Market Structures and Coordination Issues in Passenger Rail Markets

A study on policy decision-making for passenger rail transport in The Netherlands

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A study on policy decision-making for passenger rail transport in The Netherlands

by

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Preface

When I got the call from Aart de Koning (Goudappel) with the offer to research the future of the Dutch rail market, I knew I had found my graduation topic. During my years as a TU Delft student, my interest in mobility policy and public transport only increased - to the point that some of my friends now describe me as a real public transport nerd. Therefore, contributing to the relevant and sometimes sensitive debate on rail market coordination seems to me a fitting way to end my student career.

I would like to thank Goudappel for giving me the opportunity to work in a stimulating environment and to benefit from the experience and knowledge of my colleagues. In particular, I would like to thank my supervisors Wijnand Veeneman (TU Delft) and Dennis Roelofsen (Goudappel) for their support and honest feedback during this project. Our discussions contributed greatly to the outcome of this research. I would also like to thank Oded Cats (TU Delft) for officially chairing my thesis committee and for finding time in his busy schedule to read my drafts. I would finally like to mention my colleagues Alina Prey, Anne Koot, Claudia de Koning and Ragnhild Bruynooghe for their valuable feedback on the project.

After eight years as a student, it is still unknown what the future holds for me. I am grateful for all the people I have met along the way and all the things I have been able to explore outside of my studies. I will take all the experiences and friends with me as I move into adult life!

Well, with those kind words, let's get this show on the road! Or the tracks? Anyway, enjoy reading my thesis!

Tijmen Godeke
Rotterdam, April 2024

Summary

The Dutch passenger rail market[1] (PRM) is under pressure from poor punctuality and rising fares. This has led to a debate about the regulatory framework for rail services in the country. The largely monopolistic nature of the market is being closely scrutinised by market players and the European Commission, as European regulations require the introduction of competition wherever possible. Nevertheless, the Dutch parliament believes that the Dutch network can and should still be awarded directly to Nederlandse Spoorwegen (NS) under an exemption clause in European Regulation 2016/2338, which allows direct award after proof of significant system complexity and guarantees regarding cost efficiency and service quality.

This research aims to provide insight into the systemic complexity of passenger rail markets to contribute to the European debate on railway regulation and to provide recommendations for Dutch policymakers. As such, the research was set out to answer its main research question:

> *What coordination issues are present in possible market structures for passenger rail markets, and what is their impact on the system performance of the Dutch passenger rail market?*

It was decided to gather a great deal of information on passenger rail markets through a literature review and a Delphi study. This combination is a powerful tool as the information gathered through the literature review could be refined through the structured group communication process of the Delphi method. The first part of this research aimed to provide a structured way of analysing passenger rail markets and their market structure. To this end, a theoretical framework was developed, including a set of causal factors, policy issues and performance indicators. The second part of the study consisted of a Delphi study to identify the most prominent coordination issues in passenger rail markets. Finally, based on the information gathered in the Delphi study and the literature review, the Dutch passenger rail market was analysed to formulate recommendations.

See page xiii for a Dutch translation of this summary.

Market Structure of Passenger Rail Markets

The basis of this study is a theoretical framework based on the work of van de Velde, 1999, Williamson, 2000 and Veeneman, 2021, as shown in Figure 1. It divides decision-making for passenger rail markets into three levels, each with its own set of institutions. Decision-making is influenced by causal factors such as historical context and leads to a particular system performance, which can be measured by three categories of performance indicators. The strategic level of decision-making can be considered the market structure of a passenger rail market.

[1] The passenger rail market is defined in this thesis as the market for heavy rail services, excluding light rail, metro, tram and other rail-based services.

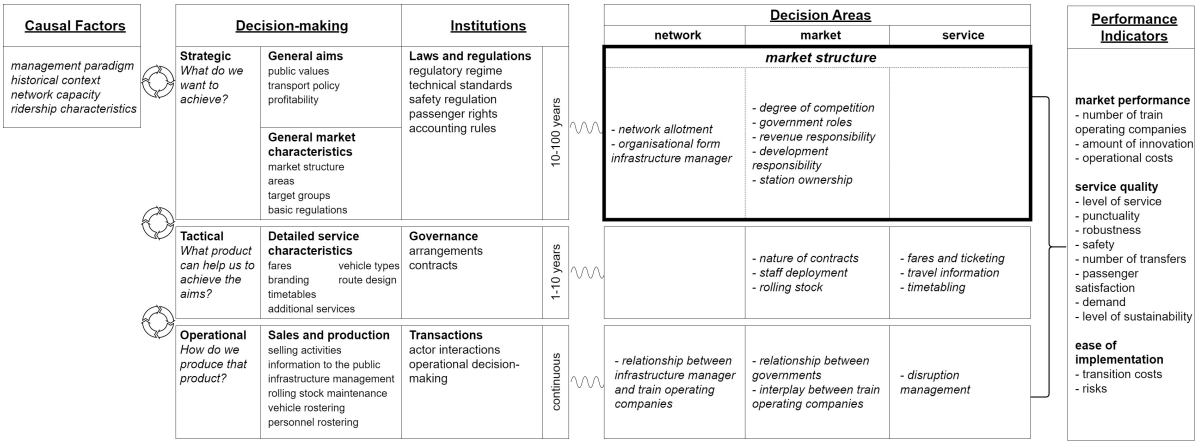


Figure 1: Theoretical framework

The research shows that the decisions for creating a market structure are highly dependent on the context of the market for which decisions are made. Therefore, the coordination of passenger rail markets is so complex that there are no one-size-fits-all solutions. The main contextual factors influencing decision-making are:

- The dominant management paradigm[2] in a jurisdiction; impacts how much influence governments wish to have over tactical decision-making (i.e. service design).
- The money flows in the market: how much governments contribute through subsidies and who owns stations and other assets.
- The ridership characteristics of the market and the relationship between different modes.
- The existing infrastructure: network capacity and density, and layout in terms of logistical corridors and/or natural boundaries.
- The existing institutional framework; influences the level of transition costs incurred by market restructuring.

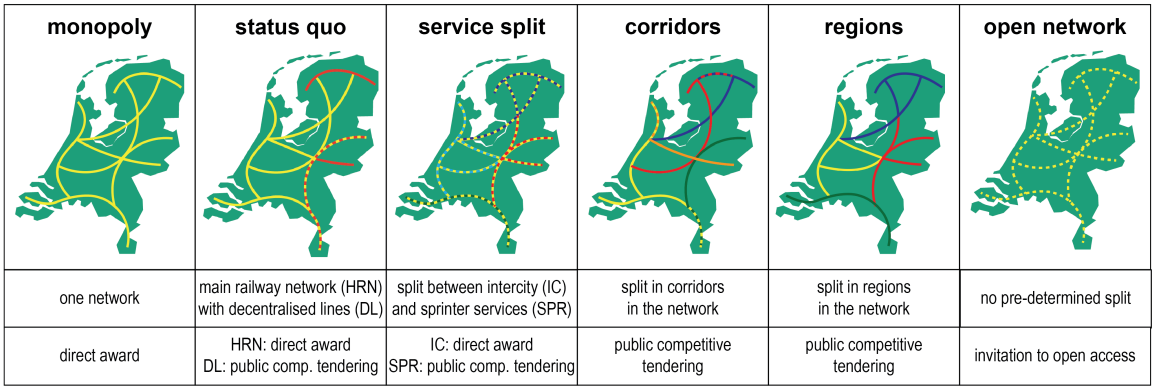
The Delphi method was used to analyse the complexity and relevance of the causal factors and topics from the theoretical framework, in addition to the literature review. An expert panel was formed from 13 (Dutch and international) stakeholders and experts from four different groups: academics, consultants, government officials and train operating companies. Input was collected during two rounds so that participants could give feedback on each other's comments.

The central debate in rail market restructuring focuses on two key strategic choices: the appropriate level of competition (direct award, public competitive tendering or open access) and the logistical division of the network (allotment). These two decisions together form the market structure framework, which can be used to create a conceptual market structure. To analyse the Dutch passenger rail market, a set of six possible market structure frameworks has been compiled that has guided the Delphi participants in the analysis of the Dutch market (see Figure 2). These frameworks combine an awarding mechanism[3] with a corresponding allotment type[4], after which the market structure can be completed by deciding on the remaining policy choices of the theoretical framework.

[2]A management paradigm is a foundational framework and set of principles guiding the government's approach to its roles in society.

[3]An awarding mechanism is the way a government grants train operating companies the right to operate a part of the network.

[4]The specific subdivision of the railway infrastructure for operational and management purposes. The allotment type may involve the division of the railway network into different segments based on factors such as geographical location or functional characteristics.



monopoly	status quo	service split	corridors	regions	open network
one network	main railway network (HRN) with decentralised lines (DL)	split between intercity (IC) and sprinter services (SPR)	split in corridors in the network	split in regions in the network	no pre-determined split
direct award	HRN: direct award DL: public comp. tendering	IC: direct award SPR: public comp. tendering	public competitive tendering	public competitive tendering	invitation to open access

Figure 2: Conceptual market structure frameworks for the Dutch passenger rail market

Relevance of Coordination Issues

The Delphi study revealed the relevance of each topic evaluated and supported the analysis of each topic. The topics considered most relevant by the panel are

- the role of governments in the coordination of the passenger rail market,
- coordination between parties to ensure adequate investment, timetabling and incident management, and
- transition and coordination costs.

First, the role of (different levels of) government is seen as one of the most relevant and important coordination issues. Governments need to allocate responsibilities appropriately between themselves and market actors to ensure the proper functioning of the passenger rail market. When allocating responsibilities, it is important to ensure that each party has sufficient knowledge and expertise to fulfil its responsibilities. In this way, government should adequately protect public values.

The second most relevant coordination issue is the coordination between market players to ensure appropriate levels of investment, passenger-oriented timetables and rapid incident management. The Delphi study shows that, even in a fully liberalised passenger rail market, there is a significant coordination challenge to address these issues. Government intervention is therefore seen as inevitable.

The third most relevant coordination issue relates to the level of transition and coordination costs that governments need to bear to create an appropriate market structure. They must therefore balance the benefits of competition with the increased transition and coordination costs. Managing players in a competitive market requires more coordination by the government, which increases transaction costs. In addition, large passenger rail markets need to be broken up into manageable pieces for train operating companies to compete for. This may require significant infrastructure investment to adapt the infrastructure to decentralised operations. Finally, governments are bound by existing legislation, which can also lead to high transition costs if changes are required.

Recommendations for the Dutch Passenger Rail Market

One of the objectives of this research was to provide arguments for different market structures for the Dutch passenger rail market. The extensive analysis of literature and input from experts and stakeholders in the Delphi study led to several recommendations for the Dutch market, regarding the degree of competition, type of subdivision and the bundling of expertise.

The main trade-off regarding the level of competition is between the benefits of more competition and the coordination and transition costs of that competition. EU rules do not allow governments to revert to direct award after introducing more competition, so the decision to increase competition is a one-way street and the benefits of competition should therefore be evident beforehand. It is also important to stress that the outcomes of the different possible market structures can never be predicted with complete certainty, so the recommendations are based on all available information and evidence.

The analysis found no conclusive evidence that the introduction of more competition in the Dutch market will or will not lead to greater cost efficiency or better quality of service. Studies on this topic are sometimes contradictory and emphasise that the effects of competition in one market cannot be extrapolated to the Dutch market. Furthermore, there have been significant improvements in the main rail network in the past without the introduction of competition. On the other hand, it has been found that the introduction of more competition leads to a sharp increase in coordination and transition costs. The consensus is that the main rail network is too large for a single (publicly tendered) concession, so it must be split up. This division inevitably leads to more transfers for passengers and a significant increase in coordination problems.

The clear disadvantages of introducing more competition and the uncertainty about the benefits lead to the conclusion that **the continuation of direct award to NS on the main rail network is the preferred way forward.** A key condition is that the current situation must be improved. The concessionaire (currently I&W[5]) needs to strengthen its position to ensure that public values are protected and that NS does not behave strategically by preventing open-access services and hindering integration with decentralised lines.

Nonetheless, this recommendation needs to be adapted to the European legal context. European legislation requires member states to introduce competition through open access and public competitive tendering in their passenger rail markets as far as possible. The freedom to deviate from this standard is vaguely described in EU Regulation 2016/2338, which requires case law for clarification. This uncertainty opens up the possibility that - regardless of what this analysis or Dutch policymakers conclude - more competition needs to be introduced in the Dutch passenger rail market. For this reason, **the path towards introducing more competition is added to this recommendation.**

The corridor framework is the preferred subdivision of the railway network if competition is to be introduced. The advantages of this framework are that it is suitable for gradual implementation (per corridor) and reduces logistical complexity in the network, which could increase reliability. Furthermore, it matches best the national travel pattern of all the decentralisation frameworks and preserves the feeder role of sprinter and intercity services. The main disadvantages of this framework are that it hampers integration between corridors, resulting in less smooth journeys for travellers (due to an increase in transfers) and that the balance of the market needs to be closely monitored, as operators may behave strategically by hindering transfers and exploiting economies of scale when operating several corridors at the same time.

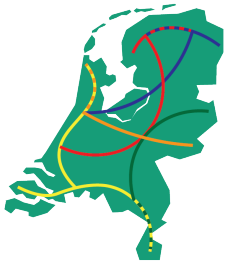
A key issue identified in the literature and by the Delphi participants is the lack and fragmentation of expertise in the rail sector. There is currently a lot of expertise and knowledge in the consultancy and academic sector as well as in regional governments, but the Delphi participants recommend that this should be institutionalised.

A key recommendation - regardless of the framework chosen - is **for the Dutch government to establish a National Public Transport Agency** (NPTA), similar to the Eisenbahn-Bundesambt in Germany. This NPTA can be an independent body with a mandate from national and regional governments to manage the rail passenger (or even public transport) market. It can carry out its role on the basis of transport policies developed by national and regional politicians, leaving strategic decisions to parliaments. The NPTA, together with the train operating companies, is responsible for tactical decision-making, i.e. the design of rail (or public transport) services and integrates the interests of all stakeholders, i.e. different levels of government, operators, infrastructure managers, passengers and residents.

The benefits of such an agency are that it clarifies the roles of market players and helps to maintain continuity and consistency in the public transport market. In addition, by bringing together experience and knowledge in one place, the NPTA can balance market forces to protect public values. In particular, it solves the problems of coordinating a large monopolist (such as NS). The majority of these problems stem from the fact that I&W lacks sufficient expertise and is therefore unable to evaluate NS initiatives adequately. However, the creation of such a body could involve significant transition costs and inevitably reduce the influence of politicians on tactical decisions.

[5] the Dutch ministry for Infrastructure and Public Waterworks

The following table provides a brief overview of the two recommended market structures, with references to the relevant chapters where these aspects are discussed in more detail.

ref.	Decision	Adjusted Status Quo	Corridors
			
7.3	degree of competition	HRN: direct award to NS. Decentralised lines: public competitive tendering. Remaining capacity: open access.	Open access on corridors if possible, otherwise public competitive tendering.
7.1	network allotment	No changes.	Division into corridors.
7.4	government roles	Governments are responsible for strategic decision-making, a national public transport agency for tactical decision-making.	idem
7.2	organisational form infrastructure manager	Deep alliances between ProRail and train operating companies.	idem
7.5	revenue and development responsibility	Revenue responsibility should lie primarily with the government, preferably through gross cost contracts. If more freedom is given to the train operating companies, they can also be responsible for a greater proportion of the revenue.	idem
7.6	station ownership	No change required.	Ownership must be transferred to an independent body to ensure fair access to stations for train operating companies.
7.7	nature of contracts	Flexible contracts are recommended, preferably as long as possible, e.g. a base period with the possibility of renewal every two years if KPIs[6] are met. For the status quo, the government must ensure that the possibility of competition on the HRN is credible.	Flexible contracts are recommended, preferably as long as possible, e.g. a base period with the possibility of renewal every two years if KPIs are met.
7.8	staff deployment	Few possibilities for improvement cost efficiency due to well-organised workforce.	More opportunities for innovation in the use of staff, as the bargaining position of staff is weaker due to fragmentation.
7.9	rolling stock	No change needed.	idem

[6]Key Performance Indicators

ref.	Decision	Adjusted Status Quo	Corridors
7.10	fares and ticketing	Further integration is not recommended.	Ticket integration in this model becomes more necessary as the number of operators increases and passengers are likely to encounter more different operators during their journey.
7.11	travel information	No change needed.	idem
7.12	timetabling and the interaction between operators	The government needs to improve its position to NS, possibly through a NPTA.	There are some coordination challenges, but these can be overcome by delegating tactical decision-making to the government or NPTA.
7.12	disruption management	The status quo has few interfaces between operators but is logistically complex. However, this can be mitigated through logistical unbundling.	The corridor model has many interfaces between train operating companies but is less logistically complex than the status quo. However, the number of interfaces cannot be reduced (significantly), which makes the problem insoluble.

Table 1: Proposed market structures for the Dutch passenger rail market

Recommendations for Policymakers

Two recommendations can be made to policymakers for the near future. First, a strategy should be formulated regarding the Dutch government's position on the European regulatory framework. It would be advisable to push for a clarification of the regulations on the passenger rail market, in particular, paragraph 4a of Regulation 2016/2338. If desired and necessary, the Dutch government can also try to change the regulations to allow direct award. However, it is not expected that an agreement can be reached on this point due to the different management paradigms between the Netherlands and the European institutions.

Second, the government should explore ways to introduce competition into the market, with the aim of complying with European legislation while acquiring more expertise and knowledge. An additional benefit of this strategy is that the government will be in a better position to coordinate the NS by making competition more likely. It is therefore recommended that a market analysis is carried out to determine which parts of the market could be opened up to competition and that a clear implementation strategy for the introduction of competition is formulated.

In conclusion, preparing for introducing competition in the Dutch passenger rail market will ensure a smooth transition when competition becomes mandatory, but will also increase the government's ability to coordinate the passenger rail market and protect public values.

Samenvatting

De Nederlandse markt voor personenvervoer per spoor[7] (PRM) staat onder druk door slechte punctualiteit en stijgende tarieven. Dit heeft geleid tot een debat over de regelgeving voor treindiensten. Het grotendeels monopolistische karakter van de markt wordt bediscussieerd door privat vervoerders en de Europese Commissie, aangezien Europese regelgeving de invoering van concurrentie waar mogelijk vereist. Desondanks is de Tweede Kamer van mening dat het Nederlandse netwerk nog steeds onderhands gegund kan en moet worden aan de Nederlandse Spoorwegen (NS) op grond van een uitzonderingsclausule in de Europese Verordening 2016/2338, die onderhandse gunning toestaat na bewijs van significante complexiteit van het systeem en garanties met betrekking tot kosteneffectiviteit en kwaliteit van de dienstverlening.

Dit onderzoek heeft tot doel inzicht te verschaffen in de systemische complexiteit van PRM's om bij te dragen aan het Europese debat over spoorwegregulering en om aanbevelingen te doen voor Nederlandse beleidsmakers. Als zodanig is het onderzoek opgezet om de belangrijkste onderzoeksvraag te beantwoorden:

> *Welke coördinatievraagstukken doen zich voor in mogelijke marktstructuren voor markten voor personenvervoer per spoor en wat is de invloed daarvan op de systeemprestaties van de Nederlandse markt voor personenvervoer per spoor?*

Er is besloten om veel informatie over PRM's te verzamelen door middel van een literatuurstudie en een Delphi-studie. Deze combinatie is een krachtig methode, omdat de informatie die via het literatuuronderzoek is verzameld, kan worden verfijnd via het gestructureerde groepscommunicatieproces van de Delphi-methode. Het eerste deel van dit onderzoek was gericht op het bieden van een gestructureerde manier om de PRM's en hun marktstructuur te analyseren. Daartoe werd een theoretisch kader ontwikkeld met een reeks causale factoren, beleidskwesties en prestatie-indicatoren. Het tweede deel van het onderzoek bestond uit een Delphi-studie om de meest prominente coördinatievraagtukken in PRM's te identificeren. Ten slotte werd op basis van de in de Delphi-studie verzamelde informatie en de literatuurstudie de Nederlandse PRM geanalyseerd om aanbevelingen te formuleren.

Marktstructuren voor Markten voor Personenvervoer per Spoor

De basis van deze studie is een theoretisch kader gebaseerd op het werk van van de Velde, 1999, Williamson, 2000 en Veeneman, 2021, zoals weergegeven in figuur 3. Het verdeelt de besluitvorming voor PRM's in drie niveaus, elk met zijn eigen instituties. Besluitvorming wordt beïnvloed door causale factoren zoals de historische context en leidt tot een bepaalde systeemprestatie, die kan worden gemeten door drie categorieën prestatie-indicatoren. Het strategische niveau van besluitvorming kan worden beschouwd als de marktstructuur van een PRM.

[7] De markt voor personenvervoer per spoor wordt in deze scriptie gedefinieerd als de markt voor "heavy rail" diensten, met uitzondering van light rail, metro, tram en andere spoordiensten.

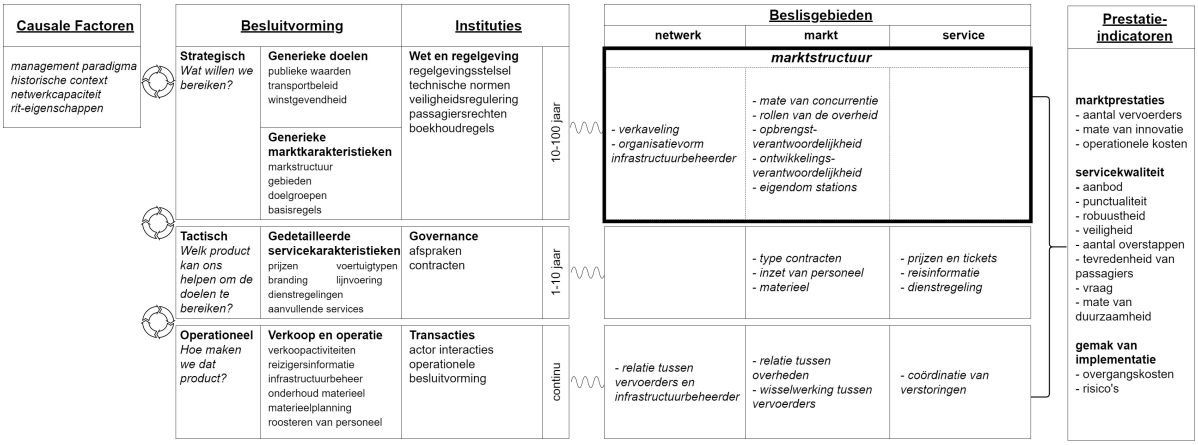


Figure 3: Theoretisch kader

Het onderzoek toont aan dat de beslissingen voor het creëren van een marktstructuur sterk afhankelijk zijn van de context van de markt waarvoor beslissingen worden genomen. De coördinatie van PRM's is zo complex omdat er geen pasklare oplossingen bestaan. De belangrijkste contextuele factoren die de besluitvorming beïnvloeden zijn:

- Het dominante managementparadigma[8] in een jurisdictie; beïnvloedt hoeveel invloed overheden willen hebben op tactische besluitvorming (bijv. dienstontwerp).
- De geldstromen in de markt: hoeveel overheden bijdragen door middel van subsidies en wie eigenaar is van stations en andere activa.
- De reispatronen van de markt en de relatie tussen verschillende modaliteiten.
- De bestaande infrastructuur: netwerkcapaciteit en -dichtheid, en lay-out in termen van logistieke corridors en/of natuurlijke grenzen.
- Het bestaande institutionele kader; van invloed op de hoogte van de overgangskosten die de herstructurering van de markt met zich meebrengt.

De Delphi-methode werd gebruikt om de complexiteit en relevantie van de causale factoren en onderwerpen uit het theoretisch kader te analyseren, in aanvulling op de literatuurstudie. Er werd een expertpanel gevormd van 13 (Nederlandse en internationale) stakeholders en experts uit vier verschillende groepen: academici, consultants, ambtenaren en vervoerders. De input werd verzameld tijdens twee rondes, zodat de deelnemers feedback konden geven op elkaars opmerkingen.

Het centrale debat in de herstructurering van de spoorwegmarkt concentreert zich op twee belangrijke strategische keuzes: het geschikte concurrentieniveau (onderhandse gunning, openbare aanbesteding of open toegang) en de logistieke verdeling van het netwerk (verkaveling). Deze twee beslissingen vormen samen het marktstructuurkader, dat kan worden gebruikt om een conceptuele marktstructuur te creëren. Om de Nederlandse PRM te analyseren is een set van zes mogelijke marktstructuurkaders samengesteld die de Delphi-deelnemers hebben begeleid bij de analyse van de Nederlandse markt (zie figuur 4). Deze kaders combineren een toewijzingsmechanisme[9] met een bijbehorend verkavelingstype[10], waarna de marktstructuur kan worden voltooid door te beslissen over de resterende beleidskeuzes van het theoretische kader.

[8] Een managementparadigma is een fundamenteel kader en een verzameling principes die richting geven aan de manier waarop de overheid haar rol in de samenleving benadert.

[9] Een toewijzingsmechanisme is de manier waarop een overheid aan spoorwegmaatschappijen het recht toekent om een deel van het netwerk te exploiteren.

[10] De specifieke onderverdeling van de spoorweginfrastructuur voor operationele en managementdoeleinden. Het verkavelingstype kan de opdeling van het spoorwegnet in verschillende segmenten inhouden op basis van factoren zoals geografische ligging of functionele kenmerken.

monopolie	status quo	service splitsing	corridors	regio's	open netwerk
					
één netwerk	hoofdrailnet (HRN) met gedecentraliseerde lijnen (DL)	splitsing van intercity- (IC) en sprinterdiensten (SPR)	splitsing in corridors van het netwerk	splitsing in regio's van het netwerk	geen vooraf bepaalde splitsing
onderhandse gunning	HRN: onderhandse gunning DL: aanbesteding	IC: onderhandse gunning SPR: aanbesteding	aanbesteding	aanbesteding	uitnodiging tot open toegang

Figure 4: Conceptuele marktstructuurkaders voor de Nederlandse markt voor personenvervoer per spoor

Relevantie van Coördinatievraagstukken

De Delphi-studie onthulde de relevantie van elk geëvalueerd onderwerp en ondersteunde de analyse van elk onderwerp. De onderwerpen die door het panel als het meest relevant werden beschouwd zijn

- de rol van overheden in de coördinatie van de PRM,
- de coördinatie tussen partijen om te zorgen voor adequate investeringen, dienstregelingen en incidentmanagement, en
- transitie- en coördinatiekosten.

Ten eerste wordt de rol van de (verschillende) overheidsniveaus gezien als een van de meest relevante en belangrijke coördinatievraagstuk. Overheden moeten verantwoordelijkheden op de juiste manier verdelen tussen henzelf en de marktpartijen om ervoor te zorgen dat de PRM goed functioneert. Bij het toewijzen van verantwoordelijkheden is het belangrijk om ervoor te zorgen dat elke partij voldoende kennis en expertise heeft om zijn verantwoordelijkheden te vervullen. Op deze manier moet de overheid de publieke waarden voldoende beschermen.

Het tweede meest relevante probleem is de coördinatie tussen marktspelers om te zorgen voor de juiste investeringsniveaus, passagiersgerichte dienstregelingen en snel incidentmanagement. De Delphi-studie toont aan dat zelfs in een volledig geliberaliseerde PRM de coördinatie van deze kwesties een grote uitdaging is. Overheidsingrijpen wordt daarom als onvermijdelijk gezien.

Het derde relevante coördinatievraagstuk heeft betrekking op het niveau van de transitie- en coördinatiekosten die overheden moeten dragen om een geschikte marktstructuur te creëren. Ze moeten daarom de voordelen van concurrentie afwegen tegen de hogere overgangs- en coördinatiekosten. Om spelers in een concurrerende markt te managen is meer coördinatie door de overheid nodig, waardoor de transactiekosten toenemen. Bovendien moeten grote PRM's worden opgesplitst in behapbare stukken waar spoorwegmaatschappijen om kunnen concurreren. Dit kan aanzienlijke investeringen in infrastructuur vergen om de infrastructuur aan te passen aan gedecentraliseerde diensten. Tot slot zijn overheden gebonden aan bestaande wetgeving, wat ook kan leiden tot hoge overgangskosten als er veranderingen nodig zijn.

Aanbevelingen voor de Nederlandse Markt voor Personenvervoer per Spoor

Een van de doelstellingen van dit onderzoek was om argumenten aan te dragen voor verschillende marktstructuren voor de Nederlandse passagiersvervoersmarkt. De uitgebreide literatuuranalyse en input van experts en belanghebbenden in de Delphi-studie hebben geleid tot verschillende aanbevelingen voor de Nederlandse markt, met betrekking tot de mate van concurrentie, het type onderverdeling en de bundeling van expertise.

De belangrijkste afweging met betrekking tot de mate van concurrentie is die tussen de voordelen van meer concurrentie en de coördinatie- en transitiekosten van die concurrentie. De EU-regels staan overheden niet toe om terug te keren naar onderhandse gunning na het invoeren van meer concurrentie, dus

de beslissing om meer concurrentie in te voeren is eenrichtingsdeur en de voordelen van concurrentie moeten dus op voorhand duidelijk zijn. Het is ook belangrijk om te benadrukken dat de uitkomsten van de verschillende mogelijke marktstructuren nooit met volledige zekerheid kunnen worden voorspeld, dus de aanbevelingen zijn gebaseerd op alle beschikbare informatie en bewijzen.

In de analyse is geen overtuigend bewijs gevonden dat de introductie van meer concurrentie op de Nederlandse markt al dan niet zal leiden tot een grotere kostenefficiëntie of een betere kwaliteit van de dienstverlening. Studies over dit onderwerp zijn soms tegenstrijdig en benadrukken dat de effecten van concurrentie in één markt niet geëxtrapoleerd kunnen worden naar de Nederlandse markt. Bovendien is het hoofdrailnet in het verleden aanzienlijk verbeterd zonder de invoering van concurrentie. Aan de andere kant is gebleken dat de introductie van meer concurrentie leidt tot een sterke toename van coördinatie- en transitiekosten. De consensus is dat het hoofdrailnet te groot is voor één (openbaar aanbesteed) concessie, dus moet het worden opgesplitst. Deze opsplitsing leidt onvermijdelijk tot meer overstappen voor reizigers en een aanzienlijke toename van coördinatievraagstukken.

De duidelijke nadelen van het invoeren van meer concurrentie en de onzekerheid over de voordelen leiden tot de conclusie dat **voortzetting van onderhandse gunning aan NS op het hoofdrailnet de voorkeur heeft.** Een belangrijke voorwaarde is dat de huidige situatie wordt verbeterd. De concessiehouder (momenteel het ministerie van Infrastructuur en Waterstaat) moet zijn positie versterken om ervoor te zorgen dat publieke waarden worden beschermd en dat NS zich niet strategisch gedraagt door open toegang diensten te verhinderen en integratie met decentrale lijnen te belemmeren.

Desalniettemin moet deze aanbeveling worden aangepast aan de Europese juridische context. Europese wetgeving verplicht lidstaten om zoveel mogelijk concurrentie in te voeren door middel van open toegang en openbare aanbesteding op hun PRM's. De vrijheid om af te wijken van deze norm is vaag beschreven in EU Verordening 2016/2338, waardoor jurisprudentie nodig is voor verduidelijking. Deze onzekerheid opent de mogelijkheid dat - ongeacht wat deze analyse of Nederlandse beleidsmakers concluderen - er meer concurrentie moet komen op de Nederlandse markt. Om deze reden **is de weg naar meer concurrentie toegevoegd aan deze aanbeveling**.

Een opsplitsing van het netwerk in corridors heeft de voorkeur wanneer concurrentie wordt ingevoerd. De voordelen van dit kader zijn dat het geschikt is voor geleidelijke invoering (per corridor) en de logistieke complexiteit in het netwerk vermindert, wat de betrouwbaarheid zou kunnen vergroten. Bovendien sluit het van alle verkavelingsopties (voor decentralisatie) het beste aan bij het nationale reispatroon en blijft de relatie tussen sprinter- en intercitydiensten behouden. De belangrijkste nadelen van dit kader zijn dat het de integratie tussen corridors belemmert, wat leidt tot minder soepele reizen voor reizigers (door een toename van het aantal overstappen) en dat het evenwicht op de markt nauwlettend in de gaten moet worden gehouden, omdat exploitanten zich strategisch kunnen gedragen door overstappen te belemmeren en schaalvoordelen te benutten wanneer ze meerdere corridors tegelijk exploiteren.

Een belangrijk punt uit de literatuur en van de Delphi-deelnemers is het gebrek aan en de versnippering van expertise in de spoorwegsector. Er is momenteel veel expertise en kennis in de consultancy- en academische sector en bij regionale overheden, maar de Delphi-deelnemers bevelen aan om dit te institutionaliseren.

Een belangrijke aanbeveling - ongeacht het gekozen kader - is dat **de Nederlandse overheid een Nationale Openbaar Vervoer Autoriteit (NOVA) opricht**, vergelijkbaar met het Eisenbahn-Bundesambt in Duitsland. Deze NOVA kan een onafhankelijk orgaan zijn met een mandaat van nationale en regionale overheden om de markt voor treindiensten (of zelfs al het openbaar vervoer) te beheren. Het kan zijn rol vervullen op basis van vervoersbeleid dat is ontwikkeld door nationale en regionale politici, waarbij strategische beslissingen worden overgelaten aan de parlementen. De NOVA is samen met de spoorwegmaatschappijen verantwoordelijk voor de tactische besluitvorming, d.w.z. het ontwerp van spoor- (of openbaarvervoers)diensten. Het kan de belangen van alle belanghebbenden meenemen, d.w.z. verschillende overheidsniveaus, vervoerders, infrastructuurbeheerders, passagiers en omwonenden.

De voordelen van een dergelijke autoriteit zijn dat het de rollen van marktspelers verduidelijkt en helpt om continuïteit en consistentie in de openbaarvervoermarkt te behouden. Daarnaast kan de NOVA,

door ervaring en kennis op één plek samen te brengen, de marktkrachten in balans brengen om publieke waarden te beschermen. Het lost met name de problemen op van het coördineren van een grote monopolist (zoals NS). Deze problemen betreffen met name het gebrek aan inhoudelijke expertise bij I&W waardoor het initiatieven van NS niet adequaat kan evalueren. De oprichting van een dergelijke autoriteit kan echter aanzienlijke overgangskosten met zich meebrengen en onvermijdelijk de invloed van politici op tactische beslissingen verminderen.

De volgende tabel geeft een kort overzicht van de twee aanbevolen marktstructuren, met verwijzingen naar de relevante hoofdstukken waar deze aspecten meer in detail worden besproken.

ref.	Onderwerp	Aangepaste Status Quo	Corridors
			
7.3	mate van concurrentie	HRN: onderhandse gunning aan NS. Decentrale lijnen: openbare aanbesteding. Overige capaciteit: open toegang.	Open toegang op corridors indien mogelijk, anders openbare aanbesteding.
7.1	verkaveling	Geen veranderingen.	Verdeling in corridors.
7.4	overheids-rollen	Regeringen zijn verantwoordelijk voor de strategische besluitvorming, een NOVA voor de tactische besluitvorming.	idem
7.2	organisatie-vorm infrastructuurbeheerder	Allianties tussen ProRail en spoorwegmaatschappijen.	idem
7.5	opbrengst- en ontwikkelverantwoordelijkheid	De verantwoordelijkheid voor de inkomsten moet primair bij de overheid liggen, bij voorkeur via bruto kostencontracten. Als er meer vrijheid wordt gegeven aan de spoorwegmaatschappijen, kunnen zij ook verantwoordelijk zijn voor een groter deel van de inkomsten.	idem
7.6	stations-eigendom	Geen verandering nodig.	Het eigendom moet worden overgedragen aan een onafhankelijke instantie om eerlijke toegang tot stations te garanderen voor spoorwegmaatschappijen.

ref.	Onderwerp	Aangepaste Status Quo	Corridors
7.7	type contracten	Flexibele contracten worden aanbevolen, bij voorkeur zo lang mogelijk, bijvoorbeeld een basisperiode met de mogelijkheid van verlenging om de twee jaar als aan de KPI's[11] wordt voldaan. Voor de status quo moet de overheid ervoor zorgen dat de mogelijkheid van concurrentie op het HRN geloofwaardig is.	Flexibele contracten worden aanbevolen, bij voorkeur zo lang mogelijk, bijvoorbeeld een basisperiode met de mogelijkheid van verlenging om de twee jaar als aan de KPI's wordt voldaan.
7.8	inzet van personeel	Weinig mogelijkheden voor verbetering kostenefficiëntie door goed georganiseerd personeel.	Meer mogelijkheden voor innovatie in het gebruik van personeel, aangezien de onderhandelingspositie van het personeel zwakker is door de fragmentatie.
7.9	materieel	Geen verandering nodig.	idem
7.10	prijzen en ticketing	Meer integratie is afgeraden.	Ticketintegratie in dit model wordt noodzakelijker naarmate het aantal vervoerders toeneemt en passagiers tijdens hun reis waarschijnlijk meer verschillende vervoerders zullen tegenkomen.
7.11	reisinformatie	Geen verandering nodig.	idem
7.12	dienstregelingen en de interactie tussen vervoerders	De overheid moet haar positie ten opzichte van NS verbeteren, mogelijk via een NOVA.	Er zijn enkele uitdagingen op het gebied van coördinatie, maar deze kunnen worden overwonnen door tactische besluitvorming te delegeren aan de overheid of een NOVA.
7.12	storingsbeheer	De status quo heeft weinig interfaces tussen operatoren, maar is logistiek complex. Dit kan echter worden verminderd door logistieke ontvlechting.	Het corridormodel heeft veel interfaces tussen spoorwegmaatschappijen, maar is logistiek gezien minder complex dan de status quo. Het aantal interfaces kan echter niet (aanzienlijk) worden verminderd, wat het probleem onoplosbaar maakt.

Table 2: Voorgestelde marktstructuren voor de Nederlandse markt voor personenvervoer per spoor

Aanbevelingen voor Beleidsmakers

Er kunnen twee aanbevelingen worden gedaan aan beleidsmakers voor de nabije toekomst. Ten eerste moet er een strategie worden geformuleerd ten aanzien van de positie van de Nederlandse overheid ten opzichte van de Europese regelgeving. Het wordt geadviseerd om aan te dringen op een verduidelijking van de regelgeving voor PRM's, in het bijzonder paragraaf 4a van Verordening 2016/2338. Indien gewenst en noodzakelijk kan de Nederlandse overheid ook proberen de regelgeving aan te passen om onderhandse gunning mogelijk te maken. Het is echter niet te verwachten dat hierover overeenstemming kan worden bereikt vanwege de verschillende managementparadigma's tussen Nederland en de Europese instellingen.

Ten tweede zou de overheid manieren moeten onderzoeken om concurrentie in de markt te introduceren, met als doel te voldoen aan de Europese wetgeving en tegelijkertijd meer expertise en kennis te verwerven. Een bijkomend voordeel van deze strategie is dat de overheid beter in staat zal zijn om

[11] Key Performance Indicators

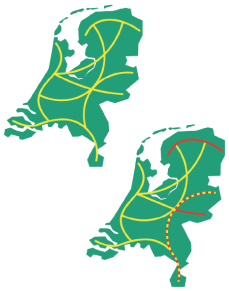
de NS te coördineren door concurrentie waarschijnlijker te maken. Het is daarom aan te bevelen een marktanalyse uit te voeren om te bepalen welke delen van de markt voor concurrentie kunnen worden opengesteld en een duidelijke implementatiestrategie voor de invoering van concurrentie te formuleren.

Concluderend kan worden gesteld dat voorbereiding op de invoering van concurrentie op de Nederlandse markt voor personenvervoer per spoor zorgt voor een soepele overgang op het moment dat concurrentie verplicht wordt, maar ook het vermogen van de overheid vergroot om de markt te coördineren en publieke waarden te beschermen.

Fact Sheet Competition

Direct Award

Monopoly or Status Quo



- ⊖ possibly not allowed under EU Regulations
- ⊖ possibly lacking proper incentives for quality improvement
- ⊖ requires strong government position towards NS
- ⊖ possibly unfair competition on decentralised lines

- ⊕ NS can provide an integral train product to passengers on a national level
- ⊕ governments cannot return to direct award after introducing public competitive tendering
- ⊕ a national public transport agency can resolve the majority of disadvantages
- ⊕ negotiated contracts can deliver good value for money

Public Competitive Tendering

- ⊕ complies with EU Regulations

- ? no conclusive evidence for improved cost-efficiency
  - ⊕ private operators are assumed to be better at adapting to market needs
  - ⊕ private operators are assumed to have lower overhead costs
  - ⊕ private operators are assumed to be better in managing resources
  - ⊖ private operators are bound by the transfer of staff and rolling stock
  - ⊖ the increased size of private operators could remove benefits
  - ⊖ there is a posibility of capital destruction by switching to tendering

- ? no evidence for higher frequency
- ? no evidence for more innovation
- ? no evidence for higher ridership growth
- ? dominance of state-owned operators prevents private entry

HRN too complex for tendering so requires decentralisation

- ⊖ decentralisation increases need for government coordination
- ⊖ decentralisation leads to more transfers for passengers
- ⊖ the government lacks expertise for large-scale tendering

Decentralisation

Service split
- ⊕ more regional integration possible
- ⊕ more transparent funding streams

- ⊖ all intercity services too large to tender as one
- ⊖ the synergy between sprinter and intercity lost, leads to misaligned transfers for passengers

Corridors
- ⊕ no significant infrastructure changes
- ⊕ corridors are the right size for tendering
- ⊕ gradual implementation possible
- ⊕ more regional integration possible
- ⊕ simpler and more robust logistical network

- ⊖ integration between corridors lost leads to more transfers for passengers

Regions
- ⊕ more regional integration possible
- ⊕ regions are the right size for tendering

- ⊖ integration between regions lost leads to more transfers for passengers
- ⊖ significant infrastructure investment necessary

Open Access

Open network

- ⊕ complies with EU Regulations
- ⊕ lower fares due to increased freedom in service development
- ⊕ can possibly increase the size of the passenger rail market

- ? no evidence of improved cost efficiency

- ⊖ suboptimal use of infrastructure capacity
- ⊖ only niche services have emerged in the past
- ⊖ no protection of public values because the supply of train services can change rapidly
- ⊖ there is no experience with open access on a large scale

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Nomenclature

Abbreviations

Abbreviation	Definition
ACM	Autoriteit Consument en Markt (*Authority for Consumers and Markets* (previously Nederlandse Mededingingsautoriteit (NMa))
avg.	average
BTM	bus, tram, and metro services
DL	decentralised lines
ERTMS	European Rail Traffic Management System
HRN	hoofdrailnet (*main railway network*) See: Figure 5
HSL-Zuid	high-speed railway line from Amsterdam to Belgium
I&W	Ministerie van Infrastructuur van Waterstaat (*Ministry of Infrastructure and Public Waterworks* (previously Ministerie van Verkeer en Waterstaat, Ministerie van Infrastructuur en Milieu))
IC	intercity service
ILT	Inspectie Leefomgeving en Transport (*Human Environment and Transport Inspectorate* (previously Inspectie Verkeer en Waterstaat (IVW))
IM	infrastructure manager
NPM	New Public Management
NPTA	national public transport agency
NS	Nederlandse Spoorwegen (*Dutch Railways*)
OMS	one-man service
PCT	public competitive tendering
PRM	passenger rail market
PTA	public transport authority
PVM	Public Value Management
SCICO	single check-in/check-out
SD	standard deviation
SPR	sprinter service
TAC	track access charge
TOC	train operating company
WP2000	Wet Personenvervoer 2000 (*Public Transport Act*)

Definitions

term	Definition
Allotment type	The specific subdivision of the railway infrastructure for operational and management purposes. The allotment type may involve the division of the railway network into different segments based on factors such as geographical location or functional characteristics.
Awarding mechanism	An awarding mechanism is the way a government grants train operating companies the right to operate a part of the network.
Concession	A concession grants a train operating company government permission to offer public transport for specific routes or areas. The concession remains valid for a specified period (Business.gov.nl, 2023).

term	Definition
Concessionaire	A concessionaire is a (semi-)government body that grants concessions to public transport operators.
Concurrence	Concurrence is the situation in which two or more TOCs have the right to offer rail transport services between the same stations located on the rail network (Baanders et al., 2011).
Coordination issue	A situation where different elements or components within a system or process need to align and work together cohesively but face challenges in doing so. Coordination problems often result from difficulties in synchronising activities, sharing information or managing dependencies between different parts of a system. They can lead to inefficiencies, delays or even failure to achieve desired outcomes. Solving coordination issues requires strategies to improve communication, streamline workflows, establish clear responsibilities and ensure that all components are aligned towards a common goal.
Development responsibility	Development responsibility typically refers to the responsibility of stakeholders to plan and implement the development of railway services and systems, such as changes to lines, timetables, vehicle types or fares (Decisio et al., 2020).
Direct award	Direct award is an awarding mechanism whereby the government grants a train operating company the right to provide train services on a section of track for a specified period without the possibility of competition. The conditions are set out in the contract agreed between the government and the train operating company.
Governance	Governance refers to the set of instruments used by the coordinator, typically the government, to manage the market. These tools can include hierarchical rules and regulations, as well as collaborative and network-based governance structures.
Institution	Institutions are the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights) (North, 1991)
Intercity service	Dutch name for an express service between large stations. Used in this thesis as a general term for long-distance trains.
Management paradigm	A management paradigm is a foundational framework and set of principles guiding the government's approach to its roles in society.
Market failure	Market failure refers to a situation where a market, in the absence of intervention, fails to allocate resources efficiently. Where market failures exist, there is a potential role for government to intervene to improve outcomes for the community, the environment, businesses and the economy (NSW Department of Industry, 2017).
Market structure	The market structure of a passenger rail market encompasses all strategic decisions, such as the degree of competition and the division of roles between market players.
Market structure framework	The combination of an allotment type and awarding mechanism(s).
Natural monopoly	A natural monopoly is an industry in which multi-firm production is more costly than production by a monopoly (Baumol, 1977). Examples include industries with large economies of scale like water services, electricity and telecommunications.

term	Definition
Open access	Open access is an awarding mechanism in which the government takes no initiative in shaping the service characteristics. Train operating companies can apply for capacity on the network for self-proposed train services. Approval is required from the infrastructure manager and the market regulator, after verification of vehicle safety and minimum requirements.
Passenger Rail Market	The passenger rail market is defined in this thesis as the market for heavy rail services, excluding light rail, metro, tram and other rail-based services.
Public Competitive Tendering	Public competitive tendering is a contract under which the government grants a train operating company the right to provide train services on a section of track for a specified period, following a tendering procedure. The government may set minimum standards and/or service requirements and grant rights to the train operating company with the most favourable offer.
Public transport authority	A public transport authority is a government body responsible for public transport within its jurisdiction.
Rail sector	The rail sector in this thesis is considered to be all stakeholders involved in the design of rail services, such as governments, TOCs, IMs, and academics and consultants.
Regulatory regime	The regulatory regime is considered to be the totality of laws and regulations applicable in this context.
Revenue responsibility	Revenue responsibility in the context of public transport refers to the obligation or responsibility of an entity to generate revenue to cover operating costs and potentially generate surplus funds.
Sprinter service	Dutch name for a local train that stops at every station. Used in this thesis as a general term for short-distance trains.
Survey fatigue	Survey fatigue refers to the phenomenon whereby individuals become disinterested, fatigued or overwhelmed by the process of responding to surveys. This can happen, for example, when a survey is (too) long, leading to a decline in the quality of responses or a decrease in the willingness of individuals to participate in future surveys.
Transaction cost	In PRMs, transaction costs refer to various expenses and barriers that market participants face in their operations. These costs include, for example, charges for access to infrastructure, compliance with regulations, and costs associated with contracting and negotiation.
Vertical integration	Vertical integration in the railway context means that both infrastructure and services are managed by a single company.

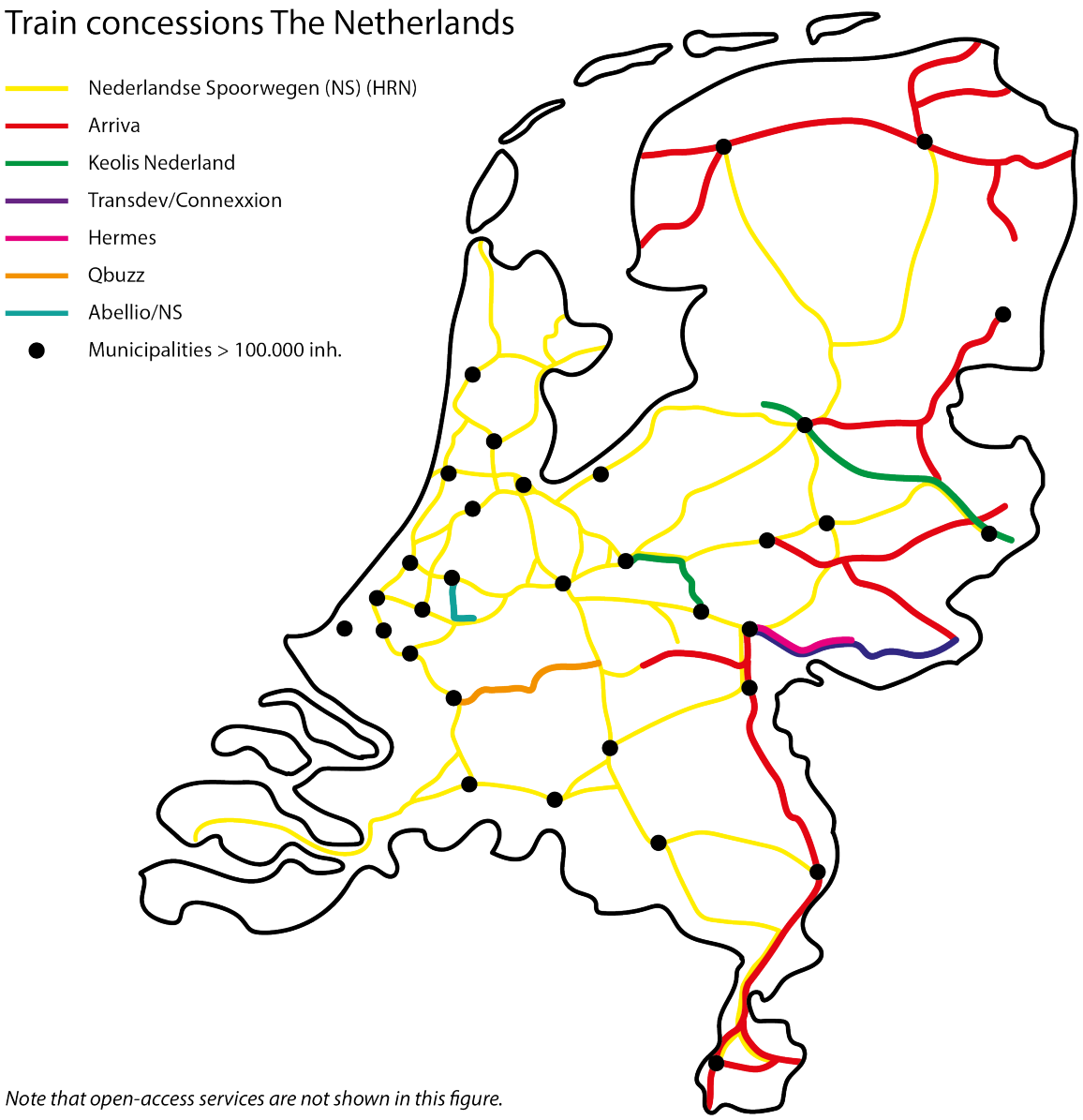


Figure 5: Allotment of the Dutch railway network (based on CROW-KpVV, 2024)

1

Introduction

The design and coordination of passenger rail services is a complex undertaking, involving challenges related to technology, funding and stakeholder participation (UN-Habitat, 2013). Although designing rail services is already an intensive process, coordinating the passenger rail market[1] (PRM) is perhaps the most challenging aspect. This view is supported by Stough and Rietveld, 1997, Marsden and Reardon, 2017 and Hirschhorn and Veeneman, 2021. The Dutch government is at a crossroads regarding rail market coordination; the monopolistic nature of the Dutch PRM is causing debate in society and conflicts with European legislation (RTL Nieuws, 2023). This issue is not only relevant for the Dutch PRM but also for other European states with problems in their respective PRM, such as Germany (Partridge, 2023). Furthermore, the use of direct award[2][3] is still widespread among European states, especially among the leading European railway nations (such as Austria and France) (Högelsberger, 2022). This thesis will delve into this topic to provide means to inform the political debate on the restructuring of PRMs by examining the systemic complexity of PRM coordination and evaluating it for the Dutch case.

The Dutch PRM is currently divided into three parts: the main railway network (HRN), some decentralised lines and open-access services[4]. The HRN has been awarded directly to Nederlandse Spoorwegen (NS) by the Dutch Ministry of Infrastructure and Public Waterworks (I&W) for the period 2025-2033, with no changes to the lines included in the concession[5], except for the removal of a large part of the international services (which will be transferred to the open-access market). Decentralised lines are subject to public competitive tendering[6] (PCT) by the provinces, often together with the bus services in the region (see Figure 5 for an overview of all passenger rail concessions). Train operating companies (TOCs) are also free to apply for capacity on the network to provide services outside the established concessions (i.e. open-access services). This has led to the emergence of international open-access services and some niche services operated by private TOCs.

It is important to note that the decision for direct award to NS was not taken without a fight. Although a majority of the parliament voted in favour of direct award, private TOCs took the Dutch government to court to challenge the decision (Redactie Trouw, 2023), and the European Commission launched an infringement procedure because of the likely circumvention of and non-compliance with EU Reg-

[1] The passenger rail market is defined in this thesis as the market for heavy rail services, excluding light rail, metro, tram and other rail-based services.

[2] Direct award is an awarding mechanism whereby the government grants a train operating company the right to provide train services on a section of track for a specified period without the possibility of competition. The conditions are set out in the contract agreed between the government and the train operating company.

[3] An awarding mechanism is the way a government grants train operating companies the right to operate a part of the network.

[4] Open access is an awarding mechanism in which the government takes no initiative in shaping the service characteristics. Train operating companies can apply for capacity on the network for self-proposed train services. Approval is required from the infrastructure manager and the market regulator, after verification of vehicle safety and minimum requirements.

[5] A concession grants a train operating company government permission to offer public transport for specific routes or areas. The concession remains valid for a specified period (Business.gov.nl, 2023).

[6] Public competitive tendering is a contract under which the government grants a train operating company the right to provide train services on a section of track for a specified period, following a tendering procedure. The government may set minimum standards and/or service requirements and grant rights to the train operating company with the most favourable offer.

ulation 1370/2007 (Railway Gazette International, 2023), which introduces open access and PCT as primary awarding mechanisms (European Parliament & Council of the European Union, 2007). Furthermore, the current practice of direct award is challenged by Regulation 2016/2338, which amends the aforementioned EU regulation (European Parliament & Council of the European Union, 2016). This recent amendment requires member states to demonstrate the opportunities for quality improvement or efficiency gains during the concession period when opting for a direct award, as well as a good underpinning of the system complexity of the PRM. As the exact interpretation of this EU regulation is still to be clarified by the European Court of Justice, this study aims to contribute to the understanding of this complexity by providing an overview of possible market structures[7] and their coordination issues for PRMs and by examining them for the Dutch market.

A coordination issue can be considered as

> a situation where different elements or components within a system or process need to align and work together cohesively but face challenges in doing so. Coordination issues often result from difficulties in synchronising activities, sharing information or managing dependencies between different parts of a system. They can lead to inefficiencies, delays or even failure to achieve desired outcomes. Solving coordination issues requires strategies to improve communication, streamline workflows, establish clear responsibilities and ensure that all components are aligned towards a common goal.
>
> Efforts to address coordination issues in PRMs aim to improve the overall efficiency, safety, and reliability of train operations while minimising disruptions and delays. Coordination is essential to ensure the seamless and integrated functioning of the various components of the railway system.

To properly address the issue and provide a framework for the study, a research question is formulated based on the knowledge gaps in the existing literature.

1.1. Knowledge Gaps and Research Goals

A preliminary review of the literature on PRMs was carried out to determine the scope and content of the existing literature on the subject. There has been a focus on the coordination of PRMs in recent years, mainly by Dutch researchers. The literature sources discuss railway coordination based on

- the Dutch market structure (van de Velde, 2011, 2019a, 2019b; van Damme, 2019; Veeneman, 2019b, 2021; Veraart, 2012),
- decentralisation (Veeneman, 2010),
- case studies and evaluations (Decisio et al., 2020; den Hollander & Baggen, 2012; Hoekstra, 2008; van de Velde, 2019a; Veeneman et al., 2014), and
- international comparisons (van de Velde, 2019a; van de Velde et al., 2009).

Although some publications discuss potential scenarios for future market structures, they are limited to specific proposals (Decisio & TwynstraGudde, 2018; M. Janssen et al., 2011) or do not provide an exhaustive overview of the possibilities and their impact on all system characteristics (M. Janssen & van Wee, 2019; van den Berg & van der Vlist, 2017). Therefore, some gaps in current knowledge may need to be addressed.

The first knowledge gap concerns the exploration of a railway network structure to develop underpinned sub-networks for potential market structures and a better understanding of the (assumed) interconnectedness of the network. Some steps towards a more quantitative approach are taken by other authors, but this could be further enriched. Therefore, a preliminary effort was made to explore the possibilities of applying a quantitative approach in this work. However, the availability of data was not sufficient to continue this approach for this study, due to budget and privacy constraints, and will not be addressed in the research questions.

[7] The market structure of a passenger rail market encompasses all strategic decisions, such as the degree of competition and the division of roles between market players.

The second knowledge gap concerns the impact of particular market structures, both on the supply and demand sides of PRMs. In particular, a clear overview of what institutions[8] a government needs to create or adapt in each possible market structure could help further policy making.

This leads to the third and final knowledge gap identified; most of the publications analysed do not address the implementation of the proposed scenarios. Policymakers need information on how implementation challenges affect their options and decisions. An important question regarding implementation is whether a certain policy can be implemented in the near future and what the transition costs might be. Further evidence on this issue can therefore be valuable for policymakers.

The main objective of this research is therefore to provide a better understanding of the complexity of possible market structures for PRMs and to examine these structures for the Dutch PRM. To ensure the analyses and recommendations of this study are suitable for practical use, the research will be conducted in the light of the aspects to be considered for compliance with EC Regulation 2016/2338, i.e:

> *4a. Unless prohibited by national law, the competent authority may decide to award public service contracts for public passenger transport services by rail directly:*
> *(a) where it considers that the direct award is justified by the relevant structural and geographical characteristics of the market and network concerned, and in particular size, demand characteristics, network complexity, technical and geographical isolation and the services covered by the contract, and*
> *(b) where such a contract would result in an improvement in quality of services or cost-efficiency, or both, compared to the previously awarded public service contract.*

The knowledge gaps and the research objective lead to the research questions.

1.2. Research Questions

The main research question is stated as follows:

> *What coordination issues are present in possible market structures for passenger rail markets, and what is their impact on the system performance of the Dutch passenger rail market?*

To answer the main research question, five sub-questions are formulated:

1. What are the possible market structures for a passenger rail market?
2. What are the main coordination issues for each possible market structure?
3. How difficult is it to solve the coordination issues of each possible market structure?
4. What is the impact of possible market structures on the system performance of the Dutch passenger rail market?
5. What is the most appropriate market structure for the Dutch passenger rail market?

A structured approach is taken to answer the research questions. First, the rationale and details of the research methods are described (Chapter 2). The first sub-question aims to provide a structured way of analysing PRM market structures. Chapter 3 therefore provides a theoretical framework that includes a set of causal factors, policy issues and performance indicators. A Delphi study was then carried out to answer the second and third sub-questions and enhance the literature findings on sub-questions four and five. Chapter 4 presents the conceptualisation of the Delphi study, after which the results are analysed in Chapter 5. Sub-questions 4 and 5 are answered by evaluating the causal factors and choices for the Dutch PRM according to the theoretical framework, resulting in a detailed description in chapters 6 and 7. The last section of Chapter 7, section 7.13, provides an answer to the second and third sub-questions regarding the relevance of coordination issues. The thesis ends with Chapter 8, which contains the answers to the research questions and a discussion of the results of this study.

[8] Institutions are the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights) (North, 1991)

2

Research Methods

This chapter explains the research methods used to answer the research questions. The study aims to identify potential market structures for PRMs and to address the complexity within these structures. In addition, the study aims to provide recommendations for the Dutch PRM. The literature provides insight into the coordination issues in different market structures. However, it is difficult to determine the extent and impact of each coordination issue based on literature sources alone, both in a general sense and specifically for the Dutch case. Therefore, an appropriate research method is chosen.

This section begins with the rationale for the chosen research method, followed by a description of the research process.

2.1. Choosing the Research Method

Different strategies can be used to address different aspects of the research question. One possible approach is to use **quantitative methods** to examine the logistical complexity of a railway network. For example, a hierarchical clustering model can be used to assess the relationship between stations and lines using passenger flow data, as suggested by Cats et al., 2015. It is important to note that this is not the only method available and other approaches may be appropriate depending on the specific research question. This and related methods are not pursued in this study due to the unavailability of the necessary data. In addition, quantitative methods can only analyse logistical complexity and lack perspective on the complexity of coordination.

Another commonly used strategy is to use **empirical data** to evaluate different market structures and the coordination issues associated with them. While it is informative to assess the impact of specific models on system performance, it is difficult to draw general conclusions from these studies. The absence of one-size-fits-all solutions (van de Velde, 2019b) means that the performance of market structures is strongly influenced by contextual and situational characteristics. Therefore, an empirical study is not considered useful for this study.

Ultimately, expert judgment is used in a systematic way to answer the research questions. This data source is considered appropriate because experts can provide insight into conceptual scenarios, which is one of the aims of this study. In addition, the use of different perspectives within a group of experts can lead to a more nuanced conclusion. **The Delphi method** is chosen for this study and will be used to answer the research questions.

This method is used *"to organise and manage structured group communication processes with the aim of generating insights on either current or prospective challenges"* (Beiderbeck et al., 2021). Experts and stakeholders are asked to anonymously answer questions in a survey format. The aggregated group opinion is then fed back to the participants so that they can review and comment on each other's responses to reach a consensus or identify areas of disagreement on the issues under review.

This method is chosen because it can provide insights into systems and future scenarios in situations where information is limited, such as the coordination of PRMs. By incorporating the perspectives

of experts and stakeholders, it is possible to understand the complex nature of a PRM. In addition, the anonymity provided by the Delphi method allows participants to contribute without the potentially destructive group dynamics present in traditional workshop or interview settings (Beiderbeck et al., 2021). However, a major disadvantage of this method is that it is slower than face-to-face meetings and requires effort to ensure that participants complete subsequent surveys (Kosven, n.d.).

2.2. Research Process

Figure 2.1 gives an overview of the research process, highlighting the research steps and corresponding sub-questions. The study is divided into three phases: preparation, Delphi study and project conclusion, which will be presented in the following sections.

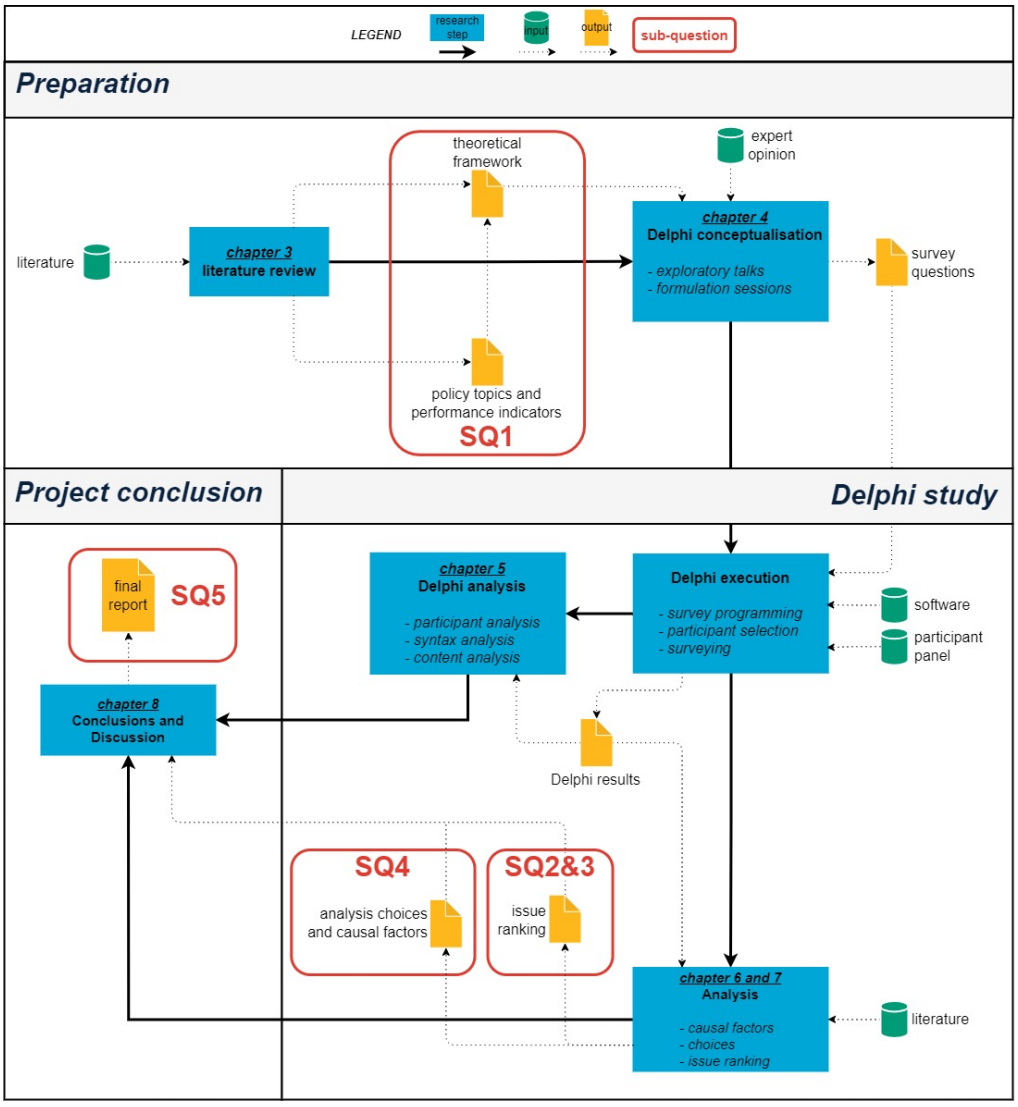


Figure 2.1: Research methods and process

2.2.1. Preparation

The first phase of this study aims to answer the first sub-question and prepare for the Delphi study. First, a comprehensive review of academic and non-academic literature will be conducted. This will result in a list of policy topics and performance indicators, and the development of a theoretical framework. The theoretical framework provides an answer to the first sub-question in Chapter 3, which outlines the characteristics of a market structure.

Secondly, based on the theoretical framework and exploratory interviews with experts, the questions of the Delphi study are conceptualised (Chapter 4). The list of policy topics and performance indicators is transformed into a list of coordination issues through two exploratory interviews with key stakeholders in the Dutch PRM, namely ProRail and I&W, and nine formulation sessions in different compositions (i.e. with only the researcher, thesis committee or experts outside the research team), with the author always present. The meetings aim to address both the substantive and formal aspects of the decisions and issues. To achieve this, external experts with diverse expertise in areas such as public transport tendering, mobility policy and surveys will be invited to participate. Following these meetings, a questionnaire will be prepared for the first Delphi round.

2.2.2. Delphi Study

The Delphi study will be carried out to complement the collected literature to answer the remaining sub-questions.

Due to the short duration of the project, a minimalist timeframe of 16 weeks is chosen. This is a reasonable duration given the recommendations of Beiderbeck et al., 2021. Also, the fact that there is no need for extensive quantitative analysis saves time for other research tasks. LimeSurvey is chosen as the software for this Delphi study as it is the only premium survey tool available to the researcher at no additional cost. This also leads to the decision to conduct the Delphi study in a *sequential* format with two rounds, as the researcher does not have software available for a *real-time* format and only 16 weeks are available for this study. The advantages of the *sequential* format are that it takes a short time to implement, is suitable for implementation with minimal experience, and gives the researcher control over the submission of the surveys. Limitations of this format are that latecomers cannot easily participate and the two-round format provides only one feedback loop (Beiderbeck et al., 2021). Consensus, as originally intended for the Delphi study, cannot be achieved in two rounds, but the feedback loop is still a powerful asset to this study. It is powerful in the sense that participants first share their views independently and then can respond to the views of others. This can provide interesting insights into the arguments presented.

The quality of the results is assessed through a participant panel, syntax and content analysis (Chapter 5). These analyses provide context for the results and support the discussion of them in Chapter 8. The results of the Delphi study are combined with the findings from the literature in a review of the content of the theoretical framework for the Dutch PRM. This makes it possible to answer sub-questions 2, 3 and 4 in Chapters 6 and 7.

2.2.3. Project Conclusion

The answers to sub-questions 2, 3 and 4, together with a formative analysis of the Delphi contributions, lead to the conclusions of this study and an answer to the last sub-question. These are discussed in the last chapter, Chapter 8. This chapter also discusses the limitations of this research and recommendations for further research.

The next chapter presents the first step of this study: the literature review to identify policy topics and performance indicators and the construction of a theoretical framework.

3

Research Topics

The first step in this research is to answer sub-question 1 by identifying possible market structures. Therefore, the components of market structures are identified as policy topics based on a comprehensive literature review of publications on PRMs. The policy topics are then integrated into a theoretical framework for describing the market structures for PRMs.

Section 3.1 discusses the sources found during the literature review. Following, section 3.2 presents a list of policy topics and performance indicators for PRM decision-making. Section 3.3 discusses the theoretical framework, in which the policy topics and performance indicators are integrated to describe market structures. The chapter concludes with an answer to sub-question 1.

3.1. Literature Review

Literature sources often discuss several aspects of a PRM, so the strategy for finding relevant topics for this study is to create a list of citations from publications that discuss aspects of PRMs. The citations are then grouped by topic to produce a list of topics and performance indicators discussed in the literature. Publications are included in the reference list if they mention some aspect of PRMs and their coordination. Inclusion could be based on a mention, description or discussion of an issue or question. This resulted in a list of policy topics and performance indicators that form the basis of a market structure.

The literature review is not limited to academic sources as the topics discussed in this research are very specific and there are a limited number of articles discussing them. In addition, consultancy reports often have a broader perspective than academic work, which can be an advantage for the comprehensive approach of this study. Finally, it is considered important to include a range of international sources and not to limit the study to Dutch language sources. This provides an international perspective on issues related to PRM coordination.

Two strategies are used to collect sources: search engines and snowballing (i.e. using the reference list to find related publications). Firstly, Scopus and Google Scholar are used as search engines. The list resulting from this initial search is extended by snowballing on this list. In addition to the two strategies mentioned above, a group of miscellaneous publications is added to the list as a result of verbal references and serendipitous findings. The search terms are listed in Appendix A.

Finally, a list of 602 citations was compiled from the 60 included sources. The sources were published between 2004 and 2021, and it is found that the technical, often Dutch, reports are larger (compared to the academic literature) and therefore contribute relatively more to the list of citations (see Appendix A: Figures A.1 and A.2).

3.2. Policy Topics and Performance Indicators

The list of citations compiled during the literature review results in a list of 28 potential topics and 12 performance indicators to be included in the study. The topics found in the literature are aggregated into a shortlist of 18 broad policy topics and 12 performance indicators, which are presented in Tables 3.2 and 3.2 respectively. Some policy topics are constructed from several potential topics in the literature; these are marked with an asterisk and can be found in Appendix A.

Table 3.1: Policy topics

policy topics
management paradigm
historical context
network capacity
ridership characteristics*
network allotment*
organisational form IM[a] and the relationship between IM and TOCs
degree of competition
government roles and the relationship between governments*
revenue responsibility
development responsibility
station ownership
nature of contracts
staff deployment
rolling stock
fares and ticketing*
travel information
timetabling
interplay between TOCs*

Table 3.2: Performance indicators

performance indicator
number of TOCs
amount of innovation
operational costs
transition costs
risks
punctuality
robustness
safety
passenger satisfaction
level of sustainability
level of supply
number of transfers

The policy topics can be used to describe PRMs and their market structures. It is necessary to clarify the relationships between the topics which leads to the creation of a theoretical framework for discussing market structures. This framework is presented in the next section.

3.3. Theoretical Framework

The theoretical framework aims to describe PRM market structures by clarifying the relationships between policy topics and performance indicators. Relevant work has already been done on the theoretical framework for public transport decision-making, on which the theoretical framework proposed in this study is based. The first subsection presents the levels of decision-making, based on the work of van de Velde, 1999. This framework is extended in the second subsection by incorporating the work of Williamson, 2000 and Veeneman, 2021 on causal factors and institutions. This section concludes with the final theoretical framework, which provides an overview of the decision areas for PRM policy-making, the causal factors in this process and performance indicators.

3.3.1. Levels of Decision-making

Public transport needs to be designed based on different levels of objectives which ultimately result in the level of service provided to passengers. To categorise objectives, van de Velde, 1999 introduced three levels of planning and control in public transport. These levels form the basis of the theoretical framework (see Figure 3.1).

Strategic level: Strategic planning deals with the formulation of general objectives and general market characteristics to achieve these objectives. In other words, what does the government want to achieve?

The general objectives consist of the public values to be captured, the transport policy formulated according to these public values and the level of profitability desired by the government. The general characteristics of the market are also determined at the strategic level; which market structure is chosen, how areas are designed and for which target groups, and which basic (e.g. safety) regulations apply to the market.

Tactical level: Tactical planning is about making choices about the acquisition of resources that can help achieve the overall objectives, and how to use those resources most efficiently. More specifically, what are the detailed characteristics of the service? This level concerns the design of train services; fares, vehicle types, branding, routes, timetables and ancillary services.

Operational level: Operational planning is concerned with how services are operated and that this is done efficiently. The operational level is therefore concerned with the actual ”selling of the product”. How are services made available to the public, how are infrastructure and rolling stock managed, and how are vehicles and staff dispatched?

The different levels of objectives are interrelated and not isolated. Objectives at the strategic level influence objectives at lower levels, but the formulation of objectives at lower levels can lead to changes at higher levels. This also applies to the causal factors and institutions for decision-making, as discussed in the next subsection.

3.3.2. Causal Factors and Institutions for Decision-making

The decision-making process is shaped by causal factors and institutions, and vice versa. Causal factors are the context that shapes the decision-making process, and institutions are the tools that governments have to implement their decisions. These levels are adapted from Williamson, 2000, who discusses the levels of governance[1] in an economic context, and Veeneman, 2021, who presents the levels in a more public administration context, building on the work of Koppenjan and Groenewegen, 2005.

Some of the **causal factors** are called *embeddedness* by Williamson, 2000. This is often associated with culture and the way culture influences decision-making. Veeneman, 2021 considers two important aspects of culture: the impact of culture on the management of conflicts of interest between government and TOC, and the balance between collective responsibility and individual profit maximisation. Culture therefore shapes the overall objectives of the decision-maker and the role it assumes in society: the management paradigm[2]. In addition to the management paradigm, three other factors are considered relevant to the causal factors in which decisions are made: historical context and path dependency in the form of network capacity and ridership characteristics. Historical context is relevant because it shapes people’s views on particular policy options. For example, bad experiences with a particular market structure may lead to negative attitudes towards that market structure. Network capacity and ridership characteristics are also relevant because they limit the ability of policymakers to switch to a different strategy than they started with.

The **institutions** are related to the three levels of decision-making. The strategic level concerns *laws and regulations*. The most important area of laws and regulations is the regulatory regime[3] for the PRM, which defines the relationship between the government and market players. Laws and regulations are formulated not only for market structure but also for safety, passenger rights, technical standards and accounting rules. In essence, laws and regulations set out the key characteristics of the market as defined by the government.

The tactical level considers *governance*, or as Williamson calls it, ”the play of the game”. Governance refers to the arrangements between government and market actors, and between market actors themselves. This may include, for example, the contract between the government and the TOC when a concession is granted, or the ”contract” between the passenger and the TOC when a passenger buys

[1] Governance refers to the set of instruments used by the coordinator, typically the government, to manage the market. These tools can include hierarchical rules and regulations, as well as collaborative and network-based governance structures.

[2] A management paradigm is a foundational framework and set of principles guiding the government’s approach to its roles in society.

[3] The regulatory regime is considered to be the totality of laws and regulations applicable in this context.

a ticket. In this way, the detailed characteristics of the service are defined by the agreements and contracts.

The third level comprises the *transactions* between market players. Veeneman, 2021 suggests looking at this level from two perspectives: institutions as a result of actor interactions and as a result of operational decisions. First, institutions can be the result of a decision-making process between market actors (e.g. the cancellation of a bus line or the purchase of new rolling stock). This process may be bound by specific rules on stakeholder involvement or required procedural steps. Secondly, institutions may be the result of operational decision-making. This refers to the many smaller and larger decisions made by individuals or entities in the market. These decisions result in the performance of the system, which is driven by the levels above.

The institutional context is broad and all levels of decision-making affect the whole system. Veeneman, 2021 also emphasised this in his paper, as most publications often focus on one particular level. Although this is easier to describe and understand, it is important to consider these levels in a broader context. Strategic decisions have a significant impact on the other levels, and day-to-day operations take place at a level where the performance of the system becomes apparent. The levels of decision-making are constantly influenced by each other, as well as by causal factors and institutions already in place or available to the government.

The next section presents the final framework of decision areas and performance indicators for PRM policymaking.

3.3.3. Decision Areas and System Performance

The previously collected policy topics and performance indicators are placed in the theoretical framework (see Figure 3.1, for a large figure, see Appendix B). The topics are grouped into a set of causal factors and three decision areas loosely based on the characteristics mentioned in EU regulation 2016/2338:

- network; considering size, network complexity, technical and geographical isolation and the way the infrastructure is managed,
- market; considering the structural and geographical characteristics of the market, and
- service; the design of train service characteristics and implementation.

First, choices about the *network* are crucial to the establishment of the market and train services. The existing infrastructure affects the way the network can be divided up (network allotment). The desired vertical separation between the IM and the TOC determines the organisational form of the IM. At the operational level, the nature of the relationship between the IM and the TOC is important.

The second decision area concerns the *market*. This area requires the most strategic choices, such as defining the role of (different levels of) government. These choices are closely linked to the degree of competition in a PRM and the associated allocation of station ownership, revenue responsibility[4] and development responsibility[5]. The market structure encompasses all these strategic choices regarding infrastructure and the market.

Tactical decisions on the market entail the allocation of the means of production, including the nature of contracts (e.g. duration and flexibility), the deployment of staff, and the ownership of rolling stock. Relationships between governments and between TOCs influence the operation of the market.

The third and final decision area concerns the train *service*. choices must be made on timetabling, fares and ticketing, and the dissemination of travel information to the public. These choices are part of the tactical level and form the main aspects of the detailed service characteristics.

[4] Revenue responsibility in the context of public transport refers to the obligation or responsibility of an entity to generate revenue to cover operating costs and potentially generate surplus funds.

[5] Development responsibility typically refers to the responsibility of stakeholders to plan and implement the development of railway services and systems, such as changes to lines, timetables, vehicle types or fares (Decisio et al., 2020).

The choices in each area ultimately determine the performance of the system. This can be measured using various indicators that can be grouped into three categories:

- *Market performance* refers to the economic dynamics of the PRM, including the number of TOCs in or entering the market, the level of innovation and investment by stakeholders, and the operating costs of all train services.
- *Service quality* can be assessed using a variety of indicators, which are often interrelated. These indicators relate to the provision of train services, including the level of service, punctuality, robustness, safety and the number of transfers required. In addition, passenger satisfaction and external factors such as sustainability are considered with their influence on demand.
- The *ease of implementation* comprises two indicators: the transition costs required to move to a new market structure (or to remain in the current structure) and the legal, financial and contractual risks associated with the market structure.

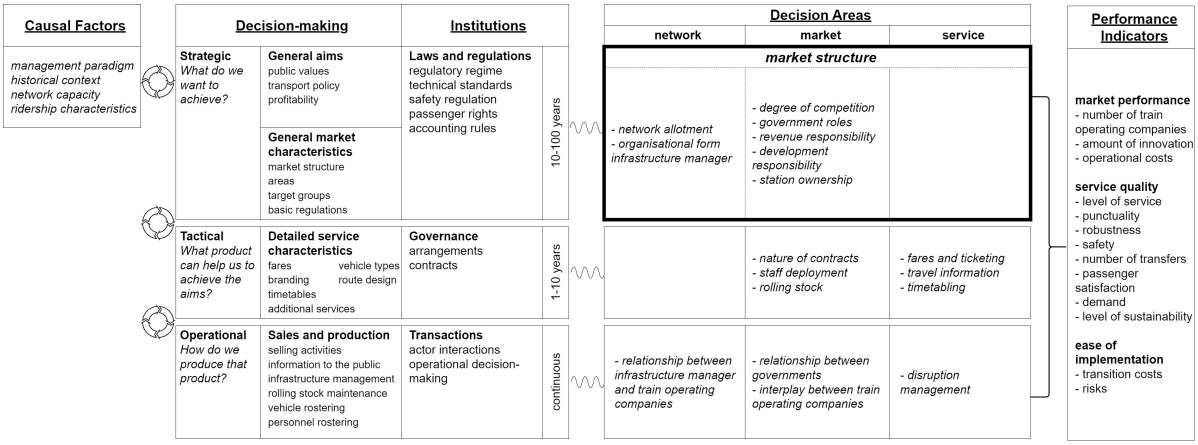


Figure 3.1: Theoretical framework

3.4. Conclusions

The first sub-question can be answered based on this chapter:

> What are the possible market structures for a passenger rail market?

The literature review identified a comprehensive list of policy topics relevant to PRM policy-making and therefore to the description of possible market structures. These can be grouped into several causal factors, three levels of decision making and three corresponding decision areas. In addition, the literature review found that the impact of policy choices on system performance can be measured by 12 performance indicators, grouped into three indicator categories.

The market structure of a PRM can be described by the strategic level of the theoretical framework. The following topics therefore make up the market structure of a passenger rail market:

- the network allotment
- the organisational form of the IM
- the degree of competition
- the allocation of government roles
- the allocation of revenue responsibility
- the allocation of development responsibility
- the allocation of station ownership

Now that we know how to describe market structures, the content of the Delphi study is conceptualised in the next chapter. It then presents the questions for the Delphi surveys.

4

Delphi Study Conceptualisation

This chapter outlines the preparation of the Delphi study, identifying coordination issues and formulating survey questions. The Delphi study has two main objectives: to identify and rank the coordination issues that exist in PRMs (sub-questions 2 and 3) and to analyse possible market structures for the Dutch PRM (sub-question 4).

To achieve this, a list of specific coordination issues will be drawn up based on the theoretical framework (see section 4.1), which can be ranked by the participants during the study. To guide the participants in their ranking of the coordination issues and their analysis of the Dutch PRM, a set of market structure frameworks will be introduced and described in section 4.2. The final section (section 4.3) presents the structure and final content of the Delphi survey.

4.1. Coordination Issues

The literature review produced a list of topics and performance indicators. Each topic relates to a choice and the potential outcomes as measured by the performance indicators. In the case of PRMs, policy topics often involve specific coordination issues. Therefore, based on the choices and performance indicators, the coordination issues of PRMs are identified.

After reviewing the literature, conducting two exploratory interviews with key stakeholders and holding nine formulation sessions, a set of 14 key coordination issues that exist in PRMs is identified. The list includes a coordination issue based on one of the following criteria:

- the answer to the question can only be given qualitatively and not quantitatively,
- there are multiple perspectives on the issue, or
- there is no conclusive answer in the included literature.

Table 4.1 presents the 14 coordination issues.

Table 4.1: Coordination issues of passenger rail markets

topic	coordination issue
organisational form of the IM and the relationship with TOCs	1. How complicated is it to achieve synergistic investments between IM and TOC(s), in the case of a certain market structure?
government roles and the relationship between governments	2. How much effort is needed to adapt the role of the national government in the event of a change in market structure, to ensure correct market and concession management? 3. How much effort is needed in the rail sector[1] to adapt the role of decentralised governments in the event of a change in market structure, to ensure correct market and concession management? 4. How complicated is the acquisition and retention of knowledge in the case of a certain market structure? 5. How much expertise is lacking in the rail sector for the proper functioning of the market, in the case of a certain market structure?
revenue responsibility	6. Which party should be responsible for revenue in the case of a certain market structure?
station ownership	7. How complicated is it to guarantee good service at stations and development of the station area in the case of a certain market structure?
fares and ticketing	8. How complicated is it to ensure that there is a simple and uniform ticketing and payment system for passengers in the event of a certain market structure?
travel information	9. How complicated is the coordination between TOCs to provide uniform, correct and up-to-date travel information to the passengers, in the case of a certain market structure?
timetabling	10. To what extent do the possibilities for coordinating regional public transport with the train network change in the case of a certain market structure? 11. How complicated is it to ensure that the timetable is optimal for the entire market, in the case of a certain market structure?
disruption management	12. How complicated is it to adequately resolve incidental disruptions in the case of a certain market structure?
market performance	13. To what extent does a certain market structure influence the number of entrants to the market?
ease of implementation	14. To what extent does a change in market structure lead to transition costs?

The second objective of the Delphi study is to analyse possible market structures for the Dutch PRM. The analysis of the coordination issues is therefore coupled with an analysis of the Dutch PRM via the use of market structure frameworks. These are discussed in the next section.

[1] The rail sector in this thesis is considered to be all stakeholders involved in the design of rail services, such as governments, TOCs, IMs, and academics and consultants.

4.2. Market Structure Frameworks

To guide participants in their analysis of the coordination issues and the Dutch PRM, a set of market structure frameworks is created, consisting of two essential aspects of a full market structure: an allotment type and an awarding mechanism. These are described in this section.

4.2.1. Allotment Types

An allotment type of a railway network is defined as

> the specific subdivision of the railway infrastructure for operational and management purposes. The allotment type may involve the division of the railway network into different segments based on factors such as geographical location or functional characteristics.

Note that an allotment type is a logistical subdivision, although some types implicitly indicate a particular awarding mechanism.

Several allotment types have been proposed for the Dutch PRM, for example by van de Velde and Röntgen, 2020, Janse de Jonge, 2012 and van den Berg and van der Vlist, 2017. This research examines six conceptual allotment types based on literature, exploratory interviews and formulation sessions. These allotment types are chosen because they provide a comprehensive overview of the main choices that policymakers can make on this issue (see Figure 4.1).

In the monopoly model, a single TOC operates all services on the network. In the status quo model, one large TOC operates most of the network, with some lines on the periphery of the network being decentralised. Train services may also be split by type of service, with intercity[2] and sprinter[3] services separated. In this model, it is obvious that sprinter services will be decentralised for a more regional focus. Another alternative is to divide the network into corridors, retaining the current logistics corridors. Complete decentralisation of all services to regions is the fifth model. In this scenario, intercity and sprinter services are not separated but only decentralised. The final model is an open network with no pre-determined routes. In this case, train services can be initiated and designed by the market, with or without government involvement.

The Delphi study couples these six types of allotment to an awarding mechanism to create a market structure framework. The considered awarding mechanisms are described in the next section.

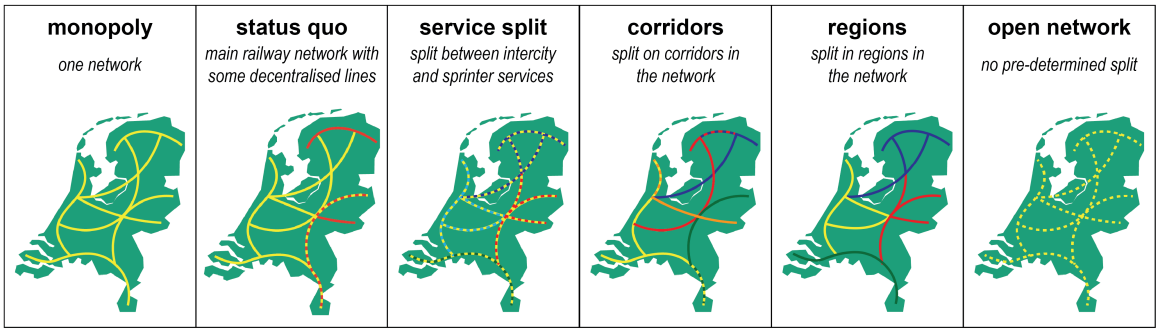


Figure 4.1: Allotment types for the Dutch passenger rail market

[2]Dutch name for an express service between large stations. Used in this thesis as a general term for long-distance trains.
[3]Dutch name for a local train that stops at every station. Used in this thesis as a general term for short-distance trains.

4.2.2. Awarding Mechanisms

TOCs may be granted access to (part of) the PRM based on different types of awarding mechanisms. Five types of these awarding mechanisms can be distinguished: monopoly, direct award, public competitive tendering, invitation to open access, and open access (see Figure 4.2). The awarding mechanisms range from little contractual freedom (in the case of direct award) to great contractual freedom (in the case of open access).

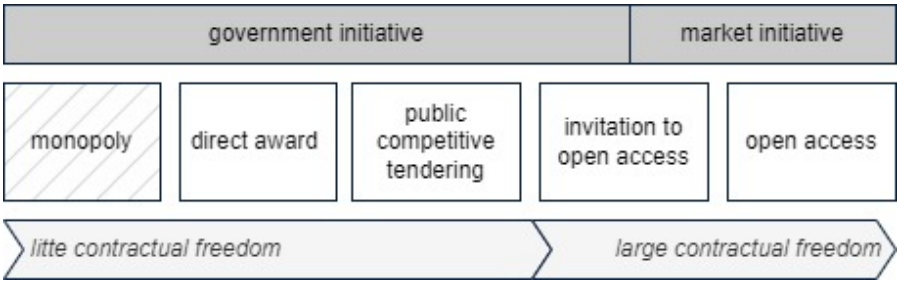


Figure 4.2: Awarding mechanisms for market access

In a *monopoly* situation, there is only one TOC and it can remain so indefinitely. This mechanism is no longer possible in the European Union and it is therefore very unlikely that countries will adopt this mechanism in the future. Therefore, this mechanism is not considered in this study.

Direct award is an awarding mechanism whereby the public transport authority[4] (PTA) grants a TOC the right to provide train services on a section of track for a specified period without the possibility of competition. The conditions are set out in the contract agreed between the PTA and the TOC.

Public competitive tendering is a contract under which the PTA grants a TOC the right to provide train services on a section of track for a specified period, following a tendering procedure. The PTA may set minimum standards and/or service requirements and grant rights to the TOC with the most favourable offer.

Invitation to open access is an awarding mechanism whereby the PTA grants track access to TOCs following a tendering procedure. It is important to note that this only grants the right to use a certain amount of track capacity, not the right to provide train services. This model was first introduced in Spain, where 70% of the network capacity was distributed to three TOCs after a tendering procedure, leaving the remaining 30% for pure open access. In this case, the PTA is not responsible for or involved in the service specification (J. J. Montero & Melero, 2022).

Open access is an awarding mechanism in which the PTA takes no initiative in shaping the service characteristics. TOCs can apply for capacity on the network for self-proposed train services. Approval is required from the IM (for capacity) and the market regulator (to prevent market failure[5]), after verification of vehicle safety and minimum requirements.

The next section presents the market structure frameworks included in the Delphi study.

[4] A public transport authority is a government body responsible for public transport within its jurisdiction.

[5] Market failure refers to a situation where a market, in the absence of intervention, fails to allocate resources efficiently. Where market failures exist, there is a potential role for government to intervene to improve outcomes for the community, the environment, businesses and the economy (NSW Department of Industry, 2017).

4.2.3. Set of Market Structure Frameworks for the Netherlands

The market structure frameworks considered for this study are constructed in such a way as to provide a wide range of possible structures without going into too much detail and offering too many different alternatives. The six market structure frameworks considered are shown in Figure 4.3.

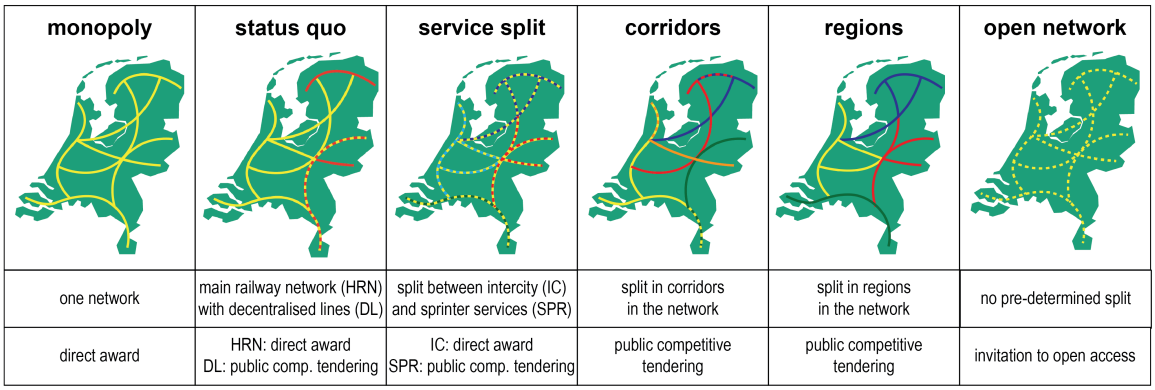


Figure 4.3: Market structure frameworks considered for this research

The next section presents the survey questions.

4.3. Survey Questions

The Delphi surveys consisted of four main components:

1. Categorising the group of participants,
2. Distinguishing between different perspectives on policy-making,
3. Matching allotment types with awarding mechanisms, and
4. Ranking and addressing the 14 coordination issues.

The questions were presented in the first round of the Delphi study. The second round of the Delphi study included feedback on participants' answers to the substantive questions and the opportunity to make comments. The full list of questions can be found in Appendix C (round 1) and Appendix D (round 2).

The following subsections discuss the questions included in the Delphi surveys.

4.3.1. Participant Categorisation

Two questions were included in both rounds to gain insight into the participant group. These questions ask about the stakeholder group to which the participant belongs (academics, consultants, government officials, TOCs and IMs) and the number of years of experience in the rail sector. The number of years of experience in the rail sector was used as a measure to determine the level of expertise of the participants.

4.3.2. Questions on Allotment Types and Awarding Mechanisms

To investigate the views of the participants regarding awarding mechanisms, they were asked in the first part of the Delphi surveys to assign an awarding mechanism to the allotment types shown in Figure 4.1 without prior knowledge of the set of market structure frameworks. Before they were asked to answer these questions, an exploratory question was posed asking participants to indicate the perspective from which they would judge the match between allotment type and awarding mechanism (Figure 4.4). This question was added to provide valuable context about the priorities of the participant group. Note that the wording in this thesis differs slightly from the survey questions, as the wording was updated after the survey was conducted.

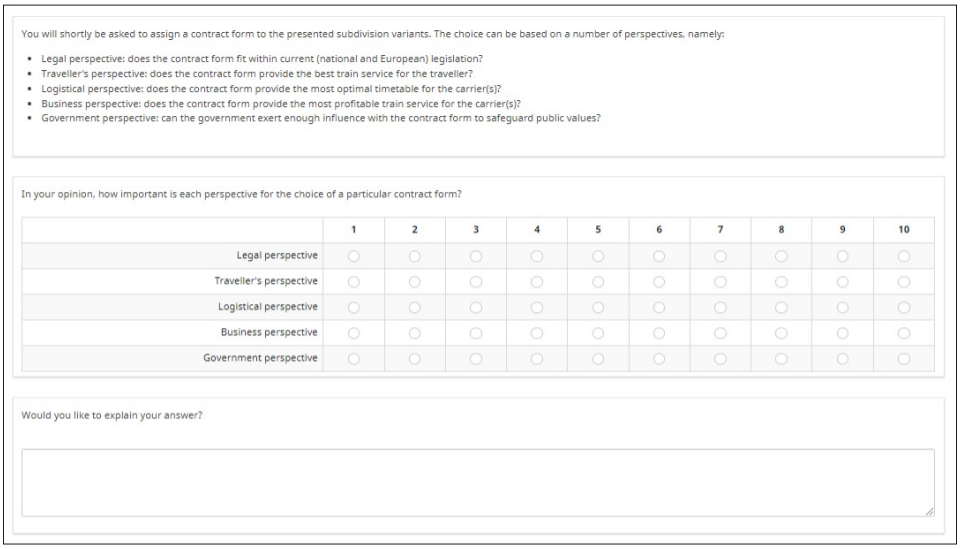


Figure 4.4: Question on the perspectives on awarding mechanisms

The questions about the assignment of the awarding mechanism to the allotment types were presented to the participants randomly and consisted of a multiple-choice question and an open question to elaborate on their choice (Figure 4.5).

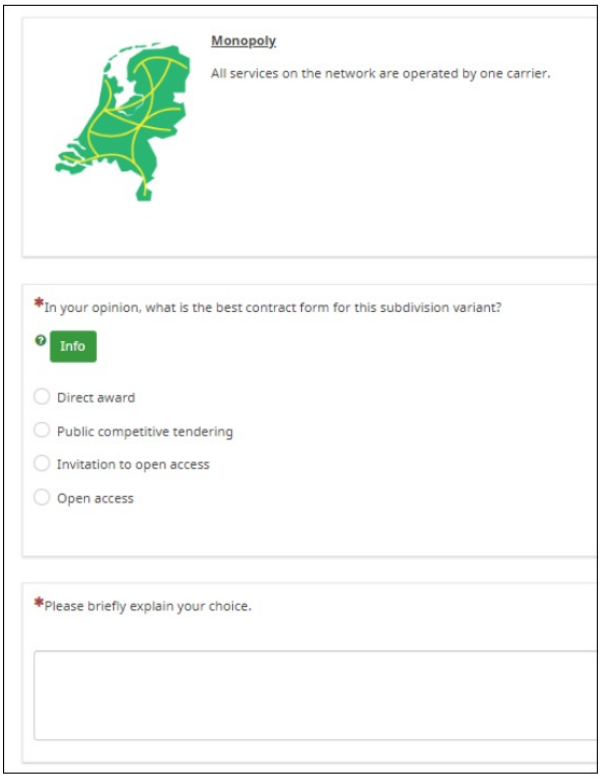


Figure 4.5: Example question on the assignment of awarding mechanisms to allotment types

4.3.3. Questions on Coordination Issues

The second part of the survey continued with an evaluation of the coordination issues (as introduced in section 4.1) for each of the market structure frameworks on a Likert scale. They were also asked to elaborate on their evaluation to give context to the complexity of the coordination issues. An example question is shown in Figure 4.6. These questions were presented in random order to counteract the effects of survey fatigue[6] on the quality of responses.

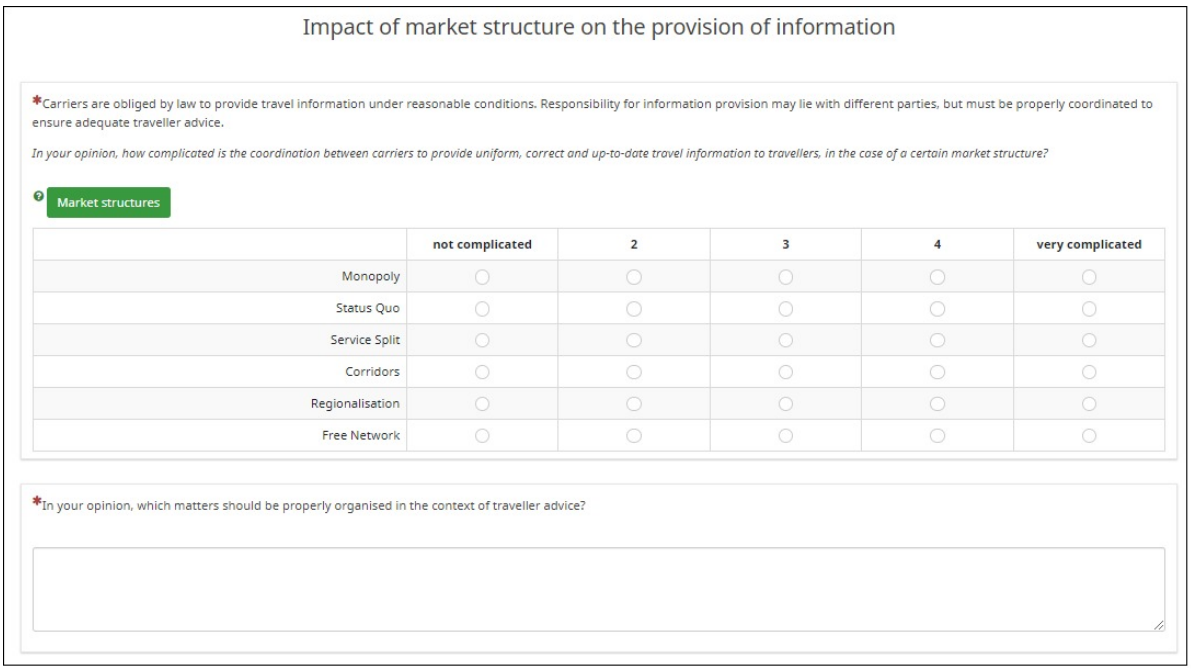


Figure 4.6: Example question on a coordination issue

[6] Survey fatigue refers to the phenomenon whereby individuals become disinterested, fatigued or overwhelmed by the process of responding to surveys. This can happen, for example, when a survey is (too) long, leading to a decline in the quality of responses or a decrease in the willingness of individuals to participate in future surveys.

4.3.4. Question on Coordination Issue Relevance

The final questions of the survey were designed to verify the responses on coordination issues. Participants were asked which coordination issues were most important for each market structure framework, to identify differences in responses due to the wording of the questions. An example question is shown in Figure 4.7.

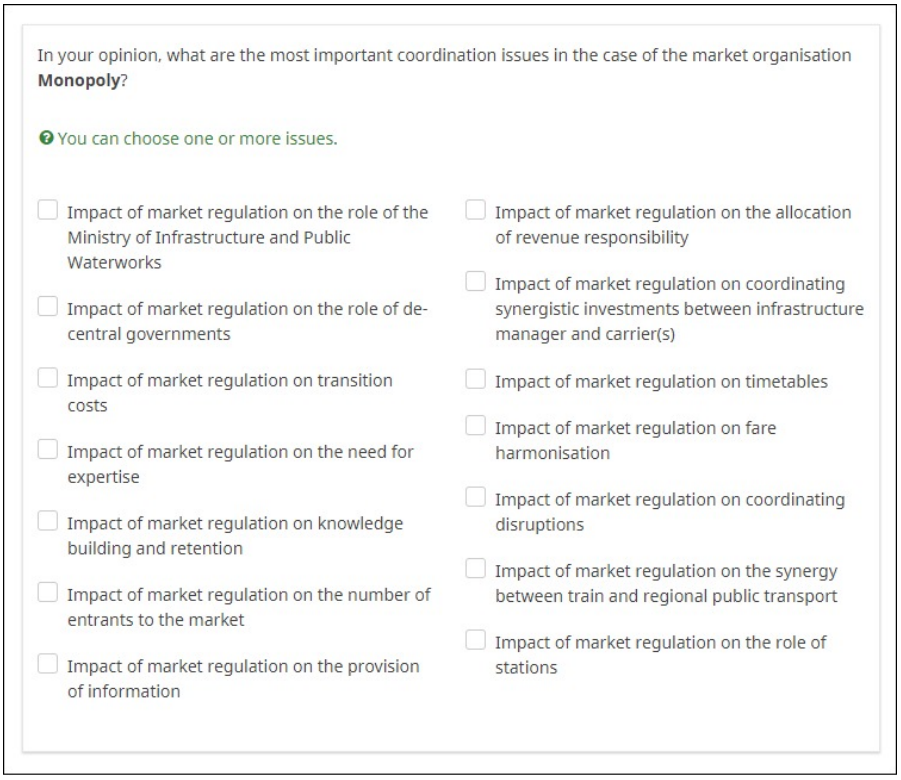


Figure 4.7: Example question on coordination issue ranking

The results of the surveys are discussed in the next chapter.

5

Delphi Study Evaluation

The Delphi surveys were conducted between 27 November 2023 and 15 January 2024. This chapter describes the analysis of the survey results. First, the composition of the panel of participants is presented, followed by a syntax and content analysis to assess the nature of the qualitative comments made by the participants. The chapter concludes with a discussion of the quality of the findings and how they can be used to answer the research questions. Finally, some suggestions are made to improve the quality of results in future studies.

This chapter discusses the findings in a formative way to contextualise the results, after which the substantive findings are presented in the following chapters along with the collected literature to answer sub-questions 2, 3 and 4.

5.1. Participant Panel

The list of potential participants was compiled based on five aspects of panel composition identified by Beiderbeck et al., 2021: *panel size*, *level of expertise*, *level of heterogeneity*, *level of interest* and *access to the panel*. Firstly, given the high level of involvement in either practice or research required for the topic of this study, it is important to find participants with a high *level of expertise*. This results in a limited pool of potential participants. Therefore, efforts were made to reach as many potential participants as possible within the time allotted for this phase of the study. Despite the small *size of the panel*, the qualitative results will be valuable as they can add nuance to the existing literature. Secondly, the issue of PRM coordination is one where opinions - at least appear to be - quite diverse, so it is important to include enough *heterogeneity* in the panel of participants. Therefore, people from five different stakeholder groups were included in the panel: academics, consultants, government officials, TOCs and IMs. As a result, it is expected that Dutch participants will have a high level of interest and therefore a higher response rate than their international counterparts. Even if this is the case, the inclusion of international participants is considered very important as they are expected to have a different perspective than the Dutch participants and are further removed from the heated discussion in the Netherlands. Finally, *access to the panel* is provided through four channels: the researcher's professional network, the thesis committee's professional network, the authors of publications on the research topic, and the participants' references.

Potential participants were mostly invited by email with a detailed description of the research objectives and the Delphi process. Potential participants outside the professional network of the researcher and the thesis committee were contacted via LinkedIn, after which they also received the full invitation by email. If potential participants did not respond in time, they were sent a reminder and eventually a pre-populated link to the first Delphi round. In the first Delphi round, participants were asked if they knew anyone in their network from which the study would benefit if they were invited.

Special attention was given to explaining the survey process to ensure that participants understood the purpose and process of the study. In addition, the anonymous nature of the study was emphasised in the introduction to encourage people to answer the questions according to their own professional

opinion rather than stating their organisation's policy.

45% of the 38 invited experts and stakeholders confirmed their participation in the study, after which 34% of those invited participated. This results in a panel of 13 participants, whose backgrounds are shown in Table 5.1.

Looking at the panel of participants, the response rate is lower than expected at 32%. In addition, 24% of the confirmed participants did not participate in the study. It is worth noting that four of the five categories are represented by at least one participant. However, the IM category has no participants. Nevertheless, the exploratory discussions revealed that knowledge of the topic under study is scarce in this stakeholder group.

Group	**Invited**	**Confirmed**	**Participated**		**Avg. experience**	**NL/int.**
			No.	Perc.	[years][1]	
Academics	9	4	4	44%	23	3/1
Consultancy	10	9	7[2]	70%	18	5/2
Governmental	8	2	1	14%	8	1/0
TOCs	5	1	1	20%	18	1/0
IMs	6	1	0	-	-	-
Total	**38**	**17**	**13**	**34%**	**19**	**10/3**

Table 5.1: Participant panel Delphi study

5.2. Syntax Analysis

The Delphi study relies heavily on qualitative comments from participants. In order to assess the quality of the comments across the set of questions, a syntax analysis is carried out to measure the engagement of the participants. Comments are labelled as whole sentences, phrases or catchwords. A high proportion of whole sentences indicates high engagement and therefore good comment quality (Beiderbeck et al., 2021; Förster & von der Gracht, 2014; Roßmann et al., 2018).

Table 5.2 shows the results of the syntax analysis. In round 1, 76% of the mandatory answers consist of whole sentences, indicating a high level of participant engagement. The last six content questions in this round were optional, resulting in a high number of blank answers (see Figure 5.1).

The questions in the second round were optional and this is reflected in the syntax (see Figure 5.2). The number of whole sentences drops to 33%, suggesting low engagement, which may be due to two reasons: redundancy in answering and survey fatigue. Firstly, participants were asked to provide feedback on the first round's input, which may have discouraged them from commenting unless they had something significant to add. In the second round of the survey, catchphrases such as 'strongly agree' or 'all true' were used to indicate agreement with participants' comments.

Secondly, survey fatigue was evident as the number of complete sentences decreased and the number of blank responses increased as the survey progressed. It was expected that survey fatigue would not be a factor in the second round, as the topics were familiar to participants and they were only asked to reflect on other participants' comments. Therefore, unlike the first round, the questions were not randomised. The increased number of questions compared to the first round could also contribute to survey fatigue.

round	**no. questions**	**mandatory questions**	**whole sentences**	
			all	mandatory
1	20	74%	60%	76%
2	37	0%	33%	33%

[1] Average taken over all rounds and all participants.

[2] 1 of the Dutch participants did not take part in the second round, and 1 international participant did take part in the second round only.

Table 5.2: Results syntax analysis

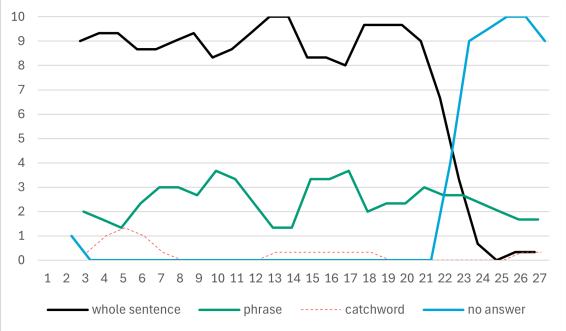


Figure 5.1: Engagement round 1 (3-period average)

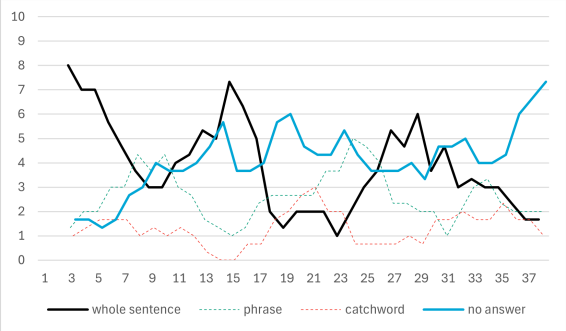


Figure 5.2: Engagement round 2 (3-period average)

5.3. Content Analysis

A content analysis was conducted to determine the argument types used by the panel of participants. The comments made by the panel of participants were analysed by assigning argument types to each statement, as introduced by Förster and von der Gracht, 2014. Each comment was assigned one or more labels: *beliefs, cause-effect relationships, lack of information, particular cases, (historical) analogies, misunderstandings, developments, experiences, differentiations, trends,* and *figures*.

In both rounds, *beliefs* (54.8% - 67.4%), *cause-effect relationships* (17.8% - 10.8%) and *particular cases* (7.5% - 3.9%) were the most used types of arguments. In addition, a lack of information in the answer was a frequent occurrence in the first round (10.6%). This may be due to the wording of the questions and the lack of expertise - rather than experience - of the participants in the field of PRM coordination.

Argument type	**Round 1**		**Round 2**	
	total	perc.	total	perc.
Beliefs	176	54.8%	206	67.3%
Cause-effect relationships	57	17.8%	33	10.8%
Lack of information	34	10.6%	3	1.0%
Particular cases	24	7.5%	12	3.9%
(historical) Analogies	11	3.4%	8	2.6%
Misunderstanding	7	2.2%	10	3.3%
Development	5	1.6%	3	1.0%
Experiences	3	0.9%	0	-
Differentiation	2	0.6%	24	7.8%
Trends	1	0.3%	6	2.0%
Figures	1	0.3%	1	0.3%

Table 5.3: Argument types

5.4. Conclusions and Discussion

Conclusions can be drawn regarding the analysis of the participant panel as well as the syntax and content analysis. Firstly, it should be noted that the participant panel is rather small and not all stakeholder categories are represented. As a result, the results cannot be assumed to be representative of the entire stakeholder population due to the lack of statistical significance. However, the results can serve as an indicator of the views of the population and can be used to nuance the findings of the literature review.

In addition, due to the under-representation of certain stakeholder categories, it was not possible to differentiate between the views of certain categories and draw conclusions from them. A larger sample size may provide potentially interesting insights into stakeholder consensus or disagreement on PRM coordination.

Finally, the analysis suggests that years of experience in the railway sector is not a reliable measure of expertise in railway market coordination. Although the average years of experience in the participant group is relatively high, some questions could not be answered by all participants due to a lack of expertise on the topic. Further studies should take this into account and find alternative measures or means of determining expertise in this area.

To improve participation in future studies, it is recommended that more time be allowed for inviting participants beyond the four weeks used in this study. In addition, a larger group of experts and stakeholders could be invited to increase the size of the participant panel while assuming the same response rate. Furthermore, a longer timeframe for contacting potential participants allows the researcher to follow up on references from previously invited experts and stakeholders.

In order to ensure the level of expertise of the panel concerning the topic under study, and to account for any differences within the panel, it is suggested that a workshop format be considered instead of the Delphi method. Although a workshop format has some limitations compared to a Delphi study (as described in Chapter 2), it allows questions to be clarified and participants to express their expertise verbally. If a Delphi study is chosen, it is advisable to conduct preliminary interviews with invitees to determine whether their level of expertise is sufficient for the scope of the study. In addition, an option could be added to the survey to allow participants to indicate that they cannot answer a question due to a lack of expertise. This way, participants only have to answer questions in their area of expertise.

The next chapters present the analysis of causal factors and choices for PRMs in general and the Dutch market, based on the results of the Delphi contributions and the collected literature.

6

Causal Factors of Passenger Rail Markets

Government decisions on PRM coordination are influenced in part by four causal factors over which it has little control. These causal factors can be seen as boundaries within which the government can shape its policy. The boundaries can change, but they do so very gradually and are therefore outside the scope of policymaking. This chapter presents the four causal factors, i.e. management paradigm, historical context, network capacity and ridership characteristics (as shown in Figure 6.1). The content of this chapter is the result of integrating literature sources and contributions from the Delphi study.

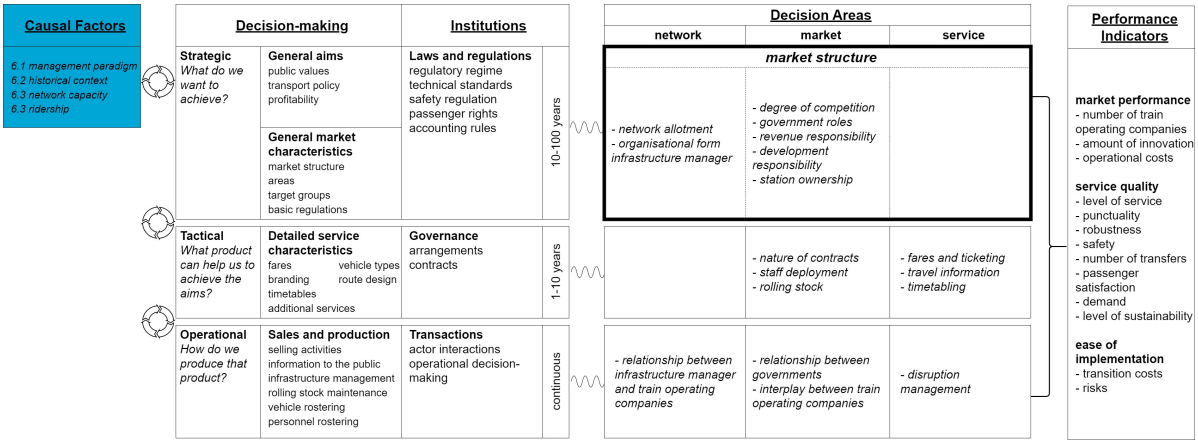


Figure 6.1: Chapter structure Chapter 6

6.1. Management Paradigm

Throughout history, there have been, and continue to be, differing views on how markets - and therefore PRMs - should be coordinated by governments. A management paradigm is defined in this thesis as follows:

> *A management paradigm is a foundational framework and set of principles guiding the government's approach to its roles in society.*

The management paradigm in a country changes gradually over time and influences the range of responsibilities a government assumes in a PRM. This section therefore discusses the existing management paradigms, which responsibilities in the PRM can be assigned to the Dutch government, and what perspectives exist for the execution of these responsibilities.

6.1.1. Management Paradigms and Governance

Katsamunska, 2012 very clearly describes the changes in management paradigms over the last century, starting from the relatively static traditional public administration to a more changing landscape of management paradigms. This section describes this traditional public administration, and how it was succeeded by New Public Management (NPM) and finally evolved towards Public Value Management (PVM).

Traditional public administration (TPA) is understood to be "*an administration under the formal control of the political leadership, based on a strictly hierarchical model of bureaucracy, staffed by permanent, neutral and anonymous officials, motivated only by the public interest, serving and governing party equally, and not contributing to policy but merely administering those policies decided by the politicians*" (Hughes, 2003). Katsamunska, 2012 describes this as a way to "*run the state in a stable and predictable way*" and that it "*was not prepared to meet new challenges and was resistant to change*".

Since the 1980s, governments have focused on introducing competition and privatisation to reduce costs and improve quality when designing public transport policy. This approach is based on the dominance of **New Public Management** (NPM), a line of thinking that moves away from the belief that centralised command and hierarchical control are the necessary means for government (Katsamunska, 2012). It therefore focuses on solving market failures when creating governance structures.

According to welfare economics, perfect competition and the absence of market failure can be achieved through the establishment and optimal maintenance of basic institutions. To prevent market failure, the government should regulate the market. van Damme, 2019 identifies two types of market failure relevant to the PRM; *externalities* and *complementarities*.

van Damme, 2019 defines externalities or external effects as market transactions that affect third parties. Complementarities occur when a product only provides value if another product is also available. In a PRM, externalities can be horizontal, between TOCs using the same infrastructure, or vertical, between passengers and TOCs. Complementarities are important because passengers are only interested in the final product, which is the sum of the services provided by different TOCs.

Effective governance is essential to address market failures in PRMs. Governance refers to the set of instruments used by the coordinator, typically the government, to manage the market. These tools can include hierarchical rules and regulations, as well as collaborative and network-based governance structures (Veeneman, 2021). Hirschhorn and Veeneman (2021) outline the steps of governance as "*the identification of goals, the development of policies necessary to reach those goals, and the allocation of powers and responsibilities across actors as well as the attachment of resources to those policies.*"

Although some countries (mostly Anglo-Saxon countries such as the USA and the UK) have gone quite far in their adoption of NPM, a study by C. Pollitt et al., 2007 shows that a significant part of European states - including the Netherlands - have followed a different path in the period of NPM adoption, referred to as the Neo-Weberian State (Bouckert & Pollitt, 2004). These states retain the view that government is an irreplaceable force in society that cannot be delegated to the private sector and is driven by the forces of efficiency, competitiveness and consumer satisfaction (C. Pollitt et al., 2007).

The hesitation and nuance that some European states have added to NPM, as described above, can already be seen as a sign that they believe that NPM may not be the best paradigm after all. This can be seen by examining one of the elements added by these states as described by (Bouckert & Pollitt, 2004):

> *A shift from internal orientation towards bureaucratic rules to an external orientation towards meeting citizens' needs and wishes. The primary route to this achieving this effect not the employment of market mechanisms (although they may occasionally come in handy) but the creation of a professional culture of quality and service.*

In the last two decades, the aspect of governments being responsive to the needs and wishes of citizens has become increasingly important in the Netherlands, and the government has been slowly moving towards a new management paradigm: **Public Value Management** (PVM). This paradigm is based on:

> *a broader measure than is conventionally used within the new public management literature, covering outcomes, the means used to deliver them as well as trust and legitimacy. It also addresses issues like equity, ethos and accountability* (Kelly et al., 2002).

Under PVM, increasing public value is most important, moving away from the goals of cost reduction and efficiency improvement towards goals related to trustworthy government, the interests of future generations and the overall improvement of public transport services for its passengers (Kavanagh, 2016; van de Velde & Alexandersson, 2020). This also results in a different approach by governments to the coordination of PRMs.

According to PVM, the coordination of the PRM and the relationship between stakeholders should protect all public values (Veeneman, 2019a). Governments should therefore involve stakeholders in decision-making rather than focusing solely on competition to protect public values (Kavanagh, 2016).

Coordinating relationships between stakeholders in the PRM can be challenging due to their different perspectives on public value and market operations. It is important to involve all stakeholders, governments, TOCs, IMs, passengers and non-users, in the development of PRM policy. Good governance by the government is therefore essential (Hirschhorn & Veeneman, 2021).

The governance of the PRM under PVM has become increasingly challenging in recent decades due to the growing number of public values associated with public transport. In addition to obvious values such as accessibility, other values such as safety, environmental quality, social equity, national competitiveness, economic development, technological leadership, human resource allocation and social welfare have been identified (Kavanagh, 2016). Governments often use a wide range of governance instruments in PRMs to capture public value. However, this can lead to conflicting and ineffective results, as noted by Veeneman, 2021.

Developing an appropriate governance structure is challenging because of the interdependencies between different governance instruments and public values, which can make it difficult to determine the isolated impact of a single instrument on performance (Hirschhorn & Veeneman, 2021). Second, studies of governance change often focus on examining formal institutions such as rules and regulations. Formal institutions are a crucial element of the market, but their functioning is also influenced by informal dynamics. These include informal institutions, stakeholder interactions, decision-making processes, steering strategies and the framing of political decisions within the institutional environment (Farrell & Héritier, 2003; Helmke & Levitsky, 2004; Hirschhorn & Veeneman, 2021). Finally, the development of a governance structure always takes place within a specific context. This context is critical to the outcome and renders conclusions about the effects of governance instruments unclear (Hirschhorn & Veeneman, 2021; Hirschhorn et al., 2018; Pawson & Tilley, 1997). As stated by Hirschhorn, 2020:

"[Public transport] *governance involves designing and implementing rules and processes that do not land on a clean slate; path dependencies, interests of incumbent actors, existing logics of action, and shared understandings play a role in determining the solutions proposed for and the eventual function of* [public transport] *systems.*"

It is now recognised that governments have a role to play in coordinating the PRM, protecting public values and providing an appropriate governance structure. This can be referred to as the government's

system responsibility with regard to the PRM. The following section explores this definition in the context of the Netherlands.

6.1.2. System Responsibility and Policy Development

The Dutch national government, in the form of I&W, is responsible for ensuring the proper functioning of the Dutch PRM. The Dutch Council for the Environment and Infrastructure (ILT) recognises four types of system responsibility (Decisio et al., 2020):

- Formal-legal perspective; organisation through laws and regulations,
- Financial-economic perspective; organisation through a level playing field,
- Political-administrative perspective; organisation through consensus and coalitions (e.g. agreements and covenants), and
- Social-Societal perspective; organisation through process management.

In principle, therefore, I&W is responsible for creating and managing the PRM in a way that protects public values - it is the system responsible. This means that it can, if it wishes, delegate many tasks to other entities, even the role of concessionaire[1] (as is already the case for the decentralised lines outside the HRN). In other words, the main task of I&W is to organise the PRM in such a way that good contractual arrangements can be made and the railway services can function optimally through the involvement of the main stakeholders (van de Velde & Alexandersson, 2020).

In order for I&W to fulfil its system responsibility, it has to determine its key policies: what kind of service is desired for the Netherlands, what level of scale is most important and, ultimately, what public values need to be protected (Koppenjan, 2012; van de Velde & Röntgen, 2020)? Although seemingly simple, the answers to these questions are very complex. As mentioned above, it is expected that an increasingly wide range of public values will be included and protected in the design of the Dutch PRM. These values may change over time and may not be consistent with each other. For this reason, it is important to recognise cognitive and resource limitations when developing policy. It is therefore understandable that Hirschhorn and Veeneman, 2021 refers to Lindblom, 1959 when discussing the relationship between public values and policy-making: "*It is not feasible to expect that policymakers can have full ex-ante insight into the totality of values affected by governance design, and perhaps 'muddling through' is not only the single feasible approach but also the most effective one*".

Hirschhorn and Veeneman (2021) put forward a so-called *adaptive approach* as a way for policy makers to go about their process. With an adaptive approach, decision-making should take place on a middle ground between a comprehensive approach (with the challenges mentioned above) and an incremental approach (where interdependencies between public values are largely ignored). This view is supported by the fact that the success of railway reforms is more positive when reforms are implemented sequentially rather than simultaneously. An adaptive, sequential approach allows room for learning between reform stages (Friebel et al., 2010). Nevertheless, it is important that there is a clear view of the key societal goals at all times.

We now have a clear view of the system responsibility of I&W and the perspective from which policy and governance structures should be developed. The next objective is to determine how to formulate an appropriate set of policy objectives for I&W. It is of great importance for the government to create a clear formulation of its objectives in the case of PRM restructuring. In other words, what is wrong with the current situation? How are public values (not) protected in the current situation? Only if these questions are properly addressed can implementation be effective and ex-post evaluation take place to determine whether the change was as planned (Thompson, 2007).

Two things need to be taken into account when formulating policy objectives. First, there is often little consensus on the issue of PRM restructuring. This is because people's opinions are based not only on informed judgement but also to a large extent on political attitudes. It is therefore difficult to conclude what the problem is and how to solve it (Thompson, 2007). In a workshop study by van de Velde and Alexandersson, 2020, experts advise political decision-makers to agree on broad objectives between

[1] A concessionaire is a (semi-)government body that grants concessions to public transport operators.

stakeholders as a starting point for effective PRM restructuring by the system manager (in the Dutch case: I&W).

Secondly, the status quo is often neglected when formulating objectives. In some cases, it may be the best strategy to (mostly) do nothing, as this may lead to the best outcome of all possible routes. Therefore, the do-nothing scenario should always be included in the set of alternatives (Thompson, 2007). Finally, the process of policy formulation cannot take place in a vacuum and policymakers need to be aware of the current (political) situation. van de Velde and Alexandersson, 2020 mention for example the existence of windows of opportunity, path dependency and the influence of local heritage. Taking these factors into account makes policy formulation and recommendations more pragmatic to achieve real improvements.

The Influence of Politics

PRM policy-making is heavily influenced by (national and regional) politics, with the House of Representatives overseeing the HRN concession. Although the House of Representatives formally has the final say on the HRN concession, its real influence is very limited because of the privatisation of NS. This sometimes leads to accusations that politicians focus too much on incidents without the necessary knowledge of the complexities of the PRM (de Jong, 2007; M. Janssen et al., 2011). This dynamic can also lead to a misalignment of expectations when it comes to rail concessions. Politicians may have high expectations, leading to overly promising bids from TOCs and subsequent disappointment from politicians (Decisio et al., 2020).

A second issue is the decision as to which level of government should be responsible for the railway policy agenda. Some argue that the Dutch PRM should be managed in its entirety (i.e. by the national government). Others, however, believe that delegating responsibility to lower levels of government (such as provincial councils) would improve regional integration and better tailor rail services to regional and local needs (M. Janssen et al., 2011).

It can therefore be recommended that - for a smooth political decision-making process - the political desires for the preferred public values and requirements for the railways (e.g. in terms of quality, accessibility, innovation and cost structure (de Goeij, 2011)) should be determined in the political arena. The development of transport services and operations can then be delegated to a separate authority (e.g. I&W or another entity) or the TOCs.

Frame 6.1: The influence of politics on PRM policy decision-making

The policy-making process is influenced by different perspectives on how to achieve an optimal rail service for society. The next section discusses these perspectives in more detail.

6.1.3. Delphi Contributions: Perspectives on Policy Development

There are five different perspectives on the development of PRM policy, namely the legal, passenger, logistics, economic and governmental perspectives. The legal perspective is concerned with whether a policy is in line with current national and European legislation. The passenger perspective is concerned with what policy can provide the best possible rail service for the traveller. The logistical perspective argues for an optimal logistical solution with the most optimal timetable for the TOC(s). The economic perspective looks at how well (the results of) a policy performs economically. I.e. how profitable is the market? The government perspective looks at how well government can influence the market to protect public values.

The panel of participants reflected on the five perspectives in the Delphi surveys (see Table 6.1). It is important to note that due to the small sample size, the means and standard deviations are not statistically significant and should only be considered as indicators.

It is clear that the passenger perspective is considered most important as rail services are created for the passenger. Rail services must therefore be optimal for the passengers using the service. Although this is the most important perspective, participants stress that the other perspectives cannot be neglected.

The second most important perspective considered by the participants is the government perspective. It is seen as important because, as discussed earlier in this chapter, governments are the ones who need to protect public value and be able to steer society towards this goal. Governments must therefore adopt coordination strategies to limit the market power of TOCs and government expenditure on rail services. The latter is closely linked to the economic and logistical perspective.

In order to keep government expenditure low, it is considered important that timetables are logistically (sub-)optimal so that there is a positive business model. The future sustainability of the system cannot be guaranteed if the finances are not under control. Some in the participant group state that (semi)governmental organisations do not always pay enough attention to this economic aspect, so that there can be negative benefits for the taxpayer. Furthermore, if the business model is not positive, TOCs will not enter the market, which poses its own challenges. In addition to the economic side of good logistics management on the network, the Dutch rail infrastructure is almost at capacity, so it should be used efficiently.

The perspective on which there is the most disagreement among participants is the legal perspective. From an idealistic point of view, laws and regulations should be used as a tool to achieve set policy objectives. Although this alignment of policy and law is desirable, in reality, this is not always the case. In the Dutch case, EU regulations define the playing field on which the Dutch government can manage the PRM. These rules are quite strict, although there is some room for interpretation. Long-term change is eventually possible, but there are doubts about how realistic this could be.

This leads to the debate about the limits of the discussion on PRM reform. On the one hand, it can be argued that the development of policy should be driven by a discussion of public values and that laws and regulations are tools to safeguard these public values - and can therefore be changed accordingly. On the other hand, it can be argued that the discussion on policy should take place within the current legal framework. In this case, the introduction of more competition is an obligation and the PRM must be optimised for this. This debate should be resolved before moving on to the decision-making process.

perspective	**avg. [1-10]**	**SD**
traveller	8.7	1.8
government	7.4	1.7
legal	6.5	3.1
business	5.8	1.9
logistical	5.8	2.4

Table 6.1: Average importance of perspectives and standard deviations

6.1.4. Conclusions

Three main conclusions can be drawn from this section. First, traditional public administration and NPM are no longer the only management paradigms. The introduction of PVM leads to a shift in the Dutch government's focus from cost reduction objectives to the protection of public values. Decision-making will therefore take into account not only efficiency objectives but also broader societal goals such as safety, environmental quality and social equity. It is not yet clear whether the dominant management paradigm in the Netherlands is also the paradigm under which the European policy-making process operates. This will be examined in the next section.

Secondly, it has been established that the Dutch government is responsible for the market structure. It can choose to take on the role of concessionaire or even be involved in the design of the train services, but this is not strictly necessary. The role of the government should therefore be explicitly defined during the decision-making process.

Finally, the passenger perspective is considered by the Delphi participants to be the most important aspect from which policy should be made. The other perspectives therefore support the main objective of the railways: a good service for the passengers. Although the legal perspective also supports the final objective, it represents an obstacle in the policy-making process. Participants agree that laws and regulations should be a tool to achieve policy objectives, but also a factor to be considered in the short term, as regulations (especially EU regulations) can only be changed in the long term, if at all. The discussion should therefore take into account the likely scenario that decisions will have to be taken within this European institutional framework.

The following section discusses the historical context of PRM in the Netherlands and explains the institutional framework.

6.2. Historical Context

Decision-making is strongly influenced by the historical and institutional context When it comes to re-structuring PRMs, decisions are almost always made in relation to the existing market. It is therefore useful to have a good understanding of the market and how it came to be to understand the starting point of the policy discussion. This section presents the historical context and the current institutional set-up of the Dutch PRM.

6.2.1. Historical Context and European Regulation

PRM reform in the Netherlands in recent years has mainly been driven by European policy and regulation. Initially, the EU was interested in improving the financial situation in the member states, focusing mainly on freight transport. Later, the EU's attention shifted to passenger transport as the liberalisation of the utilities sectors became more relevant. The main objective of EU policy is to create a free and unified European railway market (VEU, 2013) by introducing vertical separation between IMs and TOCs and competition between TOCs. To this end, Regulations 1370/2007 and 2016/2338 were adopted (European Parliament & Council of the European Union, 2007, 2016). These regulations stipulate that the available awarding mechanisms can be used in the following order:

1. Governments must carry out a market analysis to determine whether private TOCs are willing to operate parts of the rail services on a **open access** basis.
2. Governments may use **public tendering** for the parts of the network that are not to be operated under open access (and are often unprofitable and require government subsidies).
3. EC Regulation 2016/2338 has created an exception for governments to **directly award** parts of the network to an operator without the possibility of competition.

The exact interpretation of these regulations has yet to be determined, so there is still debate as to which parts of a network can be directly awarded and how strictly open access should be the dominant awarding mechanism in the PRM.

The EU also promotes further integration by encouraging technical innovation and standardisation. These measures contribute to the elimination of discrimination between TOCs from different member states and the ultimate goal of a single European PRM (Crozet, 2019; van de Velde, 2019b, 2019c; van Damme, 2019).

Due to the above-mentioned further tightening of railway regulation by the EU (European Parliament & Council of the European Union, 2016) and the resulting market pressure from private TOCs in the Netherlands, there is a high level of uncertainty in the sector. This uncertainty is exacerbated by the fact that the national government has not taken a long-term decision on market restructuring. The current state of the Dutch PRM requires a clear way forward so that stakeholders can plan their actions accordingly (van de Velde et al., 2009).

The main objective is to create a more formal framework of roles and relationships between market actors so that rights, obligations and responsibilities are clearly divided between the parties involved. This applies not only to the roles of the market parties but also to the different ministries of the national government (Sorgdrager et al., 2008; van den Berg & van der Vlist, 2017; van de Velde et al., 2009). In addition to the previous recommendation, the policy decisions on the future of the Dutch PRM must be made in a well-considered and timely manner, as the results of these decisions will determine the future of the sector (van de Velde & Röntgen, 2020). The next subsection provides a brief description of the institutional configuration of the Dutch PRM.

6.2.2. Institutional Configuration of the Dutch Passenger Rail Market

This description is an updated and adapted version from van de Velde and Röntgen, 2009.

I&W is responsible for general railway policy, payments to the IM and TOCs and the granting of concessions for passenger transport on the HRN, as well as infrastructure management of the entire network (see figure 6.2). The ILT and the Authority for Consumers and Markets (ACM) are responsible for various regulatory issues such as safety and fair access to the PRM.

ProRail is the IM of the entire Dutch railway network. It is a company wholly owned by the Dutch government. The infrastructure management concession is awarded directly and I&W pays ProRail an annual subsidy for its operations. This is supplemented by charges under access agreements with the TOCs operating on the network.

NS is a TOC wholly owned by the Dutch State. NS holds a directly awarded concession to provide passenger rail services on the HRN. Previously these services were not subsidised (NS paid 86 million euros per year to I&W), but the Dutch government currently pays a subsidy to NS (13 million euros per year) (Rijksoverheid, 2023). Some regional rail services are decentralised and the responsibility of regional PTAs. These services are all awarded via PCT, sometimes together with local bus services.

Both NS and ProRail have to maintain a certain level of service according to the text of their concession. An essential element of the concessions is that both companies have to prepare an annual transport plan (NS) and an infrastructure management plan (ProRail). Both plans have to be assessed and approved annually by I&W.

TOCs can apply to ProRail for capacity outside the existing concessions to provide open-access services on the network. In addition to a capacity analysis by ProRail, ACM carries out a market analysis to assess the impact on market balance and can prohibit such open-access services if they cause a significant market failure.

Finally, two entities are responsible for stations in the Netherlands; ProRail owns the track infrastructure, while NS Stations (part of the NS holding) owns the station buildings. The TOCs pay user charges for the use of this infrastructure and service (Decisio et al., 2020). ACM monitors that NS Stations treats all TOCs equally in terms of access conditions and user fees.

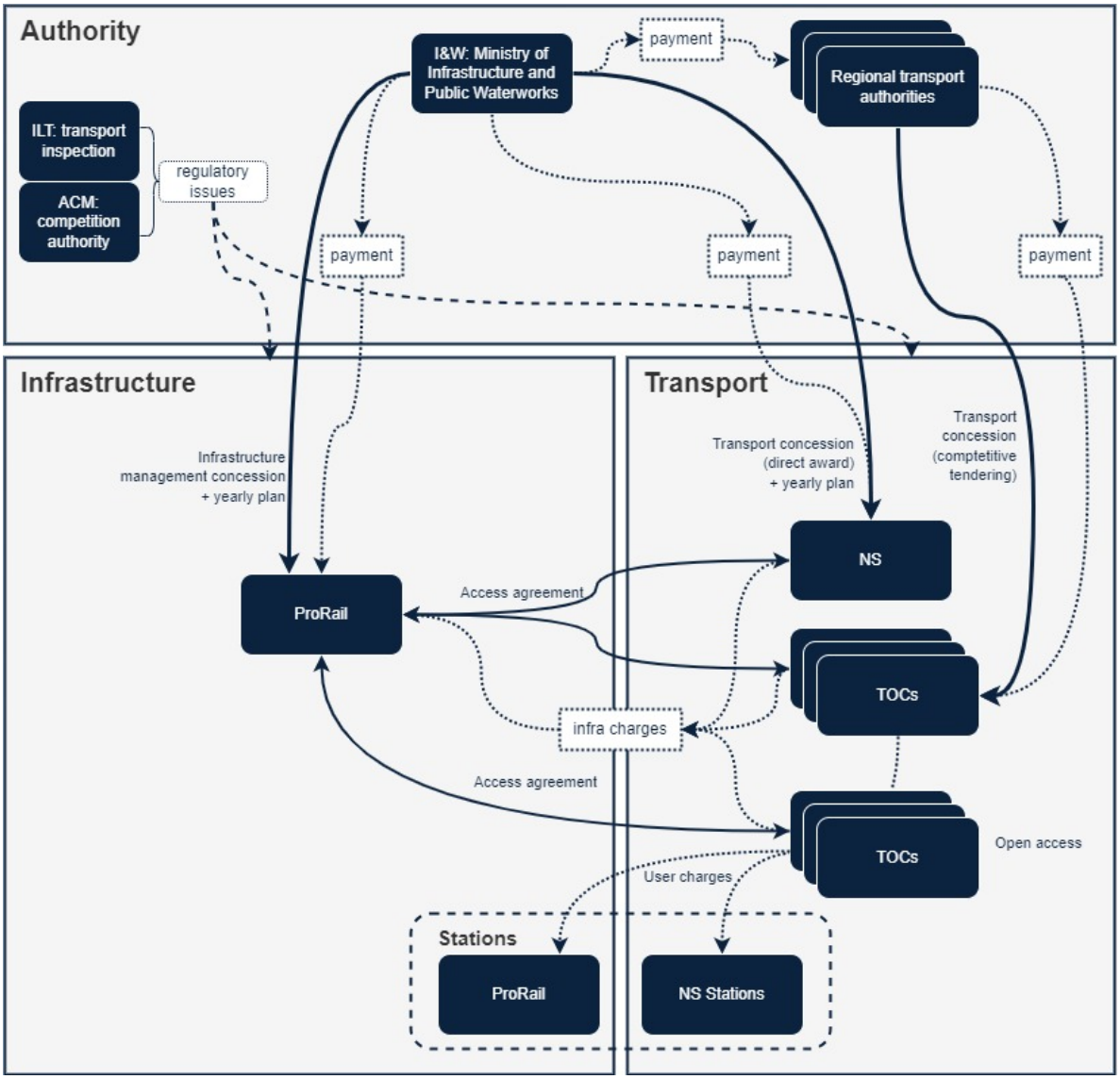


Figure 6.2: Institutional configuration of the PRM in The Netherlands (updated from van de Velde and Röntgen, 2009)

6.2.3. Conclusion

The main conclusion that can be drawn from the analysis of the historical and institutional context of the Dutch PRM is that European regulations are a key determinant of the Dutch institutional framework in the future. Current EU regulations are at odds with the current institutional configuration in the Netherlands, leading to a debate on whether and how the institutional configuration needs to be changed in the future. The resolution of this debate is crucial as it creates uncertainty in the sector.

The next section describes the impact of network capacity and ridership characteristics.

6.3. Ridership Characteristics and Network Capacity

This section describes the characteristics of Dutch PRM ridership and its impact on network capacity.

6.3.1. Ridership Characteristics

The Dutch rail network is dense and heavily used, with a very high number of train-kilometres per kilometre of track. This means that, together with Japan and Switzerland, the Netherlands has one of the busiest rail networks in the world. Despite this high density, **punctuality** was one of the highest in the world (van den Berg & van der Vlist, 2017; van de Velde & Röntgen, 2020), although it has declined in recent years due to staff shortages and some major disruptions (89.7% in 2023 compared to 92.6% in 2019 on (ProRail, n.d., 2020)). The punctuality levels of the train services of NS and the other TOCs are similar, although they are difficult to compare due to the different nature of the services. The train services on the decentralised lines are logistically simpler, so the timetables are more robust and therefore better able to deal with disruptions (Baanders et al., 2011; Decisio & TwynstraGudde, 2018; Janse de Jonge, 2012).

Traveller satisfaction has increased since the introduction of the Dutch Public Transport Act (WP2000). Although passenger satisfaction was initially higher on decentralised lines than on NS-operated lines, the gap has recently narrowed. For example, between 2001 and 2018, the percentage of people rating NS services as 7 or better increased from 45% to 86% (Decisio et al., 2020; Janse de Jonge, 2012; van den Berg & van der Vlist, 2017). The latest survey shows that in 2022, passenger satisfaction on the HRN was even slightly higher than on the decentralised lines (7.7 versus 7.5) (CROW-KpVV, 2022). The improvement in service quality over recent decades is identified as the main driver of ridership growth (Harms et al., 2017).

In terms of **ridership**, the number of passenger-kilometres increased by about 30% between 2000 and 2018. (Decisio et al., 2020). After the COVID-19 pandemic, however, ridership fell sharply; ridership on the HRN fell by 29.6% (NS, n.d.). This makes previous predictions very unreliable, although ridership has increased steadily since the end of the pandemic. Studies from before the pandemic predicted a large increase in ridership, ranging from 27% to 45% between 2014 and 2040 (see figure 6.3), with the increase mainly in the western part of the Netherlands and even a decrease in the rural parts of the country (Gelauff, 2019; Veeneman, 2010).

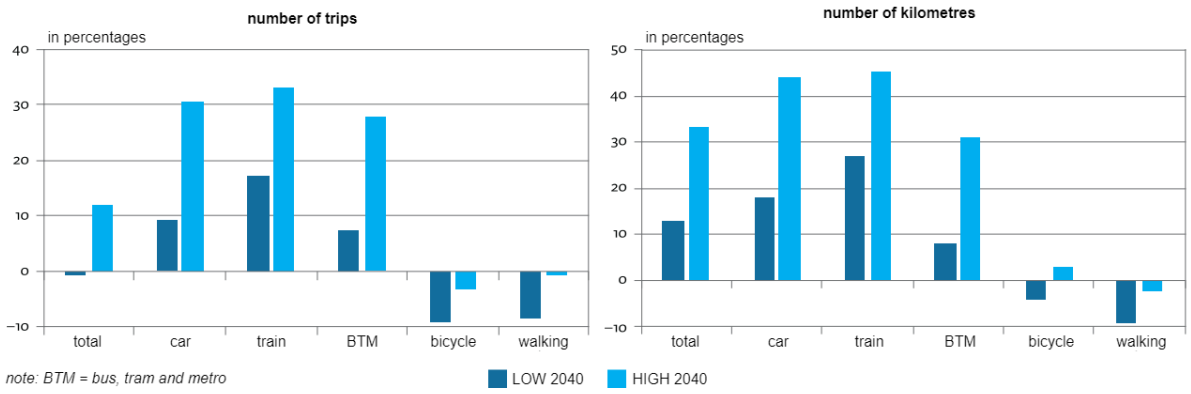


Figure 6.3: Development of trips (left) and kilometres (right) per modality 2014-2040 (Gelauff, 2019)

6.3.2. Network Capacity

Whatever happens with passenger numbers, the **network capacity** will be a major issue in the Netherlands, as it is almost at its limit, even if the planned and current projects are implemented (van den Berg & van der Vlist, 2017). This concerns not only the capacity of the regular lines but also the capacity of stations and depots, bicycle parking at stations and freight transport (Gelauff, 2019; Veeneman, 2019b). Most of the problems occur in the Randstad, where almost no additional trains can be scheduled and where ridership is the highest (M. Janssen & van Wee, 2019; van den Berg & van der Vlist, 2017). In addition, TOCs such as NS are experiencing staff shortages which are affecting service quality (NOS Nieuws, 2022).

The Kernteam Landelijk Netwerkuitwerking Spoor, 2020 states that technological improvements can help to increase the current capacity of the infrastructure. They mention *Automatic Train Operation*, automated *Traffic Management System* and the *European Rail Traffic Management System* (ERTMS) as promising ways to reduce the time between trains. Another advantage of ERTMS is that it reduces dependency on technical installations, as the system is largely based on onboard technology and data centres (as opposed to tracks and signals) (Veeneman, 2019b).

The Dutch rail infrastructure is optimised on a national level, resulting in many dependencies and network effects that lead to a complex timetable (more so than in other countries) (M. Janssen & van Wee, 2019; van de Velde & Röntgen, 2020; Veraart, 2012). This, together with the capacity limits of the network, results in a fragile timetable. van den Berg and van der Vlist, 2017 reports that trains are overcrowded at peak times and that delays on the HRN affect the whole network. The **robustness** of the network is therefore reduced and changes to the network and train services are more difficult to implement (Janse de Jonge, 2012).

6.3.3. Conclusions

Network capacity and ridership are key causal factors in the context in which decisions can be made for the Dutch PRM. The combination of high ridership and limited capacity will play an increasingly important role in the decision-making process of the PRM, as it can create significant barriers to the implementation of certain market structures.

The main causal factors for PRM in the Netherlands are now understood. The next chapter continues with the choices for PRM in the Netherlands.

7

Choices for Passenger Rail Markets

This chapter presents the choices for PRMs and discusses them in the light of the Dutch PRM. The policy choices - as identified in chapter 3 - will be assessed in turn, starting from the strategic level of decision-making down to the operational level. Note that the operational level choices are described simultaneously with the choices of the higher levels, as they are closely related to them. The last section of this chapter presents the results of a study on the relevance of each of the coordination issues analysed in the Delphi study. The content of this chapter is the result of integrating literature sources and contributions from the Delphi study.

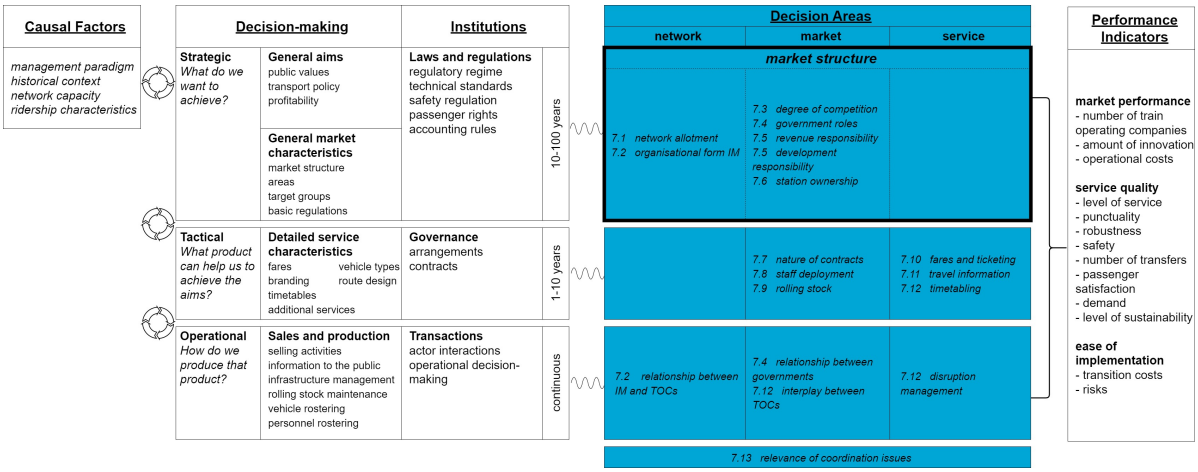


Figure 7.1: Chapter structure Chapter 7

7.1. Network Allotment

The Dutch rail infrastructure (for heavy rail) is currently divided into four distinct parts: the HRN, decentralised lines, HSL-Zuid and open access services. This section deals with the logistical subdivision of the HRN, the HSL-Zuid (which is currently concessioned together with the HRN) and the decentralised lines. The awarding mechanisms often associated with certain types of allotment are not discussed here (see section 7.3 for this topic). The types of allotment considered in this study are presented in section 4.2.1 (see also Figure 7.2).

Proposals for a particular type of network allotment are usually based on two arguments: that smaller allotment areas (than the current one) create more opportunities for introducing competition, and that decentralisation creates more regional focus and influence of regional governments (often together with the integration of bus, tram and metro services (BTM)). These arguments are discussed in the next subsection, after which the proposed allotment types are discussed in detail.

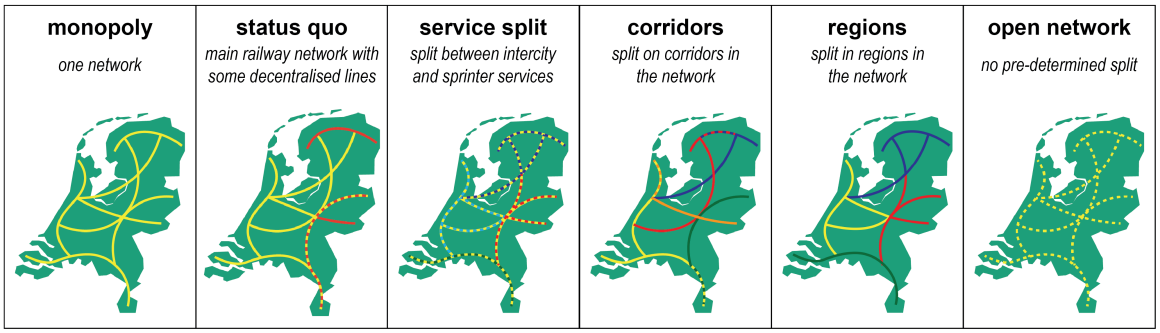


Figure 7.2: Allotment types for the Dutch passenger rail market

7.1.1. Reasons for Subdivision

Firstly, to create more opportunities for competition, it was assumed that smaller lots were necessary to allow small TOCs to enter the market. This approach has been abandoned over the years in favour of larger subdivisions, sometimes with multimodal concessions (Decisio et al., 2020). There is no consensus among the Delphi participants as to how large the subdivisions need to be for the introduction of competition, although most respondents tend to agree that the size and complexity of the HRN make it difficult or impossible to use PCT.

This is consistent with the literature on the subject. Nash et al., 2016, 2019 mention on two occasions that econometric evidence from the UK and Germany shows that the largest concessions in those countries are too large, beyond the necessary economies of scale (e.g. in terms of depots, staff and rolling stock). Other sources warn against too much fragmentation, which in turn creates barriers to entry because TOCs are unlikely to be able to make an attractive bid with new rolling stock for each concession area (together with other economies of scale) (M. Janssen et al., 2011; Mouwen, 2019; van den Berg & van der Vlist, 2017).

Second, smaller subdivisions and decentralisation are often proposed to create more regional focus and influence of regional and local governments. The Dutch railways have been largely a national affair since World War I, with NS as the only TOC operating on the Dutch rail infrastructure. In this situation, NS tended to focus on national projects (such as high-speed rail) rather than local projects (Veeneman, 2019b). Although a shift towards more regional planning of rail services can be argued, the case of Germany (where most rail services are the responsibility of the Länder) shows that there is still a role for the national government in coordinating interregional services, which regional governments do not pay enough attention to (Nash et al., 2016).

In addition to the regional focus, decentralisation is often assumed to have positive effects on the integration of train and BTM services. Integrated public transport has many advantages for passengers. A multimodal concession or even greater synergy between the train and BTM can achieve this. There is evidence in the literature that multimodal concessions do indeed increase ridership and have positive

benefits for passengers (Decisio & TwynstraGudde, 2018; Janse de Jonge, 2012; van Dijk, 2007), but Hoekstra, 2008 mentions that the real advantages and disadvantages are not yet clear. While this presumed synergy sounds promising, it neglects that regional and national rail (sprinter and intercity services) are also currently interconnected. Therefore, a network where market integration is protected but regional differentiation can take place seems to be the most promising solution (Koppenjan, 2012).

7.1.2. Allotment Types

The logistical aspects of the proposed allotment types can be examined on the basis of findings in the literature. These include (1) the alignment with passenger behaviour, (2) the potential for synergy with BTM, (3) the impact of concurrence, (4) the impact on capacity, (5) the robustness of the infrastructure and (6) the infrastructure changes required.

Looking at **passenger behaviour**, it is clear that trains are widely used at a national level. According to Janse de Jonge, 2012, 72% of passengers travel across provincial borders, and the main growth in ridership will occur between urban areas, primarily between the major cities of Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven (Gelauff, 2019). In addition, van den Berg and van der Vlist, 2017 found that 76% of trips are made without the need for a transfer. A 2011 study by Baanders et al. found that decentralising parts of intercity services would result in a significant number of train passengers having to make an extra transfer. The Dutch rail network should therefore focus on creating corridors between urban areas. This is why corridor allotment is sometimes proposed. However, according to M. Janssen, 2019, only 41% of travellers encounter more than one TOC on the same trip in such a model.

Delphi contribution: Opportunities for synergy between train and BTM

The Delphi participants rated the possibilities for synergy between train and BTM for each type of allotment. The possibilities were rated on a 5-point Likert scale from 'less possibilities' (1) to 'more possibilities' (5). The corresponding averages are shown in Table 7.1. The panel suggests that the allotment types 'service split' and 'regions' have a positive impact on the possibilities for synergy between train and BTM.

allotment type	avg. [1-5]
monopoly	2.1
status quo	2.9
service split	4.0
corridors	3.2
regions	4.2
open network	2.0

Table 7.1: Results impact of allotment type on the synergy between train and BTM

Frame 7.1: Delphi contributions: synergy between train and BTM

When discussing allotment types, the role of **concurrence of services** is often mentioned. Baanders et al., 2011 defines concurrence as *the situation in which two or more TOCs have the right to offer rail transport services between the same stations located on the rail network.* Mouwen, 2019 and Janse de Jonge, 2012 suggest that decentralisation is possible in parts of the network where there is no significant concurrence with the HRN. However, it is difficult to predict the outcome of a situation where two TOCs operate on the same infrastructure, despite the generally positive experience of current decentralisation.

Most sprinter services within the HRN have a high degree of concurrence with intercity services. This can be explained by the fact that sprinter services play a large 'feeder' role for intercity services. The

coherence of train services on the HRN is therefore very important for the overall journey time. Decentralisation of the network will inevitably lead to more regional rather than national optimisation, which in turn means more transfers for passengers (Baanders et al., 2011; Mouwen, 2019). The total number of transfers for a given type of allotment is difficult to determine as it depends on the specific timetables. However, the effect of an extra transfer has been discussed in the literature. Studies show that an extra transfer can significantly increase the perceived travel time, ranging from 8 to in some cases 30 minutes (van den Berg & van der Vlist, 2017; van Damme, 2019). This additional perceived travel time cannot only be explained by the transfer itself but also by the challenges for the passenger in terms of ticket differentiation and inconsistent information provision (Koppenjan, 2012). Finally, multiple TOCs operating on the same infrastructure (tracks and stations) lead to a coordination task.

The fourth aspect of an allotment type is its effect on **infrastructure capacity**. Baanders et al. already stated in 2011 that decentralisation leads to a decrease in infrastructure capacity. Coupled with actual and projected growth in ridership and service provision, it is expected that decentralisation will lead to a significant challenge for ProRail, which already faces overcapacity on parts of the network every year (ProRail, 2023). In less densely populated countries with a less interconnected network, this issue plays a smaller role than in the Netherlands (Veraart, 2012).

A fifth aspect is the **robustness** of the services associated with a type of allotment. Two perspectives can be associated with this aspect. Firstly, it could be argued that large areas are advantageous for dealing with disturbances. The idea is that a large TOC can keep more rolling stock in reserve because it does not have a significant impact on operating costs. For example, large TOCs (such as NS) can use different types of rolling stock as a quick fix for broken trains (M. Janssen, 2019). Provinces have found a solution to this problem by forcing TOCs to share rolling stock between areas in the event of a disruption (van den Berg & van der Vlist, 2017). This brings us to the second perspective. Some argue that the current planning of staff and rolling stock by NS (which is national) leads to a greater dispersion of the problem in the event of disruption. Smaller areas should therefore reduce the complexity and vulnerability of the network (Koppenjan, 2012). However, others mention that the resolution of incidents becomes more complex when more TOCs are involved in the process, which in turn leads to a greater role for the IM (Baanders et al., 2011; Janse de Jonge, 2012).

The last aspect to be considered is the required **infrastructure changes** for a type of allotment. Substantial changes in the allotment of the Dutch infrastructure will result in a high number of required infrastructure changes, as tracks and stations are tailored to the current situation. The regionalisation of services has the greatest impact on infrastructure design, as trains will need to be able to turn at border stations, for which the infrastructure is not currently designed. The expansion of stations - especially in the centres of large cities - poses major challenges due to the lack of space in these locations (van den Berg & van der Vlist, 2017). In addition to the redesign of tracks and stations, service facilities and holding yards are usually built for a national network and therefore do not cover certain regions. It should be noted that these facilities are already close to capacity. If not properly addressed, these facilities can create significant market power (Alexandersson et al., 2012; Decisio & TwynstraGudde, 2018).

The infrastructure changes required for a different type of allotment will require very high levels of public investment and will take a long time due to stricter regulations, scarcity of space around infrastructure, external factors of construction (such as emissions), building on a densely used network and the already high costs of improving existing infrastructure (+/- €20 billion) (van de Velde & Röntgen, 2020; Veeneman, 2019b). Additional changes are estimated to cost hundreds of millions per project and billions for larger projects (van den Berg & van der Vlist, 2017).

7.1.3. Conclusions

Further decentralisation of the Dutch rail network will bring a number of challenges that need to be properly addressed. Passengers will inevitably have to make more transfers as a result of further decentralisation. The national character of demand and the feeder role of the sprinter services require careful planning to avoid extra and inconvenient transfers. Decentralisation also has an impact on capacity, as trains will have to turn at the boundaries of subdivisions. Finally, infrastructure changes for a change in allotment require a high level of investment, in addition to the large investment needed to improve the existing infrastructure.

The next section presents the options for managing the rail infrastructure.

7.2. Organisational Form of the IM and the Relationship with TOCs

The first railway companies began as, as the name suggests, railway construction companies, which built, owned and operated their networks separately. Eventually, all the networks were merged into one with the creation of national railway companies. In recent decades, with the introduction of competition, it is believed that the IM must operate independently of the TOCs to ensure non-discriminatory and fair access to the network for the TOCs (Finger & Messulam, 2015; Thompson, 2007; van den Berg & van der Vlist, 2017). This is not in line with economic theory, which suggests that a natural monopoly[1] with scale and synergy as dominant characteristics should be handled by a vertically integrated entity[2]. Vertical separation as a prerequisite for competition inevitably leads to significant transaction costs[3] (Veraart, 2012). This raises the question of how infrastructure management should be organised.

On the issue of **ownership** (private versus public), the consensus is that at least the IM should be publicly owned. This is because it is responsible for the long-term planning and maintenance of the network, which requires high costs and a long-term planning horizon - something that private companies are often unwilling or unable to (Finger & Messulam, 2015). In addition, capacity management is a complex process that requires a great deal of multi-party consultation, which is lost when private ownership is transferred between private parties between concessions (Sorgdrager et al., 2008).

7.2.1. Institutional Models and Incentive Misalignment

Four institutional models are possible for the organisation of infrastructure management; vertical separation, deep alliances, a holding model or vertical integration (see: Figure 7.3). Vertical separation involves a complete legal separation between the TOC and the IM (Perennes, 2017). In a deep alliance model, the TOC and IM are still separate entities, but share staff for specific projects and sometimes even share costs and revenues. In the holding model, the TOC and IM are part of the same holding company, but still separate entities within that holding company. In the case of vertical integration, one entity is responsible for both train operations and infrastructure management, with full legal and organisational consolidation.

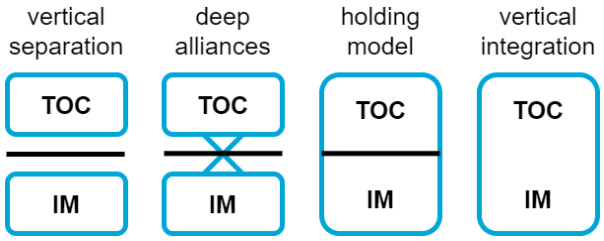


Figure 7.3: Institutional models for infrastructure management

The main objective of vertical separation is to reduce costs and improve the quality of rail services by introducing competition on the network. To achieve this, it is assumed that fair access to the infrastructure is necessary and therefore vertical separation of TOC and IM. In addition, vertical separation can lead to greater cost transparency and cost reductions from restructuring (Mizutani et al., 2015). The benefits of competition are only useful if the benefits outweigh the transaction costs created when separating TOC and IM (Mizutani et al., 2015; van de Velde, 2019c). The main driver of transaction costs is the misalignment of incentives between the two aforementioned parties (McNulty, 2011; van den Berg & van der Vlist, 2017).

[1] A natural monopoly is an industry in which multi-firm production is more costly than production by a monopoly (Baumol, 1977). Examples include industries with large economies of scale like water services, electricity and telecommunications.

[2] Vertical integration in the railway context means that both infrastructure and services are managed by a single company.

[3] In PRMs, transaction costs refer to various expenses and barriers that market participants face in their operations. These costs include, for example, charges for access to infrastructure, compliance with regulations, and costs associated with contracting and negotiation.

van de Velde et al., 2012 distinguish four main planning horizons where **incentive misalignment** exists: (1) long-term planning, which concerns investments in assets with long payback periods, mostly fixed assets, (2) medium-term planning, which concerns the development of train services (including staffing), (3) short-term planning, which concerns timetabling, and (4) real-time planning, which concerns the execution of train services and adjustments in case of unforeseen events. The institutional arrangements therefore aim at solving these problems: improvement of train services, adjustments, punctuality and better use of available capacity (van de Velde, 2019c).

The literature pays particular attention to the misalignment of incentives in infrastructure investment. van de Velde, 2019c and Veeneman, 2019a describe that there are investments that require changes in rolling stock and infrastructure (such as changes in catenary voltage, new safety systems and noise reduction measures). These investments can change the cost structure and the IM often bears the costs while the TOC benefits from the investments.

Nash et al., 2016 describes the solution in the United Kingdom where IMs and TOCs form **deep alliances** in which they cooperate on issues ranging from specific activities to the whole train service. In these alliances, costs and revenues are often shared to remove misaligned incentives. The disadvantage of this model is that both the IM and the TOC, although separate entities, are responsible for infrastructure costs and the allocation of capacity to the tracks. This prevents a level playing field for other TOCs and discourages competitive bids from potential new entrants. van de Velde et al., 2012 therefore recommends alliances only in cases where a single TOC is dominant in the regions.

Some countries go a step further and use a **holding model**, where the TOC and the IM are part of the same legal holding, but are different organisational units. van de Velde et al., 2012 suggests that this model is appropriate when the holding has a significant market share. The advantage of this model is that new entrants have fair access to the network, but transaction costs are minimised by having both parties within the same holding. This makes it easier to coordinate investments, production planning and scheduling. In addition, the transparency of cost structures created by this model is maintained, as in the case of full vertical separation.

The literature suggests that to achieve cost savings through vertical separation, a strong **regulator** should be established to oversee economic equilibrium and a level playing field. In addition to being an economic regulator, it can also play a role in setting short and long-term priorities that may not be aligned with the objectives of IMs and TOCs (Finger & Messulam, 2015; Smith et al., 2018; van de Velde & Röntgen, 2020; van Damme, 2019). The absence of a strong regulator can lead to high transaction and interface costs (Mouwen, 2019).

Another mechanism to address misaligned incentives is the use of **track access charges** (TACs) to match supply and demand and give the IM the highest possible return on investment (Finger & Messulam, 2015). Although promising, international studies have been inconclusive as to whether these financial incentives are sufficient to create the optimal system without knowledge of the long-term planning of the TOCs. The risk is that IMs will use TACs to minimise costs rather than to optimise the use of resources (Alexandersson et al., 2012; van de Velde, 2019c). In addition, J. Montero and Finger, 2020 and van Damme, 2019 suggest that low TACs may promote competition, while high TACs do the opposite. Furthermore, when different levels of government are concessionaires, it is important to check that TACs are correctly charged to TOCs (Nash et al., 2016). van den Berg and van der Vlist, 2017 also mention the use of **subsidies** to motivate market participants to seek system-level solutions.

7.2.2. Effects of Institutional Models

Several studies have been conducted to econometrically measure the effects of vertical separation on cost reduction. van de Velde et al., 2012, Mizutani and Uranishi, 2013 and Mizutani et al., 2015 examined the effects of vertical separation in combination with PCT on cost reduction. They found that the effectiveness of vertical separation is related to network density. That is, how much the infrastructure is used. The results of these studies suggest that a busier network results in a lower effectiveness of vertical separation in reducing costs, and may even increase costs for the densest networks. The reasons given by these authors are coordination and transaction costs: good coordination is important but becomes more difficult with greater vertical separation. McNulty, 2011 also found that vertical separation led to higher costs in the UK.

The above studies also found no evidence that vertical separation is per se superior to the holding company model, but also that the change in cost-reducing effects of the holding company model is almost negligible compared to vertical separation.

J. Montero and Finger, 2020 report that there is currently no consensus on how much vertical separation should be introduced in PRMs and that the current regulation still allows all models. The studies on the relationship between vertical separation and cost reduction also suggest that countries should be free to choose a model (Mizutani et al., 2015). Furthermore, van de Velde et al., 2012 even states that there is no evidence that vertical separation is "unconditionally superior or inferior" to other models and that TOC entry is possible under any model. M. Janssen and van Wee, 2019 also mention that the removal of vertical separation in the Dutch market is likely to have little or no impact on overall accessibility.

7.2.3. Delphi Contributions

In the Dutch PRM, the TOC and the IM are split into two separate entities (see also Figure 6.2); ProRail was set up as an independent administrative body (ZBO) for the role of the IM, with some distance to I&W (Veeneman, 2019a). Each year ProRail concludes access agreements with the TOCs, allocating a certain amount of capacity. The decision rules are transparent and define which trains have priority in cases where trains arrive at a station at the same time (M. Janssen et al., 2011). In the case of open-access services, ProRail determines whether there is sufficient capacity and the ACM decides whether the economic balance is not disturbed by the entry of the open-access TOC (van den Berg & van der Vlist, 2017).

Although the cooperation between ProRail and the TOCs is described as sufficient (van den Berg & van der Vlist, 2017), the current institutional arrangement leads to some challenges in this respect (van de Velde, 2019c). B. Janssen, 2009 conducted a study on the relationship between NS and ProRail and found some aspects problematic; NS is dependent on ProRail because the latter has a monopoly on the infrastructure. Two aspects may lead to opportunistic behaviour by ProRail, namely information asymmetry and the dependence of TOCs on ProRail. These aspects relate to ProRail's declaration of overcapacity (which can be prevented or delayed) and its capture of advantages in the distribution of costs and benefits. ProRail can and does operate legally as a social enterprise rather than a state enterprise. This strategy has strengthened ProRail's independent course. Over the years, several initiatives have been taken to better align the incentives between ProRail and the TOCs.

First, an investment committee was set up to resolve conflicts between NS and ProRail. Veeneman, 2019a reports that this committee is quite reactive, so it can take a long time to resolve conflicts. Secondly, the implementation of ERTMS is now the responsibility of I&W, so coordination and investment can be done at the initiative of the government. Thirdly, the programme '*Beter en Meer*' (Better and More) was initiated, which resulted in much better cooperation between NS and ProRail (van de Velde, 2019c). This initiative is an example of how an alliance between IM and TOC can lead to positive results. Finally, there are different levels of escalation between NS and ProRail.

The Delphi participants reflected on the issue of infrastructure management and in particular on the challenges related to infrastructure investment. Most participants agree that government has an important role to play in planning and coordinating investment. The government can balance the long-term costs and benefits of infrastructure. In addition, (additional) investment is only worthwhile if train services are maintained over a long period of time. This is also true for changes in the type of allotment, so the desired supply and type of service must be formulated before infrastructure needs can be derived from the former. Participants argue that the government can play this role, as it already does for road infrastructure.

7.2.4. Conclusions

There are several possible arrangements for managing railway infrastructure. Studies show that there is no superior option in all situations. It is clear that the main challenge is to reap the benefits of vertical separation and a level playing field while ensuring that coordination costs are kept under control and investment is incentivised.

In the Netherlands, further vertical integration is more likely than vertical separation, as studies suggest that dense networks (such as the Dutch network) have no cost advantages over vertically integrated IMs, apart from facilitating competition. Coordination and supervision by the government is necessary, especially for investments in infrastructure projects. In conclusion, deep alliances between TOCs and ProRail are the most promising arrangement, as cooperation programmes already exist and therefore require few institutional changes.

The next section discusses the degree of competition that can be introduced into a PRM and reviews the literature on the effects of different awarding mechanisms.

7.3. Degree of Competition

This section describes one of the hottest topics in the public transport policy debate: the degree of competition to be introduced into the PRM. As this is a hotly debated topic, it is good to recall why the introduction of competition has become common practice and the basis of European policy. The reasons for introducing competition will also be the criteria against which the different forms of competition will be examined in this section.

The PRM policy debate of recent decades has been driven by two main arguments for achieving greater cost efficiency and better service for passengers. First, Hirschhorn et al., 2018 describes that the degree of competition between TOCs was initially thought to have the greatest impact on achieving cost reductions. However, his study shows that these factors were not considered as important as previously thought. This is consistent with the view, implicit in this thesis, that PRM policy is not limited to a discussion of the degree of competition but is concerned with a wide range of coordination issues - a view also supported by van de Velde and Alexandersson, 2020.

Secondly, competition is expected to have a positive impact on the quality of service for the passenger, which is further enhanced by the reinvestment of the cost reductions resulting from the aforementioned increase in cost efficiency (Thompson, 2007). van Damme, 2019 states that competition is therefore preferable to regulation if the institutional framework is properly designed.

Before assessing the awarding mechanisms, it is important to distinguish between decentralisation and the introduction of competition. Section 7.1 discusses the decentralisation of train services, which is a logistical exercise and can be used as a tool to enable the introduction of competition. This section refers to studies on competition, but these studies are almost always based on cases where decentralisation and competition are introduced at the same time. Therefore, the effects cannot be examined separately.

This section first describes the nature of the sources of information on the subject and then discusses the awarding mechanisms of monopoly, PCT and open access. This is followed by a discussion of implementation issues. The section concludes with a discussion of the degree of competition in the Dutch PRM.

7.3.1. On Information and Understanding

To establish the relationship between awarding mechanisms (and other institutional features of a PRM, for that matter) and their effects, one would ideally like to compare these awarding mechanisms with each other in a controlled environment. Unfortunately, reality is unruly and there are no experiments in these matters. All studies of PRM coordination struggle with these problems: exogenous and endogenous variables are difficult to separate, effects that occur in one setting cannot be expected to occur in another (Mouwen, 2019), there is often a lack of consistent and comparable data from before and after policy reforms in different contexts (Decisio & TwynstraGudde, 2018; Nash et al., 2019), there is no knowledge of the situation without policy reform (Nash et al., 2016) and countries are difficult to compare due to their unique institutional, political and historical contexts (van de Velde, 2019b). For these reasons, studies that attempt to quantify the effects of policy choices produce inconclusive and sometimes contradictory results; it is often not possible to conclude that one choice is better than another, but more importantly, it is not possible to conclude the opposite (M. Janssen & van Wee, 2019; van de Velde, 2019c).

The second nuance to consider is the specificity of the institutional framework in a PRM. This thesis outlines general options for institutional frameworks and the key choices. However, research suggests that the role of the private sector is highly dependent on the specific framework adopted by countries (Thompson, 2007), all of which are based on the key contextual factors and attributes of that country (Preston & Robins, 2013). These therefore need to be identified before a choice is made (see sections 6.2, 6.1 and 6.3). In addition to the influence of country specificity, Friebel et al., 2010 suggests that the PRM is sensitive to changes in the institutional framework, which reinforces the understanding that there is no one-size-fits-all model for PRMs (van de Velde & Alexandersson, 2020). In conclusion, any model can work, depending on the value that policymakers seek from the model and the consistency of choices in the institutional framework (van de Velde, 2019a; Veeneman, 2021).

The next section discusses the advantages and disadvantages of each awarding mechanism, based on the current understanding of the literature and contributions from the Delphi study. The Delphi participants evaluated the different awarding mechanisms through a set of six market structure frameworks (see Figure 7.4), which will be covered in the following.

monopoly	status quo	service split	corridors	regions	open network
					
one network	main railway network (HRN) with decentralised lines (DL)	split between intercity (IC) and sprinter services (SPR)	split in corridors in the network	split in regions in the network	no pre-determined split
direct award	HRN: direct award DL: public comp. tendering	IC: direct award SPR: public comp. tendering	public competitive tendering	public competitive tendering	invitation to open access

Figure 7.4: Allotment types for the Dutch passenger rail market

7.3.2. Direct Award

A direct award is an awarding mechanism whereby the PTA grants a TOC the right to provide train services on a section of track for a specified period without the possibility of competition. The terms and conditions are set out in a contract agreed upon between the PTA and the TOC. In practice, this is a near monopoly, but the PTA is legally able to choose another TOC if it wishes. In most cases, the TOC operating under a direct award is partly or wholly owned by the government.

In the monopoly framework, a single TOC operates all services on the network. In the status quo framework, NS operates most of the network, with some lines on the periphery of the HRN being decentralised and put out to public tender. The literature and the Delphi participants identify several disadvantages and advantages of the use of direct awards, which are discussed below.

Disadvantages of Direct Award

The main argument put forward by participants for the introduction of PCT on the HRN is the fact that direct awards may not be allowed on parts of the network that are profitable under EU law. There are some exceptions, but there is no case law on this. The impact of this law is therefore unclear.

Secondly, there are no automatic incentives for the TOC to improve services in line with public values, e.g. quality, cost to the passenger and integration with other modes of transport (van den Berg & van der Vlist, 2017). The TOC does not have to compete with other TOCs, so there is a risk that it will design its services to its advantage. This can be mitigated if the government influences the TOC's decision-making, for example by being the largest or sole shareholder. However, there is always the question of how much room for manoeuvre the government needs to give the TOC to make its own strategic decisions (Veraart, 2012). In addition, the government must ensure that the monopolist does not undermine the opportunities for open-access services by strategically designing its timetable.

The third disadvantage of direct award is the negotiating position of the PTA. The bargaining position is already weakened by the fact that the concession is already (though not formally) awarded to the TOC before negotiations have even begun. Nevertheless, the PTA can exert more influence on the TOC's offer in advance than with a PCT (van den Berg & van der Vlist, 2017). Nevertheless, most participants agree that better concession management is needed to maintain the status quo. They state that the government needs to acquire more expertise and knowledge to better monitor, manage and develop train services. A body with sufficient expertise makes the thread of PCT more likely. This is consistent with publications by Veeneman, 2019a and van den Berg and van der Vlist, 2017 on the governance strategy of I&W. They describe the current strategy as being based on the thread of PCT, which should incentivise NS to continue to improve. Veeneman, 2019a gives three reasons why this

strategy is no longer viable for the future. Firstly, the strategy is finite if the concession is awarded directly time after time. Second, the complexity of the PRM increases if the credibility of the strategy is maintained by further decentralisation each time the concession is awarded. Moreover, as mentioned above, the current hybrid model of direct award on the HRN and PCT on decentralised lines may no longer be possible if European rules become stricter.

Finally, in a situation where there are parts of the network under PCT, the TOC under direct award can compete on these parts, whereas the reverse is not possible. This creates an uneven playing field, exacerbated by the fact that direct award TOCs often operate on large parts of the network and can therefore use their scale and power to offer a very competitive bid (Sorgdrager et al., 2008).

Advantages of Direct Award

Firstly, most participants agree that PCT on the HRN is not possible because if the HRN concession is put out to tender as a whole, it will be the largest and most complex public transport tender in the world. It is therefore unknown whether there is a TOC able and willing to bid for this concession. Others argue that the current timetables could be simplified to make them more suitable for tendering. On the other hand, simplifying and splitting the HRN's services could result in disadvantages for passengers in terms of additional transfers, fare differentiation and separate payment methods.

Secondly, European legislation does not allow PTAs to revert to direct award after adopting PCT. This creates a barrier for PTAs to experiment with PCT as it is a definitive choice (Veeneman, 2019a).

Third, the creation of a strong regulator can mitigate many of the existing disadvantages of direct award (Sorgdrager et al., 2008; Veraart, 2012). Some argue that the emergence of another player in the sector will only lead to more complexity and that the current players are equipped for all tasks, while others favour a single entity with clear responsibilities and in charge of the PRM, which they believe will lead to less bureaucracy and complexity.

Fourthly, some studies have found that negotiated public transport contracts sometimes deliver better value for money than PCT contracts. These studies base their conclusions on case studies of bus services in the southern hemisphere (D. Hensher & Stanley, 2003, 2005, 2008; Kavanagh, 2016; Stanley & Hensher, 2008). These authors mention that *"a trusting partnership between the PTA and the bus operating company is seen as being an integral part of such arrangements*". In such arrangements, the PTA and the TOC can work together to achieve common goals. However, the applicability of these conclusions to rail services is not established.

Finally, the introduction of PCT on the HRN is not expected to lead to significant differences, as rolling stock and personnel will inevitably have to be transferred to the new TOC. In other words, the new situation will only lead to a new management of the company. This removes real market pressure and nullifies the benefits of competition. Others argue that the new management will be able to make different decisions about rolling stock and personnel, with significant consequences. The next section on PCT presents the current understanding of the impact of PCT on PRMs.

7.3.3. Public Competitive Tendering

Public tendering is an awarding mechanism whereby the PTA grants a TOC the right to provide train services on a section of track for a specified period, following a tendering process. The PTA may set minimum standards and/or service requirements and award the rights to the TOC with the most favourable bid. The impact of PCT on cost efficiency, rail services and the market dynamics are discussed in this section.

Impact of PCT on Cost Efficiency

Countries began to adopt PCT as a way of increasing cost efficiency and reducing government subsidies. It is believed that privately owned TOCs are better able to tailor their services to the needs of markets and customers (Thompson, 2007). They have lower overhead costs due to their organisational form (small, flexible and self-governing (M. Janssen et al., 2011)), are better able to plan human resources and take advantage of more favourable employment conditions (van den Berg & van der Vlist, 2017).

While this sounds very promising, some very important comments should be made here. First, private TOCs have to deal with existing rules on the transfer of staff and rolling stock. This limits freedom in

terms of employment conditions and sometimes even in terms of staff scheduling (van den Berg & van der Vlist, 2017). Secondly, there is a risk of capital destruction if, for example, TOCs buy completely new (unnecessary) rolling stock in favour of the existing fleet (Koppenjan, 2012). Thirdly, one of the main advantages of private TOCs under PCT is their small size and flexibility. This can eventually lead to ”organisational anorexia” where TOCs do not have sufficient buffers, making the service less reliable (Koppenjan, 2012). In addition, the advantages of small and flexible TOCs can evaporate when larger parts of a network are put out to tender and TOCs grow accordingly (M. Janssen et al., 2011).

Several studies have attempted to quantify the impact of PCT on cost efficiency. As noted earlier in this chapter, the conclusions of these studies are based on individual cases and cannot be extrapolated across markets (Alexandersson, 2010; M. Janssen et al., 2011; Mofair, 2009; Nash et al., 2016; M. G. Pollitt & Smith, 2005). Furthermore, studies on cost efficiency contradict each other; Alexandersson, 2009 found that the introduction of PCT in the Netherlands led to a cost reduction of about 20%, while Veeneman et al., 2014 found the opposite when comparing tendered and non-tendered concessions. The introduction of PCT in Germany was found to have led to cost reductions (Mofair, 2009; Mouwen, 2019; Nash et al., 2016, 2019), while Preston and Robins, 2013 concluded that the introduction of PCT in the UK was ultimately welfare negative due to the ”*complexity and fragmented nature of the supply side arrangements*”.

It can therefore neither be concluded nor ruled out that PCT leads to greater cost efficiency.

Impact of PCT on Rail Services

The literature identifies several effects of PCT on rail services, often related to service integration, frequency, ridership, safety and overall innovation. Janse de Jonge, 2012 shares that these effects depend on what the concessionaire contracts with the TOC and are only partly the result of PCT and decentralisation, as requirements can be contractually defined.

A major effect of PCT is the loss of **integration of train services** at a national level. Competition in the Netherlands requires a division of the HRN, which makes interregional journeys more difficult. This will inevitably affect the number of transfers passengers have to make during their journey.

Secondly, PCT has often led to an increase in service **frequency** (Baanders et al., 2011; Decisio & TwynstraGudde, 2018). This option is supported by (potential) cost efficiencies that can be used to offer more services to passengers (van Dijk, 2007). The main condition for increasing frequency is the availability of capacity on the infrastructure to do so (Decisio & TwynstraGudde, 2018). Unfortunately, this is not always the case - as illustrated in section 6.3. If more than one TOC is awarded capacity on a section of track, capacity may even be reduced because of concurrence between services (Baanders et al., 2011).

In addition to increasing frequency, competition is often seen as an incentive for **innovation** (van den Berg & van der Vlist, 2017). Incentives for TOCs to innovate are cited as long-term, large concessions, contracts where the development function and revenue responsibility are assigned to the TOC (see also section 7.5), and tendering procedures where innovation is directly rewarded (Mouwen, 2019). Decisio et al., 2020 reports that the level of innovation in the Netherlands is equal between the decentralised lines (operating under PCT) and the HRN (operating under direct award). The same is true for Sweden, where the introduction of competition is thought to have little effect on innovation (Alexandersson & Hultén, 2005). Reasons for this understanding can be found in the incentives for innovation mentioned above; competition in the Netherlands requires decentralisation - something that reduces the size of concessions (M. Janssen & van Wee, 2019), and the short concession period of current concession contracts is at odds with the often long payback period of innovation (Mouwen, 2019).

Some suggest that PCT (in combination with decentralisation) can improve **ridership** because of better synergy between train and BTM, lower fares and a better image (Baanders et al., 2011) (for example through the use of new rolling stock (Mouwen, 2019)). FMN (a partnership of Dutch private TOCs) estimates that it can increase ridership after PCT by 16 to 25% in the first year and 20% in the following five years. Janse de Jonge, 2012 evaluated their plans and concluded that these growth figures are not feasible, as the lines where PCT was previously introduced (and on which the estimates are based) are not comparable 1:1 with the proposed lines to be converted to PCT. Nevertheless, van den Berg and van der Vlist, 2017 report that some growth can be expected. Looking at the scientific data, there

was indeed an increase in demand after the introduction of PCT in the Netherlands (van Dijk, 2007), but there is no evidence that this is solely due to the introduction of PCT (Nash et al., 2016; van de Velde & Alexandersson, 2020).

Following the introduction of PCT in the UK, concerns were raised about **safety**. Although there have been some major accidents in this particular case, several sources state that there is little reason to believe that privatisation leads to a decrease in safety (M. Janssen & van Wee, 2019; Nash et al., 2016; van den Berg & van der Vlist, 2017). The ILT reports that for the Dutch PRM, there are regulations at the European level to prevent a decrease in safety. The only cause for concern is a recent statement by the ILT that (Dutch) TOCs do not sufficiently ensure the professional competence of drivers, which can lead to incidents (Decisio et al., 2020).

Impact of PCT on Other Aspects

The introduction of PCT has an impact on the number of TOCs in the market and the procedural costs for the government.

Competition is only meaningful if enough parties are competing in the market (Decisio et al., 2020; Veraart, 2012). The **number of TOCs** able to bid seriously for a regional concession in the Netherlands has proved to be limited, with an average of 4 to 8 competing TOCs per concession (Decisio et al., 2020; Janse de Jonge, 2012). Most TOCs in the Dutch market are subsidiaries of state-owned companies (van den Berg & van der Vlist, 2017), with EBS being the only exception. Some smaller international TOCs have competed but have not been successful in winning a contract (Decisio et al., 2020). In addition, it is interesting to note that after liberalisation there has been no increase in the private sector at the European level apart from the state-owned companies (van de Velde, 2019b). It is not clear whether the involvement of state-owned companies harms the market entry of private guanine companies (Nash et al., 2016).

Delphi participants rated the influence of the market structure framework on the number of entrants using a 5-point Likert scale ranging from ”negative influence” (1) to ”positive influence” (5). The results, presented in Table 7.2, suggest that an increase in contractual freedom and smaller lots in the market structure framework leads to a higher number of entrants. The ’monopoly’ and ’status quo’ frameworks have a clear negative effect on the number of entrants. Furthermore, there is a higher degree of disagreement among the participants regarding the influence of the ’open network’ framework, as indicated by the higher standard deviation (0.90) compared to the other market structure frameworks.

market structure framework	**avg. [1-5]**	**SD**
monopoly	1.33	0.78
status quo	2.17	0.83
service split	3.67	0.78
corridors	3.67	0.65
regions	3.75	0.62
open network	3.92	0.90

Table 7.2: Estimated impact of market structure framework on the number of entrants to the Dutch PRM

When governments decide to introduce competition rather than direct award, they must take into account the **procedural costs** of this new awarding mechanism. For example, tendering procedures are very complicated and costly. Transaction costs as a result of PCT are estimated at 4 to 8 million euros per concession (van den Berg & van der Vlist, 2017) and a tendering process can take up to four years (van de Velde & Röntgen, 2020).

Three frameworks for PCT implementation were evaluated by the Delphi participants and are discussed below.

Service Split

Train services can be split by service type, with intercity and sprinter services separated. It is obvious that in this case, sprinter services will be decentralised for a more regional focus. This is directly one of

the main advantages of this model, as stated by the participants. The sprinter services can be optimised at a regional level, while the intercity services can be optimised at a national level. In addition, some believe that the intercity services are likely to be profitable, while the sprinter services are not. By dividing along this axis funding streams can become more transparent.

Participants identified significant challenges to PCT in this model. Although decentralised sprinter services lend themselves to PCT, the tendering of all intercity services is considered to be too large for a single TOC to bid for. In addition, the synergy between sprinter and intercity services may be lost if the services are separated. This leads to integration problems and would require strong government involvement in network development. Moreover, changing to a service split model would require the government to acquire a great deal of new expertise in network development and tendering procedures - the latter being identified by participants as very important to the success of a PCT model.

Finally, the participants propose different strategies for the implementation of a service split model. The challenges of integration and the dismantling of the national TOC require a clear division of tasks between the TOCs in the market. As stronger government involvement and acquisition of expertise were identified as one of the main challenges, an (independent) organisation for the management and development of the PRM could be considered. Finally, a catalogue of train paths, which could be provided by ProRail and/or I&W, could be created to facilitate integration and eliminate interface problems.

Corridors

Another alternative is to divide the network into corridors while maintaining the current logistical corridors. This approach reduces the need for significant infrastructure changes. Participants identified several advantages of this model compared to the other decentralisation models.

Firstly, the scale of the corridors in the current network is suitable for PCT, being neither too small nor too large. In addition, the relatively isolated nature of the corridors allows PCT to be introduced gradually, one corridor at a time. This gives the government time to learn and removes some of the risks of changing the whole PRM at once. Thirdly, the separate tendering of corridors leaves room to tailor concession contracts to the specific nature of the corridor, with opportunities for regional integration. Finally, some believe that the logistical simplification of the corridor model compared to the current model will reduce the logistical challenges in terms of disruptions and rolling stock failures currently experienced on the heavily interconnected network.

In addition to the benefits, participants identified several challenges with the corridor model. Firstly, as the corridors are being separated, there is a necessary role for the government to ensure that there is some integration between the corridors. However, the main uncertainty with this model seems to be the interface between the corridors. It is not known how people move between the corridors and what the impact of their unbundling might be. Solving this problem requires expertise in network development and the involvement of different stakeholders in the process. For this task, it is clear to the participants that the government needs to acquire a lot of expertise in this area (as mentioned earlier in this thesis). Secondly, to reduce the transaction costs of large tenders in this model, the possibility is raised of making concession periods longer and based on benchmarking; concessions can then be extended if certain benchmarks are met (more on this in section 7.7). Third, it is necessary to include clauses in the contracts to ensure that a single TOC cannot take advantage of the interaction benefits of operating on two or more corridors. For example, the government can limit the number of corridors per TOC.

Regions

Full regionalisation of all services is the fifth model evaluated by the participants. In this scenario, intercity and sprinter services are not separated but only decentralised. The main advantages of this model are that it allows for even greater regional integration (compared to the other models) and that full decentralisation results in regions of a size appropriate for PCT.

Three disadvantages were identified by the participants. With full decentralisation, national corridors are likely to disappear or be difficult to establish. This has a major impact on passengers, who in the Netherlands mainly travel nationally (see section 6.3). Strict conditions must therefore be included in the contracts for integration between regions. Secondly, regionalisation requires significant changes to the infrastructure to create extra capacity at border stations (see section 7.1).

In conclusion, the governments need to weigh up the benefits of regional policy influence to the costs of implementing such a model.

7.3.4. Open Access

Open access is an awarding mechanism in which the PTA does not take the initiative in defining the characteristics of the service. TOCs can apply for capacity on the network for self-proposed train services. Approval is required from the IM (for capacity) and the market regulator (to prevent market failure), following an inspection of rolling stock safety and minimum requirements.

Nash et al., 2016 describe the effects of open access on the market and the services offered, based on several case studies. They report that in most cases open access TOCs have offered lower fares by reducing on-board services rather than competing on speed or frequency. In addition, the introduction of open access has increased the size of the PRM, to the benefit of passengers. According to the same study, these effects are influenced by five factors: high traffic volumes, low track access charges, the ease of obtaining suitable paths, the perception that the existing TOC is relatively inefficient and could be undercut on costs, and the availability of spare infrastructure capacity.

The implementation of open access in the European PRM has not led to immediate improvements. An international comparison of nine European countries by Casullo, 2016 shows that there has been some market entry by new TOCs, but that cost reductions have not (yet) been visible. This finding is supported by Perennes, 2017 who states that it may take several years for open-access services to emerge and improve due to barriers to entry such as lack of available infrastructure capacity, technical barriers and the capital-intensive nature of the rail industry.

Several disadvantages emerge from the literature and the Delphi study. First, Nash et al., 2016 cites the case of Czechia, where the introduction of open-access services led to congestion problems on the most popular routes. This is an indication that infrastructure capacity is not being used optimally. Second, there is no conclusive evidence that regular open-access services emerge after market opening, as in Germany, where even after 25 years of open access, new entrants cover less than 1 per cent of services (Séguret, 2009; van de Velde & Alexandersson, 2020), although ”niche” services (e.g. night trains) emerge more frequently (Perennes, 2017). Thirdly, the supply of services can be drastically reduced and quickly changed due to cherry-picking by the TOCs. To ensure that public values and a certain level of service are protected, the government has to buy additional services from the TOCs to fill the gaps, which can be very expensive. Finally, there is no experience with open access on such a large scale, so it is very uncertain what impact this decision will have on the PRM.

To address these challenges, the government will need to set entry conditions for TOCs or even enter into contracts with TOCs. This practice is likely to move towards concession contracts, which was not intended in this model. The Delphi participants therefore do not consider open access to be a viable market structure for the Dutch network.

EU member states may restrict the right to open access for two reasons The first is the need to protect the economic equilibrium on sections and lines where a concession exists. The market regulator (ACM in the Netherlands) carries out a preliminary assessment (van den Berg & van der Vlist, 2017; van de Velde & Röntgen, 2020). Secondly, the IM carries out a capacity analysis to ensure that there is sufficient capacity in the network for an open-access service alongside existing services. How these reasons are taken into account in the decision-making process and how the concession holder is compensated for the loss of revenue must be clearly described in any concession contract (van de Velde & Röntgen, 2020).

One way to get around the above limitations is to introduce a new awarding mechanism, which in this thesis is called an *invitation to open access*. This is an awarding mechanism in which the PTA grants capacity to TOCs after a tendering procedure. It is important to note that this only grants the right to use a certain amount of track capacity, not the right to provide train services. This model was first introduced in Spain, where 70% of the network capacity was distributed among three TOCs after a tendering procedure, while the remaining 30% was reserved for pure open access. In this case, the PTA is not responsible for or involved in the service specification (J. J. Montero & Melero, 2022). With this mechanism, TOCs have the freedom to design their timetables but are not constrained by unclear capacity limits.

7.3.5. Conclusions

Looking at the literature on the level of competition, the two main reasons for introducing competition can be assessed. The literature shows us that the effect of competition on cost efficiency is inconclusive. Therefore, it can neither be confirmed nor denied that competition leads to more cost efficiency. In addition, some benefits of competition can be mentioned in terms of quality of service, but it is questionable whether these benefits apply to the Dutch PRM. For example, increased frequency is cited as one of the main factors in improving services, but there is almost no additional capacity left on the Dutch infrastructure.

The main dilemma in deciding on the degree of competition is the balance between the assumed benefits of competition and the additional coordination costs for the government. Since the benefits of PCT and open access are questionable, the additional coordination costs of introducing more competition are significant, and the problems with direct award can be solved without competition, it can be concluded that - if European legislation allows it - direct award is the preferred award mechanism.

If the introduction of competition becomes mandatory, the corridor model is considered the most appropriate by the Delphi participants. Although integration between corridors is lost and the market balance needs to be closely monitored, it requires the least infrastructural changes and allows for gradual implementation.

Irrespective of the level of competition, questions are raised about the role of governments in the proposed market structures. The next section discusses the role of governments and the relationships between them.

7.4. Government Roles and the Relationship between Governments

It was noted in section 6.1 that the Dutch government wants to protect public values regarding rail services through some form of government intervention. The majority of Delphi participants agree that the role of the national government will need to be increased, regardless of the market structure implemented. It is noteworthy that participants argue that even in an open-access model (where the basic premise is less government intervention) there is a large coordinating role for the government. The role of government needs to be adapted to address the challenges identified in the current situation. This section describes these challenges and proposes a national public transport agency to resolve these issues.

7.4.1. Challenges for the Dutch Government

At present, NS has a high degree of autonomy in shaping its services, while the regional TOCs have more influence from the PTAs (Decisio et al., 2020; van den Berg & van der Vlist, 2017). This ensures that regional services are well adapted to the needs of the region (Janse de Jonge, 2012; Nash et al., 2019; van Dijk, 2007). I&W's strategy towards NS is described by Veeneman, 2019a as 'hands-off', i.e. management based on contractual obligations rather than substantive involvement. The Delphi participants and some literature sources van den Berg and van der Vlist, 2017; Veeneman, 2019b agree that a more engaging strategy is needed to improve the role of government, which leads to the second challenge.

The Delphi participants contribute that the government needs to acquire more expertise and knowledge to better monitor, manage and develop rail services and to strengthen its position in relation to NS. For example, I&W currently has limited experience with concessions and relies partly on input from consultants, NS and ProRail. The possible introduction of PCT on a large scale will require it to acquire this expertise externally or from the regional PTAs (M. Janssen et al., 2011). van de Velde and Röntgen, 2020 refer to the case of the UK, which showed that a significant amount of preparation (in terms of time and staff) led to the successful tendering of large parts of the rail network. Nevertheless, the authors mention that securing expertise and knowledge is a difficult task as it is largely based on experience, which is difficult for a single PTA to acquire as tendering procedures are not frequent (Decisio et al., 2020; de Goeij, 2011; Mouwen, 2019; van de Velde, 2019b, 2019c).

The third challenge for the government is the sometimes confusing division of responsibilities between different branches and levels of government, which hampers the management of the IM and the TOCs. For example, the Ministry of Finance is a shareholder in NS, while I&W is the system manager and concessionaire of NS (van den Berg & van der Vlist, 2017). In addition, the IM and the TOCs have to take into account not only the interests of the national government but also those of the regional governments. Furthermore, in most cases, the people involved in preparing and carrying out the bidding process are different from those involved in operating and managing the concession. This hampers the transfer of knowledge and 'philosophy' of the concession between government(s) and TOC(s) (Decisio et al., 2020).

Fourthly, literature sources mention that the smooth, timely and independent gathering and sharing of information between stakeholders is seen as key to achieving ambitions in the PRM and for governments to maintain a good grip on the market (Janse de Jonge, 2012; Nash et al., 2019; Thompson, 2007; van den Berg & van der Vlist, 2017; van de Velde & Röntgen, 2020). Furthermore, equal access to data and information is key to a level playing field for TOCs. Otherwise, the incumbent TOC has a huge advantage over new entrants as it has data on both operating costs and passenger behaviour (Decisio et al., 2020).

Finally, cooperation and alignment of interests between different levels of government require attention. The Delphi participants also seem to agree that the role of regional governments is always present. It is therefore important to ensure that their interests are heard and taken into account in decision-making. The specific level of (de-)centralisation is of particular importance, as it may increase the role of these governments (e.g. in the case of full regionalisation) or make cross-border services more difficult. In addition, structural change may entail transition costs as tasks are transferred between different levels of government. Cooperation may be hampered by the fact that regional PTAs initially focused solely on acquiring the necessary expertise for tendering (Veeneman, 2019b), as well as the tendency of regional

PTAs to protect their interests at the expense of the public transport system as a whole (M. Janssen et al., 2011; Rover, 2016).

7.4.2. National Public Transport Agency

Several strategies have been proposed in the literature to address the challenges of gathering information and expertise. Some suggest the creation of a 'standard concession' for rail services to counter fragmentation between concessions (Janse de Jonge, 2012). Others suggest that I&W should take a stricter approach and impose more restrictions and conditions, for example on rolling stock, control of TOCs and cooperation between concessions (Baanders et al., 2011; van den Berg & van der Vlist, 2017).

The most prominent strategy proposed is the creation of a national public transport agency (M. Janssen et al., 2011; Mouwen, 2019; Nash et al., 2019; Sjonger & Weeda, 2008; van de Velde et al., 2009) to create an entity with *"the necessary independence, knowledge and integral view of transport"* (van den Berg & van der Vlist, 2017). A National Public Transport Agency (NPTA) can be an independent body with a mandate from national and regional governments to manage the passenger rail (or even public transport) market. It can carry out its role based on transport policies developed by national and regional politicians, leaving strategic decision-making to parliaments. The NPTA, together with the TOCs, is responsible for tactical decision-making, i.e. the design of rail (or public transport) services and integrates the interests of all stakeholders, i.e. different levels of government, TOCs, IM, passengers and residents.

The *Eisenbahn-Bundesambt*

The Dutch government can look at international examples of NPTAs that have already been implemented. A striking example is the German Federal Railway Authority (*Eisenbahn-Bundesambt*), which is responsible for concessions of national and (if delegated by the Länder) regional rail services, safety supervision and advising the national TOC on service development through a multi-stakeholder advisory board (*Netzbeirat*). This authority is under direct supervision of the German Ministry for Digital and Transport (Eisenbahn-Bundesambt, 2024).

Frame 7.2: The Eisenbahn-Bundesambt

The creation of an NPTA can go a long way towards addressing the challenges identified in the previous section. Firstly, it can create clarity in the roles of the market players; I&W is responsible for transport policy (strategic decision making), the NPTA has the final say on the design of train services through different awarding mechanisms (tactical decision making) and the TOCs are responsible for operations (operational decision making). Secondly, the agency inherently creates continuity and consistency across all concessions as it is responsible for all of them. For this reason, it is argued that all public transport concessions in the country should be assigned to the NPTA. Thirdly, a national agency can bring together the experience and knowledge of the entire public transport market in one place, resulting in an entity capable of balancing market forces and protecting public values in the long term (M. Janssen et al., 2011; van den Berg & van der Vlist, 2017; van de Velde & Röntgen, 2020). Finally, a strong agency with the appropriate responsibilities and expertise has a strong position in relation to TOCs operating under a direct award, as it can counterbalance their power.

7.4.3. Conclusions

In conclusion, two main coordination issues need to be addressed. First, the government needs to decide how it wants to structure its relationship with TOCs and the IM. This may be a hierarchical relationship, with contractual steering and strict conditions, or a more hybrid arrangement, where co-operation plays an important role. Second, the government needs to decide which entity in the PRM will be given what responsibility. Tasks can be distributed among existing players or assigned to a new government agency.

It is clear from the literature and the input from the Delphi participants that the government needs to strengthen its information position and gather more knowledge and expertise to adequately manage the PRM. This can again be done by expanding and intensifying existing relationships, or by establishing a new body with the resources to do this.

7.5. Revenue and Development Responsibility

This section describes the financial arrangements in the PRM in terms of government subsidy and revenue responsibility. Revenue responsibility in the context of public transport refers to the obligation or responsibility of an entity to generate revenue to cover operating costs and potentially generate surplus funds. Revenue responsibility is typically vested in either the PTA or the TOC and the specific arrangements are set out in the concession contract, often in conjunction with the development responsibility. The choices that the government can make in this regard are discussed further in this section.

First, the financial context of the Dutch PRM is described, and then the choices and implications of assigning revenue responsibility are described. Subsequently, the allocation of development responsibilities is discussed. The contributions of the Delphi participants are then presented, after which this section is concluded.

7.5.1. Financial Context of the Dutch Passenger Rail Market

The financial situation of the Dutch PRM has gone through roughly three phases in the last century. Before privatisation, NS was subsidised by the national government and did not have to pay for the use of the infrastructure. Until 2008, NS paid nothing to the Dutch state for the transport concession. After that period, NS was obliged to pay an increasing amount of fees for the transport concession as well as user fees for the infrastructure (Decisio et al., 2020). This was partly due to the relatively low operating costs of NS compared to other TOCs (van de Velde & Röntgen, 2020). This came to an end during the COVID-19 pandemic when ridership dropped significantly and revenues were insufficient to cover operating costs. Since then, NS has received subsidies for its operations.

The TOCs operating on the decentralised lines have always received state subsidies, as they are unprofitable but considered essential for public service reasons (Finger & Messulam, 2015). The PTAs receive subsidies from the national government through the *Brede Doel Uitkeringen* and the *Provinciefonds*. Decisio et al., 2020 report that national subsidies are decreasing while operating costs are increasing. To counter these effects, PTAs are opting to reduce the number of services, increase fares and use more of their own funds to finance operations. An earlier report articulated the belief of regional governments that they should not be responsible for financing public transport and that the costs should be borne by the national government (Decisio & TwynstraGudde, 2018).

A key dynamic often mentioned in discussions of structural reform is the cross-subsidisation between profitable and unprofitable services. NS states that it operates sprinter services at a loss and compensates for these losses with its profitable intercity services. Although it is not known how large these cross-subsidies are, it is understood that sprinter services are indeed less profitable than intercity services. This is because intercity services have higher capacity utilisation than sprinter services. In addition, intercity trains have fewer stops and higher speeds than sprinter trains. This results in a more efficient use of rolling stock (Sjonger & Weeda, 2008). In the case of any form of decentralisation, these dynamics must be taken into account, as they can change the profitability of certain parts of the network (Baanders et al., 2011; J. Montero & Finger, 2020).

Decisio et al., 2020 states that if the government decides to introduce more competition, several TOCs should be able to compete on a level playing field. In this way, PTAs will have a real choice when awarding concessions. To create a level playing field, TOCs should bear the financial risk that they cannot pass on to the taxpayer (i.e. the government). This means that the government cannot own (all) shares in a TOC, which is currently the case with the Dutch government owning all shares in NS. In the current situation, the Ministry of Finance acts as shareholder and steers towards a healthy financial return, while I&W acts as concessionaire and system manager (van den Berg & van der Vlist, 2017).

This section continues with a discussion of the difference between gross and net cost contracts.

7.5.2. Gross and Net Cost Contracts

When allocating revenue responsibility, two types of contracts can be considered: net cost or gross cost contracts. Under a net cost contract, the TOC bears the cost (and therefore the risk) of operating the train service, including all operational costs such as staff and maintenance. The TOC then receives compensation from the PTA to cover part of these costs. The amount received by the TOC is determined on the basis of a pre-agreed rate per train kilometre or other appropriate basis. Under a gross cost

contract, the PTA bears the full cost of operating the train service, including all operating costs. The TOC receives compensation from the PTA for providing the train service but is not directly involved in the costs of operation. Under this contract, the PTA bears the revenue responsibility.

Most research concludes that revenue responsibility should lie with the party best able to manage the risks that affect revenues. For exogenous risks, this should be the government. However, for risks related to service design, the risk is best managed by the party responsible for development. This is discussed in a later section.

The main advantage of a net cost contract is the financial incentive for the TOC to increase revenues by attracting more passengers. This can have a positive impact on service quality, better information provision, seamless transfers between services and other innovations (M. Janssen et al., 2011). In addition, the national TOC can be managed efficiently through financial incentives such as fines and bonuses, which is more difficult under a gross cost contract (van den Berg & van der Vlist, 2017).

Gross cost contracts, on the other hand, often do not include financial incentives but are managed through contractual service quality conditions (M. Janssen et al., 2011; McNulty, 2011). Although this type of contract increases the preparation and monitoring costs for the PTA, it is more attractive to TOCs as they do not have to bear the operational risk (Nash et al., 2016).

Although the literature on the effects of both types of contract is inconclusive (Beck, 2011; Hunold & Wolf, 2013; Link, 2016, 2017; Mouwen, 2019; Nash et al., 2016, 2019), a major expert study on the subject by van de Velde and Alexandersson, 2020 comes to a clear recommendation. Their group of experts strongly recommends the use of gross cost contracts for public transport services for a variety of reasons; the increase in ridership under net cost contracts is considered ”illusory”, and the alignment of risk and revenue responsibility is considered the most important aspect. According to these experts, gross cost contracts are therefore the best alternative. Furthermore, the experts conclude that gross cost contracts are easier and simpler to manage if and when the PTA is equipped to contribute to service design and risk assessment. In addition, van de Velde and Eerdmans, 2014 makes a valid point that incentivising TOCs does not always have to be accompanied by financial instruments, but can also include, for example, contract extension if passenger satisfaction is sufficient.

The next section discusses the allocation of development responsibilities.

7.5.3. Development Responsibility

Development responsibility typically refers to the responsibility of stakeholders to plan and implement the development of railway services and systems, such as changes to lines, timetables, vehicle types or fares (Decisio et al., 2020). Responsibility for development can be allocated at the three levels introduced in the theoretical framework (strategic, tactical and operational). The strategic level is usually vested in the government and the operational level is in the TOC. The tactical level is the main point of discussion, as the division of responsibilities can be very different.

PTAs often take on a significant part of the development responsibility to ensure that public values are protected. While this strategy ensures government influence over public transport, the strict and detailed product descriptions limit the ability of TOCs to innovate and differentiate themselves from other TOCs (van den Berg & van der Vlist, 2017). As PCT can already hinder communication between PTAs and TOCs (by focusing on contractual obligations and hierarchical control) a more collaborative approach is often proposed in the literature (D. Hensher & Houghton, 2004; D. Hensher & Stanley, 2003; Kavanagh, 2016; Stanley, 2009; Stanley et al., 2005).

PTAs are increasingly using collaborative strategies to develop rail services, often through ’development teams’ in which PTAs, TOCs and sometimes consumer organisations and municipalities work together. A step further is the creation of a joint development company or public transport agency responsible for all tactical decisions. These collaborative approaches ensure public influence while using the knowledge and expertise of the TOCs to promote innovation and the best possible quality of service. An important side-effect of these collaborative approaches is that TOCs may behave strategically, using collaboration and negotiation to increase concession margins. Finally, the collaboration between PTA and TOC must protect the competitive position of the TOC, so innovation should take place in a secure environment and according to a transparent, pre-determined procedure (van de Velde & Alexan-

dersson, 2020; van de Velde & Eerdmans, 2014; Veeneman, 2019a).

7.5.4. Delphi Contributions

The Delphi participants were asked which party should be assigned revenue responsibility. The results show that in all market structure frameworks considered, the majority of respondents indicated that revenue responsibility should be assigned to the TOC (Table 7.3). This seems to contradict the above-mentioned study by van de Velde and Alexandersson, 2020. The reasons given by participants for this choice are that TOCs are best placed to respond to demand and the market and that financial incentives can be used to manage based on public value. A key element mentioned by participants is that the revenue responsibility should be linked to development responsibility.

This can be seen as an indicator that the participants in this Delphi study are essentially in agreement with the study by van de Velde and Alexandersson. In the Netherlands, PTAs often intervene in some way in the development of services - contrary to the proposed freedom in the proposed market structure frameworks. It could therefore be assumed that the development of services lies with the TOC in these frameworks and therefore also the revenue responsibility. This is also reflected in the greater disagreement between participants in the monopoly and status quo scenarios, where the government plays a greater role in service design. This is reinforced by the participants' belief that in the case of large - and therefore less attractive - concessions (as in a monopoly or status quo), the risks are too great for the TOCs and should instead be allocated to the government.

market structure	TOC	PTA	different
monopoly	64%	36%	0%
status quo	67%	33%	0%
service split	80%	20%	0%
regions	80%	20%	0%
open network	73%	27%	0%

Table 7.3: Results on the allocation of revenue responsibility

7.5.5. Conclusions

In order to protect public values, the government needs to subsidise certain services that would otherwise not be profitable. To provide these subsidies, two types of contracts are possible: net cost or gross cost contracts. The choice between these two types of contracts depends on the decision as to which entity is primarily responsible for developing the service and therefore best placed to manage the risks associated with operating the train service. A clear decision is therefore needed as to which entity is responsible for which level of decision-making. The main challenge in this respect is at the tactical level, where collaborative strategies are more often used so there is a grey area as to who is the primary risk bearer.

The next section describes the role of station ownership and development.

7.6. Station Ownership

This section discusses the ownership and development of stations. The first part describes the current situation in the Netherlands, after which the challenges of decentralisation and competition are discussed. Finally, the Delphi contributions are presented and the section is concluded.

7.6.1. Current Situation in the Netherlands

Two entities are responsible for stations in the Netherlands; ProRail owns the track infrastructure, while NS Stations (part of the NS holding) owns the station buildings. The TOCs pay user charges for the use of this infrastructure and service (Decisio et al., 2020). ACM monitors that NS Stations treats all TOCs equally in terms of access conditions and user fees. Despite the non-discriminatory use of stations, the relationship between NS and the other TOCs has not always been optimal (Sorgdrager et al., 2008; van den Berg & van der Vlist, 2017; van de Velde & Röntgen, 2020).

This division of responsibilities between ProRail and NS is described as complex and unclear by van den Berg and van der Vlist, 2017 and Teulings, 2019. Despite a perhaps confusing institutional configuration, stations are in the middle of the European Union in terms of customer satisfaction, although satisfaction has increased over the years.

7.6.2. Challenges of Decentralisation and Competition

It is understood that in the event of decentralisation and the introduction of more competition, ownership of stations will need to be transferred from NS Stations to an independent entity in order to remove barriers to entry in terms of access to these stations (Koppenjan, 2012; Nash et al., 2016). In some cases, with minimal decentralisation, ownership could remain with NS Stations to avoid unnecessary transition costs, reportedly in the hundreds of millions of euros (van den Berg & van der Vlist, 2017).

The main dilemma here is the trade-off between fair access to stations and the benefits of vertical integration of train services and stations. Ownership of stations can be an incentive for TOCs to invest in them to increase ridership and be a valuable part of the TOCs' revenue stream (as in Hong Kong, for example, and even in the Netherlands, where stations have become hotspots for restaurants and shops). This can even have a positive impact on the protection of public values (M. Janssen & van Wee, 2019; van de Velde & Röntgen, 2020). Teulings, 2019 notes that the separation of stations makes sense in sparsely populated areas to allow better competition on the tracks, but may not outweigh the benefits of vertical integration in large urban areas.

7.6.3. Delphi Contributions

The Delphi participants recognise the dilemma outlined above but feel that fair access is paramount so that in the event of further decentralisation, ownership of stations should indeed be transferred to an entity other than NS Stations. This should be an independent entity and not (one of) the TOCs operating on the network, as becomes a problem at border stations where several TOCs operate. With a monopoly or in the status quo, they see no reason to change the current institutional configuration.

7.6.4. Conclusions

The main dilemma arising from the position of the stations is how much decentralisation can take place before the ownership role of NS Stations becomes untenable. The Delphi participants agree that the status quo does not require reform, but further decentralisation makes structural change inevitable.

7.7. Nature of Contracts

The literature describes two aspects of rail service contracts that require attention from PTAs: the duration of the contracts and the degree of flexibility included in them. These issues are therefore discussed in this section. The Delphi participants did not reflect on this issue.

7.7.1. Duration of Contracts

For multimodal passenger rail transport contracts (as is common in the Netherlands), contracts usually have a duration of 10 to 15 years, which is in line with European legislation (Public Service Obligation). European legislation allows even longer durations if the contract is unimodal (more than 50% rail services in the contract) (M. Janssen et al., 2011). The duration of contracts in the Netherlands has become increasingly longer, together with a decrease in the number of PTAs (Decisio et al., 2020).

The main trade-off to consider with respect to contract duration is the cost efficiency of long contracts versus the competitive pressure of short contracts. There is evidence that longer contracts lead to better cost efficiency as they allow for greater investment by TOCs and incentivise a more long-term approach to services (Hunold & Wolf, 2013; Link, 2016, 2017; McNulty, 2011; Nash et al., 2016, 2019; Veeneman et al., 2014). Although good for cost efficiency, long contracts have a negative impact on the competitive pressure of PCT, as contracts are awarded less frequently.

In addition, long contracts mean that risks are harder to predict in advance, so a sufficient degree of flexibility needs to be built into the contracts (Decisio et al., 2020). This is discussed in the next section.

7.7.2. Flexibility in Contracts

There will always be unforeseen events during the life of a contract. It is therefore considered very important to include conditions for service changes and renegotiation in the contract. For example, it may be desirable to exchange service levels between underused and busy routes during the contract period. In order to formalise the possibilities for both parties, it is also necessary to include the procedures for evaluating proposals. This could be through voluntary renegotiation, arbitration, litigation or regulation (Kavanagh, 2016; Thompson, 2007; van Dijk, 2007).

Decisio et al., 2020 report on the experience with contracts in the Netherlands. They report that ”*in general, contracts are experienced as sufficiently flexible*” and that most contracts contain clauses that allow both the PTA and the TOC to adapt to new developments. On the other hand, they report that in practice the freedom a TOC receives from the PTA depends on the degree of risk aversion of the PTA, as high risk aversion can lead to a high level of detail in the contracts.

Two possible strategies are mentioned concerning the nature of the contracts. Firstly, Switzerland has adopted a strategy in which there are no fixed contract periods, but all TOCs are subject to a two-year review based on which changes to the contracts can be made; such as an extension of the contract (M. Janssen et al., 2011). A second strategy mentioned in the literature is the transfer of rolling stock to the government so that TOCs can enjoy more freedom (Nash et al., 2019).

7.7.3. Conclusions

PTAs need to strike a balance between cost efficiency and competitive pressures when designing their contracts. It can be concluded that contracts need to be at least as long as possible to incentivise a more long-term approach. In addition, a hybrid approach - such as the Swiss model - may be advisable to adapt to market developments.

7.8. Staff Deployment

One of the key components of public transport operations is staffing. The hourly cost of staff is made up of various elements such as salaries, social benefits, pensions, premiums and the type of staff. It is one of the main aspects where TOCs can innovate and compete and is therefore recognised as one of the aspects with the highest savings potential compared to other aspects (such as TACs and kilometre costs) (Sjonger & Weeda, 2008). This section discusses a way to secure these cost savings and the challenges associated with their implementation. The Delphi participants did not evaluate this issue.

7.8.1. Innovation and One-man Service

Although international comparisons show that NS staff are highly productive (van de Velde & Röntgen, 2020), ways to improve productivity further have been raised, most notably the introduction of a one-man service (OMS). OMS initiatives have mostly been proposed to make staff more versatile; they can act as drivers, ticket inspectors, service and (small) maintenance employees. The premise of OMS is to reduce the need for multiple staff on a train and thus reduce operating costs. A study by FNV, 2017 shows that costs are already 10% lower at TOCs operating under PCT in the Netherlands due to the efficient use of staff.

Several issues have been raised about the introduction of OMS, summarised by Sjonger and Weeda, 2008. Firstly, OMS may lead to less social safety in quiet times - although there are not always controls on trains with a conductor. Secondly, some claim that only a conductor can safely close the doors. This can be refuted by the existence of safe and reliable automatic systems, which are widely used. An additional advantage of automatic doors is that boarding times are reduced (you can argue with a conductor, but not with an automatic door). Thirdly, trade unions have raised the argument that OMS removes the service component of a conductor. This can also be refuted as passengers on sprinter services are often commuters (who know their route well) and there are automated systems for train announcements. However, intercity passengers may have a greater need for an attendant as they are less likely to be commuters. Fourthly, some argue that OMS increases fare evasion. This is easily refuted, as smart planning with spot checks can keep the chance of checking the same as with two-man service. Furthermore, all TOCs have started to use OMS, so the benefits seem to outweigh the possible loss of revenue. Finally, trade unions warn of job losses in the sector if OMS is widely introduced. Practice shows that this is not true, as frequencies have increased on the parts of the Dutch network where OMS has been implemented (which requires more staff) and TOCs still need staff for inspection teams. van Dijk, 2007 reports that, after the introduction of PCT in the Netherlands, the number of people employed in the public transport sector has not declined.

Although very promising, employee innovation is limited by employment contracts and the willingness of existing employees to cooperate. This challenge will be discussed in the next section.

7.8.2. Transfer of Staff

Under Dutch law (WP2000), the direct transfer of staff is mandatory when a new TOC takes over services on part of the network. This also means a transfer of business in terms of labour law, so the new TOC has to take the existing workforce into account (Nash et al., 2016, 2019; van de Velde & Röntgen, 2020). NS already expressed concern in 2012 that its staff might not want to transfer to a new employer (Janse de Jonge, 2012), probably because of increased work pressure due to the change in management, rolling stock, timetables and other procedures (Decisio et al., 2020).

Although employment conditions are protected by collective agreements and sometimes by public transport contracts with the PTA, NS staff use their strong bargaining position to negotiate good employment conditions and even the organisation of day-to-day operations. This strong position of staff and the fact that TOCs inherit the working practices and wages of their predecessors makes it more difficult for TOCs to achieve efficiency gains, which in turn can lead to higher fares or lower quality of service compared to a situation with more freedom. On the other hand, the compulsory transfer of staff provides TOCs with a degree of certainty that they will have sufficient staff for their operations (Decisio et al., 2020; van den Berg & van der Vlist, 2017). van Dijk, 2007 shows that - at least in the early days of PCT - TOCs did not have any difficulties in improving efficiency.

7.8.3. Conclusions

In conclusion, the treatment of staff is a sensitive issue. TOCs need to ensure that staff are treated well and find ways of introducing innovations without alienating the existing workforce. OMS is a promising strategy for improving cost efficiency, but it seems to have a lot of union backlash that needs to be addressed.

7.9. Rolling Stock

Rolling stock is an asset for TOCs that carries significant investment risk and therefore influences their ability to compete in the market (Alexandersson et al., 2012). On the other hand, TOCs can use (new) rolling stock to improve efficiency and service quality. This section describes the role of rolling stock as a barrier to entry and exit for TOCs and as a constraint to innovation. The Delphi participants did not assess this issue.

PTAs often have extensive requirements as to the rolling stock to be used for operations. This and other characteristics of rolling stock create a barrier to entry and exit for TOCs (van Dijk, 2007). Firstly, the long depreciation period of rolling stock makes it difficult, if not impossible, to achieve a return on investment, so without appropriate mechanisms to counteract, it can be a deal breaker for new entrants. This is linked to the fact that ownership of rolling stock requires technological know-how, which new TOCs may lack (Decisio et al., 2020). In addition, TOCs face problems in organising their rolling stock on time due to lengthy purchase or transfer procedures and difficulties in obtaining the appropriate licences from the safety authority (Janse de Jonge, 2012; Sorgdrager et al., 2008).

A number of solutions have been proposed to address the issue of rolling stock: leasing, refurbishment, standardisation and transfer of rolling stock. Leasing arrangements, where the rolling stock is owned by a public or private entity, can be a solution to overcome the entry barrier for TOCs and put the owning entity in a good position to adopt a long-term strategy. It is important to ensure that the owning entity does not charge high premiums if transport contracts are short (Nash et al., 2019).

The second solution proposed is for TOCs to minimise financial risk by using refurbished rolling stock. Experience shows that there are almost no examples of market entry with brand-new rolling stock. This is exacerbated by the fact that there is only a limited second-hand market for rolling stock (Perennes, 2017).

The third solution is to standardise rolling stock to make it easier to lease and refurbish. This will increase efficiency and potentially the bids of TOCs. The PTAs in the European PRM therefore need to agree on a standard type of rolling stock, as a group of PTAs in the Netherlands has done. (van Dijk, 2007).

The last strategy is to include clauses in transport contracts to transfer rolling stock to the new TOC when the incumbent loses a contract. In the Netherlands, the Dutch state and NS have agreed to the *Redelijke Regeling* (Reasonable Arrangement) to ensure that NS can transfer its rolling stock to a new TOC in the event of decentralisation. It is noteworthy, however, that the private TOCs rejected the obligatory transfer of rolling stock when they submitted a plan for decentralisation in 2012 (Janse de Jonge, 2012; van de Velde & Röntgen, 2020).

In conclusion, the main challenge for PTAs is to design contracts that make the most of the competitive dynamics of the market (i.e. removing barriers to entry and exit), while at the same time incentivising TOCs to provide the best possible rolling stock for operation.

7.10. Fares and Ticketing

One of the key aspects on which TOCs can compete in the PRM is the setting of fares to create attractive services for passengers. As well as competing on price - although average revenues appear to be the same regardless of the exact fare structure (Janse de Jonge, 2012) - fares can be used to make transfers to services operated by other TOCs less attractive (M. Janssen & van Wee, 2019) and fill trains by price differentiation (Finger & Messulam, 2015).

For this reason, private TOCs do not want fare harmonisation as it is not in their competitive interest (Janse de Jonge, 2012). Therefore, the main discussion does not seem to be about fare harmonisation but rather about ticket harmonisation. This section presents the literature findings on this topic, followed by a discussion of the Delphi contributions on this topic. Finally, the section concludes with the main decision points.

7.10.1. Ticketing

In the current situation in the Netherlands, passengers can use the *OV-chipkaart* (public transport smart card) or *OV-Pay* (payment by debit or credit card) when travelling by public transport. You must check in and check out with your smart card, debit card or credit card at one of the TOC's ticket machines. This allows fare differentiation between TOCs but creates a lack of clarity for passengers as they have to make sure they check in and out at the right place (Janse de Jonge, 2012). According to a report by Team Kwartiermaker Permanente structuur, 2012, passengers already make many mistakes, so it can be expected that this will become a bigger problem as decentralisation increases and passengers have to use more TOCs during their journey. This is why single check-in/check-out (SCICO) is often proposed.

SCICO is a system where the TOCs are responsible for revenue allocation instead of the passenger. Passengers can check in at the start of their journey and check out when they arrive at their destination, while the TOCs allocate the revenue afterwards. This requires close cooperation between TOCs and PTAs and makes it a complex undertaking. It makes it easier for passengers, but it is not compatible with price differentiation on parts of the network where two services are running on the same tracks (Team Kwartiermaker Permanente structuur, 2012).

SCICO is legally possible because the Dutch government has the power to set fares for public transport services (Decisio et al., 2020). It is also technically possible, as reported by Team Kwartiermaker Permanente structuur, 2012. Another major disadvantage of SCICO, apart from the removal of the possibility of fare differentiation, is the increased complexity for TOCs in terms of transaction times and capacity limits of current technical installations. Nevertheless, Team Kwartiermaker Permanente structuur, 2012 concludes that the technical feasibility of SCICO - although not proven in practice - will not be the main bottleneck for this project.

7.10.2. Delphi Contributions

Delphi respondents recognise the need to minimise barriers for passengers but consider the ability of TOCs to compete on price to be more important. Ticket integration has already been improved by the introduction of the *OV-chipkaart* and *OV-Pay*, but some believe that this could be further improved by government intervention. They state that the PRM is not comparable to regular markets (due to its unique and technical aspects) and needs to be managed more by the government. Others believe that enough has been done and that TOCs need the freedom to differentiate fares to protect the dynamism of the market. The main challenge, according to the Delphi participants, is the allocation of revenues. When models such as a service splitting or open access are introduced, this becomes very difficult. Splitting by corridor or region is a little easier. This is therefore used as an argument against further ticket integration.

7.10.3. Conclusions

In conclusion, the main trade-off in ticketing and fares is between allowing market forces to operate and ensuring a smooth journey for passengers. For each possible form of decentralisation, the impact on the traveller must be carefully assessed to determine when the ticketing becomes too complex for passengers. In the Netherlands, there is currently no need for further integration, but this may change in the future.

7.11. Travel Information

The provision of travel information to passengers in the Netherlands is governed by WP2000, which requires TOCs to provide information appropriately and to contribute financially to a national travel information system (Decisio et al., 2020). This national system has taken shape in BISON (*Beheer Informatie Standaarden OV Nederland*) and is responsible for the development, management and operation of information standards for the exchange of travel information, focusing on dynamic travel information (BISON, n.d.). It is explicitly not responsible for the frond-end provision of information to passengers, as this is left to third parties.

The main coordination issue arises as more decentralisation is introduced and more TOCs enter the market. The question is whether the provision of travel information can be left to market parties, or whether the government needs to establish a national body for this (Decisio & TwynstraGudde, 2018).

Delphi respondents recognise this issue but do not consider it to be very important. They see that in a monopoly situation, there is no incentive to provide accurate travel information, but also note the problems of fragmentation in the market. They do not agree on how the incentives are aligned in the market, with some stating that it is in the interest of all TOCs to provide accurate information across all services and operators, but some arguing that it may be in the interest of a TOC to prevent cross-service information to keep passengers on its part of the network.

Most respondents support a stronger role for the government in regulating the provision of travel information, as it is already difficult to establish one provider for all information in the current situation in the Netherlands.

In conclusion, the provision of travel information can be organised in two ways: the government can set up a national information provider or it can let the market take the initiative and only set the conditions for the exchange of information. This will depend on how well the TOCs can be expected to provide accurate information and a comprehensive interface for passengers.

7.12. The Relationship between TOCs

One of the main operational challenges in the PRM is the relationship between TOCs. As there are interfaces between their services, they must work together to provide a coherent service to passengers. This section discusses this relationship and how it affects timetabling and disruption management.

7.12.1. Interplay between TOCs

The interplay between TOCs becomes more complex as more players enter the PRM, which can lead to coordination issues. Some even argue that optimal coordination cannot be achieved if too many actors are involved (Janse de Jonge, 2012; J. Montero & Finger, 2020). Despite concerns about the relationship between TOCs, most authors agree that the incentives of TOCs are sufficiently aligned to avoid major problems (van de Velde et al., 2009). These incentives are mostly along the lines of a common interest in aligning schedules to create an overall attractive service for passengers (Janse de Jonge, 2012). This does not mean that there is no role for the government to create additional incentives to strengthen cooperation between TOCs (van den Berg & van der Vlist, 2017).

Three strategies are suggested in the literature to incentivise TOCs to cooperate well; firstly, the establishment of partnerships between market actors (such as the *Coöperatie Openbaar Vervoerbedrijven* and *Nationaal Openbaar Vervoer Beraad* in the Netherlands). Secondly, governments can oblige TOCs to cooperate by including clauses in their transport contracts. This is already common practice in the Netherlands (Decisio et al., 2020; van den Berg & van der Vlist, 2017). Third, to avoid high monitoring costs, cooperation can be encouraged by rewarding TOCs based on passenger satisfaction (M. Janssen et al., 2011).

The interplay between TOCs determines how well timetabling and disruption management are organised. These issues will therefore be discussed in the following sections, based on the literature and the contributions from the Delphi study.

7.12.2. Timetabling

Up to 40 parties use the Dutch railway infrastructure in one way or another every day, from passenger and freight transport to maintenance of rolling stock and stations. To standardise the allocation of capacity to these parties, ProRail and NS have developed Donna PTI, a national capacity management application. All parties can use this application to plan their services, while ProRail retains final responsibility. This facilitates cooperation between TOCs as they can explore possible train paths themselves and take into account possible disruptions (ProRail & Clarify, 2012). Finally, the timetabling of passenger services is influenced by the degree of decentralisation. The dynamics of the different market structure frameworks for the Netherlands are therefore discussed based on the literature and contributions from the Delphi study.

Status Quo

The literature and the Delphi participants do not agree on the incentives of NS concerning timetabling. On the one hand, NS has an incentive to produce the best timetable for passengers on a national level and is well equipped to do so because it can use information on movements in (almost) the whole network to optimise its timetables (M. Janssen & van Wee, 2019). On the other hand, it is argued that the strong position of NS is problematic for several reasons. Firstly, the huge advantage NS has in terms of expertise, experience and manpower makes it difficult for new TOCs to enter the PRM (Sorgdrager et al., 2008). Secondly, the fact that many system functions are allocated to NS creates an uneven playing field for other TOCs (Veraart, 2012). Thirdly, the Delphi participants acknowledge that the operation of NS is strongly influenced by the will of its (well-organised) employees and sometimes disregards the passenger perspective. Fourthly, it is difficult for the government to make demands without financial compensation. Finally, NS has little incentive to seek synergies with regional public transport services, as it has a strong national focus. However, it is debatable which service should be aligned with which, i.e. regional public transport can also be coordinated with rail services and not vice versa.

Decentralisation

As mentioned above, decentralisation brings with it some major risks. When TOCs are responsible for different parts of the network, they are only incentivised to optimise their services and not to coordinate well with other parts of the network (M. Janssen & van Wee, 2019). Furthermore, they may even be incentivised to hinder transfers to other parts of the network to attract and keep passengers on their services (Baanders et al., 2011). This is not in the passenger's interest, so the literature and some of the Delphi participants argue that a central authority needs to be responsible for this coordination (van Damme, 2019).

The greatest misalignment of incentives is expected to occur in the case of a **split in service** between intercity and sprinter services. A study by M. Janssen, 2019 shows that in this case 41 per cent of passengers will face competition on their routes and will therefore experience the negative effects of misaligned incentives. For this model, it is therefore crucial for the government to manage the timetable.

Decentralisation in the form of **corridors** and **regions** is also expected to result in poorer service, although to a lesser extent because these models involve fewer interfaces between TOCs. The aforementioned study by M. Janssen, 2019 also evaluates these models and shows that these models strain the integration at a national level, as transfers between corridors or regions become more difficult. The advantage of the regional model is that it can make the most of the synergies between train and regional public transport, which can be of great benefit to the passenger. However, it is not known how great these benefits are in reality, as integration at a regional level may improve but worsen connections with intercity services.

There are many unknown consequences to a model with an **open network**. The Delphi participants expect that spontaneous alignment of open-access services is unlikely. Participants are also uncertain about the incentives for regional integration with regional public transport. In a model with PCT, these alignments can be secured in the contracts.

7.12.3. Disruption Management

Participants in the Delphi study assessed the impact of TOC relationships on the management of disruptions. Several views emerged. In principle, the situation with a monopolist should be the simplest model for dealing with disruptions. However, the Dutch case shows that disruptions often have a national impact - often described as an 'oil slick effect' - because NS employees demand long and non-repetitive routes. This intertwines services more than necessary and therefore hurts this issue.

Participants do seem to agree that more TOCs in the market leads to more interfaces between them, making coordination more difficult. An open-access model is therefore expected to be very difficult. Others argue that the resolution of problems does not depend on the number of TOCs, but solely on the actions of the traffic manager and the IM.

7.12.4. Conclusions

In conclusion, there is still uncertainty about the alignment of incentives concerning timetabling and disruption management. There is some degree of misalignment of incentives in all models, but it is most pronounced in the service-splitting model. Although it is expected to be the best model in this respect, a model with a (semi-)monopolist also has several (perhaps unexpected) problems that reduce the monopolist's ability to produce a favourable timetable and to manage disruptions effectively, as well as disrupting the level playing field if other TOCs are (or want to become) active.

7.13. Relevance of Coordination Issues

The existence of a coordination issue does not mean that it is always relevant. An issue may be easy to solve or, on the contrary, very difficult. Therefore, the relevance of the coordination issues of PRMs was assessed by the Delphi participants.

7.13.1. Scoring Relevance

The relevance of coordination issues in different market structure frameworks was assessed by the Delphi participants using Likert-type questions. 11 issues were rated on a 5-point Likert-scale, while 3 were rated differently, namely the impact of the market structure on (1) synergy between rail and regional public transport, (2) allocation of revenue responsibility and (3) number of market entrants. These issues are discussed earlier in this chapter.

At the end of the first survey, participants were asked to indicate the relevance of the coordination issues per market structure, rather than per issue. They could select as many issues per market structure framework as they considered important. This question was added to check whether the relevance scores per issue correspond to the overall view of participants on the relevance of coordination issues.

The average Likert score was used to rank the relevance of coordination issues and the standard deviation was used to assess the extent to which the relevance of coordination issues is expected to vary between market structures.

7.13.2. Results

Table 7.4 shows the relevance scores. A comparison between the average relevance of the coordination issues and the control questions reveals some unexpected results. Three issues, namely the impact of market structure on the need for expertise, the coordination of synergistic investments between IM and TOC, and the acquisition and retention of knowledge, have a significantly lower ranking after the control questions than the average relevance. This can be explained by the wording of the questions.

The impact of the market structure on the need for expertise is assessed by the question:

> *In your opinion, how much expertise is lacking in the rail sector for the proper functioning of the system, in the case of a certain market structure?*

This question was rated very highly for all market structures, as the overall view is that there is a general lack of expertise - so there is a challenge in every situation. However, participants do not seem to consider expertise to be an essential coordination issue for a particular market structure, but rather a condition for adequate coordination. This reasoning also applies to the issues of acquiring and retaining knowledge and coordinating synergistic investments between IM and TOC. Although each of these challenges is important in any market structure, they are more general challenges and are not considered the most important for any particular market structure.

Two issues have a significantly higher ranking according to the control questions compared to the first: the impact of the market structure on the role of decentralised governments and fare harmonisation. This can be explained by the fact that these coordination issues are relatively easy to resolve, but are of great importance for the success of a market structure.

The standard deviation of the relevance of coordination issues shows that there is a variation in how much the relevance of coordination issues is expected to change between different market structures. The issues with the highest standard deviation are the impact of the market structure on timetables (1.02), the harmonisation of fares (0.96), the coordination of incidental disruptions (0.92), the coordination of synergistic investments between IM and TOC (0.91) and the acquisition and retention of knowledge (0.90). The impact of market structure on the role of stations (0.58) and the role of I&W (0.63) is expected to vary the least between the market structures evaluated.

Coordination issue	**Relevance**			**avg. [1-5].**	**SD**
Impact of market structure on ...	ranking	check	delta		
... the role of I&W	1	1	0	3.52	0.63
... the need for expertise	2	12	-10	3.15	0.82
... transition costs	3	3	0	3.14	0.81
... coordinating synergistic investments between IM and TOC	4	13	-9	3.08	0.91
... timetables	5	6	-1	2.97	1.02
... acquisition and safeguarding of knowledge	6	14	-8	2.94	0.90
... coordinating incidental disruptions	7	7	0	2.89	0.92
... the role of decentralised governments	8	2	+6	2.87	0.77
... fare harmonisation	9	4	+5	2.85	0.96
... the role of stations	10	11	-1	2.65	0.58
... the provision of information	11	10	+1	2.59	0.76
... the synergy between train and regional public transport		5			
... the allocation of revenue responsibility		8			
... the number of entrants to the market		9			

Table 7.4: The relevance scores of coordination issues

7.13.3. Conclusions

In conclusion, according to the results of the Delphi study, several issues can be considered as most relevant. It is interesting to note that the issues that can be considered formative - rather than related to the train service itself - are considered the most relevant: the role of government, acquisition of expertise and transition costs. It can be concluded that these issues need to be well managed to ensure a good environment.

In addition to the formative issues, timetabling and coordination of investments are also considered quite relevant, but their relevance varies between the different market structures. Overall, they are important to take into account when considering PRM restructuring.

8

Conclusions and Discussion

The Dutch passenger rail market[1] (PRM) is under pressure from poor punctuality and rising fares. This has led to a debate about the regulatory framework for rail services in the country. The largely monopolistic nature of the market is being closely scrutinised by market players and the European Commission, as European regulations require the introduction of competition wherever possible. Nevertheless, the Dutch parliament believes that the Dutch network can and should still be awarded directly to Nederlandse Spoorwegen (NS) under an exemption clause in European Regulation 2016/2338, which allows direct award after proof of significant system complexity and guarantees regarding cost efficiency and service quality.

This research aims to provide insight into the systemic complexity of passenger rail markets to contribute to the European debate on railway regulation and to provide recommendations for Dutch policymakers. As such, the research was set out to answer its main research question:

> *What coordination issues are present in possible market structures for passenger rail markets, and what is their impact on the system performance of the Dutch passenger rail market?*

It was decided to gather a great deal of information on passenger rail markets through a literature review and a Delphi study. This combination is a powerful tool as the information gathered through the literature review could be refined through the structured group communication process of the Delphi method. The first sub-question aimed to provide a structured way of analysing passenger rail markets and their market structure. Chapter 3 therefore provides a theoretical framework that includes a set of causal factors, policy issues and performance indicators. A Delphi study was then carried out to answer the second and third sub-questions, with the most prominent coordination issues identified in section 7.13. The fourth and fifth sub-questions were answered by evaluating the causal factors and policy issues for the Dutch passenger rail market according to the theoretical framework. This resulted in a detailed description of the market in chapters 6 and 7.

8.1. Market Structures and System Complexity

The research shows that the structure of a passenger rail market comprises a series of policy choices on different aspects of the market, which can be analysed using a theoretical framework (see Figure 8.1). The system complexity of a market can therefore be determined by examining all the framework's causal factors and policy choices. Using this structured way of analysing passenger rail markets enables policymakers and researchers to understand the nature and complexity of these markets better than has previously been possible. This strengthens the policy debate on market (re)structuring.

[1] The passenger rail market is defined in this thesis as the market for heavy rail services, excluding light rail, metro, tram and other rail-based services.

The market structure of a PRM can be described by the strategic level of the theoretical framework developed in this study. The following topics therefore make up the market structure of a passenger rail market:

- the network allotment
- the organisational form of the infrastructure manager
- the degree of competition
- the allocation of government roles
- the allocation of revenue responsibility
- the allocation of development responsibility
- the allocation of station ownership

The central debate in rail market restructuring focuses on two key strategic choices: the appropriate level of competition (direct award, public competitive tendering or open access) and the logistical division of the network (allotment). These two decisions together form the market structure framework, which can be used to create a conceptual market structure. To analyse the Dutch passenger rail market, a set of six possible market structure frameworks has been compiled that has guided the Delphi participants in the analysis of the Dutch market (see Figure 8.2). These frameworks combine an awarding mechanism[2] with a corresponding allotment type[3], after which the market structure can be completed by deciding on the remaining policy choices of the theoretical framework.

The research shows that the decisions for creating a market structure are highly dependent on the context of the market for which decisions are made. Therefore, the coordination of passenger rail markets is so complex that there are no one-size-fits-all solutions. The main contextual factors influencing decision-making are:

- The dominant management paradigm in a jurisdiction; impacts how much influence governments wish to have over tactical decision-making (i.e. service design).
- The money flows in the market: how much governments contribute through subsidies and who owns stations and other assets.
- The ridership characteristics of the market and the relationship between different modes.
- The existing infrastructure: network capacity and density, and layout in terms of logistical corridors and/or natural boundaries.
- The existing institutional framework; influences the level of transition costs incurred by market restructuring.

8.2. The Relevance of Coordination Issues

The Delphi study revealed which coordination issues were considered most relevant, based on a list of issues identified in the literature. The Delphi study shows that the most relevant coordination issues in all possible market structure frameworks are:

- the role of governments in the coordination of the passenger rail market,
- coordination between parties to ensure adequate investment, timetabling and incident management, and
- transition and coordination costs.

First, the role of (different levels of) government is seen as one of the most relevant and important coordination issues. Governments need to allocate responsibilities appropriately between themselves and market actors to ensure the proper functioning of the passenger rail market. When allocating

[2] An awarding mechanism is the way a government grants train operating companies the right to operate a part of the network.

[3] The specific subdivision of the railway infrastructure for operational and management purposes. The allotment type may involve the division of the railway network into different segments based on factors such as geographical location or functional characteristics.

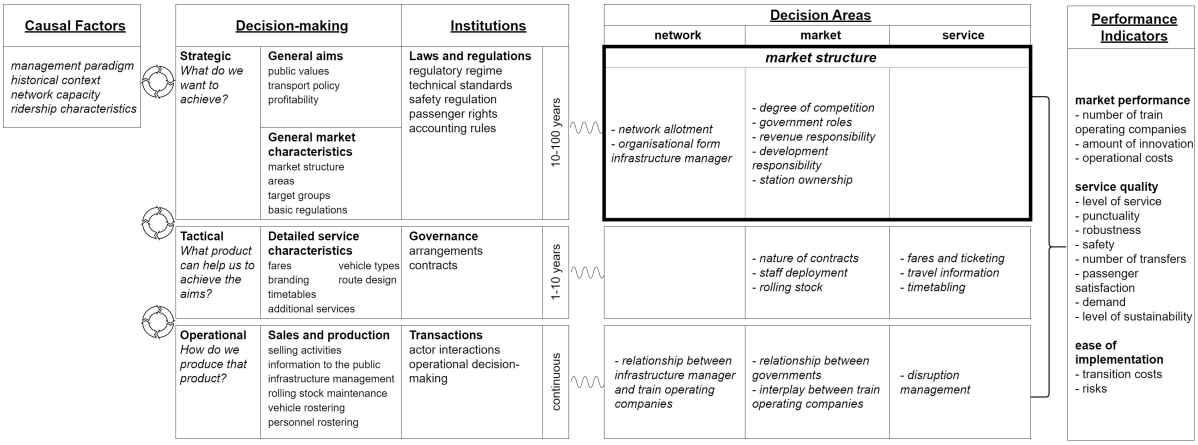


Figure 8.1: Theoretical framework

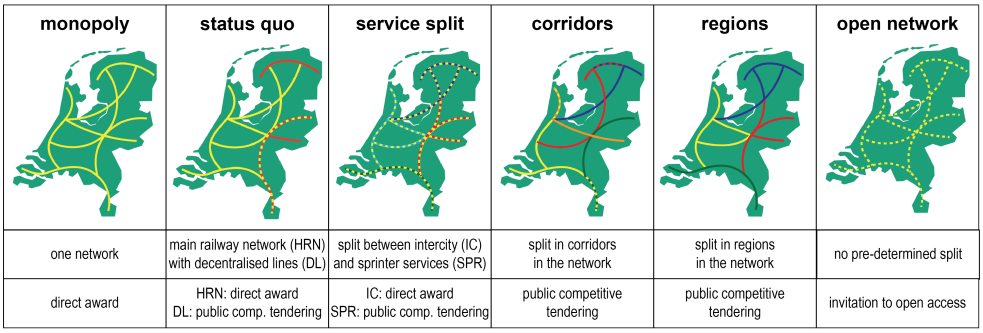


Figure 8.2: Market structure frameworks for the Netherlands

responsibilities, it is important to ensure that each party has sufficient knowledge and expertise to fulfil its responsibilities. In this way, government should adequately protect public values.

This leads to the second key coordination issue: coordination between market players to ensure appropriate levels of investment, passenger-oriented timetables and rapid incident management. The Delphi study shows that, even in a fully liberalised passenger rail market, there is a significant coordination challenge to address these issues. Government intervention is therefore seen as inevitable.

The third key coordination issue relates to the level of transition and coordination costs that governments need to bear to create an appropriate market structure. They must therefore balance the benefits of competition with the increased transition and coordination costs. Managing players in a competitive market requires more coordination by the government, which increases transaction costs. In addition, large passenger rail markets need to be broken up into manageable pieces for train operating companies to compete for. This may require significant infrastructure investment to adapt the infrastructure to decentralised operations. Finally, governments are bound by existing legislation, which can also lead to high transition costs if changes are required.

Unfortunately, the question of how to solve the coordination problems identified above can only be partially answered based on this research. Although there were contributions from the literature and the Delphi study that identified the relevance of the coordination issues, there were only general statements about potential solution spaces. Therefore, this research can only provide a conceptual insight into solving coordination problems without delving into a quantitative or detailed understanding of specific solutions.

8.3. Recommendations for the Dutch Passenger Rail Market

One of the objectives of this research was to provide arguments for different market structures for the Dutch passenger rail market. The extensive analysis of literature and input from experts and stakeholders in the Delphi study led to several recommendations for the Dutch market, regarding the degree of competition, type of subdivision and the bundling of expertise.

8.3.1. Degree of Competition

The main trade-off regarding the level of competition is between the benefits of more competition and the coordination and transition costs of that competition. EU rules do not allow governments to revert to direct award after introducing more competition, so the decision to increase competition is a one-way street and the benefits of competition should therefore be evident beforehand. It is also important to stress that the outcomes of the different possible market structures can never be predicted with complete certainty, so the recommendations are based on all available information and evidence.

The analysis found no conclusive evidence that the introduction of more competition in the Dutch market will or will not lead to greater cost efficiency or better quality of service. Studies on this topic are sometimes contradictory and emphasise that the effects of competition in one market cannot be extrapolated to the Dutch market. Furthermore, there have been significant improvements in the main rail network in the past without the introduction of competition. On the other hand, it has been found that the introduction of more competition leads to a sharp increase in coordination and transition costs. The consensus is that the main rail network is too large for a single (publicly tendered) concession, so it must be split up. This division inevitably leads to more transfers for passengers and a significant increase in coordination problems.

The clear disadvantages of introducing more competition and the uncertainty about the benefits lead to the conclusion that the continuation of direct award to NS on the main rail network is the preferred way forward. A key condition is that the current situation must be improved. The concessionaire (currently I&W[4]) needs to strengthen its position to ensure that public values are protected and that NS does not behave strategically by preventing open-access services and hindering integration with decentralised lines.

Nonetheless, this recommendation needs to be adapted to the European legal context. The general management paradigm (how governments see their role in society) in the Netherlands has begun to shift in recent decades from New Public Management to Public Value Management, while the European Union still adheres to the belief that government intervention should be kept to a minimum. However, Dutch policymakers often do see a role for the state in society that cannot be fulfilled by private companies. They therefore believe that state intervention in the passenger rail market is necessary to protect the accessibility and affordability of rail services. This difference of opinion is the reason for the discussion between Dutch and European officials.

European legislation requires member states to introduce competition through open access and public competitive tendering in their passenger rail markets as far as possible. The freedom to deviate from this standard is vaguely described in EU Regulation 2016/2338, which requires case law for clarification. This uncertainty opens up the possibility that - regardless of what this analysis or Dutch policymakers conclude - more competition needs to be introduced in the Dutch passenger rail market. For this reason, the path towards introducing more competition is added to this recommendation.

8.3.2. Allotment Type

The possibility of more competition raises the question of how this should be introduced in the Dutch market. In the Delphi study, participants analysed six different market structure frameworks with different subdivisions (see figure 8.2), resulting in a recommendation for an appropriate subdivision:

- The participants all agree that the introduction of competition requires the main network to be split into smaller parts, as they do not expect any operator (other than NS) to be able to take over the whole network at once. This will remove the monopoly and status quo framework.
- An analysis of the literature showed that Dutch passengers travel predominantly nationally so

[4] the Dutch ministry for Infrastructure and Public Waterworks

full regionalisation would lead to a sharp increase in extra transfers. The full regionalisation framework was therefore rejected.

- The Delphi participants believe that concurrency[5] should be kept to a minimum, which would increase sharply in the service split framework due to the possibility of different operators for intercity and sprinter services on the same line section. This framework is therefore dropped.
- According to the Delphi study, the current logistical layout of train services should be maintained as far as possible, which eliminates the open-access framework. Furthermore, the open access framework would reduce the reliability of services as operators could start and stop services at any time.

This leaves the corridor framework as the preferred subdivision if competition is to be introduced. The advantages of this framework are that it is suitable for gradual implementation (per corridor) and reduces logistical complexity in the network, which could increase reliability. Furthermore, it matches best the national travel pattern of all the decentralisation frameworks and preserves the feeder role of sprinter and intercity services. The main disadvantages of this framework are that it hampers integration between corridors, resulting in less smooth journeys for travellers (due to an increase in transfers) and that the balance of the market needs to be closely monitored, as operators may behave strategically by hindering transfers and exploiting economies of scale when operating several corridors at the same time.

8.3.3. National Public Transport Agency

A key issue identified in the literature and by the Delphi participants is the lack and fragmentation of expertise in the rail sector. There is currently a lot of expertise and knowledge in the consultancy and academic sector as well as in regional governments, but the Delphi participants recommend that this should be institutionalised.

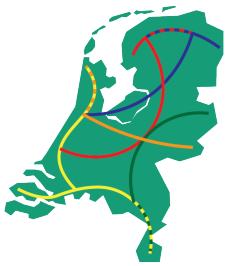
A key recommendation - regardless of the framework chosen - is for the Dutch government to establish a National Public Transport Agency (NPTA), similar to the Eisenbahn-Bundesambt in Germany. This NPTA can be an independent body with a mandate from national and regional governments to manage the rail passenger (or even public transport) market. It can carry out its role on the basis of transport policies developed by national and regional politicians, leaving strategic decisions to parliaments. The NPTA, together with the train operating companies, is responsible for tactical decision-making, i.e. the design of rail (or public transport) services and integrates the interests of all stakeholders, i.e. different levels of government, operators, infrastructure managers, passengers and residents.

The benefits of such an agency are that it clarifies the roles of market players and helps to maintain continuity and consistency in the public transport market. In addition, by bringing together experience and knowledge in one place, the NPTA can balance market forces to protect public values. In particular, it solves the problems of coordinating a large monopolist (such as NS). The majority of these problems stem from the fact that I&W lacks sufficient expertise and is therefore unable to evaluate NS initiatives adequately. However, the creation of such a body could involve significant transition costs and inevitably reduce the influence of politicians on tactical decisions.

8.3.4. Proposed Market Structure

The following is a detailed description of the two proposed market structures for the Dutch passenger rail market. The recommendations are based on the analysis of the literature and the Delphi contributions. A detailed explanation of the recommendations can be found in the relevant chapters.

[5] Concurrence is the situation in which two or more TOCs have the right to offer rail transport services between the same stations located on the rail network (Baanders et al., 2011).

ref.	Decision	Adjusted Status Quo	Corridors
			
7.3	degree of competition	The main rail network (HRN) is awarded directly to NS, regional services remain under public competitive tendering, and open-access services are allowed on the remaining capacity via a catalogue of available paths.	A market analysis is carried out first to see if there are corridors that can be operated under open access, the rest can be put out to public tender on a corridor-by-corridor basis.
7.1	network allotment	The existing allotment does not require major infrastructure changes and takes advantage of national integration.	Dividing the network into smaller parts is necessary to introduce competition. Dividing the network along corridors allows gradual implementation, reduces logistical complexity, fits in with national travel patterns and preserves the feeder role between sprinter and intercity services.
7.4	government roles	Governments are only responsible for strategic decisions. They delegate the responsibility of the concessionaire to an NPTA, which makes tactical decisions with input from governments and other stakeholders.	idem
7.2	organisational form infrastructure manager	Research shows that deep alliances work best in dense networks, such as in the Netherlands. Close cooperation between train operating companies and infrastructure managers through an NPTA is therefore recommended. In this model, the role of the NPTA can be collaborative, as it is expected that few issues will need to be resolved hierarchically between the parties.	Research shows that deep alliances work best in dense networks, such as in the Netherlands. Close cooperation between train operating companies and infrastructure managers through an NPTA is therefore recommended. The role of the NPTA in this model will inevitably be more hierarchical, as there is likely to be more conflict due to the nature of the allotment.
7.5	revenue and development responsibility	The government wants to protect public values, which requires influence on tactical decisions. Revenue responsibility should therefore lie primarily with the government, preferably through gross cost contracts. The NPTA can be responsible for development in close cooperation with the infrastructure manager and the train operating companies. If more freedom is given to the train operating companies, they can also be responsible for a greater proportion of the revenue.	idem

ref.	Decision	Adjusted Status Quo	Corridors
7.6	station ownership	No change required, as transfer of ownership brings more costs than benefits.	Ownership must be transferred to an independent body to ensure fair access to stations for train operating companies.
7.7	nature of contracts	Flexible contracts are recommended, preferably as long as possible, e.g. a base period with the possibility of renewal every two years if KPIs[6] are met. This will maintain competitive pressure but also certainty for train operating companies. This will encourage innovation and investment. For the status quo, the government must ensure that the possibility of competition on the HRN is credible, otherwise, there is little incentive for NS to improve.	Flexible contracts are recommended, preferably as long as possible, e.g. a base period with the possibility of renewal every two years if KPIs are met. This maintains competitive pressure but also certainty for operators. This encourages innovation and investment.
7.8	staff deployment	Alternatives need to be explored to improve cost efficiency in this area without alienating the existing workforce, as staffing is one of the largest cost components.	In this model, there are more opportunities for innovation in the use of staff, as the bargaining position of staff is weaker due to fragmentation.
7.9	rolling stock	Rolling stock can still be owned by the train operating companies, but transfer clauses between concessions are required in the contracts.	idem
7.10	fares and ticketing	Fare differentiation is seen as the key to effective competition, so further integration is not recommended. Ticketing is already harmonised through the use of OV-Chipkaart and OV-Pay. This can be further improved by introducing a comprehensive payment system, possibly with other modes of transport (single check-in/check-out).	Ticket integration in this model becomes more necessary as the number of operators increases and passengers are likely to encounter more different operators during their journey. To avoid problems on a large scale, single check-in/check-out may be recommended.
7.11	travel information	Information management is not seen as a problem. The government only needs to set the conditions for information sharing (as is already the case).	idem
7.12	timetabling and the interaction between operators	The government needs to improve its position to NS. An NPTA can achieve this, and promote better cooperation between train operating companies.	There are some coordination challenges, but these can be overcome by delegating tactical decision-making to the government or NPTA.
7.12	disruption management	The status quo has few interfaces between operators but is logistically complex. However, this can be mitigated through logistical unbundling.	The corridor model has many interfaces between train operating companies but is less logistically complex than the status quo. However, the number of interfaces cannot be reduced (significantly), which makes the problem insoluble.

Table 8.1: Proposed market structures for the Dutch passenger rail market

[6] Key Performance Indicators

8.4. Recommendations for Policymakers

Two recommendations can be made to policymakers for the near future. First, a strategy should be formulated regarding the Dutch government's position on the European regulatory framework. It would be advisable to push for a clarification of the regulations on the passenger rail market, in particular, paragraph 4a of Regulation 2016/2338. If desired and necessary, the Dutch government can also try to change the regulations to allow direct award. However, it is not expected that an agreement can be reached on this point due to the different management paradigms between the Netherlands and the European institutions.

Second, the government should explore ways to introduce competition into the market, with the aim of complying with European legislation while acquiring more expertise and knowledge. An additional benefit of this strategy is that the government will be in a better position to coordinate the NS by making competition more likely. It is therefore recommended that a market analysis is carried out to determine which parts of the market could be opened up to competition and that a clear implementation strategy for the introduction of competition is formulated.

8.5. Limitations and Future Research Recommendations

A considerable amount of information was gathered for this study in a very short time by a single researcher. A long list of literature sources was compiled, supplemented by input from experts and stakeholders from different parts of the railway sector, in the Netherlands and abroad. This resulted in a clear overview of the current understanding of the dynamics behind policy decisions concerning passenger rail markets. Much information was already available in the literature and it is also interesting to note that there are aspects of passenger rail markets that cannot be scientifically proven or understood - such as the impact of tendering mechanisms on cost efficiency.

The highly contextual nature of the impact of policy decisions makes the study of market structures complex. The relationships between aspects of passenger rail markets can be quite opaque, so there has been a lack of a structured way of discussing the issue. The aim of this study was therefore to break the issue down into manageable chunks to shed light on the true level of complexity. The framework presented in this thesis allows policymakers and researchers to analyse the different aspects separately and to use the information gathered for this research as a catalogue of the currently available knowledge on these aspects. Furthermore, this research has identified the relevance of certain aspects in the debate on market restructuring. For example, some aspects can be ignored, while others are very important to consider. This may also help to focus the policy debate on the right issues.

Nevertheless, some comments on the limitations of this research and recommendations for future studies should be made.

8.5.1. Strategies for Information Gathering

It can be recommended for future studies to increase the number of feedback loops in the Delphi study to refine and nuance the research findings. This can be done by including a different form of information gathering, by organising group workshops with experts to improve the quality of input. This was also one of the main suggestions following the syntax analysis, where it became clear that some experts did not have sufficient expertise in some areas. Group workshops could be organised in parallel with the Delphi approach to allow participants to take part in the survey(s) only, without being obliged to take part in the workshops.

The dynamics in passenger rail markets are described based on much input in Dutch in this study, both from the literature and from the Delphi input. Although an attempt was made to include as much international input as possible, it must be acknowledged that much of the literature on the subject is in Dutch and the Delphi panel was predominantly Dutch-speaking. This may have an impact on the research findings and should therefore be taken into account. The dynamics were found to be highly contextual. Therefore, it cannot be excluded that some of the dynamics on which the conclusions of this research are based cannot be generalised to countries other than the Netherlands. This applies not only to the list of determinants and decisions but also to the relevance of the individual issues.

8.5.2. The Participant Panel

The contribution of the Delhi study could have been enhanced by the participation of a larger sample group. A larger sample would open up the possibility of distinguishing between the different views of the participating groups and analysing the dynamics of the political debate. In addition, a larger sample would also increase the level of expertise on the panel, which would greatly benefit the study. There are several reasons why the sample group for this study included only 13 participants; firstly, the response rate was quite low compared to expectations and the effort put into reaching out to potential participants. Secondly, due to the short duration of this research, there was relatively little time to compile the list of potential participants and contact them. Finally, due to the sequential nature of the Delphi study, it was not considered possible to allow participants to join the study during the Delphi rounds. The search for potential participants was therefore completed before the start of the first round. This could have been extended to increase participation.

Due to the small number of participants, this research was not able to explore the perspectives of different stakeholders in the railway sector. A larger Delphi study could be carried out to find out whether the views of different stakeholder groups differ between categories or countries.

8.5.3. A Broader Scope

Due to the focus on the Dutch passenger rail market, this research did not compare different countries to understand the different levels of complexity between them. To answer such questions, more information is needed on the logistical complexity of rail networks (through quantitative modelling methods), differences in cost efficiency (by finding new ways of processing empirical data), differences in dynamics between countries and the impact of external factors on market dynamics, and insight into the desired levels of KPIs of rail services.

Firstly, a study of the logistical complexity of national rail networks could be explored to identify what makes the underlying networks complex and how this varies between networks. In addition, the impact of different market structures on passenger behaviour and infrastructure needs could be identified. For example, clustering models or analysis of timetables (and how these could be simplified) could be considered.

Another issue not explored in this research is the impact of the policy aspects described here in an international context. For example, how do these dynamics change when national markets are integrated with neighbouring markets? What are the differences between countries in these dynamics and how can they be compared? What are the appropriate market structures in these contexts? Are there other relevant issues?

The third issue that could be further explored is the dynamics of synergies between different modes of transport on rail services. For example, one could test whether the theoretical framework and dynamics described in this study can be applied to other modes of transport. Other questions that remain unanswered include how services can be integrated, what level of rail service is appropriate in which locations (e.g. light rail versus heavy rail), or what are the benefits of regional versus national integration.

Finally, this study focused heavily on the choices and causal factors of policy making. The theoretical framework identified a list of performance indicators based on the literature. However, this issue was not explored further and could therefore benefit from further research. For example, questions could be raised about which performance indicators are most relevant or what are the appropriate levels of performance indicators for quality monitoring.

In conclusion, governments and researchers should start preparing for the possible introduction of competition in the Dutch passenger rail market. This will ensure a smooth transition in the scenario where competition becomes mandatory in the Netherlands, but it will also increase the government's expertise in coordinating passenger rail transport, which can ultimately improve rail services even in the current situation.

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A

Literature Review (extended)

A.1. Literature Search

Table A.1: Literature study search terms

engine	search term	hits	additions	snowball
Scopus	market AND governance AND railway	61	0	-
Scopus	market AND coordination AND railway	45	0	-
Scopus	governance AND trein	1	0	-
Scopus	marktcoördinatie AND spoor	0	0	-
Scopus	markt AND coördinatie AND spoor	0	0	-
Scopus	governance AND spoor	0	0	-
Scopus	marktcoördinatie AND trein	0	0	-
Scopus	markt AND coördinatie AND trein	0	0	-
Scopus	”4th railway package”	7	1	6
Google Scholar	coordinatie spoormarkt	90	5	-
Google Scholar	hoofdrailnet	161	6	2
Google Scholar	aanbesteding hoofdrailnet	6870	1	-
Google Scholar	studie gunning hoofdrailnet	1480	1	-
Google Scholar	decentralisatie spoor	88800	1	8
Google Scholar	railway regulation	905000	7	1
	miscellaneous		19	-
	Total number of sources			**58**

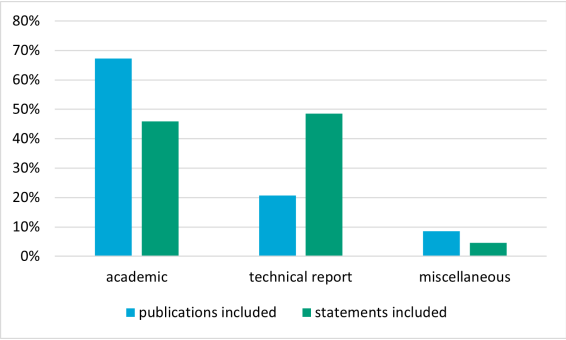

Figure A.1: Included source types

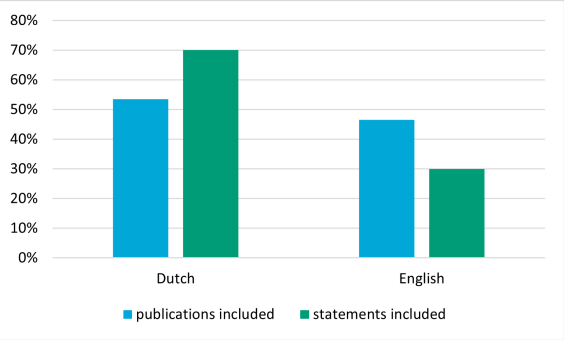

Figure A.2: Included source languages

A.2. Policy Topics

Table A.2: Topic shortlist (extended)

topic from literature	topic shortlist
management paradigm	management paradigm
historical context	historical context
network capacity	network capacity
ridership characteristics passenger preferences passenger behaviour	ridership characteristics
choice of allotment infrastructure changes synergy with local PT	network allotment
infrastructure management	organisational form IM and the relationship between IM and TOCs
degree of competition	degree of competition
role national governments role regional governments knowledge management market control and oversight role of passenger organisations	government roles and relationship between governments
government subsidies revenue responsibility	revenue responsibility
development responsibility	development responsibility
station ownership	station ownership
nature of contracts	nature of contracts
staff deployment	staff deployment
rolling stock	rolling stock
harmonisation of tariffs and ticketing, and revenue allocation	fares and ticketing
travel information management	travel information
schedule alignment	timetabling
organisational form of TOCs cooperation between TOCs	interplay between TOCs

B

Theoretical Framework (large figure)

See the next page.

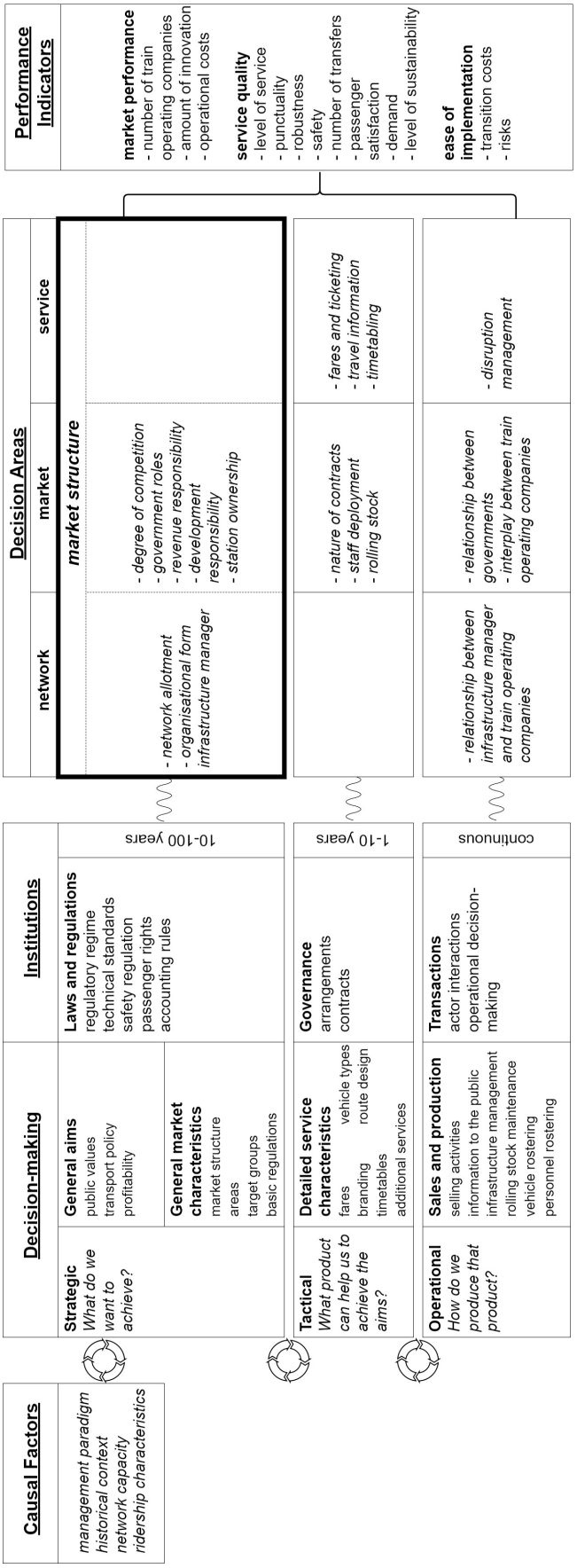

Figure B.1: Theoretical framework

C

Survey Questions Round 1

Please note that the wording of some definitions used in the survey questions has been changed in the thesis.

Question	Format
Thank you for your cooperation in this research! The aim of this research is to contribute to shaping the Dutch rail market. This research is aimed at assessing various divisions of the network and coordination issues that arise in the sector. This survey is therefore divided into two parts: First you will be asked to assess six divisions of the network (subdivision variants) and to assign contract types to them. Second, you are asked to rate the importance of a series of coordination issues in six possible market forms. The duration of this survey is approximately 1 hour. The deadline for this first round is December 10, 2023. Your contribution will only be processed anonymously. This research is monitored by Tijmen Godeke, master's student at Delft University of Technology and graduate intern at Goudappel (mobility consultancy). For questions about this research, please contact [email adress] or [phone number]. The Delphi study: The Delphi study aims to generate consensus among respondents to this study. This is done by presenting the results of this first round in the second round, so that respondents can assess and comment on each other's insights. To achieve this and maintain the objective nature of the research results, your comments will only be processed anonymously. Therefore, I encourage you to respond to the questions from your own professional perspective.	
Introduction	
Before the substantive questions are presented to you, there are first two questions to classify you into a category of respondents. The answers to these questions will not be traceable to you in the final publication.	
Which stakeholder group do you belong to?	nominal
How many years of expertise do you have in the rail sector?	numerical
Part 1: Subdivision variants	
The first part of this research focuses on the relationship between the subdivision of the rail network and contract forms. Six subdivision variants are presented to you. You will be asked to assign a contract form to each of these variants. First, the contract forms are explained, after which the subdivision variants are presented.	

Question	Format
Direct award: Direct award is a contract form where the government grants a concession to a carrier for a specific duration, without the possibility for competition. Terms are included in the contract on which the government and the carrier have agreed. Public competitive tendering: Public competitive tendering is a contract from where the government grants a concession to a carrier for a specific duration, after a tendering procedure. The government grants the concession to the party with the most favourable offer. Invitation to open access: Invitation to open access is a contract form where the government invites carriers to compete on a part of the railway network next to the existing carrier (the "Spanish model") without any form of concessioning. Open access: Open access is a contract form where the government does not take any initiative in the shaping of the railway market. Carriers can apply for capacity on the network for self-proposed train services, which only need approval from the infrastructure manager and ACM (The Netherlands Authority for Consumers and Markets). Subdivision variants: In this part of the study, six possible subdivisions are discussed. These are conceptual subdivisions where the boundaries of areas have not yet been determined. Below is an overview of the selected subdivision variants. *Figure C.1* Please continue to the questions.	
Is there a subdivision variant that you would like to add to the list above?	open
Assignment of contract forms	
This question is optional. You will shortly be asked to assign a contract form to the presented subdivision variants. The choice can be based on a number of perspectives, namely: • Legal perspective: does the contract form fit within current (national and European) legislation? • Traveller's perspective: does the contract form provide the best train service for the traveller? • Logistical perspective: does the contract form provide the most optimal timetable for the carrier(s)? • Business perspective: does the contract form provide the most profitable train service for the carrier(s)? • Government perspective: can the government exert enough influence with the contract form to safeguard public values?	
In your opinion, how important is each perspective for the choice of a particular contract form?	Likert-10
Would you like to explain your answer?	open
Subdivision variant Monopoly	
All services on the network are operated by one carrier.	
In your opinion, what is the best contract form for this subdivision variant?	nominal
Please briefly explain your choice.	open
Subdivision variant Status Quo	
The network is the same as in the present. There is a main railway network, with some decentralised lines. Minor changes in the number of decentralised lines are also part of this scenario. The main railway network is operated by one carrier, and the decentralised lines each have their own operator.	
In your opinion, what is the best contract form for the main railway network in this subdivision variant?	nominal

Question	Format
In your opinion, what is the best contract form for the decentralised lines in this subdivision variant?	nominal
Please briefly explain your choice.	open
Subdivision variant Service Split	
The network is divided into the intercity and sprinter services. The intercity services are operated nation-wide by one carrier. The sprinter services are split into regions and can be operated by different carriers. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route.	
In your opinion, what is the best contract form for the intercity services in this subdivision variant?	nominal
In your opinion, what is the best contract form for the sprinter services in this subdivision variant?	nominal
Please briefly explain your choice.	open
Subdivision variant Corridors	
The network is divided into corridors. The corridors can be operated by different carriers, where intercity and sprinter services are operated by the same carrier on a corridor. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route.	
In your opinion, what is the best contract form for this subdivision variant?	nominal
Please briefly explain your choice.	open
Subdivision variant Regionalisation	
The network is divided into regions. One carrier operates in each region, with intercity and sprinter services operated by the same carrier in a region. Carriers can provide train services in more than one region. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route.	
In your opinion, what is the best contract form for this subdivision variant?	nominal
Please briefly explain your choice.	open
Subdivision variant Free Network	
The network is divided into regions. One carrier operates in each region, with intercity and sprinter services operated by the same carrier in a region. Carriers can provide train services in more than one region. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route.	
In your opinion, what is the best contract form for this subdivision variant?	nominal
Please briefly explain your choice.	open
Part 2: Coordination issues	
The second part of this survey will focus on assessing a number of coordination issues. For 14 of these issues, you will be asked how important they are in different market structures. In the context of this research, a coordination issue is defined as follows:	

Question	Format
A coordination issue concerns the question of which resources the government should use to properly manage a market. These resources can, for example, consist of legislation and regulations, incentives or cooperation. The purpose of this part of the survey is to identify which issues play an important role if a particular market structure is chosen. The market structures included in this study consist of a subdivision variant (as in the first part of the survey) and an associated contract form. The proposed market structures are based on a literature study in which the most obvious interpretation of the market was sought. The market structures have been determined as follows: *Figure C.2* The questions are structured in the following way: 1. First a brief introduction is given. 2. The specific coordination question is then asked. 3. You are asked how big a role a particular issue plays in the case of the 6 market structures. 4. Finally, you will be asked to explain your choice by providing some concrete examples of things that need to be organised during implementation. For example, the questions could look like this: *Figure C.3* Please continue to the questions.	
Impact of market structure on the role of the Ministry of Infrastructure and Public Waterworks	
A certain market structure leads to a set of tasks for the ministry of Infrastructure and Public Waterworks to prevent market failure. The total range of market coordination tasks can be shared with decentral governments, the infrastructure manager, a (regional or national) public transport agency, and the carrier(s). The ministry of Infrastructure and Public Waterworks is the responsible ministry for the railways in The Netherlands. Decentral governments in this context are the current concessioning authorities, i.e. 10 provinces, 2 metropolitan areas and 1 public transport bureau.	
In your opinion, how much effort is needed to adapt the role of the Ministry of Infrastructure and Public Waterworks in the event of a change in market structure, in order to ensure correct market and concession management?	Likert-5
What, in your opinion, are the most important things to organise properly in the context of this issue?	open
Impact of market structure on the role of decentral governments	
A certain market structure leads to a set of tasks for decentral governments in the rail sector. Possible tasks could include: tender procedure and management, infrastructure management, rolling stock management, and development of the public transport product. The rail sector in this context is the set of governments, carriers, infrastructure managers, and academics and consultants. Decentral governments in this context are the current concessioning authorities, i.e. 10 provinces, 2 metropolitan areas and 1 public transport bureau.	
In your opinion, how much effort is needed in the rail sector to adapt the role of decentralised governments in the event of a change in market structure, in order to ensure correct market management and concession management?	Likert-5
What, in your opinion, are the most important things to organise properly in the context of this issue?	open
Impact of market structure on transition costs	
Transition costs may include changes in legislation and regulations, infrastructure adjustments, market restructuring costs, and procurement costs.	

Question	Format
In your opinion, to what extent does a change in market structure lead to transition costs?	Likert-5
In your opinion, what are the main causes of transition costs?	open
Impact of market structure on the need for expertise	
A certain market structure requires expertise in the rail sector regarding, for example, multimodal concessions, inter-governmental cooperation, public procurement and vertical integration. The rail sector in this context is the set of governments, carriers, infrastructure managers, and academics and consultants.	
In your opinion, how much expertise is lacking in the rail sector for the proper functioning of the system, in the case of a certain market structure?	Likert-5
On which issues do you think more expertise should be gathered?	open
Impact of market structure on the acquirement and safeguarding of knowledge?	
A good information and knowledge position is of great importance when organising the market. This means there must be good insight into product information (including passenger flows and revenues). In addition, sectoral knowledge (about timetables and tendering, among other things) must be adequately safeguarded.	
How complicated is organising the acquirement and safeguarding of knowledge in the case of a certain market structure?	Likert-5
Which matters, in your opinion, should be properly organised in the context of the knowledge position?	open
Impact of market structure on the provision of information	
Carriers are obliged by law to provide travel information under reasonable conditions. Responsibility for information provision may lie with different parties, but must be properly coordinated to ensure adequate traveller advice.	
In your opinion, how complicated is the coordination between carriers to provide uniform, correct and up-to-date travel information to travellers, in the case of a certain market structure?	Likert-5
In your opinion, which matters should be properly organised in the context of traveller advice?	open
Impact of market structure on the allocation of revenue responsibility	
When revenue responsibility is vested in the carrier (in the form of a net-cost contract), he has an incentive to increase his turnover by reducing costs or attracting more travellers. This is because they cannot pass the risk on to the taxpayer. On the other hand, when revenue responsibility is vested in the government (in the form of a gross-cost contract), the public function of public transport can be better safeguarded.	
In your opinion, which party should be responsible for revenue in the case of a certain market structure?	Nominal
Please explain your choices.	open
Impact of market structure on coordinating synergistic investments between IMs and carrier(s)	
In some cases, infrastructure manager and carrier(s) are both necessary for certain investments that benefit the entire rail sector (for example when implementing ERTMS). Because the cost structure can change due to investments, they will not be established without coordination. In addition, a long-term strategy for these synergistic investments is difficult to shape due to the incentive misalignment.	

Question	Format
How complicated is it to achieve synergistic investments between infrastructure manager and carrier(s), in the case of a certain market structure?	Likert-5
In your opinion, which matters should be properly organised in the context of synergistic investments?	open
Impact of market structure on timetables	
A certain market structure can create more transfers for travellers, because in some cases services across subdivision boundaries are no longer possible. In addition, in the case of multiple competing carriers, a prisoner's dilemma may arise, whereby each carrier optimises its timetable according to its own interests, but this does not lead to an optimal system.	
In your opinion, how complicated is it to ensure that the timetable is optimal for the entire system, in the case of a certain market structure?	Likert-5
In your opinion, which matters should be properly organised in the context of the timetable? And, from what perspective should optimisation be established (for example, from a traveller or logistics point of view)?	open
Impact of market structure on fare harmonisation	
Competing carriers can use rate differentiation to discourage switching carriers. In addition, single check-in/check-out is hampered by rate differentiation.	
How complicated is it to ensure that there is a simple and uniform ticketing and payment system for travellers in the event of a certain market structure?	Likert-5
Which matters, in your opinion, should be properly organised in the context of fares?	open
Impact of market structure on the synergy between train and regional public transport	
The synergy between train services and regional and local public transport (bus, tram, metro) can lead to growth in passengers and cost efficiency.	
To what extent do the possibilities for coordinating regional public transport with the train network change in the case of a certain market structure?	Likert-5
How does the coordination of regional public transport with the train network change in your opinion in the case of a certain market structure?	open
Impact of market structure on coordinating disruptions	
The chance of disruptions increases as the capacity on a route section is reached. Coordination becomes more complicated as more parties drive on a route section or station, with a complicated timetable as an additional complicating factor. Cutting up the network also leads to a reduction in scale, which reduces the availability of additional equipment.	
In your opinion, how complicated is it to adequately resolve incidental disruptions in the case of a certain market organisation?	Likert-5
In your opinion, which matters should be properly organised in the context of disruptions with a different market structure?	open
Impact of market structure on the number of entrants to the market	
The size of the regions in the case of a certain market structure can have an impact on the attractiveness for carriers to compete, because the scale has an impact on the possibilities for carriers to make a profitable proposal for train services.	
In your opinion, to what extent does a certain market structure influence the number of entrants to the market?	Likert-5

Question	Format
In your opinion, what are the most important things to take into account when choosing a market structure, in the context of the number of market parties?	open
Impact of market structure on the role of stations	
Development in and around stations is influenced by the ownership structure. In addition, access to stations and other service facilities can be an entry barrier for new entrants in the case of a certain market structure.	
How complicated is it to guarantee good service at stations and development of the station area in the case of a certain market structure?	Likert-5
In your opinion, what are the most important things to take into account when choosing a market structure, in the context of the service function and development of stations?	open
Overview coordination issues	
The following questions are optional. You can also continue to the conclusion. The following questions address how important coordination issues are in the case of a particular market organisation. You can select the issues that you believe are most important per market organisation. These may be one or more issues per market market organisation.	
In your opinion, what are the most important coordination issues in the case of the market organisation Monopoly?	multiple choice
In your opinion, what are the most important coordination issues in the case of the market organisation Status Quo?	multiple choice
In your opinion, what are the most important coordination issues in the case of the market organisation Service Split?	multiple choice
In your opinion, what are the most important coordination issues in the case of the market organisation Corridors?	multiple choice
In your opinion, what are the most important coordination issues in the case of the market organisation Regionalisation?	multiple choice
In your opinion, what are the most important coordination issues in the case of the market organisation Free Network?	multiple choice
Conclusion	
Would you like to add another coordination issue that you missed in this survey?	open
Do you have any additional comments?	open
After completing this survey, is there anyone you think would provide valuable input to this survey? Please leave his or her contact details below.	open
You have reached the end of the first round of this Delphi study. Thank you very much for completing this survey! The second part of this research will take place from December 18 to January 12. You will receive the survey on December 18. If you have any questions or comments regarding this survey, please get in touch using the contact details below.	

Table C.1: Survey questions round 1

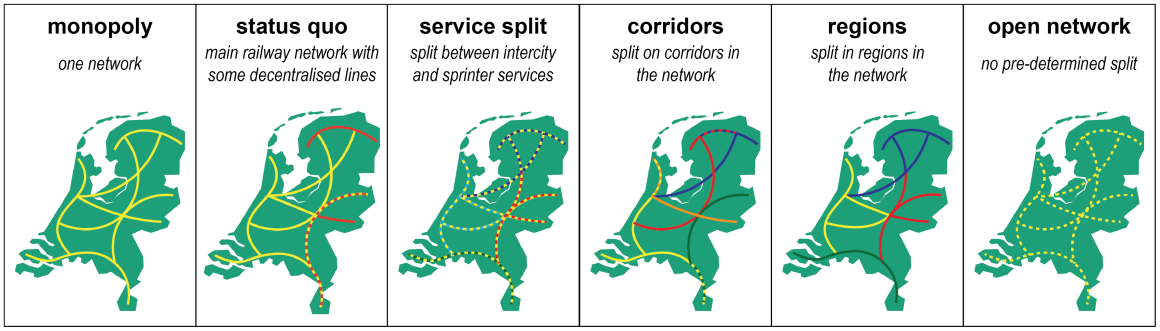

Figure C.1: Figure Part 1: Subdivision variants

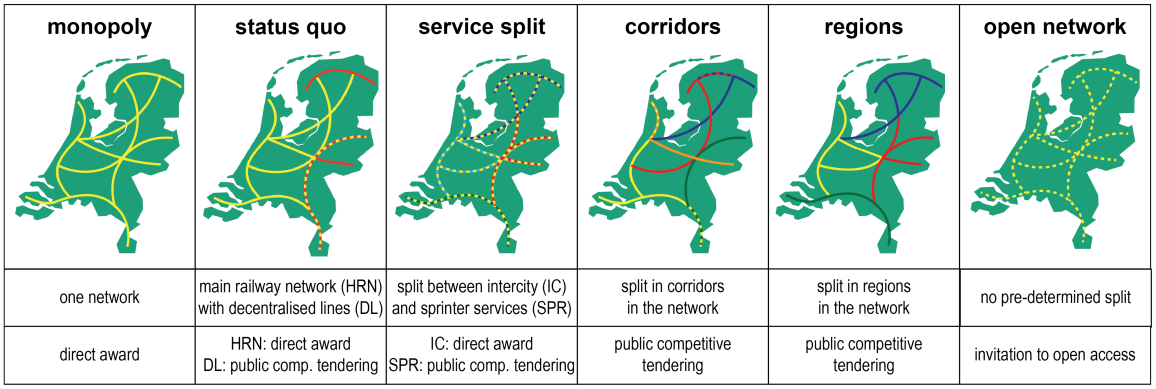

Figure C.2: Figure Part 2: Coordination issues

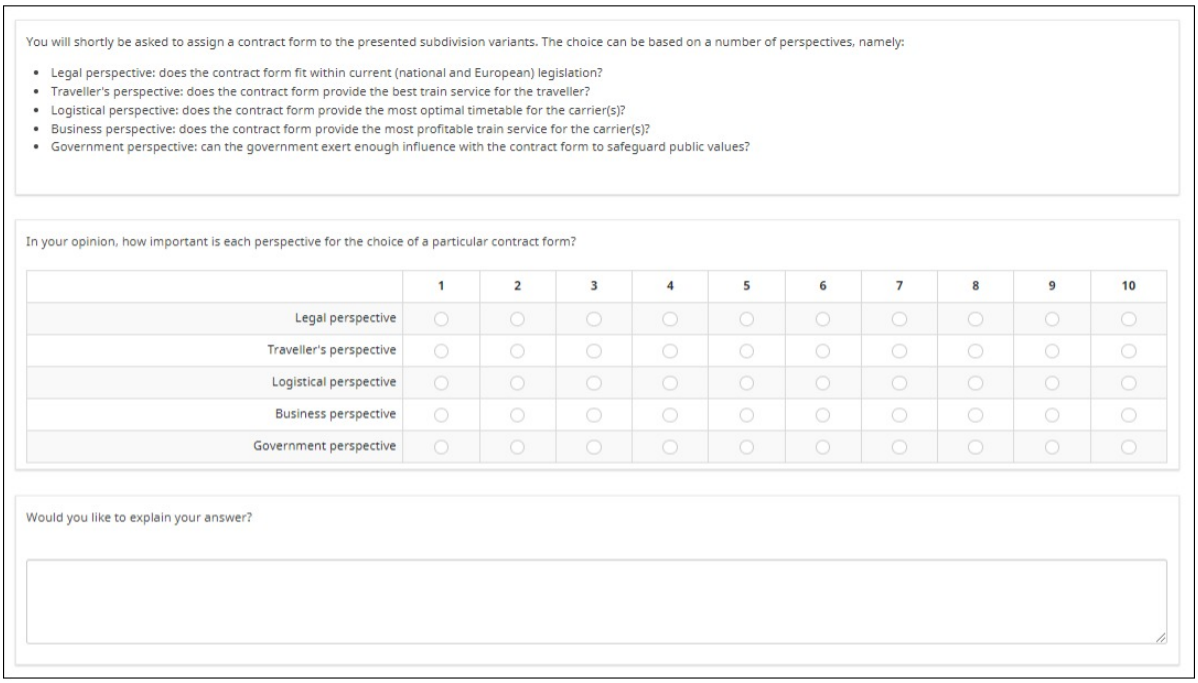

Figure C.3: Figure example question

D

Survey Questions Round 2

Please note that the wording of some definitions used in the survey questions has been changed in the thesis.

Question	Format
Thank you again for your cooperation in this research! In this second – and final – round of this Delphi study, the results from the first round are presented. You can then respond or provide explanations at your own discretion. The feedback will be presented in three parts; first the decision-making perspectives are discussed, secondly the possible contract forms, after which the coordination issues are presented. The duration of this survey is approximately half an hour. The deadline for this first round is January 14, 2024. Your contribution will only be processed anonymously. This research is monitored by Tijmen Godeke, master's student at Delft University of Technology and graduate intern at Goudappel (mobility consultancy). For questions about this research, please contact [email adress] or [phone number]. The Delphi study The Delphi study aims to generate consensus among respondents to this study. This is done by presenting the results of this first round in the second round, so that respondents can assess and comment on each other's insights. To achieve this and maintain the objective nature of the research results, your comments will only be processed anonymously. Therefore, I encourage you to respond to the questions from your own professional perspective.	
Introduction	
Before the substantive questions are presented to you, there are first two questions to classify you into a category of respondents. The answers to these questions will not be traceable to you in the final publication.	
Which stakeholder group do you belong to?	nominal
How many years of experience do you have in the rail sector?	numerical
Part 1: Perspectives	

Question	Format
In the first round, the question was asked from what perspective the choice of a contract form for the Dutch rail market should be taken. The choices were: • Legal perspective: does the contract form fit within current (national and European) legislation? • Traveller's perspective: does the contract form provide the best train service for the traveller? • Logistical perspective: does the contract form provide the most optimal timetable for the carrier(s)? • Business perspective: does the contract form provide the most profitable train service for the carrier(s)? • Government perspective: can the government exert enough influence with the contract form to safeguard public values? The respondent group assessed the perspectives as follows: *Figure D.1* The traveller and government perspective are seen as the most important perspectives. The reason given for this is that safeguarding public values, and therefore good public transport for the traveller, is the most important for the design of public transport. There is most disagreement about the legal perspective. On the one hand, the legal framework is mentioned as a given, in which the market structure must be formed. On the other hand, it is stated that the legal framework must and can be adjusted if there are good reasons for this. With regard to the business and logistics point of view, it is stated that profit should not necessarily be leading, but a favourable timetable and a reasonable business case are preconditions for the proper functioning of the system.	
Would you like to comment on this?	open
Allotment types	
In the first round you assessed the relationship between subdivision variants of the rail network and contract types. The results of this part are now presented to you, after which you can comment on the results. Providing a comment is not mandatory. You can now move on to the questions.	
Subdivision variants Monopoly and Status Quo	
These two subdivision variants are presented together here because they are very similar. In the monopoly scenario, all services on the network are run by one carrier. With the Status quo, the network is the same as it is now. There is a main rail network, with some decentralized lines. Small changes in the number of decentralized lines are also part of this scenario. The main rail network is run by one carrier and the decentralized lines each have their own carrier. The respondent group assessed the market forms for the Monopoly and Status Quo subdivision variants as follows: *Figure D.2*	
Arguments in favour of public competitive tendering of the network or HRN • Direct award is not permitted and is not in line with the WP2000. • With public competitive tendering there is more choice and better requirements can be imposed. • The government's negotiating position is improved. • In the case of a direct award, the carrier is given too much power compared to the contracting authority. • The dynamics in the market are not improved by public interference. Would you like to respond to this?	open

Question	Format
Arguments in favour of open access HRN • HRN is financially profitable, so there is no reason for public competitive tendering. Would you like to respond to this?	open
Arguments against public competitive tendering of the network or HRN • The entire network or HRN is too large, integral, complex and risky a concession to take over in one go. It is also too big to have (often) concession takeovers. • Public competitive tendering does not lead to substantive differences, because the equipment and personnel must be taken over from NS. • The NS is a well-known partner, while the relationship with a new carrier is unknown. • The current model works well. Would you like to respond to this?	open
Comments in the case of direct award of HRN • A direct award requires cooperation and appropriate guidance from the government, and there must be a very strong benchmark element. • When combined with public competitive tendering of the secondary lines, the question arises whether cross-subsidy is desirable (and the holder of the HRN concession can therefore possibly compete in public competitive tendering below market price). • Direct award of HRN must take place without subsidy, because this part of the network is financially profitable. Would you like to respond to this?	open
Subdivision variant Service Split	
The network is divided into the intercity and sprinter services. The intercity services are operated nation-wide by one carrier. The sprinter services are split into regions and can be operated by different carriers. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route. Results round 1 The respondent group assessed the market forms for the Service Split subdivision variant as follows: *Figure D.3*	
Arguments in favour of public competitive tendering • The public tendering of intercity trains is possible if they are also divided into regions or corridors. • Tendering corridors one by one can promote the learning process. • Sprinters are often not profitable, so require government subsidies. This makes tendering more obvious. • Public tendering provides the opportunity for regional optimization. Comments on public competitive tendering • Better guidance and direction from the government is a prerequisite for tendering for intercity services. The government must build up more expertise for this. Would you like to comment on this?	open
Arguments in favour of open access • The HRN covers costs, so there is no reason for government intervention there. Arguments against open access • There is a need for coordination between carriers. This can possibly be done with open access, but public tendering would then be more obvious. Would you like to comment on this?	open
Subdivision variant Corridors	

Question	Format
The network is divided into corridors. The corridors can be operated by different carriers, where intercity and sprinter services are operated by the same carrier on a corridor. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route. Results round 1 The respondent group assessed the market forms for the Corridors subdivision variant as follows: *Figure D.4*	
Arguments against the corridor variant • Poorly implementable and vulnerable. They are long lines with little or no synergy with other lines. This results in a logistical drama in the event of disruptions or equipment failure. Would you like to comment on this?	open
Arguments in favour of invitation to open access • There may be a possibility for cross-subsidy to take place between sprinters and intercity trains on a corridor. Would you like to comment on this?	open
Arguments in favour of public competitive tendering • The corridors are manageable for carriers, so size is not a problem. • The corridors allow the right package of requirements to be put together for each corridor. • Public tendering leads to the best price-quality ratio for the traveller. Would you like to comment on this?	open
Comments on public competitive tendering • Good requirements must be set by the contracting authority to ensure good coordination between carriers on the same corridor. • Public tendering is not possible at the moment, but it will be possible in the long term. Private award can then function as a starting situation. • In the case of public tendering, the concession period may be longer and become dependent on benchmarked performance. This prevents unnecessary transaction costs. • It is important that there is not always the same winner. • The government still needs a lot of expertise for public tendering. Would you like to comment on this?	open
Subdivision variant Regionalisation	
The network is divided into regions. One carrier operates in each region, with intercity and sprinter services operated by the same carrier in a region. Carriers can provide train services in more than one region. The intercity service is an express train between major stations. The sprinter service is a local train that stops at every station on its route. Results round 1 The respondents are unanimous about the most suitable contract form for this subdivision variant. Public competitive tendering is assessed as most suitable. *Figure D.5*	

Question	Format
Comments on this subdivision variant • Open access is not an option, because parts of the subnetworks are not profitable. In addition, open access limits the timetable, which may create the need for the government to purchase additional timetables. • Public tendering is the least bad option for this allotment variant. • This subdivision variant opens up the option of tendering without excessive risks, with good regional integration, and manageable plots for carriers. • The integration between regions (in terms of ticketing and timetables) is very important with this variant. • This variant does require a thorough redesign of the timetable and adjustments to the infrastructure. Would you like to comment on this?	open
Subdivision variant Free Network	
The network is not specified in advance. The services are designed by the carrier, possibly in collaboration with other carriers or the government. Results round 1 The respondent group assessed the market structures for the Corridors subdivision variant as follows: *Figure D.6*	
Arguments in favour of open access • Market organization has always had to take place under government intervention. There are examples where open access has created services and new capabilities that would not have happened without open access. • Open access can possibly be supplemented with tenders. Would you like to comment on this?	open
Arguments against open access • You don't know what service is offered. • The supply is limited and can change quickly. • Government intervention becomes very expensive due to possible additional purchase of timetable hours. • Open access does not lead to a coherent product or efficient use of the network. • Carriers must be checked in advance whether they are operationally and financially capable of operating the train service for the long term. Would you like to comment on this?	open
Impact of market structure on the role of the Ministry of Infrastructure and Public Waterworks	
A certain market structure leads to a set of tasks for the ministry of Infrastructure and Public Waterworks to prevent market failure. The total range of market coordination tasks can be shared with decentral governments, the infrastructure manager, a (regional or national) public transport agency, and the carrier(s). The ministry of Infrastructure and Public Waterworks is the responsible ministry for the railways in The Netherlands. Decentral governments in this context are the current concessioning authorities, i.e. 10 provinces, 2 metropolitan areas and 1 public transport bureau. The respondent group assesses the effort required to adapt the role of the Ministry of Infrastructure and Public Waterworks in the event of a change in market structure as follows: *Figure D.7*	

Question	Format
General remarks In many of the scenarios, the coordinating role of the government will become much more important, with the necessary adjustments. The interpretation of that role may differ. The government must take on a larger role and take more control with regard to the public transport product and network development. Particularly in the case of further subdivision of the network, it is important that I&W has the knowledge to arrange this correctly. This knowledge is currently lacking, and it relies too much on the knowledge of the incumbent carrier and ProRail. It must develop its own vision and make choices so that the right market form and carriers can then be found. Matters that lie with I&W: • Properly recording a Program of Requirements with explicit input from travellers • Consultation with the ministry of Education regarding student travel rights. • Guaranteeing the price for the traveller via a predetermined mechanism. • Have a vision on the goals of the rail system in the Netherlands. • Understanding technical characteristics of the track (timetable, connections, etc.) • Vision on market development (demand). • Assessing the value of open accession proposals. Would you like to comment on this?	open
Comments regarding open access • Open access requires little effort, because the initiative lies with the market and there is no concession. • The government's withdrawal could lead to major problems. • We are not yet equipped at all for open access. How do we ensure that all pre- and post-transport and mutual train connections continue to run smoothly for many years to come, if the highest order modality belongs to a free entrepreneur in open access. Would you like to comment on this?	open
Comments regarding monopoly • A monopoly requires a great deal of effort, because the government decides. • Regional authorities must be involved in decision-making. Would you like to comment on this?	open
Impact of market structure on the role of decentral governments	
A certain market structure leads to a set of tasks for decentral governments in the rail sector. Possible tasks could include: tender procedure and management, infrastructure management, rolling stock management, and development of the public transport product. The rail sector in this context is the set of governments, carriers, infrastructure managers, and academics and consultants. Decentral governments in this context are the current concessioning authorities, i.e. 10 provinces, 2 metropolitan areas and 1 public transport bureau. The respondent group assessed the effort to adapt the role of decentral governments in the case of a certain market structure as follows: *Figure D.8*	
Comments regarding monopoly • Here it is difficult for local authorities to realize their wishes. • Decentralized governments could be better involved in decision-making. Would you like to comment on this?	open
Comments regarding regionalization and service split • Decentralized governments probably have a greater role here. This depends on how much influence is allocated in the tender procedures. • Decentralized governments can also adapt sprinters to their wishes here on the HRN. Would you like to comment on this?	open

Question	Format
Comments regarding open access • Here, decentralized authorities have little or no direct influence. • We are not yet equipped at all for open access. How do we ensure that all pre- and post-transport and mutual train connections continue to run smoothly for many years to come, if the highest order modality of a free entrepreneur is open access. Would you like to comment on this?	open
Impact of market structure on transition costs	
Transition costs may include changes in legislation and regulations, infrastructure adjustments, market restructuring costs, and procurement costs. The respondents estimate the amount of transition costs per market structure as follows: *Figure D.9*	
Comments regarding open access In the case of open access, a number of things must be offered to carriers: • Flexibility in vehicle types • Possibilities for the parking and maintenance of rolling stock Would you like to comment on this?	open
Comments regarding market structures Capacity can be lost, and compensation can be very expensive. • The train route can change, which affects infrastructure demand. • The transformation of the roles of NS, ProRail and the ministry is substantial. • The more parties active on the railways, the less responsible these parties feel for the transition. In that case, this requires more investment. Would you like to comment on this?	open
Comments regarding changes • The unique character of the Dutch market structure creates a challenge in shaping the details of a new market structure. • Changing to a different market structure can provide a better quality/price ratio. These benefits for the traveller may outweigh the transition costs. • The type of transition costs varies per scenario but is high everywhere (with the exception of the status quo). Would you like to comment on this?	open
Impact of market structure on the need for expertise	
A certain market structure requires expertise in the rail sector regarding, for example, multimodal concessions, inter-governmental cooperation, public procurement and vertical integration. The rail sector in this context is the set of governments, carriers, infrastructure managers, and academics and consultants. Respondents assessed the need for new expertise in the case of a given market structure as follows: *Figure D.10*	
General comments regarding the need for expertise • In general, there is a lack of expertise. • A gradual transition provides space for a learning process. • In a monopoly the problem is slightly smaller than in the case of open access. The more market is introduced, the more ProRail's role changes, which requires additional expertise. Would you like to comment on this?	open

Question	Format
Comments regarding the amount of expertise required to introduce (more) open access There are two views on the amount of expertise for open access: • For networks with open access, the knowledge to ensure coherence is lacking, for example in timetables, rates, connections, diversions. • Open access networks do not require additional expertise. Would you like to comment on this?	open
Impact of market structure on the acquirement and safeguarding of knowledge	
A good information and knowledge position is of great importance when organising the market. This means there must be good insight into product information (including passenger flows and revenues). In addition, sectoral knowledge (about timetables and tendering, among other things) must be adequately safeguarded. The respondents assessed how complicated it is to organize the acquirement and safeguarding of knowledge as follows: *Figure D.11*	
Comments on acquiring and safeguarding knowledge in relation to market structure • Acquiring and safeguarding knowledge is easier to establish in the case of a monopoly, but in the case of tendering and open access, obtaining knowledge from the carrier becomes increasingly difficult. • This is reinforced by entry and exit; the knowledge remains in the operation, but at management and planning level this becomes more difficult as there are more entries and exits. • Others argue that with a monopoly the government cannot gather knowledge because everything is protected. Would you like to comment on this?	open
General comments about the safeguarding of knowledge • Knowledge exchange should be regulated through contracts or regulations. • The knowledge position must be safeguarded by the government, so that relevant knowledge is collected within the government and actually used. • There must be a central entity that organizes the safeguarding of knowledge. Would you like to comment on this?	open
Impact of market structure on the provision of information	
Carriers are obliged by law to provide travel information under reasonable conditions. Responsibility for information provision may lie with different parties, but must be properly coordinated to ensure adequate traveller advice. The respondents assessed the complexity of organizing coordination between carriers for travel information to travellers as follows: *Figure D.12*	
Comments regarding the provision of travel information • Providing travel information problematic in the case of a monopoly. • A competitive situation does not provide any additional incentives. • In a free network you get good information, but only per carrier. • Sharing travel information between carriers is very complicated, so the more carriers the more complicated it is. • In general, carriers have an incentive to jointly provide good travel information. • The tasks regarding travel information should be arranged centrally, so that information is shared uniformly with the traveller. Others say that there are already guidelines and regulations that must be adhered to, and that sharing passenger information is not difficult for organizations active in the rail domain. Would you like to comment on this?	open
Impact of market structure on the allocation of revenue responsibility	

Question	Format
When revenue responsibility is vested in the carrier (in the form of a net-cost contract), he has an incentive to increase his turnover by reducing costs or attracting more travellers. This is because they cannot pass the risk on to the taxpayer. On the other hand, when revenue responsibility is vested in the government (in the form of a gross-cost contract), the public function of public transport can be better safeguarded. The respondents assessed the allocation of revenue responsibility in different market structures as follows: *Figure D.13*	
Remarks on allocating revenue responsibility At the carrier: • In the case of a free network. • Carriers are best able to determine the price because they are best informed about market demand. At the government: • When revenue allocation becomes complicated (for uniform rate). • In the case of a free network to maintain a uniform tariff system and guarantee public function. • In the case of major concessions, only the government can bear the risk. Other remarks • Are there other ways to incentivize carriers to perform well? • The development function and minimum requirements must be related to the revenue responsibility. Would you like to comment on this?	open
Impact of market structure on coordinating synergistic investments between IMs and carrier(s)	
In some cases, infrastructure manager and carrier(s) are both necessary for certain investments that benefit the entire rail sector (for example when implementing ERTMS). Because the cost structure can change due to investments, they will not be established without coordination. In addition, a long-term strategy for these synergistic investments is difficult to shape due to the incentive misalignment. The respondents assessed the following regarding establishing synergistic investments between infrastructure manager and carrier(s): *Figure D.14*	
Remarks on synergistic investments • Coordinating investments is only very complicated in a free network because the future supply is unknown. • There is only certainty with a monopoly, because you can then respond to developments in society. • The more carriers, the more complicated it becomes, and the more there is a role for the government in determining and coordinating investments. Would you like to comment on this?	open
Impact of market structure on timetables	
A certain market structure can create more transfers for travellers, because in some cases services across subdivision boundaries are no longer possible. In addition, in the case of multiple competing carriers, a prisoner's dilemma may arise, whereby each carrier optimises its timetable according to its own interests, but this does not lead to an optimal system. The respondents assessed the following regarding the coordination of the timetable in the case of a certain market structure: *Figure D.15*	

Question	Format
Comments about timetable coordination • The coordination is very complicated in a free network. • In a monopoly, coordination is not complicated at all. However, with a monopolist, the demands of the labour unions are more often taken into account. • As complexity increases, the space will increasingly have to be designed by the government and ProRail. • The complexity is specific to each zone on the network, because some parts of the network are logically connected. Would you like to comment on this?	open
Impact of market structure on fare harmonisation	
Competing carriers can use fare differentiation to discourage switching carriers. In addition, single check-in/check-out is hampered by rate differentiation. The respondents assessed the following about organizing a ticketing and payment system for travellers in the case of a certain market structure: *Figure D.16*	
Comments on government intervention • It is mentioned that it is not obvious that the government should intervene in setting rates, in a different way than in other markets of the economy. • Others argue that the government can and should intervene and establish a nationally prescribed system. This allows one public transport system to be created for the traveller. Would you like to comment on this?	open
General remarks • In a free network, each carrier wants to set its own price. • A uniform ticketing and payment system can be achieved through tendering. • A uniform payment system has already been achieved with the OV chip card and OV-Pay. The revenue distribution between carriers is the most complicated. • Non-uniform ticketing is possible, if the price is significantly lower. Would you like to comment on this?	open
Impact of market structure on the synergy between train and regional public transport	
The synergy between train services and regional and local public transport (bus, tram, metro) can lead to growth in passengers and cost efficiency. The respondents assessed the possibilities for harmonizing regional public transport with the train network for different market structures as follows: *Figure D.17*	
Comments on the synergy between regional public transport and the train network • Coordination is difficult to enforce, so it depends on the incentive for the carrier. • Carriers in a monopoly or open access may “ignore” synergy because they consider other motives more important. • Regionalization and service splitting clearly offer additional possibilities. • The coordination options also depend on the extent to which local authorities can influence the timetable. Would you like to respond to this?	open
Impact of market structure on coordinating disruptions	
The chance of disruptions increases as the capacity on a route section is reached. Coordination becomes more complicated as more parties drive on a route section or station, with a complicated timetable as an additional complicating factor. Cutting up the network also leads to a reduction in scale, which reduces the availability of additional equipment. The respondents assessed the coordination of incidental disruptions in a certain market structure as follows: *Figure D.18*	

Question	Format
Comments on the number of entities in the market • The more parties are involved, the more complicated the coordination becomes • Others argue that it is complicated in the current situation, because the NS has a national deployment of equipment and personnel. When splitting up, the disruption only occurs in the area where the disruption occurs. • Others argue that the number of parties is not the problem, but the agreements with the infrastructure manager. Would you like to comment on this?	open
General remarks • The problem is mainly in places where there is overlap between carriers. • The incentives must be well organized; the financial incentives should not be more important than the interests of the traveller. Would you like to comment on this?	open
Impact of market structure on the number of entrants to the market	
The size of the regions in the case of a certain market structure can have an impact on the attractiveness for carriers to compete, because the scale has an impact on the possibilities for carriers to make a profitable proposal for train services. The respondents assessed the influence of market structure on the number of market entrants as follows: *Figure D.19*	
Comments on the number of entrants The factors that influence the number of entrants are: • Scope of the timetable • The availability of equipment • The length of the tender • The responsibilities of the carrier during the concession • The manageability of the business case • The allocation of system tasks and operational interconnections at the current carrier The number of carriers is not a goal in itself, the goal is a healthy market. The question is whether the Netherlands is large enough to be able to exert sufficient influence on this. Would you like to comment on this?	open
Impact of market structure on the role of stations	
Development in and around stations is influenced by the ownership structure. In addition, access to stations and other service facilities can be an entry barrier for new entrants in the case of a certain market structure. The respondents assessed the complexity surrounding the development of the station area in the case of a certain market structure as follows: *Figure D.20*	
Remarks on station ownership structure • The development of stations should be carried out by a completely independent party (such as ProRail) (just like Schiphol). • Others argue that the synergy between stations and train services can provide an incentive for the carrier to attract additional travellers through an attractive train product and station. • In any case, the stations should not belong to one carrier if there is competition on the track around that station. Would you like to comment on this?	open

Question	Format
General comments on station development • The passenger flows guide the development of the station areas, because this is now done on a commercial basis by ProRail, NS, municipalities, and other real estate companies. Therefore, a market structure that limits the number of travellers can influence this. • At stations with a confluence of carriers, the development of stations must be well organized. Would you like to respond to this?	open
Conclusion	
Do you have any additional remarks?	open
Do you want to receive the final report after completion?	open

Table D.1: Survey questions round 2

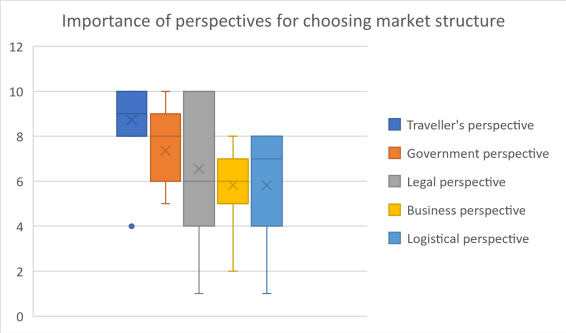

Figure D.1: Results round 1: perspectives

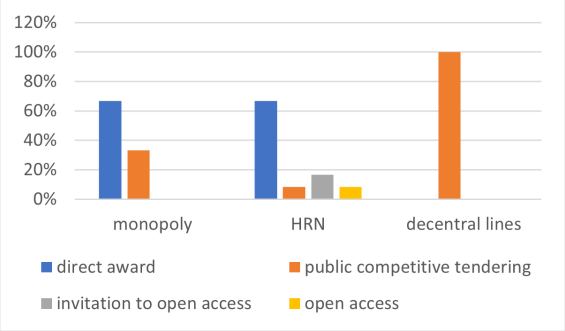

Figure D.2: Results round 1: Monopoly and Status Quo

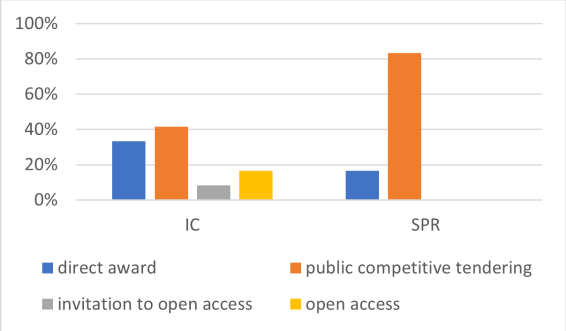

Figure D.3: Results round 1: Service Split

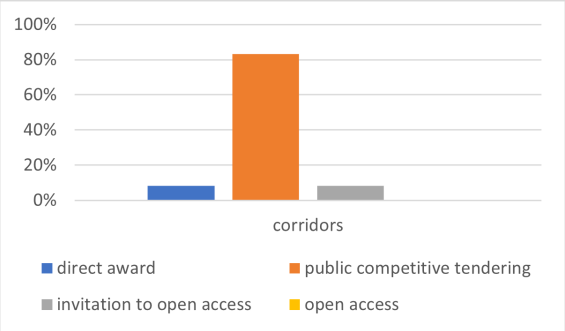

Figure D.4: Results round 1: Corridors

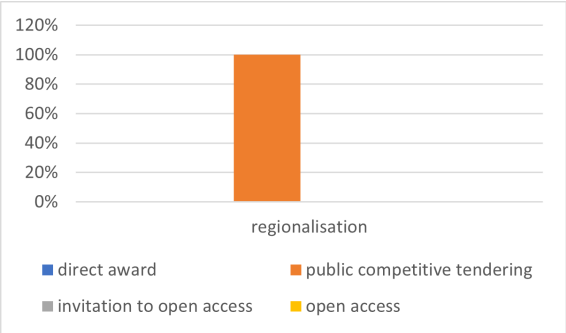

Figure D.5: Results round 1: Regionalisation

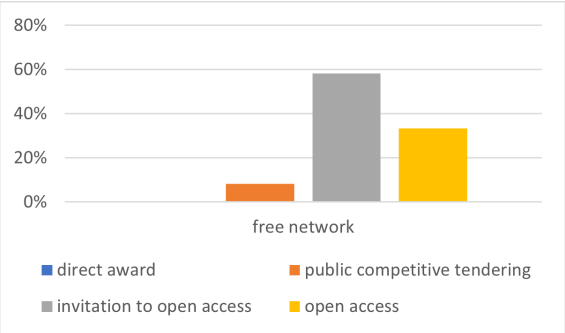

Figure D.6: Results round 1: Free Network

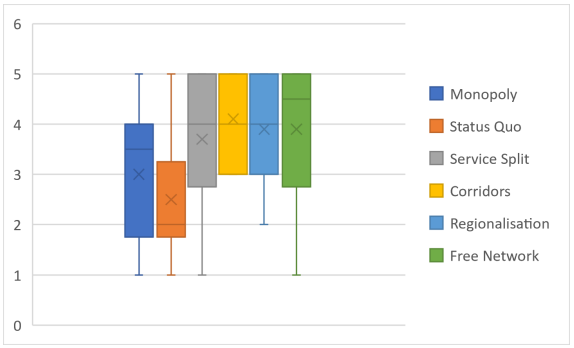

Figure D.7: Results round 1: impact of market structure on the role of the Ministry of Infrastructure and Public Waterworks

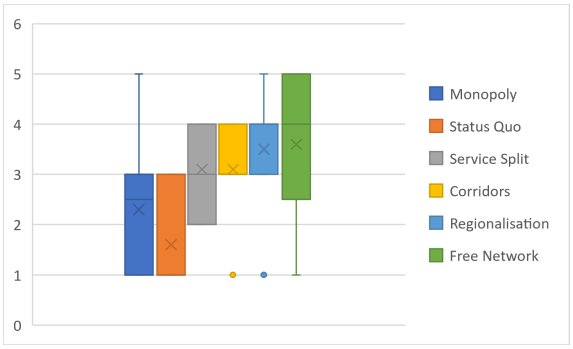

Figure D.8: Results round 1: impact of market structure on the role of decentral governments

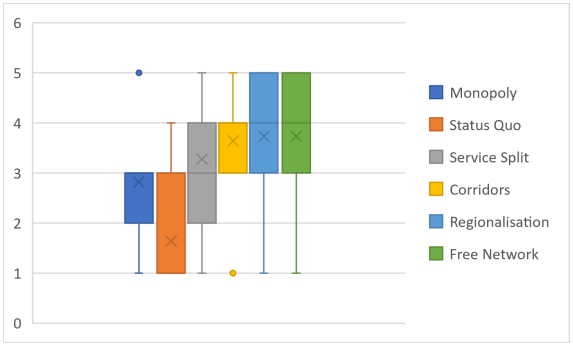

Figure D.9: Results round 1: impact of market structure on transition costs

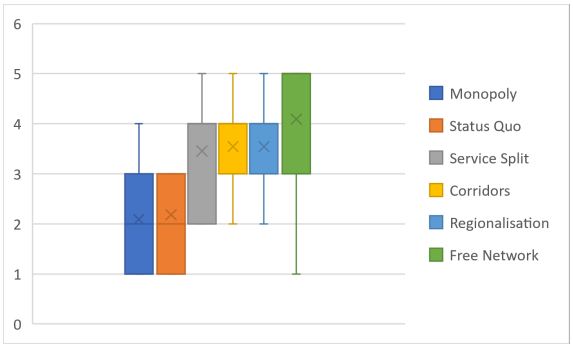

Figure D.10: Results round 1: impact of market structure on the need for expertise

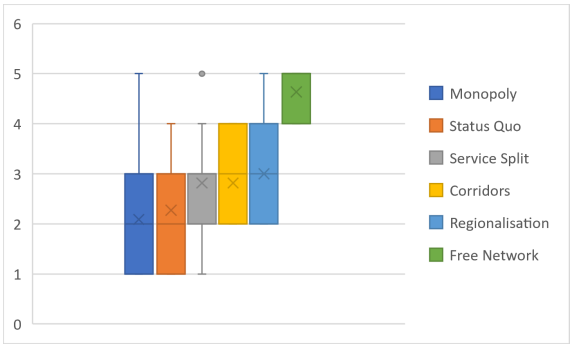

Figure D.11: Results round 1: impact of market structure on the acquirement and safeguarding of knowledge

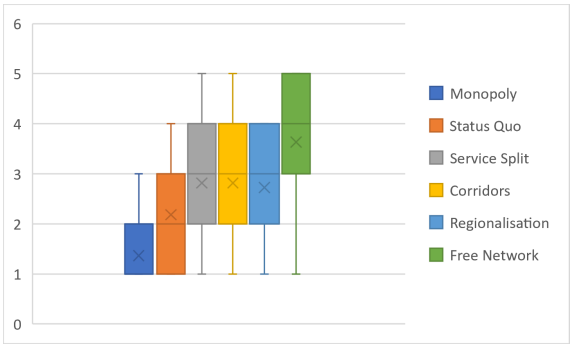

Figure D.12: Results round 1: impact of market structure on the provision of information

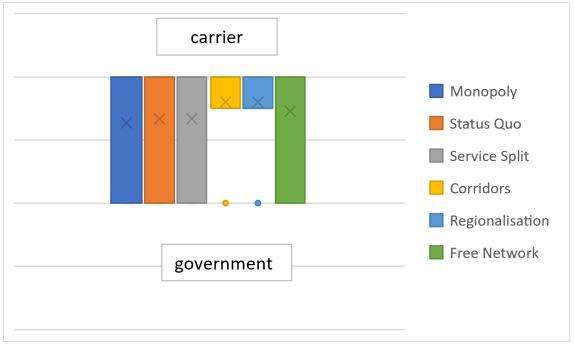

Figure D.13: Results round 1: impact of market structure on the allocation of revenue responsibility

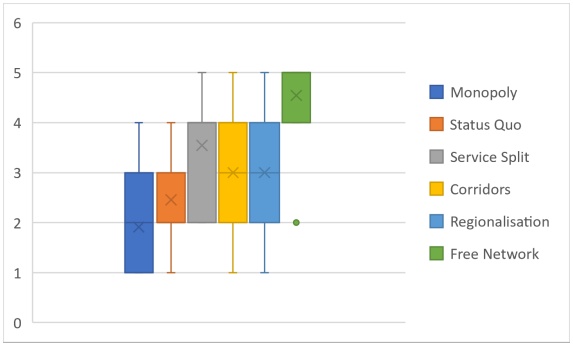

Figure D.14: Results round 1: impact of market structure on coordinating synergistic investments between IMs and carrier(s)

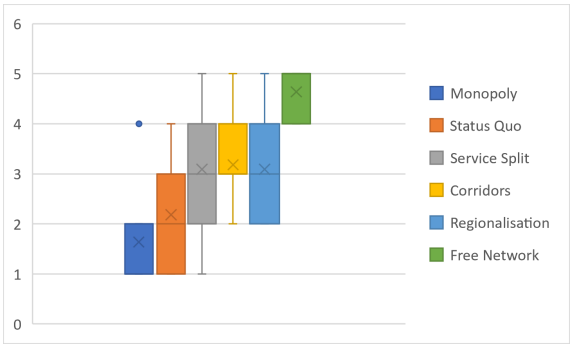

Figure D.15: Results round 1: impact of market structures on timetables

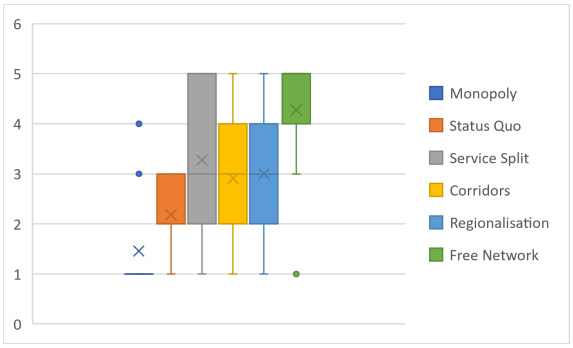

Figure D.16: Results round 1: impact of market structure on fare harmonisation

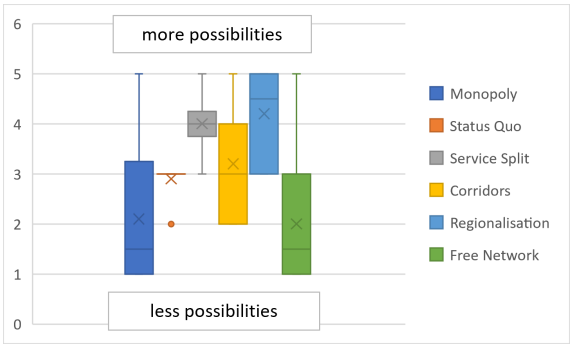

Figure D.17: Results round 1: impact of market structure on the synergy between train and regional public transport

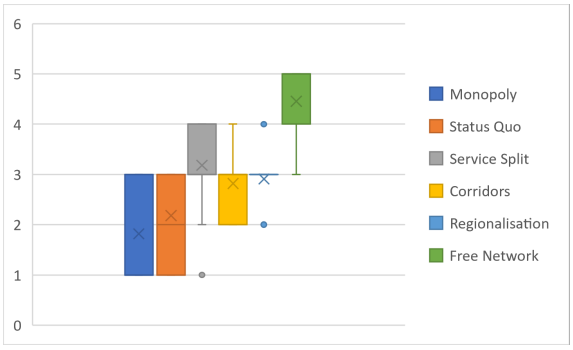

Figure D.18: Results round 1: impact of market structure on coordinating disruptions

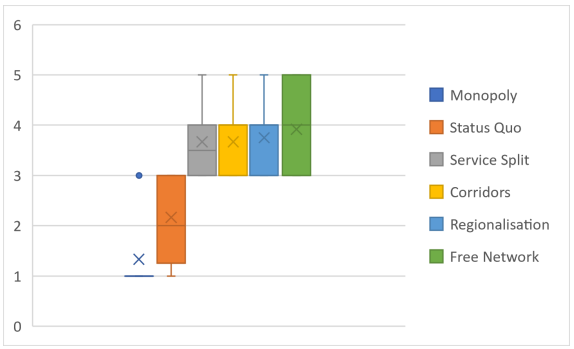

Figure D.19: Results round 1: impact of market structure on the number of entrants to the market

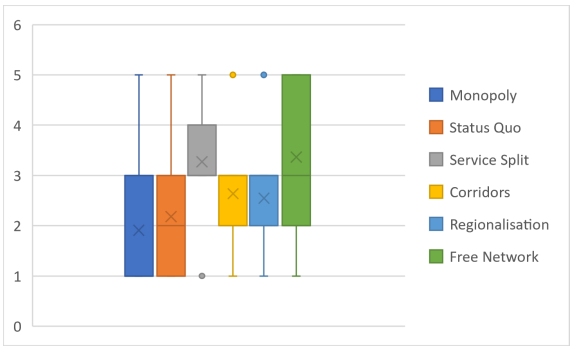

Figure D.20: Results round 1: impact of market structure on the role of stations