. Furthermore, the method circumvents the practical difficulty of bringing experts together at the same location at the same time. Finally, the method permits engaging stakeholders of multiple affiliations.

Variants of Delphi emerged highlighting objectives different from consensus. The Policy Delphi "*seeks to generate the strongest possible opposing views on the potential resolutions of a major policy issue*" (Linstone & Turoff, 2002, p. 84). The ranking-type Delphi is used to establish the relative importance of issues building authoritative rankings (Schmidt, 1997). This chapter combines and adapts these two variants to establish a Global Delphi in Public Transport (hereafter GDPT).

2.3.2 The GDPT: general structure and choice of experts

The GDPT was structured in three different stages: (i) brainstorming (respondents could freely propose all relevant elements in connection to the issues at stake); (ii) narrowing down (respondents shortlisted most relevant elements from previous stage); and (iii) rating (respondents rated shortlisted elements). Each of these stages used one online questionnaire. A dedicated blog was also created to support the survey as an additional communication channel: the blog served as a platform for the publication of results and updates, and to provide information on the survey's motivation and aims.

Regarding the choice of experts, it is crucial to ensure breadth of knowledge amongst panellists (Delbecq, Van de Ven, & Gustafson, 1975). Panel-building in a Delphi has two moments: (i) defining the relevant expertise and (ii) identifying individuals with that knowledge.

Concerning relevant expertise, the GDPT's interest was to gather knowledge on (i) PT performance monitoring and/or evaluation and (ii) the design and function-

ing of organisational forms adopted in diverse PT systems worldwide. Two common approaches for the identification of experts are sampling based on actor types and snowball sampling. The first approach presumes that representativeness in terms of actors' types guarantees representativeness in terms of perspectives and aims to include stakeholders based on diversity of affiliation. In snowball sampling, the researcher starts off by picking a small number of stakeholders, and then asks them to mention other potential participants (Cuppen, 2010). The GDPT combined both approaches.

The sampling based on actor's type, followed some operationalisation steps:

a) First, the GDPT aimed at including individuals of prominence in the field – i.e. current or previous affiliation to eminent organisations, as well as active involvement in major international *fora*, major universities, government entities responsible for PT, PT providers, and participation in editorial boards of prominent international journals.
b) Second, the GDPT targeted a blend of stakeholders in all relevant roles in PT, ensuring the inclusion of multiple views, i.e. (i) academics, (ii) government officials, (iii) employees from transport operating companies, (iv) users' associations, (v) employees of multilateral institutions, and (vi) consultants. In the case of academics, two more aspects were considered: works published in relevant international journals and retrieved on Google Scholar, and variety of backgrounds based on academic discipline: transport geography; transport economics; transport engineering; public administration and policy; and urban planning.
c) Finally, the survey sought experts based in and/or with expertise on varied geographical locations (ensuring the global character of the GDPT).

Based on these characteristics, a matrix was built to help the selection of participants. In a first exercise to populate the matrix, around 170 names were found. Some of the authors' professional contacts were also part of the list. At this point, a sample of the initially identified experts was contacted and asked to provide recommendations of other experts to participate in the survey (snowball sampling) – names suggested that had not been identified previously were also included in the matrix. All experts identified after these steps were assessed more closely to confirm the direct relevance of their work for the topics being surveyed – not every expert in PT is necessarily knowledgeable on the issues at hand.

Invitations to participate were sent to experts by email including the link to the first questionnaire. Based on the number of emails that bounced back and the number of accesses to the questionnaire, it is possible to confirm that 96 experts received the first link. The first questionnaire was fully responded by 54 experts. From those 54, 48 participants completed the second questionnaire. A final group of 46 participants from

18 different countries[1] concluded the third and last questionnaire completing the entire survey. In a Delphi, the survey's coordinator has no ability to enforce participation of invited experts and having a low turnout is a significant risk. However, the GDPT's numbers are very positive: response rate was high, dropout along the survey low, and the profile of respondents shows the desired diversity, including approximately 60% practitioners and 40% academics, as well as varied technical and regional knowledge (Figure 2.1).

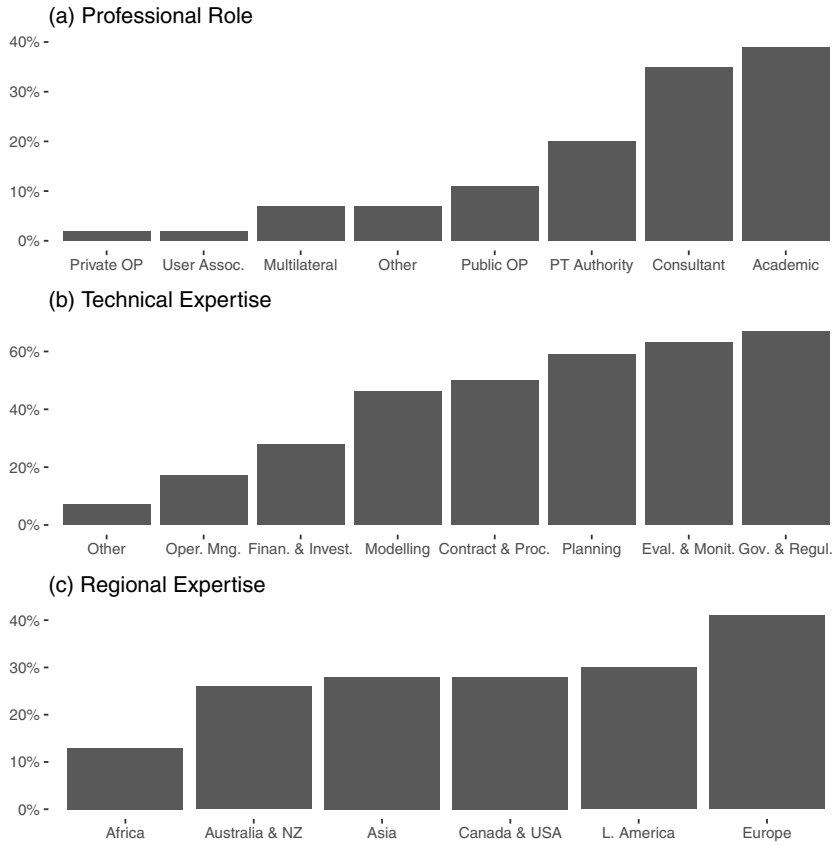

Figure 2.1: Profile of experts that concluded the GDPT
Statistics are based on self-stated information by respondents. Respondents could choose multiple options. Percentages are in relation to the total number of participants.

[1] Australia, Brazil, Canada, Chile, Colombia, Denmark, England, France, Italy, Japan, Netherlands, New Zealand, Norway, Singapore, South Africa, Sweden, Turkey, and USA.

2.3.3 Round 1: Brainstorming

The first questionnaire of the Delphi used both open-ended and Likert-scale questions.

In the open-ended questions, experts were asked to assume they would be hiring a consultant to analyse a PT system and, thus, had to list and briefly describe at least five performance indicators that they would want to have examined by the consultant. Experts were instructed to prioritise indicators that, in their view, would be better able to provide relevant information on critical aspects of PT (there was no instruction as to what critical meant). By not imposing a limit to the number of indicators as well as not defining any specific performance dimension to be measured, experts were given free room to expose their views. In addition, experts were also asked to associate each indicator they had listed to a broad performance aim. This 'pairing' of indicator and aim followed the idea of two levels of analysis in performance, which was described in Section 2.2.1 above and presented to experts in the questionnaire. A second similar question requested experts to list and describe at least five organisational features that, on their view, would be important drivers of PT performance. Once again, there was no request for considering any specific type of performance. The question clarified what was meant by organisational feature, based on the literature described in Section 2.2.2.

In the subsequent set of questions, using Likert-scale, experts were presented with 'pairs' of performance aims and indicators that are frequently discussed in PT literature (e.g. Environmental Sustainability/per capita emissions of NOx). This question was deliberately asked after the open-ended questions, avoiding any bias. The 'pair' structure was again consistent with the idea of two level of analysis of performance used in the questionnaire. Experts had to rate the relevance of these 'performance pairs' in a scale from 1 to 5. The same rating type of question was proposed in relation to a literature-based list of PT organisational features (e.g. Allocation of Ownership of Long-Life Assets). These rating questions were included in the GDPT as 'fall-back options': in case the open-ended questions had generated answers that would need to be discarded (a frequent problem in Delphi), the responses to the rating questions could be used to inform the following rounds of the survey reducing the loss of expert input. This safety net was not needed though, as the open-ended questions generated nearly 700 lines of content fitting the research aim.

Analysis of Responses

Answers to open-ended questions were qualitatively analysed. Major themes were identified, grouped, and redundancies eliminated. After the revision of the full set of answers, an intercoder reliability test was performed via independent analyses of large samples from both the answers related to performance and the answers related to organisational form. The triangulation of these assessments afterwards showed that virtually all initial coding was coherent. Minor differences were reconciled to generate the final output of this round.

Revising and coding such large amount of information was challenging and required striking a balance between, on the one hand, the task of consolidation to produce a reasonably-sized list to be used in following rounds of the survey (by experts that have limited time available for participation) and, on the other hand, avoiding generalization that would defeat the purpose of the GDPT. Having asked the experts for a brief description of their input was crucial to help clarifying opinions and enriching the material. One further important aspect of the qualitative coding was the use of sensitising concepts – general conceptual guidelines derived from existing literature and used to support the interpretation and organization of input received from experts (Bowen, 2006).

In relation to performance, the evaluation frameworks developed by Dajani & Gilbert (1978) and Fielding et. al (1985) were taken as source of sensitizing concepts. These frameworks define three broad classes of performance measures (i) cost-efficiency (technical relationships between service input and service outputs), (ii) service effectiveness (the degree to which PT achieves mobility goals), (iii) cost-effectiveness (relationship between service inputs and consumption of services). In addition, they also include a fourth dimension, impact measures, which accounts for indirect beneficial or negative, intended or unintended impacts of PT on social well-being, economic development, and environment.

These frameworks were not taken prescriptively, and only served as guidelines for the interpretation and organisation of the answers received; the final output of this round was primarily shaped by actual responses. One example involved the attempt to have experts associate broad performance aims and indicators – the 'pairing' exercise. During the design of the first questionnaire, the possibility that this would raise difficulties was foreseen. Firstly, because terminology in PT may be very confusing, especially when experts from different geographical regions dialogue. There were cases in which the same indicators were associated to different broad aims by respondents, highlighting how difficult it is to conceptualise and operationalise these broad values. Language and professional jargon need particular care in Delphi surveys to avoid misinterpretations. Furthermore, answers showed that the conceptual discussion on broad performance aims was mostly restricted to academics; practitioners in the panel hardly used definitions like efficiency or effectiveness. As a result, the authors decided not to persist with the discussion of broad aims and, instead, to restrict the performance discussion in following rounds of the GDPT to performance indicators, lest participants could lose interest in the survey and no meaningful result would be achieved.

The coding process identified the following broad performance themes emerging from experts' answers: 'Supply,' 'Cost and Revenue,' 'Financial Sustainability,' 'Usage,' 'Service Quality and User Satisfaction,' 'Accessibility Impacts,' 'Wider Impacts,' 'Other.' These thematic blocks were divided in 38 clusters that contained 109 performance indicators in total (Annex 2.1).

Concerning organisational features, van de Velde (1999) was used as a source of sensitising concepts. The author describes the varied forms PT organisation assumes depending on actors involved, the way their relationship is governed, and the allocation of strategic, tactical and operational tasks amongst these actors. These concepts were not employed prescriptively, and the responses provided by experts shaped the coding process.

Answers revealed again how convoluted the use of terminology in PT may be. The term 'regulator', for instance, was frequently used to designate the body responsible for the integrated planning of PT, but was also used to refer to the entity responsible for enforcing regulations in the industry (watchdog tasks). These roles are sometimes (but not always) combined in one entity and the use of the same denomination is a common cause of misunderstandings. Additionally, many participants went beyond the consideration of formal structural elements of PT and listed 'soft' elements, such as the skillset of staff, trust, and leadership, for instance.

After the coding of Organisational Features, the following major themes were identified: 'Initiative and Funding,' 'Planning,' 'Operations,' 'Contracting Practices,' 'Control and Accountability,' 'Other Integration and Fragmentation Features,' 'People and Relationships,' 'Other.' These thematic blocks were divided in 24 clusters containing 70 organisational features (Annex 2.1). The feedback material sent to experts after the Brainstorming round included the two full inventories (performance indicators and organisational features) and any comments respondents had included in their answers.

2.3.4 Round 2: Narrowing down

The second round of the GDPT consisted of a shortlisting exercise. Experts were asked to select seven performance indicators and seven organisational features amongst all those in the inventories produced in Round 1. The question requested experts to prioritise indicators better able to provide insights on most critical aspects of PT and organisational features with greater impact on performance. The proposal of a limit of seven items per shortlist intended to emphasise the need for prioritisation, given the very large inventories that had been built in Round 1[2]. It was also a strategy to limit the workload of respondents – a pre-emptive measure to reduce possible dropout.

Analysis of Responses

Two types of analyses were performed in relation to the responses received from experts. A first approach considered votes given at the level of individual variables, i.e. a simple count of votes that each performance indicator and each organisational feature

[2] The specific number of seven performance indicators and seven organisational features was suggested because this was the average number of performance indicators listed by each respondent in Round 1.

received. A second examination was done for cross-checking results. Responses were also examined at the cluster level, i.e. the analysis of responses took into account what would have been the sum of votes given to each of the clusters that had been defined in the coding of Round 1. For instance, the performance cluster 'Total (and operating) costs ratios' defined in Round 1 comprised nine different indicators. All votes given to these nine indicators were thus added to assess the total votes of the respective cluster. This second analysis revealed that selecting a shortlist of seven items for the subsequent round of the GDPT would not adequately reflect experts' priorities. The cluster 'Total (and operating) costs ratios' is again an example: it was the third most voted cluster in the inventory of performance indicators, but since these votes were dispersed amongst the nine alternative individual indicators, none of these nine would, individually, be present in the final shortlist of seven. Therefore, whilst clearly relevant to experts, no cost ratio would have made the cut. The authors decided to increase the size of the shortlists to ten variables each (results in Tables 2.1 and 2.2).

In the comments accompanying the responses in this round, some experts manifested that the question proposed in the GDPT should have defined a specific policy objective to serve as a guide for the shortlisting of performance indicators: *'All performance is about your objectives; if you clarify that, you answer the question asked. Objectives vary between systems and over time,'* remarked one participant. The GDPT deliberately avoided instructing experts to attach their choices to the assessment of specific policies or performance aims. This was coherent with the objective of using the GDPT as a first step for a more comprehensive approach to PT. The fact that some of the experts were expecting to receive a specific policy or goal on which to base their opinion suggests that the premise of this study is accurate and that the GDPT managed to frame questions in accordance to its purpose.

Table 2.1: Summary of results Round 2 for performance indicators

Performance Indicators	Respondents (%)
Cost-recovery ratio	45%
Modal split: by trips and passenger km	41%
User satisfaction (overall index)	37%
On-time performance according to timetable	31%
Ratio between travel time in PT and car	30%
% of inhabitants (or users) living within walking distance to frequent PT service	30%
Ridership per capita	27%
Cost per passenger km	21%
Total revenue and total cost	17%
Comfort: average vehicle occupation, fleet conditions and characteristics	16%

Table 2.2: Summary of results Round 2 for organisational features

Organizational Feature	Respondents (%)
Integrated fare and ticketing (clearinghouse functions)	59%
Funding framework: source, availability, autonomy/control	57%
Integrated planning: multimodal and multijurisdictional agency or capability	43%
Policy Integration: cross-sector links with other govt. areas	39%
Clear legal and regulatory frameworks: mandates and performance targets	34%
Long-term strategic PT plan	31%
Contracts: risk allocation and incentive structure	28%
Skill set and technical expertise of staff	27%
Awarding mechanism employed	23%
Level of competition among operating companies (re. market concentration)	21%

Note: The tables indicate only summarised descriptions of variables

The two final shortlists, presented in Tables 2.1 and 2.2, were defined by majority of votes (Schmidt, 1997). Four experts voted for more options than requested in the questionnaire, so their choices were considered based on weighted values in order for results not to be skewed. The feedback material sent to respondents included the two shortlists of ten items, the ratio of votes each variable had received, and other comments made by experts.

2.3.5 Round 3: Rating

In the final questionnaire experts were asked to allocate a total of a hundred points amongst (all or part of) the ten shortlisted performance indicators and to do the same for the shortlisted organisational features. The points were to be freely distributed to reflect the relevance of variables as if experts had to select variables for a comparative study of PT in 15 metropolitan areas. The stated objective of this hypothetical comparative study was to unveil how different ways of organising PT influence different types of performance.

The wording in the questionnaire once more referred to the performance indicators' ability to provide insights on strategic aspects of PT and to the organisational features' ability to drive performance. Furthermore, to avoid inducing any bias, variables were presented in a random fashion in each individual questionnaire, so each participant saw a list ordered differently.

Analysis of Responses

Answers were compiled and measured in different ways (described in Tables 2.3 and 2.4): (i) the average points received by each variable ('Avg. Points'); (ii) the standard deviation of points received ('Std. Dev.'); (iii) the highest single score attributed to the

variable by one expert ('High'); (iv) the percentage of experts attributing zero point to a variable ('Zeros'); and (v) the rank of variables based on the amount of points they received ('Rank'). A comparison with their ranking in the previous round is also possible ('Rank 2').

Table 2.3: Summary of results Round 3 for performance indicators

Performance Indicators	Avg. Points	Std. Dev.	High	Mode	Zeros	Rank	Rank 2
User Satisfaction (overall index)	15.91	11.03	50	15	11%	1	3
Cost-Recovery Ratio	15.24	9.07	30	20	14%	2	1
Modal Split	13.20	9.68	40	20	20%	3	2
% of Inhabitants (or users) living within walking distance to Frequent PT Service	9.78	7.71	30	10	23%	4	6
Ridership per Capita	9.57	8.70	30	5	25%	5	7
Ratio between Travel time in PT and Car	8.22	6.36	25	10	25%	6	5
On-time Performance according to Timetable	8.04	6.95	20	0	32%	7	4
Total revenue and total cost	7.28	8.39	30	0	45%	8	9
Cost per Passenger Km	6.98	6.77	26	0	36%	9	8
Comfort	5.78	5.88	20	0	41%	10	10

Table 2.4: Summary of results Round 3 for organisational features

Organisational Features	Avg. Points	Std. Dev.	High	Mode	Zeros	Rank	Rank 2
Policy Integration: cross-sector links with other govt. areas	14.65	7.79	30	10	9%	1	4
Funding: source, availability, autonomy/control	14.37	11.20	50	15	18%	2	2
Long-term Strategic PT plan	12.65	7.82	30	10	11%	3	6
Integrated Planning: multimodal and multijurisdictional agency or capability	12.46	8.42	40	10	16%	4	3
Integrated Fare and Ticketing (clearinghouse functions)	10.28	8.81	40	10	25%	5	1
Clear Legal and Regulatory Frameworks	8.96	6.87	30	10	25%	6	5
Contracts: risk allocation and incentive structure	8.43	7.50	30	10	27%	7	7
Skill set and technical expertise of staff	7.43	6.96	25	0	34%	8	8
Awarding Mechanism Employed	4.50	5.09	20	0	48%	9	9
Competition among Operating Companies (re. market concentration/fragmentation)	4.09	4.55	15	0	50%	10	10

2.4 Results and discussion

Overall, the choices made by experts reveal some central elements in the discussion on the relationship between organisation and performance in PT. In relation to performance, answers manifest a preference for a high-level system-wide assessment of PT using multipart indicators. Concerning PT organisation, integration emerged as the central dimension: policy integration, integrated strategic planning, and integration of tasks and system elements were top-rated.

On a more micro perspective, the GDPT's results provide a 'menu' of core performance indicators and organisational features. These twenty elements (ten and ten respectively) spell out the broader views highlighted just above. A first catalogue of remarks in relation to this 'menu' is proposed, although it warrants further investigation. Importantly, these remarks look at results from a particular perspective, i.e. they consider the chapter's purpose *to define what performance metrics are suitable to measure strategic PT outcomes and what organisational features might drive strategic outcomes*.

2.4.1 Performance indicators

The analysis of performance indicators shortlisted in Round 2 shows important findings.

Interactions and overlaps. There are interactions and/or overlaps within the ten most voted metrics – e.g. 'User Satisfaction' and 'Comfort,' since the latter is a component of the first. The same with 'Total Revenue and Total Cost' and 'Cost per Passenger Km'. Rather than a problem with the survey, these 'redundancies' demonstrate the consensus amongst experts around the importance of certain broad aims – e.g. the pervasiveness of PT can be associated to at least six indicators in the list. At the same time, this underscores the controversies on the choice of best indicators to translate broad aims (as mentioned in Section 2.2.1).

Patronage goals. Another aspect of consensus visible in the shortlist is the prevalence of indicators associated to patronage goals. The only indicator directly related to coverage goals is '% of inhabitants (or users) living within walking distance to frequent PT service'.

'Big Picture' system-wide indicators. The three most voted indicators ('Cost-recovery Ratio', 'Modal Split' and 'User Satisfaction') are system-wide measures composed by other variables. They provide a 'big picture' of PT systems rather than information on specific service elements.

Noted absences. Amongst absences from the shortlist, 'Vehicle Km per Capita' and 'Subsidy Level' had voting rates close to the 'top ten' items, but not enough to be shortlisted. Furthermore, none of the environmental impact or affordability indicators

included in the first round's inventory was shortlisted. The 'best ranked' amongst these two categories was 'Percentage of income or household budget spent on transport', at only the 26th overall position. This is surprising considering the increasing attention environmental and affordability goals receive today.

Results from Round 3 add new angles to these observations. When faced with the task of comparing the relative importance of shortlisted indicators, some participants realised interactions and overlaps that had resulted from Round 2. One participant mentioned, for example: 'Some of these [performance indicators] are substitutes or inputs to others, e.g. comfort is an input to customer satisfaction arguably leading to a need only for the latter.' These observations corroborate the point on redundancies discussed above.

'Big Picture' system-wide indicators again. The three most voted indicators remained the same between Rounds 2 and 3. The upshot in Round 3 is the visible gap in points separating them from the rest of the list. This underscores the preference that consulted experts manifested in relation to multipart measures that provide information on ample aspects of PT.

A controversy with 'User Satisfaction'. Whilst 'User Satisfaction' was the highest rated amongst all shortlisted indicators (15.91 points on average), experts' views on its importance proved to be also highly dispersed (standard deviation above 11), denoting fragmented opinions.

Consensus. Opinions around 'Comfort' are less fragmented. This indicator had the lowest standard deviation (5.88) and a high percentage of 'zeros' (41%), both results suggesting lower relative importance. This may be caused by the overlap with 'User Satisfaction' as highlighted in the comment from the respondent included above. The same reasoning may explain the variation in ranking of the indicator 'On-time Performance according to Timetable' – i.e. it lost positions possibly for being a component of user satisfaction.

The lower informative value of 'Total Revenues or Total Costs. The very high percentage of 'zeros' attributed to 'Total Revenues and Total Costs' (45%) corroborates opinions expressed by some experts advocating that cost measures are more informative per unit of production. The presence of this indicator in the shortlist might be a reflection of terminology misinterpretations during the Delphi.

2.4.2 Organisational features

The analysis of the shortlist of organisational features produced in Round 2 allows important observations:

Consolidation versus fragmentation debate. According to consulted experts, the way tasks are allocated amongst actors or the way system features are combined or separated represent the core organisational dimension behind performance. The debate on

consolidation and fragmentation – either in terms of tasks and roles amongst PT actors, or in relation to PT system features – appears in at least four features amongst the top ten: 'Integrated Fare and Ticketing,' 'Integrated Planning,' 'Policy Integration (cross-sector links with other govt. areas),' and 'Long-term strategic PT plan.' The selection of all these elements reinforces the importance attributed to coordination as a central aspect in PT.

Integration as Coordination. Comments from experts indicate that the rationale associating integration and coordination seems to have guided some of their opinions, for instance: '*A unique organisation responsible for the planning of the transport issues of the city as a whole, considering all modes and making long term plans.*' However, evidence indicates that formal integration through hierarchic governance is not a condition for coordination, either in PT (Chisholm, 1992) or more broadly (Ostrom, 1990).

Consensus. There was a visible consensus amongst experts in relation to the importance of the two most voted features; 'Integrated Fare and Ticketing' and 'Funding: source, availability, autonomy/control' had a clear vote advantage in relation to the remaining features.

Interactions and overlaps. As with performance indicators, the shortlist of organisational features has a series of components that interact and/or overlap with each other. There was clear emphasis on Strategic and Tactical tasks (van de Velde, 1999), particularly PT policy design and planning.

'Old favourites' in the bottom of the list. Liberal reforms taking place in the last decades sought to reduce public spending in PT. Regulatory changes and business practices targeted rules for market access and competition as crucial mechanisms to promote these efficiencies. As such, 'Awarding Mechanism Employed' and 'Competition amongst Operating Companies' have been prominent features in discussions related to PT, seen as strong performance drivers (as described in Section 2.2.2). The GDPT shows a different scenario though. It is true that these two features are shortlisted; however, they hardly made the cut. Experts seem to have concluded that these features are less impacting.

Noted absences. 'Regulatory agency or capability (watchdog)' and 'Business structure of operating companies (formal versus informal paratransit models),' included in the inventory produced in Round 1, have been also at the centre of recent policy and academic debates. Nonetheless, they were not shortlisted in Round 2.

Other interesting aspects involving organisational features emerge in Round 3.

Coordination at the core – the consolidation versus fragmentation debate strengthened. Consistently with Round 2, PT features of integration (either tasks or system characteristics) are emphasised by experts. These features are four of the five with highest average score, and a low percentage of experts attributed a 'zero score' to any of them.

Interactions and overlaps. The position of PT policy design and planning as important drivers of performance was strengthened when average points are considered. Interactions and overlaps may have contributed to this outcome, as seen from some comments provided by experts: '*My inclusion of 'Long-term Strategic Plan' assumes that the plan was developed with robust engagement of local and state agencies that provide policy and funding guidance as well as agencies and functions that have an impact on (leverage) transit operations – land use, economic development, housing, etc.*'

Dissention in relation to funding. Round 3 shows mixed results in relation to the importance attributed by experts to funding practices: whilst this feature received the second highest amount of points, it also shows the highest standard deviation amongst all features. This repeats the situation observed above with the performance indicator 'User Satisfaction.' It may be a result of how questionnaire three was framed, proposing a selection of features for a comparative study – maybe experts consider fare and ticketing integration less informative if used for this purpose.

A confirmed consensus. Once again, there is some consensus on the relative lack of relevance of 'Awarding Mechanism Employed' and 'Competition amongst Operating Companies.' Both remained at the bottom of the ranking after votes in Round 3. Not only they received fewer points, but also opinions in relation to these two features are less dispersed (they show the lowest standard deviation rates) and they received 'zeros' from 48% and 50% of respondents respectively.

Ranking changes. 'Policy Integration (cross-sector links with other govt. areas)' topped the ranking in terms of points received, whilst 'Integrated Fare and Ticketing,' which had the highest percentage of votes in Round 2, moved to the fifth position. One possible explanation is the framing of the question in Round 3, as speculated above concerning the dissention in relation to funding.

2.4.3 Experts and Method

The GDPT combined elements of a Policy Delphi (evoking multiple conflicting views on issues) and a ranking-type Delphi (building authoritative ratings). It was effective in gathering a diverse set of experts and it promoted a qualitative exercise – by design not statistically significant – with results that could hardly be achieved through a different method. The periodic feedback helped in keeping experts engaged, and the high response rates testify to this. In addition to the feedback reports, a dedicated blog was created and used to post survey's details and updates. Finally, by introducing the point allocation methodology instead of a simple ranking question in the last round, the GDPT does not only measure consensus among voters', but also allows more analyses with recourse to simple parametric statistics.

Difficult trade-offs were faced during all phases of the survey. Selecting experts for the panel involves choosing between engaging a large, more diverse set of respondents,

or a smaller group ensuring closer contact and higher chance of commitment by experts – whilst the first route was chosen for the GDPT, a substantial effort was made to keep participants engaged (e.g. with the dedicated blog). Moreover, communications with experts had to ensure adequate provision of information whilst avoiding unnecessary long messages or questionnaires that could discourage participation of experts with limited time. Finally, coding in Round 1 was challenging and time consuming. It involved two conflicting tasks: consolidation and no excessive generalisation of answers – that would defeat the purpose of the Delphi.

Some limitations are inherent to the Delphi methodology. On a procedural level, it is not possible to claim that all relevant experts were included in the panel. Databases may be incomplete; conferences, journals and other fora may not encompass geographically diverse members; and experts may not have been recommended due to personal reasons. However, panel-building in the GDPT observed best practices (Delbecq et al., 1975; Marchau & van de Linde, 2016). Language may also influence the outcomes of the survey: questionnaires were written in English, a possible source of difficulty for non-native speakers. This was chosen in the GDPT to guarantee that all experts were answering to the exact same questions. Particularities involving professional jargon may also have been a source of misinterpretations, both by the Delphi participants and by the coordinating team. In terms of content, the process of managing the survey involves a great deal of subjectivity. The survey coordinator has a crucial role structuring the dialogue between experts and supporting the articulation of their opinions. In the GDPT, cross-checks amongst authors were used to increase the impartiality of the coordinating role when coding responses. Finally, whilst the Delphi promotes breadth, results may lack in depth. The limited time availability of experts, the need to maintain questionnaires concise, and the lack of direct interaction lead to less detailed accounts than what can be achieved with, for example, personal interviews (Van Dijk, 1990).

2.5 Conclusion and future research

Despite involving difficult trade-offs, the choice and use of the Delphi method in this study were successful, producing new and rich data. The GDPT gathered and articulated the views of diverse actors: around 60% of which are practitioners, and 40%, academics, across different technical disciplines and world regions. By eliciting expert opinion to build authoritative inventories and ratings of core performance indicators and organisational features in PT, the GDPT defines performance metrics suitable to measure strategic PT outcomes and organisational features that drive strategic outcomes.

In relation to performance, system-wide indicators were consistently preferred by experts as metrics to assess PT. In relation to organisational features, the GDPT's results

emphasise the importance of integration on policy and strategic planning levels, as well as in relation to system's tasks and components. On a more micro perspective, three performance indicators in particular were clearly underscored: 'User Satisfaction,' 'Cost-recovery Ratio,' and 'Modal Split' (although views on the relevance of the first show important levels of dissension). Concerning organisational features, policy and planning integration features dominated the rating: 'Policy Integration: cross-sector links with other government areas;' 'Integrated Planning: multimodal and multijurisdictional agency or capability;' and 'Integrated Fare and Ticketing.' Funding practices were also highlighted as relevant performance drivers, but experts' opinions in this respect were less consensual. On the other hand, 'Awarding Mechanism Employed' and 'Competition amongst Operating Companies' have, according to consulted experts, a less predominant role as performance drivers.

The results produced can serve as input for future research on the dependencies and interactions amongst PT organisational and performance elements, considering the approach suggested in Section 2.2.3. A number of routes can be adopted to build on and complement the GDPT's findings, and it is interesting to further develop the findings of a Delphi with additional methods that can complement the survey – workshops or case studies, for instance (de Loë, 1995). One possibility is to organise a workshop bringing together some of the participating experts to further discuss the results achieved, interpret the initial conclusions proposed in this study, and draw new lessons. Alternatively, the same can be done via separate interviews with these experts. The direct interaction with experts, which was not possible in the GDPT, can help deepening the understanding about their views and elucidating possible misinterpretations occurred in the online survey environment. A third possible route is to employ the study of cases. Both across-case comparison and within-case analysis can shed light on the relationship between organisation and performance, using the variables selected by experts in the GDPT. Comparing cases might reveal contextual particularities that are also relevant and might not have been identified in the survey. Furthermore, the use of cases permits incorporating the longitudinal dimension of analysis, and thus to draw lessons derived from the way PT systems have evolved in time. These two sets of insights (context and time) can be powerful tools for complementing the GDPT and help establishing causal links between organisation and performance in PT.

Annex: Inventory of performance Indicators and Organisational Features

A. Performance Indicators Listed by Experts in the First Round of the Delphi:

SUPPLY		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
1. Vehicle km or seat km	7%	a) Total number of vehicle km or seat km (at peak hour).
2. Vehicle km ratios	9%	a) Per capita. b) Per route km/operating day. c) Per vehicle.
3. Length of network	< 5%	a) Total route km per capita.
4. Operating Hours	7%	a) Service hours per capita.
COST AND REVENUE		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
5. Total Revenue and Total Cost	13%	a) Total Revenue (and total fare box revenue) and Total Cost (and total operating cost).
6. Total (and operating) costs ratios	28%	a) Per vehicle km. b) Per vehicle hour. c) Per boarding or per journey (linked trip). d) Per vehicle km per hour. e) Per vehicle. f) Per capacity km. g) Per passenger km. h) Per mode. i) Maintenance cost per vehicle.
7. Labour	5%	a) Vehicle hours per employee. b) Revenue vehicle hours per operator employee hours. c) Revenue per employee. d) Vehicle km per maintenance employee. e) Revenue vehicle hours per adm. & professional employee. f) Vehicle km per employee.
8. Total (and fare box) revenue ratios	19%	a) Per vehicle km. b) Per passenger km. c) Per boarding or per journey (linked trip). d) Per line. e) Per ticket type. f) Per PT mode. g) Per area.
9. Other	5%	a) Total extra-operational revenue. b) Fuel Consumption per vehicle c) Vehicle hour per service hour.

FINANCIAL SUSTAINABILITY		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
10. Cost recovery or subsidy level	37%	a) Cost-recovery. Operational revenue (fare revenue and fare substitute payments) in relation to operational costs and all costs (operating costs plus capital charge) with explicit indication of compensation payment (e.g. for concessionary travel). b) Subsidy Level. Percentage of operational costs subsidized by the government. c) Operating deficit per capita. d) Fiscal Solvency.
11. Cost per passenger ratios	24%	a) Total cost (fixed and variable) per passenger km (weighted values). b) Capital cost (equivalent average annual cost) per passenger. c) Operating cost per paid passenger km. d) Operating cost and subsidy per boarding.
12. Investment	< 5%	a) Per capita spending on PT (operating and capital budgets) compared to investment in other transport modes. b) Share of urban transport investments used for PT (3 or 5 years running average).
USAGE		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
13. Total Ridership	19%	a) Count of boardings and journeys (linked trips) by location and time of the day.
14. Ridership ratios	35%	a) Ridership per capita: boardings and/or journeys (linked trips) per capita. b) Total passenger km (at company or route level). c) Count of passengers by socio-economic groups.
15. Modal Split	39%	a) Ratio of PT usage (both by trips and passenger km) in relation to other modes (motorized or not) or comparison between different PT modes.
16. Occupancy Ratios (average or daily)	37%	a) Passenger per vehicle. b) Boardings per vehicle operating hour. c) Boardings per vehicle km. d) Passenger km per vehicle km. e) Passenger per vehicle km. f) Passenger km per place km (sitting and standing places). g) Passenger km per route km. h) Vehicle km (including dead running) per boarding.
17. Car ownership	< 5%	a) Per capita automobile ownership and use.
SERVICE QUALITY AND USER SATISFACTION		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
18. Users' access to Information	11%	a) Ease of access to information. Quality and usefulness of information regarding network map, scheduled services, quality and timeliness of information on service disruptions.

19. Punctuality and Reliability	46%	a) On-time performance according to timetable. b) On-time performance based on users' perception. c) Reliability of Headways or Excess Waiting Time (train headways or average excess waiting time on selected bus routes (measure at stop level). d) Compliance to programmed offer of services. e) Breakdown Ratio: mean km before failure or breakdown rate per distance (per period). f) State of Good Repair: assets and systems are maintained to a given standard and available for service.
20. Travel Time Measures	24%	a) Ratio between travel time in PT and car. b) Average in-vehicle travel time. c) Average route time between terminal stations during peak-hour. d) Average travel times by origin and destination (in different times of the day, to achieve measure of congestion). e) Percentage of passengers with travel time up to 30 minutes. f) Average time waiting plus trip time plus time accessing destination. g) Total travel time divided by the total number of passengers (weighted values).
21. Operating speed	11%	a) Average operating speed (overall and per transport mode).
22. Transfers and Connectivity	7%	a) (Average) boardings per journey for selected origin-destination pairs or measure of transfer waiting times.
23. Comfort	18%	a) Average occupation of standing passengers per square meter (during peak hour), fleet conditions (age, cleanliness etc.), and fleet characteristics (air-conditioning, Wi-Fi etc.).
24. Safety	22%	a) Ratio of staff and users injured or killed (per service-km or per trips). b) Regional per capita traffic fatality rates. c) Reach the 5% best world benchmarks.
25. Security	5%	a) Ratio of staff and users victims of crimes while in the system.
26. User Satisfaction, Acceptability and Complaints	39%	a) Index of overall user satisfaction: based on multiple criteria (punctuality, accessibility, connectivity, comfort, cleanliness, perceived safety, etc.). Measured through regular surveys with users and non-users. b) Number (and description) of complaints in relation to total number of passengers. c) Share of customized vehicles
27. Other	< 5%	a) Route numbers per service hour. b) Level of Transport Infrastructure idleness.
ACCESSIBILITY IMPACTS		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
28. Access to Destinations	9%	a) Number of opportunities and services that can be reached by public transport within a given time or distance.

29. Access to PT	33%	a) Average walking time or distance to access selected routes. b) Percentage of inhabitants (or users) who live within walking distance of frequent transport service. c) Number of stations or bus stops per square km. d) Distance between PT stops.
30. Fairness and Affordability	28%	a) 'Access to Destinations' measure for low income population. b) 'Access to PT' measure for the bottom 40% *'increase social inclusion and reduce inequality.'* c) Percentage of income or household budget (of low income or lowest quartile) spent on transport. d) Percentage of immobile. e) Percentage of poor served by subsidies. f) Average fare per passenger km. g) Average fare relative to petrol costs for medium-size car for short, medium and long trips (to be defined).
31. Universal Design	9%	a) Percentage of stations/stops or terminals with facilities such as on level boarding / escalators and lifts.

WIDER IMPACTS (SOCIAL, ECONOMIC AND ENVIRONMENTAL)

Cluster	Mentioned by	Experts' Description and Comments (if applicable)
32. Emissions	22%	a) Levels of air pollutants and noise nuisance per passenger km. b) Avoided CO2 emissions per passenger km in relation to CO2 emission per km by car. c) Percentage of zero or low emission vehicles in the fleet. d) Ratio of passengers transported in hybrid, electric and alternative fuel vehicles. e) Total emissions reduced in the urban transport sector and amount of reduced emissions transferred to monetary savings.
33. Energy usage	< 5%	a) kWh/person-km. b) By time. c) By source.
34. Econ. Activity, Community and Regional Develop.	< 5%	a) Ratio of operators' income (contract payment) reinvested in local communities and regions and not sent interstate or offshore. b) Economic activity indicators
35. Public health	< 5%	a) Indicators for measuring impacts in public health and safety.
36. Accountability	< 5%	a) Quality of operational data to users, communities and researchers.

OTHER

Cluster	Mentioned by	Experts' Description and Comments (if applicable)
37. Staff turnover	< 5%	a) Percentage of staff turnover per passengers
38. Priority to PT	< 5%	a) Share of PT network where measures to give PT priority are adopted. b) Share of infrastructure dedicated to PT in relation to that dedicated to individual modes.

B Organisational Features Listed by Experts in the First Round of the Delphi:

PT INITIATIVE AND FUNDING		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
1. Initiative and Responsibility for PT	7%	a) The legal right/responsibility to initiate and regulate PT: sector is regulated and state defines entry rules or deregulated and admits market autonomous initiative. b) Level of Government with PT Responsibilities.
2. Funding Framework	30%	a) Source, availability, autonomy/control of funding for PT.
3. Commitment to PT	11%	a) Level of Political Commitment. *'In case of a higher level of political commitment the institutions will be more powerful (I hope).'* *'Transportation should be a major concern of the decision makers, and its administration trusted to competent professionals.'* b) Leadership: existence of Champion to advance PT agenda. c) Level of Investment in public transport per year. d) Adoption of public transport priority features over private modes.
PLANNING		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
4. PT Plans	15%	a) Long-term Strategic Plan. Defining long-term quantitative and qualitative mobility goals and ensuring short-term decision-making is consistent with these goals. b) Annual Service Plan. c) The Tools for Planning and Evaluation.
5. Planning Responsibilities	41%	a) The Allocation of Planning Responsibility b) Multimodal and multijurisdictional Integration of PT Planning. Agency or Integrated Strategic Planning Capability integrating the planning of all PT modes within the metropolitan area or region and integrating all involved jurisdictions.
6. Cross-sectoral Links	22%	a) Policy Integration: Coordination between government entity responsible for PT and other government levels and policy bodies/areas (Land Use, Road, Environment, Urban Development etc.).
7. Government Entity Responsible for PT: Governance and Organisational Structure	24%	a) Procedure for Board and Management Members Selection (political appointment, election, merit-based etc.) and who it is accountable to. b) The Decision-making process. c) Concentration or Fragmentation of management structure in different layers. d) The Departmental Structure / Organisational chart indicating internal structure and responsibilities. e) Cross-organisational coordination and learning. f) The number of staff.

OPERATIONS		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
8. Operational Responsibilities	13%	a) Responsibility for Service Design, including definition of timetable, and Degree of Operational Control. b) Responsibility for Asset Management. c) The use of part-time transport operating companies for peak hours.
9. Transport Operating Companies: Ownership and Business Structure	20%	a) Nature: Private, public, mixed-capital, special-purpose company etc. b) Business structure: formal business structure versus informal paratransit business model. c) Annual O&M costs (size of organisation). d) Percentage of non-operational staff. e) Share of employees with pension rights etc. under no-termination contracts.
10. Operations Market Structure and Characteristics	22%	a) Competition Amongst Transport Operating Companies (existing or potential new entrants) – concentration/ fragmentation of Market. b) Allocation of Ownership of long-life assets (such as garages or depots, terminals etc.). c) Size of the area over which PT is provided.
CONTRACTING PRACTICES		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
11. Tendering	39%	a) Awarding Mechanism Employed: Competitive tendering, direct award, performance-based award etc. b) Adoption of International Tendering. c) Periodic competitive tendering. d) Tendering Unit or Capability: competent team responsible for procurement of both materials from suppliers and services, applying consistent and transparent rules to all bidders. e) Transparency of the tender process and of the remuneration of transport operating companies. f) Complexity of Services to be procured. g) Involvement of Private Sector and Proportion of PT operated by private providers.
12. Contractual Regime and Elements	30%	a) Allocation of Risks and Incentive Structure. b) Use of contracts with both private and public transport operating companies. c) Length of contract with transport operating companies.
CONTROL AND ACCOUNTABILITY		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
13. Transparency of institutional setting and regulatory framework	11%	a) Clear legal and regulatory frameworks including clear mandates and performance expectations in relation to all actors.

14. Regulation	24%	a) Regulatory Agency or Capability (watchdog). b) Conflict Resolution Body: Entity responsible for conflict resolution between government entity responsible for PT and transport operating companies. c) Use of Price Regulation. d) Pro-active law enforcement – criminal and traffic related incidents.
15. Social Control	>5%	a) Consulting Forum for Control of Management. b) Visibility of elected officials.
16. User Orientation	17%	a) Community and User Outreach: Established mechanisms for consultation and communication with community and users. b) 'Urban Mobility Observatory'.
17. Budget constraints	>5%	a) Adoption of Budget Constraints

OTHER INTEGRATION AND FRAGMENTATION FEATURES

Cluster	Mentioned by	Experts' Description and Comments (if applicable)
18. System Integration	35%	a) Integrated fare and ticketing (clearinghouse functions). b) Degree of Vertical Integration (Infrastructure and Operations). c) Integrated information system. d) Integration of Feeder services and connection times. e) Ability to interact with industry (entities such as taxi companies and bike sharing).
19. Other Integrating Bodies	<5%	a) Use of Infrastructure Coordinator. b) Use of Financial Authority.
20. Separation of Responsibilities	20%	a) Separation of Planning and Regulating responsibilities. b) Separation of Planning and Operating responsibilities. c) Separation of Planning and Funding Responsibilities. d) Separation of Funding and Operating responsibilities.

PEOPLE AND RELATIONSHIPS

Cluster	Mentioned by	Experts' Description and Comments (if applicable)
21. Staff Elements	28%	a) Skill set and technical expertise of staff. b) Professional development: programs for recruiting, training, and retaining staff. c) Degree of gender diversity in staff of transport operating companies. d) Workforce relations.
22. Trust, Partnership and Communication	11%	a) Trust/Partnership/Communication between government entity responsible for PT and transport operating companies. b) Degree to which information is shared amongst transport operating companies.

OTHER		
Cluster	**Mentioned by**	**Experts' Description and Comments (if applicable)**
23. Fare Setting, Review, and Collection	11%	a) Allocation of fare tasks; fare practices.
24. Level of innovativeness	7%	a) Ability of government and operating companies to incorporate innovative practices and new technologies, including the use of information technology systems.

Chapter 3

Organisation and performance of public transport: a systematic cross-case comparison of metropolitan areas in Europe, Australia, and Canada*

* The content of this chapter has been published as Hirschhorn, F., Veeneman, W., van de Velde, D., 2019. Organisation and performance of public transport: A systematic cross-case comparison of metropolitan areas in Europe, Australia, and Canada. Transp. Res. Part A Policy Practice 124, 419–432. The final publication and supplementary online material are available at https://doi.org/10.1016/j.tra.2019.04.008.

Abstract

The chapter investigates how the interplay between six organisational elements of public transport systems (conditions) – i.e. integration of planning responsibilities within an authority at the regional/metropolitan level; land-use and transport integration; long-term metropolitan public transport planning; agency over funding; fare integration, and allocation of risks between government and operators – influences two key performance indicators (outcomes) – modal split and cost-recovery. The study focuses on selected metropolitan areas in Europe, Australia, and Canada, and employs Qualitative Comparative Analysis (QCA). QCA can handle multiple explanatory conditions in combination, framing the relationship between conditions and studied outcomes in terms of necessity and sufficiency. The chapter reveals three alternative combinations of organisational elements that are sufficient for achieving each outcome, underscoring that modal split and cost-recovery depend on the combined effects of multiple conditions (conjunctural causality), and that different paths can lead to similar results (equifinality). Furthermore, even though both outcomes are linked to higher usage of public transport, findings suggest that each of them might require decision-makers to give attention to different elements. Higher modal split is closely linked to both integration between land-use and transport, and the integration of planning responsibilities within an authority at the regional/metropolitan level. Higher cost-recovery, in turn, requires focus on the way agency over funding and risk allocation strategies shape incentives for savings and/or revenue generation.

3.1 Introduction

This chapter contributes to the literature on the governance of metropolitan public transport (PT) and, in particular, the discussions concerning the connection between organisational form and performance (e.g. Hensher and Stanley, 2008; Preston and Almutairi, 2013; Sørensen and Gudmundsson, 2010). The underlying assumption in this literature is that elements of the organisation of PT, such as the ownership structure of operators (public or private), contractual allocation of risks, and fare integration might influence the achievement of performance goals (like sustainability or accessibility for example). These studies examine the links between the introduction or reform of PT organisational elements and variations in performance indicators (e.g. changes in levels of emissions/passengers or in number of passengers).

Existing work in this field often takes an incremental view though, and tries to isolate the performance outcomes potentially brought by the introduction or reform of one single element of PT organisation. Whilst these analyses provide relevant insights, this chapter takes a different approach. Recognising that PT is a complex system made up of interacting and interdependent elements and actors (Macmillen, 2013), and that PT's governance is wicked (Marsden & Reardon, 2017), this study focuses on the combined effects that multiple elements of PT organisation have on performance outcomes.

By building on Chapter 2, this study examines six elements of the organisation of PT – i.e. integration of planning responsibilities within an authority at the regional/metropolitan level; land-use and transport integration; long-term metropolitan PT planning framework; agency (decision power) over funding; fare integration; and allocation of risks between government and operators – as potential explanatory factors (or conditions) of two key performance indicators (outcomes): modal split and cost-recovery. The chapter aims to answer *what (combinations of) elements of the organisation of PT are sufficient conditions for higher levels of modal split and cost-recovery*. To this end, two models are developed. The first, for the outcome modal split, compares twenty-two cases: eleven metropolitan areas are examined, each, in two distinct moments in time, 2005 and 2015. The second model, for the outcome cost-recovery, compares fourteen of the first twenty-two cases: seven metropolitan areas are examined, each, in 2005 and 2015.

Methodologically, the chapter responds to calls for more qualitative and mixed-method research in PT (Marsden & Reardon, 2017; Schwanen, Banister, & Anable, 2011) and employs Qualitative Comparative Analysis (QCA) (Ragin, 1987, 2008). QCA is well-suited for the study of complex policy and social phenomena in case studies (Blackman, Wistow, & Byrne, 2013; Byrne, 2013; Gerrits & Verweij, 2016). The method tackles complexity using set-theory and Boolean algebra techniques, and can identify minimally sufficient combinations of conditions for the outcome(s) of interest.

Additionally, QCA can account for conjunctural causation and equifinality, i.e. QCA recognises that most often, it is the interplay of several conditions that leads to an outcome and, furthermore, different combinations of conditions may lead to the same outcome.

Section 3.2 contextualises this study within existing PT research. Section 3.3 introduces the methods used. The operationalisation of outcomes and conditions is explained in Section 3.4, whilst Section 3.5 presents results of the analysis. Section 3.6 critically assesses these results, followed by conclusions in Section 3.7.

3.2 Public transport performance and the influence of organisational elements

PT performance can be understood in two dimensions. A first broader dimension relates to public values and the goals society expects government to achieve in a policy area (Jørgensen & Bozeman, 2007; Koppenjan, Charles, & Ryan, 2008). In PT, they can be sustainability, accessibility, minimisation of public subsidies etc. These PT goals translate, broadly speaking, into two often opposing types of objectives: increased ridership (goals that depend on increasing usage) and coverage (goals that depend on amplifying the availability of services despite low usage) (Faivre d'Arcier, 2014; Walker, 2008). The second dimension of performance refers to the translation of those broad goals into quantitative metrics. These metrics are performance indicators, such as emissions/passenger or average distance to PT stops.

Well-established literature investigates how PT performance, measured by performance indicators, can be influenced by different elements of the organisation of PT systems, such as the ownership structure of operators (public or private), contractual allocation of risks, integration or fares (e.g. Hensher and Stanley, 2008; Preston and Almutairi, 2013; Sørensen and Gudmundsson, 2010). In this context, Chapter 2 developed an international Delphi survey, consulting experts across academia and industry to identify and rate (i) key performance indicators and (ii) main organisational elements in PT able to drive a system's performance. Results show that experts emphasise ridership-related performance indicators, with PT modal split and cost-recovery amongst the top rated. The first indicator refers to the ratio of PT usage in relation to overall usage of (motorised) transport modes, and is indicative of PT's attractiveness to users. The former indicator refers to the ratio between revenues coming from passenger fares and overall operating costs, and is indicative of PT's financial sustainability. Concerning organisational elements, in turn, results from Chapter 2 highlight the integration of planning responsibilities within an authority at the metropolitan level; policy integration between land-use and transport; the development of long-term PT

plans; availability and stability of funding; ticket and fare integration, and risk allocation strategies. In light of these results, this chapter examines how these six elements of PT organisation influence the performance indicators modal split and cost-recovery. A brief review of related literature follows.

Integration has become a key guiding principle for transport policies' institutional and structural development over recent decades (Potter & Skinner, 2000). Transport integration is a multifaceted concept though, and can take many forms (Hull, 2005; May, Kelly, & Shepherd, 2006; Preston, 2010; Stead & Geerlings, 2005). One type of integration refers to the consolidation, within one authority, of responsibilities for planning multiple PT modes at the regional/metropolitan level. Kumar and Agarwal (2013), Marsden and May (2006), and Pemberton (2000) advance that PT services can achieve better results when planning is done by an overarching organisation with authority over an area corresponding to major commuter patterns. Such an integrated planning authority, they claim, can avoid conflicting directions from overlapping planning agencies, make policy implementation more coherent, and avoid harmful competition between modes. Authors also call for integration between PT and other policy areas (such as environment or health) (Hull, 2008; Stead & Geerlings, 2005). In this context, the integration between land-use and transport policies, in particular, is seen as core in urban areas (Stanley, 2014), given the strong connection between the built environment and travel patterns (Ewing & Cervero, 2010; Van Wee, 2002; Zegras, 2010). Hickman et al. (2013) and Cervero (2013) point that good integration between urban planning and transport is critical to allow greater PT usage, walking and cycling, whilst Stanley (2014) points that it can also enable greater accessibility and social inclusion. Finally, at the tactical level (van de Velde, 1999), the integration between schedules, ticketing, and fares etc. can help make PT systems simpler for passengers to understand and use, consequently leading to higher ridership levels (Chowdhury, Hadas, Gonzalez, & Schot, 2018; Redman, Friman, Gärling, & Hartig, 2013; Sharaby & Shiftan, 2012). These three types of PT integration are accounted for in this study through the conditions *Integrated Planning Authority*, *Land-use and Transport Integration*, and *Fare Integration* (see Section 3.4.3).

The preparation and adoption of long-term metropolitan PT plans and an enabling funding framework are two other factors that can favour better performance. Authors recognise long-term PT plans as critical tools to define clear goals and mission to authorities, setting a long-term vision for PT and how it is supposed to achieve the political goals determined by government. These plans may include issues such as the profit and market share aims, the general description of the services, the area of supply and target groups and also plans for important network elements such as definition of major corridors or interchange hubs (Nielsen et al., 2005; van de Velde, 1999). Long-term plans can promote the stability of transport strategies and of a high quality service,

influencing positively transportation patterns and, thus, helping the implementation of an integrated and more attractive PT system (Gwilliam, 2003; May, 2004; Nielsen & Lange, 2007). Similarly, an enabling funding framework ensuring availability and stability of resources is core for PT performance (Bouf & Faivre d'Arcier, 2015; Hess & Lombardi, 2005). Litman (2014) and Faivre d'Arcier (2014) emphasise that earmarked sources of subsidy increase funding autonomy and predictability, as they constitute secure resources to improve the quality of PT supply. Veeneman et al. (2015) highlight how the realisation of public goals in PT is hindered when funding and decision-making take place in different government levels. These two organisational elements (long-term planning and funding framework) are accounted for in this study through the conditions *Long-term metropolitan PT planning framework* and *Agency (decision power) over funding* (see Section 3.4.3).

Concerning risk allocation strategies between government and operators, studies focus on possible performance outcomes connected to the use of different awarding mechanisms, or of different contractual forms regulating service provision and remuneration (broadly speaking gross-cost and net-cost contracts), as well as the influence of the ownership of operators (public or private). These analyses show mixed results: Mees (2005) concludes that Melbourne's urban rail and tram systems' privatisation and franchising contracts failed to deliver expected increases in ridership and cost-savings. Roy and Yvrande-Billon (2007) find that private bus companies regulated under gross-cost contracts are more efficient than operators under net-cost contracts. Mizutani and Urakami (2003) conclude that public bus companies are less efficient than private companies, whereas no significant differences are found by Filippini and Prioni (2003). Filippini et al. (2015) compare bus lines operated under competitively tendered contracts and performance-based negotiated contracts and their overall results show no considerable cost-efficiency differences. Risk allocation is accounted for in this study through the condition *Risk Allocation to Operators* (see Section 3.4.3).

All literature described above offers important insights to support PT policy decisions. However, these studies often takes an incremental view and isolates the impacts that the introduction or reform of a single element of PT organisation has on performance. This approach might be the result of the predominance in public transport research of an emphasis on a few disciplines and quantitative methods, eventually overlooking some critical aspects shaping PT governance and decision-making (Marsden & Reardon, 2017; Schwanen et al., 2011). Like other social science and policy problems, understanding the relation between the governance of PT and performance requires a complexity-informed view, acknowledging that outcomes depend on the interaction between multiple system elements and context characteristics (Blackman et al., 2013; Verweij & Gerrits, 2012). This is the case with PT, which is made up of interacting and interdependent elements such as infrastructures, technology, social norms, and

regulations. PT, thus, cannot be understood as reducible to stable and deterministic relationships between variables (Macmillen, 2013).

Furthermore, PT governance is wicked and decision-making involves networks of multiple actors with diverse and sometimes conflicting perspectives in relation to the goals they expect public policies to achieve (de Bruijn & Dicke, 2006; Koppenjan et al., 2008; Thacher & Rein, 2004). Good PT performance depends on the perspective of the stakeholder considered (Faivre d'Arcier, 2014). Furthermore choices between ridership and coverage objectives, or even the alignment between different ridership objectives, entail trade-offs (Walker, 2008). Even though modal split and cost-recovery are both ridership-related indicators, and thus with a tendency to be positively affected by growth in PT usage, they may not always align. Vassallo et. al (2009), for instance, have found that despite a significant increase in PT ridership in Madrid between 1996 and 2004, modal split only increased in trips between the centre and the periphery, whereas it decreased in trips within peripheral areas. Additionally, cost-recovery levels dropped due to increasing subsidies.

Recognising the importance of the interplay between PT's systemic elements and its context, as well as the wicked nature of PT governance, this chapter seeks new insights on key mechanisms connecting organisation and performance in PT. To this end, and responding to calls for more mixed-method research in public transport, the chapter combines qualitative and quantitative data and employs QCA.

3.3 Methods

3.3.1 Qualitative Comparative Analysis

QCA (Ragin, 1987, 2008) is particularly suited for the analysis of complex social phenomena and wicked policy issues (Blackman et al., 2013; Byrne, 2013; Gerrits & Verweij, 2016). QCA can account for conjunctural causation and equifinality: the method recognises that most often, it is the interplay of several conditions that leads to an outcome and that different paths may lead to the same outcome. This is possible due to QCA's set-theoretic nature. Conditions and outcomes are defined as sets in which cases have a membership score, and cases, in turn, are operationalised as configurations constituted by these conditions. QCA then works by systematically comparing cases' properties (the outcome and conditions) to identify set-relations between them, and frames this relationship in terms of sufficiency and necessity (Rihoux & Ragin, 2009; Schneider & Wagemann, 2012). A (combination of) condition(s) is sufficient if it can lead to the outcome by itself, although other (combination of) condition(s) can also lead to the same outcome. A (combination of) condition(s) is necessary if it is always present when the outcome occurs, but it does not ensure the outcome will happen.

Operationally, QCA can be broken-down into the following steps: calibration; analysis of necessity; construction of the truth table, and Boolean minimisation of the truth table for the analysis of sufficiency.

Calibration is the process by which the researcher, relying on substantive knowledge, converts raw case data into set membership scores defining if a case is either in or out of the set (membership score of 1 or 0). The fuzzy-set variant of QCA (fsQCA) can account for non-perfect superset/subset relation, and fuzzy membership scores can take any value between 0 and 1, where 0 indicates full non-membership, 1 indicates full membership, and 0.5 is the crossover point where there is a maximum ambiguity regarding whether a case is more in or out (Ragin, 2009). With fuzzy set calibration a researcher can bridge the quantitative assessment of degree of membership between 0 and 1 and qualitative differentiation of cases between full membership, full non-membership and the points where cases are more in a given set than out (Ragin, 2008). As a result, fsQCA is able to model quasi-necessity or quasi-sufficiency probabilistically: a (combination of) condition(s) is sufficient for the outcome if its presence (nearly) always leads to an outcome, whereas a (combination of) condition(s) is necessary if it is (nearly) always present when the outcome is observed (Skaaning, 2011; Thomann & Maggetti, 2017).

After calibration, the researcher should check if any condition is necessary for the outcomes, i.e. if any condition is a superset of the outcome. QCA proceeds, then, with the analysis of sufficiency (the main focus of this chapter), by building a truth table. In a truth table, each row displays a logically possible combination of the conditions under analysis, considering both their presence and absence (negation). With six conditions the truth table has 64 rows (i.e., 2^6). Finally, the truth table is minimised using Boolean techniques, and rows are compared to eliminate logically redundant factors: "*If two Boolean expressions differ in only one causal condition yet produce the same outcome, then the causal condition that distinguishes the two expressions can be considered irrelevant and can be removed to create a simpler, combined expression.*" (Ragin, 1987, p. 93). This process reveals all minimally sufficient combinations of conditions for the occurrence of the outcome.

3.3.2 Case selection

In QCA, it is important to include cases that vary both in relation to hypothesised conditions and outcomes analysed. This, however, cannot be done at the expense of a reasonable degree of comparability to ensure that effects of alternative explanatory conditions are alleviated (Toshkov, 2016). The cases in this chapter are PT systems in metropolitan areas (i) from Western economies, (ii) from high income countries (as defined by the World Bank's indicator of Gross National Income per capita); (ii) from member-countries of the Organisation for Economic Co-operation and Development

(OECD), and (iii) with a population size between 1.5 and 5.5 million inhabitants and population density below 1,500 persons per square-km in 2014 (OECD).[1]

Two additional steps complemented case selection. First, cases meeting the criteria above were assessed taking into account research design issues, particularly availability of data and the ease to find local experts for interviews. Potential interviewees were then contacted, and the final list of cases was formed by those metropolitan areas in which interviewees agreed to collaborate: Amsterdam, Berlin, Birmingham, Helsinki, Madrid, Melbourne, Montreal, Oslo, Stockholm, Turin, and Vancouver. The QCA model developed for modal split includes data of these eleven metropolitan areas in 2005 and in 2015, resulting in 22 cases. The QCA model developed for cost-recovery, in turn, looks at data from seven of these metropolitan areas, again in 2005 and 2015, totalling 14 cases.

3.4 Calibration

3.4.1 Fuzzy-set calibration

This study adopts fsQCA since it allows for a more nuanced operationalisation of outcomes and conditions. The main task of the researcher during calibration is to define three qualitative anchors: full membership (1), full non-membership (0), and the crossover point (0.5). These choices should be grounded on substantive and case knowledge. Parameters of underlying raw data (such as prominent gaps) can help as supplementary input for calibration decisions. Other practical guidelines include avoiding the definition of overly skewed sets or scores exactly on the crossover point (Schneider & Wagemann, 2012; Thomann & Maggetti, 2017; Vis, 2009). The calibration of quantitative interval-scale data can follow different techniques. The direct and indirect methods (Ragin, 2008) rely on software support. Another option, described by Schneider and Wagemann (2012) and Verkuilen (2005), is to assign fuzzy-scores based on categorical differences between cases. In this chapter, the outcomes are calibrated using the latter technique. The calibration of qualitative information, in turn, is less formalised in QCA literature, but guidelines exist (e.g. de Block and Vis, 2018; Legewie, 2017). For the calibration of the six conditions, the chapter develops fuzzy-scores building on the literature presented in Section 3.2. The next sub-sections and Table 3.1 explain the calibration of outcomes and conditions. Table 3.2 presents the final calibrated data. Online Material contains supplementary calibration information and summaries of the cases studied.

[1] World Bank data available at: https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD. OECD data available at https://stats.oecd.org/Index.aspx?Datasetcode=CITIES (access on April 2018).

Table 3.1: Calibration

Sets	Definition	Calibration thresholds		Scoring
Outcomes	Membership in the set of cases with higher levels of modal split of PT (**SPLIT**)[1]	**1.00**: Above 40%. **0.75**: Between 30.1% and 40%. **0.45**: Between 20.1% and 30%. **0.25**: Between 10.1% and 20%. **0.00**: Up to 10%.		Thresholds defined using EMTA and UITP databases. Cases are grouped across five categories based on their modal split ratio.
	Membership in the set of cases with higher levels of cost-recovery (**CR**)[2]	**1.00**: Above 55%. **0.70**: Between 45.1% and 55%. **0.35**: Between 40.1% and 45%. **0.00**: Up to 40%.		Thresholds defined using EMTA database. Cases are grouped across four categories based on their cost-recovery ratio.
	Membership in the set of cases with stronger Integrated Planning Authority (**PA**)[3]	Multijurisdictional	**1.00**: An organisation is established with planning authority over PT in an area corresponding to major commuting patterns covering multiple local jurisdictions (or such area is a single jurisdiction). **0.70**: An organisation is established with planning authority over PT in portion of the area corresponding to major commuting patterns across multiple local jurisdictions. **0.00**: No such organisation exists and PT planning takes place only at the local level.	The condition aggregates two attributes and the final score is their minimum (logical AND). Qualitative case studies (Online Material) support case scoring.
		Multimodal	**1:00**: The integrated planning authority plans modes that carry at least 75% of PT demand. **0.70**: Between 50% and 74.9% of PT demand. **0.35**: Between 25% and 49.9% of PT demand. **0.00**: Less than 25% of PT demand.	

Table 3.1: Calibration (*continued*)

Sets	Definition	Calibration thresholds		Scoring
Conditions	Membership in the set of cases with higher degree of land-use and transport integration (**LUT**)[4]	Institutionalisation of Regional Planning	**1.00**: Regional Planning is institutionalised and regional plans prepared. **0.00**: No institutionalised regional planning or regional plans.	The condition aggregates two attributes and the final score is their minimum (logical AND). Case studies (Online Material) support scoring of the first attribute. EMTA and UITP databases support scoring of the second attribute.
		Mode share walking and biking	**1.00**: Above 42%. **0.70**: Between 27% and 42%. **0.35**: Between 18.1% and 26.9%. **0.00**: Below 18.1%.	
	Membership in the set of cases with metropolitan long-term PT planning framework (**LP**)[5]	**1.00**: A PT strategic planning framework determines the preparation of a long-term PT strategy (10 years horizon at least) at the metropolitan level and also its periodic revision, and/or links the long-term PT strategy to short-term implementation plans. A long-term PT plan is in place and it is not the first time the framework is adopted. **0.70**: Previous requirements apply, however the long-term PT plan is in place for the first time. **0.00**: No PT strategic planning framework. Only *ad hoc* plans.		Qualitative case studies (Online Material) support case scoring.
	Membership in the set of cases with higher degree of agency (power decision) over funding at the regional level (**AF**)[6]	Tax base for PT subsidies	**0.70**: At least 60% of PT subsidies come from local/regional tax base. **0.00**: Less than 60% of PT subsidies come from local/regional tax base.	The condition aggregates two attributes. The final score is their sum. Qualitative case studies (Online Material) support case scoring.
		Earmarked PT funds	**0.30**: At least 20% of PT subsidies are from earmarked sources. **0.00**: Less than 20% of PT subsidies are from earmarked sources.	

Table 3.1: Calibration (*continued*)

Sets	Definition	Calibration thresholds		Scoring
	Membership in the set of cases with higher degree of fare integration (**FI**)[7]	**1.00**: All kinds of tickets (single, daily, season etc.) offer access to all modes and operators. Price does not vary depending on operators used or transfers. This is valid for modes carrying at least 80% of PT demand. **0.70**: A single trip fare varies depending on operators used or whether transfers are required. Only some multi-journey or multi-operator fares allow access to all modes and operators. **0.35**: Fares vary depending on operators used or whether transfers are required. Multi-journey or multi-operator fares may exist, but cover only part of modes and/or operators. **0.00**: Travelling from point A to point B costs the equivalent of the sum of each trip leg.		Qualitative case studies (Online Material) support case scoring.
	Membership in the set of cases with higher degree of risk allocated to operators (**RO**)[8]	Production risk	**1**: Operators bear production risk, or no contract exists and operator is privately owned. **0**: Operator does not bear production risk, or no contract exists with in-house operator.	The condition aggregates three attributes. The final score is their average. Qualitative case studies (Online Material) support case scoring.
		Commercial risk	**1**: Operator bears commercial risk, or no contract exists with privately owned operator. **0**: Operator does not bear commercial risk, or no contract exists with in-house operator.	
		Long-term risk	**0**: In-house operator. **1**: Not in-house operator.	

Main sources used to support the operationalisation of the outcomes and conditions:
(1) EMTA and UITP; (2) EMTA; (3) (Kumar and Agarwal 2013; Marsden and May 2006; Pemberton 2000); (4) (Cervero 2013; Suzuki, Cervero, and Iuchi 2013; Searle 2016; Hickman, Hall, and Banister 2013; Mäntysalo, Kangasoja, and Kanninen 2015); EMTA and UITP for share of biking and walking; (5) (Nielsen et al. 2005; van de Velde 1999; May 2004; Gwilliam 2003); (6) (Faivre d'Arcier 2014; Veeneman et al. 2015; Litman 2014) (7) (Chowdhury et al. 2018; Redman et al. 2013; Sharaby and Shiftan 2012); (8) (Mees 2005; Roy and Yvrande-Billon 2007; Filippini and Prioni 2003)

Table 3.2: Raw outcome data and final fuzzy-scores of outcomes and conditions

Case	Modal Split (%)	Cost-rec. (%)	Outcomes		Conditions					
			SPLIT	CR	PA	LUT	LP	AF	FI	RO
Amsterdam05	16.4	38.2	0.25	0.00	1.00	1.00	1.00	0.00	0.70	0.00
Amsterdam15	23.2	49.8	0.45	0.70	1.00	1.00	1.00	0.00	0.70	0.67
Berlin05	33.3	46.5	0.75	0.70	1.00	0.70	0.70	0.00	1.00	0.75
Berlin15	34.4	55.3	0.75	1.00	1.00	1.00	1.00	0.00	1.00	0.76
Birmingham05	12	--	0.25	--	0.00	0.35	0.00	0.00	0.33	1.00
Birmingham15	14.3	--	0.25	--	0.00	0.00	0.70	0.00	0.33	1.00
Helsinki05	37.8	56.5	0.75	1.00	0.35	0.70	1.00	0.70	1.00	0.33
Helsinki15	39.4	48.3	0.75	0.70	1.00	0.70	1.00	0.70	1.00	0.49
Madrid05	49.5	44.5	1.00	0.35	1.00	0.35	0.00	0.70	0.70	0.47
Madrid15	40.6	51.1	1.00	0.70	1.00	0.70	0.00	0.70	0.70	0.39
Melbourne05	7.3	--	0.00	--	1.00	0.00	0.00	0.70	1.00	0.67
Melbourne15	9.3	--	0.00	--	1.00	0.00	0.00	0.70	1.00	0.67
Montreal05	17.4	53	0.25	0.70	0.00	0.00	1.00	0.70	1.00	0.00
Montreal15	20.6	50.9	0.45	0.70	0.00	0.00	1.00	0.70	1.00	0.00
Oslo05	21.6	56.3	0.45	1.00	0.00	0.35	0.00	0.70	0.70	0.33
Oslo15	34.2	50.5	0.75	0.70	1.00	0.70	1.00	1.00	1.00	0.33
Stockholm05	40.0	36.2	0.75	0.00	1.00	0.70	0.00	0.70	1.00	0.67
Stockholm15	39.1	39.5	0.75	0.00	1.00	0.70	0.70	0.70	1.00	0.83
Turin05	26.7	--	0.45	--	1.00	0.35	0.00	0.00	0.70	0.67
Turin15	27.4	--	0.45	--	1.00	0.35	0.00	0.00	0.70	0.67
Vancouver05	11.8	--	0.25	--	1.00	0.00	0.00	1.00	1.00	0.00
Vancouver15	16.1	--	0.25	--	1.00	0.00	1.00	1.00	1.00	0.00

3.4.2 Outcomes

Modal Split (SPLIT) and Cost-recovery (CR). The modal split of PT analysed in this chapter refers to the number of trips made in PT modes in relation to the total number of motorised trips. Cost-recovery refers to the percentage of operating costs covered by fare revenues. As stated in Section 3.2, despite being measures of ridership-related objectives, they may not always be aligned. Consequently, it is appropriate to develop a separate model for each outcome. The raw data used for the calibration of outcomes is drawn from the Barometer report from the Association of European Metropolitan Transport Authorities (EMTA) (2009, 2016, 2017) (in the case of modal split, cases not covered by the Barometer have their data coming from the Mobility in Cities Database

from the International Association of Public Transport (UITP) (2006, 2015a) that employs a compatible calculation method).[2]

Calibrating the ratios of modal split and cost-recovery is complex because no normative theory is available to determine what should be deemed high or low levels of these measures. Assigning fuzzy-scores to them based on categorical differences between cases is a helpful way to distinguish relevant and irrelevant differences in ratios, since the numerical distances between ratios of modal split or cost-recovery do not have the same qualitative meaning. In the case of modal split, EMTA's and UITP's entire database were checked to find a general indication of modal split ratios worldwide. The overall average PT modal split of metropolitan areas in these databases is approximately 30%. When considering the ratios of the twenty-two studied cases, this level is located where a clear gap can be seen, and this is used as a reference to determine the crossover point. Other breakpoints are then set using other gaps in the raw data, resulting in a five-value fuzzy-score. In the case of cost-recovery, a similar process is used: overall, average cost-recovery level presented in Barometers' 2006 and 2014 is 46%. This value is positioned in a visible gap in the data of the fourteen studied cases, and thus marks the crossover zone. Other breakpoints are stipulated using gaps in the cases' data to eventually form a four-value fuzzy-score.

3.4.3 Conditions

Integrated Planning Authority (PA). To define the set of cases with stronger planning integration, PA is based on two attributes: first, it considers whether cases have an overarching planning organisation with authority over an area compatible with commuting patterns, and not restricted by local political borders. Second, it evaluates the extent to which such authority is multimodal, i.e. the relevance (based on demand levels) of the modes planned by such authority (regardless if the authority only defines minimum service requirements or specific day-to-day operational activities). The two attributes are aggregated following the weakest link technique (logical AND) (Legewie, 2017).

Land-use and Transport Integration (LUT). To define the set of cases with higher degree of integration between land-use and transport, LUT is based on two attributes: first, it considers whether regional planning is institutionalised and regional plans prepared (regardless of the statutory character of these plans, since this is not a requirement for successful spatial planning (Mäntysalo, Kangasoja, & Kanninen, 2015; Searle, 2016)). A strong planning framework, especially at the regional level, is key to support the development of integrated strategies (Hickman et al., 2013; Paulley & Pedler, 2000; Suzuki et al., 2013). Second, LUT considers the extent to which cases display mobility patterns indicative of good integration, manifested by higher levels of walking and bik-

[2] The authors contacted the teams responsible for the compilation of each database.

ing (Cervero, 2013; Hickman et al., 2013). The attributes are aggregated following the weakest link technique (logical AND) (Legewie, 2017).

Long-term metropolitan PT planning framework (LP). The condition LP assesses whether cases have stipulated a planning framework that mandates the adoption and periodic revision of a strategic long-term plan for PT at the metropolitan level. LP also considers the continuity over time of such planning framework, valuing cases that adopt and maintain an organised long-term planning cycle for a longer period. The condition proposes a three-level fuzzy-score to distinguish cases.

Agency (decision power) over funding (AF). The condition evaluates the availability and degree of agency over funding at the regional level. AF considers two attributes. First, the level of government that is primarily responsible for PT funding, since this can affect the achievement of societal goals (Veeneman et al., 2015). Second, the amount of funds coming from earmarked sources, which indicates funding security and stability (Faivre d'Arcier, 2014; Litman, 2014). The score of both attributes is added up to a maximum score of 1. Earmarked sources of funding are not usual and rarely constitute the bulk of PT subsidies, so the value assigned to this attribute in the proposed fuzzy-score is lower.

Fare Integration (FI). This condition assesses cases' degree of fare integration (it does not consider ticket integration). PT fares can be zone or distance-based, or flat across the region. Regardless of the underlying pricing structure, integrated fares do not vary depending on the number of operators used or whether transfers are required (Sharaby & Shiftan, 2012). Based on this definition, the condition proposes a four-level fuzzy-score.

Risk Allocation to Operators (RO). This condition defines the set of cases in which a higher degree of risk is allocated to operators, considering both short-term and long-term risks. The proxy for short-term risk is the allocation of risks in contracts for PT service delivery: gross-cost contracts allocate production risks to operators and net-cost contracts allocate production and commercial risks to operators. Each of these two types of risks constitutes one attribute. For cases adopting different types of contract, the arrangements used in modes carrying at least 80% of PT demand is considered. The proxy for long-term risk, instead, is the ownership structure of the operator(s). The assumption is that in-house operators are ultimately backed by government and thus less exposed to bankruptcy and possibilities of being taken out of the market. If private and public operators coexist, the nature of prevailing operators (carrying at least 80% of PT demand) determines the attribute's score. The three attributes are scored separately and averaged to compute the final score of RO (Legewie, 2017). Online Material includes information specific to all cases in which demand levels are used to support scoring of RO.

3.5 Results

3.5.1 Analysis of Necessity

A condition is interpreted as necessary when it is a superset of the outcome, and consistency is the parameter of fit indicating the proportion of the outcome that is included in the set of each condition (Duşa, 2018). To claim that a condition is necessary, it must display a consistency level of at least 0.9 (Vis & Dul, 2016). When developing the necessity test, it is also important to inspect if the conditions are relevant or trivial, i.e., a condition might be a superset of the outcome because it occurs virtually in all cases, regardless of a positive or negative outcome (Goertz, 2006; Schneider & Wagemann, 2012). Air, for instance, is a trivial necessary condition for armies to operate (Goertz, 2006, p. 89). A parameter to measure relevance of necessary conditions is RoN (Relevance of Necessity), and Duşa proposes 0.6 as a minimum "*decent relevance threshold*." (2018, p. 123). The condition FI is the only to pass the consistency threshold, however it has very low RoN value. Therefore, none of the conditions is declared necessary for either modal split or cost-recovery (see Online Material for details).

3.5.2 Truth Table and Minimisation

The analysis of sufficiency, main interest in this study, proceeds with the Truth Table Algorithm (Ragin, 2008). In the truth table, each row displays a logically possible combination of the conditions under analysis. Each case is assigned to a row. This is based on the cases' membership in the combination of conditions displayed by each row, calculated with fuzzy multiplication (Ragin, 2008). Rows that do not cover any case are called logical remainders: they represent logically possible configurations that have no empirical manifestation within the cases studied. The researcher, then, must define which configurations of conditions are sufficient for the outcome. Two parameters support this decision: frequency cut-off and consistency cut-off. The first refers to the minimum number of cases a row should cover to be deemed sufficient, conventionally set at one (Rihoux & Ragin, 2009; Schneider & Wagemann, 2012). The second parameter considers the measure of consistency that, in the analysis of sufficiency, indicates the degree to which the combination of conditions displayed in a row is a subset of the outcome. The cut-off is conventionally set at least at 0.75 (Rihoux & Ragin, 2009; Schneider & Wagemann, 2012). Tables 3.3 and 3.4 show the truth tables for modal split and cost-recovery built with a frequency cut-off of one and a consistency cut-off of 0.9.

Once the truth table is built, Boolean minimisation follows. This procedure reduces longer expressions into shorter solution formulas revealing combinations of conditions that are minimally sufficient for the outcome. Minimisation works by comparing pairs of truth table rows and eliminating logically redundant factors. According to QCA's Standard Analysis (Ragin, 2008; Ragin & Sonnet, 2005), minimisation can derive

Table 3.3: Truth Table for Modal Split

PA	LUT	LP	AF	FI	RO	OUT	Incl.	Cases
1	1	1	1	1	0	1	1.000	Helsinki15, Oslo15
0	1	1	1	1	0	1	1.000	Helsinki05
1	1	0	1	1	0	1	1.000	Madrid15
1	1	0	1	1	1	1	1.000	Stockholm05
1	1	1	1	1	1	1	1.000	Stockholm15
1	1	1	0	1	1	1	0.924	Amsterdam15, Berlin05, Berlin15
1	1	1	0	1	0	0	0.803	Amsterdam05
1	0	0	0	1	1	0	0.706	Turin05, Turin15
0	0	0	1	1	0	0	0.692	Oslo05
0	0	0	0	0	1	0	0.640	Birmingham05
1	0	1	1	1	0	0	0.638	Vancouver15
0	0	1	1	1	0	0	0.588	Montreal05, Montreal15
1	0	0	1	1	0	0	0.524	Madrid05, Vancouver05
1	0	0	1	1	1	0	0.506	Melbourne05, Melbourne15
0	0	1	0	0	1	0	0.385	Birmingham15

Table 3.4: Truth Table for Cost-recovery

PA	LUT	LP	AF	FI	RO	OUT	Incl.	Cases
0	0	1	1	1	0	1	1.000	Montreal05, Montreal15
0	0	0	1	1	0	1	1.000	Oslo05
0	1	1	1	1	0	1	1.000	Helsinki05
1	1	1	0	1	1	1	0.901	Amsterdam15, Berlin05, Berlin15
1	1	1	1	1	0	1	0.900	Helsinki15, Oslo15
1	1	0	1	1	0	0	0.658	Madrid15
1	1	1	1	1	1	0	0.622	Sockholm15
1	1	1	0	1	0	0	0.620	Amsterdam05
1	0	0	1	1	0	0	0.500	Madrid05
1	1	0	1	1	1	0	0.433	Stockholm05

Note for Tables 3.3 & 3.4: 'OUT' is the outcome column. It takes a score of 1 if the row passes the frequency and consistency thresholds. 'Incl.' refers to the inclusion level, which is the measure of consistency.

three types of solutions that vary according to how they approach the use of logical remainders: complex, parsimonious, and intermediate.[3] The main text presents the intermediate solution, that should be the focus of the substantive discussion (Schneider

[3] The validity of the different types of solution is the source of debates amongst scholars: see Ragin (2008) or Schneider and Wagemann (2012) for arguments pro the intermediate solution. See Baumgartner (2015) for arguments pro the parsimonious solution. This discussion is beyond the scope of the current study.

& Wagemann, 2012). For this solution, minimisation compares all rows passing the frequency and consistency cut-off points and, additionally, part of the logical remainders, the so-called 'easy counterfactuals'. Logical remainders are deemed easy counterfactuals when they include a condition that the researcher, based on existing substantive knowledge, can plausibly expect to be conducive for the outcome. In other words, minimisation of the intermediate solution blocks only difficult counterfactuals. This study's intermediate solution considers that the presence of all conditions contribute positively to both outcomes, except for RO in relation to which no assumption is made.

Figures 3.1 and 3.2 display two presentations of the solution models for modal split and cost-recovery. First, the solution formulas (A) reveal three alternative minimally sufficient combinations of conditions for each outcome. Second, an XY-plot (B) depicts the superset/subset relationship between outcome and solution. The consistency of the two solution models and of individual pathways are superior to the consistency cut-off set for the truth tables, thus the minimum threshold to declare sufficiency is observed throughout the entire analysis. Moreover, the intermediate solution produces only one model for each outcome, indicating that there are no ambiguities that could weaken results' explanatory power (Baumgartner & Thiem, 2015). Online Material presents supplementary information for all analyses in this section.

3.6 Discussion

3.6.1 Analysis of results

As expected, the condition *fare integration* appears across all pathways, as it passes the consistency threshold for necessity. However, as noted in Section 3.5.1, it is a trivial condition. The condition *land-use and transport integration*, whilst not necessary, is included in all solution pathways for modal split, showing high empirical relevance for this outcome. This confirms the strong connection between the built environment and modal choice (Ewing & Cervero, 2010; Van Wee, 2002; Zegras, 2010), highlighting the crucial role of this condition for increasing the attractiveness of PT. Amsterdam is the only case in the sample with a high degree of *Land-use and transport integration* but lower level of modal split (an issue further discussed below). An *Integrated planning authority* also shows high empirical relevance for higher modal split, and is part of two solution pathways. In the third pathway, a closer look at the cases shows that only in Helsinki05 no fully integrated planning authority exists. However, even if low, there was some degree of planning integration: YTV, a regional organisation formed by four municipalities (Espoo, Vantaa, Kerava and Kirkkonummi) was responsible for PT services crossing municipal borders (inter-municipal buses and commuter trains) and acted as planning authority for municipal services in Espoo and Vantaa. In the city

A

Pathways	Consistency	Cases
PA*LUT*AF*FI	1.00	Madrid15, Stockholm05, Helsinki15, Oslo15, Stockholm15
PA*LUT*LP*FI*RO	0.94	Amsterdam15, Berlin05, Berlin15, Stockholm15
LUT*LP*AF*FI*ro	1.00	Helsinki05, Helsinki15, Oslo15
Solution: Consistency: 0.97 and Coverage: 0.58		

B

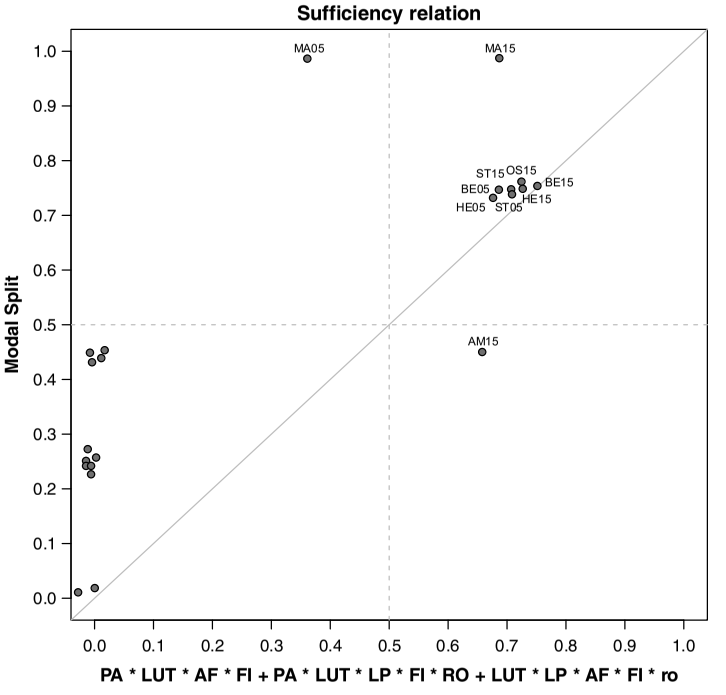

Figure 3.1: Solution Model for Modal Split

a. Solution Pathways. The uppercase letters indicate that the condition is present. Lower case indicates the negation (absence) of the condition. The * denotes a conjunction (logical AND). The pathway consistency shows how consistent that configuration is with the assertion that the combination of conditions is sufficient for the outcome. The solution consistency indicates the degree to which membership in the solution model is a subset of membership in the outcome. Coverage assesses the degree to which a cause or causal combination accounts for instances of an outcome. Thus, solution coverage expresses how much of the outcome is covered by the model (Ragin 2008).

b. Sufficiency relation. Cases above the diagonal line are consistent with the sufficiency assertion. Typical cases (upper right quadrant) display the outcome and are explained by a solution pathway. Deviant cases, instead, can be of two types: at the lower right quadrant, they are members of a solution pathway but do not display the outcome; at the upper left quadrant they display the outcome even though no solution pathway covers them. At the lower left quadrant cases are not in any pathway and do not display the outcome. Points in the chart are jittered as they were too densely clustered.

A

Pathways	Consistency	Cases
LUT*LP*AF*FI*ro	0.92	Helsinki05, Helsinki15, Oslo15
AF*FI*pa*ro	1.00	Oslo05, Montreal05, Montreal15, Helsinki05
PA*LUT*LP*FI*RO*af	0.90	Amsterdam15, Berlin05, Berlin15
Solution: Consistency: 0.95 and Coverage: 0.73		

B

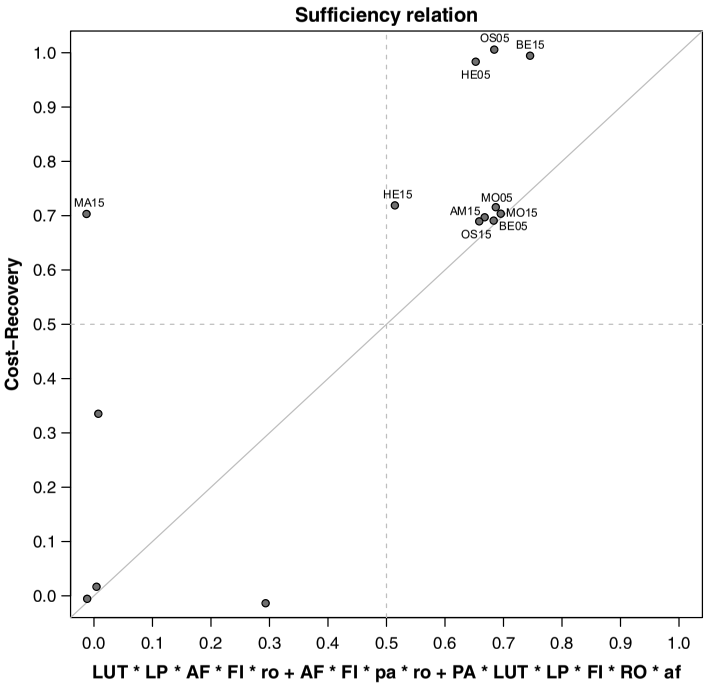

Figure 3.2: Solution Model for Cost-Recovery
a. As described in Figure 3.1
b. As described in Figure 3.1

of Helsinki, the municipally owned HKL acted as planning authority and operator for the metro, bus and trams. It is plausible to conclude that *integrated planning authority* is also an important enabling condition for higher modal split.

Concerning cost-recovery, *agency over funding* and *risk allocation between government and operators* appear in all solution pathways, being always part of the story explaining this outcome. The way these two conditions are combined seem to shape incentives for cost-savings and/or for revenue generation. In the first two pathways, the conjunction AF*ro is present in cases that display high cost-recovery. The higher *agency over funding* in primarily locally funded PT systems, found in Scandinavian countries for instance, appears to create incentives for planning authorities to minimise PT costs (borne by their shareholders). As a result, contracting transfers operational responsibilities and associated cost risks only. The third pathway, instead, includes the conjunction af*RO that suggests that the lower *agency over funding* in primarily state-funded PT systems, as Amsterdam's for instance, creates less incentives for planning authorities to minimise spending, but to use the allocated budget to maximise production instead (van de Velde, Veeneman, & Schipholt, 2008). Contracting, in this case, transfers both planning and operational powers, as well as commercial and production risks. Operators have room to design services and look for ways to cut costs and maximise revenues. Getting the right alignment between *agency over funding* and *risk allocation* might help explain how Amsterdam changed status between 2005 and 2015, and moved to the set of cases with higher levels of cost-recovery: GVB, the municipally owned operator, and the regional planning authority formalised a net-cost contract since 2007. However, just having the right alignment between these two factors is not enough to ensure higher cost-recovery, as the example of Madrid05 demonstrates. These institutional design characteristics involving *agency over funding* and *risk allocation strategy* might result from path dependencies and processes specific to the cases. In Amsterdam and Berlin, for instance, strong municipally owned operators have historically occupied a prominent role in planning PT. Thus, when a contract was formalised between them and respective planning authorities, the choice of a net-cost arrangement that kept these actors with a significant planning role might have been a reflection of the then existing practices, regardless of (or in addition to) incentives generated by the funding framework.

For some cases, multiple pathways explain the same outcome. Two pathways identified for modal split for instance, cover Oslo15, Helsinki15, and Stockholm15. This raises the question of which of the combinations of conditions is most likely to be operative influencing the occurrence of the outcome. The situation in Oslo is even more interesting because this is the only case that changes status from 'less in' to 'more in' the set of cases with higher modal split. Oslo went through several important changes during the period analysed. A metropolitan planning authority was established (Ruter in 2008),

funding agency was enhanced (due both to a commitment by Oslo and Akershus counties to maintain subsidies always at least at their 2007 levels, and to increasing earmarked funds from Oslo's toll ring), fare integration was advanced (important reforms in 2008 and 2011) and a PT planning framework as well as a regional land-use and transport plan were formalised. All these changes can contribute to Oslo's success according to the different solution pathways. However, the regional integrated multimodal planning vision brought by Ruter and the enhanced availability and decision power over funding seem particularly noteworthy: increased and more stable funds enabled the single planning body to implement a series of changes to enhance PT services and attract more users (higher frequency, higher ticket and fare integration, better passenger information systems, new infrastructure etc.). It is plausible to suspect that the pathway including both *integrated planning authority* and *agency over funding* (PA*LUT*AF*FI) is operative. A follow-up within-case analysis could explore this hypothesis.

Other cases, instead, are not fully accounted for by the models, suggesting that factors exogenous to the analysis might be influencing outcomes. Madrid15 has high levels of cost-recovery but is not part of any solution pathway. The same situation occurs with Madrid05 concerning modal split. Amsterdam15, on the other hand, presents a more interesting situation because, although it displays a combination of conditions that is sufficient for higher levels of modal split (PA*LUT*LP*FI*RO), it does not achieve the outcome. Amsterdam's modal split grows in the period analysed, but some factor seems to slow down this process and eventually the case does not reach levels of modal split comparable to high performing cases. A possible barrier for PT modal split in Amsterdam is the very high share of bike use. Amsterdam, and The Netherlands in general, have particularly favourable conditions for biking (even topography, dedicated infrastructure, and a strong bike culture based on decades-long supporting policies) and, as result, bikes represent a strong competition for PT, especially for shorter trips in congested city areas. However, evidence also indicates that many PT trips take place due to the fact that passengers can use their bikes to access stations (first/last mile of the trip) (Pucher & Buehler, 2008; Rietveld, 2000). This suggests that there is a two-way relationship at work between bikes and PT. Madrid and Amsterdam are deviant cases and thus offer leads for follow-up within-case studies that can complement this analysis and unveil new barriers or contributing factors preventing or enabling the occurrence of studied outcomes (Beach, 2018; Schneider & Rohlfing, 2016).

Finally, no combination of conditions is connected to both higher levels of modal split and cost-recovery (no single pathway for both outcomes is the same). This provides another evidence that even though modal split and cost-recovery are measures linked to ridership objectives, they might not be always aligned goals. This does not mean that modal split and cost-recovery are contradictory goals and that a choice between

one and the other is necessary. However, achieving each of these goals might ask for a different approach. As just observed, *integration between land-use and transport* and an *integrated planning authority* are core for higher modal split, although not sufficient per se for the outcome. Cost-recovery requires focusing on the way *agency over funding* and *risk allocation strategies* are designed in combination, shaping incentives for cost-savings and/or revenue generation – although again, the combination of these conditions per se is not sufficient.

3.6.2 Research limitations

The current analysis inevitably has limitations. QCA has been criticised by many authors (Collier, 2014; S. R. Lucas & Szatrowski, 2014; Tanner, 2014) (but see also responses in De Meur et al., 2009; Ragin, 2014; Vaisey, 2014). One disadvantage of QCA is that whilst it is able to discern set-relational cross-case patterns, such patterns do not necessarily reflect causation, and the method does not explain the underlying causal processes driving outcomes. Subsequently, the pathways identified by QCA do not clarify whether conditions at play are causal, and can trigger a process, or scope (contextual) conditions, also relevant, but that only constitute a factor that has to be present for a relationship to work (Beach, 2018). Complementing QCA with within-case analyses (e.g. using process tracing) can help address these shortcomings (Beach, 2018; Schneider & Rohlfing, 2016). Finally, QCA's ability to incorporate the time dimension is restricted. It cannot distinguish whether different conditions work in sequence or at the same time for instance. Examining cases in distinct moments in time constitutes one of the possible strategies to add a longitudinal perspective to the analysis (Schneider & Wagemann, 2012; Vis, Woldendorp, & Keman, 2013). It allows observing how cases move across different truth table rows or in the XY plot as they change over time.

Furthermore, systematic publication of performance data is still a relatively recent practice amongst authorities. No standard terminology or calculation method exist to define performance metrics. As a result, both data availability and comparability pose difficulties. To mitigate these challenges, this study uses databases from renowned institutions that have been promoting benchmarking efforts. Additionally, it is not possible to ensure that every potentially relevant variable has been included in the analysis (as highlighted by deviant cases). This, nevertheless, does not mean the purpose of a study or method breaks down (Radaelli & Wagemann, 2018), and the chapter's choice of conditions is backed by expert opinion and academic literature.

3.7 Conclusion

This chapter advances that PT is a complex multifarious system in which technical elements and multiple actors with diverse and conflicting values coexist. As a result, it proposes that the study of PT governance, and particularly the relationship between organisation and performance, should take a complexity-informed approach, recognising that outcomes in PT are the result of the interplay between its systemic elements and context. This claim is aligned with current discussions in PT governance literature that criticise the lack of a systemic comprehension of PT and also of the wicked nature of its governance (Macmillen, 2013; Marsden & Reardon, 2017). To address this gap, the chapter examines how the interplay between six PT organisational elements is connected to higher modal split and cost-recovery levels. The study adopts fsQCA, a method well-suited for the analysis of complex social phenomena and wicked policy issues (Blackman et al., 2013; Byrne, 2013; Verweij & Gerrits, 2012).

The analysis identifies three alternative sufficient combinations of conditions connected to each outcome, underscoring PT's expected causal complexity: modal split and cost-recovery depend on the interplay between several conditions, and different paths can lead to the same results. Even though modal split and cost-recovery are related to PT usage maximisation, no single pathway leads to both outcomes. This does not mean these goals are incompatible (cases in this analysis show that it is possible to have both attractive and financially sustainable PT), but that achieving each goal might require policy-makers and transport authorities to focus on different factors. Results suggest that *integration between land-use and transport* and an *integrated planning authority* are central for enabling higher modal split, whereas higher cost-recovery is associated to the way *agency over funding* and *risk allocation strategies* shape incentives for savings and/or revenue generation.

These insights can potentially be extended to metropolitan areas beyond those included in the analysis. Generalisations, however, should be circumscribed to similar cases, and mainly analysts or policy-makers interested in other medium-sized high-income metropolitan areas in Western economies might benefit from this study's findings. This is because generalisation from case studies in general, and QCA too, is moderate (George & Bennett, 2005; Gerrits & Verweij, 2016). Differently from *purely* quantitative research methods that estimate the average effect of independent variables (effects-of-causes approach), case-study designs like QCA search for explanations that are first and foremost linked to the cases being analysed (causes-of-effects approach) (Mahoney & Goertz, 2006).

Methodologically, the chapter responds to calls for mixed-method research in transport studies (Marsden & Reardon, 2017; Schwanen et al., 2011) by combining the use of qualitative and quantitative data with QCA, a novel method in this field.

Concerning the discussion on the relationship between organisation and performance, in turn, the analysis' results produce thicker knowledge on the interplay between diverse elements of PT organisation, providing decision-makers with more leverage to influence strategic outcomes. Findings also open possibilities for future research. Coming work can explore other potential causal relations, such as interdependencies between PT organisational elements, or even the opposite causal direction and the possible influence of good performance on the organisational set-up of PT. Furthermore, follow-up studies can help explain underlying causal mechanisms and also expose barriers or enabling factors omitted in this study (Beach, 2018; Schneider & Rohlfing, 2016). These in-depth analyses can focus on other relevant issues that possibly affect the functioning of PT systems, like path dependencies, informal institutions, or the capacity of key actors.

Part II

Tackling the '*How* Gap'

In part I of the dissertation, I addressed the first gap in mainstream public transport literature identified in the general introduction. Chapters 2 and 3 advanced the need of a complexity-oriented view to approach the relationship between governance and performance, i.e. performance outcomes are analysed as the result of the interplay between multiple governance elements, rather than being understood as the sum of isolated policies and regulatory reforms.

In Part II, I turn to a second shortcoming in public transport research and tackle the limited understanding of the notion of governance that prevails in mainstream literature. Most works interpret governance as (and focus exclusively on) the introduction or reform of formal institutions – such as legislation, policies, contracts, or ownership nature of actors – to then investigate their potential impacts on performance. I, instead, am interested in understanding governance more broadly, as a political activity and process and, thus, in examining the importance that elements such as informal institutions, political steering, and individuals' agency may have in influencing public transport outcomes. The next two chapters address these often-neglected dimensions of governance.

In Chapter 4, I analyse how informal institutions and the agency of individuals interact with formal frameworks in ways that support well-functioning attractive public transport systems. To this end, I follow-up on and supplement the findings from Chapter 3 by further scrutinising the results identified for two cases studied in that analysis – Oslo and Amsterdam. Using an in-depth longitudinal analysis, I look into the main institutional developments in public transport occurred in these two metropolitan areas since the 1980s. The analysis is informed by concepts and frameworks from new institutionalism, which allow me to (i) identify existing informal institutions and instances of key individuals' agency, and, (ii) conceptualise the ways in which they interact with formal institutions in processes of institutional creation and change. Findings show that formal frameworks, informal institutions, and key actors co-exist and interact in complementary, substitutive, and accommodating manner; they facilitate collective decision-making on issues ranging from integrating land use and transport to managing budget constraints.

In Chapter 5, I look into the future of personal mobility and examine the emergence of mobility as a service (MaaS). There is limited understanding about this service model and, most importantly, its potential implications for public transport usage. Specifically, in Chapter 5, I identify and conceptualise the governance approaches being used by public sector actors in relation to the development of MaaS – i.e. I look into the steering posture and instruments adopted by these players to guide the trajectory of MaaS. To this end, I conduct an in-depth analysis of three metropolitan areas previously studied in the dissertation – Amsterdam, Birmingham, and Helsinki. This analysis is informed by governance theories – in particular, studies discussing meta-governance and the

role of meta-governors – as well as the literature on socio-technical transitions – the multilevel perspective framework especially. Drawing on this theoretical background and on the empirical findings, the chapter formulates six governance approaches to MaaS across cases: analyser, architect, convener, experimenter, lawmaker, and provider. These basic models encompass strategies ranging from hands-on strong intervention in MaaS development niches to hands-off information collection efforts.

Chapter 4

The governance of attractive public transport: Informal institutions, institutional entrepreneurs, and problem-solving know-how in Oslo and Amsterdam*

* The content of this chapter has been accepted for publication in Research in Transportation Economics and is available at https://doi.org/10.1016/j.retrec.2020.100829.

Abstract

Public authorities are under mounting pressure to promote more sustainable urban mobility, including a modal shift from cars. With an empirical focus on Oslo and Amsterdam metropolitan areas, this chapter analyses how the interplay between formal frameworks, informal institutions, and individuals' agency can contribute to making public transport more attractive in relation to other modes. Findings indicate that formal frameworks, informal institutions, and key actors co-exist and interact in complementary, substitutive, and accommodating manner; they work alongside each other to facilitate collective decision-making on issues ranging from integrating land use and transport to dealing with budget constraints. By identifying these types of interaction, this study shows that, to advance transport sustainability, authorities not only need insight on *what* policies to design, but can also benefit from understanding *how* policy-making and implementation unfold. A broader insight offered by the chapter is that financial performance goals appear as a main policy driver in public transport, eclipsing sustainability concerns.

4.1 Introduction

Globally and in Europe, the transport sector accounts for one fourth of total emissions, with the road sub-sector being the largest contributor in terms of volume (International Energy Agency, 2018). Urban mobility and transport sustainability are thus at the top of policy agendas (Marsden & Rye, 2010), underpinning high level ambitions to curb negative externalities linked to traffic (e.g. European Union, 2014). Public authorities are expected to lead a transformation in mobility patterns, and the enhancement of PT to promote a modal shift from cars is key (Banister, 2008). In this context, it is critical to understand how governance structures and processes influence PT's attractiveness to users.

Although the influence of governance on PT performance constitutes a long-established and still current topic of investigation (Bray, Hensher, & Wong, 2018; Chadwick, 1859), much of the existing literature in this field has a narrow focus, predominantly emphasising the importance of formal rules and structures in driving PT's results. Other relevant governance questions – e.g. the role of informal institutions, political framing, and power relations – are so far understudied.

Recently, though, there has been greater interest in tackling these other complex questions of governance (Hansson, 2013; Isaksson, Antonson, & Eriksson, 2017; Rye, Monios, Hrelja, & Isaksson, 2018), and a growing recognition that they can help understand how policies are designed and implemented the way they are (Marsden & Reardon, 2017). To contribute to this growing literature strand, this chapter's aim is two-fold: first, to identify instances of informal institutions and individuals' agency that, alongside formal institutions, influence PT outcomes; and second, to characterise the nature of these interactions. Analytically, this study employs concepts from institutional theories to inform a longitudinal qualitative case-study design. Empirically, the focus lies on the success of Oslo and Amsterdam metropolitan areas in promoting attractive PT, manifested in their positive modal split trends.

The chapter proceeds with a brief literature background in Section 4.2. Section 4.3 describes methods used in the analysis. The formal institutional framework of the PT sector in each case is described in Section 4.4, whereas Sections 4.5 and 4.6 unveil informal institutions and individuals relevant to PT success, whilst also distinguishing how they interact with formal institutions. Concluding remarks follow.

4.2 Public transport and governance: starting points

This section first briefly revises mainstream PT governance literature. Following that, it lays out the chapter's analytical framework by building on theories of governance and institutional analysis.

4.2.1 The influence of governance on PT attractiveness

A sizeable literature examines how elements of governance can influence diverse PT outcomes, such as levels of sustainability, accessibility, or cost-efficiency. This body of work dates back at least to the 19th century (Chadwick, 1859), but gained significant traction in more recent decades, after the deregulation experience in the UK in the 1980s, with the introduction of competition in the sector via mechanisms such as awarding and contracting (Evans, 1988; van de Velde, 2005). The potential of governance elements to improve the attractiveness of PT in relation to other transport modes is of particular interest in this literature. Analytically, these studies examine how legislation, policies, and contracts allocate strategic, tactical, and operational (hereafter STO) tasks (van de Velde, 1999)[1] amongst actors (public and private), and how this may translate into variations in levels of performance indicators such as ridership, modal split, or user satisfaction.

The literature analysing elements at the strategic level evaluates how ridership or user satisfaction may be affected by the choice between organising PT with open market entry for operators and concentrating the right of initiating services in the state's hands (Cowie, 2014; van de Velde, 2014). Authors also consider the importance of long-term strategic planning frameworks, and argue that they can promote the stability of transport strategies and high quality service, making PT more attractive (Gwilliam, 2003; May, 2004). Analyses of elements at the tactical level, in turn, indicate that the integration of planning tasks within an overarching organisation, with authority over multiple modes in an area corresponding to major commuter patterns (a regional public transport planning authority, hereafter PTA), can make policy implementation more coherent and avoid harmful competition between modes (Kumar & Agarwal, 2013; Pemberton, 2000). Studies also look into the potential impacts on passengers and ridership levels resulting from the adoption of different awarding mechanisms, including competitive tendering (Mouwen & Rietveld, 2013), or from the use of varied contractual regimes between authorities and operators (Mees, 2005). Furthermore, literature also points to the performance benefits brought by ticketing and fare integration (Buehler et al., 2019; Sharaby & Shiftan, 2012). At the operational level, studies examine the link between customer satisfaction and factors like service quality attributes – such as bus stop furniture (shelter and benches), bus cleanliness, and overcrowding (Eboli & Mazzulla, 2007); the ownership nature of operators; and the number of operators in a given market (Fiorio et al., 2013; Jain et al., 2008).

[1] The 'strategic level' refers to deciding on public transport 'aims' such as policy goals in terms of accessibility and modal share. The 'tactical level' refers to service design (routes, frequencies, fares, vehicle design, etc.), i.e. determination of 'means'. The 'operational level' refers to operational management, e.g. crew and vehicle rostering or facility and vehicle maintenance.

4.2.2 A more comprehensive take on governance

Whilst providing relevant insights to policy-makers and academics, the literature described in Section 4.2.1 could benefit from broadening their scope of analysis to include more dimensions of governance. Broadly speaking, governance, and thus theories of governance, are concerned with the ways in which societies create and uphold rules and order in social processes in the pursuit of collective interests (Bevir, 2013; Peters & Pierre, 2016). The concept encompasses the governance of policy processes, both the formulation and implementation of policies, and the method of political steering, from hierarchical imposition to sheer information measures (Héritier, 2002; Treib et al., 2007).

Analytically, the concept of governance can be broken down into three distinct dimensions: politics (concerning the actor constellation, i.e. range of actors involved in the process of policy-making); polity (concerning the institutional landscape in which these actors operate); and policy (concerning political steering, i.e. the nature and character of steering instruments being used) (Treib et al., 2007). These three dimensions of governance are intertwined and elements of each of them coexist empirically. Nonetheless, the tripartite analytical distinction is useful to shed light on some shortcomings in the literature outlined in Section 4.2.1. Mainstream studies have a narrow focus on the influence of formal institutions and organisational form on PT performance. As a result, these works emphasise governance as design, but neglect governance as a political process, disregarding the role of broader governance questions that are also critical to understand PT policy design and implementation (Marsden & Reardon, 2017).

In the last decade, however, there has been growing engagement with a broader set of governance questions. Hansson (2013), for instance, analyses steering cultures and their influence in the development of successful PT procurement. Hrelja et al. (2017) and Rye et al. (2018) investigate the role of informal institutions in complementing formal frameworks to facilitate coordination in PT planning. Sørensen et al. (2014) examine congestion charging schemes to draw lessons related to the barriers to PT policy formation and implementation in contentious issues. Isaksson et al. (2017) employ literature on policy integration to explain implementation challenges related to the integration of sustainable mobility in strategic local/regional land use and transport planning. Finally, Tennøy (2010) concludes that the way planners frame congestion problems influences what they see as important objectives, alternatives, and methods of evaluation, affecting their plans and the outcome of measures adopted. This study joins these authors and examines how informal institutions and individuals' agency interact with formal frameworks, all being determinant for PT attractiveness.

Formal and informal institutions

Within rational-choice institutionalists, North defines institutions as *"…the humanly devised constraints that structure political, economic and social interaction."* He adds that "*They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).*" (1991, p. 97). Historical institutionalists, in turn, define institutions as formal and informal routines and conventions ranging from rules of constitutional order to conventions governing trade unions relations (Hall & Taylor, 1996). For sociological institutionalists, institutions include formal rules and norms, symbol systems and cognitive scripts that frame and guide human action (Hall & Taylor, 1996).

The point here is not to delve into different conceptions of institutions; rather, the upshot is that both formal and informal institutions matter. The importance of informal institutions in particular lies on their character as rules of the game informing political life, but being created, communicated, and enforced outside of officially sanctioned channels; they exist in collectively shared understandings, conventions, and procedures that structure behaviour, and help handling social interaction and coordination (Helmke & Levitsky, 2004).

Informal and formal institutions may interact in different ways. Helmke and Levitsky (2004, pp. 728–729) define a typology of such relationships. *Complementary* informal institutions facilitate the pursuit of goals within the existing formal framework; they are efficiency enhancing and may create or strengthen incentives to comply with formal rules. *Accommodating* informal institutions are created by actors who dislike outcomes generated by formal rules, but that cannot alter these rules; instead, they act within existing frameworks to develop accommodating institutions that help them reconcile their interests with existing arrangements. *Competing* informal institutions appear when ineffective formal institutional environments (not enforced, thus not actually constraining or enabling individuals) allow actors to ignore or violate them; these informal institutions structure incentives in ways that are incompatible with formal rules. *Substitutive* informal institutions are employed by actors who seek outcomes compatible with formal rules and procedures in environments where these are ineffective; substitutive informal institutions may work as a second-best, lower-cost option to achieve what formal institutions were designed, but failed, to achieve.

This typology is visibly shot through with human agency and emphasises the central role of change agents in driving interactions between formal and informal frameworks, to eventually transform the existing institutional setup. These agents are crucial in promoting cumulative and consequential change in institutions according to the way they engage with the existing institutional environment and exploit the "gaps" and "soft spots" between rules and their interpretation (Mahoney & Thelen, 2010). Therefore, the concept of agency and actors' ability to shape institutions need further detailing.

Agency: institutional entrepreneurship and know-how

Human agency refers to individuals' ability to intentionally pursue their interests and to influence the social world (Scott, 2001). Recognising the importance of agency, recent institutional analysis has increasingly challenged the deterministic view according to which institutional pressures explain actors' behaviours. Instead, there is growing recognition that, as already pointed out, individuals are not only constrained by institutions, but also have the possibility of choice and can shape institutions as they interpret and enact them (Peters, 2011).

The notion of institutional entrepreneurship emerges in this context. It refers to *"…activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones."* (Maguire, Hardy, & Lawrence, 2004, p. 657). Institutional entrepreneurs use political and social skills to intervene strategically, as well as mobilise and combine resources to set agendas and drive institutional change; they *"…engage critically and strategically with institutions rather than simply playing pre-assigned roles"* (Lowndes & Roberts, 2013, p. 145). Thus, these entrepreneurs are able to reflect on the institutional *status quo* to both challenge existing rules and practices, and institutionalise the alternative rules and practices they champion (Garud & Karnøe, 2003).

Scholars also acknowledge the role of agency amongst public officials during policy implementation (Hysing & Olsson, 2017). This occurs in the context of growing need for specialised know-how, enabling public officials to deal with problems of growing complexity in fragmented networked governance environments (Sehested, 2009). Such know-how includes (but goes beyond) technical expertise. It also demands from individuals the ability to critically reflect on their role and tasks, combine in-depth knowledge and values with those from diverse professional sectors, as well as collaboration, communication, and networking skills (Hysing, 2014; Sehested, 2009). This problem-solving know-how lends public officials legitimacy and recognition as 'experts' amongst society and decision-makers, giving them greater autonomy and policy influence (Hysing & Olsson, 2017).

In this chapter, the importance of individual agency lies on the consideration of the influence of institutional entrepreneurs and of public officials with problem-solving know-how.

4.3 Methods and materials

This study is problem-driven, rather than theory-driven; it aims to advance the understanding about complex and understudied issues in PT governance rather than test theories to enable prediction and control. In particular, this study scrutinises context-

dependent phenomena to identify informal institutions and actors that exhibit entrepreneurial skills and problem-solving know-how, as well as to analyse their interactions with formal institutions. Qualitative case studies constitute an appropriate approach for this type of in-depth investigation (Flyvbjerg, 2006; George & Bennett, 2005). The chapter employs process tracing, a case-study method based on the collection and use of evidence from within a case to trace the processes that may have led to an outcome (e.g. PT attractiveness) – i.e. to uncover the sequence of events that could allow making inferences about causal explanations (Bennett & Checkel, 2015; George & Bennett, 2005). Process tracing analyses trajectories of change focusing on the collection and analysis of "causal-process observations", i.e. an insight or piece of data that provides information about context, process, or mechanism, contributing to causal inference (Collier, Brady, & Seawright, 2010). Careful description is thus a foundation of the method (Collier, 2011; Mahoney, 2010).

In this chapter the use of process tracing supports the longitudinal analysis of Oslo and Amsterdam to highlight processes of cumulative and highly transformative institutional changes in PT. This is the case because whilst process tracing has been conceived as an approach for within case studies, the method is also well suited to draw inferences based on comparative designs (Bengtsson & Ruonavaara, 2016), in particular through paired comparisons ("duel-process tracing", as labelled by Tarrow [2010]). Process tracing is also appropriate for this chapter's analysis as it allows mediating between structure and agency, investigating the institutional context and the motivations and information of individuals, by employing information identified by previous research and pursuing new leads and evidence to account for cases and events (Toshkov, 2016).

Following a nested design (Toshkov, 2016), case selection builds on the previous chapter. Within the cases studied in Chapter 3, Oslo and Amsterdam are success stories in relation to modal split and, thus, the two metropolitan areas serve as "paradigmatic" and analytically relevant examples for the current study (Flyvbjerg, 2006). Oslo is the only example in the sample analysed in Chapter 3 that moves from the set of low performing cases in 2005 to the set of cases with higher levels of modal split in 2015. Statistics show a strong upward trend in the modal split of PT within motorised trips in the metropolitan area of Oslo, moving from 24% to 37% between 2006 and 2016 (Ruter, 2012, 2017). Amsterdam, in turn, stands out for being a so-called 'deviant case': it displays a combination of conditions that is conducive to higher levels of PT modal split and, yet, the absolute value of Amsterdam's modal split is not as high as that of the high performing cases in the sample. The hypothesis advanced in Chapter 3 is that the 'deviance' from the expected outcome is possibly caused by the high share of bike use in Amsterdam, competing with PT. Evidence corroborates this assumption; whilst there is some synergy between bikes and trains (bikes are an important mode for station access and egress), the relationship with buses and trams is not of the same nature, particu-

larly in major urban areas like Amsterdam (KiM, 2016b, 2016a). Between 2006 and 2016, the modal split of bikes in Amsterdam grew from 24% to 30% approximately; in the same period, the share of PT trips and that of PT within motorised trips remained stable (around 11% and 23% respectively) (CBS Statistics Netherlands, 2006, 2016). This is plausibly a positive trend, showing that PT maintained its attractiveness even in face of the growing use of bikes.

The empirical material for the analysis comes from academic and grey literature, policy documents, and interviews with key stakeholders from diverse affiliations (Table 4.1). Findings from these sources were triangulated to substantiate the chapter's conclusions.

Table 4.1: List of Interviewees

Case	Affiliation	Id.
Oslo	Ruter	O1
Oslo	Ruter	O2
Oslo	Ruter	O3
Oslo	Norwegian State Railways	O4
Oslo	Oslo Municipality	O5
Oslo	Institute of Transport Economics (TØI)	O6
Oslo	Institute of Transport Economics (TØI)	O6
Oslo	Institute of Transport Economics (TØI)	O8
Oslo	Norwegian University of Life Sciences	O9
Oslo	Private consultant	O10
Oslo	Private consultant	O11
Amsterdam	Vervoerregio Amsterdam	A1
Amsterdam	Vervoerregio Amsterdam	A2
Amsterdam	Amsterdam Municipality	A3
Amsterdam	Amsterdam City Council	A4
Amsterdam	GVB	A5
Amsterdam	Universiteit van Amsterdam	A6
Amsterdam	Delft University of Technology	A7
Amsterdam	Private consultant	A8

4.4 Formal institutions in Oslo and Amsterdam

Consistently with case selection criteria, this section also follows-up on Chapter 3 and presents the formal frameworks that were identified as conducive to higher levels of modal split in Oslo and Amsterdam. The purpose here is to develop a longitudinal

investigation of these formal institutions that may serve as a building block for the analyses in Sections 4.5 and 4.6. The content presented in this section is synthesised in Table 4.2.

4.4.1 Oslo

According to the findings from Chapter 3, modal split success in Oslo is driven by an enabling framework combining conditions for: (i) regional multimodal planning integration; (ii) fare integration; (iii) availability and decision power over funding (see *Public transport framework in Oslo* below); and (iv) land use and transport integration (see *Land use and transport integration framework in Oslo* below).

Public transport framework in Oslo

In 1986, PT planning went through important changes in Norway. Counties took over the responsibility for planning local and regional PT, whereas heavy rail remained the responsibility of the national government. In Oslo (both a county and a municipality) PT planning became the responsibility of AS Oslo Sporveier (hereafter Sporveier), and in Akershus, the surrounding county, this role was vested in Stor-Oslo Local Transport (hereafter SL). Thus, PT planning across the metropolitan area was fragmented between the two authorities, even though the Ministry of Transport and Communications had suggested a single PT planning authority for the entire area since 1968 (Ruter, 2018).

In 2007, Sporveier and SL finally merged into Ruter, a single PTA for buses, metro, and trams in both counties. Ruter, a private company owned by the counties (60% Oslo and 40% Akershus), is responsible for PT strategy, service design, including route definition, ticketing and fare policies, branding, and passenger information. Interviewee O11 highlights that with Ruter, a regional vision for PT became prominent, manifested, for instance, in the increasing formalisation and systematic elaboration of long-term plans by the authority (e.g. Ruter, 2009, 2012). Indeed, since its initial days, Ruter also tackled the need for greater ticket and fare integration. After difficulties involving delays and cost overruns with a pre-existing project for electronic ticketing (Flexus), Ruter successfully implemented a smartcard and a payment application for smartphones eliminating paper tickets. Concerning fares, Oslo had a flat tariff for decades, but 88 zones existed in Akershus, turning the overall comprehension of the system quite complex. After a major reform in 2011, the number of zones was reduced (currently the metropolitan area is divided in four), and fares are fully integrated.

Another central feature of PT's institutional setting, funding too went through important reforms in 1986. Earmarked national funding for PT was abolished, putting regional authorities under pressure to decide how to allocate county taxes across different public services; the need for greater PT cost-efficiency was one of the triggers

Table 4.2: Formal PT frameworks

	Oslo	Amsterdam
Regional multimodal planning integration	PT planning was regionalised in 1986. It remained fragmented across Oslo and Akershus counties until 2007, when Ruter was established as the single regional PTA and responsible for planning metro, bus, and tram services.	The 2000 Transport Act regionalised PT planning responsibilities. Since then, Amsterdam's PTA holds formal power to plan metro, bus, and tram services in the area corresponding to Amsterdam and 14 surrounding municipalities.
Fare and ticket integration	Ruter implemented a multimodal smartcard and a payment app for smartphones. Concerning fares, Ruter instituted a major reform in 2011 to simplify the tariff system that by then mixed Oslo with a flat tariff and Akershus with 88 zones.	Ticketing and fares have been highly integrated in The Netherlands since 1980. Currently a nationwide smartcard is valid across all PT modes and operators, and fares are based on regional per-km fees set by the PTA.
Availability and decision power over funding at regional level	In 1986 national earmarked funding was abolished and counties became the main source of PT subsidies. After a period of budget constraints in previous decades, currently there is substantial availability of earmarked funds for PT. Oslo and Akershus formally committed to a minimum subsidy level to Ruter, and the national government has reappeared as a major funder via diverse formal policy instruments, i.e. the Oslo Packages and the Urban Agreements.	Funding of PT has historically been a responsibility of the national government, with regional and local authorities having barely any tax levy powers.
Long-term planning framework	Formal systematic elaboration of strategic long-term plans has been the norm after the establishment of Ruter in 2007.	A long-term planning framework has been formally in place since 1993, with the establishment of the first Regional Traffic and Transport Plan.
Contractual risk allocation	Since the adoption of tendering in the late 1990s and early 2000s, gross-cost contracting prevails. PT operators are only liable for production risks. The PTA retains commercial risks, being also responsible for detailed service design.	Since the enactment of the 2000 Transport Act, Amsterdam's PTA has been adopting net-cost contracts in four concession areas. Operators bear production and commercial risks, but also have room to establish detailed service design in order to attract more passengers.
Land use and transport integration	No agency or government level has formal powers to regulate both land use and transport planning at the regional scale. Norway's Planning and Building Act is the main framework for land use planning. County governments elaborate non-statutory plans for issues of regional importance, such as integrated land use and transport planning. Municipalities are the main spatial planning authorities. A compact city policy has been adopted in Oslo and Akershus since the 1980s.	No agency or government level has formal powers to regulate both land use and transport planning at the regional scale. The Dutch Spatial Planning Act is the main framework for land use planning. All levels of government must prepare non-statutory Structure Plans. Municipalities are the main spatial planning authorities. A compact city policy has been adopted by the municipalities in the Amsterdam metropolitan area since the 1980s.

for the introduction, in Norway, of competitive tendering in 1994 (Bekken, Longva, Fearnley, & Osland, 2006). Bus services in Akershus were soon tendered-out, whereas in Oslo this process began in full earnest in the early 2000s (Finn, 2005). Tram and metro services in Oslo were directly awarded to subsidiaries of Sporveier. With tendering, there was a general move to gross-cost contracts, as opposed to the negotiated net-cost contracts prevailing until then (Bekken et al., 2006; Longva & Osland, 2010). Gross-cost contracting has strengthened the PTAs' roles in service design, as they retained tactical planning responsibilities and thus are responsible for setting detailed service design.

In the early 2000s, the funding context changed. At the regional scale, after the creation of Ruter, Oslo and Akershus formally committed to keep subsidy contributions at least at 2007 real levels. At the national level, funding packages, mainly the Oslo Packages and the establishment of Urban Agreements[2], substantially increased availability of resources for the PTA. The first Oslo Package, from 1990, was established as a long-term funding programme for road expansion projects only, based on funds from government and revenues raised from road tolls. Oslo Packages 2 and 3, from 2001 and 2008, instead, also allocated funds for PT infrastructure investments. Oslo Package 3, crucially, directs earmarked funds for PT operational costs too. Concerning the Urban Agreements, they have been implemented in the wake of the Parliament's Climate Agreement based on a White Paper from the Ministry of Environment (2012). The document stipulates increased national funding for PT and the so-called zero-car-growth target, according to which PT, biking, and walking should absorb any new travel demand in major urban areas. These commitments led to the signature of contracts in which the national government agrees to co-fund projects for counties and municipalities that, in exchange, must reduce emissions according to defined targets. Oslo and Akershus are part of the programme since its outset and, alongside Ruter, have been receiving substantial funds. As a whole, thus, the overall availability of funding for PT has been significantly enhanced in recent years. Moreover, beyond the improvements to PT allowed by these funds, the Oslo Packages and the Urban Agreements also contain important disincentives for car use.

Land use and transport integration framework in Oslo

Norway's Planning and Building Act, the country's main framework for land use planning, went through a major reform in 2008; Regional and Local Planning Strategies were introduced, allowing counties and municipalities to determine for which areas to prepare plans (OECD, 2017a). The national government has few direct responsibilities.

[2] The expression 'Urban Agreements' refers to various contracts and reward schemes adopted by the Norwegian government in connection with the 2012 Parliament's Climate Agreement. See more in Tønnesen et al. (2019).

County governments elaborate plans for issues of regional importance, such as integrated land use and transport plans, but that have limited influence; regional plans are non-statutory and serve essentially as guidelines for local planning. Municipalities are the main spatial planning authorities.

No agency or government level combines formal powers to regulate both land use and transport planning at the regional scale. Yet, since the late 1980s both Oslo and Akershus follow integrated strategies for a compact city policy of concentrated development, advancing densification of housing and employment, brownfield redevelopment, and restrictions on urban expansion (Næss, Næss, & Strand, 2011). This aimed to reduce the need for travelling by car and counterbalance the sprawling and increasing congestion ongoing after World War II (Næss, Strand, Næss, & Nicolaisen, 2011). This policy direction was expressed in municipal and county spatial plans in Oslo and Akershus, but also in national strategies like the 1993 National Policy Provisions for Coordinated Land Use and Transport Planning, and later in Oslo Package 3.

4.4.2 Amsterdam

According to the findings from Chapter 3, Amsterdam's PT modal split is benefited by an enabling framework combining conditions for: (i) regional multimodal planning integration; (ii) fare integration; (iii) long-term planning; (iv) a higher degree of contractual risks allocated to operators (see *Public transport framework in Amsterdam* below); and (v) land use and transport integration (see *Land use and transport integration framework in Amsterdam* below).

Public transport framework in Amsterdam

Whilst the state-owned Dutch Railways have provided all rail services, local and regional transport services in The Netherlands historically have worked based on licenses granted by the national government. Public and private had autonomy to create new services. Incumbent operators enjoyed great stability, having their operational deficit compensated by the national government since 1969 (van de Velde & Savelberg, 2016). Overall, neither authorities nor operators were explicitly focused on passenger needs and quality attributes, such as on-time performance, travel speed, or service frequency; focus, at the time, was mainly on production/supply parameters of service (Mouwen & Rietveld, 2013). As a result, PT was characterised by cost inefficiencies and low modal share (van de Velde & Savelberg, 2016).

Concerned with this scenario, in the 1990s the Dutch national government formed an advisory committee (Commissie Brokx Openbaar Vervoer) to develop recommendations that eventually triggered the enactment of a new Passenger Transport Act in 2000. The Act's stated goals were to increase PT cost-recovery and ridership levels. One of the main changes introduced with the Act was the decentralisation of PT planning to

province governments and, in main metropolitan areas, to regional authorities; heavy rail remains a responsibility of the national government. In this context, the Regionaal Orgaan Amsterdam, an already existing regional voluntary cooperation, became the PTA within the territory comprising Amsterdam and 15 surrounding municipalities (currently 14, due to the merge between Zeevang and Edam-Voolendam in 2012). In 2006, the PTA received permanent and mandatory status as a City Region and was renamed Stadsregio Amsterdam. In 2014, certain policy responsibilities held by PTAs were devolved to municipalities and provinces, but the entity, then renamed Vervoerregio Amsterdam, retained planning responsibility for PT.

The 2000 Transport Act also introduced mandatory use of competitive tendering, but national rail and local transport in main cities, including Amsterdam, were exempted from this obligation. Four concession areas were defined in the Amsterdam region – Zaanstreek, Waterland, Amstelland-Meerlanden, and Amsterdam city – and a single operator was granted exclusive rights as provider of PT in each of them. Whilst the Amsterdam concession has traditionally been directly awarded to GVB (the municipally owned operator of trams, buses, and metro), competitive tendering has been used in the remaining areas. The concession contracts are net-cost, and operators retain fares and the commercial risk connected to revenue fluctuation. Coupled with this arrangement, operators have service design freedom within certain minimum functional requirements set by the PTA, thus being stimulated to use their market knowledge to attract more users (van de Velde et al., 2008). Analyses of PT performance show that despite declining subsidies from the national government (main funder of PT in the country) due to austerity measures in recent years, the Transport Act led to overall cost-savings in tendered and non-tendered concessions nationwide. Little has been achieved in terms of increasing PT's modal share though (van de Velde & Savelberg, 2016).

PT's formal institutional environment in Amsterdam has also been marked by a reasonably long and stable trajectory of integration in ticket and fare policies, as well as the systematic preparation and use of strategic planning framework for PT. National integrated ticketing and fare systems date back to 1980 in The Netherlands, and were reformed between 2005 and 2011. A smartcard (the OV-chipkaart), valid across all PT modes and operators, replaced paper tickets, whereas zone pricing was replaced for a system based on regional per-km fees set by each PTA. Therefore, and differently from Oslo, historically passengers have faced lower entry barriers to the PT system. In relation to long-term planning, it has been first formalised in the early 1990s when the Regionaal Orgaan Amsterdam elaborated the first Regional Traffic and Transport Plan. This plan was revised in 2004 following the planning framework cycle, and then replaced in 2017.

Land use and transport integration framework in Amsterdam

The Dutch Spatial Planning Act, the country's main framework for land use planning, was reformed in 2008 under the slogan 'decentralise where possible, centralise where necessary', and established that each level of government is to identify its interests and to apply planning instruments to realise them through structure plans. All three levels of government must prepare (non-statutory) structure plans. Municipalities are the main spatial planning authorities.

No agency or government level combines formal powers to regulate both land use and transport planning at the regional scale. Still, municipalities in the Amsterdam region followed national strategies for concentrated development during most of last century (Geurs & van Wee, 2006). Similarly to Oslo, a compact city policy prevailed in the 1980s and 1990s, combined with the so-called 'ABC principles,' introduced to guide the location of businesses according to their accessibility characteristics, help compact development, and discourage the use of cars. These strategies were meant to counteract suburbanisation and decline in population and living conditions in main cities (Geurs & van Wee, 2006; Schwanen, Dijst, & Dieleman, 2004). At the municipal level, the compact city policy was expressly included in Amsterdam's 1985 municipal Structural Plan, but densification and mixed land uses were already prevalent strategies since the 1970s (Bertolini, 2007). Amsterdam's recent structural plan from 2011 continues to advance brownfield redevelopments, new housing, as well as stricter parking allowances.

4.5 Informal institutions and individual agency in Oslo and Amsterdam

Informed by the analytical framework defined in Section 4.2 and based on the leads investigated in Section 4.4, this section identifies main instances of informal institutions and individual agency that contribute to PT success in each case (see summary in Table 4.3).

Table 4.3: Informal institutions and individual agency in Oslo and Amsterdam

	Manifestation	Present in
Informal institutions	Shared understanding of PT as a facilitator of regional development	Oslo and Amsterdam
	Shared understanding of PT as a facilitator of green development	Oslo and Amsterdam
Agency	Problem-solving know-how	Oslo
	Institutional entrepreneurs	Amsterdam

4.5.1 Public transport as a facilitator of regional economic development

The changes in the formal institutional setup of PT in Oslo and Amsterdam during the last decades were profoundly influenced by the rise of neoliberal ideas in the 1970s and 1980s, usually associated with the New Public Management (NPM) label. NPM policies gave primacy to values like efficiency and effectiveness in public administration, advancing horizontal specialisation, structural devolution, and the creation of specialised agencies (Hood, 1995). The results of these reforms have been to some extent positive in increasing cost-efficiency in PT, but not satisfactory regarding ridership and cost-recovery levels (Fearnley, 2005; van de Velde & Savelberg, 2016). Consequently, PT planning and delivery in Oslo and Amsterdam in recent years have increasingly targeted ridership and revenue growth. This is frequently described by documents and interviewees as a user-driven approach, and, in concrete terms, is chiefly linked to a shift of production towards high-demand lines that can be more profitable.

In Oslo, "*We have moved from areas where we can't provide frequency to investing in areas where we can guarantee frequency to such an extent that we can actually do away with timetables*", affirms Ruter's CEO (International Association of Public Transport (UITP), 2015b). This strategy, still according to the CEO (Jenssen, 2015), follows guidelines from the HiTrans Manual (Nielsen et al., 2005), and intends to invert the usual supply-oriented approach to PT planning to put the user in the first place. In Amsterdam, in turn, the same approach became more salient after subsidy cuts in the wake of the 2008-10 financial crisis. In the context of budget pressures, interviewee A8 recalls, rather than scrapping costs, the decision in Amsterdam was to improve service quality and attract more passengers to help increase revenues. The network was revised to improve intermodal connection with trains. In addition, GVB's concession, by far the largest in terms of subsidies and passenger levels, was renegotiated to amplify the operator's freedom in service design so that the company could focus resources on increasing the frequency of high-demand lines. Furthermore, requirements related to distances between PT stops were relaxed, explains interviewee A5.

In both cases, some success in attracting more passengers to PT has been attributed to measures that concentrate service provision in high demand areas. Nonetheless, interviewees also acknowledge that the decision on where to provide PT always involves important challenges; prioritising service in certain areas at the expense of others requires that some local constituencies accept receiving lower service levels. Informal institutions support coordination regarding this decision. In particular, the shared understanding that PT should be an engine for regional development and managed as a financially sustainable undertaking, with adequate levels of cost-recovery (rather than generating deficits to be covered by governments), supports PTAs' in managing potential conflicts of interests. This shared understanding, apparent in Oslo and Amsterdam (as in other jurisdictions [Hrelja et al., 2017]), is underpinned by NPM values of ef-

ficiency and effectiveness, and is concretely manifested, for instance, in non-binding plans of both PTAs (e.g. Regionaal Organ Amsterdam, 2004; Ruter, 2015). Amsterdam's OV-Visie 2010-2030, for example, states that PT has a leading role in making the region more attractive to people and businesses, as it develops into a metropolis that competes with other European metropolises (Stadsregio Amsterdam, 2010). These strategic documents have relevant guiding role, confirms interviewee A1.

4.5.2 Public transport as a facilitator of green development

In Oslo and Amsterdam, the responsibilities for land use and transport planning are fragmented between municipalities and the PTAs respectively; no entity has formal powers to integrate these policy areas. Furthermore, not unfrequently, regional and local interests clash regarding where to incentivise densification and where to prevent it (Bergsli & Harvold, 2017; Schwanen et al., 2004). Yet, in both cases there has been general congruence between spatial and transport planning, helping to moderate sprawling and car usage (Geurs & van Wee, 2006; Næss, Næss, et al., 2011).

Næss et al. (2011) demonstrate how the emergence of a shared view on the importance of sustainable development played a crucial role in enabling spatial policies that favour PT over car in Oslo. Their analysis of plans, professional journal articles, and interviews with politicians and planners show that there has been a high degree of professional and political consensus about urban densification as an overall strategy for sustainable urban development. Oslo Package 3, for instance, is explicit about the aim of modal shift from cars to PT in view of sustainability goals. In Oslo municipality, in particular, the consensus around PT as a tool for sustainable mobility is more prominent, and this agenda has been strengthened in the latest municipal political term, explains interviewee O3: the coalition in power set ambitious targets for reducing emissions and car use, increasing restrictions for parking and investments in bike infrastructure, as well as banning cars from the city centre. In addition, a shared understanding about the importance of coordinated land use and transport planning as a tool for economic competitiveness is also visible. The Oslo Region Alliance, a collaborative, political membership organisation comprising 79 local authorities across counties and municipalities surrounding Oslo is illustrative. The Alliance's stated goal is to strengthen the area as a competitive and sustainable region in Europe. Furthermore, Oslo and Akershus adopted their first non-binding Regional Plan for Land Use and Transport (2015), accommodating concentrated development guidelines, but also highlighting the goal of competitive growth. The plan expressly underscores the importance of a shared consensus, when referring to achieving these goals: *"The most important in this regard has been to gain a common understanding of the most important challenges and priorities, based on the development pattern and the transport system we have today."* (2015, p. 3).

In The Netherlands, similar shared understandings are present. Concentrated development strategies are linked to the rise of a strong environmental agenda, favouring PT over driving, as well as to the intent to recover cities in decline, especially after the Oil crisis (van der Burg & Dieleman, 2004). This has materialised in a strong national consensus on a set of enduring notions on spatial configurations and development strategies, the so-called 'Dutch planning doctrine', in which co-government between national administration, provinces, and municipalities, based on extensive negotiation and mutual consensus, has been an underlying principle (Faludi, 2005; van der Valk & Faludi, 1997). Some claim the 'doctrine' to be now in disarray (Roodbol-Mekkes, van der Valk, & Korthals Altes, 2012), as national spatial strategies have lost influence power due to a reorientation of spatial planning towards more emphasis on a regional economic approach in which economic development has become the main priority (Zonneveld Wil & Evers D., 2014). This shift can also be seen at the regional level, e.g. in the establishment of the Metropolitan Region Amsterdam in 2007, a joint provincial-municipal collaborative forum (without formal political powers) to discuss issues of regional importance. The entity aims to foster economic growth, based on the development of the region as a European metropolis, attracting companies, residents, and visitors. Overall, the system continues to function mainly on the basis of high level of trust and consensus (OECD, 2017b), and coordination is supported by the shared understanding on the positive economic role of integration between land use and transport.

4.5.3 Problem-solving know-how

"It is not only about the institutions, but also the people within them" (interviewee O11). Oslo's stakeholders repeatedly highlight Ruter's importance for PT's success, also indicating that the PTA promotes a mind-set of *"moving people rather than buses"* (interviewee O7). The PTA has effectively implemented a coordinated multimodal vision, ending quarrels within the 'PT family': before Ruter, PT professionals in Sporveierand SL worked in 'modal silos' focusing on developing projects for their respective mode; overall coordination was poor, recalls O10. Ruter's problem-solving capacity has also become evident due to their ability to overcome the operational and reputational problems with Flexus by implementing successful ticketing and real-time passenger information systems, eventually gaining great credibility, says interviewee O8. Furthermore, there is frequent recognition, amongst interviewees, of the added value brought by Ruter's staff coming originally from other professional backgrounds. These people carry expertise and managerial skills from the private sector and promote new views and practices that are seen as beneficial to PT. This characteristic, in fact, can be traced back to Sporveier's time: interviewee O11 describes how a particular director pushed for the development of innovative programmes of user survey and travel guarantee scheme in the 1990s as a way to shift the company's priority to clients.

In sum, staff at Ruter are described as possessing high technical expertise and problem-solving capacity, being key in developing high-quality service. PT's good results in terms of higher service standards and growing ridership are associated to Ruter and its personnel. They gained credibility and legitimacy amongst politicians and civil society, and are regarded as 'experts,' with greater ability to influence PT policy and planning as their decisions are trusted.[3]

4.5.4 Institutional entrepreneurs

The shared understanding about the importance of PT as a tool for regional economic development is at the backdrop of the emphasis on service frequency in main lines in Amsterdam. Nonetheless, interviewees also refer to the contribution that key individuals have had in promoting this approach. In this sense, the alderman for transport for the city of Amsterdam during 2010-2014 is unanimously cited as a key figure.

The position of alderman for transport in Amsterdam is very relevant. Besides the role within the municipality, they normally occupy a place at the two main governing bodies of the PTA, the council and the daily board. Amidst the pressures brought by reduced funding availability after the financial crisis, the alderman sought to shift the then prevailing logics of action. Rather than resorting to cost scrapping, the alderman promoted further investment in PT to make it more attractive and, as such, able to cater for more passengers and generate more revenues. The alderman mobilised other important players and took advantage of a good relationship and alignment with GVB's CEO at the time. This was pivotal to enable consensus on a new logic of action based on the need to do more with less money ("*meer effect per euro*" in the alderman's words), which eventually materialised in the network reforms and the changes in service delivery specifications described in Section 4.5.1. Another key political actor frequently mentioned in interviews is the subsequent alderman for transport (2014-2018), who maintained this logic of action in relation to PT – i.e. recognising the need to reconcile cost-efficiency and increased service revenues.

4.6 The interplay between formal institutions, informal institutions and key actors

This section employs the typology introduced in Section 4.2.2 (Helmke & Levitsky, 2004) to connect the contents from Sections 4.4 and 4.5. The objective is to distinguish the types of interaction between formal and informal institutions as well as key actors

[3] The reference to Ruter's capacity is not based on a comparison to Amsterdam's PTA. It only reflects findings from case investigation in Oslo.

in supporting processes of coordinated decision-making. These insights are then synthesised in Table 4.4.

Table 4.4: Interaction between formal institutions, informal institutions and key actors

	Ridership vs coverage	Land use and PT integration	Policy implementation capacity	Subsidy constraints
Oslo	Complementary	Substitutive	Complementary	--
Amsterdam	Complementary	Substitutive	--	Accommodating

The first coordination issue in which this interaction is relevant is the decision on where to provide PT, which ultimately reflects the inherent trade-off between ridership and coverage objectives (i.e. increasing usage versus maximising spatial availability of PT) (Walker, 2008). As discussed above, concentrating resources on more profitable lines located in dense areas relies on a shared understanding about PT as a tool for regional economic development backing the PTAs' choices that might cause some constituencies to be less served than others. Nevertheless, these shared understandings cannot fully eliminate tensions that arise in the definition of priorities around PT planning and delivery, and interviewees highlight that decisions to cancel services frequently face opposition and require negotiations and compromises with politicians and users. Therefore, the existence of strong PTAs with formal powers (and, in the case of Ruter, organised as an independent commercial company) is an important enabling condition to allow any shared understanding to be translated into decisions. Thus, in both Oslo and Amsterdam, informal and formal institutions work alongside each other, in a *complementary* manner, to facilitate the pursuit of ridership goals within the existing rules of the game.

A second example of coordination challenge involves the integration between land use and transport planning. The disconnect between the allocation of responsibilities for land use (local level) and PT planning (regional level) opens room for potential difficulties in collective decision-making. In this instance, the shared understanding around PT as a tool for green development helps coordination in a manner analogous to what Helmke and Levitsky (2004) call *substitutive*. Similarly to complementary relationships, these substitutive informal institutions are employed by actors who seek outcomes compatible with the existing formal frameworks, but which the latter cannot achieve. Voluntary cooperation and consultation are examples of solutions adopted in Oslo and Amsterdam that work as 'lower-cost' options compared to creating new formal institutions to govern both policy areas (as it is also unlikely that municipalities would relinquish their land use planning powers). Nevertheless, informal institutions show limitations once again. Not infrequently, municipalities decide to build based on local interests even if these clash with regional objectives of avoiding densification in certain areas. In Akershus, says interviewee O1, although the county government could override

municipalities' decisions that contradict the 2015 Regional Plan, this will not happen if politicians at the two levels of government are from the same party. Another illustration of the limitations of informal institutions in this case is that national governments continue to invest in expanding road capacity, in contradiction to efforts to promote concentrated development and favour PT (Tennøy, Tønnesen, & Gundersen, 2019). Once again, formal institutions are important to address these coordination challenges. In the case of Oslo, for instance, the shared views on the importance of sustainability and green development is strengthened and enabled by the formal national funding policies. The abundant funds linked to certain environmental and spatial goals in the Oslo Packages and in the Urban Agreements facilitate and steer joint decisions.

A third example concerns the interaction between formal institutions and key actors and is illustrated by Ruter's recognised high policy implementation capacity. The PTA's staff is acknowledged for possessing professional know-how including (but beyond) technical expertise. Their problem-solving skills involve being creative in implementing new practices and ideas from other professional areas; some of the key staff in the PTA, including the CEO, come from professional backgrounds other than transportation. Ruter's staff are regarded as experts with legitimacy and credibility. Politicians and citizens trust their decisions, which grants them more autonomy and facilitates prioritisation and policy implementation when dealing with contentious issues – such as emphasis on high-demand lines or aspects involving multimodal coordination and fare reforms. Interviewee O1 recalls that before the establishment of Ruter, Sporveier had limited planning freedom; currently the PTA has greater autonomy to act according to their judgement. This does not mean that Ruter's staff know-how is *per se* sufficient to resolve all coordination and decision-making challenges. Oslo's formal institutional environment is a strong enabler: first, and evidently, it grants Ruter with formal PT planning powers in the two counties. Second, and in stark contrast with Amsterdam, the increasing availability and stability of funding both from regional and national sources create favourable conditions for their know-how to be developed and used (Nielsen et al., 2005). Thus, Ruter's skilled staff *complement* and enhance the performance of the existing effective formal frameworks. Interviewees describe a positive feedback loop in Oslo, involving greater political autonomy for Ruter, increased funding, and higher ridership: "*In 2012 we started receiving a lot more money because we were doing a good job*" underscores O1.

Amsterdam's response to budget pressures constitutes the final example of a coordination challenge that is resolved based on the interaction between institutions and the way key individuals act to promote change. Key individuals were able to, within existing rules, act entrepreneurially to modify prevailing logics of action. Dealing with reduced national subsidies and having no ability to interfere with the legislation that defines these rules, Amsterdam's alderman for transport championed a new consensus,

mobilised other players, and built coalitions around the idea of "*meer effect per Euro*." The alderman worked to 'sell' and 'market' new ideas in order to set agendas and implement institutional change (Hardy & Maguire, 2017), eventually being able to *accommodate* his interests within the existing framework. This does not imply that heroic actors exist and can alone achieve their goals regardless of other circumstances (Hardy & Maguire, 2017); the formal position held by the alderman and other players was crucial to provide them with legitimacy and political powers, thus working as enabling conditions to allow institutional entrepreneurship to emerge (Maguire et al., 2004).

4.7 Concluding discussion

Public authorities are under mounting pressure to govern a shift in personal mobility, promoting more sustainable transportation patterns that include greater use of PT at the expense of cars. This chapter investigates two success stories – Oslo and Amsterdam – which, according to previous research, display formal institutional frameworks that support the attractiveness of PT. A longitudinal analysis confirms that in recent decades the two cities pursued reforms that strengthened their formal institutional environments, contributing to positive PT outcomes. However, it also shows that their success relied on informal institutions and key actors that, alongside formal frameworks, help coordination and decision-making on issues ranging from the integration between land use and transport to addressing subsidy restrictions. Formal and informal institutions and key actors interact in complementary, substitutive, or accommodating manners, influencing how policies are designed and implemented, driving PT outcomes.

The results confirm that institutions both constrain and enable agents, whereas the latter can also shape institutions as they interpret and enact them. The upshot thus is that change agents foster the dynamic interplay between formal and informal frameworks by acting in the analytical space that opens up between (formal or informal) rules and their interpretation and enforcement; these spaces allow actors to introduce new rules (on top and alongside existing ones), to remove existing ones, or to implement them in new ways (Mahoney & Thelen, 2010). In other words, agents have a central role in triggering institutional change over time through the way they engage with the properties of existing institutional frameworks that permit or invite specific kinds of change strategies. This highlights that public authorities must be aware of the relevance of informal institutions and individuals' agency. Acknowledging and comprehending the importance of existing shared understandings and the influence of key players, either political leaders or civil servants, constitute important tools to inform policy-making processes, given the potential that these factors have to enhance the effectiveness of, or even partially substitute, formal frameworks in supporting successful PT.

This study also underscores that, differently from the view prevailing in PT research, the relationship between governance and performance is not unidirectional; both affect and are affected by each other in a complex dynamic interplay. The analysis of Oslo describes a positive loop in which good performance is supported by an enabling formal institutional setup, but, at the same time, positive outcomes strengthen the legitimacy of said formal institutions, increasing their effectiveness. Interviewees in Oslo emphasise that there is general trust in the work developed by the PTA, which consequently gains political influence, is entrusted with more funding, and enjoys more freedom to deal with potentially controversial trade-offs in policy design and implementation.

Finally, this study shows that whether complementary, substitutive, or accommodating, the relationships identified in Section 4.6 are markedly market-driven; economic and PT revenue growth appear as the main PT policy drivers, potentially jeopardising sustainability goals. Although most environmental benefits of PT are related to the number of users, evidence suggests that compatibility between growth and sustainability might be limited. Interviewee O1, for instance, observes that the attractive PT in Oslo sometimes is moving people away from walking and biking, even for very short trips. Similarly, research in the UK has found that electoral considerations might lead politicians to prioritise economic growth at the expense of sustainability (Bache, Bartle, Flinders, & Marsden, 2015). Overall, it is dubious whether growth can be decoupled from pollution generation and resource depletion (Næss, Saglie, & Richardson, 2019; Wanner, 2015). The business orientation in PT planning and provision can also affect accessibility and transport equality goals. Focusing resources on main lines at the expense of less dense areas risks to accelerate the divide in mobility patterns between main city and suburbs, something already visible in Oslo and Amsterdam (Ruter, 2015; Vervoerregio Amsterdam, 2018). This is the case because such approach presupposes that a tightly integrated transport system is able to provide users with alternatives to PT in suburban areas, especially for first and last mile trips. If, however, these options are not in place, population in the latter might increasingly need to rely on cars.

Whilst insights provided by this chapter are relevant and aligned with findings from other studies (Bache et al., 2015; Hrelja et al., 2017; Wikström, Eriksson, & Hansson, 2016), some limitations are inevitable. The conclusions are based on context-dependent governance processes and, as such, are mostly contingent to the analysed cases. There is no certainty that similar factors always play the same role. Likewise, other factors that go beyond the scope of the chapter – and were hence omitted from this analysis – might also have influenced PT outcomes in Oslo and Amsterdam: changes in fuel prices, congestion charging schemes, or lower levels of car ownership amongst younger generations are just a few examples. Finally, it is not possible to ensure that this research has identified all relevant informal institutions or key actors in Oslo and Amsterdam, and the elements described in Section 4.5 do not represent an exhaustive list.

Yet, the analysis expands knowledge on understudied topics, and, in addition to the practical policy implications discussed above, it also opens opportunities for continued research. Follow-up investigation could further explore Oslo and Amsterdam in order to revise and expand current findings and unveil other potentially relevant informal institutions, such as informal conventions and procedures (including analytical methods), key actors not found in this study, or to enhance the typology proposed in Section 4.6. Additionally, other comparable cases could also be investigated using the leads established in this study. In this sense, coming analyses can look into instances in which ineffective informal institutions or unsuccessful efforts of key actors (both admittedly difficult to determine) undermine PT success, or even work to identify manifestations of potentially negative aspects of shared understandings – such as group thinking or conventional ways of policy-making that might exclude certain actors or interests from the political process. Such future research can be crucial to advance the understanding of trends that this chapter highlights. This is to say: if public authorities are to intervene effectively in the formulation and implementation of PT policies, scholars and decision-makers must go beyond the discussion of *what* needs to be done to improve PT and discern the complexities around *how* the governance of policy-making processes unfolds.

Chapter 5

Public transport regimes and mobility as a service: Governance approaches in Amsterdam, Birmingham, and Helsinki*

* The content of this chapter has been published as Hirschhorn, F., Paulsson, A., Sørensen, C. H., Veeneman, W., 2019. Public transport regimes and mobility as a service: Governance approaches in Amsterdam, Birmingham, and Helsinki. Transp. Res. Part A Policy Practice 130, 178–191. The final publication is available at https://doi.org/10.1016/j.tra.2019.09.016.

Abstract

This chapter examines governance responses to Mobility as a Service (MaaS). The analysis focuses on the interactions between public transport systems and MaaS developments in Amsterdam, Birmingham, and Helsinki. Case comparison is informed by the multilevel perspective on socio-technical transitions and literature on meta-governance of networks. Drawing on these frameworks and on empirical findings, the chapter formulates six governance approaches to MaaS across cases: analyser, architect, convener, experimenter, lawmaker, and provider. These basic models encompass strategies ranging from hands-on strong intervention to information collection efforts. Consistent with the transitions literature, these six approaches indicate that public transport regimes seek to control the apparent disruptive potential of MaaS by incrementally absorbing innovations; to this end, regime actors adopt governance responses that tend to reproduce existing institutionalised ways of doing and prevailing logics. Furthermore, the six approaches reveal intense interaction between regime and niche, suggesting that a niche-regime space might have emerged in the cases; actors travel and operate across niche, regime, and niche-regimes, mainly driven by concerns with market share and revenue streams in the mobility system.

5.1 Introduction

A small but rapidly growing body of literature analyses the emergence of mobility as a service (hereafter MaaS) (Docherty, Marsden, & Anable, 2018; Lyons, Hammond, & Mackay, 2019; Mulley, 2017). The MaaS proposition relies on a new service model that allows frictionless mobility based on the integration, in a single gateway, of multiple services currently offered in a fragmented fashion. From their smartphones, MaaS users should be able to plan, manage, and personalise multimodal door-to-door trips, paying for the whole journey in a single transaction. The MaaS rhetoric promises a future with seamless intermodality in the palm of customers' hands, ensuring the same freedom and convenience offered by cars, without the need to own one.

Despite the narrative's focus on customers' convenience, much of the agitation around MaaS is due to the opportunities and risks it poses to other actors and institutions in the mobility ecosystem (OECD, 2018). Yet, so far limited attention has been devoted to the repercussions of MaaS on metropolitan public transport (PT) (Hensher, 2017; Mulley & Kronsell, 2018; G. Smith, Sochor, & Karlsson, 2018). This is relevant because behind the 'MaaS discourse', lies the promise of smarter policy-making and better management of PT supply and demand based on greater knowledge of users' behaviour. This, in turn, can support political ambitions on matters of sustainability, congestion, and use of urban space (Datson, 2016; Mulley, 2017; Parkhurst, Kemp, Dijk, & Sherwin, 2012). Consequently, governments wish to steer a MaaS trajectory that favours multimodality with a prominent role for PT, whilst also avoiding solutions that discourage walking and cycling or increase car use.

However, whilst having similar interests, governments may choose different ways to deal with the Maas governance challenge. This chapter analyses how public sector actors are responding to MaaS initiatives vis-à-vis the organisation and provision of PT, to identify and conceptualise current governance approaches to this innovation. The empirical focus lies on regional public transport authorities (hereafter PTAs) and national ministries in Amsterdam, Birmingham, and Helsinki.

Methodologically and analytically, this study responds to calls for more qualitative and mixed-method approaches in public transport research, and greater exchange with and use of concepts and methods from the social sciences (Marsden & Reardon, 2017; Schwanen et al., 2011). The multilevel perspective on socio-technical transitions (MLP) offers a heuristic lens to structure the comparative design across three analytical levels: niches (silos for innovations), regimes (dominant established practices and associated rules), and landscape (the wider context in which niche and regimes are inserted) (Geels, 2002). According to the MLP literature, the land passenger mobility system contains multiple regimes, amongst which the car regime holds a dominant position (Geels, 2018; Parkhurst et al., 2012). The chapter, instead, focuses on the PT regime and

on its interactions with MaaS niches. Nevertheless, the MLP lacks adequate conceptualisation of actors' roles and strategies in transitions (de Haan & Rotmans, 2018; Wittmayer, Avelino, van Steenbergen, & Loorbach, 2017), so this analysis is complemented with literature on network governance, in particular meta-governance theories (Jessop, 2002; Koppenjan & Klijn, 2004; E. Sørensen & Torfing, 2009). Drawing on these two frameworks and on empirical material, the chapter delineates six approaches being adopted in the governance of MaaS in the three cases: analyser, architect, convener, experimenter, lawmaker, and provider.

Section 5.2 introduces the MLP framework and the main concepts from governance theories used in the analysis. Section 5.3 describes methods and materials, whereas Section 5.4 presents case findings. The information in this section is organised across the MLP levels: first the landscape level, which is common across cases, and then PT regimes and MaaS niches (as defined in Section 5.2) of each case. Afterwards, Section 5.5 builds on previous sections to formulate six basic models of governance approaches to MaaS. Reflections and concluding remarks follow in Section 5.6.

5.2 Analytical framework

This section explains the main tenets of the MLP framework and of governance theories that are then employed as analytical framework for the chapter's analysis.

5.2.1 The multilevel perspective and the socio-technical system of land passenger mobility

The MLP (Geels, 2002) is a widely used framework to address the adoption, diffusion or rejection of new technologies (Sovacool & Hess, 2017). The premise of the MLP is that transitions are processes that result from the interplay of developments at three analytical levels: landscape, regimes, and niches. Therefore, socio-technical systems, including the land passenger mobility system, as well as respective events and actors, can be described and understood employing the MLP (e.g. Berkeley et al., 2017; Geels, 2012; Nykvist and Whitmarsh, 2008).

The landscape is the wider context constituted by exogenous elements that cannot be directly influenced by regime or niche actors, but that influence them through pressures that can either be of stabilising or destabilising nature. Examples of landscape factors include changes in demographics, cultural preferences, macro-economic or macro-political developments.

A series of current trends destabilise the land passenger mobility system, and are said to threaten the dominant position held by cars (Geels, 2018; Kingsley & Urry, 2009). Most notable amongst these trends, is the increasing concern with global warm-

ing, moving transport sustainability to the top of policy-making agenda (Banister, 2008; Marsden & Rye, 2010; Nykvist & Whitmarsh, 2008). In this context, a supranational entity as the EU can act as a 'landscape actor', able to generate destabilising pressures through regulation on emissions and strategies towards sustainable mobility (Hoffmann, Weyer, & Longen, 2017). In addition, authors also highlight pressures connected to the expansion of digitalisation and ICT, as well as sharing economy, that can modify individuals' preferences on how to travel (Geels, 2018; Meyer & Shaheen, 2017; Sperling, 2018). On the other hand, stabilising trends also exist. Geels (2018) suggests that neoliberal ideologies strengthen the current configuration of land passenger mobility by favouring the continued predominance of the car regime, as they resonate with the individualism and freedom associated with private cars. Along similar lines, Nykvist and Whitmarsh (2008) highlight stabilising trends supporting increased car use in Europe, such as growing incomes, greater participation of women in the labour force, and increases in speed and convenience of travel.

Regimes, in turn, represent the set of semi-coherent rules that orient and coordinate the activities of social groups and that reproduce the various elements of socio-technical systems, such as shared beliefs, norms, standardised ways of doing; the concept of regime can be applied to empirical topics of different scope (e.g. primary fuels or entire electricity systems) (Geels, 2011, 2012). Regimes are constituted of multiple dimensions, such as technology, regulation, user practices and markets, cultural meaning, and infrastructure (Geels, 2002; Geels & Schot, 2007). Small adjustments accumulating into stable trajectories across these dimensions promote incremental innovation in regimes. In this sense, regimes account for the (dynamic) stability of socio-technical systems. Furthermore, as *"socio-cognitive rules of routinized practice"* (Svensson & Nikoleris, 2018, p. 464), regimes reinforce prevailing logics and exert structuring force upon change processes (Fuenfschilling & Truffer, 2014; A. Smith, Voß, & Grin, 2010). In this sense, a transition is defined as the shift from one regime to another (Geels & Schot, 2007).

The land passenger mobility system contains diverse conceptually distinct regimes according to the transitions literature. The car regime is traditionally understood as a separate and dominant regime (Geels, 2018; Hoffmann et al., 2017; Sovacool & Axsen, 2018). This dominance is ensured through a series of stabilising factors and lock-in mechanisms, ranging from cultural values and the preference for the feeling of freedom promoted by ownership and individual transportation, to sunk investments in road infrastructure, car manufacturing plants, and important interests from diverse powerful players including car manufacturers and the oil industry (Geels, 2012; Sheller & Urry, 2000; Urry, 2004). Other modes of transport, on the other hand, constitute subaltern regimes according to literature. In relation to PT, some authors speak of subaltern regimes for each mode of transport (a bus regime, a train regime, etc.), whilst others consider a

broader secondary regime of public transport (Geels, 2012; Kemp, Avelino, & Bressers, 2011; Parkhurst et al., 2012). Empirically, as parts of the wider land passenger mobility system, all these regimes maintain intense links (and, in fact, MaaS' ambition is to make passengers' experience seamless when using multiple transportation modes). However, the conceptual differentiation is useful to delimit the scope of analysis in this chapter: the focal regime analysed here is the broader PT regime, involving the provision of all collective modes of land passenger transport services available to the general public within a metropolitan area, and linking it to its direct environment. Following the general concept of regimes, PT regimes too comprise multiple dimensions: drawing on Geels (2018), Section 5.4 addresses the regime of each studied case by describing their main techno-economic developments, actors, and institutions.

Finally, niches are protected silos for innovation, such as R&D laboratories and pilot projects. They provide the environment for testing and learning-by-doing. Through multiple experiments, and with support from influential groups, niche-innovations can gain momentum and "*…overcome the constraining influence of regimes, branch out, link up with wider change processes, and drive transformations in those same regime structures over the longer-term.*" (Smith et al., 2010, p. 440).

The development of biofuels and electric vehicles are examples of niches in the land passenger mobility system (Geels, 2012, 2018). Geels (2012) also mentions tele-working and tele-shopping as components of ICT niches in personal mobility. Parkhurst et al. (2012) discuss intermodal personal mobility niches, analysing initiatives that allow the combination of multiple modes of transport in the same journey. This chapter focuses on MaaS niches. MaaS is defined here as the business model based on offering passenger mobility services via a single platform, and integrated in at least three ways: (i) collection and organisation of information from various mobility offerings (public and private, collective and individual modes); (ii) combination of these offerings, as well as user input (trip customisation), for itinerary recommendation; and (iii) a single transaction allows booking and paying for the whole journey (Datson, 2016; Kamargianni, Li, Matyas, & Schäfer, 2016; Mulley, Nelson, & Wright, 2018). The MaaS niches analysed in the chapter are those aiming to develop offerings to cover all these elements, not only part of them.

Despite being recognised as a key framework for analysing socio-technical transitions, the MLP has been criticised for an excessive focus on structures and lack of attention to actors' agency, politics, and power (e.g. Avelino, 2017; Smith et al., 2005). Hence, the MLP is unable to conceptualise actors' roles and interactions in transitions (de Haan & Rotmans, 2018; Wittmayer et al., 2017); the role of public sector actors, in particular, has traditionally been analysed implicitly in transitions literature, limiting the understanding of the state's nature and functions in these processes (Johnstone & Newell, 2018).

5.2.2 Complementing the MLP with governance theories

To tackle some of the limitations of the MLP, this study employs governance theories. Broadly speaking, governance, and thus theories of governance, are concerned with creating and examining the conditions for ordered rule and collective action; the ways in which societies create and uphold rules and order in social processes in the pursuit of collective interests (Bevir, 2013; Peters & Pierre, 2016; Stoker, 1998). Analytically, the concept can be broken down into three distinct dimensions: politics (concerning the actor constellation, i.e. range of actors involved in the process of policy-making); polity (concerning the institutional landscape in which these actors operate); and policy (concerning political steering, i.e. the nature and character of steering instruments being used) (Treib et al., 2007). This chapter emphasises the third analytical strand. It takes governance as every mode of political steering involving public and private actors, including traditional modes of government and different types of steering, from hierarchical imposition to sheer information measures (Héritier, 2002). The focus is on the interpretation of the interactions between PT regimes and MaaS niches to understand and conceptualise the governance approaches employed by public sector actors in relation to MaaS.

Therefore, the literature on the meta-governance of networks and meta-governors (Jessop, 2002; Koppenjan & Klijn, 2004; E. Sørensen & Torfing, 2009) constitutes a relevant source to support this study. Meta-governance refers to the role of the state and its instruments to initiate, support, and guide networks; the aim of this intervention is to ensure that networks, formed by governmental and non-governmental actors, contribute to the production of public value and to solutions for wicked policy challenges (Bevir & Rhodes, 2016; Koppenjan & Klijn, 2004). The legitimacy, special resources, and capacities of state actors give them a lead to act as meta-governors (Klijn & Koppenjan, 2000). They can mobilise knowledge and resources across the network whilst retaining the ability to influence the scope, process and outcomes of policy-making (E. Sørensen & Torfing, 2009).

Particularly relevant for this study is the typology of four forms of meta-governance developed by Sørensen and Torfing (2009): (1) *policy and resource framing* (limited and hands-off intervention to define the basic task of the network and the conditions for tackling this task, but without direct participation in the production of outcomes, as tasks are carried out by other network actors; (2) *institutional design* (strong hands-off intervention to determine the arenas for interaction between actors and the basic rules of engagement, thus influencing the scope, character, composition, and procedures of the networks, but without a direct involvement in the execution of tasks); (3) *facilitation* (limited hands-on intervention, directly collaborating with the network and its activities to support process management and conflict resolution, lowering the transaction costs of interacting); and (4) *participation* (strong hands-on intervention to influence

the joint production of outputs and outcomes, aligning network activities with the governance ambitions pursued by the meta-governor). This framework depicts the possible ways in which public sector actors intervene in networks to achieve their political goals through varied steering tools, and even interacting directly with other network players through negotiations or by carrying-out tasks in certain circumstances. The typology can be useful to examine governance processes in the mobility sector (see e.g. Hansson, 2013) and thus to help address some of the weaknesses in the way the state has been examined so far in the MLP literature, supporting the analysis of responses to MaaS.

5.3 Methods and materials

The chapter takes a problem-driven research approach. It does not aim to test the theoretical frameworks discussed and their hypotheses to enable prediction and control, but to identify and conceptualise governance approaches to MaaS. These involve and are influenced by multiple interdependent actors and elements of different nature, like values, technology, and culture. This study, thus, requires concrete and context-dependent knowledge, and the qualitative case-study method is well suited to this end (Flyvbjerg, 2006; George & Bennett, 2005; Guba & Lincoln, 1994). This study employs the structured and focused comparison design (George & Bennett, 2005), and moves forward by asking the same questions from each case, focusing on those case elements defined according to the analytical framework presented in Section 5.2.

Consistent with the research aim and approach, case selection follows three main criteria. First, given that MaaS is a recent and still understudied phenomenon, the chapter examines cases that can operate as reference points; i.e. cases that highlight more general characteristics related to the governance approaches to MaaS. The objective is to use paradigmatic cases (Flyvbjerg, 2006) with prototypical value and strategic importance in relation to the general problem under examination. Helsinki is a front-runner in the development of MaaS, and thus can provide a longer history of events for investigation, whereas Amsterdam and Birmingham currently witness the development of relevant MaaS activities, but have received little attention from literature. Second, cases show diversity across defining elements of their PT regimes, thus contributing to the chapter's goal of contrasting governance factors that might influence actors' approaches to MaaS: the three metropolitan areas vary in relation to the market share of PT, ticketing, and fare policies, and display a different institutional setup in the sector. Third, case selection is guided by practical research considerations, such as availability of sources and familiarity with the cases' languages.

The analysis is based on academic works, grey literature, policy documents, and interviews. Twenty individuals representing a varied set of stakeholders – PTAs, min-

istries, transport operators (public and private), user associations, and MaaS providers – were contacted for interviews, and sixteen agreed to collaborate (Table 5.1). All evidence was collected during late 2018 (one interview conducted in 2019). Findings were triangulated to substantiate conclusions.

Table 5.1: List of Interviewees

Case	Affiliation	Id.
Amsterdam	PTA	A1
Amsterdam	Ministry of Infrastructure and Water Management	A2
Amsterdam	Amsterdam Municipality	A3
Amsterdam	Transdev NL	A4
Amsterdam	GVB	A5
Amsterdam	Tranzer	A6
Amsterdam	MaaS Global Amsterdam	A7
Birmingham	PTA	B1
Birmingham	Department for Transport	B2
Birmingham	Transport Systems Catapult	B3
Birmingham	Transport Focus West Midlands	B4
Birmingham	MaaS Global West Midlands	B5
Helsinki	PTA	H1
Helsinki	Ministry of Transport and Communications	H2
Helsinki	OpenMaaS	H3
Helsinki	MaaS Global Helsinki	H4

5.4 Empirical findings

To consistently present the data collected from cases, this section is organised across the MLP levels: first the landscape level, which is common across cases, and then PT regimes and MaaS niches of each case. The regime of each case, in particular, is described based on main techno-economic developments, actors, and institutions.

5.4.1 The landscape for metropolitan land passenger mobility across cases

Interviewees and documents from the three cases tend to emphasise the same destabilising landscape trends discussed in Section 5.2.1, stressing the increased concerns around environmental degradation and the spread of digitalisation leading to an inevitable move towards platform-based economies (e.g. interviewees A2, B1, Vervoerregio Amsterdam [2017], HSL [2017a]). Another reported trend is the decreasing interest of younger generations in owning cars, i.e. a growing preference for access to use over

ownership, within a shared-economy environment (e.g. interviewees A1 and B4 or Stadsregio Amsterdam [2016]). Overall, there is a perception that these trends alter the way people wish to travel and their relationship with PTAs and operators. To be clear, whilst there is general agreement about main trends identified across cases, there is no consensus about the transformative potential of these trends. The rhetoric of MaaS developers that were interviewed suggests that a fundamental shift is in motion, whereas transport operators tend to air scepticism about chances of more profound changes. Opinions from other stakeholders are divided. Finally, whilst there is consensus about the hegemony of cars, interviewees did not highlight landscape stabilising trends and appear to take car dominance for granted, and a permanent feature of the land passenger mobility system.

5.4.2 Amsterdam's PT regime

The market share of PT within motorised trips in Amsterdam moved from around 17% to 23% between 2006 and 2015. Cost-recovery levels grew in the same period, from 38% to nearly 50%. The monthly pass price in 2016 was €50.50, and the area's annual gross domestic product per capita in the same year was €34,700 (European Metropolitan Transport Authorities, 2009, 2017, 2018). Concerning funding, the national government is the primary source of PT subsidies through earmarked transfers to PTAs; these funds are used for operational costs and small infrastructure projects; meanwhile, the national government funds larger scale projects directly. PT subsidies are not indexed to inflation and have grown below this rate in recent years, creating important budget pressures in the sector. Ticket integration is guaranteed by a single nationwide smartcard valid across all PT modes and operators. The smartcard is managed by a joint-venture owned by all operators in the country. A national travel information system for PT exists since the 1990s. The platform is managed by a cooperation between all PTAs and the Ministry of Infrastructure and Water Management (hereafter Dutch Ministry).

Concerning main actors and institutions, the Dutch Law on Passenger Transport from 2000 decentralised PT planning responsibilities to regional authorities. Amsterdam's PTA plans and tenders concessions for bus, tram, and metro services in the city of Amsterdam and 14 surrounding municipalities. There are four concession areas: Zaanstreek, Waterland, Amstelland-Meerlanden and Amsterdam city. For each of these areas, a single operator is granted exclusive rights as provider of PT. The Amsterdam concession is directly awarded to the municipally owned operator (GVB), whilst competitive tendering is used in the remaining areas. The concession contracts are net-cost, so operators retain all fare revenues – and the commercial risk connected to revenue fluctuation. Coupled with this arrangement, operators have considerable freedom to design services; the PTA sets minimum requirements and maintains close dialogue with operators throughout the contract duration. Operators are also in charge

of branding and ticket sales. Fare prices are the sum of a national boarding fee and a regional per-km fee set by each PTA. In addition to funding responsibilities mentioned above, the national government, through the Dutch Ministry, is responsible for the organisation of heavy rail services. The national railway company plans and operates intercity and regional trains.

5.4.3 Amsterdam's MaaS niches

At the time of writing, two main initiatives mark the development of MaaS in Amsterdam: the introduction of a MaaS proposition in the Amstelland-Meerlanden concession and a pilot project in the Zuidas business district. Although apparently territorially limited, both initiatives have a metropolitan scope as they involve travellers and transport networks that cross the borders of the concession area or the neighbourhood.

The Amstelland-Meerlanden concession is the second largest in Amsterdam, and Schiphol International Airport is in this area. The 2016 Schedule of Requirements for a new bidding of the concession acknowledges the emergence of new mobility options and behaviours enabled by new (uses of) technology, such as bike and car sharing, and integrated payment solutions (Stadsregio Amsterdam, 2016). The document asks for '*An operator that does not limit itself to 'its own' bus product, but also sees a role when it comes to improving pre- and post-transport in connection with 'its own' bus product, by optimising the connection to other (public) transport systems.*' (free translation). The document sets broad objectives and minimum requirements, leaving a lot of room for the operator to develop new services that respond to the new context. With MaaS, the PTA intends to respond to changes in users' interests on how to travel, seeking new ways to support PT ridership, increasing connectivity to enable regional economic growth – says interviewee A1.

The concession contract (2018-2027) was awarded to Connexxion. Their winning bid includes: the introduction of two MaaS platforms, Tranzer and Whim; AML Flex (on-demand taxi-like service adopting PT fares and smartcard); and agreements with shared-bikes companies. Tranzer, a Dutch app, offers, at the time of writing, single tickets for trips with the Dutch national railway company, GVB's trams and buses, and Connexxion's buses (in the case of GVB and Connexxion, drivers visually check smartphone tickets). Whim, the Finnish app from MaaS Global, is not active in Amsterdam yet. As explained by interviewees A5 and A7, metro stations are not equipped with turnstiles able to read QR code tickets (the technology required by MaaS Global). In addition, MaaS Global and operators have not yet reached a commercial agreement regarding ticket sales and pricing. Tranzer and MaaS Global want to be able to sell discounted multimodal and multi-operator tickets (and not only single tickets). However, operators resist opening up these for third party sale because they are subsidised tickets, explained interviewees A4 and A6. Moreover, there is no legal obligation for

them to do so. One further controversial issue is the lack of agreement on how to share information about passengers' trips: privacy legislation prevents the opening-up of smartcard data on users' whole journey.

The Zuidas Pilot, in turn, originates from a specific concern with traffic congestion from both Amsterdam's municipality and firms located in the neighbourhood. Due to major infrastructure works planned for the area in the next ten years, the problem is expected to worsen substantially. In 2017 and 2018, the municipality conducted two small-scale experiments to test MaaS-like solutions (Zuidas Mobility Experience). They later sought financial support from the Dutch Ministry and Amsterdam's PTA to scale-up these initiatives.

The Dutch Ministry had already been interested in MaaS and, in 2016, commissioned a white paper 'Mobility as a Service' to set a definition for MaaS: *The provision of multimodal, demand-driven mobility services, offering customised travel options to customers via a digital platform (e.g. Mobile app) with real-time information, including payment and transaction processing* (MuConsult, 2017). This definition was complemented with a list of seven core functionalities, requiring, for instance, user's introduction of 'personal settings'; journey planning function; and ticketing and payment functionalities (Dutch Ministry of Infrastructure and Water Management, 2017). According to interviewee A2, from the ministry, The Netherlands must hurry to experiment with and define how to govern MaaS to avoid problems similar to New York's congestion associated to uncontrolled growth in ride hailing services.

The Dutch Ministry decided to organise and fund (for three years) seven MaaS pilots throughout The Netherlands, and Zuidas was included in this program. Amsterdam's PTA agreed to co-fund the project. The pilots will be tendered-out to consortia that can deliver a MaaS solution aligned with the Dutch Ministry's required definition and core functionalities. In late 2018, interested consortia entered into a Framework Agreement to qualify for the bidding of individual pilots in 2019. In parallel, the Dutch Ministry is negotiating a single standard API with car and bike sharing companies. This agreement could benefit all seven pilots, as MaaS providers would not have to negotiate separate contracts with each operator.

The municipality of Amsterdam and the Dutch Ministry are dealing more directly with the daily management of the Zuidas Pilot, but Amsterdam's PTA participates in frequent meetings with both. The PTA also convenes with operators to come up with a single offer in relation to ticket commercialisation that could be applied in the project. Interviewees from the municipality, the PTA, and the Dutch Ministry highlight that the three parties maintain a good relationship and seek consensual solutions, but mention diverging preferences too. The Dutch Ministry has a strong interest in comparing results and maximising learning across the seven pilots. For this, they need MaaS solutions to be relatively uniform, following their detailed definition and core functionalities.

This, however, is not necessarily compatible with the municipality's interest in shaping their project to their own particular context. Whilst the Dutch Ministry starts from a common solution, the municipality wants to focus on the problem and allow room for the market to come up with a tailored response, points interviewee A3.

5.4.4 Birmingham's PT regime

PT's modal share within motorised trips in the West Midlands region in the UK has remained fairly stable in recent years, varying from 12% to 14% between 2006 and 2015. In 2015, the price of a monthly pass was €82.00, whilst the area's annual gross domestic product per capita was €23,536 Euro (European Metropolitan Transport Authorities, 2009, 2017, 2018). No data on cost-recovery ratios, comparable to similar information from Amsterdam and Helsinki, is available. Concerning funding, PT's operating budget comes mainly from the transport levy raised at the local level, which, however, is funded by UK's Central Government. These funds are used by local or regional authorities to pay bus operators for concessionary scheme tickets and a minor portion of PT services that is defined as socially necessary, as well as to fund other operational expenditure. In addition, all PT services in the UK receive subsidy through the Bus Service Operators Grant; in some areas, this is paid directly to bus operators whereas in others, such as Mayoral combined authorities, the local authority receives the payment and can decide how it is paid to bus operators. This grant was originally conceived as a fuel duty rebate, although it is no longer necessarily calculated on that basis. Local authorities may use these funds for other measures, such as encouraging operators to invest in smart card readers or in buses powered by alternative fuels. PT funding has been decreasing in recent years, generating budget pressures in the sector (Centro, 2014; House of Commons Transport Committee, 2019; West Midlands Combined Authority, 2018).

Passenger information (timetables and ticketing) is made available by Transport for West Midlands, the PTA, in partnership with local authorities and operators through 'Network West Midlands', which is also the common brand that identifies PT services. Swift, the smartcard managed by the PTA, is an important integration element in the relatively fragmented PT sector in the West Midlands. It offers multi-operator, multi-modal season tickets, and a pay-as-you-go scheme. The smartcard, however, co-exists with separate ticketing schemes managed directly by operators.

The West Midlands Combined Authority was established in 2016 based on the devolution agreement signed with the UK Government. The Combined Authority is responsible for, amongst other policy areas, PT strategy and policy. Within the Combined Authority, the PTA is the arm responsible for coordinating investments in West Midlands' (Birmingham and six surrounding municipalities) transport infrastructure, and to create a more integrated network. Buses carry approximately 80% of PT trips

in the region. This market is deregulated and the provision of bus services, except for those deemed socially necessary, depends on operators' initiative. The PTA has limited planning roles and does not design services or fare policies for instance. Their involvement in these issues relies mostly on collaboration with market players. One example is the Bus Alliance, created in 2015. The Alliance is a collaborative initiative that gathers diverse stakeholders, including bus operators, the Combined Authority, local authority highways and transportation departments, and Transport Focus (users' watchdog) to discuss such topics as congestion, bus emissions standards, and ticketing. Besides bus services, the West Midlands have one tramline; its operation, previously franchised, has recently been taken over by the Combined Authority. In addition to its participation in funding PT, the Central Government, via the UK's Department for Transport (hereafter DfT), franchises heavy rail services. Concerning local rail, since 2017, services are jointly managed by DfT and a consortium formed by local authorities. This structure moves a step closer to a potential devolution of franchising responsibility.

5.4.5 Birmingham's MaaS niches

Since 2014, local authorities and the PTA (at the time called Centro) have been assessing the potential benefits that MaaS could deliver to personal mobility in the West Midlands. As highlighted in interviews, this interest emerged in the context of decreasing public funding for PT and, at the same time, general enthusiasm amongst politicians with the potential of technology to solve transport problems. Overall, MaaS was seen as a tool to improve PT ridership and the general economic environment. After commissioning a study on MaaS, the PTA obtained political support to develop these types of services in the West Midlands, without public funding though. Interviewee B1 recalls that two courses of action were considered. The first was to seek EU funding, but that would involve a long-term process with studies and trials to form conclusions about how to implement MaaS. The second option was to promote a business opportunity in the West Midlands, i.e. facilitate an environment in which interested parties could meet and develop MaaS projects. The second route was preferred.

In this context, the PTA and MaaS Global met. The start-up had recently been capitalised and was interested in showcasing their app, Whim, outside Finland, says interviewee B5. The PTA and MaaS Global signed a Memorandum of Understandings, also including other parties such as National Express (main operator in the region), and Transport Systems Catapult (a UK government not-for-profit technology and innovation research centre). This Memorandum constitutes a non-binding and non-exclusive commitment between the parties to collaborate to develop MaaS in the West Midlands, with the aim to ensure that MaaS is both commercially viable and supports societal goals, such as decreasing congestion and pollution. The Memorandum establishes general agreements in relation to data sharing: only data at the aggregate level and no

personalised or commercially sensitive information is shared. In relation to ticketing and pricing, MaaS Global and National Express entered into a separate agreement to regulate their business partnership. The PTA's main role has been to facilitate relationships in the fragmented context of West Midlands' PT regime.

The key distinctive feature of Whim's offering in the West Midlands so far is the use of the smartcard Swift to commercialise ticket packages. MaaS providers' preference, as seen in the case of Amsterdam, is to interact with clients only via smartphone. However, given the relative lack of integration in West Midlands' PT, both MaaS Global and the PTA opted for a different solution, since they were interested to go live as soon as possible with a minimally viable product, recalls interviewee B5. Irrespective of Whim, though, the PTA is moving towards greater payment integration; the Memorandum of Understandings is non-exclusive and the PTA continues to look for new partners and new initiatives. In 2018, some operators started accepting contactless payment, Swift Mobile expanded, and recently a pilot for the sale of tickets for the tram network via phone applications using Google Wallet was rolled-out. As in Amsterdam, there is no directive or regulation determining that operators need to open their tickets for sales by third parties though. Interviewee B1 believes that UK's government could intervene by developing a consensual code of conduct in relation to ticket (re)sale and pricing.

There was no direct involvement from DfT in these developments; they were nonetheless kept informed, indicate interviewees B1 and B2. More broadly, DfT joined MaaS4EU, an EU project whose main goal is to provide quantifiable evidence, frameworks, and tools to enable the MaaS concept. Moreover, the Department commissioned a study from Transport Systems Catapult on the potential of MaaS in the UK. Finally, in late 2018, DfT issued a call for evidence seeking information to support their Future of Urban Mobility Strategy. This Strategy is to be followed by a regulatory review process, consisting in further analytical work on forms of government intervention in new mobility services; whether and how the UK will regulate MaaS is still an open question, point interviewees.

5.4.6 Helsinki's PT regime

The share of PT within motorised trips and the cost-recovery levels in Helsinki are fairly high and stable over the years. Between 2006 and 2015, these ratios varied from approximately 38% to 40% and between 56% and 48% respectively. In 2016, the price of a monthly pass was €152.30, and the area's annual gross domestic product per capita €56,600 (European Metropolitan Transport Authorities, 2009, 2017, 2018). Differently from Amsterdam and Birmingham, PT funding comes primarily from the tax base of local authorities; municipalities transfer grants to the Helsinki Regional Transport Authority, the PTA, and negotiate the desired level of service. Ticketing in Helsinki is managed by the PTA; the system is fully integrated since the 1980s, and both a smart-

card and tickets via smartphone application are valid across modes and operators in the metropolitan area (Helsinki, Espoo, Kauniainen, Vantaa, Kerava, Sipoo, Kirkkonummi, Siuntio and Tuusula). The PTA provides an online journey planner and makes schedule data available for third-party developers.

According to the Finnish Regional Development Act, since 2010 Helsinki's PTA is responsible for PT planning in the entire metropolitan area. The PTA plans and organises bus, metro, tram, and commuter rail services. Besides the responsibility for the general institutional setup of the sector, the Finnish government manages long-distance rail services. Municipalities, in turn, and in addition to funding operational costs, invest in PT infrastructure, such as railway stations and terminals, being compensated for this by the PTA. As a result, local governments have important clout over PT, as highlighted by interviewee H1. All regional PT is contracted-out: bus services are competitively tendered, metro and tram services are procured from Helsinki's municipally owned operator, and commuter rail services procured from the Finnish State Railways. Contracts between the PTA and operators are based on gross costs, so all fare revenues accrue to the authority that consequently retains commercial risks. As such, and differently from Amsterdam and Birmingham, it is Helsinki's PTA that develops detailed service design and plans, defining PT offering, routes, and timetables. They are also responsible for the marketing of PT and for providing passenger information. The PTA also defines fare prices.

5.4.7 Helsinki's MaaS niches

The emergence of MaaS in Helsinki is the result of actions by both public and private players, with a decisive role for the former. Key actors are the Ministry of Transport and Communications (hereafter Finnish Ministry), the start-up MaaS Global, and Helsinki's PTA. ITS Finland, a non-profit association that includes private corporations, public agencies, and academic institutions has also been involved in initiatives supporting the early conceptualisation and promotion of MaaS.

At the national level, diverse strategy documents issued by the Finnish Ministry in recent years, such as the First and Second National ITS Strategies (2009 and 2013) and the Transport Revolution report (2011), emphasise an interest and need to develop ICT-enabled solutions to enhance personal mobility. The documents aim to support more sustainable choices and challenge the use of private cars. They refer to a door-to-door approach to mobility and the use of integrated payment methods.

These strategies were followed by a reform in the National Transport Act, voted by parliament in 2017. A central aim of the reform is to promote digitalisation of transport services and more efficient use of data, as part of the government's flagship project to create a growth environment for digital business. As stated by the Finnish Ministry, *"The aim is to create a favourable operating environment for digital services and new*

business models…" (LVM, 2017). The role of government is limited to ensuring the proper functioning of free market forces: *"[i]nnovation and service platforms will be promoted in sectors where the public administration plays a role in terms of the functioning of the markets. Mobility as a Service is an example of such a sector."* The reform of the Transport Act is organised in three stages. The first stage (2018) harmonises, under the Act, the provisions on road transport (PT, taxi, and freight), and establishes initial provisions on access to data. It requires transport providers to open their data related to routes, timetables, stops, and fares, as well as interoperability of ticketing systems via open APIs. The second stage (2019) enables further interoperability between different transport modes by organising all transport and traffic registers and data under one legislation, also including data about air, sea, and rail markets in addition to road transport. Importantly, it determines that MaaS providers can access season ticket's APIs on behalf of clients. The third stage concerns subsidiary issues, e.g. educational requirements for truck drivers, real-time data on heavy traffic, and emergency plans for logistic companies in case of major road and infrastructure accidents.

As government strategies developed, MaaS Global was founded betting on a platform-based service to compete with car ownership; the company's vision, indicates interviewee H4, is that people are willing to pay for the freedom of mobility allowed by cars, and hence this is where economic opportunities lie. By offering mobility services as packages based on consumers' needs, in a manner similar to the telecommunication sector, MaaS Global intends to provide travellers with alternative ways to make door-to-door trips that are as convenient as the car but less costly. Whim, MaaS Global's app launched in 2016, offers a pay-as-you-go option and two subscription packages with which users can access PT, taxis, and car rental in Helsinki. In the favourable context of Finnish legislative reforms, the fact that the Finnish Ministry regulates both transportation and ICT was a lucky coincidence, says H4. The company also counts on the knowledge and network of its founder and CEO, who was previously the CEO of ITS Finland and thus connected to discussions around MaaS since the inception of the concept. Furthermore, MaaS Global also counts on the support from the MaaS Alliance, an international network of influential players lobbying in favour of MaaS.

Helsinki's PTA, in turn, has not accompanied the national legislative changes and the development of Whim with enthusiasm at first, suggest interviewees H1 and H4. In 2016, the PTA agreed with the sale of single tickets via Whim (MaaS Global, 2016), but this meant a partial compromise only; a fully satisfactory solution to MaaS Global would have to include season tickets. By only selling single tickets, MaaS Global is not able to build a financially viable business model, explained H4. First, this is inconvenient to users because, even if they buy a monthly or unlimited subscription, they still have to book single tickets for each trip. Second, MaaS Global pays the full price of these single tickets, whilst clients are paying a discounted fare via Whim (Audouin &

Finger, 2018). The PTA justified its reluctance indicating that municipalities subsidise monthly passes and the authority must keep track of the place of residence of the passengers who buy them.

During 2017, the PTA conducted studies to evaluate the implications of the new Transport Act, MaaS' potential benefits and drawbacks, and the authority's possible role in this scenario (HSL, 2017b, 2017a). These studies concluded that MaaS would be mostly in line with the PTA's mission, but that cooperation with MaaS providers would involve risks. Increasing their scope for action without guidance could drive customers away from PT, jeopardising sustainability goals and harming PT's finances. To mitigate these risks, the PTA could step in to create an urban mobility platform based on PT.

This last conclusion is a hint of what was to come. In 2018, amidst pressures connected to the new Transport Act's reforms already implemented or soon to be implemented, the PTA took actions towards further involvement with MaaS. They hired staff to work exclusively on MaaS and introduced OpenMaaS "*one of the world's first open retail interfaces for single tickets*" (HSL, 2018c). Other initiatives that have a bearing on the expansion of MaaS include the procurement of frame contracts and of the "Idea Lab for New Mobility Services", both intended to develop new digital solutions to mobility challenges defined by the authority (including ridesharing, leisure journeys, and solutions to reduce the need to travel) (HSL, 2018b, 2018a). Crucially, the PTA decided to include season tickets in OpenMaaS in late 2018 (Audouin & Finger, 2018).

5.5 Approaches to MaaS

By iteratively contrasting case findings with notions from the MLP and the meta-governance literature, the analysis now moves up a level from case description to formulate six basic models of governance approaches to MaaS: analyser, architect, convener, experimenter, lawmaker, and provider. These insights are then synthesised in Tables 5.2 and 5.3.

In Amstelland-Meerlanden, Amsterdam's PTA promotes the appearance of MaaS within the regular PT concession. The authority frames its perspective and goals related to MaaS in the concession's Schedule of Requirements, setting general policy objectives and guidelines of what it expects from bidders. MaaS, then, comes in the form of new (complementary) mobility services to be designed by the operator that, in turn, has freedom to design and implement its proposition within established policy and financial frames. This approach is here labelled *architect*; it is analogous to policy and resource framing characterised by Sørensen and Torfing (2009), based on limited and hands-off intervention. The architect does not have direct involvement in the execution of tasks to design and implement MaaS, but instead sets goals and frames policies and

Table 5.2: Governance approaches to MaaS across cases

Case	Actor	Approach	Analogous to	Operates at	Description
Amsterdam	PTA	Architect	Policy and resource framing (1)	Regime	Enables the niche with hands-off soft intervention to set broad goals framing policies and resources. Tasks are carried-out by other network actors (contracted-out) that have freedom to act within policy and financial frames.
		Convener	Facilitation (3)	Regime and niche	Enables the niche with hands-on soft intervention, using influence to help build relationships and networks. Supports and mediates dialogue and collaboration. Seeks mutually acceptable solutions. Relies on free market incentives for parties to come up with solutions, but ensures these are aligned with societal goals.
	Ministry	Convener	Facilitation (3)		(as described above)
		Experimenter	--	Regime and Niche	Enables the niche with hands-on strong intervention. The main aim is scoping via learning-by-doing. Seeks to maximise this using living labs as 'controlled experiments'. Tasks are carried-out by other network actors (contracted-out), but outputs follow detailed guidelines.
Birmingham	PTA	Convener	Facilitation (3)		(as described above)
	DfT	Analyser	--	Regime	Conducts scoping activities. Devolves responsibilities but seeks knowledge, collects evidence, and closely follows different initiatives to be equipped to intervene in free market if deemed necessary.
Helsinki	PTA	Provider	Participation (4)	Regime and Niche	Uses hands-on strong intervention. Mobilises resources to design and offer desired solutions ascertaining a position of leadership, i.e. maintaining/recovering original balance of power in a changing scenario.
	Ministry	Lawmaker	Institutional design (2)	Regime	Enables the niche with hands-off strong intervention. Regulation is the instrument to (re)design the system's institutional setup to allow market forces to drive innovation.

Table 5.3: Degrees of intervention across cases

	Hands-on ⟷			**Hands-off**
Strong	PTA Helsinki (provider)		Finnish Ministry (lawmaker)	
↕		Dutch Ministry (experimenter)		
			PTA Amsterdam (architect)	
Soft	PTAs Amsterdam and Birmingham, Dutch Ministry (convener)			DfT (analyser)

Note: This comparison represents a relative measure specific to the cases analysed.

resources, whilst tasks are to be carried-out by other network actors (contracted-out), who have some leeway to do so. From the perspective of the MLP framework, the architect is thus a niche enabler and transitional actor (Geels & Schot, 2007), operating at the regime level. Concerning the Zuidas Pilot, Amsterdam's PTA maintains a limited degree of intervention, but their approach is more hands-on and facilitative in character. They wish to enable the niche by directly interacting with the network of actors to facilitate and mediate dialogue, and to seek mutually agreed solutions for an agreement concerning ticketing. By doing so, the PTA uses its influence to directly (and through a soft form) guide niche outcomes aligned with societal goals, thus without resorting to coercive steering. These features characterise the *convener* approach, analogous to the facilitation role defined by Sørensen and Torfing (2009). From the MLP point of view, the convener travels across and operates at regime and niche levels to enable niche activities.

In the same Zuidas project, the Dutch Ministry not only frames objectives, but also determines specific solution requirements: a MaaS definition and core functionalities must be observed across all pilots. As explained by interviewee A2, their main goal is to learn by doing, and pilots are used as living labs to provide lessons for a more informed definition of a long-term response to MaaS. This posture is eminently scoping in nature and, already from the outset, seen as temporary: a more definitive role for government is to be defined after in-depth experience is gained with MaaS. In this role, the Dutch Ministry employs strong hands-on intervention, and uses its political influence and economic power to determine the direction of MaaS pilots. Tasks are to be carried-out by other network actors, moved by economic interests, but according to strictly defined guidelines. These characteristics form the approach labelled *experimenter*, that has no direct link with a particular meta-governance form defined by Sørensen and Torfing (2009). From the perspective of the MLP, the experimenter intervenes directly

at niche level by aligning actors' agenda and defining precise guidelines to determine the trajectory and outputs of the niche. In addition, but to a lesser extent, the Dutch Ministry also adopts a convener approach, manifested in their negotiations to facilitate the creation of a single API with bike sharing and car rental companies.

In Birmingham, the PTA acts to connect MaaS providers and the PT regime (initially MaaS Global and National Express, but possibly also others). These parties are then able to establish a relationship and develop a business solution to implement MaaS. The Memorandum of Understandings, a non-binding and non-exclusive commitment, crystallises this collaborative and consensual approach. Ultimately, the PTA also relies on market incentives to drive actors interested in carrying risk in the pursuit of profit. By promoting relationships and a conducive environment, the PTA directly influences the niche's trajectory and outputs, to ensure that they are also aligned with targeted societal goals. Consequently, the PTA's governance approach to MaaS is also eminently that of a *convener*. Considering the MLP framework, thus, Birmingham's PTA is a niche enabler and transitional actor, operating at regime and niche levels.

DfT's approach to West Midlands' MaaS niche is marked by awareness and observation. Similarly to their posture towards some other MaaS initiatives, the Department shows interest in collecting evidence and learning from experiences in the UK and abroad. Within the UK's broader devolution agenda, DfT's interest is to equip government to choose if and how to govern the development of MaaS. Therefore, similarly to the Dutch Ministry, DfT adopts a predominantly scoping attitude. However, differently from the Dutch example, DfT's scoping is more hands-off and with no direct intervention in task implementation. DfT's approach is here labelled *analyser*, and is not analogous to any particular meta-governance form defined by Sørensen and Torfing (2009). From the standpoint of the MLP, the analyser is eminently a regime actor.

In Helsinki, in response to legislative changes, recent actions by the PTA involve direct hands-on intervention in the development of MaaS; they mobilised resources to design and offer desired solutions, including the hiring of dedicated staff to work with MaaS and the creation of OpenMaaS. This posture involves a movement of adjustment or re-orientation in a changing environment, with the aim to secure a leadership position in the PT ecosystem. Helsinki's PTA intervenes directly in MaaS implementation and definition of outputs and this approach is here defined as that of a *provider.* The provider is analogous to the participation role defined by Sørensen and Torfing (2009), and considering the MLP, they operate both at regime and niche levels; they seek to restrain competition between niche solutions and regime (Geels, 2018).

Finally, the Finnish Ministry influences the development of MaaS through successive strategy documents supporting innovation in transportation, and, eventually, opting for a binding policy instrument – the new Transport Act. Whilst hands-off, leaving implementation of the Act to other actors, this intervention is strong due to its coercive

and detailed prescriptions. The Act redefines the strategic institutional setup and the rules of engagement between actors in the PT ecosystem. Overall, this approach shows characteristics analogous to the role of institutional design proposed by Sørensen and Torfing (2009), and is here labelled *lawmaker*. From the perspective of the MLP, the Finnish Ministry restrains from direct involvement with implementation tasks or output production in the MaaS niche, operating and exerting power from the regime level.

5.6 Concluding discussion

This research is motivated by a concern with the scenario of agitation around and limited understanding about MaaS and its potential implications for PT. To address this issue, this chapter examines interactions between PT regimes and emerging MaaS niches, to understand and conceptualise initial governance responses to MaaS in Amsterdam, Birmingham, and Helsinki. Findings support the formulation of six basic models of governance approaches to MaaS across cases. They range from direct hands-on strong intervention in niches through participation in the provision of MaaS, to hands-off soft scoping via collection of evidence. Initial reflections on these findings follow.

5.6.1 Reproduction of practices from PT regimes

Despite the advertised novelty and disruptive potential of MaaS, responses from public sector actors in the three cases are consistent with the MLP's expectation that regimes tend to reproduce institutionalised practices in shaping or resisting to the development of niches (Fuenfschilling & Truffer, 2014; Geels, 2014; A. Smith et al., 2010). In Amsterdam's PT regime, the PTA's main role is to set policy goals and to frame resources (defining minimum service requirements and the budget of each concession); the authority relies on tendering and contracting to guide their relationship with operators. The latter have a high degree of freedom to define service characteristics. This predominantly hands-off approach is combined, in certain moments, with close dialogue with operators to handle changes needed through the course of their contractual relationship. This is very similar to the architect and convener approaches being adopted by the PTA in relation to Amsterdam's MaaS niches. In the case of the Dutch Ministry, the picture is, for the moment, less simple, given their temporary approach to MaaS as experimenters. In the PT regime, they are directly responsible for providing commuter train services, but their participation is primarily marked by the strong and hands-off setup of the sector's overall institutional framework. This is done via legislative intervention (the Dutch Transport Act) and resources-framing (definition of total PT subsidy). This way, one might expect that once the national pilots are concluded, the Dutch Ministry will step-out of the niche and substitute the hands-on intervention for

a more hands-off approach, similar to their regime practices. Interviews hinted at this, but there is yet no formal position on this matter.

Within the UK's deregulated bus sector (outside London), the PTA does not have the legal prerogative to initiate PT services, but, instead, has to rely on market forces to do so. Reforms, e.g. the 2017 Bus Act, increased the range of tools available to PTAs to influence planning and service delivery. However, these tools are still limited when compared to other countries in Western Europe for instance. Whilst responsible for the definition of PT policy aims, West Midlands' PTA primarily relies on the ability to bring stakeholders together, promote dialogue, and support relationships across the system. The Bus Alliance is illustrative of this posture that is also reflected in the convener approach to MaaS. In relation to DfT, the choice of a more hands-off approach in relation to West Midlands' MaaS niche could be interpreted as a reflection of a PT regime (and overall UK policy environment) increasingly characterised by the devolution of responsibilities to regional and local authorities. As in the case of the Dutch Ministry, interviews hint at a possible change in approach with more formal regulation of MaaS initiatives in coming years, but this is uncertain now.

Finally, in Helsinki, the PT regime is strongly centralised around their PTA, that plans and organises all modes, including detailed service design, fare prices, payment and ticketing systems, branding, and marketing. As such, Helsinki's PTA employs hands-on strong governance in PT, which is aligned with the provider approach they have recently taken in relation to Helsinki's MaaS niche. The PTA's reported initial reluctance towards MaaS could have been expected in this context: after years promoting branding and customer relationship efforts, the appearance of a MaaS intermediary threatening their direct link with passengers and individuals' travel information is plausibly undesired. Furthermore, the PTA's intention to develop their own MaaS solution – and thus secure the *status quo* of leadership in the provision of transport – could be an additional reason to be cautious about the uptake of Whim. The Finnish Ministry also maintains, in relation to Helsinki's MaaS niche, the same type of approach employed in the PT regime, marked by the setup of the institutional framework via legislation.

5.6.2 MaaS in the niche-regime space

The investigation shows that public sector actors, frequently portrayed as static regime players in transitions literature (Johnstone & Newell, 2018; Wittmayer et al., 2017), may also see the need to operate and exert power directly in niches. This could suggest that the studied MaaS niches might have 'broken the niche bubble' to interact more intensively with regimes. To be sure, this does not mean that MaaS is a fully viable and competitive solution to replace or substantially modify the PT regime, but that it gained considerable attention and it is no longer a niche-exclusive silo. This speaks

to Avelino's definition of 'niche-regimes' as a space in which transformative power is exercised to develop new structures and institutions: "*While the regime is focused on reinforcing existing structures and institutions, and the niche is focused on developing new resources, there is a third type of 'space' in which actors are focused on developing new structures and institutions. Clearly, these three spaces are intertwined, and actors travel back and forth between and across them*" (2017, p. 510).

Moreover, whilst the six governance approaches show that actors might use various – or a mix of – approaches depending on the context of their actions, overall governance responses acknowledge MaaS as a potential way to reach new PT demand and/or as a threat that could move PT ridership to other modes. This is, the intense interaction at a niche-regime space appears to be primarily driven by a concern with PT's market share and revenue streams. This concern is evident, for instance, in the challenges involving agreements for ticketing and data sharing. The governance approaches are mainly directed to adjust the regime so that MaaS can be incorporated and accommodated incrementally, in a synergetic rather than competitive way. Meanwhile, objectives connected to more sustainable mobility appear to be a secondary priority at the moment.

5.6.3 Research opportunities

The six governance approaches rely on a simplification of a more nuanced reality of complex interactions; other factors, such as different regime elements or simultaneous niche-innovations not emphasised here, might also be connected to emerging responses to MaaS. Importantly too, the six approaches are inspired by responses adopted within the context of specific cases and, thus, the same players might act differently in other situations. Finally, this chapter focuses on public sector actors at regional and national levels, and does not analyse more deeply other relevant players, including car manufacturers and IT companies. Nonetheless, the scheme of governance approaches represents a first exploratory effort to fill a void in current literature that has few empirical studies about MaaS or its governance. These proposed approaches can be revised and enhanced, serving as a stepping-stone for future work on the same or different cases.

Importantly, this study takes an initial step to allow coming work to address the extent to which early responses to MaaS set the stage for subsequent developments. In this sense, at least two complex questions emerge. The first question concerns the type of development trajectories these varied governance approaches may entail – i.e. the types of interaction between MaaS niches and PT regimes in the future. One way to look at this issue is to contemplate the alternative transition pathways defined in MLP literature – i.e. the different forms in which developments across the three levels of the MLP may occur in transition processes (Geels & Schot, 2007). By seeking to shape MaaS in a way that favours synergetic rather than competitive relations with the PT regime, public sector actors across cases attempt to steer pathways like *transformation* (under moderate landscape

pressure, incumbent actors gradually adopt not sufficiently developed niche-innovations as add-ons to the regime) or *reconfiguration* (under landscape pressure, symbiotic niche-innovations are incorporated into the regime and, over time, with a sequences of component innovations, may cause substantial changes in the regime's basic architecture). A second related, and even more complex question, is whether and how the different governance approaches can influence the uptake of MaaS. The emerging literature prospecting the impacts of MaaS on travellers' behaviour shows that the potential effects and direction of changes brought by this innovation remain uncertain (see Durand et al., 2018 for a review). The empirics presented in Section 5.4 highlight that so far none of the public sector actors analysed in this chapter has been able to find the governance response to tackle some critical challenges preventing a larger deployment of MaaS, such as issues of ownership and use of passengers' data, or revenue sharing arrangements. Crucially, they also show that impasses around these issues have so far outweighed in importance the concerns with environmental degradation; the interest in using MaaS as a tool to drive more sustainable mobility appears to remain mostly circumscribed to discourse. Ultimately, governance alone might not be sufficient to explain the future path of MaaS, its uptake, and the results it delivers, representing just one of multiple explanatory factors.

However, it is perhaps too early to determine the extent to which initial governance responses can lead to desired trajectories or deliver positive outcomes (e.g. sustainable mobility goals). MaaS, as currently understood, is in its first years, whereas transitions are decades-long processes. Furthermore, and like other innovations in land passenger mobility, MaaS involves numerous actors across multiple commercial and non-commercial initiatives dispersed in time, space, and speed of development. This complexity suggests that forms of command and control traditionally used in PT governance, such as tendering and contracting, might not be the most suitable response to achieve certain political objectives in the case of MaaS. In the age of the so-called 'smart mobility', 'smart governance' might entail, instead, the need for meta-governors to combine existing and new practices, seek collaboration with a more diverse set of actors that possess various backgrounds and new and competing ideas, as well as engage in creative destruction of existing beliefs and practices to promote the development of new ones (E. Sørensen & Torfing, 2017). Importantly, public sector actors should be able to ensure that transport provision is guided by societal goals, rather than by the interest in commercialising users' data. A continued effort to build knowledge on the governance of MaaS is key to support decision-makers in this challenge.

Chapter 6

Conclusion

This dissertation is motivated by the urgent need to address critical problems caused by today's mobility patterns in metropolitan areas that affect both current as well as future generations. Travelling within car-centric cities is time consuming, uncomfortable and unsafe, significantly restricting people's access to basic services and opportunities, and ultimately impacting individuals' fundamental right of freedom of movement. Moreover, congested cities unleash tremendous negative externalities, such as economic losses, increased air contamination, noise, and solid waste, that affect the entire urban population and jeopardise future generations. It is imperative to promote a drastic change in current metropolitan mobility patterns, moving cities to a more sustainable trajectory that, as highlighted by the Brundtland Report (1987), addresses environmental, social, and economic dimensions of urban life.

A crucial component of the move towards more sustainable mobility is a modal shift away from cars, with increased usage of public transport (PT) at the expense of private vehicles (Banister, 2008; Bertolini & le Clercq, 2003). However, elected politicians, public officials, operators' management, and academics (in other words, decision-makers broadly conceived) struggle with the complexities involving. PT policy-making (Marsden & Docherty, 2013; Stough & Rietveld, 1997; UN-Habitat, 2013). Personal surface transportation is a complex socio-technical system, made up of the interplay between elements of diverse nature, such as technology, finance, and values, and in which roles and responsibilities are diffused across a multiplicity of actors, both public and private, with varying interests and incentives. As a result, decision-makers are faced with the need to understand and manage increasingly complex formal and informal processes of interaction for collective decision-making, involving public and private actors, and through which they coordinate practices to achieve a multitude of societal goals linked to PT (such as sustainability, cost-effectiveness, and accessibility). In other words, addressing the governance of PT is thus of paramount importance if we hope to improve metropolitan mobility.

This is precisely the focus of this dissertation, which has systematically analysed the multiple dimensions of PT governance and the mechanisms linking this multifaceted phenomenon to the performance outcomes observed in several metropolitan areas. In this concluding chapter, I critically reflect on some of the main issues discussed in previous chapters and on possibilities for continued research in this field. Section 6.1 reviews the key research questions presented in Chapter 1 and the answers proposed in the dissertation. Section 6.2 discusses some of the societal implications of the dissertation's findings and underscores insights connected to the practical experiences with the methods used in this work. The last section, 6.3, offers concluding remarks, including possible future research directions.

6.1 Summary of findings

The research's stated aim was to *identify and explain key mechanisms by which governance can influence PT performance, supporting a modal shift away from cars, ultimately leading to the broader goal of more sustainable metropolitan mobility*. To this end, the dissertation was divided into two parts, each addressing one critical shortcoming of the mainstream literature on PT governance.

Part I addressed the first gap: existing literature often views the relationship between governance and performance through incremental lens, and tries to isolate the impacts that the introduction or reform of a single element of PT governance has on a type of performance. Chapters 2 and 3, instead, recognise the complex and systemic character of PT governance, acknowledging that performance stems from the interplay between multiple systemic elements. Identifying key variables in the analysis of the relationship between governance and performance, these chapters then scrutinise the actual interaction of said variables in real-world metropolitan transport systems. This approach sheds light on the drivers of better performance, and thus on the enablers of sustainable mobility ambitions.

Part II, in turn, broadened the view of governance that prevails in PT studies currently. The latter tend to have a narrow focus, analysing only the influence that formal institutions have on performance thus ignoring the importance of other facets of governance, such as informal institutions, political steering modes and instruments, and individual actors' agency. Chapters 4 and 5, in turn, join a growing strand of literature interested in understanding governance as a complex political process of policy design and implementation that involves, but is not restricted to formal institutional setups. These chapters acknowledge the role of those often-neglected dimensions of PT governance, and scrutinise real-world metropolitan transport systems to understand how informal institutions, political steering modes and instruments, and individual actors' agency interact with formal institutions to promote more attractive PT.

Findings in Part I corroborate the claim that the relationship between governance and performance is best understood from a complexity-oriented view, according to which performance outcomes are the result of the dynamic interplay between multiple factors – including formal elements such as legislation, policies, contract forms, or ownership nature of actors (together referred to as organisational elements) – rather than the summation of isolated policy interventions. This perspective helps to fill what the dissertation calls the '*what* gap', showing decision-makers *what* measures to take (what mix of organisational elements to consider) for a better design of PT systems. In Part II, findings support the view that some often-neglected dimensions of governance, beyond organisational elements, are critical to the outcomes observed in PT systems. This is, performance depends on not only the formal institutional setup of PT, which

constrains and enables actors, but also on informal institutions, steering approaches employed, and individuals' agency (manifested in the way actors interpret and enact institutions). These findings help to fill what the dissertation calls the '*how* gap', showing decision-makers how we 'do' PT in reality, and emphasising that there might be important discrepancies between institutional design and actual policy implementation.

To address these gaps, four key research questions were formulated in Chapter 1, and answered in the following chapters, as summarised below.

RQ1: Considering the existing body of knowledge in academia, industry, and public sector organisations, what are the most critical (i) PT performance indicators, and (ii) PT organisational elements influencing performance?

Method: The Delphi method; the Delphi is based on an iterative process of consultation with sector experts via consecutive questionnaires interspersed with controlled feedback in an anonymised process.

Answer: After an international Delphi survey, the key performance indicators selected by experts were system-wide metrics linked to ridership objectives (maximisation of PT usage), such as user satisfaction, cost-recovery, and modal split. In contrast, indicators connected to the spatial availability of services were not highly rated in the survey. On the other hand, integration emerged as the central governance dimension according to consulted experts; policy integration between public transport and other policy areas, a single integrated planning authority at the regional/metropolitan level, and ticket and fare integration were highly rated. Funding frameworks and contractual risk allocation between public authorities and transport operators were also highlighted as relevant public transport performance drivers. (Chapter 2)

RQ2: How does the dynamic interplay between some of the most critical organisational elements of public transport systems influence key performance indicators? What combination(s) of said organisational elements drive successful performance across different PT systems?

Method: Qualitative comparative analysis (QCA); following-up on Chapter 2's results and combining quantitative and qualitative data, QCA is used for a systematic cross-case analysis of selected metropolitan areas from high-income Western-economy countries, that frames the relationship between organisational elements and performance indicators in terms of sufficiency and necessity.

Answer: The analysis identifies three alternative sufficient combinations of organisational elements in PT, each of which are conducive to each of the outcomes studied, i.e. higher levels of modal split and cost-recovery of PT (solution pathways). This underscores PT's causal complexity; modal split and cost-recovery depend on the interplay of several conditions. Furthermore, there is not a single path that can lead to the same outcomes. More broadly, the solution pathways indicate that (i) integration between land-use and transport and (ii) an integrated planning authority are crucial

for enabling higher modal split, whereas higher levels of cost-recovery are connected with the way in which (i) agency over funding and (ii) risk allocation strategies shape incentives for savings and/or revenue generation. (Chapter 3)

RQ3: How do informal institutions and key individuals' agency influence PT performance, and play a role in promoting more attractive PT?

Method: In-depth qualitative longitudinal case studies; the study scrutinises selected cases from the sample studied in Chapter 3, following-up on and supplementing that chapter's findings.

Answer: Based on the longitudinal analysis of PT in Oslo and Amsterdam metropolitan areas, the study identifies two examples of informal institutions, both defined as shared understandings –*public transport as a facilitator of economic development*, and *public transport as a facilitator of green growth*. Furthermore, the study pinpoints two instances of agency by key actors – defined as *problem-solving know-how* and *institutional entrepreneurship* – that contribute to more attractive PT (based on higher levels of modal split of PT). Findings also show that formal institutions, informal institutions, and key actors co-exist and interact in three distinct ways – complementary, substitutive, and accommodating – to facilitate collective decision-making and coordination on controversial issues. These include the trade-off between ridership and coverage objectives (increasing PT usage versus maximising PT spatial availability regardless of usage), integration between land use and PT planning, policy implementation capacity, and the handling of budget pressures. In other words, informal institutions and individuals' agency have a key role as they can enhance the effectiveness of (or even replace), formal institutions in supporting the governance of successful PT. However, informal institutions and actors' agency also have limitations, and formal institutions remain critical enabling factors of attractive PT. (Chapter 4)

RQ4: How do public sector actors steer the implementation of new technologies and service models in the mobility ecosystem, e.g. mobility as a service (MaaS), that promise to enhance the attractiveness and use of PT?

Method: In-depth qualitative comparative case studies; the study scrutinises selected cases from the sample studied in Chapter 3, following-up on and supplementing that chapter's findings.

Answer: Based on the comparative analysis of Amsterdam, Birmingham, and Helsinki, the study identifies and conceptualises six governance approaches in use to steer the development of MaaS: *analyser*, *architect*, *convener*, *experimenter*, *lawmaker*, and *provider*. These basic models encompass strategies ranging from hands-on strong intervention (direct intervention in the MaaS development niche with actual participation in the production of outputs) to information collection efforts (distant and hands-off measures to maintain awareness and build knowledge of MaaS). The study also

finds that, consistent with the transitions literature, these six approaches indicate that public transport regimes seek to control the apparent disruptive potential of MaaS by incrementally absorbing innovations rather than allowing them to overtake the existing logics of action. PT planning authorities and national ministries adopt governance responses that tend to reproduce existing institutionalised practices. Furthermore, the six approaches reveal intense interaction between the incumbent institutional regime and MaaS niches, suggesting that a niche-regime space might have emerged in the cases; actors travel and operate across these three spaces – niche, regime, and niche-regimes – mainly driven by concerns with market share and revenue streams in the mobility system. (Chapter 5)

6.2 Critical reflections

This section synthesises the dissertation's main findings to elucidate their broader policy implications. In addition, it also reflects on the experience with the methods used to conduct this work, highlighting insights that can be useful for other researchers.

6.2.1 Policy and societal implications

The complexity of PT governance

This dissertation expands the view of governance that prevails in PT policy and research, advancing original ways to think about the relationship between governance and performance in the sector. More specifically, Part I highlights a combinatorial perspective through which diverse governance elements interact to influence performance outcomes. Part II emphasises multiple facets of the notion of governance that are often neglected by PT decision-makers, such as informal institutions and agency.

As a result of these two critical contributions, the dissertation emphasises PT governance as a political process for collective decision-making that determines and is determined by the interaction between institutional designs and implementation practices as triggered and managed by individual or collective agents, that are also influenced by actual performance results being achieved. In other words, whilst mainstream PT literature has so far approached governance as an independent variable that can drive performance outcomes, this dissertation advances that governance is also the outcome (dependent variable) of social, economic, and political developments, expressed in the policy, polity, and politics dimensions (Treib et al., 2007). The relationship between governance and performance is thus both context-dependent and not unidirectional; governance and performance affect and are affected by each other in a complex dynamic

interplay. The study of Oslo in Chapter 4 reveals a positive loop: good performance is the result of a series of governance elements, including an enabling formal institutional setup, informal institutions, and key actors' agency; at the same time, positive performance outcomes strengthen the legitimacy of said institutions and actors, increasing their effectiveness. Interviewees in Oslo affirmed that there is general trust in the work developed by the transport planning authority that, consequently, gains political influence, is entrusted with more funding, and enjoys more freedom to deal with potentially controversial trade-offs in policy design and implementation.

The implication is that PT governance, being both an independent and dependent variable, cannot be treated as a clean slate to be filled with new piecemeal policy interventions; path dependencies, incumbent interests, existing logics of action and shared understandings play a role in determining the functioning of PT systems. As underscored by the distinction between '*what*' and '*how*', the way that institutions (formal and informal) are introduced, interpreted and enacted by individuals may lead to significant discrepancies between design and implementation practices. This reinforces the notion that decision-makers should be cautious with advertised policy success formulae or silver bullets; there is no good governance *a priori* and in theory, but only *ex post* when aims are achieved. Previous positive experiences elsewhere should be seen as a potential leads, not as answers.

The importance of integration for coordination

The dissertation highlights that finding strong coordination mechanisms remains one of the core themes in PT policy and research. This is particularly evident in Part I, which focuses on the formal institutional setup of PT systems that might be conducive to better performance. The experts consulted in the Delphi study in Chapter 2 point to integration as the most crucial dimension of governance in PT, top-rating several policy and planning integration features. In the follow-up cross-case analysis using QCA in Chapter 3, the empirical investigation shows that integration between transport and land use planning, as well as integration in the planning of multiple modes of PT within a single overarching authority at the regional level, are key drivers of higher levels of PT attractiveness (measured through modal split levels).

However, the confidence in integration as a silver bullet for successful coordination should be seen with caution. As discussed in Chapter 2, there is substantial evidence that hierarchic integration is not a condition for coordination, either in PT (Chisholm, 1992) or more broadly (Ostrom, 1990). The QCA study in Chapter 3 also offers examples. Whereas the overall analysis shows that integration is key for higher PT modal split levels, some of the cases studied in Chapter 3 – e.g. Vancouver – present a tightly integrated institutional framework and still struggle to achieve said positive performance outcome. Furthermore, results show that the link between integration and

enhanced cost-recovery levels, an indicator of financial sustainability, is not so strong, and that cost-recovery is instead primarily connected to other institutional setup elements, i.e. agency over funding and risk allocation strategies. Finally, other dimensions of governance, beyond the formal institutional setup (and its degree of integration), are also critical for PT performance, as highlighted in Part II of the dissertation. In sum, integration has limitations and might not be necessary or even optimal for coordination.

Moreover, one could argue that the high status attributed to integration in these discussions shows that policy-makers and academics continue to struggle with a decades-old debate. Greater integration is indeed not a new prescription for better PT performance, and has been recommended as a way for better coordination for several decades already (Chisholm, 1992; Gwilliam, 1979; Potter & Skinner, 2000). This view has been strengthened thanks to the negative results usually associated with New Public Management (hereafter NPM) liberalising policies introduced in the 1980s, that presumed that the public-sector adoption of private-sector managerial practices, would promote more efficiency and effectiveness in the delivery of public services (Hood, 1991; Osborne, 2006). However, NPM initiatives have eventually been linked to growing and harmful fragmentation in policy design and implementation. Since the early 2000s, scholars advocate for a post-NPM approach based on a change in emphasis away from structural devolution, disaggregation, and single-purpose organisations, and toward a "joined-up government" or "whole-of-government" perspective that could apply a more holistic strategy in government (Christensen & Lægreid, 2007), i.e. once again highlighting the need for integration. In the case of PT in particular, analyses of liberalising reforms in different contexts suggest that although those practices may have helped in driving down costs related to service provision, they were not always successful in creating attractive services that could also promote satisfactory demand levels (see e.g. Cowie 2014; Mees 2005; Preston and Almutairi 2013). Integration continues to be the advised remedy (e.g. Della Porta et al. 2019; Buehler, Pucher, and Dümmler 2019), but knowing when and how to promote is still a challenge for academics and government. A possible way forward in this struggle could be to invest more in empirical analyses that scrutinise how specific tasks and roles can be allocated across distinct actors and at different government levels, in a more or less integrated fashion – and how these choices might have different performance repercussions (e.g. van de Velde et al., 2008; Veeneman and Mulley, 2018).

The considerations above also suggest that traditional forms of command and control used in PT governance, such as full hierarchical integration, tendering, and contracting, might not be the most suitable ways to achieve certain political objectives attached to mobility. To increase the efficiency, effectiveness, and legitimacy of policy-making and policies, decision-makers need to be flexible to pursue new governance modes. They must combine existing and new practices, foster collaboration with

a more diverse set of actors that possess various backgrounds and espouse new and competing ideas, and engage in creative destruction of existing beliefs and practices to promote the development of new ones (E. Sørensen & Torfing, 2017). This is particularly relevant for the governance of a rapidly changing socio-technical system such as personal mobility, as studied in Chapter 5 via the case of MaaS.

The so-called 'customer-oriented' view to PT planning and provision: a win-win approach

Echoing the importance attributed to integration discussed above, another apparent response to the shortcomings of previous policies is an increasing focus on users. This is visible in the strengthening of a customer-oriented discourse that advances the need to focus on users' needs and preferences to improve the quality PT services in order to attract more passengers. Such view is manifested in diverse policy measures and discussions that became evident in several moments of this dissertation. In Chapter 2, the results of the Delphi study show that most consulted experts prefer performance indicators linked to ridership objectives, such as user satisfaction, cost-recovery, and modal split of PT, rather than those measures linked to the amplification of the spatial coverage of PT services. Chapter 4, in turn, discussed the growing trend in PT planning and provision to increase PT supply in dense areas with greater demand, at the expense of service in less dense areas. The focus on customers also appears in the case of MaaS, analysed in Chapter 5. The service's business proposition relies on the offer of mobility services customised according to users' individual needs and preferences, allowing seamless mobility across multiple modes of transport.

This customer-oriented view is put forward as a win-win game that can both maximise tariff revenue and contribute to sustainability goals. Indeed, most environmental benefits of PT are related to the number of users, especially if they substitute car trips for PT. However, as discussed in Chapter 4, the compatibility between (on one side) economic growth with increased mobility and (on the other side) sustainability, might be limited. The rhetoric of providing better services to passengers whilst also promoting greater sustainability overshadows a series of potential negative consequences of current mobility policies. Chapter 2's results are again revealing, highlighting that the relative importance given by consulted experts to indicators connected to environmental preservation, accessibility, and spatial availability of PT is low. Furthermore, the evidence in Chapter 4 shows that the PTA in Oslo notices that improved PT with very high frequency is moving people away from walking and biking, even for very short trips. Additionally, increasing PT supply in dense areas and thus reducing the spatial coverage of services presupposes that a tightly integrated transport system is able to provide users with alternatives and complementary modes of transportation (especially for first and last mile trips). If, however, these additional mobility options are not

in place, people in areas underserved by PT might increasingly need to rely on cars. Finally, Chapter 5 shows that MaaS is still distant from the objective of presenting such a multimodal integration tool promoted in the customer-oriented discourse, as it is still in very early stages of development. Importantly, Chapter 5 also shows that impasses around commercial issues involving PT planning authorities, transport operators, and MaaS developers have so far eclipsed concerns with political objectives connected to sustainable mobility.

The upshot is that policies associated with the user-oriented approach overlook environmental and social sustainability goals in favour of economic growth. This view implicitly assumes the possibility of decoupling growth from pollution generation, resource depletion, and inequalities, which is highly controversial (Næss et al., 2019; Pangbourne, Mladenovic, Stead, & Milakis, 2019; Wanner, 2015). Moreover, in addition to the potential environmental and social negative externalities discussed above, the user-oriented discourse is problematic because it makes value trade-offs involved in PT policy less transparent to the general public. It is also worrisome that very few academic studies bring up this facet of mobility discussions.

6.2.2 Methodological considerations

Whereas PT studies, broadly speaking, employ predominantly quantitative analyses (Banister et al., 2012; Marsden & Reardon, 2017), this dissertation adopts a mixed method research approach, with more emphasis on qualitative methods. The experience of conducting this project showed that debates about the merits and shortcomings of each approach are strong and ongoing. In particular, quantitative researchers tend to doubt the value of qualitative analyses; criticism include issues such as the lack of testable hypotheses, the (excessively small) size of case or interviewee samples, and even the supposed *storytelling* nature of qualitative case studies. These remarks seem to be aligned with the view advanced by King et al. (1994), who sought to strengthen qualitative research by applying norms drawn from quantitative research, particularly from regression analysis and related techniques. However, this overlooks the fact that quantitative and qualitative research traditions pursue different research goals, which in turn produce different norms about research practices that make sense within their own tradition and scope (Mahoney & Goertz, 2006). Rather than seeking to displace any approach, this dissertation combines quantitative and qualitative data and analyses; by taking advantage of multiple sources of leverage, bridging qualitative and quantitative approaches, the dissertation comprehensively tackles the complexities of PT governance.

Research Design

Looking back at the experience of developing this dissertation, it is possible to conclude that the mixed method and nested design adopted here were successful. Even though the dissertation is constituted of a compilation of self-contained analyses, the different data and methods employed throughout this work were effective in helping concatenate the content of distinct chapters in a coherent sequence that responds to each research question and also jointly address the overall aim of the dissertation.

The combination between the Delphi method and QCA in Part I is noteworthy in this respect. Interestingly, the choice for using QCA in this dissertation occurred early on in the research design process, whereas the Delphi method only came later as a promising alternative to deliver an output that would be needed as input for a QCA study. At that stage, the main option in consideration was developing a systematic literature review to define relevant variables for a QCA; however, the Delphi method soon proved to offer a more original and well-suited way to conduct this preparatory step, with other advantages already highlighted in Chapter 1. Combining the two methods – Delphi and QCA – was relatively straightforward, showing that both can work well together, thus representing a useful alternative for future research. Surely their combined use involved challenges as well. As highlighted in Chapter 2 and in the Addendum, the participation of experts or the exact output of a Delphi are not under the researcher's control, and the survey might as well deliver results that are not suitable for a combined research design. Specific preventive measures can be taken to mitigate this risk (see the Addendum). However, in the context of a PhD research, in which researchers knowingly face significant pressure and stress (Woolston, 2019), the type of uncertainty involved in a Delphi must be carefully assessed to help in the decision of including this method as part of the project.

In relation to the later use of QCA, challenges can be significant too. The study developed in Chapter 3 heavily relied on variables whose operationalisation and calibration were based on qualitative information. This implied very intensive data collection effort to develop tasks for which only few guidelines are available in literature. As a result, developing the analysis was time consuming, demanding extensive testing and fine tuning. Again, considering the context of a PhD research, this particular aspect of Chapter 3 could have been designed differently. To conclude, the follow-up in-depth and small-n case-study in Part II were also very effective whilst involving fewer research design challenges. The experience during the preparation of Chapters 4 and 5 confirmed the claim made by several important authors that, in the context of social science, case studies are the most appropriate tool to investigate context-dependent phenomena (Flyvbjerg, 2006; George & Bennett, 2005; Yin, 2017). A practical consideration that should be taken into account is that as much as translation tools might be advanced and helpful, the level of understanding that a researcher can achieve is

always limited when they are not familiar with the national language of interviewees or policy documents. Whilst the dissertation presents robust and reliable findings, this factor represented a drawback in the study of cases such as Helsinki and Amsterdam for instance, and could have been considered during the initial research design steps.

The Delphi method

The methodological addendum to this dissertation reviews the experience with the Delphi method, its main advantages and drawbacks, and some novel practices that could counteract some of the method's pitfalls. In this Conclusion chapter, it is important to highlight that PT governance research can exploit the Delphi to better understand complex governance questions, seeking direct input from stakeholders from diverse affiliations, and diverse technical and regional backgrounds. The Delphi can produce a breadth of views as it offers direct access to experts' opinions across the globe, without requiring all of them to meet at the same place and time. By using the Delphi, this dissertation adopts an original approach to review the current state of the art in the field of PT governance: rather than following the usual expedient of academic literature reviews, Chapter 2 offers a similar output by means of empirical research. The Delphi allowed for the compilation of rich qualitative information produced via a structured dialogue process combined with statistical aggregation of this information, using qualitative and quantitative data and analyses. Importantly, the experience in this dissertation shows that the Delphi is well suited to be one component of a broader mixed-method research design; using qualitative and quantitative data and analyses, Chapter 2's results provided an unique building block for continued examination in following chapters of this dissertation: the final ratings of the Delphi were input variables to inform the QCA in Chapter 3.

Qualitative Comparative Analysis

QCA is not yet common in PT research, even though it has had a successful track record in other sub-fields of social science for more than 30 years. Besides its originality in PT studies, the method was chosen due to the unique way in which it illuminates the relationship between PT governance and performance from a complexity-oriented view, being also well-suited for the analysis of medium-n samples of cases. The method recognises that most often, it is the interplay of several factors that leads to an outcome, and that different paths may lead to the same outcome. Based on set-theory and the use of Boolean algebra techniques to examine qualitative and quantitative case data, QCA handles multiple explanatory variables and identifies whether they are necessary and/or sufficient for the outcome. Therefore, the use of QCA in the dissertation leverages synergies between qualitative and quantitative approaches. In addition, and like the Delphi in Chapter 2, QCA works better as a tool for broader multimethod research designs; QCA

methods may be used at different points in the analysis, either to help the researcher with leads for continued case exploration (as in this dissertation), or to summarise and logically check findings that have already been derived from case studies (Mahoney, 2010). This dissertation makes the most of QCA by combining it both with the Delphi from Chapter 2 – which represented an initial step to create input for QCA – and with the in-depth qualitative analysis from Chapters 4 and 5, in which case data and findings from QCA served as leads for follow-up investigation supplementing initial results.

Qualitative in-depth case studies

Qualitative in-depth analysis of a small-n sample of cases, or even within-case analysis, is the type of research in which the contrast between qualitative and quantitative traditions is perhaps most evident. In this sense, it is important to remember that each approach seeks a different type of objective: case studies seek to explain particular outcomes in specific cases (causes-of-effects approach), whereas statistical studies try to estimate the average effects of independent variables (effects-of-causes approach) (Mahoney & Goertz, 2006). Thus, the two types of research should be judged according to distinct criteria. This dissertation takes the causes-of-effects approach to pursue the comprehensive explanation of specific outcomes in specific cases. In the context of social and political sciences, in-depth case analysis is the most suitable tool for this purpose; concrete, context-dependent knowledge is the norm, and context-independent theory based on hypothesis testing for prediction and control may not be a feasible goal (Flyvbjerg, 2006). The choice of small-n analyses in Chapters 4 and 5 follows naturally from the dissertation's nested design, since Part II follows up on and supplements the data collection and findings from Part I.

6.3 En route to better performance: the next stop for public transport governance

This dissertation set-off to *identify and explain key mechanisms by which governance can influence PT performance, supporting a modal shift away from cars, ultimately leading to the broader goal of more sustainable metropolitan mobility*. By combining multiple sources of leverage and bridging qualitative and quantitative approaches, this dissertation contributes to advancing a critical understanding of PT policy-making. Ultimately, findings go beyond this initial aim and reveal that this relationship is not unidirectional; performance can influence governance in a dynamic interplay. As a result, the dissertation offers new insights that will allow decision-makers to intervene more effectively in PT policy design and implementation processes in search for improved performance outcomes.

Some limitations, however, need to be taken into account. A first difficulty faced in this dissertation, rarely discussed explicitly in PT studies, is data availability, quality, and comparability. Systematic publication of performance data is still a relatively recent practice amongst planning authorities. Furthermore, no standard international terminology, collection, or calculation methods exist, and thus specific national and local practices, as well as typical professional jargon, may create misunderstandings and generate spurious information. The difficulties with terminology represented a potential drawback in the communication in the Delphi study, as highlighted in Chapter 2. The 'data challenge', in turn, clearly created barriers for developing Chapter 3, both by restricting cases that could be used in that study, but also later on in the comparison of selected cases. The field of PT would benefit from greater data transparency and joint initiatives of data collection and harmonisation at the international level.

Correspondingly, another important limitation concerns the generalisation of findings from this dissertation. In an eminently qualitative work such as this, generalisation is modest (although also in quantitative studies generalizations require caution, as they tend to rely on simplifications that disregard critical contextual differences generating questionable certainties). It is not possible to affirm that relationships and mechanisms found in studied cases will operate similarly in other cases or different circumstances. Chapters 3, 4, and 5, that involve detailed and contextual case information, emphasise this limitation. This is detrimental to the impact of this work in possibly providing lessons and examples that are valuable to cases that are not studied in this dissertation. Whilst it might be true that there is still little research about policy transfer in the transport sector in particular, and little evidence on the extent to which the observed policy transfer does lead to more effective outcomes (Marsden & Stead, 2011), this should not prevent attempts to improve mechanisms for sharing knowledge across cities or countries.

Finally, it is not possible to ensure that the analyses in the preceding chapters considered all relevant variables – research efforts in social and political sciences are inherently limited and can only investigate a portion of a much broader universe. Chapters 4 and 5 did not discuss issues such as macroeconomic cycles, variations in fuel price, changing mobility preferences across younger generations that could also have impacts in their analyses.

All the same, this study represents an important and innovative scientific contribution and creates opportunities for continued research. In addition to using novel methods in the field of PT governance, like the Delphi and QCA, the dissertation draws on governance theories, institutional analysis, and socio-technical transitions literature, reflecting the increasingly interdisciplinary character of PT research; there is a growing dialogue between PT and other disciplines within the social sciences, such as geography, anthropology, and sociology (e.g. the mobilities literature [Sheller and

Urry, 2016, 2006]). In this sense, one avenue to be explored is the relevance to PT of concepts and theoretical frameworks from international relations theories, e.g., Allison's (1971) seminal perspective on decision-making models, Nye's (2004) discussion of coordination mechanisms such as soft power – perhaps useful in the continued analysis of integration, as indicated in Section 6.2 – and the various models of agency that underpin the study of international politics (see review in Epstein 2013). The last aspect emerged as particularly critical in this dissertation, and future research has to further explore the role of agency in triggering and fostering institutional change in PT. Studies focusing on the role of key actors are too few, are only loosely conceptualised as champions or leaders; more in-depth analyses (e.g. using concepts from institutional change theories or approaches from behavioural public administration) can yield valuable insight. Another research avenue in PT governance connected to the role of agency, concerns the investigation of processes of de- or re-politicisation, (Bache et al., 2015; Reardon & Marsden, 2019). This is, more attention is needed to the way different actor (constellations) involved in deliberation and decision-making processes in PT, and the extent to which this is driving or not desired societal outcomes.

Several other vital questions arising from this dissertation call for follow-up investigation. One example is the noted lack of studies scrutinising mobility in suburban municipalities; most analyses (including this work) look at metropolitan areas as a whole and the divide in mobility patterns across suburban municipalities and main cities needs to be better understood (as discussed in Chapter 4 and in Section 6.2 above). Similarly, more in-depth analyses of metropolitan areas in lower-income centres in South America, Africa, and Asia are needed; these are areas in which urban regions face more acute challenges, due to higher rates of urbanisation and population growth. In those regions PT can have a greater role in tackling inequalities, but studies related to transport justice are still few and recent (e.g. Martens 2016; Sheller 2018), and more analyses of the topic are needed to address this issue.

From a practical perspective, this dissertation's findings and their implications point to at least three concrete policy recommendations. The highly contextual-dependent nature of the bidirectional relationship between governance and performance; the continued struggle to develop and fine-tune coordination mechanisms; and the insufficiency of policies focused on high demand areas in addressing sustainability ambitions.

First, if governance is the outcome of social, economic, and political developments and good performance can enhance the effectiveness of governance in multiple dimensions (increasing the legitimacy of and trust in formal frameworks and individuals), it is clear that the relationship between governance and performance is highly contextual-dependent. Thus, decision-makers should be cautious with advertised policy success formulae or silver bullets. So-called international best practices and benchmarking should be seen as a potential leads to action, but never as final answers. The importance

of context, and thus of informal institutions and individual actors, also underscores that acknowledging and comprehending the importance of existing shared understandings and of the influence of key players, either political leaders or civil servants, constitute important tools to inform policy-making processes, given the potential that these factors have to enhance the effectiveness of, or even partially substitute, formal frameworks in supporting successful PT. In other words, change agents have a central role in triggering institutional change over time through the way they engage with the properties of existing institutional frameworks that permit or invite specific kinds of change strategies. In this way, decision-makers must be aware and support broader stakeholder engagement in governance processes; involving a wider set of interests in decision-making processes is possibly more cumbersome, representing a measure with high transaction costs, but the gains compensate the effort.

Second, considering the importance of the debates about optimal coordination mechanisms, decision-makers should be open to experiment innovative forms of governance. To increase the efficiency, effectiveness, and legitimacy of policy-making and policies, they must combine existing and new practices, foster collaboration with a more diverse set of actors that possess various backgrounds and espouse new and competing ideas, deliberately leave aside existing beliefs and practices to promote the development of new ones that can represent a qualitative step change despite the associated risks, and show tolerance toward complexity (E. Sørensen & Torfing, 2017).

Third, moving PT production to high-demand areas at the expense of less dense locations is insufficient, *per se*, to achieve sustainability ambitions attached to PT; this policy must be coupled with the expansion of complementary transportation options for first and last mile trips, in order to mitigate the risks of increasing reliance on cars by suburban populations. In this sense, a word of caution is necessary in relation to the still common bias in favour of technological easy technological fixes. The enthusiasm with emerging mobility services needs to be critically assessed and it is too early to expect that at this stage MaaS could represent a complete mobility complement to PT and decisively influence decisions about car ownership and mode choice.

Crucially, at this moment financial interests are the main policy driver in PT, whereas the environmental and social dimensions of sustainability assume secondary importance. This is particularly worrisome in a context in which the world's five largest publicly-traded oil and gas majors have invested over $1Bn in the three years following the Paris Agreement lobbying to delay, control or block policies to tackle climate change (InfluenceMap, 2019). By tackling the governance challenge to understand how we actually 'do' PT, comprehending the disparities between policy design and implementation, this dissertation helps equipping decision-makers and citizens in general to critically assess current policy directions, making current value trade-offs more transparent, and allowing more effective interventions to fix today's wicked mobility issues.

Methodological addendum

Reflections on the application of the Delphi method: lessons from a case in public transport research*

* The content of this chapter corresponds to a revised version of the article published as Hirschhorn, F. 2019 Reflections on the application of the Delphi method: lessons from a case in public transport research, International Journal of Social Research Methodology, 22(3), 309-322. The final publication is available at https://doi.org/10.1080/13645579.2018.1543841.

Abstract

The paper outlines draws lessons from the application of the Delphi method in Chapter 2. The primary objective of this chapter is to develop insights that can support other researchers or practitioners preparing to apply the Delphi. To this end, the analysis focuses on aspects such as the choice of method, selection of experts, design of questionnaires, interaction between survey coordinator and participants, and the analysis of experts' responses. Some of the challenges encountered during the survey, the way they were dealt with, and risk mitigation strategies used by the Delphi coordinator are also highlighted. This study additionally contributes to the methodological debate by reflecting on the introduction of novel practices that can help overcome typical pitfalls of the Delphi: a dedicated blog supporting the survey, safety-net questions, and a constant-sum type question.

I.1 Introduction

One of the main discussions in the field of governance of metropolitan public transport systems (PT) involves the relationship between organisational form and performance. The underlying assumption in these debates is that certain elements of the organisation of PT (such as market entry rules, contracting models, and integrated fare policies) can promote or hinder public goals attached to PT (such as sustainability, cost-efficiency, and safety) Analysts seek to shed light on the links between organisation and performance to discern potentially better strategies on how to organise PT services.

Chadwick (1859), for instance, contrasts competition for the field (competition for having access to a market or area where to deliver PT services) and competition within the field (related to the competition between different transport providers operating in the same market). This same theme spurred much research after the British bus deregulation in 1986, and similar deregulation attempts elsewhere (Cowie, 2014; Fernández & Muñoz, 2007). The possible performance impacts of different awarding mechanisms or varied contractual regimes between government authorities and operating companies are also part of this literature (Stanley & Hensher, 2008; Vigren, 2016). Some authors examine the issue of ownership structure, both at the market level and at the level of operating companies, and assess their possible performance implications (Docherty et al., 2004; Scheffler, Hartwig, & Malina, 2013). The role of key stakeholders, the arenas where they interact, and the tier of government responsible for PT policy are also scrutinised as relevant features of the organisational setup of PT that might influence performance (Pemberton, 2000).

These analyses offer important insights and help improve the understanding of some key mechanisms linking the governance of PT and performance. However, by only looking at the summation of effects of isolated policy interventions, they may fail to capture a more textured view of PT governance. PT is a complex, multifarious, socio-technical system in which different technical elements, actors (with multiple interests), and norms coexist (de Bruijn & Herder, 2009; Schwanen, 2013). These systems are complex and more than the sum of their parts (Macmillen, 2013); as such, their analysis can benefit from a configurational perspective that acknowledges that several elements interact and influence each other (Ostrom, 2010; Ragin, 1987). In other words, analyses of the relationship between organisational form and performance in PT can benefit from the recognition of this systemic character, and of the importance of the interplay between different organisational elements.

To operationalise said configurational approach, the first step is to identify and select adequate research variables. Therefore, the problem posed for PT research is to select performance indicators suitable to measure the achievement of strategic goals in PT, as well as organisational features that might affect strategic outcomes. Chapter 2 did so

by using a participatory approach, the Delphi method. The Delphi relies on a sequence of questionnaires distributed to selected experts in a process managed by a survey coordinator. After the first round of questions, and preceding any new questionnaire, the survey coordinator provides participants with anonymous feedback on answers offered by all panel members. Individual participants can reflect on this feedback and reconsider their opinions when responding to subsequent questionnaires. This process, interspersing anonymous questionnaires and controlled opinion feedback, constitutes a powerful mechanism to expose and articulate diverse views on an issue and to help creating knowledge to solve complex policy issues.

By developing a Global Delphi in Public Transport (GDPT), Chapter 2 gathered insights from PT experts across the world. The GDPT produced authoritative inventories and ratings of core performance indicators and organisational features affecting performance in PT. Chapter 2 discusses the GDPT's results, as well as their possible implications for the study of PT under a complexity-oriented and systemic lens. This chapter, instead, uses the GDPT as an example of the application of the Delphi method to critically reflect on the method itself. The chapter looks at some of the challenges encountered during the survey, the way challenges were dealt with, some risk mitigation strategies, and lessons learned. The description of the GDPT points to assets and drawbacks of the Delphi, and thus can support researchers or practitioners wishing to apply the methodology. In particular, the GDPT introduces novel practices that can be applied in new Delphi studies to help overcome some typical pitfalls of the method, as well as to leverage some of the method's strengths: a dedicated blog supporting the survey, safety-net questions, and a constant-sum type question.

I.2 Research strategy

I.2.1 Choice of method

As advanced in Section I.1, transport research many times fails to recognise the complex and systemic character of PT and does not address the topic in a comprehensive manner. Macmillen observes that: "*As complex systems, however, modern transport systems are more than the sum of their parts. They cannot be understood as reducible to stable, established and deterministic relationships between variables.*" (2013, p. 203). It is thus necessary to find new approaches to analyse PT governance that allow moving beyond an incremental perspective, which only considers isolated policies or variables. A configurational approach thus appears as an alternative to tackle the question on how performance of PT may be affected by the organisation of the system, since it allows an examination of the combined effects produced by multiple relevant factors. For this, however, a necessary first step is to identify the factors that can serve as adequate research variables.

The specialised literature on the debate around the performance repercussions of different features of the organisational form of PT, briefly illustrated in Section I.1 of the Addendum, constitutes a first relevant input to develop this task and define suitable organisational and performance factors to be analysed in combination. However, as highlighted by Schwanen et. al (2011), PT research has overall focused on a limited range of actors, leaving aside the role played by and the views from important players, such as financial institutions, insurance companies, and social movements. The Delphi method emerges as a possible tool to help identifying the critical factors in the discussion surrounding the relationship between organisation and performance in PT. It allows approaching PT governance with systemic lenses and, at the same time, perform this task attending to views of other types of stakeholders beyond academia. The Delphi was initially conceived as a methodology to achieve consensus amongst a small and selected group of experts, but over time new variants of the method appeared and opened up for inputs from more actors as well making the Delphi also applicable as an open and inclusive participatory process. Delphi techniques recognise and seek value in the articulation of varying and contrasting visions as a tool to support the solution of complex policy matters (Turoff, 1970). Kezar and Maxey (2016) corroborate this perception, and emphasise that the Delphi technique is particularly well suited to solve complex and multi-layered problems that require the attention of multiple stakeholder groups.

Therefore, the Delphi was chosen, and the GDPT conceived, as a means to find suitable organisational features and appropriate indicators that can help guiding PT policy design and evaluation, whilst also seeking the views of other stakeholders beyond academia who possess relevant knowledge in the field, thus relying on insight beyond a simple literature review. The GDPT integrates views of academics and practitioners from varied backgrounds and this search for variety of views will be made clear in the description of GDPT's process to identify and select participants (Section I.3.2 of the Addendum). The ambition to amplify the reach of PT research to consider a wider set of actors is understood and applied with caution though. In some cases (the GDPT, for instance), not any and all stakeholder directly or indirectly involved with PT will have relevant knowledge for debating questions that are essentially technical and require in-depth expertise of the field. For example, questions about if/how the adoption of competitive tendering to select bus operators might, as an organisational feature of PT, impact levels of cost-recovery, if asked to stakeholders not minimally familiarised with these issues, might lead to irrelevant responses.

I.2.2 The Delphi method

The Delphi method was developed within the RAND Corporation in the 1950s. Back then, it was devised as an organised participatory process for consensus building. By eliciting the opinions of experts, the Delphi method was shaped to build authoritative

forecasts in relation to the occurrence of events or trends. Originally, the method was created and used for decision-making regarding military matters, and only years later it was disclosed to the general public (Dalkey & Helmer, 1963). Nowadays, its use is widespread in a variety of domains, such as technology forecasting, engineering, and the nursing sector, as well as in different social science fields (Gupta & Clarke, 1996; Landeta, 2006).

Procedure-wise, the Delphi relies on a sequence of questionnaires distributed to selected experts in a process managed by a survey coordinator. After the first round of questions, and preceding any new questionnaire, the survey coordinator provides participants with anonymous feedback on answers offered by all panel members, ensuring that opinions are not assigned to particular individuals. Participants can reflect on this feedback and reconsider their opinions when responding to subsequent questionnaires. This process, interspersing questionnaires and controlled opinion feedback, continues until a desired level of consensus is reached amongst respondents or until opinions are stable across survey rounds (Dajani, Sincoff, & Talley, 1979; von der Gracht, 2012).

Rowe and Wright (1999) identify four core elements in a Delphi survey:

(a) Anonymity: providing opinions anonymously and free of direct interaction with other respondents should allow participants to express themselves freely, under no influence of potential dominant figures or group conflicts. Opinions and arguments can thus be evaluated on their merit only.
(b) Iteration: the multiple rounds in a Delphi allow participants to reassess their own judgements and, given the anonymity of the process, reconsider earlier responses.
(c) Controlled feedback: after each round participants are confronted with the group's opinions and encouraged to re-evaluate their own responses. This feedback is normally presented through statistics based on aggregated responses. It is also possible to include in this feedback some anonymised textual arguments offered by participants in support of certain opinions.
(d) Statistical aggregation of group responses: at the end of the survey, the group's opinion is taken as the statistic average (mean/median) of overall opinions of panellists in the final round.

Whilst the use of the Delphi follows some central features, the method is flexible in its application and the researcher has the possibility to customise the process to the particular characteristics of the problem in discussion, or to their specific objectives. As a result, a number of variants of the method have emerged and continue to be developed (Kezar & Maxey, 2016; Schmidt, 1997; Steinert, 2009; Turoff, 1970). These variants adapt the method in different ways, such as techniques to select participants, types of questions employed, tools used for the analysis of responses, and type of outcome sought (see, for instance, discussion in de Loë et al. 2016; Paré et al. 2013).

I.3 The Global Delphi in Public Transport (GDPT)

I.3.1 Survey structure

The GDPT was structured in three different stages: (i) brainstorming (respondents could freely propose all relevant elements in connection to the issues at stake); (ii) narrowing down (respondents shortlisted most relevant elements from previous stage); and (iii) rating (respondents rated shortlisted elements). In each of these stages, one questionnaire was used. This design was mainly inspired by the ranking-type Delphi (Schmidt, 1997), although it does not strictly follow the structure and steps proposed by Schmidt and others who have employed this variant (Okoli & Pawlowski, 2004; Paré et al., 2013). Differences are highlighted in the remainder of this section. Figure I.1 of this Addendum summarises the GDPT structure and steps.

The GDPT was entirely carried out with online questionnaires, using a survey platform to collect and aggregate responses. In addition to direct email interaction, a dedicated blog was created to support the GDPT. The blog served as a platform for the publication of GDPT's results, as well as to provide more detailed information on the survey's motivation and aims. By creating this separate communication channel, the GDPT managed to make additional information available for those participants interested in learning more about the survey, whilst avoiding very lengthy emails that could be overwhelming to participants with limited time availability.

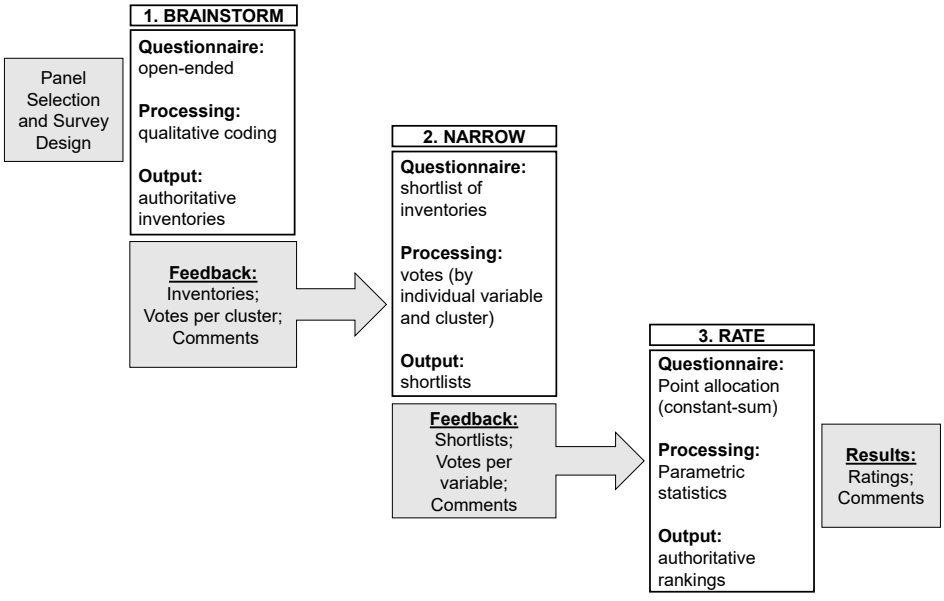

Figure I.1: Schematic representation of the GDPT

I.3.2 Choice of experts

The choice of experts is a crucial step to ensure that breadth of knowledge is represented amongst panellists (Delbecq et al., 1975). Panel building in a Delphi comprises two moments: (i) defining the relevant expertise and (ii) identifying individuals with the desired knowledge. Concerning relevant expertise, the GDPT attempted to cover knowledge on (i) PT performance monitoring and/or evaluation and (ii) the design and functioning of organisational forms adopted in diverse PT systems worldwide. Importantly, the GDPT recognises that this expertise is also outside academic debates and tries to gather the views of varied types of practitioners as well. For the identification of experts, the GDPT combined two conventional approaches, namely sampling based on actor types and snowball sampling. The first approach seeks representativeness in terms of perspectives by sampling actors from diverse affiliations. In snowball sampling, the researcher starts of by picking a small number of stakeholders, and then asks them to recommend other potential participants.

In terms of actor types, the following criteria were used to find academics and practitioners that could contribute to the survey:

(a) Variety of roles: different types of stakeholders: (i) academics, (ii) government officials, (iii) transport operating companies, (iv) users' associations, (v) multilateral financing institutions, (vi) consultants. In the case of academics, two more aspects are considered: (i) works published in relevant journals and retrieved on Google Scholar, and (ii) variety of academic discipline in PT: geography; economics; engineering; public administration and policy; and urban planning.
(b) Knowledge in a variety of organisational settings: experts based in, and/or with expertise on different geographical locations.
(c) Prominence in the field: affiliation to eminent organisations, as well as involvement in major international fora, major universities, government entities responsible for PT, PT providers, participation in editorial boards of prominent journals.

A matrix for the identification of experts was developed to support this selection process (Table I.1 of this Addendum). After a first exercise to populate the matrix, some of the initially identified experts were asked to provide recommendations for other specialists that could participate (snowball sampling) and the suggested names that had not been previously identified were included in the panel. All experts were then assessed more closely to confirm the direct relevance of their work for the topics being surveyed, i.e. that their work in PT was indeed connected to PT governance on its various dimensions. The matrix illustrates the central objective of the GDPT to encompass a broader set of views on the debate organisation-performance. The survey includes an ample set of practitioners from several backgrounds. It also gives room to relevant actors who tend to be 'less heard', such as users' associations, multilateral financing institutions

Table I.1: Matrix for the identification of experts

		Africa	Oceania	USA and Canada	Latin America	Europe	Asia
Practitioners	Consultants	3	2	3	2	5	2
	Multilaterals	2	--	--	3	--	3
	Operators	3	6	4	4	11	2
Governments	Authorities	5	4	5	4	9	3
Passenger Association		--	--	--	--	2	
Academics	Public administration	1	2	2	2	6	1
	Engineering	3	2	1	2	2	3
	Traveller behaviour	1	2	2	2	1	2
	Economics	1	1	2	1	4	2
	Urban planning	1	1	2	1	2	6

and private consultants. At the same time, the important views from academics – with varied technical and geographical experience – are still considered.

A minor imbalance in favour of European participation is also visible in the matrix. This was ultimately the result of the greater ease in identifying experts across contacts from personal networks of GDPT's authors or through these contacts' recommendations. Faced with this initial outcome in the construction of the matrix, a trade-off became evident: either reducing the potential panel to prevent the survey to be skewed towards a European view, or keeping as many participants and views as possible to avoid the risk of a very low rate of responses. The GDPT followed the latter path, mainly because the association of experts to a region in the initial matrix took into account their regional base (in the case of the experts who work in multilateral funding institutions, the region indicates their current affiliation in terms of geographical area of work), which does not correspond necessarily to their regional knowledge. Most (if not all) the experts who were screened have knowledge on diverse international PT systems and the fact that they are based in or currently work with a given region does not curtail the panel's overall geographical breadth of knowledge. This trade-off is nonetheless relevant because it is related to a potential pitfall of the Delphi method: the survey coordinator has no control over response rates, and there is a real risk of having just a few participants reacting, and/or a high rate of withdrawals throughout survey rounds, which can compromise the entire Delphi process.

The first communication with potential participants described the overall goals of the survey, indicated the planned number of questionnaires, and outlined the expected duration of the entire process. The link for the first questionnaire was also included in the first email; due to the large number of invitees, the GDPT's authors chose not to approach and consult individuals' willingness to participate in advance to providing them

with access to the questionnaire. The decision to proceed this way highlights another trade-off connected to the design of a Delphi and linked to the number of participants that one is willing to involve in the survey. The larger the set of experts, the harder it is to interact more directly with each of them, whereas closer interaction is feasible with a small panel. The GDPT's final participation numbers were very positive nonetheless, response rate was high, and drop-out numbers very low compared to other Delphi studies: 96 experts accessed the first online questionnaire. The first questionnaire was responded by 54 experts. Of these, 48 responded to the second questionnaire, and finally, 46 experts from 18 different countries[1] concluded the third and last questionnaire. The profile of respondents shows the intended diversity, including approximately 60% practitioners and 40% academics, varied technical and regional knowledge, and with no one group being overrepresented (Figure I.2 of this Addendum).

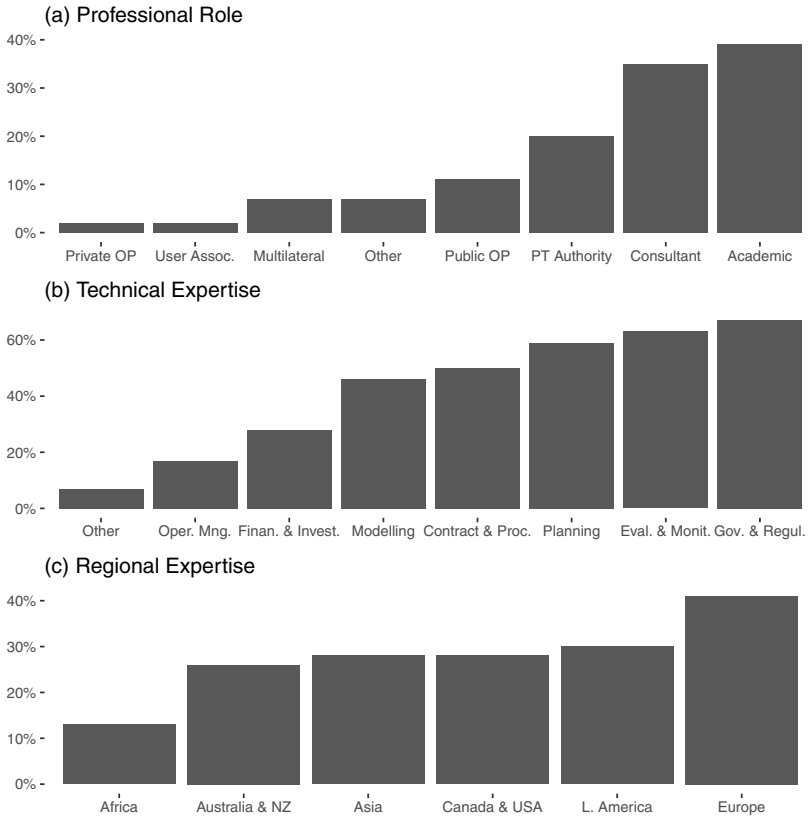

Figure I.2: Profile of experts that concluded the GDPT. Statistics are based on self-stated information by respondents. Respondents could choose multiple options.

[1] Australia, Brazil, Canada, Chile, Colombia, Denmark, England, France, Italy, Japan, Netherlands, New Zealand, Norway, Singapore, South Africa, Sweden, Turkey, and USA.

I.3.3 Round 1: brainstorming

The questionnaire

The first questionnaire of the Delphi used two sets of questions. The first set contained open-ended questions, while the second contained Likert-scale questions.

In the open-ended set, experts were presented with a decision situation and asked to assume they would be hiring a consultant to analyse a PT system. They had to list and briefly describe (in one or two sentences) at least five performance indicators that they would want examined by the consultant. Experts were instructed to prioritise indicators better able to provide relevant information on what, in their views, would be critical aspects of PT. Experts were also asked to associate each selected indicator to a broad performance aim. The question did not set any limit to the number of indicators that could be suggested and avoided defining any specific performance goal to be measured. Similarly, a second question asked experts to list and briefly describe (in one or two sentences) at least five organisational features considered important drivers of PT performance.

The second set of questions in the brainstorming exercise presented experts firstly with some 'pairs' of performance aims and indicators normally found in PT literature analysis (e.g. Environmental Sustainability; per capita emissions of NOx) and secondly with a list of organisational features normally discussed in PT literature (e.g. Allocation of Ownership of Long-Life Assets). The performance pairs and the features in the list had to be rated using a Likert-scale from 1 to 5. The Likert-scale questions were deliberately included as the second set of questions to avoid introducing any bias before open-ended questions. They were visible to participants in a second page of the questionnaire (accessible only after completion of the first set of questions).

The Likert-scale questions were introduced in the survey as a risk mitigation strategy: in case the answers to the open-ended questions were not suited to the research goal (due to misinterpretations, for instance) and had to be discarded (a risk in Delphi), the responses to the rating questions could be used to inform the following rounds of the survey. As such, the Likert questions offered a way to reduce possible loss of expert input. This risk did not materialise in the GDPT, and the open-ended questions generated nearly 700 lines of content fitting the research aim. Responses to the Likert-scale questions, thus, were not be used in the remaining of the survey.

Analysis of responses and feedback material

Answers to open-ended questions were qualitatively analysed and coded. The coding identified major themes, eliminated redundancies, and produced long inventories of performance indicators and organisational features based on expert opinion. Sensitising concepts (Bowen, 2006) based on relevant PT literature were used as guidelines for the interpretation and organisation of input received from experts, and no supporting

software was employed although resorting to these tools is also possible (Bailey et al., 2012; de Loë, Murray, & Brisbois, 2016). The three authors of the GDPT worked in parallel in the coding task: the main author of the GDPT performed an initial coding of the entire set of answers. As a reliability test, the co-authors independently coded randomly selected samples of the answers received. The three independent analyses produced consistent conclusions, with minor exceptions. These differences were discussed, and the main author reconciled them to generate the final output of this round. This triangulation procedure is similar to the one proposed by Schmidt et al. (2001).

The coding process was the most challenging and time-consuming step of the entire GDPT. It involved a constant trade-off between two conflicting tasks: consolidation, on the one hand (to produce a reasonably-sized list to be used in following rounds by experts who have limited time available for participation) and, on the other hand, no excessive generalisation of answers (which could defeat the purpose of the Delphi by impoverishing experts' inputs). Asking experts to include brief descriptions of their answers, a measure proposed by Schmidt (1997) and Okoli and Pawlowski (2004), was essential for this step. It helped to clarify opinions and enrich the material.

Finally, two inventories were produced listing core performance indicators and core organisational features. The feedback material sent to experts after this stage included

Table I.2: Sample from Inventory of Performance Indicators

ACCESSIBILITY IMPACTS		
Cluster	**Mentioned by**	**Indicators**
Access to Destinations	9%	a) Number of opportunities and services that can be reached by public transport within a given time or distance.
Access to PT	33%	a) Average walking time or distance to access selected routes. b) Percentage of inhabitants (or users) who live within walking distance of frequent transport service. c) Number of stations or bus stops per square km. d) Distance between PT stops.
Fairness and Affordability	28%	a) 'Access to Destinations' measure for low income population. b) 'Access to PT' measure for the bottom 40% 'increase social inclusion and reduce inequality.' c) Percentage of income or household budget (of low income or lowest quartile) spent on transport. d) Percentage of immobile. e) Percentage of poor served by subsidies. f) Average fare per passenger km. g) Average fare relative to petrol costs for medium-size car for short, medium and long trips (to be defined).
Universal Design	9%	a) Percentage of stations/stops or terminals with facilities such as on level boarding / escalators and lifts.

these two inventories, indicating also the percentage of respondents who mentioned elements in each cluster, and all additional comments made by experts. Table I.2 in this Addendum exemplifies the coding structure with a sample from the inventory of performance indicators from the GDPT.

I.3.4 Round 2: narrowing down

The questionnaire

In Round 2, experts were asked to shortlist seven performance indicators and seven organisational features amongst all those listed in the inventories produced in Round 1. The wording used in this questionnaire was consistent with the previous round and requested experts to prioritise indicators better able to provide insights on most critical aspects of PT and organisational features with greater impact on performance.

Establishing a limit number for the shortlist items was a strategy to emphasise the need for prioritisation (also in view of the very long inventories from round 1) and to reduce the workload of participants (another pre-emptive measure against possible fatigue). Literature does not offer a recommendation in relation to what this limit number should be, and there are authors who suggest that no limit should be established (Schmidt, 1997). In the GDPT, the suggested number of seven items was chosen because it was the average number of performance indicators listed by each respondent in Round 1.

Analysis of responses and feedback material

In similar Delphi designs authors suggest building the final shortlist based on simple majority of votes (Schmidt, 1997). The GDPT followed this criterion, although after a two-fold counting process. A first analysis considered votes at the level of individual variables, i.e. votes that each performance indicator and each organisational feature received. In addition, a second examination was conducted for cross-checking results: responses were counted at the cluster level – i.e. the sum of votes given to each of the clusters (those defined in the coding of Round 1 as illustrated in Table I.2). For instance, the performance cluster 'Total (and operating) costs ratios' defined in Round 1 comprised nine different indicators, so all votes given to these nine indicators were added to assess the total votes of the respective cluster.

The analysis at the cluster level revealed that defining a final shortlist of seven items for the subsequent round of the GDPT would not adequately reflect experts' priorities. The cluster 'Total (and operating) costs ratios' is again an example: overall, it was the third most voted cluster in the inventory of performance indicators, but because these votes were dispersed amongst the nine alternative individual indicators, none of these nine would, individually, be in the final shortlist of seven. Therefore, whilst clearly

relevant to experts, no cost ratio would have made the cut. To circumvent this potential shortcoming, the GDPT coordinator expanded the final shortlists, each to include the ten most voted variables.

In Round 2, four experts voted for more options than requested in the questionnaire, which could skew the results. This is a potential limitation of Delphi techniques because experts might not fit their responses to the format defined by the coordinator. The survey coordinator must be flexible to identify the issue and act to find a solution 'on the go.' The GDPT's coordinator reached out to these four experts to consult them about the possibility of repeating the exercise selecting only the stipulated number of items. Experts who could not repeat the exercise had their votes considered based on weighted values.

The feedback material sent to respondents described the two shortlists, including the ratio of votes that each variable received and any comments from experts.

I.3.5 Round 3: rating (constant-sum)

The questionnaire

The final questionnaire of the GDPT introduced a constant-sum (or fixed-sum) question. Experts were presented with a practical decision situation: they were asked to consider the elements shortlisted in Round 2 as possible variables to be employed in a comparative study of PT in 15 metropolitan areas; said comparison's aim was to unveil how different ways of organising PT influence performance. Experts had to allocate a hundred points amongst (all or part of) the variables in each shortlist to indicate the relevance of the variables for the hypothetical study. To avoid inducing any bias, the online platform where the survey was conducted listed variables in random order across the questionnaires sent to participants. Furthermore, the platform would not allow the exercise to be concluded unless exactly a hundred points had been allocated.

Analysis of responses and feedback material

In Round 3, answers were compiled and measured with multiple statistics: (i) the average points received by each variable, (ii) the standard deviation in points received by each variable, (iii) the highest single score attributed to each variable, (iv) the percentage of experts attributing zero point to a variable and (v) the ranking of variables based on the amount of points they received. Results also included information on how preferences moved between rounds, by indicating the ranking of variables (based on votes) in Round 2. Table I.3 below presents a sample of the results of this round.

Although very common as a survey method and of simple execution, the constant-sum format had not yet been employed as part of a Delphi survey, to the best of the author's knowledge. The main advantage envisaged in the adoption of this format was

Table I.3: Sample of results Round 3

Performance Indicators	Avg. Points	Std. Dev.	High	Mode	Zeros	Rank	Rank 2
User Satisfaction (overall index)	15.91	11.03	50	15	11%	1	3
Cost-Recovery Ratio	15.24	9.07	30	20	14%	2	1
Modal Split	13.20	9.68	40	20	20%	3	2
% of Inhabitants (or users) living within walking distance to Frequent PT Service	9.78	7.71	30	10	23%	4	6
Ridership per Capita	9.57	8.70	30	5	25%	5	7
Ratio between Travel time in PT and Car	8.22	6.36	25	10	25%	6	5
On-time Performance according to Timetable	8.04	6.95	20	0	32%	7	4
Total revenue and total cost	7.28	8.39	30	0	45%	8	9
Cost per Passenger Km	6.98	6.77	26	0	36%	9	8
Comfort	5.78	5.88	20	0	41%	10	10

the possibility of analysing results with simple parametric statistics (average points, standard deviation, etc.). If a simple ranking question (in which experts were asked to order variables according to their relevance from 1 to 10) were to be used instead, the range of analytical tools available for the examination of responses would be more restricted: most literature on Delphi agrees that only nonparametric statistics can be used to measure level of consensus in these cases (e.g. de Loë 1995; Schmidt 1997, but see Norman (2010) for a different opinion). The constant-sum question prevents this possible drawback whilst still allowing rankings to be built based on the amount of points allocated to each variable. Furthermore, it also allows analysing the level of consensus or divergence between experts through the measures of standard deviation, maximum single score or zero scores attributed to each item.

I.4 The GDPT's findings in brief

The results of the GDPT highlight a couple of broader central elements in the discussion surrounding the relationship between organisational form and performance in PT. In regards to performance, answers manifest a preference for a high-level system-wide assessment of PT, using multipart indicators – overall user satisfaction, cost-recovery, and modal split. In the GDPT's results, these three-core metrics are separated from the rest by a clear gap in points. Concerning features of organisational form driving performance outcomes, integration emerged as the central dimension: policy integration between public transport and other sectors, single integrated planning authority, as well as ticket and fare integration were highly rated by Delphi experts.

In addition to these broad conclusions, the GDPT's results also provide a 'menu' of core performance indicators and organisational features. These twenty elements (ten and ten, respectively) define what, in the view of the consulted experts, are the most important performance metrics suitable to measure strategic PT outcomes, and what organisational features might affect strategic outcomes. This output, more broadly discussed in Chapter 2, enables proceeding with future research efforts on the dependencies and interactions amongst PT organisational and performance elements – addressing the gap explained in Section I.1 in this Addendum.

I.5 Impressions and lessons learned

The experience with the GDPT highlights some important strengths of the Delphi method. It first confirms that the Delphi can be a powerful research tool to increase access to the valuable – and often difficult to reach – opinion of experts. The input produced in the GDPT comes from a wide variety of technical and geographical perspectives that other research methods would not be able to gather. Additionally, the international reach of the survey, facilitated by the use of online questionnaires, is also a positive asset of the Delphi: engaging experts globally is extremely hard if conventional face-to-face interviews are to be used, for instance. As a result, and representing another of the method's advantages, the Delphi can produce a breadth of views that makes it almost unparalleled as a building block for continued and more in-depth analysis – for example based on workshops, interviews, or case studies (de Loë, 1995; Van Dijk, 1990).

It is also noteworthy that the Delphi allows tailoring the survey according to the researcher's needs. This adaptability appears as one of its greater strengths, evidenced by the continuous and increased use the method since its inception (Gupta & Clarke, 1996; Landeta, 2006). Although the GDPT is mostly inspired by the ranking-type Delphi, it includes a series of changes in relation to the original design of this type of survey, in particular a dedicated blog supporting the survey, safety-net questions, and a constant-sum type question.

The first important change introduced in the GDPT refers to the use of a dedicated blog as a repository of information where survey's details and updates were posted. Having this additional channel for communication was helpful to keep participants engaged. Those participants interested in learning more about the survey had this information available in a separate 'venue', whilst the core communication for the GDPT process (questionnaires and feedback) could be conveyed in objective and clear emails.

Another novelty of the GDPT was the use of the safety-net questions in Round 1. Open-ended questions in Delphi may lead to a wide range of responses, varying sub-

stantially both in format and content. If some responses do not fit the purpose of the survey, the coordinator might be forced to discard substantial amount of material. This is not only frustrating given the difficulty in obtaining such type of qualified input, but also jeopardises the continuity of the survey. The input received with the Likert-type questions in Round 1 of the GDPT was a guarantee that the survey would not have to be dropped in case of problems with the open-ended questions.

Finally, the point allocation methodology in Round 3 is one further new practice developed in the GDPT. This was particularly relevant to enhance the analytical tools available to assess experts' responses. Simple but powerful parametric statistics are transparent, easy to understand and replicate and, at the same time, provide multiple perspectives through which answers can be analysed, including a ranking based on average points, consensus or dissent based on standard deviation, maximum single scores and zero scores.

On the other hand, some limitations are inevitable in any research effort. Some difficult trade-offs are involved in developing a Delphi. Selecting experts for the panel requires choosing between engaging either a large and more diverse set of respondents, making close interaction a more difficult task for the Delphi coordinator or, alternatively, a smaller group of individuals who may be easier to follow closely and contact, possibly creating higher commitment by respondents, but also reducing the scope of views consulted. Whilst the first route was chosen for the GDPT, a substantial effort was also made to keep participants engaged (e.g. with the use of the dedicated blog). Moreover, communication with experts had to ensure adequate provision of information whilst avoiding unnecessary long messages or questionnaires that could discourage participation of experts with limited time to contribute. Finally, coding in Round 1, the most time-consuming step of the GDPT, involved two conflicting tasks: consolidation of responses for the feedback material in a clear and concise manner and, at the same time, prevention of excessive generalisation of answers, which would defeat the purpose of the Delphi.

These trade-offs underscore the crucial role played by the survey coordinator in articulating opinions and structuring the dialogue between experts, indicating a possible source of weakness in the Delphi. This process is not immune to subjective judgements and this is particularly relevant in the qualitative coding process (thus the importance of using a reliability test as a mitigation measure). On this same note, the praised adaptability of the Delphi may come at a cost: many times authors do not take into account minimum study design and reporting expectations in Delphi studies, producing less rigorous research (C. A. Brown, 2007; de Loë, Melnychuk, et al., 2016).

In addition, it is not possible to ensure that the expert selection procedure employed in the GDPT guarantees that all relevant individuals were included in the panel, or that the final list did not suffer from any bias. This may be the case for different reasons:

databases used may be incomplete; experts may not always publish their work; conferences, journals and other major fora may not be geographically pluralistic; and experts may not have been recommended due to personal reasons. However, the criteria and procedure followed are consistent with best practices in Delphi studies (Delbecq et al., 1975; Marchau & van de Linde, 2016).

Finally, difficulties with the questionnaires or simple respondent fatigue may have prevented further participation in the GDPT. If the Delphi process appears too complex or time consuming, experts may not join or may later drop-out during the survey (C. A. Brown, 2007). One possible source of difficulty in the GDPT was language: questionnaires were prepared in English, which may have discouraged non-native speakers. This route was chosen, nevertheless, to ensure that all experts were answering to the exact same questionnaires. Professional jargon may also be a source of misinterpretations, both by the Delphi participants and by the survey coordinator.

I.6 Conclusion

This chapter set-off to describe a particular application of the Delphi method – the GDPT – and, based on this experience, to reflect on the method's strengths and weaknesses. The Delphi proved its merits by enabling the GDPT to move beyond some of the limitations that are common to participatory approaches and conventional face-to-face interviews. It offers participants anonymity, which allows free expression of opinions, and, enabled by ICT technologies, it also permits the consultation of experts from different parts of the world acting in different roles, circumventing the impossibility of gathering all participants in a single place at the same time.

Furthermore, by employing the Delphi, the GDPT could engage actors that are not often part of public transport research. The survey proved effective in bringing together and articulating diverse views from professionals of different affiliations, as well as from varied technical and geographic backgrounds. As a result, the GDPT promoted a qualitative exercise – by design with no statistically significant results – with an output that would hardly be achieved in a different way. The expert insight provided by the Delphi can be a powerful component of a mixed-method research design if findings are complemented with more in-depth research, like case analyses.

Tough trade-offs are faced by the Delphi coordinator whilst preparing and conducting the survey, such as deciding the number of experts to approach and the way to engage them to attract and maintain participation, dealing with experts' responses so that the Delphi survey is not compromised and overall objectives are achieved, and balancing information conciseness and richness in the qualitative coding analysis. These trade-offs highlight the critical role played by the survey coordinator, which is a

possible source of weakness of the Delphi process. However, whilst highlighting these challenges, the chapter also provided suggestions on how to tackle them. Thanks to the adaptability of the Delphi, the GDPT introduced positive practices that not only suited its particular research objectives, but also expand the Delphi's toolkit and, thus, can be used in future applications. The dedicated blog, the safety-net questions, and the constant-sum question offer researchers strategies to circumvent or mitigate limitations of the Delphi, whilst still taking advantage of the method's potential.

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About the author

Fabio Hirschhorn was born and raised in São Paulo, Brazil. He earned a law degree (LL.B.) from the University of São Paulo's Law School (Faculdade de Direito do Largo São Francisco) in 2004, and subsequently worked as a corporate lawyer with M&A contracts in the financial sector. Fabio decided to shift careers and, in 2009, he moved abroad to pursue a Masters Degree (MA) in economics and international relations at the Paul H. Nitze School of Advanced International Studies (SAIS) from the Johns Hopkins University. In 2011 Fabio started working at The World Bank in Washington, DC, supporting policy, institutional, technical and financial analyses for the design and implementation of urban transport projects in Brazil, Colombia and Peru. By the end 2015 he started working at Delft University of Technology in The Netherlands, initially as part of the EU-funded Petra Project, collaborating with the team responsible for developing the governance analyses and manual related to the creation of a digital-platform for journey planning and urban mobility information. Also at Delft University, Fabio decided to pursue a PhD degree investigating issues on the governance of urban mobility, under the supervision of Dr. Wijnand Veeneman and Dr. Didier van de Velde, at the Faculty of Technology, Policy and Management. In particular, Fabio's PhD dissertation examines the influence of governance on performance outcomes in public transport systems in metropolitan areas. During his PhD Fabio also developed a fruitful collaboration with K2 – The Swedish Knowledge Centre for Public Transport and VTI Swedish National Road and Transport Research Institute, that involved residency periods in Lund and Stockholm in 2018 and 2019 respectively. Currently Fabio works as a post-doctoral researcher in the same research group in Delft, developing new analyses on issues connected to the governance of urban mobility.

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