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Analysis of competition in European open access long-distance passenger rail markets

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**UNIVERSITY OF
PLYMOUTH**

**ANALYSIS OF COMPETITION IN EUROPEAN
OPEN ACCESS LONG-DISTANCE PASSENGER
RAIL MARKETS**

by

LISA IRENE FEUERSTEIN

A thesis submitted to the University of Plymouth in partial fulfilment for the
degree of

DOCTOR OF PHILOSOPHY

Plymouth Business School

December 2019

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The work on this thesis has been a very interesting and challenging journey, where I not only learned a great deal about the network and railway industry but also about myself and my individual way of working and learning. Would I do it again? Yes! Would I do it once more? Probably not... Looking back, I spent more than 4 years with at least 3,000 hours preparing this thesis, read at least 600 papers, books and reports, drank more than 1,000 cups of coffee, met many interesting people and printed countless pages. Since this thesis would have never been possible with the help of some people, I want to say thank you.

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Yours sincerely

A handwritten signature in black ink that reads "Lisa Fe" followed by a long, horizontal, slightly wavy line.

Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

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Abstract**Analysis of competition in European open access long-distance passenger rail markets, by Lisa Irene Feuerstein**

This thesis explores factors influencing open access competition in long-distance passenger rail transport in Europe. It fills a gap in the existing literature by providing expert opinions on open access competition, by identifying and rating factors influencing competition positively or negatively as well as their correlation and shift over time, and by comparing practical examples of influencing factors in two cases. To answer the research questions, a combination of qualitative and quantitative methodology was applied: a Delphi study helped to construct a theoretical framework, the case study filled the framework with practical examples. To structure and frame the analysis and to reveal the cause-and-effect relationships, a PESTLE analysis was used. It clustered the identified factors into political, economic, social, technical, legal and environmental influence. This structured research approach reveals the following findings: open access competition is a tool to revitalise the passenger rail market, it is beneficial for customers by increasing quality and often decreasing prices, and it can improve the efficiency of incumbent operators. However, only a slight increase in competition is expected within the next 10 years. A total of 34 influencing factors were identified, of which political/legal and economic factors have the greatest influence. The findings show that the strength and type of factors vary between the different EU member states. An overall shift of factors can be observed over the last decade. It is also revealed that all factors closely relate to one another and are part of a network. Within this identified network, the right combination of influencing factors needs to be

present to make open access competition possible. Finally, this thesis shows that the introduction of a competitive market proved to be difficult, especially due to the slow introduction of the necessary legal framework and the high economic risks and long-term investments. However, open access competition is possible and proves to be beneficial in the long run.

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B. List of abbreviations

Agcom	Autorità per le garanzie nelle comunicazioni (Italian Competition and Market Guarantee Authority)
ANSF	Agenzia Nazionale per la Sicurezza delle Ferrovie (Italian Railway Safety Agency)
ART	Autorità di Regolazione dei Trasporti (Italian Railway Authority)
BMVI	Bundesministerium für Verkehr und digitale Infrastruktur (German Transport Ministry)
BNetzA	Bundesnetzagentur (German Federal Network Agency)
CD	České dráhy
DB Fv	DB Fernverkehr AG
DB	Deutsche Bahn
DB/ÖBB	Cooperation of DB Fernverkehr AG and ÖBB Personenverkehr
DMU	Diesel-powered train units
EBA	Eisenbahnbundesamt (German Federal Railway Authority)
EC	European Commission
ECJ	European Court of Justice
ERA	European Union Agency for Railways
ERegG	Eisenbahnregulierungsgesetz (German Railway Regulation Law)
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
EU	European Union
EUR	Euro, European currency
FSI	Ferrovie dello Stato Italiane S.p.A.
HKX	Hamburg-Köln-Express
HS/HC	High-speed and high capacity
IM	Infrastructure manager or infrastructure provider

IS	Inquiring System
LEO	LEO Express
MIT	Ministero delle Infrastrutture e die Trasporti (Italian Transport and Infrastructur Ministry)
MTR	MTR Express
NTV	Nuovo Trasporto Viaggiatori
ÖBB Pv	ÖBB Personenverkehr
ÖBB	Österreichische Bundesbahnen
OD	Origin-Destination
ORR	Office of Rail and Road
PSO	Public service obligation
RAC	Rail access charges
RDC	Rail Development Corporation
RFI	Rete Ferroviaria Italiana S.p.A (Italian infrastructure provider)
RIC	Regolamento Internazionale delle Carrozze (international coach regulation)
ROSCO	Rolling stock leasing companies
RU	Railway undertaking
SJ	Swedish railways
TI	Trenitalia
TSI	Technical specification for interoperability
GB	Great Britain
URSF	Ufficio Regolamentazione del Servizio Ferroviario (Italian Railway Service Regulatory Office)

1. Chapter 1: Introduction

Almost 200 years ago in the age of industrialisation, the railway was a major force for social change all over Europe. Originally meant to transport goods such as coal, wood and steel, a market for personal mobility and railway travel developed quickly and the passenger figures increased exponentially. People could travel faster, more comfortably and consequently more often – cities and countries grew closer together and the railway added a new dimension of mobility for the entire population. Urban growth was taking place in interaction with human migration, industrial development and the extension of the rail network (Baron 2015). This marked the beginning of the golden age of passenger rail transport with its often prestigious lines.

Yet, ever since the 1970s, rail's share of passenger transport in Europe has declined from 10% to a stable 6% in the 2000s (Di Pietrantonio & Pelkmans 2004, EC 2017g). The benefits of market growth in recent decades fell to other modes of transport such as private car travel, air or coach transport, while rail struggled to keep old and win new customers. The reasons for this development are diverse and were often initiated by political decisions. Over decades, politicians favoured air and road transport regarding investment in new infrastructure, tax regulation and so forth. The passenger rail industry itself was insufficiently dynamic and failed to adapt to changing customer wishes and new standards in the mobility market (Niedhart 2009).

To break this trend and once again strengthen, modernise and revitalise rail transport in Europe, a new political and legal framework was established by the European Union ("EU"). New regulations and directives were introduced from 1991 onwards to perform this task (Holvad 2009). This was a starting point for

major changes in European passenger rail transport and resulted in gradual transformation which is still in progress. The old state monopolies were broken up step by step and new competitors started operation (Warnecke & Götz 2012), on which this thesis focuses.

Despite the changes which took place in recent years, European rail transport finds itself at a crossroads (EC 2011): new challenges such as the implementation of a pan-European train control system, or the adaptation to the growing opportunities due to digitalisation present themselves. Old challenges such as the high fixed-costs structure and the relatively slow liberalisation of the market remain. Several studies show that the existing law in the books is on the one hand not yet fully implemented and on the other hand is often transferred differently into national law (Laperrouza & Finger 2009, Everis 2010, Kirchner 2011). This results in a fragmentation of the European rail market and naturally creates a difficult market environment for EU-wide competition.

Since competition was introduced at varying speeds in different sections of the European rail market, it developed diverging forms. This thesis focuses on the specific type of open access competition in long-distance passenger rail, considering only day trains running on EU territory. Open access arrangements in the various countries are a condition for this type of competition, since EU regulation currently only manifests open access for international services through Directive 2007/58/EC. These open access arrangements are already implemented in national regulation in several EU countries, e.g. Germany, Sweden, the Czech Republic, Italy and Austria (Beckers et al. 2009, Holvad 2009, Tomes et al. 2016). From December 2020 onwards, the open access competition provisions will be expanded to domestic passenger transport through Directive 2016/2370/EC.

However, despite the favourable political and legal conditions in some countries, open access competition still remains scarce even in these markets. This leads to the assumption that other factors besides the political and legal ones influence the likelihood of competition in the market. In this thesis, factors influencing competition are defined as circumstances or aspects that have an impact on or consequences for competition and encourage it in a positive or hinder/weaken it in a negative way. The factors can be different in type, therefore a PESTLE analysis is used: it groups the factors into political/legal, economic, social, technical, or environmental clusters. Influencing factors may include entry barriers that prevent competition, legal changes that enable competition, underlying determinants of the industry, preferences of the customers, etc.

This assumption is further strengthened by a closer investigation of the different forms of existing open access competition, which reveals that competition between the new entrants and the state incumbents takes different forms: in Italy, the competitor Nuovo Trasporto Viaggiatori (“NTV”) established a high quality, high-speed concept with massive investments in rolling stock and aimed for a high market share from the first day of operation. In Germany, the competitor Locomore entered the market with conventional, second-hand rolling stock on only one route and later complemented the coach-network of its new owner, FlixBus. This also indicates that economic, social and technological factors influence competition in the market and shape it differently. This background leads to some important questions:

- *Which factors influence open access competition in long-distance passenger rail transport in Europe positively or negatively and thus promote or hinder competition?*

- *Bearing in mind the different forms of competition: does the strength of individual influencing factors vary between countries and what is the reason for that?*
- *How do the influencing factors interact and is there a correlation between influencing factors?*
- *Can a shift of influencing factors be observed over time?*

By answering the above questions, this thesis contributes to the knowledge of market liberalisation, the gradual transformation process and the introduction of competition in the European long-distance passenger rail. It complements the mainly theoretical knowledge with findings from the existing competition. It aims to help decision makers and market players to understand and act in a competitive market and reach the goal of revitalisation of the passenger railway industry. In this way, it intends to help make rail more competitive and also reveal beneficial cooperation.

1.1. Research objectives

In line with the important questions posed in the above section, the objective of this thesis is to identify positive and negative factors influencing this type of competition, their strength, their interplay, their shift over time and variations between countries. Since the market environment is complex and multi-layered, a PESTLE framework is applied (see 4.2.3.). It structures the process of collecting and clustering of factors into political/legal, economic, social, technical and environmental influences. Also, it guides the revealing of interrelations between factors as well as clusters. Finally, it allows the presentation of a holistic picture. This helps to deepen the understanding of the fragmented

European market and to answer the question, if open access competition is possible.

More specifically, the research objectives are:

1. to identify positive and negative factors influencing open access competition in long-distance passenger rail;
2. to assess the strength of influencing factors;
3. to explore the possible mutual correlation of influencing factors;
4. to explore the possible shift of influencing factors over time;
5. to analyse the differences in strength/type/correlation and shift of influencing factors between countries;
6. to assess if a competitive market can be introduced into long-distance passenger rail and, if this is the case, how it can be achieved best.

Objective 1 needs to be addressed first since all other objectives build on this step. After the fulfilment of objective 1, objective 2-4 can be initiated and worked on in parallel. Objective 5 needs to be addressed afterwards, since it requires a closer investigation of the outcome of objectives 1-4 and adds another dimension. However, the chosen philosophical background (4.1.) implies that the truth is pragmatic and experimental. This means that continual questioning and considering different perspectives is necessary throughout the whole study and that all objectives need to be reassessed in a dynamic process when new information appears. Objective 6 is the last objective to be addressed; it builds on the fulfilment of objectives 1-5.

1.2. Motivation

“Transport is an important area of academic study and one which is problem rich, stimulating a great deal of debate in areas which impact on everyday lives” (Cowie & Ison 2018, p. 1).

In times of liberalisation and increasingly faster innovation and change, the topic of this thesis is very relevant to the passenger rail industry as well as regulators and decision makers. Various examples from different backgrounds show that static and entrenched structures in industries, which have been stable over decades, can change fundamentally within a few years, leaving the companies involved with the choice between giving up or starting a reorientation. One prominent example for this is the telecommunications industry, which, like the railway industry, is considered a network industry (see section 2.1.). The European telecommunications market was protected over decades and characterised by powerful monopolies which dominated the market. After liberalisation in 1998, new players emerged quickly, leading to fierce competition. Consequently the rules of the game changed fundamentally: incumbents and new entrants were forced to reconsider their strategy and scope of business to survive and be successful (Fladung 2004).

Long-term oriented industries with incremental change, like the railway industry, are particularly endangered by such developments, since they are slower to adapt to changes. It is therefore necessary to research this field to provide insights in the market development for policy makers, incumbents, and new competitors. It is certain that the railway sector faces fundamental changes, especially in passenger rail: the EU plans further liberalisation, the passenger mobility market is changing and new possibilities enabled by the internet and other technological innovations occur, e.g. driverless cars and trains.

However, rapid liberalisation, which could be observed in the telecommunications industry, has not yet occurred in the railway industry. The liberalisation of the railway market started three decades ago and is still an ongoing process, in some countries successful, in others less so. The widespread and extensive discussion around the Fourth Railway Package (see section 2.1.2. for a detailed definition) recently shows how many strong and differing opinions on passenger rail liberalisation exist and that further research on its nature is necessary. And open access competition, one of the most concise indicators of a liberalised market, is a particularly suitable field for further research.

Finally, this thesis is also motivated by a lack of relevant literature on real life open access competition in the market. Current case studies and in-depth observations can provide rich, detailed insights in open access competition in Europe, but this has only been done by few researchers (e.g. Kirchner 2011, Warnecke 2014, Tomes et al. 2016, EC 2016b), with some of the research being outdated due to the recent market entry of new competitors. After the first bigger wave of new competitors starting in 2011, the present day is of special interest for researchers since it reveals much about open access competition in the market and its influencing factors. The coming years will show if the concept is successful and fulfils its purpose.

1.3. Structure of the thesis

This thesis is structured as follows: chapter 1 will introduce the reader to the topic. Chapter 2 will give an overview of the network industry, the railway industry and the rail liberalisation process in Europe. An overview of six countries, where the Railway Reforms resulted in open access competition,

introduces the reader to the cases which are analysed more closely later on in the thesis. In chapter 3, the literature review shows how the research topic can be set in the framework of existing literature and which issues have already been discussed there and which gaps exist. Chapter 4 illustrates the research methodology: it explains the aim and objectives of the thesis as well as its philosophical background. It also introduces the reader to the theoretical framework of Delphi studies, case study research and the PESTLE framework. Chapter 5 points out how the Delphi study was conducted, starting by outlining the Delphi process. Each stage of Delphi is reported individually, showing the development of findings through all stages. Chapter 6 introduces the case study framework and incorporates the investigation of the German and the Italian case. Chapter 7 gives a holistic examination of influencing factors and a weighting of the factors. Finally, chapter 8 draws a conclusion, giving a review of the core findings, recommendations for politicians and railway companies, and suggestions for further research.

The following picture gives a graphical overview of the structure of the thesis, showing that Delphi study and case study play a central role and are closely interlinked:

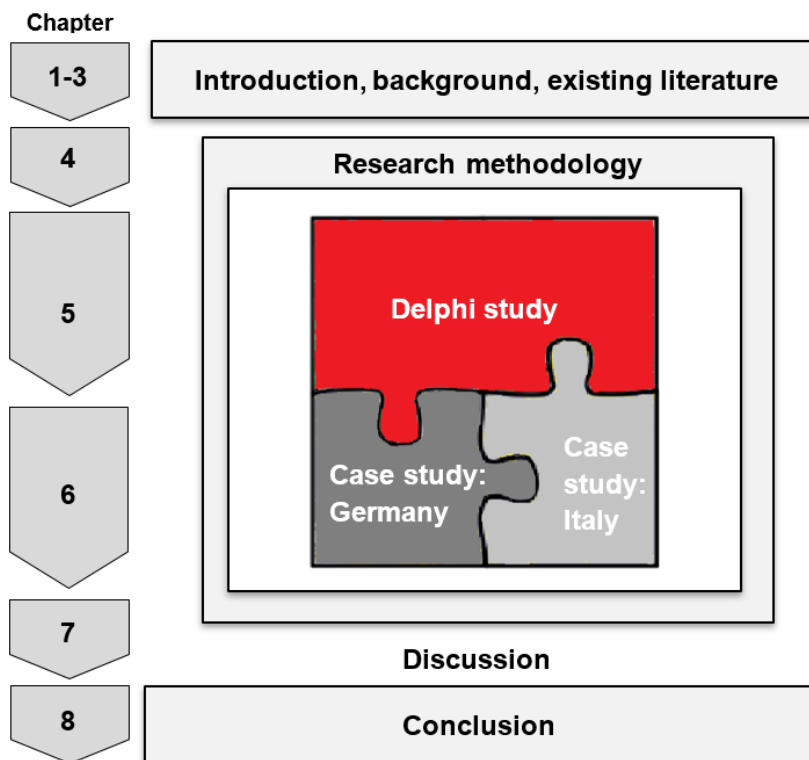


Illustration 1: Structure of the thesis (author's own diagram)

2. Chapter 2: Market and legal environment

2.1. Background and definitions

The following section gives an overview of the main economic and legal setting of this thesis. It starts by introducing competition in the network and the railway industry, including some relevant definitions. The section then discusses the liberalisation process of the European railway industry, including a detailed overview of the four Railway Packages.

2.1.1. Competition in the network and railway industry

In the last three decades, network industries all over the world have undergone broad changes and have been subject to liberalisation, privatisation and profound reforms. The EU is no exception to this trend and ever since the Single European Act of 1987 and the single market programme, reforms have taken place in different network industries, such as the railway industry (Bickenbach 2000, Knieps 2006). To achieve efficiency and equity goals, competition is now seen as a more powerful tool than monopoly in network industries (Bickenbach 2000). As a special type of industry, network industries are characterised by a high degree of complexity and interdependency. A clear definition of networks and network industries is of importance for this thesis to understand the aspects underlying the railway industry. Therefore, the following section defines the core parameters and gives a general overview of the industry.

A network is characterised as a number of links between connection points, where the links serve as transmission routes. Networks are complex systems, whereas individual parts cannot be examined in isolation due to various

interlinked elements (Knieps 2007). They consist of three elements: nodes, links and mesh. Nodes are the points where different links are concentrated and form a crossing. Links are the ties and connections between these nodes, being the fundamental unit of the network. The mesh gives a network its shape and dimension, it is the overall structure or pattern of a network (van Loon 2006). The crucial feature of networks is the complementarity between the nodes and links: the delivery of a service in a network industry always requires the use of more than one network component (Economides 2006). Networks form the basis of many important industries, e.g. in electricity, postal services and as well rail transport.

The railway industry is a network industry with high importance and a long history in Europe. It traditionally plays an important role for most member states. Railways connect cities, regions and countries, ensure the transportation of goods, connect people and play an important strategic role in wars. Therefore, rail is seen as an “integrated socio-technical system” (Finger & Messulam 2015, p. 19). The railway industry is an integrative mechanism that overcomes geographical barriers, helps to develop underdeveloped zones, and can provide minimum transport services for the population (Campos & Cantos 1999). In the EU’s transportation strategy, rail plays an important role (EC 2011). The railway sector contributes strongly to the EU’s economy, as the estimated gross value added of the entire supply chain of rail services in the EU is around 140 billion EUR, while employing more than 2 million people. The EU’s railway sector has an estimated cost volume of over 100 billion EUR, of which passenger and freight rail revenues cover 60%, while 30% are covered by public subsidy and 10% by other sources of income (Steer Davies Gleave 2015).

This shows that the railway industry, like many other network industries, is of high economic importance for countries. It is therefore subject to extensive regulation. The railway industry fulfils all defined features that characterise network industries (Bergman et al. 1998, Lapuerta & Moselle 1999, Economides 2006, Knieps 2006, 2007, Casullo 2016):

Making the product or service available to the customer crucially relies upon an underlying network, which is the track network, stations, signalling, etc.

This physical network produces high sunken costs which have mostly been incurred already and cannot be fully recovered, like the track network.

The underlying track network is considered a “natural monopoly”, competition in provision of this network would result in an expensive and very inefficient duplication of facilities. Baumol defines a natural monopoly as an “industry in which multifirm production is costlier than production by a monopoly” and/or “to which entrants are not “naturally” attracted, and are incapable of survival even in the absence of “predatory” measures by the monopolist” (1977, p. 810).

Network externalities exist, which occur when actors in the market impact each other, even if they do not pay for the impacts (Fladung 2004). Network externalities can be of a positive or negative nature: positive network externalities occur e.g. when more stations are included into the track network and more customers profit from the network. They are also called network effects. Negative network externalities occur e.g. when many different companies use the track network at the same time and cause congestions.

When analysing the cost situation within network industries, economies of scale, scope and density play a fundamental role. Economies of scale exist when the increase of input leads to an over-proportional increase in output, resulting in a reduction in unit costs. E.g. the more trains run on an existing network, the lower the costs will be for each train. Economies of scope exist when two outputs can be produced at lower average cost for each output by one single company than by several companies. This can occur e.g. when overheads or IT-systems can be used by both passenger and freight rail providers within one company and the costs are shared. Economies of density exist when dense urban environments lead to higher efficiency: e.g. when the tracks are better utilised, the increased usage results in more services, which then leads to more trains on the network. This results in a decrease of unit cost which are divided over a higher output up to a certain optimum point (see also section 3.2.).

The services of the industry are potentially competitive, which applies for both passenger and freight rail services.

The industries have often been dominated by big state-owned monopolies.

Today, big state-owned rail incumbents still play a dominant role in Europe.

As in all network industries, in the railway industry one can differentiate between network infrastructure and network provider. Even though both components are complementary, they can be sub-classified on four levels. All levels can be built or serviced independently of one another (Knieps 2007):

Level 1: network service provider (e.g. railway undertakings like DB Fernverkehr)

Level 2: infrastructure manager (e.g. DB Netz)

Level 3: network infrastructure (e.g. tracks/signalling)

Level 4: public resources (e.g. sites/land)

The separability of the four components in network industries generally enables competition. This is also the case in the railway industry: for many decades, vertically integrated railway companies were regarded as natural monopolies, due to their presupposed economies of scale. Today, only the rail infrastructure is considered a natural monopoly and changes in regulation over the last three decades show that competition in the railway industry is possible (Campos & Cantos 1999, Alexandersson 2009). This is practicable due to the separability of the management and ownership of the network infrastructure and land on one side and the operation of services on the other (Knieps 2007). The following illustration by Beckers et al. (2009) gives an overview of rail's value chain and the resulting separability:

The illustration has been removed due to Copyright restrictions

Illustration 2: Rail's value chain, adapted from Beckers et al. (2009)

Infrastructure in this context means “essential facilities”, those parts of a network which enable the services and are too costly to be duplicated by other operators, like track, stations, signalling, and maintenance facilities (Seabright 2003). The infrastructure is managed by an infrastructure manager (“IM”). IMs can be defined as “either the owners of railway infrastructure or companies that have been awarded concession contracts. They are responsible for the safety and maintenance of railway installations, as well as for making any necessary renovation and capacity expansion investments. Most importantly, they are

responsible for making their infrastructure available to the different train operating companies” (Finger & Messulam 2015, p. 7).

Train operating companies, rail service operations or undertakings (“RU”) are in direct contact with customers as they provide the transportation service. RUs can combine their own inputs with inputs bought from other players (Finger & Messulam 2015). They can be divided into freight and passenger transport, where freight transport delivers cargo and goods. Passenger rail can be divided into regional and long-distance passenger rail, where regional transportation is mostly short-distance trips with a high stopping pattern and a relatively short travel time and high degree of commuters. Regional passenger rail is generally operated on behalf of public authorities and subsidised (Beckers et al. 2009). Long-distance passenger rail transport is defined as regularly scheduled Intercity or Eurocity trains (e.g. ICE, IC, EC, RJ, SC, TGV) which transport passengers with a one-way trip length of at least 50 km by having a relatively limited stopping pattern. Most long-distance services provide additional features like different service classes, on-board catering, entertainment, etc. (Beckers et al. 2009). Long-distance passenger rail can also include night trains, providing special sleeping cars and travelling overnight, as well as charter and event trains that only run on special occasions (Kirchner 2011).

Having discussed the theoretical basics of the network and railway industry, it becomes clear that competition in such an industry is not achieved easily and constitutes a relatively new phenomenon. Competition in general can be described as the aspiration of two or more persons/groups/entities to reach a goal where the higher level of target achievement of one player leads to a lower level of target achievement of the other player (Schmidt 2005). Competition as a tool in economics ensures that private interest and social welfare match each

other. Consequently, competition is not an end in itself, but a means to economic welfare (Neumann 2000). Competition is thus a dynamic process, defined by action and reaction of the market actors, even the announcement of competition can trigger dynamic competition (Schmidt 2005). A precondition for competition is the absence of legal entry barriers (Knieps 2015). Competition policy is one of the oldest elements of EU regulation, it is already included in the EEC Treaty of 1957. From the EU's point of view, competition is a means to increase and preserve welfare. The welfare of consumers is at the centre of activities. This political orientation can be related to the "Chicago School" (Busch 2010).

In the railway industry, competition takes different forms, some of them more frequent than others. Since this thesis focuses on long-distance passenger rail, it investigates a special, demarcated part of competition: intramodal open access competition of day trains in the EU. Intramodal competition thereby means competition between two or more RUs, for this thesis two or more long-distance passenger RUs (Bergantino et al. 2015). Intermodal competition on the other hand refers to competition with other transport modes, here long-distance coaches, flights and motorised private transport (Seabright 2003). Two different types of intramodal competition exist: competition for the market and competition in the market. Competition for the market means the situation when two or more RUs compete to obtain access to the market. In this case, the network is split in regions and operators bid for monopoly rights or franchises to operate services for a limited time (Cox et al. 2002, Holvad 2009). As in other network industries, this type of competition is most frequent in the railway industry. It is most common in regional passenger rail and also used in British long-distance passenger rail. In some countries, however, regions or whole

networks are directly awarded to RUs, without bidding processes, as with Dutch long-distance passenger rail (Economides 2006, Beckers et al. 2009). When two or more RUs compete on the tracks, not for the tracks, competition in the market or on-track-competition exists. Competition takes place in the market on the same routes for the same customers at the same time. The RUs run the services on those lines under their commercial responsibility and do not hold public service contracts or franchises, e.g. in German long-distance passenger rail and in freight rail (Holvad 2009, Warnecke & Götz 2012). A pre-condition for competition in the market is open access arrangements in the country (Holvad 2009). Currently, EU regulations only manifests open access for international services through Directive 2007/58/EC, however, some countries have already implemented open access in their national regulation (e.g. Germany, Sweden, the Czech Republic, Italy, Austria, Great Britain) (Beckers et al. 2009, Tomes et al. 2016).

The above section shows that competition in the railway industry is possible. However, close observation and continual monitoring is needed and lead to a fundamental tension in competition policy: on the one hand, liberalisation of a market promotes competition by disciplining inefficient firms and ensuring consumer benefits. On the other hand, over-regulation itself can lead to inefficiency of the system and may result in an expropriation of the previous network investments. Consequently, network industries embody diverse challenges for competition law and policy-making in terms of liberalising the market and maximising the benefits while controlling the abuse of monopolistic positions (Lapuerta & Moselle 1999, Knieps 2007). The following section provides examples for the complexity of competition in the railway industry:

On the political and legal side, the underlying premises of competition is that all competitors have access to the network on equal terms. However, most railway companies were and are traditionally state-owned and vertically integrated.

Such companies, being both IM and RU, pose a danger for competition.

Discrimination is possible and easily carried out, e.g. by complication of network access, setting of high prices, non-provision of sufficient capacity, cross subsidisation, and denial of necessary information. On the one hand, separation between infrastructure and operations is therefore considered as highly beneficial for effective competition (Bickenbach 2000, Knieps 2006, 2007, Brandt 2008). On the other hand, the railway industry is characterised by strong coordination which is needed between IM and RU, especially since various facilities are necessary to provide transportation on rail. This is one reason why some economists and politicians dread vertical separation. Railway systems are seen as a complex interplay between the various players – not only IM and RUs, but also the RUs among each other (Seabright 2003, Finger & Rosa 2012).

Further, the lack of customised regulation also influences competition: many interdependencies exist between the different factors in the network industries and some of the goals of liberalisation have conflicting aims, which often results in a weighing off. Since the railway industry supplies the population with public transport, not only profit maximisation, but also welfare maximisation must be considered. Full liberalisation or privatisation can lead to a reduction in safety level or the abandonment of unprofitable lines, which remain of importance for the population (Alexandersson 2009). Further, some public control is necessary for military and industrial causes. This is why the majority of European railways are still publicly owned and highly regulated. Consequently, regulatory steps are

often taken carefully, which can slow down or hinder a transformation to a fully competitive industry. The railway sector is therefore considered to be rather slow in innovation and it generally changes mostly incrementally (Friedlaender et al. 1992, Campos & Cantos 1999, Beria et al. 2012).

From an economic perspective, the railway industry also provides challenges: like most network industries, the railway industry is a very capital-intensive sector with high initial costs. Mostly, these high ex ante investments are tied for long periods of time or are sunken costs in case of rail infrastructure. Often, a lack of investment into infrastructure can be observed, which is the case in state ownership and also in private ownership, as the example of the rail infrastructure in Great Britain shows. Besides the building of infrastructure, the maintenance is equally costly. The covering of the total infrastructure costs by infrastructure fees is mostly unrealisable. Therefore other pricing approaches are necessary, influencing the financial gap that needs to be compensated for by governments. In EU regulation, the concept of marginal-cost pricing is incorporated as a basis for infrastructure pricing. Marginal costs thereby reference to costs caused by one additional train using the rail infrastructure (Campos & Cantos 1999, Messulam & Finger 2015).

Another example for high initial costs in passenger rail is the ownership of rolling stock: when no leasing market is established, the ownership of rolling stock is essential and characterised by high ex ante investments, a long purchase time (3-4 years) and a long amortisation time (up to 15-20 years). These factors result in long product lifecycles with slow incremental change and often discourage entrants and investors who are unwilling to take the risks (Seabright 2003). Besides the high initial costs, especially the passenger railway industry is also characterised by a high operating cost structure.

Operating costs include e.g. infrastructure fees, diesel fuel or electrical energy, leasing of rolling stock, maintenance of rolling stock, on-board staff, commercial costs and overhead (Finger & Messulam 2015, Sanchez-Borras 2015).

After considering the cost side, the demand side also provides challenges: while transport in general can be defined as the service of displacing an object from point A to point B, beginning and ending at given dates, it shows a high differentiation (Seabright 2003). Irrespective of the service on sale, transport demand is essentially a derived demand, satisfying the need for accessibility. This means that the demand for transport services is inseparable from people's need to reach destinations, goods, services, or activities and often, transport demand is unequally distributed throughout the day (Seabright 2003, Litman 2017, Cowie & Ison 2018). Seabright states that "railways are not like any other industry, not even any other network industry", which means rail transport is also different from transport in general (2003, p. 76). Railways can provide railway services and railway infrastructure at the same time within one company. Further the "back haul problem" has an enhanced role in rail transport: demand in both directions of a line is often unbalanced, leading to a relatively low overall load factor of trains and asymmetric costs (Rietveld & Roson 2002). Finally, the existence of strong incumbents that already serve a high degree of the demand are characteristic for the railway industry, especially in long-distance passenger rail. Their dominance often leaves little room for broad market entry of competitors and allows them to achieve surplus profits over an extended period. The "invisible hand" of perfect competition has no impact in network industries, since it does not incorporate the existence of economies of scale. In this case governments must differentiate between common market power and market power due to characteristics of network

industries and create appropriate regulation to control it (Economides 2006, Knieps 2007). Further, network effects also influence competition: the wider a network of rail passenger connections, the better for the customers, since they can reach a higher number of destinations. An existing company with such a network therefore has positive network effects and an increased demand and consequently a competitive advantage over a new entrant.

Having in mind that the railway industry is characterised by a general necessity for suitable regulation and control, generally low profitability and financial loss due to a high cost structure, a financial gap exists which needs to be closed. Besides average instead of marginal cost pricing or perfect price discrimination, subsidies are a common tool to close this existing gap. However, this necessity of subsidies also influences competition in the network and railway industry: it is one reason why competition for the market is more frequent than competition in the market (Economides 2006).

Bearing all this in mind, it is worth mentioning that the political and economic concepts of the network and railway industry have been relatively stable in the last ten years, showing a similar and steady development all over Europe. Some recent considerations of politicians and parties seem to move in another direction: in 2017, the British Labour Party considered rail privatisation as harmful to passengers' interests and is working on a concept to return Britain's rail services, along with mail and energy companies, to public ownership (Asthana & Steward 2017). The recent coalition agreement of the new German Government emphasises the public responsibility of rail and the improvement of quality and number of connections, while no privatisation, further unbundling or strict enhancement of competition is planned (CDU 2018). These trends need to

be observed closely in the next years, since they will have major consequences for open access competition.

2.1.2. Railway Reforms and liberalisation

In the White Paper on Transport from 2001, the European Commission (“EC”) considers transport a key factor in modern economies. However, by the end of the twentieth century, rail transport in Europe was in a bad shape: national railways were heavily subsidised and considered inefficient, the market share was mostly stable or decreasing over the years and rail transport was characterised by low levels of customer satisfaction (Friebel et al. 2010, Holvad 2017). “[T]here is a permanent contradiction between society, which demands even more mobility, and public opinion, which is becoming increasingly intolerant of chronic delays and poor quality of some transport services. [...] The transport system needs to be optimised to meet the demand of enlargement and sustainable development” (EC 2001, p. 6). This general discontent led to several reforms which were bundled in the “Railway Packages”, causing a liberalisation of the European railway market. Liberalisation thereby means opening an industry to competition or the implementing of a regulatory framework which has the effect of intensified competition, to increasing efficiency and innovation (Bougna & Crozet 2016, Financial Times 2017). As part of liberalisation, deregulation is described as the process when sector-specific exceptional rules lose their importance in the market and the general economic law will be applied (Knieps 2007). The process of deregulation in network industries can be divided into three phases (Bergman et al. 1998, p. 7):

Phase 1 “monopoly”: “[s]ervices are supplied by one firm and regulation is concerned with the prevention of monopoly abuse in retail markets”.

Phase 2 “monopoly and competition”: “[c]ompetition is gradually introduced into some or all markets and regulation focuses on: monopoly abuse in both retail and interconnect markets by dominant incumbents; emerging competition issues; and public service obligations”.

Phase 3 “competition”: “[h]ere competition is extensive and increasingly effective in some or all markets. Some light-handed regulation is needed, as in other competitive markets, to ensure fair trading practices and the maintenance of public service objectives”.

The greatest intensity of regulation is needed in phase 2, especially regarding interconnection and when the infrastructure is operated and owned by vertically integrated incumbents. However, over time the effectiveness of competition increases and the requirement of regulation diminishes (Bergman et al. 1997).

The EU’s regulatory framework also followed this path: for several decades, regulation in the network industry was perceived as an important tool to protect common interests. Big state-owned monopolies existed, and competition was not possible. Today, over-regulation is perceived as a means to hinder innovation and progress, often protecting inefficient incumbents (Alexandersson 2009). By introducing the Railway Reforms, the EC pursued the goal of building a single, efficient and competitive market for rail throughout Europe, which satisfies the customers and allows a shift of other transport modes to rail (Nash 2008, Holvad 2009, Kirchner 2011). This requires a clear reduction of costs and a continuous improvement of service quality. The markets need to be opened, an active promotion of competition and a consequent tackling of barriers to market entry is necessary. To ensure the required level playing field for all rail

companies, compliance with technical standards and market access conditions across Europe is necessary (Kirchner 2011, De Francesco & Castro 2017).

One important starting point of the Railway Reforms were the successful reforms in Sweden, where a vertical separation between infrastructure and operators took place in 1988 (Alexandersson & Rigas 2013). This led to a rethinking of European rail policy and finally resulted in the Directive 91/440/EEC in 1991, starting the separation of infrastructure and operations and therefore opening the rail network for operators. The market opening was done in small, gradual steps, with a high degree of heterogeneity in the member states, since each directive and regulation was implemented in national law in a different legal framework (Alexandersson & Rigas 2013). Originally, European railway regulation was conceived as economic regulation, however, over time economic, social and technical regulation increasingly grew together and the boundaries became blurred (Finger & Messulam 2015).

The First Railway Package is known as the infrastructure package, it was launched in 1988 and finally adopted in 2001. As well as the opening-up of the international rail freight market, it promoted accessibility of infrastructure for all RUs and by setting rules for the management, accounting and monitoring of IM, it reduced discrimination. In 2010, the package was recast to fill existing gaps, merge and modify directives for simplification, and add new rules (Holvad 2009, Kirchner 2011, EC 2017a). The Second Railway Package was launched in 2002 and adopted in 2004, and is mostly known for the full opening of the freight market. It established the foundation of the European Union Agency for Railways (“ERA”) and further enhanced technical interoperability and safety standards (EC 2017b). The Third Railway Package was launched in 2004 and adopted in 2007, best known for the opening of the international passenger rail

market by 2010, including cabotage. This allowed all licenced RUs to operate cross-border open access competition, but several exceptions were stated. The package further regulates passenger rights and certification and licencing of train drivers and crews (Holvad 2009, EC 2017c). The Fourth Railway Package was launched in 2013 and adopted in 2016, after a period of lengthy and difficult discussion. The original proposal included the market opening of domestic passenger rail transport, a far-reaching obligation for competitive tendering of Public Service Obligation (“PSO”) contracts, a new role of ERA and a further advancement of separation between infrastructure and operations. It was separated into two pillars, the market pillar and the technical pillar. The technical pillar was adopted in April 2016, improving and speeding up the process of rolling stock authorisation and licencing, further enhancing interoperability and improvement and harmonisation of railway safety. The market pillar has been adopted in December 2016, introducing stricter rules for PSO and opening the market for domestic open access competition from 2021 onwards (European Parliamentary Research Service 2016, EC 2018).

The following table gives an overview of the significant directives and regulations of the four Railway Packages and beyond:

Package	Date of Adoption	Directive / Regulation	Subjects	Amendment or repeal of
	29/07/1991	91/440/EEC	<i>“Development of the Community’s railway”</i> incl. - management independence of railway operations - separation of accounts for infrastructure and operations management - opening the rail network for operators - improvement of financial situation	
	19/06/1995	95/18/EC	<i>“Licencing of railway undertakings”</i> incl. - procedures for licencing railway operators - licence is valid on the Community’s territory	
	19/06/1995	95/19/EC	<i>“Allocation of railway infrastructure capacity and the charging of infrastructure fees”</i> incl. - establishment of allocation body in all member states to guarantee non-discriminatory access - non-discriminatory charging of infrastructure fees based on a marginal cost basis	

	23/07/1996	96/48/EC	<i>"Interoperability for trans-European high-speed rail"</i> incl. - preparation/adoption of Technical Specification for Interoperability ("TSI"s) for all member states	
The 1st Railway Package	26/02/2001	2001/12/EC	- opening-up of the international rail freight market for competition - independent organisational entities for RUs/ IMs - separation of accounts for passenger and freight operations as well as public service and other passenger service operations	91/440/ECC
	26/02/2001	2001/13/EC	- extending the licencing principle to all RUs with EU-wide acceptance - setting of framework for licence obtaining	95/18/EC
	19/03/2001	2001/14/EC	<i>"Allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification"</i> incl. - IMs must publish network statements - IMs must provide network capacity analysis - creation of independent regulatory body for monitoring and arbitration	95/19/EC
	19/03/2001	2001/16/EC	<i>"Interoperability for trans-European conventional rail"</i> , extending the TSI concept to conventional rail	96/48/EC
The 2nd Railway Package	29/04/2004	881/2004/EC	<i>"Establishing a European Railway Agency"</i> , incl. - describing form, functions and responsibilities	
	29/04/2004	2004/49/EC	<i>"Safety on the Community's railways"</i> incl. - common approach/mutual recognition principles regarding safety regulatory issues - creation of safety authority in all member states	95/18/EC 2001/14/EC
	29/04/2004	2004/50/EC	- speeding up of interoperability of the conventional and high-speed trans-European railway network	96/48/EC 2001/16/EC
	29/04/2004	2004/51/EC	- complete opening of the rail freight network in the EU from 01/01/2007, also within member states	91/440/EEC
The 3rd Railway Package	23/10/2007	2007/58/EC	- opening-up the European market to international passenger rail services by 01/01/2010, including cabotage, but with several exceptions	91/440/EEC 2001/14/EC
	23/10/2007	2007/59/EC	<i>"Certification of train drivers operating locomotives and trains on the railway system in the Community"</i> incl. - harmonisation of standards on train crews	
	23/10/2007	1371/2007/EC	<i>"Rail passengers' rights and obligations"</i> incl. - liability of RUs - minimum requirement for passenger information	
	23/10/2007	1370/2007/EC	<i>"Public passenger transport services by rail and by road"</i> incl. - requirements for providing PSO - encouragement of use of competitive tendering	1191/69/EEC 1107/70/EEC
	17/06/2008	2008/57/EC	<i>"Interoperability of the rail system within the Community"</i> to further advance interoperability	96/48/EC 2001/16/EC 2004/57/EC
	16/12/2008	2008/110/EC	- updated version of the safety directive	2004/49/EC
	16/12/2008	1335/2008/EC	- establishing of ERA and its role and functions	881/2004/EC
Recast of 1st Railway Package	21/11/2012	2012/34/EC	- independence and competence of regulatory bodies - access to necessary facilities - rules for infrastructure funding and management	91/440/EEC 95/18/EC 2001/14/EC
	07/04/2016	2016/545/EC	<i>"Regulation on procedures and criteria concerning framework agreements for the allocation of rail infrastructure capacity"</i> incl. - increase transparency of path allocation and existing agreements - framework agreements should not specify on a particular train path, being flexible in time	2012/34/EC

The 4th Railway Package	11/05/2016	2016/796/EC	<i>“European Union Agency for Railways”</i> incl. - explanation of ERA's role and functions - centralisation of homologation ¹ , licencing and safety regulation (one-stop shop)	881/2004/EC
	11/05/2016	2016/797/EC	<i>“Interoperability of the rail system within the EU”</i> incl. - further advancement of interoperability - determining of ERA as European Rail Traffic Management System-authority	2008/57/EC
	11/05/2016	2016/798/EC	<i>“Railway Safety”</i> incl. - guidelines to ensure development and improvement of safety - harmonisation of regulatory structure	2004/49/EC
	14/12/2016	2016/2338/EC	<i>“Award of public service contracts for domestic passenger transport services by rail”</i> incl. - new and adapted requirements for PSO - stricter regulation of direct awarding of contracts	1370/2007
	14/12/2016	2016/2370/EC	<i>“Opening of the market of domestic passenger transport services by rail and the governance of the railway infrastructure”, incl.</i> - opening-up the European market to domestic passenger rail services in form of open access by 12/2020, but with several exceptions (e.g. PSO on the line)	2012/34/EC
	14/12/2016	2016/2337/EC	<i>“Regulation on the normalisation of the accounts of RUs”,</i> - repealing Directive 1192/69/EEC	1192/69/EEC

Table 1: Overview of the Railway Packages, adapted from Holvad 2009, Kirchner 2011, Holvad 2017, sources: EC regulations & directives

Regarding open access competition, Directives 91/44/EEC and 95/19/EC were of high importance, since they formed the basis for non-discriminatory network access and infrastructure fees. Especially for high-speed rail, Directive 96/48/EC triggered the process of technical harmonisation by introducing TSI standards that refer to new subsystems which were significantly updated.

All member states are obliged to transfer the directives into national law, but a certain leeway is given which leads to different states of national liberalisation (Kirchner 2011). Up to now, all member states have implemented the First Railway Package, however, some with a time lag. In 2010, the EC referred 13 member states (among those were Austria, the Czech Republic, Germany and Italy) to the European Court of Justice (“ECJ”), mostly due to a lack of independence of essential functions and regulatory bodies and insufficient infrastructure

¹ Homologation in this context means the process of certifying rolling stock to indicate that it meets defined specifications and standards like safety and technical requirements. It is also known as vehicle authorisation.

charging. The ECJ decided that a holding structure, existing in Germany and Austria, can provide independence of IM and is therefore allowed, contradicting the EC's long-term preference for total vertical separation (European Parliamentary Research Service 2016). Greece, Luxembourg and Romania were sued by the EC for not transposing the Recast into national law (EC 2016a). This example shows that regulatory measures against anti-competitive practice can take years before they are properly enforced (Knieps 2015). In the framework of the Second Railway Package, all necessary institutions have been set up by the member states. The ERA was established in 2004 and has operated from 2006 onwards (European Parliamentary Research Service 2016).

However, despite the implementation into national law, full and consistent liberalisation has not been achieved. A full level playing field for incumbents and new competitors does not yet exist (Bergantino 2015). The market remains fragmented and many steps still lie ahead, especially for open access competition. "[L]iberalisation will certainly be a rocky road for many railways and countries" in the next years, as Alexandersson & Rigas state (2013, p. 97).

Regarding Bergman et al.'s (1998) three phases of deregulation, the European passenger rail industry currently finds itself in the second phase of coexistence of both monopoly and competition. Some competition is already introduced; however, regulation is still needed to guarantee fair competition for all market participants, especially with the existence of vertically integrated incumbents. To understand the effect of the Railway Reforms and the initiated liberalisation on long-distance passenger rail, the following section will give an overview of how individual markets developed in the light of the above.

2.2. Six examples of rail liberalisation

As described above, competition is still a rare phenomenon and the market is fragmented in type and degree of liberalisation (Laperrouza & Finger 2009, Kirchner 2011). The European regulation has been implemented differently in national law and open access competition is not yet permitted on an EU-wide basis. Five countries are of particular importance for an analysis of open access competition, since competitors entered the markets in competition to the incumbent operators: in Germany, the Czech Republic, Italy, Sweden and Austria, open access competition currently takes place, taking different forms. The 6th example of competition in Great Britain (“GB”) gives another valuable insight, since it differs in structure from the other countries and has undergone drastic changes in the past. To provide a background for the analysis part of the thesis, this section gives a brief overview of how competition developed in these six countries under investigation.

In 2011, the latest version of Kirchner’s Rail Liberalisation Index was published, which compares the status of the relative degree of market opening in the European rail market (incl. Switzerland and Norway). The study provides a benchmark of the legal framework and the de facto barriers to market access, distinguishing between freight and passenger transportation. The “LIB-index” rates the countries on a scale between 0 and 1000, thereby consisting of two sub-indices: on the one hand the LEX-sub-index (law in the books) which investigates the power of the regulatory body and the underlying laws. On the other hand, the ACCESS-sub-index (law in action) which examines the informational, administrative and operational barriers. Kirchner divides the countries analysed into three groups regarding their degree of market opening: the “advanced” countries with the best conditions for possible market entrants,

the countries “on schedule” and the “delayed” countries, where different parts of the market remain closed or not accessible for new entrants (see illustration 3). In this framework, Sweden (855 points), GB (852 points) and Germany (814 points) are considered as countries with advanced liberalisation, Austria (761), Italy (705) and the Czech Republic (705) are countries where liberalisation is on schedule:

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Illustration 3: Rail Liberalisation Index (Kirchner 2011, p. 69)

However, Kirchner’s analysis only investigates passenger transport in total and does not distinguish between long-distance and regional transport. Also, many changes in the market occurred after the completion of the latest study in 2011. For example, open access competition was introduced in the Czech Republic, Austria and Italy, as further explained below.

2.2.1. Germany

Germany is the most populous European country with 82.8 million inhabitants, it is characterised by its dense population, strong economic status, and relatively high purchasing power (Eurostat 2019a). Railways have a long history in Germany and the operated network at 33,400 km is one of the largest and

densest in Europe (Schwilling & Bunge 2014, DB 2018a). The modal split of passenger rail is 8.6% (Eurostat 2019b). The average yearly amount of rail passenger kilometres per inhabitant is around 1,100 with an average fare revenue of ca. 0.13 EUR (Steer Davies Gleave 2015). The incumbent of long-distance transport, DB Fernverkehr AG ("DB Fv"), is separated from the IM DB Netz, but both companies are part of Deutsche Bahn holding ("DB"). The starting point for competition was the Railway Reforms in 1994. After they came into force, all long-distance lines have been run commercially and open access competition is allowed (Kirchner 2011, Finger & Rosa 2012, Schwilling & Bunge 2014). However, the market share of competition is less than 1% of the overall transport capacity, and for a long time, competitors focused on niches, fearing the direct competition with DB Fv (BNetzA 2017c). Currently, two open access competitors operate in the market: Thalys and Flixtrain.

In 1997, Thalys was the first competitor entering the German market on the international high-speed route between Cologne/Dortmund and Brussels with five daily train pairs², as a joint venture of the French and Belgian incumbents SNCF and SNCB and temporarily DB Fv (Heuermann & Delfmann 2009, Thalys 2017). In 2002, InterConnex was the first private competitor that entered Germany, providing one to two daily train pairs on the line (Gera-)Leipzig-Berlin-Rostock(-Warnemünde). InterConnex extended the offer to the lines (Liberec CZ-)Zittau-Cottbus-Berlin-Stralsund(-Binz) and Dresden-Neustadt-Berlin-Stralsund and briefly (Neuss-)Cologne-Berlin-Rostock. In 2014, it ceased operations (Seguret 2009, Netzwerk Bahnen 2016). In 2012, the private operator Hamburg-Köln-Express ("HKX") began to compete with DB Fv on the

² Train pair generally refers to two trains on one line between two destinations, which run in opposite directions, often as a round trip

Cologne-Hamburg line with up to three daily train pairs. HKX was expected to have a market share of 5-10% (CMA 2016). Between 2015 and 2016, HKX extended its offer to Frankfurt. However, after reducing its offering, HKX ceased operations in 2017 and was acquired by the German coach-operator FlixBus which started operating the line again in March 2018 under its FlixBus brand (Monopolkommission 2015, HKX 2017a, FlixBus 2018c). In 2016, the private operator Locomore started operations with one daily train pair on the highly frequented Berlin-Stuttgart line in direct competition to DB Fernverkehr (Locomore 2017c). After five months of operations, Locomore went bankrupt and ceased operations. It was bought by FlixBus and the Czech company LEO Express ("LEO") and is operated on the same line under the brand FlixBus (FAZ 2017, Locomore 2018).

2.2.2. Czech Republic

The Czech Republic, with 10.6 million inhabitants, is significantly smaller than Germany and characterised by a high degree of urbanisation, a stable economy, and relatively low purchasing power, but with high variability between regions (Eurostat 2019a). The Czech railway network, with 9,460 km, is among the densest in Europe (SZDC 2018). The modal split of passenger rail is 8.9% (Eurostat 2019b). The average yearly figure for rail passenger kilometres per inhabitant is ca. 700 (Steer Davies Gleave 2015). The incumbent is České dráhy ("CD"), it is fully separated from IM SZDC (Kirchner 2011). The formal market opening took place with the Railway Act in 1994, but national and international open access was only possible from 2003 onwards after the separation of infrastructure and operations. However, open access is only possible on those routes which the Ministry of Transport removed from PSO.

This is the case on the Prague-Ostrava route (Tomes et al. 2014). Two open access competitors exist: LEO and RegioJet (Tomes et al. 2016).

In 2011, the private operator RegioJet, subsidiary of the tourism company Student Agency, started operations on Prague-Ostrava(-Hvirov) with nine daily train pairs, in direct competition to CD. In 2016, it expanded its operations in the Czech Republic and Slovakia, and later to Austria (Tomes et al. 2016, RegioJet 2017). On the Prague-Ostrava route, RegioJet is expected to have a market share of 35-40% (CMA 2016). In 2012, the second private competitor LEO started operations, also on the Prague-Ostrava line with eight daily train pairs. The company also expanded its operations within the Czech Republic, Slovakia and later Poland (Tomes et al. 2014, LEO 2016, LEO 2017). On the Prague-Ostrava route, LEO is expected to have a market share of 25-30% (CMA 2016). In 2017, LEO and FlixBus invested in the bankrupt Locomore, where LEO is also responsible for operating trains (FAZ 2017).

2.2.3. Italy

Italy, with 60.6 million inhabitants, is one of the bigger countries in Europe (Eurostat 2019a). It is characterised by its long and narrow geographical shape, by a weakening economy in recent years, and average purchasing power. The rail network in Italy has a total length of 16,700 km, and the high-speed lines are designed to connect the densely populated and economically important regions with one another (Croccolo & Violi 2013, RFI 2017a). The modal split of passenger rail is relatively low at 6.1% (Eurostat 2019b). The average yearly figure for rail passenger kilometres per inhabitant is around 750 with an average fare revenue of ca. 0.065 EUR (Steer Davies Gleave 2015). The incumbent is Trenitalia S.p.A. ("TI"), it is separated from IM Rete Ferroviaria Italiana ("RFI");

both companies are part of Ferrovie dello stato Italiane holding (“FSI”). The starting point for liberalisation was the separation of infrastructure and operations in 2000. Open access competition in Italy has been allowed since 2003 for purely commercial services, including all high-speed lines (Bergantino 2015). However, when competition affects PSO lines negatively, open access can be limited (Kirchner 2011). Currently, two open access competitors operate on the Italian network: NTV and DB FV & ÖBB Personenverkehr AG (“DB/ÖBB”).

In 2009, the joint venture of the German and Austrian incumbents DB/ÖBB started operations on the international Munich-Innsbruck-Verona/Milan/Venice line with five daily train pairs. It partly competed with TI in regional transport, which resulted in the prohibition of intermediate stops (Warnecke & Götz 2012). In 2010, Arenaways was the first company that started purely commercial services, providing two daily train pairs between Milan and Turin. Since TI offered regional services on the same route, cabotage was forbidden, denying Arenaways intermediate stops. This resulted in the company’s bankruptcy in 2011 (Warnecke & Götz 2012). In 2012, the private operator NTV started its high-speed operations in direct competition to the incumbent on the Rome-Milan, Rome-Turin and Rome-Venice lines with several daily trains (Warnecke 2014). NTV gradually expanded to more lines and increased daily connections (Bergantino 2015). On the overall Italian high-speed market, NTV is expected to have a market share of 35% (NTV 2018b).

2.2.4. Sweden

Despite its size, Sweden is relatively sparsely populated with 10.1 million inhabitants. It is characterised by a strong economic status and high purchasing

power (Eurostat 2019a). The rail network in Sweden is 14,660 km long, but most passenger transport takes place in the densely populated south (Trafikverket 2017). The modal split of passenger rail is 9.3% (Eurostat 2019b). The average yearly amount of rail passenger kilometres per inhabitant is around 1,250 with an average fare revenue of ca. 0.055 EUR, which is relatively low in a European comparison (Steer Davies Gleave 2015). The incumbent SJ AB ("SJ"), is fully separated from IM Trafikverket. The liberalisation process started in 1988 with the Transport Policy Act. This formed the basis for open access competition, which has been allowed from 2009 onwards on the entire network (Alexandersson 2009, Alexandersson & Riga 2013). Currently, two open access competitors operate in the market: MTR Express and Transdev.

In 2009, Veolia Transport (now called Transdev Sverige AB) started its operations on the Malmö-Stockholm line in direct competition to SJ with two daily train pairs at weekends. The company increased its services after full market liberalisation to two daily train pairs in 2011 (Warnecke & Götz 2012, Nilsson et al. 2013). Since 2015, MTR Express ("MTR"), a subsidiary of MTR Corporation, started to compete with SJ on the Stockholm-Gothenburg line, providing four daily train pairs. MTR increased the number of train pairs up to ten per day (Barrow 2015, MTR 2017). On the route Stockholm-Gothenburg, MTR is expected to have a market share of 25-30% (CMA 2016).

2.2.5. Austria

With 8.8 million inhabitants, Austria is one of the smaller countries in Europe and is characterised by its mountainous structure, an average purchasing power, and the densely populated metropolitan area around Vienna (Eurostat 2019a). The rail network is over 4,800 km long (ÖBB-Infrastruktur 2018). The

modal split of passenger rail in Austria is 12.1% which is high in a European comparison (Eurostat 2019b). The average yearly figure for rail passenger kilometres per inhabitant is around 1,350 with an average fare revenue of ca. 0.17 EUR, which is high in a European comparison (Steer Davies Gleave 2015). The incumbent ÖBB-Personenverkehr AG (“ÖBB Pv”) is separated from IM ÖBB-Infrastruktur, both companies are part of Österreichische Bundesbahnen holding (“ÖBB”). Open access competition in Austria has been permitted in theory since 1998 (Schienen Control 2017). However, it is only allowed on lines where no PSO exists (Kirchner 2011). Therefore the market share of competition is still relatively low. Besides the international competitor RegioJet, only one open access competitor operates on the Austrian network: in 2011, the private operator WESTbahn started operations in competition to ÖBB Pv on the Vienna-Salzburg route, providing more than eleven daily train pairs (Warnecke 2014). The company has increased the connections and has an estimated market share of 20-25% on the route (CMA 2016).

2.2.6. Great Britain

GB has 66.3 million inhabitants and is characterised by its division into four constituent countries with individual capitals, a high purchasing power and densely populated metropolitan areas around the capitals, especially London (Eurostat 2019a). The rail network is over 32,000 km long (Network Rail 2019). The modal split of passenger rail in GB is 8.8%, which is slightly higher than the European average (Eurostat 2019b). The average yearly figure for rail passenger kilometres per inhabitant is around 950 with an average fare revenue of ca. 0.15 EUR, which is high in a European comparison (Steer Davies Gleave 2015). What makes the British case special, is that no incumbent operator

exists. With the railway reform in 1994, the incumbent was split into over a 100 companies and RUs and IM have been fully separated ever since. The reforms also resulted in the privatisation of the IM until 2002, when it was once again taken under state control.

The infrastructure is now owned and operated by Network Rail and is regulated by the Office of Rail and Road (“ORR”) (Nash 2008, Kirchner 2011).

Competition in GB mainly takes place for the market: RUs bid for a franchise by naming an amount of needed funding to run the specified services or a premium they are prepared to pay. A weighted scoring system is used to select the winner. What makes the British case special is the fact that competition for the market is mixed with elements of competition in the market: open access competition is allowed, but only to a certain degree. The RU needs to apply at ORR and Network Rail for permission (CMA 2016).

Three main open access providers currently operate on the British network, First Hull Trains, Grand Central and Eurostar. Since 2000, Hull Trains operates services between Hull and London via the East Coast Main Line. It started with three daily trainpairs and increased the frequency in the following years, also extending the line to Beverley. It was bought by First Group in 2003. Since 2007, Grand Central operates services between London and Sunderland also via the East Coast Main Line, starting with three daily connections. Since 2010, it also operates services between Bradford Interchange and London. In 2011, the company was bought by Arriva UK, a subsidy of DB. Further, Eurostar runs open access connections between mainland Europe and GB since 1994, mainly between London and Paris and Brussels. In the next years, more market entries are expected, e.g. by First Group on the line London-Edinburgh (Preston 2009, Niedhard 2009, Grand Central 2019, Hull Trains 2019, ORR 2019).

3. Chapter 3: Literature review

Railway competition in the context of railway liberalisation is the subject of a number of scientific articles and studies. Various types of literature in the field of transport economics have been reviewed for this thesis, with a focus on intramodal competition in long-distance passenger rail. To file and organise the literature, the literature mapping software “Citavi” was used. The literature was analysed by clustering the content of the articles into six categories: political, economic, social, technical, legal and environmental content, in line with the PESTLE analysis (see 4.2.3.). In addition, the topics with the highest relevance and the most frequent appearances in existing literature were grouped in sub-categories. The analysis showed that the knowledge generated could often be classified in two or three categories, but that very few articles observed the wider portfolio of all PESTLE factors. The largest part of the existing literature deals with economic content, e.g. efficiency, profitability, access fees. The second largest part covers literature with political and legal content, mostly dealing liberalisation, regulation and vertical separation. The category which is least observed regarding competition is environmental content.

In the following, open access competition in long-distance passenger rail is placed within the framework of the relevant literature and the key points are discussed briefly.

3.1. European Railway Reforms and their effect

Without doubt, the liberalisation process changed the European railway industry over recent decades and the change is still ongoing. Three Railway Packages have already been implemented and resulted in a market opening, the Fourth Package will lead to further transformation in the next years (Finger &

Messulam 2015, Holvad 2017). By introducing the Railway Reforms, the EC's primary goal was the building of a single, efficient and competitive market for rail throughout Europe, which satisfies the customers and allows a shift of other transport modes to rail. Holvad (2017) states that it is complex to assess the reform's outcome at this point, for several reasons: the legal framework is still evolving, it has not yet been completely implemented in all member states, and the separation of outcomes of legislative initiative from other possible factors is difficult. Nonetheless, the reforms and their influence on the industry and on competition is widely discussed in the literature and some studies give initial evidence on the reforms' success:

The existing literature widely agrees on the point that the single European railway market has not been achieved yet: member states have implemented EU law into national law at different speeds and to different degrees which led to a fragmentation (Nash 2008, Holvad 2009, Friederiszick et al. 2009, Kirchner 2011, Finger & Rosa 2012, Steer Davis Gleave 2012). Laperrouza & Finger (2009) observe a tension between member states and EC in terms of governance and regulation. They also find a fragmentation of the European railway sector at the technical (e.g. interoperability), financial (e.g. insufficient situation of most RUs), organisational (inadequate organisation structures) and administrative/legal level (different designs and ways of implementation). This fragmentation led to market opening evolving only slowly and is the reason for the low degree of competition (Laperrouza & Finger 2009, Kirchner 2011). Beria et al. (2012) find that the de facto level of market opening remains limited and that some incumbents are blocking the further liberalisation process, with the support of some governments. In their eyes, this is a reason why the entire potential has not yet been developed. Everis (2010) observe a gap between

formal and practical market opening and see impartial and powerful economic regulation and the full implementation of EU regulations and directives as part of the solution. Friebe et al. (2010) state that “reforms “in the books” are not all that matters and that the implementation of reforms is important” (p.16).

Stronger authorities which enforce the regulation in all member states could improve the situation (Kirchner 2011, Alexandersson & Rigas 2013). Overall, the European rail market is evidently growing together. However, to achieve a single European market, many challenges still lie ahead (Laperrouza & Finger 2009, Holvad 2017).

The increase of productivity and efficiency caused by reforms is widely discussed in the existing literature. “Their main conclusions are that entry of competition results in an increase of efficiency [...] and horizontal separation increases efficiency [...]. There is less consensus about the effect of vertical separation on efficiency” (Tomes 2017, p. 144). Only a limited number of studies investigate effects of open access competition on long-distance passenger rail (Casullo 2016). Oum et al. (1999) compare a wide range of papers on rail productivity and efficiency and show that liberalisation and deregulation generally increase efficiency. Friebe et al. (2010) agree, but they also stress that the effect is dependent on how the reforms are packaged: sequential reforms improve efficiency while multiple reforms in packages have negative effects. More specifically, Asmild et al. (2009) investigated if efficiency of railway systems has been improved by the reform initiatives of the EC between 1995 and 2001. They find an improvement in technical efficiency and conclude that accounting separation is an important factor in improving efficiency in the use of material and staff costs. Bouf et al. (1999) find increased productivity of railway companies since the late 80s which they explain mainly

by the reduction in the number of employees; they find no clear correlation to reforms. A recent study on open access competition by Casullo (2016) indicates that until now, greater efficiency is not evident. He finds that the introduction of open access competition leads to higher operating costs for railway systems, and states that “additional costs linked to the entry of new operators can outweigh the potential positive effect of competition” (p. 21). When analysing the cost efficiency of open access providers and their PSO counterparts in Britain, Wheat et al. (2018) reveal similar results, finding that open access providers can exploit lower input prices and more agile business models, which is, however, outweighed by the cost disadvantage of operating at lower density compared to the PSO providers. They conclude that both types of competition can co-exist without major cost disadvantages in the industry.

Despite active competition in freight and regional passenger rail, open access competition in long-distance passenger rail remains limited and incumbents continue to have significant market power (Bergantino 2015, Tomes et al. 2016, Beria et al. 2016a). The reforms form the basis for the market entry of competitors in various countries (Alexandersson & Rigas 2013, Beria et al. 2016a), but other factors also seem to influence the market entry of new competitors (Everis 2010). Kirchner (2011) states that open access seems to remain unattractive for RUs. Powerful incumbents still play a big role and retain a large market share (Holvad 2009, Finger & Rosa 2012). In recent years, however, a wave of new private competitors entered the markets and achieved a market share of 20-30% on individual corridors in Austria, the Czech Republic and Italy (Casullo 2016). The new entrants are heterogeneous in nature (Tomes et al. 2016), but rarely are completely external to the transport industry (Bergantino 2015): in most cases, they are a subsidiary of an existing state

incumbent (e.g. DB/ÖBB in Italy), a company which is partially owned by other incumbents (e.g. NTV and WESTbahn), or a company that is established by private operators active in the transportation or railway sector (e.g. RegioJet, MTR). Tomes et al. (2016) observe two types of open access competition in Europe: a niche-approach as in Germany and GB and a head-on-approach as in Italy and the Czech Republic. Finally, Beria et al. (2012) state that “the absence of competitors does not prove the lack of liberalisation. It might well be that the market is too small or unprofitable” (p. 115).

Until now, it remains impossible to comprehensively assess the success of the recent reforms in terms of customer satisfaction and a resulting shift from other transport modes to rail. “Overall, it is difficult to demonstrate a direct linkage between rail regulatory reform initiatives and the rail modal share in the passenger transport market” (Holvad 2017, p. 24). This is due to the indirect influence of regulatory framework on modal share. Cost performance resulting in lower prices and customer orientation and the adaptation to customer expectations of RUs play a major role (Holvad 2017). However, some recent examples indicate the positive effect of open access competition for customers. Beria et al. (2016) observe open access competition in the Italian market and find that the incumbent TI reduced its economy fares by an average of 15%, providing prices on a similar level to the competitor NTV. It also introduced new services for the customers like NTV’s. Bergantino et al. (2015) state that on the lines operated by NTV and TI, a shift away from airlines to rail can be observed. In the Czech market, Tomes et al. (2016) show that open access competition between incumbent CD and the competitors RegioJet and LEO led to a reduction in second class fares by 46% as well as a significant improvement of quality of services on the Prague-Ostrava line. Vigren (2017) also finds an

average reduction of the incumbent's fares by 12.8% in Sweden. These examples indicate that open access competition, as one result of the market liberalisation, increases customer satisfaction and initiates a shift to rail. Everis (2010) state that "[t]he prime challenge that the rail industry faces is the threat to its position and/or future from failing to develop products and services that are as attractive to potential users as those of other modes" (p. 34).

Lodge (2002) states that "[r]egulatory reform is often seen as a road paved by good intentions, but leading to 'policy hell'" (p. 271). From his point of view, it seemed as if the regulatory regime in railway industry was often biased in favour of the incumbent and was perceived as too weak. However, his analysis of the Railway Reforms in Britain and Germany shows that generally branding railway regulation as "wrong" is too simple. He states that the question which needs to be asked is why particular regulatory design recipes were chosen and to analyse what institutional incentive has influenced the perception of regulatory failure. Holvad (2009) also stresses the influence of factors outside the railway sector which can have long-term effects on regulation and reforms and therefore also need to be considered. Overall, several researchers find that the legal framework in the EU is a necessary step to create the basic conditions for liberalisation and de facto market access. The recent reforms have already brought benefits and led to a visible lowering of entry barriers in Europe (Friebel et al. 2004, Nash 2011, Kirchner 2011, Holvad 2017). Holvad (2009) believes in the success of rail restructuring and expects a revitalisation and a more efficient and customer-oriented sector and Niedhart (2009) and Alexandersson (2009) expect the current period to be the crucial stage for the development of competition, and also indicate that several problems remain to be solved in the coming years.

3.2. Factors influencing competition

In the literature, various factors influencing competition have been identified and discussed, e.g. paths allocation processes (Tomes et al. 2014), vertical separation (Nash 2008), rail access fees (Lang et al. 2013), productivity of incumbent and competitor (Villemeur et al. 2003), network effects (Niedhart 2009), access to distribution facilities (Seabright 2003), customer loyalty and price sensitivity (Paha et al. 2013), rolling stock availability (Warnecke & Götz 2012), technical compatibility within the EU (Laperrouza & Finger 2009), intermodal competition (Heuermann 2007), and discrimination against/conflict between competitors (Beria et al. 2016a). To date, no scientific work provides a comprehensive overview of the field of influencing factors and their strength, correlation and shift over time. Below, the influencing factors which have been discussed most prominently in the literature are briefly presented:

One topic which is discussed widely and frequently is the vertical separation or unbundling of rail infrastructure from rail operations. After initial experience with vertical separation in Sweden, the starting point was set by Directive 91/440, introducing greater transparency regarding cross-financing and non-discriminatory access for new entrants to the rail network. In the directive, only accounts separation was required, organisational or institutional separation remained optional (Holvad 2017). From then on, different positions exist in the relevant literature and among politicians regarding the necessary degree of vertical separation and its effects. This can also be observed in the conception phase of the Fourth Railway Package and on several legal proceedings between the EC and member states at the ECJ (e.g. Germany and Austria) (Nash 2011, Kirchner 2011, Van de Velde 2015). Analysing the existing

literature, it becomes apparent that researchers come to divergent and even conflicting findings. Unbundling is closely related to the existence of economies of scale, scope and density. As described in 2.1.2, railways are typically characterised by economies of scale, scope, and density. “The existence of substantial fixed costs [...] traditionally led economists to assume the presence of important economies of scale in the industry”, claim Cantos & Campos (1999, p. 5). However, the evidence on economies of scale in European railway companies is mixed, but more conclusive on the existence of economies of density (Smith & Wheat 2012). Several researchers verify the general existence of economies of scale in the railway industry (Cowie 2002, Smith & Wheat 2012), and Growitsch & Wenzel (2009) find economies of scale in most European railways. However, the size of economies of scale varies among countries and companies (Merkert et al. 2010, Smith & Wheat 2012). Cowie (2002) further states that economies of scale are not only associated with infrastructure, but also with service provision. The existence of economies of scale and its connection to the efficiency of railway companies forms the basis for the discussion of unbundling. Unbundling generally “refers to reforms that lead to the creation of several more or less independent units [...] out of an integrated railway that previously combined train operation and infrastructure management within a single line of command” (Van de Velde 2015, p. 53). Campos & Cantos (1999) define three main options for vertical organisation of railway companies: vertical integration, competitive access, and vertical separation. Vertical integration is the historical and traditional model of one large single integrated incumbent that incorporated infrastructure and operations. Competitive access refers to an integrated operator that is required to provide access to the infrastructure on a fair and equal basis. A complete

vertical separation means the existence of two fully separated companies, the IM and the RU, sometimes even privatised. There is a general agreement that no “one-size-fits-all” solution is available (Van de Velde 2015). Still, experts and researchers from the industry disagree on the ideal model of vertical organisation and its effects on efficiency and liberalisation: Blainey (2018) summarises that full integration minimises transaction costs, reduces complexity of regulation, provides clear accountability and a homogeneous customer experience. However, it also produces inefficiencies and cost inflation, slower innovation cycles and discourages striving for new market opportunities. Nash (2008) states that “separation of infrastructure from operations involves costs, but it is the most effective way of achieving within mode competition.” Those countries that have succeeded in separating infrastructure and operations have been most successful in introducing competition, e.g. Great Britain and Sweden (Nash 2008, Alexandersson & Rigas 2013). Beria et al. (2012) also see vertical separation as an instrument to enhance liberalisation of the industry, Campos & Cantos (1999) state that vertical separation facilitates the entry of additional RUs and encourages competition. This could also lead to increased efficiency on profitable routes. Kirchner (2011) disagrees to some degree: he concludes that market opening does not depend on full separation between IM and RU, the enforced non-discriminatory access to rail infrastructure for external RUs is more relevant. Growitsch & Wenzel (2009) state that the existence of economies of scale in integrated railways results in a higher level of efficiency and Mizutani & Shoji (2001) find that the costs for vertically separated railway companies are about 5.6% higher than for integrated companies. Despite finding that vertical separation has a major effect on efficiency, Friebe et al. (2010) find that to increase efficiency, vertical

separation might not be a necessary pre-condition. Driessen et al. (2006) agree that separation could be beneficial for productive efficiency, but they disagree on which form of separation is preferable. They conclude that full vertical separation might not be necessary to increase productive efficiency. Even when some economists refer to positive effects of unbundling in other network industries, Pittmann (2003) stresses that “railroads are different [...] in the degree to which the effectiveness of the operations depends on the exact point where vertical integration or vertical separation takes place” (p. 5). Despite the positive effects that unbundling might have on liberalisation and efficiency, a great number of disadvantages and risks are associated with unbundling (Campos & Cantos 1999): vertical separation can lead to a loss of economies of scope, possibly reduced attractiveness to the user compared with the integrated system, increased transaction costs, and a possible reduction in investment incentives by the company or body managing it. These risks resulted in critical questioning within member states whether full vertical separation was the right step for the railway industry. Finally, it can be observed that from a global perspective, full vertical separation in the railway sector is not the dominant institutional configuration and relatively rare (Van de Velde 2015) and that there is no difference in the degree of new market entry in countries with full vertical separation (Bergantino 2015).

The literature agrees that network effects have an influence on the level of competition. Laird et al. (2005) define network effects “as the second round reverberation effects on unit costs, prices and outputs in related markets” (p. 543). Consequently, they result in entry barriers for new competitors and create advantages for incumbents: with an increase in network effects of the incumbent, the likelihood of successful market entry of new competitors

decreases (de Villemeur et al. 2003, Niedhart 2009). Especially when an entrant only competes on a point-to-point route with the incumbent, network effects are a source of asymmetry and strengthen the incumbent (Seabright 2003). The network effects may incur switching costs for customers, which reduces the likelihood that they leave the incumbent's network (Paha et al. 2013). Also, in the event of vigorous price competition as in the Czech Republic, the incumbent can reduce prices on the competitive route while cross-subsidising profits from other routes of the network or the low prices on the route might even increase demand in the rest of the network. The incumbent is therefore not as vulnerable to price competition as the new entrant is (de Villemeur et al. 2003).

Infrastructure costs or rail access charges ("RACs") account for a large proportion of RUs' operational costs, ca. 25-30% (Finger & Messulam 2015). Therefore the setting of RACs plays a big role for the existence of open access competition (Holvad 2009, Nash 2011, Lang et al. 2013). In general, "the level of RACs defines the financial gap to be compensated for by government subsidies. RACs also define the conditions for the operational margin of train operators as well as the overall competitiveness of rail vis-à-vis the other transport modes", say Messulam & Finger (2015, p. 323). Directive 2001/14/EC requires that RACs need to be based on short run marginal social costs, but where excess demand for capacity exists, scarcity charges can be included. This leaves a great degree of leeway for member states, which results in an significant variety of type and level of RACs (ECMT 2005, Nash 2011, Calvo & De Ona 2012). Due to the high complexity of RACs, several studies observe the setting of the right RACs (e.g. Dodgson 1994, ECMT 2005, Kozan & Burdett 2005). Lang et al. (2013) argue that optimal pricing will increase competition and that more competition subsequently results in a reduction in RACs from

which the customers can profit. One crucial question is which type of RACs is correct: Calvo & De Ona (2012) show that rail charges are generally not strongly connected to the level of costs and often are a means of price discrimination and cross-financing. They state that in most countries, regional passenger trains pay the highest fees (thereby being state-subsidised), followed by long-distance passenger trains and finally freight trains, whereas freight trains generate the highest maintenance and renewal costs. ECMT (2005) state that often, some passenger transport is subsidised by too low access fees which do not cover the marginal costs and threaten the financial sustainability of the system in the long term. This is especially the case in the new member states (Holvad 2009). From their perspective, RACs must be structured differently according to the market (freight, passenger, high-speed, etc.) and should be harmonised internationally to avoid discrimination. Nash & Sansom (2001) note a move of the EC towards firm support of the principle of marginal social cost pricing. They show that purely commercial transport pricing would push prices in the wrong direction and therefore is not appropriate. They agree with Lang et al. that too high RACs hinder competition. Holvad (2009) states that “the existence of different approaches towards infrastructure charging can create problems for promoting international rail transport” (p. 38).

Most researchers agree on the poor availability of first and second-hand rolling stock on the European market and its influence on open access competition (Seabright 2003, Beckers et al. 2009, Kirchner 2011, Warnecke & Götz 2012, Beria et al. 2012). Rolling stock is one of an RU's largest recurring expense items, at around 20-30% of its fixed costs (Finger & Messulam 2015). Warnecke & Götz (2012) state that new railway rolling stock requires large-scale, long-term investments which lead to a high risk for new entrants. Moreover, the

production of rolling stock requires a high lead time. The absence of transferability of some rolling stock between countries gives the investment costs a sunken character (Seabright 2003). The high costs and the long amortisation period of rolling stock in most cases require ensured slots on tracks for a sufficient period to provide security for investors. However, this guarantee is not provided in most countries (Beckers et al. 2009). This makes it difficult to buy new rolling stock for private companies, while most incumbents can provide securities through state ownership (Beria et al. 2012). The acquisition of cheaper second-hand rolling stock is difficult in most EU countries, since no major market could be established till now (Kirchner 2011, Nilsson et al. 2013). Rolling stock leasing companies ("ROSCOs"), which lease rolling stock to RUs, are quite common in European freight rail and in British regional and long-distance transport. However, they remain relatively rare in the rest of Europe's long-distance transport markets which makes it difficult to enter a market at short notice (Dillon et al. 2015).

Another factor influencing open access competition which is closely connected to the availability of rolling stock is the absence of technical standardisation in the European market. "An initial measure towards ensuring interoperability of the European rail network was taken by the Council of the European Union in 1996 when it adopted Council Directive 96/48/EC from July 1996 on the interoperability of the trans-European high-speed rail system" (Holvad 2017, p. 8). The EC defines interoperability as "the ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance for these lines" (EC 2008, Article 2(b)). Despite the first successful steps, the process of technical harmonisation is delayed, but considered a necessity to achieve a single market. So the TSI system only

concerns new systems or old systems that are upgraded or renewed which leads to a long time horizon (Finger & Laperrouza 2009). The EC has already launched infringement proceedings against some member states (Holvad 2015). One example of problematic implementation of technical regulation is the introduction of the European Train Control System ("ETCS") and the European Rail Traffic Management System ("ERTMS") which was originally assigned to harmonise train control, but shows a development of different sub-levels with the need for individual technology (Railway Gazette International 2012). In their study, Schwilling & Freese (2014) find that executives from the railway industry who were questioned see increased regulatory measures by the EC to support the ERA as the biggest help to accelerate the development of ETCS and ERTMS. They also state that when suppliers would only be offering equipment which is fully compliant with TSI standards, ETCS and ERTMS would further be promoted. Holvad (2015) argues that since 2011, a complete set of TSIs is in place in the European rail market, but that a single, harmonised European rail system exists since this can only be achieved over a time horizon of 40-100 years, following the replacement of existing infrastructure. Warnecke & Götz (2012) state that the different electricity and train control systems within Europe hinder the transfer of rolling stock from one country to another and therefore reduce the already difficult rolling stock availability.

Finally, the threat of intermodal competition is an influencing factor that acquired significance in recent years. Even if motorised private transport is the biggest intermodal competitor for passenger rail (Eurostat 2019b), air and coach transportation are discussed more frequently in the existing literature. "It is well accepted that rational passengers make their travel choice by comparing the generalised cost of each mode (i.e. the ticket price plus the cost of time

calculated as the journey time multiplied by the value of time) and choosing the cheapest one”, says Sanchez-Borras (2015, p. 127). Several studies prove that air and rail are in direct, active competition to each other on some routes (e.g. Antes et al. 2004, Steer Davies Gleave 2006, Friederiszick et al. 2009). Other studies show that coach and rail also compete against each other due to the recent liberalisation of the long-distance coach market (e.g. Knorr & Lueg-Arndt 2016, Thust et al. 2016). Ivaldi & Vibes (2007) find that a small number of intermodal competitors in the intercity long-distance travel is enough to create a high degree of competition, which forces the players to adapt their business strategies permanently. Heuermann (2007) states that airlines force RUs to react to competition and that RUs are naturally not ready to react since these are new circumstances for them. Heuermann & Delfmann (2009) further state that the competition between rail and air has intensified in recent years. While high-speed rail is a substitute for air transportation, however, rail and air are not completely substitutable: this depends on distance, travel time, changeovers, and customers’ preferences. They find that especially on distances between 200 and 300 km, the faster the train, the higher the level of substitution. From a distance over 600 km, the usage of trains compared to air is decreasing, and from a distance over 800 km, air is mostly favoured. Some studies find that the increased competition between air and rail, especially with low-cost-airlines, resulted in an altered perception of prices with the customers and lead to an increased group of price-sensitive customers (e.g. Heuermann & Delfmann 2009, Sanchez-Borras 2015). Heuermann & Delfmann also state that DB has adapted its price system and introduced yield management to be more competitive with airlines. Antes et al. (2004) state that the mimicking of airlines’ pricing structure, especially of low cost airlines, is an effective way to stabilise

turnover and regain competitiveness. Sauter-Servaes & Krautscheid (2015) find in their analysis of air-rail-coach pricing competition that in 82% of the investigated booking cases, travelling by train is cheaper than travelling by air. Coach travel, however, is in 95% of the cases cheaper than rail. Murray (2014) and Weinrich (2013) find that coach competitors often undercut the railway's special offers and attract especially price-sensitive customers such as students and pensioners. On the German example, Knorr & Lueg-Arndt (2016) show a rapid market growth of long-distance coach lines and number of passengers after liberalisation, where coaches are especially attractive to customers with lower incomes. They also indicate rapid market consolidation. Prior to long-distance coach liberalisation in Germany, the politicians believed that no competition between rail and coach would arise, but that coaches would shift traffic from car to coach and that new traffic could be generated (Jochim & Felden 2013, Breimeier 2013). Thust et al. (2016), however, show that the market entry of long-distance coaches did not lead to an improved mobility for regions, but to a competition between rail and coach on the lucrative city-to-city market. This competition led to a shift from rail customers to coaches and resulted in the lowering of DB's prices. Breimeier (2013) finds that the main advantage of coach competitors towards RUs is the low operational cost. He also states that due to the high cost profile, railway connections can only be operated positively if they are a means of mass transportation – when the coach competition succeeds in attracting large numbers of customers away from rail, rail transportation cannot be provided in the future. Burgdorf & Eisenkopf (2018) agree that coach services' main advantage is its cost structure and find that a toll rate would significantly decrease coaches' modal share, with rail and car being the beneficiaries. However, bearing all this in mind, the existing open

access competition in Italy and Czech Republic shows that under some favourable conditions (e.g. shorter travel time, higher comfort), open access competition can succeed besides car, air and coach transportation and even can take market shares away from intermodal competitors (Croccolo & Violi 2013, Tomes et al. 2016).

3.3. Research methodology in the existing literature

Besides the analysis of content of the existing literature, it is equally interesting to investigate the research methodology used in prior studies. It is clearly noticeable that quantitative research methods dominate this field of research, especially economic, political and social literature. Many authors chose models to prove their hypotheses (Growitsch & Wetzel 2009, Preston 2009, Mancuso 2014, Li et al. 2015), though game theory approaches are often used: Ivaldi & Vibes (2004, 2007) create a simulation model to analyse inter- and intramodal competition; they use it as a tool which allows the measurement of effectiveness, using the example of passenger traffic competition on the OD-pair Cologne-Berlin. Lang et al. (2013) chose a game theory model to present a liberalised railway market with full vertical separation between IM and RU. Niedhart (2009) demonstrates and analyses different competition strategies in various basic scenarios in a multi-periodic model. Ruiz-Rúa & Palacín (2013) use a game theory approach supplemented by customer behaviour theory to quantify minimum requirements for new market entrants to remain in the market. Other authors base their research on empirical analysis: Bergantino et al. (2015) prove that two railway companies in Italy engage in strategic pricing by collecting primary data from the RU's booking homepage 60 days prior to

departure. Driessen et al. (2006) approach UIC³ data and use a Data Envelopment Analysis to construct efficiency scores and to prove that competitive tendering improves productive efficiency. Li et al. (2015) state that more qualitative research needs to be done in this field of study to complement the existing quantitative data. Some studies already base their research on quantitative methods, but triangulate them with qualitative tools such as expert and in-depth interviews (e.g. Röder 2003, Heuermann 2007) and case studies (e.g. Mulder et al. 2005, Everis 2010). The quantitative data gathered by Finger & Rosa (2012) in their study on governance of competition in the Swiss and European railway sector on key performance indicators was not sufficient and not fully reliable and they therefore turned to qualitative methods and gathered data through semi-structured interviews with different railway stakeholders. Petersen et al. state that "[some] impacts cannot be defined or measured in a precise way and it follows that a qualitative approach for assessment is preferable to an (unrealisable) quantitative approach" (2009, p. 161). Some articles with purely qualitative research methods exist, mainly based on interviews (e.g. Beirao 2007, Grischkat 2014) or case studies (e.g. Hrelja & Antonson 2014). Albers & Heuermann (2013) analyse competition dynamics in the German passenger transport industry by gathering data through semi-structured interviews and using grounded theory. Tomes et al. (2014) choose the form of a case study to prove that the promoting of competition has been delayed in the Czech Republic by the slow transformation of the passenger rail transportation sector. This method reveals valuable background information about the Czech market. Bergantino (2015) successfully reviews national

³ Union Internationale des chemins de fer, referring to the international railway federation

reports, EU documents and railway authorities' position papers to draw a synthetic picture of access condition.

All in all, the reviewed qualitative articles were mainly focused on specific cases in small, defined environments. This thesis tries to build a bridge between specific cases and individual experiences and universal principles in long-distance passenger rail.

3.4. Conclusion and gaps in the existing literature

Overall, the literature review shows that a wide degree of topics has already been discussed in detail. Firstly, it can be concluded that the EU's goal to create one single railway market, has not yet been fully reached – the market is fragmented, especially regarding implementation of EU regulation, status of liberalisation and technical standards. Secondly, the study of the existing literature shows that different authors from different backgrounds interpret topics in different ways. This represents the different positions of politicians, lobbyists, interest groups, and RUs which leads to general disagreement regarding topics such as vertical separation, degree of liberalisation and structure of RACs. This disagreement may be seen as one reason why the progress has been so slow. Thirdly, the literature research indicates that several entry barriers exist for new competitors, e.g. the procurement of rolling stock, a low profitability in the entire industry and high RACs – clearly, competition in the railway industry is still tough and the task of this thesis is to answer the question why this is the case. Finally, it is obvious that more qualitative research needs to be done to discover the different layers of the topics and to capture the different nuances of opinions of the various stakeholders.

Despite the broad discussion, the author identifies several gaps in the existing literature which this thesis aims to fill. Firstly, the author is not aware of a study which analyses the influencing factors on long-distance passenger rail in total – some studies provide a first step by including different influencing factors and dimensions (e.g. Everis 2009, Petersen et al. 2009, Laperrouza & Finger 2009, Kirchner 2011), but the holistic picture has not yet been drawn. Moreover, most studies analyse how competition influences the railway market, the incumbents, efficiency in the industry, etc. An adequate investigation of what influences competition itself has not yet been undertaken, nor an investigation on the power and relevance of the diverse drivers and their interplay. Another problem is that most literature was written before the first appearance of open access competition in the market from 2010 onwards. The consequence is that most existing literature is often theoretical and based on hypothesis. Up to date, only a few studies provide market data from existing open access competition (e.g. Seguret 2009, Tomes et al. 2014, 2016, Bergantino et al. 2015, Beria et al. 2016a, Vigren 2017). The author further claims that qualitative data in this field of study is scarce and therefore a big gap in literature exists. The literature review showed that the long-distance passenger rail industry is complex and influenced by different stakeholders and factors which are often linked. Therefore, qualitative data is of special importance in this field to identify the situation in practice and the market reality, for both incumbents and new entrants.

4. Chapter 4: Research methods

To answer the research aims described in chapter 1, appropriate research methods need to be defined by the researcher. This chapter gives an overview of the research methods of this thesis: the philosophical background is outlined to define the underlying premises under which this research is done. The research methodology of this thesis is presented and the three individual elements, Delphi study, case study research and PESTLE analysis, are described and discussed critically. Finally, the ethical considerations of this thesis are outlined.

4.1. Philosophical background

“All research [...] is guided by the researcher’s set of beliefs and feelings about the world and how it should be understood and studied” (Denzin & Lincoln 2005, p. 22).

Mitroff & Turoff (1975) state that “underlying any scientific technique, theory, or hypothesis there is always some philosophical basis or theory about the nature of the world upon which that technique, theory, or hypothesis fundamentally rests or depends” (p. 17). Therefore, before entering the field of research, each researcher needs to consider the philosophical premises under which their research is to be done. This is of fundamental importance since each philosophical background leads to a different application and development of techniques (Saunders et al. 2016). In the existing literature and common research practice, a variety of approaches exists to categorise epistemology. For this research project Mitroff & Turoff’s approach is chosen which is based on Churchman’s *“The Design of Inquiring Systems”* from 1971. Mitroff & Turoff (1975) present five different types; this concept has been applied by a variety of other researchers (e.g. Kapoor 1987, Engels & Kennedy 2007).

The underlying philosophical systems are named Inquiring Systems ("IS") where each IS can be seen as different sets of glasses through which the researcher approaches and carries out the research process. For each IS, different philosophical criteria need to be met before the findings can be accepted as valid or true (Mitroff & Turoff 1975). The difference between the systems lies in the way each system produces information and what each system regards as information. Information is inseparable from the system of inquiry that was used by the researcher to identify and produce it (Mitroff 1973). "The model acts on the input to transform it from the state of "input data" to the state of "output information"" (Mitroff & Turoff 1975, p. 20). They state that generally, there is no "one best" or "one unique" philosophical basis underlying any technique.

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Illustration 4: The processing of information, adapted from Mitroff & Turoff (1975)

Mitroff & Turoff (1975), Mitroff (1973) and Kapoor (1987) give a detailed overview of the several ISs, where each IS leads to different strengths and weaknesses. The two ISs which are relevant for this study will be briefly explained below:

In a Lockean IS, the *truth is experimental*. It is based upon an empirically-derived model and not upon theoretical considerations, it is inductive and consensual and can compress rich sources of experiential data. Raw data always comes before the development of theory. Raw data is transformed into factual information, accomplished by human judgement – mostly by the degree of agreement (Mitroff & Turoff 1975, p. 18 f.). The Lockean IS is considered the

epistemological basis for the original Delphi. It is suited to well-structured problem situations where a general consensus on the nature of the problem exists.

In a Singerian IS, the *truth is pragmatic*. Information is not purely scientific and experiential, but ethical as well and the system forms an inseparable whole. The richly diverse modes of human thoughts are stressed which makes it the richest of all IS. This model is goal- and objective-orientated and the archetype of synthetic interdisciplinary systems (Mitroff & Turoff 1975, p. 19). A Singerian researcher is convinced that the reality described is not synonymous with reality itself, but that reality is only a representation and reality itself only materialises if enough people/decision makers can be convinced of it being real. The Singerian IS embodies synthetic multimodal interdisciplinary systems and often includes all the previously described IS as sub-models in the design (Singer 1909, 1911).

A combination of Singerian and Lockean IS applied. The truth is pragmatic and experimental: the Singerian IS is considered suitable for this research project, since the knowledge of the Delphi participants is dependent on their situation and their experience with open access competition and must be scrutinised against their backgrounds throughout the whole thesis. The case study in the next step draws on this perceived reality and complements it by taking further perspectives into consideration. The author considers the Lockean IS since it is related to the original Delphi process and remains the prime philosophical basis of this technique. This is because the raw data inputs are the personal opinions of the experts and the validity is challenged by the degree of consensus in the next step. Additionally, undesirable psychological effects are prevented due to

the anonymity provided to the experts (Mitroff & Turoff 1975). However, the Lockean IS has not been chosen solely as a basis for this research project since it is best suited for well-structured problem situations where a strong consensus can be expected, which is not the case for this project (Mitroff & Turoff 1975). The complexity is increased by several political and legal influences as well as economic and social factors. Therefore it can be best addressed by using continual questioning and considering different perspectives of the Singerian IS combined with the inductive and consensual approach of the Lockean IS.

4.2. Research methodology

After establishing the philosophical basis, the research methodology and research plan are now outlined to give a clear overview of the research activity. To draw the overall picture, the research onion developed by Saunders et al. is used:

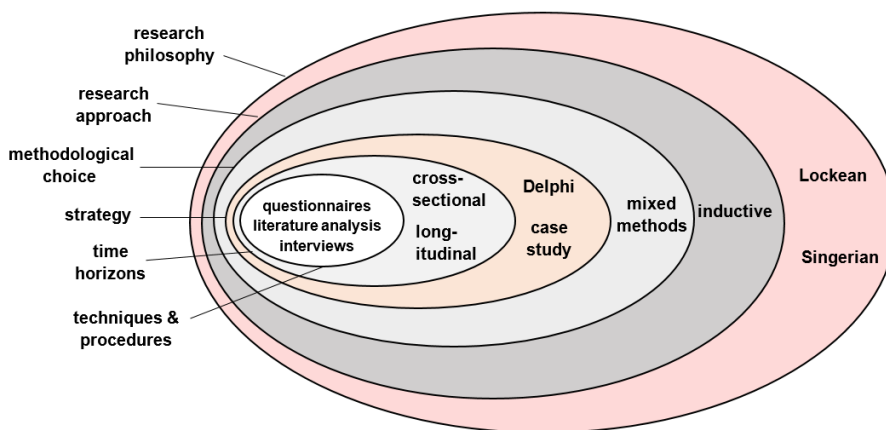


Illustration 5: Research onion, adapted from Saunders et al. (2016, p 122 ff.)

Firstly, in terms of theory development two basic research approaches exist: the inductive and the deductive approach. The deductive approach is a means to falsify or verify theory, assuming that the conclusion must be true if premises are true. It is the predominant type of research in natural science, often based

on quantitative data. Knowledge is generalised from the overall picture and from the general to the specific. In deductive research, data is collected to evaluate propositions or hypotheses which are related to existing theory (Saunders et al. 2016). The inductive approach is a means to theory generation and building, using known premises to generate untested conclusions. Knowledge is generalised from the specific details to the general and overall picture. In inductive research, data is collated to explore phenomena, identify patterns or themes and develop an overall conceptual framework. Researchers using qualitative data are more likely to use inductive research (Saunders et al. 2016). This research will follow an inductive research approach: no underlying theory is known at the start of the research process. The research collects data and forms a first set of patterns and cluster by using the Delphi study. In the next step, a detailed case study will collect further data based on the identified patterns. Finally, a conceptual framework is developed taking the outcome of the Delphi and the case study into consideration.

Regarding the methodological choice, Saunders et al. (2016) present three concepts: the mono-method which requires the use of one research approach only, the mixed-method which involves the use of two or more methods, and the multi-method which involves a wider selection of methods. This thesis follows a mixed-method approach by creating a single dataset using combined methodology. To fulfil the research objectives, both qualitative and quantitative data is collected and the findings are combined and triangulated.

The research strategy describes how the researcher aims to perform research (Saunders et al. 2016). Various approaches exist, e.g. experimental research, action research, interviews, surveys and case study research. This thesis

applies a combination of Delphi study and case study research. The strategy combines the knowledge and expertise of experts from the industry generated by the Delphi study with practical examples of competition in different market settings generated by the case study.

The time horizon of a research project is the time framework within which the project is finalised (Saunders et al. 2016). Two types of horizons exist: the cross-sectional and the longitudinal. In a cross-sectional horizon, data must be collected within a settled timeframe. In a longitudinal horizon, data can be collected repeatedly over a lengthy period. This thesis uses a combination of cross-sectional and longitudinal time horizons: the Delphi study is set in a cross-sectional time horizon; it collects data systematically over a fixed period of six months. For the case study, data is collected over a lengthy period of three years, and is continually reassessed and complemented.

The techniques and procedures of research represent data collection and analysis. This strongly depends on the methodological approach which has been chosen and the process applied significantly affects the study's validity and reliability (Saunders et al. 2016). In this thesis, primary and secondary data is gathered: within the scope of the Delphi study, questionnaires are used which collect primary data. For the case study, primary data is collected by interviewing experts. The findings are triangulated by the collection of secondary data in form of existing literature and reports, published accounts and annual reports, directives and other material. The findings from both techniques are combined in a mixed-method setting.

The research methodology described addresses the defined research objectives in the following way and is further deepened in the following sections:

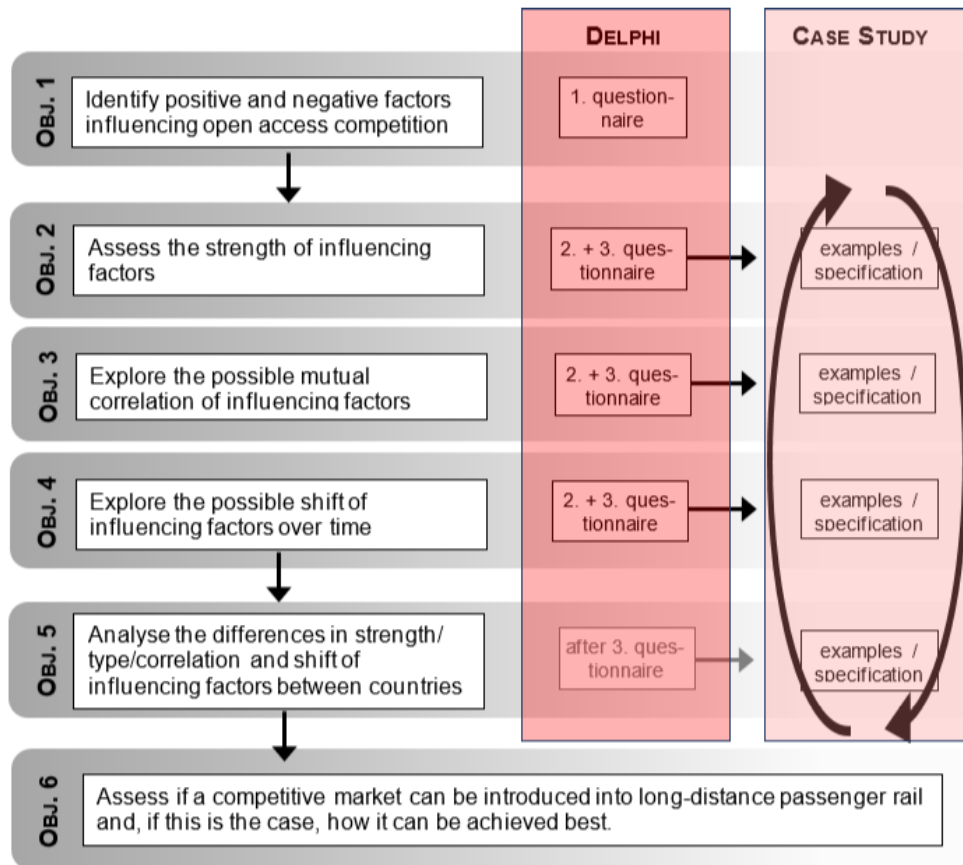


Illustration 6: Integration of research objectives into research methodology (author's own diagram)

To answer the research objectives appropriately, not only the right research methodology is of importance but also the right choice of markets. Since open access competition is not legally allowed in all EU countries and only practiced in some, a limited range of markets exists. Competition is allowed in Germany, the Czech Republic, Italy, Sweden and Austria, and has already produced interesting insights in the last years. Therefore, the Delphi study focusses on those countries. In all countries, competition takes different forms and a strong incumbent operators exists. This allows the observation of the interplay between incumbents and market entrants. Further, enough experts and researchers exist that can give valuable insights and are willing to participate in the study. Being based on the Delphi study, the case study provides a deep-dive. Therefore, enough data needs to exist, to generate detailed findings. Germany and Italy are chosen, since open access competition has a long

history in both countries, recent market entries as well as market exits took place and many interesting incidents and changes can be observed. Further, the development of competition and the approaches taken by competitors differ in both countries, giving valuable insights. In both countries, sufficient data, publications and experienced interview partners exist.

4.2.1. Delphi study

The Delphi method is a structured communication technique which ascertains and refines the judgement of a group, it “was devised in order to obtain the most reliable opinion consensus of a group of experts by subjecting them to a series of questionnaires in depth interspersed with controlled feedback” (Dalkey & Helmer 1962, p. v).

In the 1950s, the Delphi method was originally developed at the Research and Development Corporation (RAND)⁴ in California in operations research, by Dalkey, Helmer, Rescher and others (Linstone & Turoff 1975, Gordon 1994, Rowe & Wright 1999, Hsu & Sandford 2007), it was named after the Delphi Oracle in antique Greece (Cuhls 2005). The first Delphi study was based on the concept that “two heads are better than one” and consequently “n heads are better than one” (Dalkey 1969, p. 6). The original Delphi method was developed to produce forecasts of the impact of emerging technologies for the US military (Dalkey 1969, Sackman 1974).

Today, Delphi is considered a legitimate and established research method and has been applied in a wide variety of fields (Linstone & Turoff 1975, Day & Bobeva 2005, Donohoe & Needham 2009, Häder 2009). It has developed into a

⁴ RAND Corporation is a research organisation, founded after World War 2 to advise the US military. RAND develops solutions to public policy challenges and is a non-profit and nonpartisan organisation (<http://www.rand.org/about.html>).

“tool for measuring and aiding forecasting and decision making in a variety of disciplines” (Rowe & Wright 1999, p. 252). Linstone & Turoff defined Delphi as a “method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem” (Linstone & Turoff 1975, p. 3), which is most fitting for the use of Delphi in this thesis. The method is based on a structural survey process and makes use of intuitive information available to the participants and each following round is built on the knowledge gained in the previous rounds with the goal of reaching consensus (Bergner & Lohmann 2014). The technique therefore allows researchers to receive reliable first-hand data from previously defined experts (Hallowell & Gambatese 2010), who consider the matter again while being influenced by the opinion of the other experts in the panel (Cuhls 2005). Therefore, Delphi is also termed a self-learning system (Häder 2009). Hsu & Sandford say that “[c]ontrolled feedback in the Delphi process is designed to reduce the effect of noise” (2007, p. 2).

Several researchers state that there is no “single” Delphi method, it has been widely applied in diverse ways (Mullen 2003, Häder 2009, Cuhls 2005).

Nevertheless, the core components of Delphi are anonymity, controlled feedback, statistical group responses (Dalkey 1969) and iteration (Mehnen et al. 2013). Several authors tried to categorise and define different types of Delphi studies (Häder 2009). Below three basic types of Delphi are presented based on their purpose while still incorporating the core components:

Type	Conventional Delphi	Policy Delphi	Decision Delphi
Origin	RAND in 1950s	Introduced by Turoff in 1970	Introduced by Rauch in 1979
Purpose	Produce forecasts, tool for decision making process	Facilitate examination of vexing policy issues, understanding of points of consensus and disagreement	Prepare and assist decisions making, create future in reality instead of making predictions
Method	Development of consensus	Exploration of conflicting opinions	Broad discussions towards goal-oriented and well-considered management
Panel	More homogenous sample	More heterogeneous sample	Experts are recruited regarding their actual position in the decision-making hierarchy
Scientific background	More objectivist / more Lockean	More constructivist	

Table 2: Types of Delphi (Turoff 1970, Linstone & Turoff 1975, Turoff 1975, Rauch 1979, Stewart 2001, Hesse et al. 2009, Häder 2009, Linstone & Turoff 2011, Cochrane 2012, Kezar & Maxey 2016, Loe et al. 2016)

The application of the Delphi method is of special value in multi-layered, complex fields where multiple stakeholders are involved, as well for studying phenomena where limited consensus, incomplete knowledge and no hard facts or an unknown landscape exist (Donohoe & Needham 2009, Kezar & Maxey 2016). Delphi is also valuable in research projects where no precise analytical techniques can be applied and personal contact is impossible because of cost and time constraints (Day & Bobeva 2005). Whenever face-to-face meetings can be increased in efficiency by structured group communication, the heterogeneity of panels needs to be prevented or disagreements among participants need to be refereed, the Delphi study is a helpful tool (Linstone & Turoff 1975).

Delphi as a research method is a subjective-intuitive method (Cuhls 2005); it is considered a qualitative research method (Donohoe & Needham 2009), but it can be used for both quantitative and qualitative data (Häder 2009, Islam & Zunder 2014). From an epistemological point of view, it can therefore be seen from a positivist (quantitative analysis) or from an interpretivist perspective (qualitative analysis) (Lin & Song 2015). Stewart (2001) states that Delphi

“could be viewed as deriving from objectivism where the statements generated from the experts are considered as facts and objective truths, as in the case of a ‘classical Delphi’. But equally it could be derived from constructionism, where the findings only represent a shared meaning, developed from an interactive process as in a ‘policy Delphi’” (p. 923). Regarding positivist research, Delphi serves as a tool to test general assumptions and to define the characteristics of complex areas (Day & Bobeva 2005). The varieties of epistemological allocations show Delphi’s hybrid epistemological status - this is part of Critcher & Gladstone’s (1998) critique which is that Delphi may suffer from this dilemma. However, in case of this research project with its defined scope and methodological combination between Delphi study and case study research, it is not considered as problematic.

4.2.1.1. Expert panel

Scheele (1975) states that “[e]ach Delphi interaction produces a shared reality which is initially formulated by the panelists from their expectations and the style of presentation used in the initial materials; this particular reality is elaborated and modified by the succeeding interactions” (p. 61). Since the panelists produce reality for the study, the literature agrees on the point that the quality and expertise of the panel are crucial for the success of any Delphi study (Gordon 1994, Hsu & Sandford 2007, Kezar & Maxey 2016). Consequently, the composition of the expert panel is of importance for the research process and should be considered thoroughly by the researcher (Dalkey 1969).

In the existing literature, no common definition of an “expert” may be found because each Delphi study requires a different type of expert panel to be successful, always depending on the type of research question (Sackman 1974,

Mullen 2003). While Pill (1971) describes an expert as anyone with a relevant input, Mullen (2003) states that “experts are often assumed to be professionally or scientifically qualified and/or to have achieved high status” (p. 40).

Nevertheless, some underlying principles can be found in previous studies.

According to several researchers (Gordon 1994, Donohoe & Needham 2009), the research problem and study questions should be like the participant’s interest, knowledge and skills to achieve high quality, meaningful and legitimate results. According to Rogers & Lopez (2002), the expert must fulfil at least two of the following requirements: authorship, presenting at conferences, member/chair of committee, five years of practical experience, be employed as a faculty member at an institution of higher learning. The expert must also be willing to devote some of his/her often limited time to the study (Cochrane 2012) and be able to articulate judgements (Day & Bobeva 2005).

Finally, some researchers (Gordon 1994, Donohoe & Needham 2009) recommend a clear description of the selection criteria or a matrix for the experts and expert groups before each Delphi study to reach the desired research purposes. No matter how the expert is defined, it is necessary that real experts are recruited. Rowe & Wright (1999) point toward the Theory of Errors “in which accuracy is improved over rounds as a consequence of the panel experts ‘holding-out’, while the less-expert panelists ‘swing’ towards the group average” (p. 372). Best (1974) further states that “[s]elf-rated experts made estimates which were significantly [...] more accurate than estimates by self-rated nonexperts” (p. 450).

Besides the selection process of the experts, the composition of the panel plays an important role. As with the definition of an expert, the literature also does not reach consensus in the matter of panel size (Hsu & Sandford 2007): Gordon

(1994) argues that panels mostly contain between 15 and 35 participants, Delbecq et al. (1975) recommend a panel size of up to 30 experts, while Kezar & Maxey (2016) state that typically 30-60 participants form a panel. Donohoe & Needham (2009) consider a minimum of 7-15 respondents as necessary while Hallowell & Gambatese (2010) and Sourani & BEng (2015) suggest a minimum of 7-8 participants. As a matter of fact, Brockhoff (1975) states that a “general positive relationship between group size and group performance cannot be recognized” (p. 310). A closer consideration of Delphi studies in the tourist and transportation industry shows great differences in the number of participants. The Delphi studies which are of greatest interest for this research project vary between 22 (Bergner & Lohmann 2014) and 50 (Mäkitalo & Hilmola 2010).

As described above, a conventional Delphi has a more homogeneous panel while the Policy Delphi is known for a more heterogeneous panel. Nevertheless, many researchers suggest a heterogeneous panel for Delphi studies to enrich and improve the outcome (Linstone & Turoff 1975, Cuhls 2005, Hallowell & Gambatese 2010). Heterogeneous groups with experts having different perspectives on the research topic are known to produce results of higher quality than homogeneous groups (Delbecq et al. 1975, Hallowell & Gambatese 2010). However, Kezar & Maxey (2016), argue that the degree of heterogeneity mainly depends on the study’s objectives.

When the panel is finally formed, panel stability throughout the study is considered as essential since the entry of a new expert will distort the outcome of the study (Donohoe & Needham 2009).

4.2.1.2. Process of Delphi studies

In order to benefit from the Delphi method, it is necessary to clearly understand the method and its logic; only this enables methodological application and adaptation. Further, detailed and careful planning is required as well as reliable execution (Donohoe & Needham 2009):

Phase	Explanation	Tasks
1. Exploration	Free-flowing and unstructured investigation of the issues, limitations, challenges and problems that affect or are affected by the elements within the study domain.	<ul style="list-style-type: none"> Establishing criteria for selection of participants Establishing of a Delphi panel Designing of the data collection and analysis instruments Eliciting the initial set of issues to be tested through the Delphi rounds Piloting of the toolkit Assembling of information package for participants
2. Distillation	Main body of the study, several rounds of Delphi and the analysis of each round	<ul style="list-style-type: none"> Conducting rounds Reviewing of the returns from rounds Informing participant of outcome of the rounds Conducting next round
3. Utilisation	Analysing of the study outcome, summarising and utilising the outcome of the study	<ul style="list-style-type: none"> Analysing qualitative and quantitative data Writing up of results Drawing conclusions Reflecting experience

Table 3: Phases of Delphi, adapted from Linstone & Turnoff 1975, Day & Bobeva 2005, Häder 2009

The exploration phase is important for the researcher to clarify the research scope and set the basis for the Delphi study. Most researchers start the Delphi process with comprehensive desktop research (Islam & Zunder 2014) followed by one or multiple rounds of pilot tests of the questionnaire to guarantee its quality (Goldstein 1975, Day & Bobeva 2005, Donohoe & Needham 2009). As described above, the composition of the panel is the condition for successful data collection.

The distillation phase incorporates the actual interaction with the expert panel and the process of knowledge generation. In most studies, the first round starts with open-ended questions and is relatively unstructured to obtain unaffected knowledge from the panel (Rowe & Wright 1999). Some researchers, however,

provide literature reviews and structure the first round to narrow the scope and steer the panel (Weston & Davies 2007, Kezar & Maxey 2016). After the first round, the data collected will be analysed and on this basis, the questionnaire for the second round is constructed. This process is then continued until consensus is achieved or the research goal is reached. In general, it can be stated that the number of rounds varies between two and ten; but in most Delphi studies, the main improvements occur between rounds one and two, therefore Delphi studies with two or three rounds are most common (Linstone & Turnoff 1975, Hallowell & Gambatese 2010, Lin & Song 2015). Kezar & Maxey (2016) state that the number of rounds is largely dependent on the study's purpose.

To manage the Delphi rounds successfully, Donohoe (2011) recommends keeping the time between the rounds short, ideally less than two months and putting significant effort into communication with the participants to maintain commitment and enable an adequate response level. This leads to an average duration of five to eight months of a Delphi study (Häder 2009). Scheele (1975) recommends closely considering the quality of the materials provided, their style, tone and presentation. "Use lots of colour. Give the material style. [...] Use emotive language and vernacular expressions to engage panelists and convey the importance of results, not another abstract study" (Scheele 1975 p. 66). This effort can significantly reduce the drop-out rate. Gordon (1994) indicates an average response rate from 40 to 75%; however many recent Delphi studies show that it is often even lower.

In the last phase, the utilisation phase, the outcome of the study is closely analysed and summarised. The researcher writes up the results to a report or

presentation and reflect the experience to collect knowledge for future studies (Day & Bobeva 2005).

4.2.1.3. Delphi studies in existing literature

The diversity of Delphi studies shows how wide the spectrum of Delphi application is (Day & Bobeva 2005). Over the years, the technique has been applied in various fields of studies, e.g. government planning (e.g. Hesse et al. 2009), environmental management (e.g. Abukhader & Jonson 2013), health (e.g. Lange et al. 2007), marketing (e.g. Bonnemaizon et al. 2007), corporate management (Day 1975) and tourism & transportation (e.g. Bergner & Lohmann 2014, Islam & Zunder 2014, Hsu 1999). Overall, the literature on Delphi can be divided into three categories: articles about the Delphi technique itself and its usage (Sackman 1974, Day & Bobeva 2005, Donohoe 2011, Lin & Song 2015, Kezar & Maxey 2016), articles with Delphi as a foresight technique (Weston & Davies 2007, Bergner & Lohmann 2014) and articles with Delphi as a means to generate knowledge in a new field of study (partly Mäkitalo 2011, Cochrane 2012, Islam & Zunder 2014).

Bergner & Lohmann (2014) used an exploratory Delphi survey to identify challenges to global tourism through 2020 and to further comprehend their drivers, effects and nature. Of special interest in this thesis is that the authors identify that the tourism industry is affected by several external and internal drivers, including political, economic, social and environmental dimensions, like the passenger rail industry. To explore this complexity, Bergner & Lohmann chose qualitative research methodology in an exploratory approach. They addressed 22 experts with a research or consulting background of which 16 participated in the first round. The first and second round consisted of a written

questionnaire, the last round was a focus group with the possibility to send final comments via email. Bergner & Lohmann started the first round by posing open-ended questions to identify challenges and drivers. In the next round, they exported the 53 challenges identified and the participants ranked the challenges according to their prominence on a graphic scale (0 to 100 mm). The second round revealed that the experts had divergent views regarding the prominence of challenges; the researchers then allocated the challenges which had their average score in the highest quartile in the “most prominent” group. In the final round, the results were summarised in five areas of meta-challenge categories. With this research design, Bergner & Lohmann created a holistic picture of challenges despite the complexity and the dynamics within the system. For future research, they suggest their Delphi technique as a first step to study complex systems.

Islam & Zunder (2014) used a multi-technique qualitative approach combining desktop research, a Delphi study in two stages and an expert focus workshop to investigate the necessity for a new quality standard for freight transport and logistics in Europe. They addressed 100 experts of whom 90 were considered valid in the first round. Islam & Zunder used a mixed panel of experts from industry and politics. They addressed experts from top and middle management with long-term experience. For the first round, Islam & Zunder used 14 standards, developed in desktop research, which were then commented on by the experts on awareness, usage, strength and weaknesses. The expert focus workshop seems to confirm the findings from the two rounds and gives some additional recommendations. In conclusion, Islam & Zunder can confirm the use of Delphi as a research method, but they stress that “Delphi surveys can be

prone to supporting the status quo” (p. 409) since the results of their study are not radical.

Cochrane (2012) applies the Policy Delphi method to explore the concept of freight in transit. He carried out a three round Delphi based on online surveys by conducting 34 transportation experts with heterogeneous backgrounds. He started the first round with open-ended questions to animate the panel to brainstorm, followed by asking the participants to list, amongst other things, influencing factors. The outcome was a variety of different impact factors, which were grouped together and the most frequent factors were used for the next round. Then, the findings were rated on a five-point Likert scale. The outcome showed no great level of agreement, where Cochrane analysed the different panelists regarding their background. The third round implied a re-rating and a discussion and evaluation of strategies based on the answers from the previous rounds. The opinion of the panelists remained mostly stable. The Delphi method was considered a useful but time-consuming tool by the author. It was not the consensus that embodied the success, but the responses by the individual experts.

Of special interests for this project is Mäkitalo & Hilmola’s research from 2010. They used the Delphi method to analyse competition in the Finnish railway freight market. They asked why competition is not more frequent despite a liberalised market and test if Delphi is the appropriate technique for this research question. Mäkitalo & Hilmola used a panel of 50 experts from a more heterogeneous background. They carried out two rounds of Delphi by using questionnaires, starting with open-ended questions but also collecting quantitative data by using seven-point Likert scales. They discovered that the future expectations varied greatly among the experts questioned, they saw

reaching of consensus as not realistic. Therefore the experts were classified into a two-dimensional matrix and grouped into three types. In conclusion, they state that the Delphi method “worked well in collecting wide-range on arguments and views” (p. 32) and even say that it might be the only method to explore competition which does not yet exist. From their point of view, the method is suitable for the railway industry due to the diversity of players with various interests.

4.2.1.4. Strengths and weaknesses of Delphi studies

Gordon (1994) states that “Delphi studies are difficult to perform well” (p. 9) and Linstone & Turnoff (1975) argue that on the surface, the method seems to be a simple concept and that some researchers therefore chose it without considering its weaknesses. Table 4 gives an overview of the strengths and weaknesses of the Delphi method, compiled from the work of different researchers (Cuhls 2005, Donohoe & Needham 2009, Hesse et al. 2009, Cochrane 2012, Mehnen et al. 2013, Islam & Zunder 2014, Kezar & Maxey 2016):

Strengths	Weaknesses
<ul style="list-style-type: none"> • Closes gap between research and practice • Overcomes geographical and time differences • Experts are guaranteed anonymity • Reflexive and repetitive process • Flexible framework • Succeeds in research fields where other, more quantitative methods fail • Unbiased input due to prevention of negative effects of group dynamics and peer pressure • Free of personality influence, individual dominance and social pressure • Iterative process which encourages experts to converge on a consensus view • Can discover and explain disagreements 	<ul style="list-style-type: none"> • Cumulated opinion of individuals, no objective truths • Rather complex procedure • Time-consuming and high workload • Anonymity of experts may lead to careless responses • Existing paradigms could be reinforced • Can be biased to promote status quo • Danger of eliminating extreme positions and forcing middle-of-the-road consensus • If panel is designed unsatisfactorily, it reflects the personal bias of the researcher

Table 4: Strengths and weaknesses of Delphi (author's own diagram)

4.2.1.5. Critical discussion of Delphi studies

In principle, Delphi is considered an established, successful and legitimate research method which is widely applied (Linstone & Turoff 1975, Day & Bobeva 2005, Donohoe & Needham 2009). Nonetheless Delphi has often been an object of criticism. Criticism was mostly expressed regarding the concept of Delphi as a research method, its subjectivity of outcome and the interpretation of its results.

Linstone & Turoff (1975, p. 223) argue that “[s]ceptics from the allegedly “hard” sciences have at times considered Delphi an unscientific method of inquiry”. Sackman (1974) states that Delphi is considered a judgemental technique lacking internal validity and that the conventional Delphi is therefore “basically an unreliable and scientifically unvalidated technique in principle and probably in practice” (p. vi). However, some authors go as far as to state that in some fields where data is lacking or sparse, the Delphi method might be the only available possibility (Kaynak et al. 1994, Häder 2009).

The content of Delphi studies are always issues where uncertain or incomplete knowledge exists (Cuhls 2005, Häder 2009). The basic nature of Delphi is that individuals interact and develop consensus over time. Therefore, “the results of a Delphi are not just the individual items produced in the interaction but the reality comprised by the whole” (Scheele 1975, p. 65). This process results in a subjective reality, which cannot be compared to the outcome of objective, quantitative studies. Delphi is a judgemental process with some uncertain aspects (Cuhls 2005). Bearing this in mind, one needs to closely investigate the experts used for the study to guarantee high-quality and representative outcomes. The data generated by Delphi could be additionally triangulated with

other methods or existing data to challenge the outcome with a more objective reality (Höjer 1998, Gunhan & Arditi 2005, Weston & Davies 2007, Islam & Zunder 2014).

It is argued that some researchers do not consider the drawbacks of Delphi properly and therefore fail to evaluate the data in the right way which leads to falsified outcomes (Linstone & Turoff 1975). The Delphi study does not provide a common method to analyse and utilise data. “The epistemological confusion arises from focusing on Delphi results and naively taking them at face value as expert predictions of the future, rather than looking at the underpinning method which reveals Delphi as an attitude polling technique dealing in snap judgements of ill-defined issues” states Sackman (1974, p. 58).

Bearing all this in mind, the researcher must carefully evaluate if the Delphi method is the right method for the field of study – in fields where quantitative methods can be applied, this might lead to better outcomes. The researcher must also always bear in mind that the outcome of a Delphi study is the subjective reality of a group of individuals; it is therefore advisable that other modes of research are employed to triangulate the outcome. In 1974, Best agrees to this point by saying that further development regarding validation needs to be done. In 2009, Häder states that by then, no fundamental doubts about the basic functioning of Delphi had been expressed.

4.2.2. Case study research

A case study can be defined as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin 1994, p. 13). It is considered a flexible, detailed and intensive study of context-

dependent phenomena (Luck et al. 2006), being down-to-earth and attention-holding (Stake 1978) and providing a form of inquiry that enables researchers to generate a view of life in its complexity (Thomas 2016).

The origin of case study research is relatively unclear. Some see the roots in psychology, sociology and anthropology in the early 20th century, when new theory was created using case studies, as in Glaser & Strauss' work (Glaser & Strauss 1967, Eisenhardt 1989). Others see the roots even further back in time and name Frederic Le Play as the originator, when working on his studies on family budgets in 1829 (Gerring 2007, Thomas 2016). Today, case study research holds a central position in various fields of education and research, e.g. business, political science, medicine and social work (Yin 1994, Gerring 2007). Gerring states that "we are witnessing a movement in the social science away from a variable-centred approach to causality and towards a case-based approach" (2007, p. 3). This states that case study research plays a central role in today's research in social science, even though it is not without controversy (e.g. Miles 1979, Flyvbjerg 2006).

Case study research assumes various roles in a scientific context: it is defined as a data collection technique, a design feature and a research approach. Luck et al. (2006) state that case study research has no fixed methodological position, it should rather be considered a "paradigmatic bridge". This thesis will apply Yin's definition of case study research as a comprehensive research strategy (1994). Yin says that "the case study as a research strategy comprises an all-encompassing method – with the logic of design incorporating specific approaches to data collection and to data analysis" (1994, p. 13). Luck et al. state that such case study research "provides a delineated boundary for inquiry,

and a structural process within which any methods appropriate to investigating a research area can be applied” (2006, p. 103).

The case as the central element can be defined as an “individual element or group member within a sample or population such as an employee” or an “individual unit for which data have been collected” (Saunders et al. 2012, p. 666). Stake states that it “can be whatever “bounded system” [...] is of interest” for the research: a population, an institution, a specific programme or even a responsibility (1978, p. 7). Stake (1995) sees the case as an integrated system and uses the Greek symbol Θ to represent a case. When undertaking an intrinsic case study, the researcher wants to learn more about a phenomenon or a person. Therefore, a clear definition of Θ is essential. By doing instrumental case studies, these studies aim to gain understanding of a specific issue. Therefore, besides the definition of case, the definition of the issue is of special importance. Stake uses the Greek symbol Φ to represent the issue or issues. He uses the issue-question as a research question, “in order to force attention to complexity and contextuality” (1995, p. 16).

Case studies are best applied whenever “how” or “why” questions need to be answered, when the behaviour of the subjects and events in the study cannot be manipulated, when the collection of contextual conditions is relevant to the phenomenon, and when boundaries between context and phenomenon are not clear (Yin 1994, Stake 1995, Baxter & Jack 2008). In addition, case study research is relevant when more variables of interest exist than data and when multiple sources of evidence are needed and mixed (Yin 1994). It is important when “rich understanding of the context of the research and the processes

being attached” is required, mostly in explanatory and exploratory research (Saunders et al. 2012, p. 179).

However, case study research is applied to satisfy various research aims, such as providing description, testing or generation of theory, and different research questions require different case study designs (Eisenhardt 1989). According to Yin (1994), four variants of case study design exist:

The illustration has been removed due to Copyright restrictions

Illustration 7: Variants of case study design, adapted from Yin 1994

A single-case design is best applied if the case is critical in testing a well-known theory or the case is especially revelatory, extreme or unique. A multiple-case design should be applied when more than one case is relevant for the investigation with every case serving a specific purpose within the overall scope of inquiry and when replication logic can be followed. A case design should be holistic if the case investigates the global nature of a phenomenon on a more abstract level and no logical sub-units exist. An embedded case design is best applied when a phenomenon incorporates sub-units which need to be analysed individually (Yin 1994).

To achieve the research aim, there is no set of methods for case study research on which the existing literature agrees, which provides the researcher with a high degree of flexibility (Yin 1994, Luck et al. 2006). Data comes to a large extent from documentation, systematic interviewing, archival records, physical artefacts, direct and participant observation (Yin 1994, Zucker 2009). Case

study researchers typically apply mixed methods with multiple data sources to capture the phenomenon's complexity (Rosenberg & Yates 2007). The combination of data types within the case study can be highly synergetic and imply a triangulation of data (Eisenhardt 1989, Yin 1994). "This ensures that the issue is not explored through one lens, but rather a variety of lenses which allow for multiple facets of the phenomenon to be revealed and understood" (Baxter & Jack 2008, p. 544). However, this high methodological flexibility of case study research can pose a risk for researchers, since uncertainty about suitable procedural steps exists to ensure methodological accuracy (Rosenberg & Yates 2007).

Case study research is often characterised as a qualitative research methodology (Baxter & Jack 2008), but the flexibility of methods shows that case study research can be qualitative and quantitative and often is a mixture of both (Yin 1981, Gerring 2007, Saunders et al. 2012). Gerring states that "the methodological status of the case study is still highly suspect" (2007, p. 7). Luck et al. argue that "because any set of methods that will help to develop understanding can be used, case study is a bridge that spans the research paradigms" (2006, p. 105). They further state that case study research therefore has no fixed epistemological and ontological position. Indeed, the existing literature gives no clear indication of the epistemological and ontological positioning of case study research. While some consider that most case study research is considered interpretivist (Taylor & Thomas-Gregory 2015), Yin (2003) and Stake (1995) relate their approach to case study research to constructivism, which leads to a closer collaboration between the researcher and the phenomenon of research (Baxter & Jack 2008).

Taking this into consideration, it is the researcher's task to manage the opposing philosophical perspectives, and it is important that the researcher demonstrates consistency between theoretical and philosophical positions, research questions and design, and the set of applied methods (Luck et al. 2006, Taylor & Thomas-Gregory 2015).

4.2.2.1. The case study research process

Various researchers address the importance of appropriate procedural steps and a clear and transparent framework to maintain methodological integrity (Yin 1994, Stake 1995, Luck et al. 2006, Zucker 2009, Taylor & Thomas-Gregory 2015). However, a clear example or definition of the individual process steps of a case study is found only rarely (Rosenberg & Yates 2007). Rosenberg & Yates (2007) provide a clear process in nine steps, which gives a good guideline for the conception of a case study, building on and including knowledge of the existing literature (Yin 1994, Stake 1995, Luck et al. 2006, Baxter & Jack 2008, Taylor & Thomas-Gregory 2015). Their framework also serves as a framework for this thesis:

No	Step	Explanation
1	Posing of research question	<ul style="list-style-type: none"> • Clear definition of what question(s) the case study aims to answer, ideally “how” and “why”
2	Identification of underpinning theories	<ul style="list-style-type: none"> • Gain understanding of research context, e.g. in form of literature research • Identification of underlying themes and underlying theories
3	Definition of case, its context and the phenomena of interest	<ul style="list-style-type: none"> • The most important step in the process: clear definition of boundaries enables an easier and more transparent management of data • Boundaries may be set regarding time, region, units, sub-units, etc. • Participants/research subjects need to be named
4	Determination of specific case study approach / case study design	<ul style="list-style-type: none"> • Stake proposes three forms of case study research: <ul style="list-style-type: none"> ○ Intrinsic (case is studied for its own sake) ○ Instrumental (case is studied to understand issue or phenomenon of interest) ○ Collective (single case is extended to include other cases) • Yin proposes the four types of case study design described above
5	Identification of data collection method(s) most suitable to answer the research question	<ul style="list-style-type: none"> • Dependent on the type of research question • Often a mixed methods approach is used • Most common are interviews, questionnaires, documentation reviews, participant observation, etc.
6	Selection of analysis strategies appropriate to each of these data collection strategies	<ul style="list-style-type: none"> • This step overlaps with the identification of data collection since the appropriate analysis strategy is highly dependent on the method of data collection
7	Refinement of analysed data through analytical filter	<ul style="list-style-type: none"> • Not necessary for every case study • Facilitates methodological rigour • Maintains the set boundaries
8	Reduction of data into manageable units	<ul style="list-style-type: none"> • Not necessary for every case study • Organising the large volumes of data from multiple sources in a systematic and rigorous way • Can be done in the form of matrices
9	Determination of conclusion and case description	<ul style="list-style-type: none"> • Further analysis of data. Final conclusions are drawn on this basis • Matching of patterns in the data that are defensible • Writing up of case description as the product of case study research

Table 5: Case study framework, adapted from Rosenberg & Yates 2007 (author's own diagram)

In addition to the described case study process, Taylor & Thomas-Gregory (2015) name further characteristics of good case study research which aim to enhance the research process: it is important that the rigour of the research is well-defined to enhance credibility. All ethical issues of the research project need to be addressed clearly and appropriately. Finally, the presentation of the case needs to be accessible and allow the reader to evaluate and judge the case on its transferability, credibility and the trustworthiness of the data included.

4.2.2.2. Strengths and weaknesses of case study research

Yin states that despite all strengths and advantages, “good case studies are very difficult to do” (1994, p. 10). Table 6 gives an overview of case study’s main the strengths and weaknesses, compiled from the work of different researchers (Yin 1994, Bergen & While 2000, Luck et al. 2006, Baxter & Jack 2008, Zucker 2009):

Strengths	Weaknesses
<ul style="list-style-type: none"> • Closes gaps between research and practice and shows a “lived reality” • Succeeds in research fields where other, more quantitative methods fail and help in fields where large samples are not available • Allows internal triangulation by the application of mixed methods • Has a high degree of flexibility which allows adaptation to research phenomena • Generates a rich, holistic and in-depth account of research phenomena • Helps to manage research topics with high complexity and deals with a full variety of evidence 	<ul style="list-style-type: none"> • Difficult to generalise on a scientific basis • Time-consuming and often expensive • Danger of drifting off the initial phenomenon of observation due to the mass of data and impressions • Amount of rich data can be hard to analyse • Difficult to draw direct conclusions • Results are often massive, complex and broad documents: complexity of research phenomena is often hard to present simply • Possible bias when a single researcher does data collection and interpretation • Validation of solution is challenging and often complex

Table 6: Strengths and weaknesses of case study research (author’s own diagram)

In order to do successful case study research, the strengths and especially the weaknesses need to be reconsidered by the researcher throughout the case study process.

4.2.2.3. Critical discussion of case study research

Case study research is considered an established and legitimate research method that is applied in a wide field of research topics (Yin 1981, Bergen & While 2000, Flyvbjerg 2006). Nonetheless, case study research is not without controversy and often leads to criticism and misunderstandings (Miles 1979, Flyvbjerg 2006). Criticism was mostly expressed regarding a lack of rigour, biased towards verification, and a lack of generalisation capacity.

Yin states that case studies have been described as a “less desirable form of inquiry than either experiments or surveys” (1994, p. 9), especially regarding lack of rigour. He agrees that case study investigators in the past had been too sloppy by using biased views and equivocal evidence which influenced their direction of findings and finally their conclusions. Rosenberg & Yates (2007) note that the methodological flexibility of case study research may lead to uncertainty of suitable procedural steps to ensure methodological rigour.

However, by following a clear, pre-defined process, keeping a research diary recording the decision-making process, expert verification and other tools, the researcher can demonstrate rigour and high quality of the research and its findings (Rosenberg & Yates 2007, Taylor & Thomas-Gregory 2015).

Regarding verification and credibility, Miles finds the analysis process during case-writing to be “essentially intuitive, primitive, and unmanageable in any rational sense” and “memorable for its moments of sheer despair in the face of the mass of data” (1979, p. 597). Also critical in case study research “is the collection of overwhelming amounts of data that require management and analysis. Often, the researchers find themselves “lost” in the data” (Baxter & Jack 2008, p. 554). Yin (1981) agrees, saying that researchers failed to establish a clear chain of evidence for each analytical step which leads to doubt about specific conclusions. Bergen & While describe case study research as “a method as credible and robust as any other” (2000, p. 933). Zucker states that it is the researcher’s role “to test and confirm his/her findings in order to indicate the findings are valid” (2009, p. 10). Therefore, a clearly defined framework of the process of data analysis is needed to enhancing credibility (Yin 1994). Tools like Computer Aided Qualitative Data Analysis Software (CAQDAS), which help

to collect and organise data as well as recordings and source details, can further guarantee the credibility of the findings (Baxter & Jack 2008).

The possibility of generalising case study findings is also discussed in the existing literature. Zucker states that “[g]eneralization of case study findings is limited to the case itself or types of cases” (2009, p. 10). Miles (1979) believes unmanageable complexity arises when generalisation of compared cases was considered. Yin (1994) states that the answer to the question how generalisation is done is not simple. He refers to the fact that scientific facts are mostly based on multiple sets of experiments and that multiple-case studies could be a solution for generalising theoretical propositions, but not to populations or universes. Finally, Flyvbjerg states that a generalisation is not always important since “purely descriptive, phenomenological case study without any attempt to generalize can certainly be of value in this process and has often helped cut a path toward scientific innovation” (2006, p. 227). Stake states that after all, “[t]he real business of case study is particularization, not generalization” (1995, p.8).

Taking all this into consideration, the researcher must carefully design and set a clear process for the case study (Rosenberg & Yates 2007). Transparency and the presentation of evidence of each analytical step is important to build a chain of argumentation and to give the case study further credibility (Yin 1981). The researcher must also carefully consider if the case study method is the right research strategy in the relevant field of study, depending on the existence of relevant qualitative and quantitative data. Finally, Flyvbjerg states that, “the case study is a necessary and sufficient method for certain important research tasks in the social science, and it is a method that holds up well when compared to other methods in the gamut of social science research methodology” (2006,

p. 241). “The case study research has under used and under-explored potential, with broach research application and methodological flexibility,” claim Taylor & Thomas-Gregory (2015, p. 36).

4.2.3. PESTLE framework

Various studies prove how important the influence of external and internal factors is for strategic decisions in companies, especially regarding market entry strategies (e.g. Röder 2003, Ravelomanana et al. 2015). The existing literature about open access competition shows how complex and diffuse the environment of long-distance passenger rail is (Kirchner 2011) and that a clear structure is needed to analyse this type of competition in its industrial setting. The critical discussion of both the Delphi study and the case study research also reveal that a clearly structured framework is necessary to process large amounts of rich data. The PESTLE analysis, as an analytical framework of macro-environmental factors, is well suited to support the research process in this thesis: it helps to investigate complex and mulitlayered environments, clustering the factors in political, economic, social, technical, legal and environmental circumstances that characterise the business environment of an organisation, an industry or sector, or management decisions (Vronti & Vignal 2001, Peng & Nunes 2007). It is a tool to collect and categorise factors. The PESTLE framework is a common technique in business and is frequently used by practitioners and consultants in the industry.

The PESTLE framework implies that the success of an organisation/industry/management solution, and in the case of this thesis the successful implementation of open access competition, cannot be fully estimated without taking the business environment into consideration. Thus

PESTLE gives a “satellite view” (Peng & Nunes 2007). This is of special importance for this thesis, since the liberalisation process and the resulting competition in the railway market has various layers and many players with different backgrounds and motivations.

In 1965, Harvard Business School Professor Francis Aguilar conceived the “ETPS” framework to scan the environment in terms of economic, technical, political and social categories (Aguilar 1967). A few years later, Arnold Brown rephrased it to “STEP” or “Strategic Trend Evaluation Process” to organise and categorise his result of environmental scanning (Brown & Weiner 1984). It is not clear when “ETPS” or “STEP” were transformed to “PEST”, which is the predominant term used today. A few years later, the second “E” was added and defined as “ecological taxonomy”. More recently, the “L” for “legislative or legal concerns” has been added, where the “L” is often closely connected to the “P” for “politics”, which can also be observed in this study (Richardson 2012).

Today, many companies use PEST or PESTLE analysis for their strategic planning, especially due to its uni-dimensional outcome (Collins 2010, p. 2). However, the PESTLE analysis as an analysis framework itself is not precise and not clearly circumscribed. By using PESTLE, an unlimited number of variables occur: an important task for the researcher therefore is to prioritise and weight the variable with the highest impact on the field of research (Peng & Nunes 2007). In literature about research methodology, PESTLE is generally not seen as a research method or a research strategy, so it will not be used as either in this thesis.

As described above, the PESTLE framework helps to investigate complex environments by providing a structure and brings transparency into specific market circumstances. When using the PESTLE framework, the researcher

needs to observe the research topic and the market environment from a satellite perspective. This includes four basic steps: the researcher needs to identify and collect all relevant factors influencing the research topic. Next, the researcher needs to allocate the influencing factors within the PESTLE clusters. Thereby, the nature of the factors must be considered and follow-up questions must be asked. Then, the relationships between the factors need to be analysed. Finally, the researcher needs to transfer the grouped influencing factors and their relations into a holistic picture, which reflects the market environment of the research topic. Tovstiga & Aylward (2008) state that it is relatively easy to produce a list of factors with the PESTLE analysis; the real challenge lies in the identification of the cause-and-effect relationship between the factors.

To identify the core findings, this thesis will use the PESTLE framework as described above: the influencing factors on open access competition will be collected in the course of the Delphi study. Then, they will be grouped into the PESTLE clusters. In the further course of the Delphi study and the case study, the relationships between the influencing factors and the clusters will be worked out, assessing qualitative and quantitative data. This finally results in the holistic picture of the interrelations of influencing factors on open access competition, where cause-and-effect relationships become apparent.

The following graphic gives an example of which topics fit into a rail-specific PESTLE framework, deduced from what has been discussed in the literature review:

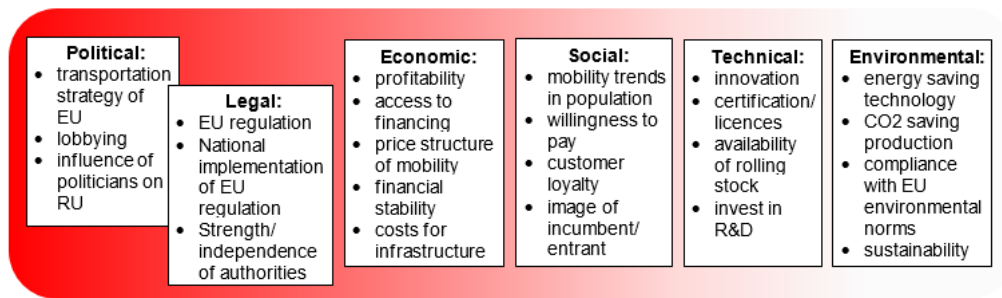


Illustration 8: Rail-specific PESTLE framework (author's own diagram)

4.3. Ethical considerations

To finalise the chapter on research methods, the ethical considerations for this thesis are discussed in the following section. No ethical risks could be identified that would lead to a cancellation of the research project. However, some risks could be identified which are named in the following. For each risk, a strategy to control the risk has been successfully implemented:

The author is employed at DB Fv and DB Fv supports the author by paying part of the student fees. Therefore, a risk of influence on the neutrality of the researcher exists. To fully avoid interference of DB Fv on the research outcome, an agreement has been made that the author can do the research freely and that DB Fv has no influence on the research process and outcome. Further, no internal data from DB Fv is used by the researcher. Also, the research data cannot be accessed by DB Fv at any time and remains strictly confidential.

The researcher receives both, personal information of the participants and their input. Therefore, confidentiality is of high importance and the risk of disclosure needs to be addressed. During the whole research process the names and contact details of the participants are kept private on the researcher's private computer and email account, under password protection. In the Delphi study, all statements and ratings are kept anonymous and no association with the participants is possible. In the interviews for the case study, due to the specific

company insights, the statements could be associated with the participants' working background. However, the interviewees are aware of this fact and this represented no obstacle for anyone of them.

With a high amount of rich, qualitative data, a risk of incorrect interpretation exists. Therefore, the research methodology is designed to process this type of data. However, to avoid further misunderstandings with the participants, the research process is designed transparently: to make sure that the participants are informed about the topic, the data collection method and their right to withdraw, information sheets are sent out and handed to all participants (see Appendix 1, 2, 6 and 7). The Delphi participants receive an update of the results with each following round and a detailed final report, which they can comment on (see Appendix 5). The case study interviewees receive a detailed interview protocol which they can also comment on and their feedback is fully included (see Appendix 9).

Finally, all research on this thesis is done in full consistency with the University of Plymouth's *Principles for Research Involving Human Participants* and ethical approval for this research has been granted by the Research Ethical Approval Committee.

5. Chapter 5: Identification of influencing factors: a Delphi study

After an in-depth study of the Delphi method and its strengths and weaknesses, the method is considered as suitable for this research project, in combination with a previous in-depth literature review and a subsequent case study.

Linstone & Turoff (2002) name some properties that lead to the need to employ Delphi, which also apply to this research:

- In this field of study, no precise analytical technique would answer the research question, but the project benefits from the subjective judgements of the experts from the industry.
- More individuals are needed to answer the research question than can be brought together in a face-to-face exchange, due to the demographic division of the experts and their lack of time. This is also the reason why frequent group meetings could not be realised.
- For this project, it is an advantage to prevent the heterogeneity of the experts since this provides important input about what competition is like in the books and in reality – therefore Delphi is a possibility to assure the results are valid.

This research project is multi-layered and characterised by political influences, multiple stakeholder interests, consensus is limited and no hard facts exist, which also encourages the employment of a Delphi study (Donohoe & Needham 2009, Kezar & Maxey 2016).

5.1. Setting of the Delphi process

The process of this Delphi study is based on the traditional Delphi process, described by Day & Bobeva (2005). It is therefore divided into three phases: the

exploration, distillation and utilisation phases. The following flow chart gives an overview of the design of the Delphi process:

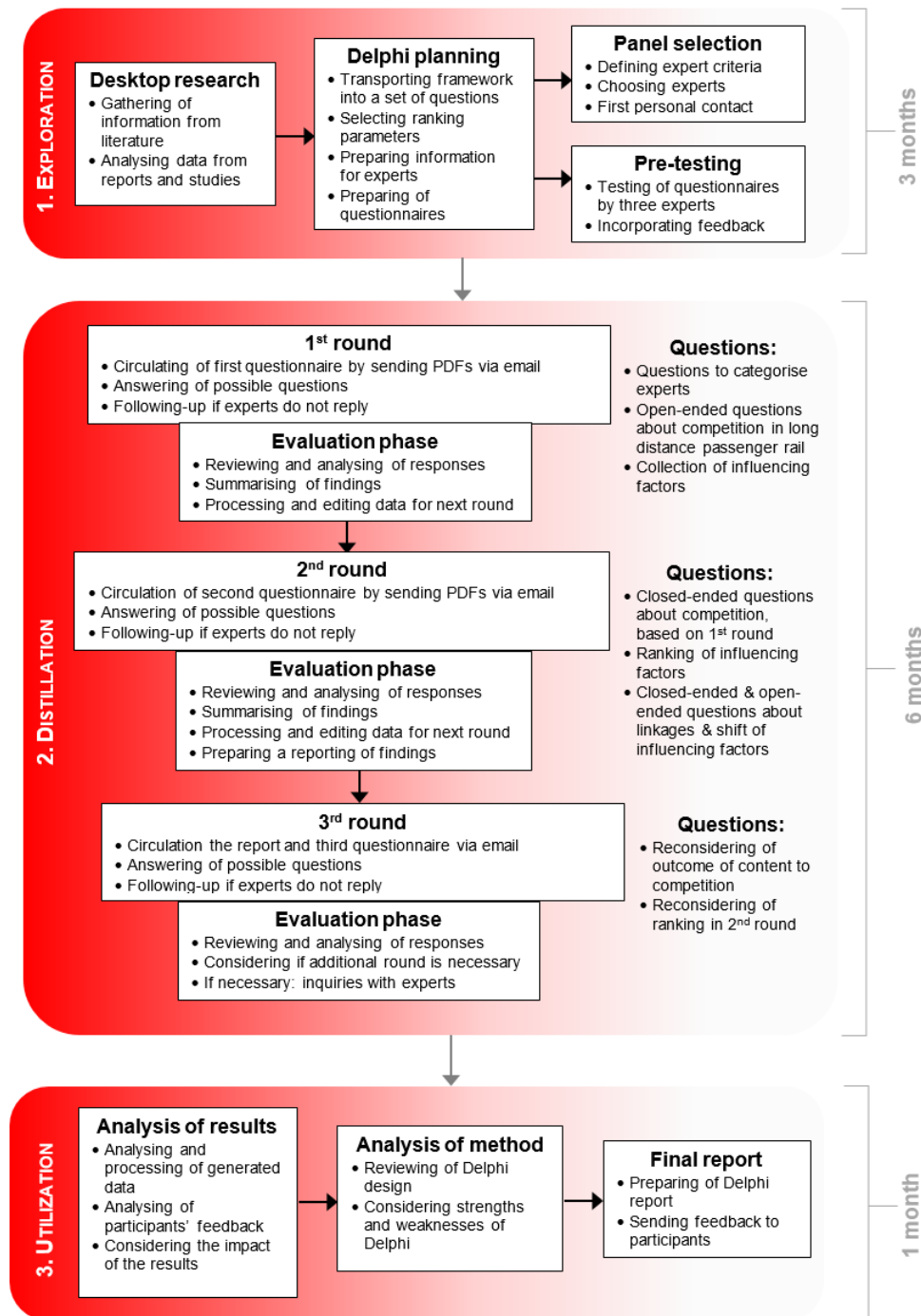


Illustration 9: Design of Delphi study, based on Day & Bobeva (2005)

5.1.1. Preparation of the Delphi study: the exploration phase

The Delphi process starts by doing extensive desktop research to gather and analyse existing literature and to define the knowledge gaps (see chapter 3). In

the following Delphi planning phase, the basic setting of the Delphi framework is detailed and a first version of the online questionnaires is prepared. The researcher plans to perform three stages of Delphi, since the main improvements in a Delphi process occur in rounds two to three and most Delphi studies have two to three rounds. However, after the third round, the researcher considers if an additional round would further enhance the findings.

The selection of the panel is of special importance, since the expertise of the participants is crucial for the success of the study. Firstly, the selection criteria for the panel are defined; the researcher divides between compulsory criteria and desirable criteria to enhance quality:



Illustration 10: Delphi panel selection criteria (author's own diagram)

Since the railway industry is multi-layered and diverse stakeholders with different experience play a role, the researcher chose a more heterogeneous and international panel. As a first step, the researcher contacted experts from her own network who fulfilled the selection criteria. Each expert received a short explanation of the research project, including the compulsory selection criteria. By asking some selected contacts to nominate further competent experts in the next step, a snowball sampling technique was applied. Those possible participants were addressed by the researcher to validate if all the selection

criteria were fulfilled and if they were willing to participate throughout all rounds of the Delphi study. Experts who could give valuable input on the research topic, are scarce and often connected among themselves; therefore the snowball sampling technique was considered suitable. In total, a panel size of 30 experts was set up, which fits into the range of average Delphi panels. To guarantee the quality of the participants, the researcher prepared individual profiles for each participant, listing job positions, publications, participation in conferences, etc.

The researcher considered several types of questionnaires, e.g. online/web-based, paper and PDF questionnaires. Leading online providers, such as SurveyMonkey, are used by researchers in all fields. The researcher decided against using online providers to protect the panel's anonymity, since server location and access to data and contact information is often unclear. The paper-based questionnaire was considered too time-consuming. The PDF questionnaire was finally chosen, since it was easy to send to the participants via email and easy for the participants to fill in (e.g. on iPads). The text could be copied from the textboxes directly and it guaranteed anonymity to the participants.

To avoid uncertainties and misunderstandings in the questionnaires, they were pre-tested by three experts from the railway industry: one expert had a background in engineering, and was well-informed about research questions and processes. The second expert had a management background, several years of experience in the field of study and was well-informed about research questions and processes. The third expert had a consulting and business development background, little experience in the field of competition and was

not well-informed about research questions and processes. The different profiles of the testers were a means to ensure good comprehensibility of definitions, questions and the researcher's intention. The feedback of the testers is included in the questionnaires.

5.1.2. Performance of the Delphi study: the distillation phase

All questionnaires were structured similarly: they started by giving the experts a brief introduction and explanation of the research project and its research goals as well as the process of the current questionnaire. Some fundamental terms were defined to make sure that all participants understood industry-specific terms in the same way. The questions posed were divided into four fields: firstly, the experts were asked to give some personal information on their experience and background to group them into a matrix to monitor the panel. This enabled the researcher to interpret the responses, bearing the experts' backgrounds in mind. Secondly, some open-ended questions followed by closed-ended questions were asked about the experts understanding and the future of competition. Many Delphi studies use open-ended questions in the first round (Sourani & BEng 2015). This is how the traditional Delphi process begins and it forms a cornerstone for the further research process (Rowe & Wright 1999, Hsu & Sandford 2007). This ensures that the participants were not influenced by preselected literature or the researcher's view. The third field was about collecting and rating factors influencing competition. The fourth field asked about linkages between and a shift of influencing factors. Those questions were not incorporated until after the first round, since they depended on the generated list of influencing factors.

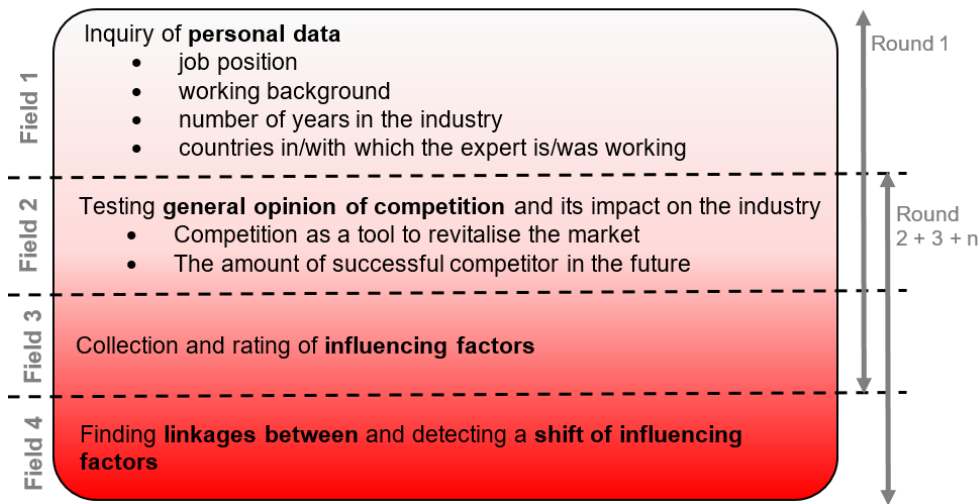


Illustration 11: Design of questions (author's own diagram)

Each questionnaire was accompanied by an information sheet which gave the participants an overview of the research process, their rights as participants and the risks and benefits of participating. It is in Appendix 1.

The first round was organised as follows: as explained above, the first questionnaire consisted of sections. Firstly, four questions on working background and personal information were asked, using a text field and ticking boxes. Next, the experts' perspective on competition was identified by posing five questions, all questions were open-ended and answered in text fields. Finally, the influencing factors were identified by giving the experts the possibility to enter 15 lines and an additional text box and asking them to tick whether the factors named were positive or negative. The first questionnaire is in Appendix 2. After the arrival of the responses, the personal information was entered in an Excel sheet where the composition of the panel was monitored. The data from the open-ended questions in the second part was analysed and the participants' replies were summarised and coded. In Excel, all codes were listed and for every reply and if one of the codes occurs, it was marked with a "1". The total for each code gave an overview, on which the statements for the

next round were formulated. The influencing factors stated by the experts were first collected, then entered in the clusters “political/legal” “economic” “social” “technical” “environmental” and “other”. Next they were compared and similar influencing factors were grouped into sub-clusters. Influencing factors that were named only once and considered as negligible by the researcher were not included in the final list.

After the finalisation of the first round, the second round was organised as follows: most Delphi studies use a combination of closed- and open-ended questions to advance the process of forming consensus (Bergner & Lohmann 2014). This research also combines the qualitative data from the first round with quantification in the second round (Häder 2009). The second questionnaire was again divided into three sections: firstly, the replies on the questions about the experts’ perspective on competition were given. The panel was requested to rate the statements on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree. The statements were grouped into three main sections, supplemented by sub-items. When the participants did not agree with the statement, they were asked to comment. Next, the collected influencing factors were stated. The participants were asked to rate these factors according to how important they were and how positive or negative their impact was on a scale from -4 (very strong negative influence) to +4 (very strong positive influence). Finally, two open-ended questions were posed to find linkages between the given influencing factors and detect a shift of influencing factors over time. For the linkages, five lines with two boxes were provided, and a text field for further comments. For the shift of factors, a textbox was given. The second questionnaire is in Appendix 3. After the arrival of the responses, the consensus for the first and second part of the questionnaire was

measured. The answers were then evaluated statistically and summarised using means and medians, which is the most common tool to process feedback (Hallowell & Gambatese 2010, Cochrane 2012). The following scheme was used to define consensus (based on Kapoor 1987):

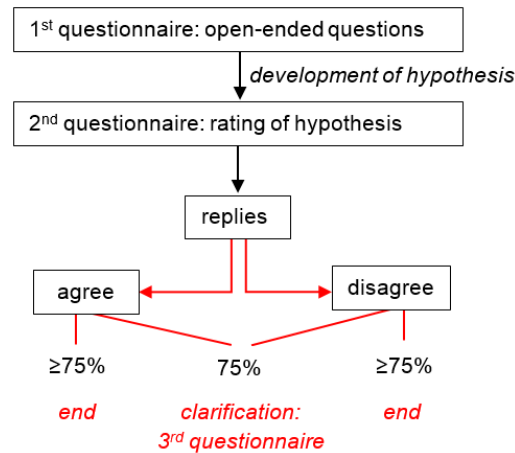


Illustration 12: Definition of consensus (author's own diagram)

The third part of the questionnaire was analysed like the first part of the first questionnaire: the replies for question 5 were entered in an Excel sheet and sorted after the number of mentions by the panel. The data from the open-ended question 6 is entered in an Excel sheet and coded according to which influencing factor the participant is writing about. All replies were listed in Excel and the included codes were marked with a "1". The sums for each code gave an overview, on which the statements for the next round were formulated.

Finally, the third round was organised as follows: the panel received a questionnaire including all statements that could not reach consensus in section 1, the list of influencing factors in section 2 and the newly formed statements for section 3. The calculated means from the second round were included in the questionnaires in section 1 and 2. The panelists needed to rate the statements and influencing factors once again, using the means of the last round as a reference value. Moreover, in section 2, an altered scale was introduced: the

panel was asked to rate the influencing factors on a scale between 0=neutral to 4=very strong influence and the possibility was now given to group a factor as either positive or negative. The statements in section 3 were rated on a 5-point Likert scale, like section 1. The third questionnaire is in Appendix 4. After the arrival of the responses, the answers were evaluated statistically and summarised using means and medians. The consensus for the first and second section of the questionnaires was measured, using the same logic as for the second questionnaire. Additional comments of experts were analysed and entered in an Excel sheet. After the finalisation of the third round, it was once again considered if an additional round would result in further consensus or additional findings and if it was therefore needed. In this research project no fourth round was undertaken.

5.1.3. Post-processing of the Delphi study: the utilisation phase

Finally, the generated data was analysed and converted into diagrams and charts. The researcher considered what impact the generated knowledge had on the industry and what consequences might arise. The Delphi report was prepared and sent out in the last step. It was prepared in PowerPoint, since that is the tool most commonly used in the industry and therefore convenient for the panel. It gave the panel a brief management summary, an overview of methodology and the panel, the findings and a brief discussion of the findings. The report was sent out via email and the participants were encouraged to contact the researcher in case of further questions and to give feedback on the report. The report is in Appendix 5.

5.2. Presentation of the Delphi results

This section presents the results of the three Delphi rounds. First, each round is described individually and finally summed up and discussed as a whole. For each round, the panel is described, the evaluation of the returned questionnaires is explained and also the transformation of content from one round to the next.

As described in section 4.2.1.1., it is essential to define criteria for the designated panel. The first personal contact with the selected experts showed that all experts fulfilled the compulsory criteria and most experts fulfilled two or more of the desirable criteria as well: 67% of all participants have more than 10 years of working experience, 60% attend forums and conferences, 50% have one or more publications, and 10% are members of transport committees. Therefore, the panel was considered good quality and the first questionnaire was sent to a total of 30 experts. The original panel had the following profile:

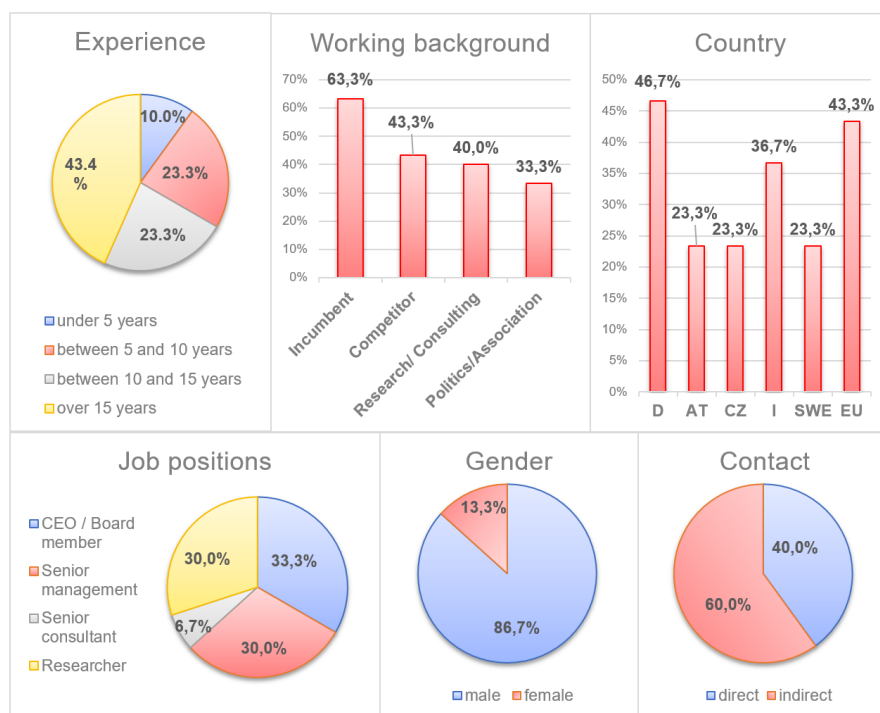


Illustration 13: Profile of the initial Delphi panel (author's own diagram)

43.3% of all participants had over 15 years' experience in the industry. 63.3% of all participants work or worked for an incumbent since competition is a new phenomenon. Many experts working for competitors started their career with incumbents. 47.7% of the participants experienced competition in Germany, since the researcher's network is centred on Germany. 33.3% of the experts hold or held CEO or board member positions, often with competitors. 30% are researchers, many of them published papers or books discussed in the literature review. Overall, the high profile of participants in the Delphi panel shows that the research topic is of relevance and of great interest to managers and researchers from the industry.

5.2.1. Gathering of experts' statements and factors: 1st Delphi round

Of the 30 experts, 25 returned a filled-out questionnaire, which leads to a response rate of 83%. 40% of the experts sent their replies before the announced deadline, 60% of the replies arrived after the reminder. All returned questionnaires were valid and could be processed. The panel for the first round had the following profile:

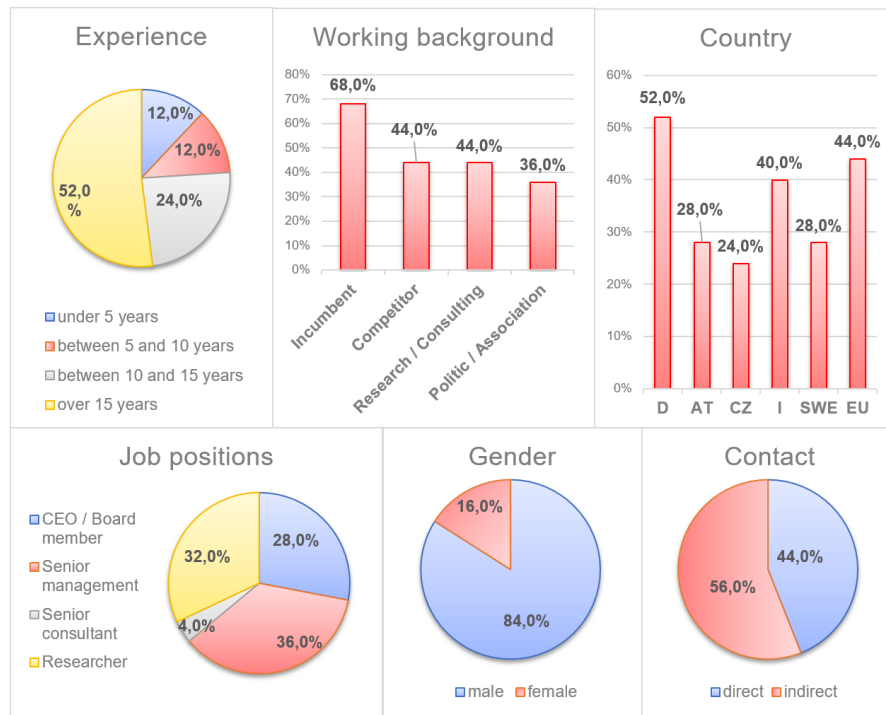


Illustration 14: Profile of the 1st round's panel (author's own diagram)

The individual questions from the first questionnaire are presented below.

Question 1-4: working background & personal information

The data generated from these questions was entered in an Excel sheet, connecting the participants' names with years of working experience, the role(s) in which they experience/experienced competition, their countries of experience and their past and present working positions. This lays the foundation for further analysis, matching the generated data to the participants' background.

Questions 5-6: How does competition shape the long-distance passenger rail market? What has changed due to competition? and What is the core effect of open access competition in the passenger rail market?

Originally, questions 5 and 6 were planned to be analysed separately, whereas question 6 was intended as the aggregation of question 5. The participants, however, linked both questions and refer from one to another. The researcher therefore decided to evaluate both questions together.

In a first step, all statements were read and the factors and changes that affect the passenger rail market were marked. Those factors were grouped into three categories: effects on passengers, on incumbents and on the railway industry as a whole. All factors which were mentioned by at least 16% of the experts were included. The effects on passengers are: a higher customer focus with better prices, higher frequency of connections, better quality, better services and more innovation – all effects are positive in nature. The effects on the incumbent are: an increase in efficiency and higher quality – also positive in nature. The effects on the railway industry are: more customers, lower overall profitability and a greater complexity of the system – positive and negative effects. This results in an overall positive effect of open access competition on the passenger rail market. The information was formulated into one statement and three sub-statements:

5. *Open access competition has an overall positive effect on long-distance passenger rail, especially for customers.*
 - 5.1. *The positive effect for customers is a higher customer focus with better prices, better quality, higher frequency of trains, better services and more innovation.*
 - 5.2. *The positive effect for the incumbent is a development to higher efficiency and quality.*
 - 5.3. *The positive effect for the industry is the gaining of new customers. It also has negative effects such as a lower overall profitability and a higher complexity of the system.*

Question 7: From an EU perspective, competition is a means to increase efficiency of railway undertakings and to modernise them, make them more responsive to customer demand and decrease overall transport emissions. From your perspective, is open access competition the right tool to reach these goals? Why?

Firstly, the experts' statements were analysed regarding agreement or disagreement with the EU's perspective. Therefore, the statements were clustered into -1 (clearly disagrees), -0.5 (disagree to some extent), 0 (pro and

contra arguments given), 0.5 (agree to some extent) and 1 (clearly agree), according to how clearly the experts gave their opinion or how many pro and contra arguments were given. This resulted in a score of 8.5 on a range of -25 to 25 which indicated a slight agreement. Several experts indicated that open access is a tool to achieve those goals, but it might not be the only tool.

When the content of the experts' statements was analysed regarding its justifications, it showed that 24% of all participants stated that open access competition is necessary for incumbents to change much faster and to achieve higher customer focus and passenger comfort. Of those who disagreed with open access being the right tool, 24% stated that a tendering/franchising-system could be a better solution to reach the goals. 12% stated that intermodal competition has been the reason for many positive changes and is a tool to fulfil similar goals. Of those participants who stayed neutral or gave balanced arguments, 16% stated that the success of open access competition is dependent on the fact that the line(s) can be produced profitably, 12% stated that it depended on free and independent infrastructure capacity and a further 12% stated that open access competition needed to be implemented completely and sufficiently. This evaluation led to the following statement and four sub-statements:

6. *All in all, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a higher customer focus and decrease emissions by attracting more customers.*
 - 6.1. *Incumbent operators change much faster and adapt much more quickly to the market.*
 - 6.2. *More customers use long-distance passenger rail.*
 - 6.3. *However, the success depends on infrastructure capacity, if open access is implemented sufficiently and if ODs (origin-destinations) or lines can be produced profitably.*
 - 6.4. *A tendering/franchising-system could possibly fulfil the goals better.*

Question 8: How would the number of competitors in the European rail market change in the next 10 years? In your opinion, will there be more or less competitors compared to today?

Firstly, the experts' statements were analysed regarding the number of competitors and the degree of competition. This showed that 52% of the participants predicted an increase, 28% were of the opinion that the number of competitors would stay the same as today, 12% predicted a decrease and 8% were unsure about the future development. Of those who predicted an increase, 69% stated that the increase would only be small. 20% of the participants expected mergers and consolidation of companies in the future. The evaluation led to the following statement and sub-statement:

7. *The number of competitors and the degree of competition will increase only slightly.*
- 7.1. *The consolidation and merger of companies is expected.*

Question 9: How would you describe your personal attitude towards open access competition?

The data generated displays that 48% of all experts had a positive attitude towards open access competition, 40% were ambivalent, 4% had a negative attitude, 4% had a neutral to positive attitude and 4% did not comment. The content of this question was not included in the further Delphi process, it rather laid the foundation for further analysis matching the generated data with the participants' opinion.

Question 10: identification of influencing factors

Firstly, the influencing factors were catalogued in a list in Excel, relating to the experts' names and whether they regarded the given influencing factor as positive or negative. 206 factors were generated in total, each participant

named an average of 8.24 factors. Within the PESTLE framework, all factors were assigned to a “political/legal”⁵, “economic”, “social”, “technical”, “environmental” or “others” cluster. Two factors contained content from two clusters and were grouped twice. This resulted in the following outcome:

PESTLE-Cluster	Negative	Positive	No distinction	SUM	%
Political/legal	23	40	12	75	36.41
Economic	33	24	3	60	29.13
Technical	18	12	3	33	16.02
Social	6	10	3	19	9.22
Others	9	4	2	15	7.28
Environmental	0	2	0	2	0.97
Technical & economic	1	0	0	1	0.49
Political/legal & economic	1	0	0	1	0.49
SUM	91	92	23	206	100.00

Table 7: Overview of clustered influencing factors (author's own diagram)

The overview shows that political/legal and economic influences were named most frequently by experts. Environmental influencing factors can be neglected which also goes hand in hand with the small number of publications in this field. This first evaluation indicated that positive and negative influencing factors seem to be balanced.

In a next step, the influencing factors within the clusters were grouped, sorted and finally sub-clusters were conceived. Those factors which could not fit into a sub-cluster were analysed closely and considered, regarding the existing literature. If the researcher deemed these influencing factors as important, it was added as a new sub-cluster. If it was considered irrelevant, it was removed. In this process, the researcher also decided to remove the “environmental”

⁵ Political and legal influencing factors were grouped together due to their interdependence and overlapping.

cluster. This resulted in a total of five clusters and 34 sub-clustered influencing factors, 200 of the original 206 influencing factors were incorporated:

Cluster	No	Influencing factor	%
Political & legal	1	Existing EU and national law in the books (e.g. regarding number and complexity of regulations, transparency, operational rules, independences and strength of regulator)	10.00
	2	Existing law in action (e.g. regarding frequency, operational rules, independence and strength of regulator)	4.00
	3	Access to facilities (stations, maintenance depots, sales offices in stations, etc.) as well as data (e.g. sales information)	7.50
	4	Access to and availability of attractive train paths	7.00
	5	General facilitation and attitude of government and politicians towards competition	4.50
	6	Unbundling (separation between infrastructure and operations)	3.50
	7	State of and investment in infrastructure	2.00
	8	Willingness or ability to subsidise operations in the country	2.00
	9	Consumer policy (e.g. customer protection, passenger rights)	1.00
Economic	10	Market potential and market size of the origin-destination ("OD"), the line or the network	8.00
	11	Costs for infrastructure (paths, stations, traction, etc.)	5.00
	12	Access to distribution systems (sales offices in stations, online sales systems, etc.)	4.50
	13	Presence of intermodal competitors (e.g. car, coach, plane), enabled by economic privileges for other transport modes	3.00
	14	Existence of network effects for incumbents	2.50
	15	Generally low profitability of the industry	3.00
	16	Access to financing (e.g. for rolling stock)	2.00
	17	Existence of cooperation or coopetition within the industry	2.00
	18	Cross-financing of RUs in the market and a lack of transparency	1.50
	19	Existence of cooperation with other transport modes (e.g. coach)	0.50
	20	Possibility for cherry-picking in the market	0.50
Social	21	Existence of (strong) unions	1.50
	22	Customer loyalty	1.00
	23	Sharing economy (e.g. rideshare, carsharing)	0.50
	24	Adjustment to customer expectation	1.50
	25	Customers' willingness to pay	1.00
	26	Entrepreneurship (capacity/willingness to develop a new business)	0.50
	27	Attitude of press and population toward competition	1.00
Technical	28	Access to rolling stock (first and second-hand as well as leasing)	6.50
	29	Lack of technical harmonisation within the EU	4.00
	30	Existence of innovation (of rolling stock, sales system, etc.)	1.50
	31	Homologation process (vehicle authorisation)	1.50
	32	Railway safety systems	1.00
	33	Availability of necessary personnel (e.g. train drivers, service staff)	0.50
Other	34	Incumbent's performance (reputation, service quality, efficiency)	4.00
SUM			100.00

Table 8: The 34 sub-clustered influencing factors (1st round) (author's own diagram)

This first weighting gives an indication of the importance or strength of the influencing factors, which is not communicated to the participants. When analysing the positive or negative influence of the above factors, it became clear that some of the influencing factors were considered both positive and negative by the participants. Some formulated the factors in different ways, while others had differing experiences concerning one factor in different countries. It is therefore not possible to undertake further analysis before rating by the experts.

5.2.2. Rating of experts' statements and factors: 2nd Delphi round

Of the 25 experts addressed, 25 returned a filled-out questionnaire which leads to a response rate of 100%. The high response rate was achieved due to a relatively short time of two months between the sending out of the questionnaires, a significant effort at communication and discussion with the participants and the high degree of interest of the participants in the topic (Donohoe 2011). 52% of the experts sent their replies before the deadline, 48% after the reminder. A few participants forgot to tick individual boxes in the questionnaire, they were contacted directly and the feedback was included in the questionnaire by the researcher. Therefore, all returned questionnaires were valid and could be processed and analysed. The constellation of the panel was identical to the previous round. The individual questions from the second questionnaire are presented below:

Question 1-3: rating of statements on perspective on competition on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree.

The ratings of the three statements and eight sub-statements of each participant were entered in an Excel sheet and analysed by calculating the mean, median, variance, standard deviation and the percentage of agreement or disagreement. As described in section 5.1.2, a statement reaches consensus when 75% of the participants agree or disagree. The following table gives an overview of the outcome:

Statement / sub-statement	% agree	% disagree	Mean	Median	v^2	S
1. Open access competition has an overall positive effect on long-distance passenger rail, especially for customers.	80.00	12.00	1.72	1	1.08	1.04
1.1. The positive effect for customers is a higher customer focus with better prices, better quality, higher frequency of trains, better services and more innovation.	88.00	8.00	1.68	1	0.78	0.88
1.2. The positive effect for the incumbent is a development to higher efficiency and quality.	96.00	4.00	1.68	2	0.46	0.68
1.3. The positive effect for the industry is the gaining of new customers. It also has negative effects such as a lower overall profitability and a higher complexity of the system.	76.00	16.00	2.12	2	1.23	1.11
2. All in all, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a higher customer focus and decrease emissions by attracting more customers.	84.00	4.00	1.76	2	0.66	0.81
2.1. Incumbent operators change much faster and adapt much more quickly to the market.	88.00	4.00	1.88	2	0.51	0.71
2.2. More customers use long-distance passenger rail	88.00	4.00	1.72	2	0.84	0.92
2.3. However, the success depends on infrastructure capacity, if open access is implemented sufficiently and if ODs or lines can be produced profitably.	76.00	8.00	2.08	2	0.95	0.98
2.4. A tendering/franchising-system could possibly fulfil the goals better.	36.00	36.00	2.92	3	1.91	1.38
3. The number of competitors and the degree of competition will increase only slightly.	72.00	4.00	2.00	2	0.96	0.98
3.1. The consolidation and merger of companies is expected.	52.00	20.00	2.52	2	1.21	1.10

Table 9: Outcome of experts' perception of competition (2nd round) (author's own diagram)

Because of this evaluation, three statements needed to be further clarified in the next Delphi round. The further analysis of the comments of participants on those three statements revealed the following arguments:

- *2.4. A tendering/franchising-system could possibly fulfil the goals better.*

A tendering system reflects the interests of authorities; these are sometimes biased to the customers' interests and therefore open access competition is the better option. In addition, which system is better suited is too dependent on the OD. One participant stated that a fully implemented tendering system might not be realistic due to limitation of funds.

To further clarify this statement, the following sub-statements were added to the questionnaire at the third round:

2.5. ... however, this strongly depends on the characteristics of individual lines (e.g. market size, degree of intermodal competition, etc.)

2.6. ... and on the availability of funds to finance such a system.

- *3. The number of competitors and the degree of competition will increase only slightly.*

The only explanation given for disagreement was that the negative factors influencing competition are still too high – if they change drastically in the coming years, more competition would be possible. No further specification was done by the participants, since six of seven participants, who did not agree, remained neutral. Consequently, the question was only altered slightly to give a clear timeframe of ten years and once again added to the questionnaire at the third round.

3. The number of competitors and the degree of competition will increase only slightly in the next 10 years.

- *3.1. The consolidation and merger of companies is expected.*

Three participants stated that there will be too few competitors in the market, often only one in each country, and therefore no one would be there to merge with. Further, some competitors are or were already linked to incumbents in other countries (e.g. WESTbahn and NTV with SNCF).

Moreover, regulators should prevent the merging of the main competitors in the market. One participant states that new competitors would rather give up the business than merge. Consequently, the statement was complemented for the third round of Delphi:

3.2.... however only a very limited number of companies exist which could merge.

Question 4: rating of influencing factors on a scale between -4 (very strong negative influence) and +4 (very strong positive influence)

Firstly, the rating of each participant was entered in an Excel sheet and linked to several evaluations: one that investigated the total number of replies, one that took the country background into consideration and one that differentiated between the working backgrounds of participants.

For the second questionnaire, a scale was chosen which took the strength as well as the type of influencing factors into consideration (-4 to +4). By analysing both dimensions, it became clear the outcome was too fuzzy to detect overall trends. Therefore the strength of the factors is investigated in a first step (+4 = 4; -4 = 4) and the fact that they are positive or negative was ignored. This resulted in the overall picture below:

No	Influencing factor	PESTL	Mean	Median	v ²	S
4	Attractive train paths	P/L	2.52	3	1.69	1.30
10	Market potential and market size	E	2.40	3	1.68	1.30
13	Presence of intermodal competitors	E	2.36	2	1.51	1.23
28	Access to rolling stock	T	2.32	2	1.42	1.19
29	Lack of technical harmonisation	T	2.32	2	1.42	1.19
15	Low profitability	E	2.28	2	1.72	1.31
31	Homologation process	T	2.28	2	1.08	1.04
3	Access to facilities and data	P/L	2.24	2	1.22	1.11
11	Costs for infrastructure	E	2.24	2	1.62	1.27
12	Access to distribution systems	E	2.00	2	1.68	1.30
20	Possibility for cherry-picking	E	2.00	2	2.08	1.44
26	Entrepreneurship	S	1.88	2	2.11	1.45
2	Law in action	P/L	1.84	2	1.33	1.16
6	Unbundling	P/L	1.76	2	2.42	1.56
5	Facilitation and attitude of government and politicians	P/L	1.72	2	1.40	1.18
1	Law in the books	P/L	1.71	2	0.71	0.84
21	Existence of unions	S	1.68	2	1.66	1.29
16	Access to financing	E	1.64	2	1.67	1.29
7	State of and investment in infrastructure	P/L	1.48	1	1.93	1.39
25	Customers' willingness to pay	S	1.48	1	1.13	1.06
14	Existence of network effects for incumbents	E	1.40	1	0.96	0.98
18	Cross-financing of RUs and a lack of transparency	E	1.40	1	1.76	1.33
34	Incumbent's performance		1.32	1	1.74	1.31
23	Sharing economy	S	1.24	1	1.62	1.27
27	Attitude of press and population	S	1.24	2	1.22	1.11
22	Customer loyalty	S	1.20	1	1.20	1.10
30	Existence of innovation	T	1.20	1	0.88	0.94
8	Willingness or ability to subsidise operations	P/L	1.13	1	0.98	0.99
24	Adjustment to customer expectation	S	1.13	1	1.11	1.05
33	Availability of necessary personnel	T	1.08	1	0.95	0.98
17	Existence of cooperation or coopetition within the industry	E	1.00	1	1.36	1.17
19	Existence of cooperation with other transport modes	E	1.00	1	1.36	1.17
32	Railway safety systems	T	0.84	0	1.17	1.08
9	Consumer policy	P/L	0.56	0	0.73	0.85

Table 10: The 34 influencing factors (2nd round) (author's own diagram)

When testing the experts' rating for consensus at a rate of 75% percent, no factor reached consensus. The rating was then grouped in three categories: 0=neutral, 1 and 2=low influence, 3 and 4=high influence. With this approach, only the factor "law in the books (1)" was rated as low influence with 83.33% by the experts and therefore consensus was achieved.

The next step investigated whether a factor was positive or negative. All factors <0 were considered as negative influences, all factors >0 were considered as positive influences. All factors rated as 0 were excluded, since no influence was expected by the experts.

No	Influencing factor	% neg.	% pos.
14	Existence of network effects for incumbents	100.00	0.00
18	Cross-financing of RUs and a lack of transparency	100.00	0.00
29	Lack of technical harmonisation	91.67	8.33
15	Low profitability	90.91	9.09
21	Existence of unions	90.00	10.00
31	Homologation process	88.00	12.00
32	Railway safety systems	83.33	16.67
13	Presence of intermodal competitors	78.26	21.74
23	Sharing economy	75.00	25.00
33	Availability of necessary personnel	75.00	25.00
11	Costs for infrastructure	63.64	36.36
16	Access to financing	63.16	36.84
22	Customer loyalty	62.50	37.50
28	Access to rolling stock	54.17	45.83
1	Law in the books	52.17	47.83
2	Law in action	50.00	50.00
12	Access to distribution systems	50.00	50.00
17	Existence of cooperation or coopeitition within the industry	46.15	53.85
3	Access to facilities and data	41.67	58.33
5	Facilitation of and attitude of government and politicians	40.00	60.00
8	Willingness or ability to subsidise operations	40.00	60.00
34	Incumbent's performance	37.50	62.50
4	Attractive train paths	34.78	65.22
30	Existence of innovation	30.00	70.00
7	State of and investment in infrastructure	29.41	70.59
25	Customers' willingness to pay	25.00	75.00
6	Unbundling	25.00	75.00
9	Consumer policy	22.22	77.78
19	Existence of cooperation with other transport modes	21.43	78.57
20	Possibility for cherry-picking	15.00	85.00
27	Attitude of press and population	6.67	93.33
24	Adjustment to customer expectation	6.25	93.75
26	Entrepreneurship	5.56	94.44
10	Market potential and market size	4.35	95.65

Table 11: Positive and negative rating of the 34 influencing factors (2nd round) (author's own diagram)

Some participants gave the feedback that they would like to give positive and negative votes since they had different experiences in different countries.

Therefore a new scale was developed for the next round, giving the participants this possibility.

Question 5: Linkages between and mutual dependency of influencing factors

A total of 163 linkages were named by the participants. These were entered in an Excel sheet and analysed regarding number of mentions and frequency of linkages between the factors. This revealed a high spread of linkages and a high degree of interconnection of the whole system. The following factors revealed the highest number of linkages.

No	Influencing factor	#	%	Mean
2	Law in action	33	20.25	1.84
1	Law in the books	27	16.56	1.71
6	Unbundling	23	14.11	1.76
15	Low profitability	19	11.66	2.28
14	Existence of network effects for incumbents	18	11.04	1.40
5	Facilitation and attitude of government and politicians	17	10.43	1.72

Table 12: Overview of factors with the highest number of linkages (2nd round) (author's own diagram)

The most frequently mentioned linkages are the following. All linkages are listed that were named at least three times:

No	Influencing factor	No	Influencing factor	#	%
1	Law in the books	2	Law in action	6	3.68
3	Access to facilities and data	12	Access to distribution systems	6	3.68
15	Low profitability	25	Customers' willingness to pay	4	2.45
1	Law in the books	29	Lack of technical harmonisation	3	1.84
2	Law in action	4	Attractive train paths	3	1.84
2	Law in action	5	Facilitation and attitude of government and politicians	3	1.84
2	Law in action	18	Cross-financing of RUs and a lack of transparency	3	1.84
5	Facilitation and attitude of government and politicians	27	Attitude of press and population	3	1.84
11	Costs for infrastructure	15	Low profitability	3	1.84
15	Low profitability	16	Access to financing	3	1.84

Table 13: Overview of the linkages named at least three times (2nd round) (author's own diagram)

The comments in the text box were also copied into an Excel sheet and analysed individually. Participants stated that in a holistic view, almost all factors are interrelated and dependent on each other. However, it is hard to

generalise since the answers may differ between countries. One participant proposed establishing clusters to show the grouping of three or more factors. Another participant stated that most factors are based on and strongly connected to the political basis and the legal framework, which can also be seen in table 12 and 13 above. The evaluation of question 5 led to the following statement and sub-statements:

5. *Influencing factors are strongly interconnected and determine one another. It is difficult to analyse them from a standalone perspective.*
- 5.1. *Law in the books (1) and law in action (2) show the highest frequency of links to other influencing factors.*
- 5.2. *The following factors show the strongest connection:*
- 5.2.1.: *Law in the books (1) & law in action (2)*
 - 5.2.2.: *Access to facilities and data (2) & access to distribution system (12)*
 - 5.2.3.: *Low profitability (15) & customers' willingness to pay (25)*
 - 5.2.4.: *Law in the books (1) & lack of technical harmonisation (29)*
 - 5.2.5.: *Law in action (2) & access to and availability of attractive train paths (2)*
 - 5.2.6.: *Law in action (2) & facilitation and attitude of government and politicians (5)*
 - 5.2.7.: *Law in action (2) & cross-financing and lack of transparency (18)*
 - 5.2.8.: *Facilitation and attitude of government and politicians (5) & attitude of press and population (27)*
 - 5.2.9.: *Costs for infrastructure (11) & low profitability (15)*
 - 5.2.10.: *Low profitability (15) & access to financing (16)*

Question 6: Shift of influencing factors in the last years

Firstly, all statements from the text box were transferred to an Excel sheet, analysed and the factors which shifted were marked. Of a total of 25 participants, 21 participants answered this question while 20 gave examples of shifts of one or more influencing factors and one participant could not observe any shifts. In total, 52 shifts of factors were identified, of which most participants gave country-specific examples. Four shifts could be identified that seemed to play an overall role and would be validated in the next round; the country examples would be investigated more closely in the case study:

No	Influencing factor	#	%
13	Presence of intermodal competitors	6	11.54
2	Law in action	4	7.69
12	Access to distribution systems	4	7.69
15	Low profitability	4	7.69

Table 14: Overview of the identified shifts of influencing factors (2nd round) (author's own diagram)

The evaluation of question 6 led to the following statement and sub-statements:

6. In the last years, a shift of individual influencing factors could be observed – the shifts vary between countries.

6.1. In general, the following factors show the strongest shifts:

6.1.1.: Presence of intermodal competition (13)

6.1.2.: Access to distribution system (12)

6.1.3.: Low profitability (15)

6.1.4.: Law in action (2)

5.2.3. Rating of experts' statements and factors: 3rd Delphi round

Of the 25 addressed experts, 23 returned a filled-out questionnaire which meant a response rate of 92%. 48% of the experts sent their replies before the deadline, 52% after the reminder. All returned questionnaires were valid and could be processed. The panel had the following constellation:

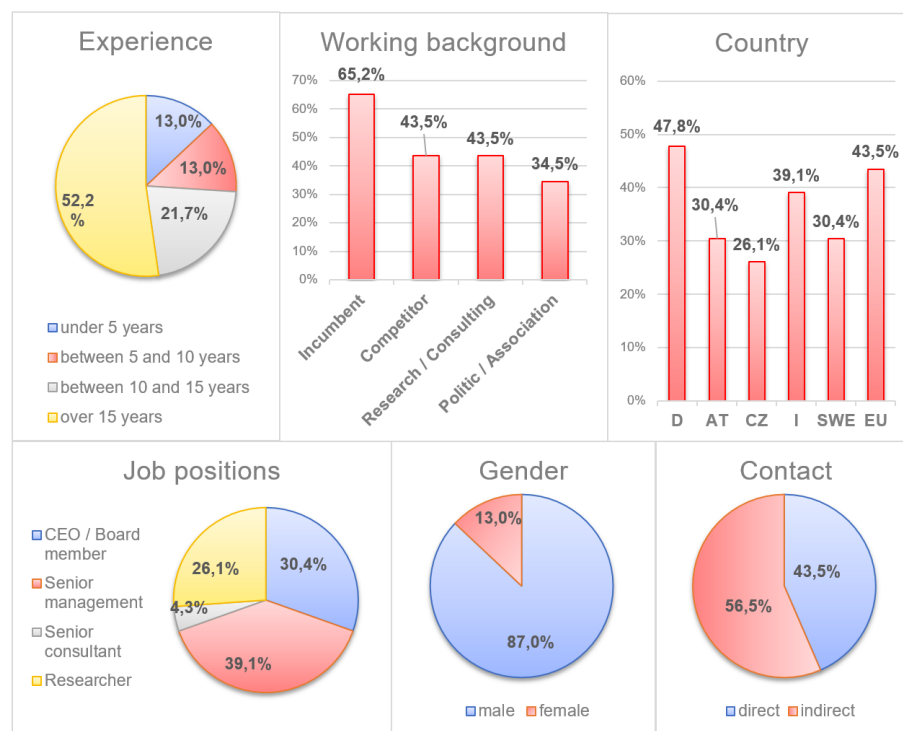


Illustration 15: Profile of the 3rd round's panel (author's own diagram)

The individual questions from the second questionnaire are presented below.

Question 2-3: rating of statements on perspective on competition on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree.

The ratings of the three original and three new statements of each participant were filled in an Excel sheet and analysed by calculating the mean, median, variance, standard deviation and the percentage of agreement or disagreement.

The following table gives an overview of the outcome:

Statement / sub-statement	% agree	% disagree	Mean	Median	v^2	S
2.4. A tendering/franchising-system could possibly fulfil the goals better...	45.45	27.27	2.77	3	1.08	1.04
2.5. ... however, this strongly depends on the characteristics of the individual lines (e.g. market size, degree of intermodal competition, etc.)	65.22	21.74	2.48	2	1.64	1.28
2.6. ... and on the availability of funds to finance such a system.	43.48	30.43	2.70	3	1.69	1.30
3. The number of competitors and the degree of competition will increase only slightly in the next 10 years.	100.00	0.00	1.67	2	0.22	0.47
3.1. The consolidation and merger of companies is expected...	59.09	9.09	2.45	2	0.79	0.89
3.2. ... however only a very limited number of companies exist which could merge.	69.57	21.74	2.30	2	1.34	1.16

Table 15: Outcome of experts' perception of competition (3rd round) (author's own diagram)

Consensus could only be reached on statement 3, all other statements did not reach 75% of either agreement or disagreement. Statements 2.5. and 3.2. came closest to a consensual agreement, statement 2.4. and 2.6. showed the greatest dissent. The comparison between the second and the third round reveals a slight adaptation except for statement 3. where in the third round some participants who were neutral in the second round moved to agreement.

Statement / sub-statement	2 nd round		3 rd round		Difference	
	% agree	% disagree	% agree	% disagree	% agree	% disagree
2.4. A tendering/franchising-system could possibly fulfil the goals better...	36.00	36.00	45.45	27.27	9.45	-8.73
3. The number of competitors and the degree of competition will increase only slightly in the next 10 years.	72.00	4.00	100.00	0.00	28.00	-4.00
3.1. The consolidation and merger of companies is expected...	52.00	20.00	59.09	9.09	7.09	-10.91

Table 16: Comparison of experts' rating on perception of competition between 2nd and 3rd round (author's own diagram)

The researcher decided that another round of Delphi would not result in either consensual agreement or disagreement. This was due to the following circumstances: statements 2.4. and 3.1. only revealed an agreement of 45% and 59%, from the second to the third round only a slight shift could be observed, mostly from the experts who voted neutral in the previous round. In the next steps, the reason for different positions needed to be investigated. Most experts who rated the statements neutral or disagreed gave no explanation on why they disagreed.

Question 4: rating of influencing factors on a scale between 0 (no influence) and 4 (very strong influence) and also marking whether they are positive or negative.

Firstly, the ratings of all participants were entered in an Excel sheet and linked to several evaluations, analogous to the previous round.

No	Influencing factor	PESTL	Mean	Median	v ²	S
4	Attractive train paths	P/L	3.27	3	0.38	0.62
10	Market potential and market size	E	3.18	3	0.42	0.65
13	Presence of intermodal competitors	E	2.86	3	0.75	0.87
15	Low profitability	E	2.86	3	0.66	0.81
11	Costs for infrastructure	E	2.86	3	0.48	0.69
28	Access to rolling stock	T	2.82	3	0.60	0.78
3	Access to facilities and data	P/L	2.68	3	0.49	0.70
31	Homologation process	T	2.64	3	0.69	0.83
29	Lack of technical harmonisation	T	2.59	2.5	1.15	1.07
5	Facilitation and attitude of government and politicians	P/L	2.50	2.5	0.98	0.99
25	Customers' willingness to pay	S	2.45	2	0.70	0.84
26	Entrepreneurship	S	2.43	3	0.91	0.95
12	Access to distribution systems	E	2.41	2.5	1.15	1.07
2	Law in action	P/L	2.36	2	1.05	1.02
6	Unbundling	P/L	2.27	2.5	1.56	1.25
16	Access to financing	E	2.27	2	0.74	0.86
20	Possibility for cherry-picking	E	2.23	2	1.27	1.13
7	State of and investment in infrastructure	P/L	2.18	2	0.88	0.94
18	Cross-financing of RUs and lack of transparency	E	1.91	2	1.54	1.24
14	Existence of network effects for incumbents	E	1.90	2	0.75	0.87
21	Existence of unions	S	1.86	2	0.48	0.69
1	Law in the books	P/L	1.81	2	0.73	0.85
24	Adjustment to customer expectation	S	1.73	2	0.93	0.96
33	Availability of necessary personnel	T	1.73	1.5	1.20	1.09
34	Incumbent's performance	other	1.68	2	0.94	0.97
30	Existence of innovation	T	1.68	1	1.40	1.18
17	Existence of cooperation or coopetition within the industry	E	1.67	1	1.84	1.36
27	Attitude of press and population	S	1.64	2	0.60	0.77
22	Customer loyalty	S	1.64	2	1.05	1.02
8	Willingness or ability to subsidise operations	P/L	1.59	1.5	1.15	1.07
19	Existence of cooperation with other transport modes	E	1.52	1	0.82	0.91
23	Sharing economy	S	1.14	1	0.94	0.97
32	Railway safety systems	T	0.86	1	0.60	0.77
9	Consumer policy	P/L	0.82	1	0.79	0.89

Table 17: The 34 influencing factors (3rd round) (author's own diagram)

Comparing the second and third round revealed that the experts generally rated the importance of influencing factors higher than in the second round by an average of 0.48. The factor "Customers' willingness to pay" showed the highest increase by 0.97 points, the only factor which decreased in importance was "Sharing economy" with -0.10 points. The variance decreased from the second to the third round by -0.52 points, the standard deviation decreased by -0.25 points, which showed the experts' ratings were coming more closely together:

IS	WAS	Influencing factor	Difference Mean	Difference v^2	Difference S
1	1	(4) Attractive train paths	0.75	-1.31	-0.68
2	2	(10) Market potential and market size	0.78	-1.26	-0.65
3	3	(13) Presence of intermodal competitors	0.50	-0.76	-0.36
4	6	(15) Low profitability	0.58	-1.06	-0.50
5	9	(11) Costs for infrastructure	0.62	-1.14	-0.58
6	4	(28) Access to rolling stock	0.50	-0.81	-0.41
7	8	(3) Access to facilities and data	0.44	-0.73	-0.41
8	7	(31) Homologation process	0.36	-0.40	-0.21
9	5	(29) Lack of technical harmonisation	0.27	-0.27	-0.12
10	15	(5) Facilitation and attitude of government and politicians	0.78	-0.42	-0.20
11	20	(25) Customers' willingness to pay	0.97	-0.43	-0.22
12	12	(26) Entrepreneurship	0.55	-1.19	-0.50
13	10	(12) Access to distribution systems	0.41	-0.53	-0.22
14	13	(2) Law in action	0.52	-0.28	-0.13
15	14	(6) Unbundling	0.51	-0.86	-0.31
16	18	(16) Access to financing	0.63	-0.93	-0.43
17	11	(20) Possibility for cherry-picking	0.23	-0.81	-0.32
18	19	(7) State of and investment in infrastructure	0.70	-1.05	-0.45
19	22	(18) Cross-financing of RUs and lack of transparency	0.51	-0.22	-0.09
20	21	(14) Existence of network effects for incumbents	0.50	-0.21	-0.11
21	17	(21) Existence of unions	0.18	-1.18	-0.59
22	16	(1) Law in the books	0.10	0.02	0.01
23	29	(24) Adjustment to customer expectation	0.60	-0.18	-0.09
24	30	(33) Availability of necessary personnel	0.65	0.24	0.12
25	23	(34) Incumbent's performance	0.36	-0.79	-0.35
26	27	(30) Existence of innovation	0.48	0.52	0.24
27	31	(17) Existence of cooperation or coopetition within the industry	0.67	0.48	0.19
28	25	(27) Attitude of press and population	0.40	-0.63	-0.33
29	26	(22) Customer loyalty	0.44	-0.15	-0.07
30	28	(8) Willingness or ability to subsidise operations	0.46	0.17	0.08
31	32	(19) Existence of cooperation with other transport modes	0.52	-0.54	-0.26
32	24	(23) Sharing economy	-0.10	-0.69	-0.31
33	33	(32) Railway safety systems	0.02	-0.58	-0.31
34	34	(9) Consumer policy	0.26	0.06	0.03
Average change			0.48	-0.52	-0.25

Table 18: Comparison of experts' rating of strength of influencing factors between 2nd and 3rd round (author's own diagram)

The testing of the rating shows that no factor achieved consensus. Analysing the factors grouped in the three categories, eight factors achieved consensus:

No	Influencing factor	Neutral in %	Low influence in %	High influence in %
4	Attractive train paths	0.00	9.09	90.91
10	Market potential and market size	0.00	13.64	86.36
27	Attitude of press and population	4.55	81.82	13.64
24	Adjustment to customer expectation	4.55	81.82	13.64
21	Existence of unions	0.00	81.82	18.18
1	Law in the books	0.00	80.95	19.05
19	Existence of cooperation with other transport modes	9.52	80.95	9.52
14	Existence of network effects for incumbents	0.00	76.19	23.81

Table 19: Influencing factors with a consensus of over 75% in a cluster (3rd round) (author's own diagram)

The next step investigated whether a factor was positive or negative. In this round, the participants could categorise a factor as negative and positive. The change in results from round two to three is not consistent due to the change in scale, but gives a good indication:

No	Influencing factor	2 nd round		3 rd round	
		% neg.	% pos.	% neg.	% pos.
29	Lack of technical harmonisation	91.67	8.33	100.00	0.00
31	Homologation process	88.00	12.00	95.24	4.76
18	Cross-financing of RUs and lack of transparency	100.00	0.00	94.44	5.56
15	Low profitability	90.91	9.09	90.91	9.09
23	Sharing economy	75.00	25.00	83.33	16.67
21	Existence of unions	90.00	10.00	80.00	20.00
14	Existence of network effects for incumbents	100.00	0.00	80.00	20.00
13	Presence of intermodal competitors	78.26	21.74	77.27	22.73
11	Costs for infrastructure	63.64	36.36	72.73	27.27
9	Consumer policy	22.22	77.78	61.11	38.89
32	Railway safety systems	83.33	16.67	58.82	41.18
22	Customer loyalty	62.50	37.50	52.63	47.37
33	Availability of necessary personnel	75.00	25.00	44.44	55.56
34	Incumbent's performance	37.50	62.50	42.11	57.89
1	Law in the books	52.17	47.83	40.91	59.09
2	Law in action	50.00	50.00	36.36	63.64
7	State of and investment in infrastructure	29.41	70.59	33.33	66.67
8	Willingness or ability to subsidise operations	40.00	60.00	31.58	68.42
25	Customers' willingness to pay	25.00	75.00	30.00	70.00
28	Access to rolling stock	54.17	45.83	28.57	71.43
3	Access to facilities and data	41.67	58.33	28.57	71.43
5	Facilitation and attitude of government and politicians	40.00	60.00	26.09	73.91
12	Access to distribution systems	50.00	50.00	25.00	75.00
16	Access to financing	63.16	36.84	25.00	75.00
17	Existence of cooperation or coopeitition within the industry	46.15	53.85	23.53	76.47
4	Attractive train paths	34.78	65.22	21.74	78.26
27	Attitude of press and population	6.67	93.33	21.74	78.26
20	Possibility for cherry-picking	15.00	85.00	20.00	80.00
26	Entrepreneurship	5.56	94.44	11.11	88.89
19	Existence of cooperation with other transport modes	21.43	78.57	11.11	88.89
24	Adjustment to customer expectation	6.25	93.75	10.00	90.00
30	Existence of innovation	30.00	70.00	5.88	94.12
10	Market potential and market size	4.35	95.65	4.76	95.24
6	Unbundling	25.00	75.00	0.00	100.00

Table 20: Comparison of experts' rating of type of influencing factors between 2nd and 3rd round (author's own diagram)

Question 5: linkages between and mutual dependency of influencing factors

The rating of the statements and sub-statements of each participant was entered in an Excel sheet and analysed by calculating mean, median, variance, standard deviation and the percentage of agreement or disagreement. The following table gives an overview of the outcome:

Statement / sub-statement	% agree	% disagree	Mean	Median	v^2	S
5. Influencing factors are strongly interconnected and determine one another. It is difficult to analyse them from a standalone perspective.	83.33	0.00	1.94	2	0.39	0.62
5.1. Law in the books (1) and law in action (2) show the highest frequency of links to other influencing factors.	59.09	13.64	2.41	2	0.79	0.89
5.2.1. Law in the books (1) & law in action (2)	59.09	13.64	2.55	2	0.79	0.89
5.2.2. Access to facilities and data (3) & access to distribution systems (12)	59.09	22.73	2.45	2	1.61	1.27
5.2.3. Low profitability (15) & customers' willingness to pay (25)	72.73	13.64	2.18	2	1.15	1.07
5.2.4. Law in the books (1) & lack of technical harmonisation (29)	45.45	13.64	2.64	3	0.87	0.93
5.2.5. Law in action (2) & attractive train paths (4)	68.18	13.64	2.32	2	1.04	1.02
5.2.6. Law in action (2) & facilitation and attitude of government and politicians (5)	59.09	18.18	2.41	2	0.97	0.98
5.2.7. Law in action (2) & cross-financing of RUs and lack of transparency (18)	59.09	9.09	2.32	2	0.76	0.87
5.2.8. Facilitation and attitude of government and politicians (5) & attitude of press and population (27)	54.55	22.73	2.64	2	0.78	0.88
5.2.9. Costs for infrastructure (11) & low profitability (15)	72.73	9.09	2.18	2	0.97	0.98
5.2.10. Low profitability (15) & access to financing (16)	50.00	27.27	2.68	2.5	1.22	1.10

Table 21: Overview of linkages between influencing factors (3rd round) (author's own diagram)

In question 5, only one statement (5.) could reach consensus and two statements come close to consensus (5.2.3., 5.2.9). The high degree of neutral answers and the feedback of the experts imply that this very specific question might be too abstract and too far away from the participants' every-day business and what they experience in the industry. Therefore, an additional round of Delphi was not expected to lead to further consensus.

Question 6: Shift of influencing factors in the last years

As in question 5, the rating of the statements and sub-statements of each participant was entered in an Excel sheet and analysed by calculating mean, median, variance, standard deviation and the percentage of agreement or disagreement:

Statement / sub-statement	% agree	% disagree	Mean	Median	v^2	S
5. In the last years, a shift of individual influencing factors could be observed – the shifts vary between countries.	70.59	11.76	2.24	2	0.77	0.88
5.1.1. Presence of intermodal competitors (13)	77.27	9.09	2.00	2	0.82	0.90
5.1.2. Access to distribution systems (12)	52.17	39.13	2.70	2	1.86	1.37
5.1.3. Low profitability (15)	45.45	31.82	2.82	3	1.15	1.07
5.1.4. Law in action (2)	59.09	18.18	2.55	2	0.70	0.84

Table 22: Overview of shifts of influencing factors (3rd round) (author's own diagram)

In comparison with question 5, only sub-statement 6.1.1. could achieve consensus and statement 6 reached an agreement of over 70%. The researcher suspects similar reasons for this as in question 5, additionally did some participants not vote and comment on all statements/sub-statements in question 6, which also indicates too great a distance from the participants' experience. Therefore question 6 was also not subject to another round of Delphi.

5.3. Discussion of Delphi findings

The Delphi study shows that open access competition has an overall positive effect on long-distance passenger rail. The study implies that it is a tool to increase efficiency in the market, modernises passenger rail, establishes a higher customer focus, and decreases overall transport emissions. Despite this, the panel estimated only a slight increase in competition in the next ten years. This suggests that the conditions for open access competition in Europe are still

not ideal. No consensus could be reached within the panel on whether a tendering/franchising-system could fulfil the goals better.

When analysing the 34 identified influencing factors, it becomes apparent that the economic and political/legal factors have the strongest overall influence, followed by technical and social factors. When arranged in a matrix according to their strength and type of influence, the following graph emerges:

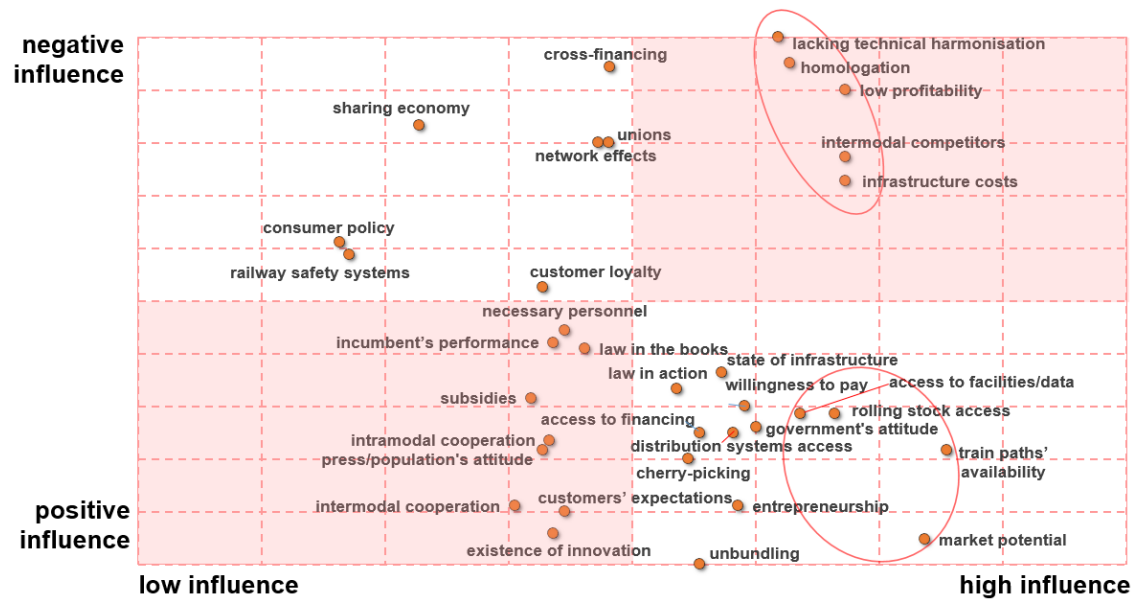


Illustration 16: Matrix on strength and type of influence on open access competition (author's own diagram)

With this graph, it becomes apparent that lacking technical harmonisation, homologation process, low profitability, intermodal competition and costs for infrastructure have a high negative influence on competition. These factors need to be reconsidered closely by national politicians as well as the EU. To improve the conditions for open access competitors in the market, the impact of those factors needs to be reduced. The graph also shows that the factors availability of train paths, market potential, rolling stock access and access to facilities and data have a high positive influence, promoting competition. To improve conditions for open access competition, those factors need to be further strengthened and reinforced. Despite having an underlying role, law in

action and law in the books can be found at the centre of the matrix, with law in action having a slightly higher influence than law in the books. The experts do not perceive the direct influence of these factors as high. The factors existence of cooperation/coopetition within the industry, cross-financing of RUs and unbundling had the highest variation in expert rating. This matches the varying opinions in the literature, where unbundling is widely discussed by experts with different points of view (e.g. Bouf et al. 1999, Nash 2008, Kirchner 2011).

No consensus could be reached on the exact rating of the influencing factors' strengths, but the mean gives a good indication. The panel's rating grew closer together between the second and the third round; variance and standard deviation decreased ($v^2 = -0.52$, $S = -0.25$). Thus the factor of customers' willingness to pay had the largest increase in importance (0.97), followed by market potential and market size (0.78) and facilitation and attitude of government and politicians towards competition (0.78).

The literature review and experience from the industry show that the railway market in Europe is diversified and fragmented. Different working or researching backgrounds as well as different countries reveal a different picture. Therefore, the outcome is analysed regarding the panel's working background and country of experience. Different influencing factors take different forms in different countries. When investigating the top ten influencing factors regarding the country background, the following picture emerges, showing that a small number of factors may be found in the top five of most countries, e.g. train paths' availability, low profitability and market potential. With the outcome that no country shows an identical profile, the findings from the existing literature on different degrees of liberalisation are confirmed:

No	Germany	Italy	Austria	Sweden	Czech Republic	EU
1	10 market potential	15 low profitability	15 low profitability	4 train paths	4 train paths	15 low profitability
2	4 train paths	4 train paths	4 train paths	10 market potential	10 market potential	4 train paths
3	15 low profitability	10 market potential	29 techn. Harmonisation	28 access to rolling stock	11 cost for infrastructure	10 market potential
4	13 intermodal competition	13 intermodal competition	31 homo-logation	12 distribution system	25 willingness to pay	28 access to rolling stock
5	11 cost for infrastructure	29 techn. Harmonisation	11 cost for infrastructure	26 entrepreneurship	13 intermodal competition	11 cost for infrastructure
6	29 techn. harmonisation	31 homo-logation	10 market potential	13 intermodal competition	15 low profitability	13 intermodal competition
7	28 access to rolling stock	11 cost for infrastructure	28 access to rolling stock	15 low profitability	31 homo-logation	29 techn. harmonisation
8	3 access to facilities	28 access to rolling stock	3 access to facilities	3 access to facilities	16 financing	31 homo-logation
9	25 willingness to pay	3 access to facilities	13 intermodal competition	11 cost for infrastructure	3 access to facilities	3 access to facilities
10	31 homo-logation	20 cherry-picking 25 willingness to pay	25 willingness to pay	6 unbundling 5 attitude of gov. & politicians	5 attitude of gov. & politicians	12 distribution system

Table 23: TOP 10 influencing factors clustered along the panel's country backgrounds (author's own diagram)

When investigating the top ten influencing factors regarding the working background, it again became apparent that most of the same factors occurred in the top five of each group. While the group of “research/consulting” experts showed the greatest deviation from the other groups, the groups “incumbent” and “political/association” showed the greatest similarities. Since many experts from the groups had working experience in both fields, a great overlap between both groups existed:

No	Incumbent	Competitor	Political/ Association	Research/ Consulting
1	4 train paths	4 train paths	4 train paths	10 market potential
2	10 market potential	11 costs for infrastructure	10 market potential	13 intermodal competition
3	15 low profitability	10 market potential	15 low profitability	4 train paths
4	11 costs for infrastructure	3 access to facilities	11 costs for infrastructure	28 rolling stock
5	13 intermodal competition	15 low profitability	3 access to facilities	15 low profitability
6	29 techn. harmonisation	31 homologation	28 rolling stock	2 law in action
7	31 homologation	25 willingness to pay	31 homologation	3 access to facilities
8	3 access to facilities	13 intermodal competition	26 entrepreneurship	11 costs for infrastructure
9	28 rolling stock	28 rolling stock 16 financing	13 intermodal competition 29 techn. harmonisation	12 distribution system
10	25 willingness to pay	29 techn. harmonisation	16 financing 25 willingness to pay	26 entrepreneurship

Table 24: TOP 10 influencing factors clustered along the panel's working background (author's own diagram)

Regarding the correlation between factors, the outcome of the Delphi study has not been as clear as the previous findings. The Delphi panel agreed that all factors were strongly interconnected and determined one another and that it was difficult to analyse them from a standalone perspective. Only the connection of low profitability in the industry and customers' willingness to pay almost reached consensus. Similar findings apply for the shift of influencing factors. The panel only reached consensus regarding the shift of the influencing factor presence of intermodal competitors, many panelists did not vote on this question.

5.4. Conclusion of Delphi findings

The Delphi studied proved to be a good tool to structure expert opinion and group discussions. It showed that different positions existed among experts, depending on their working and country background. Despite these differences, a structured list of influencing factors could be worked out and mapped. This

framework is suitable as a guideline for further analysis, e.g. the following case study. The findings of the Delphi study also direct the focus of the following analysis to the influencing factors of a political/legal and economic nature, which seems to have the highest overall influence. It also confirms the relevance of the research topic of this thesis, since open access is perceived as a tool to increase efficiency in the market, modernises passenger rail, establishes a higher customer focus, and decreases overall transport emissions. The panel's estimation of low increase in open access competition expresses the need for further improvement of conditions to increase the likelihood of beneficial competition, e.g. regarding the lacking technical harmonisation, rolling stock homologation or costs of infrastructure, which are rated negatively.

Regarding correlation between and shift of influencing factors over time, the Delphi study can give some indications, but could not fully answer the research questions. It becomes clear that all influencing factors closely relate to each other and are part of a network. Therefore, influencing factors cannot be analysed from a standalone perspective and need to be considered as a part of a system. The following case study needs to investigate correlation and shift of influencing factors more closely.

6. Chapter 6: Validation and characterisation of influencing factors: a case study

After consideration of the case study's strengths and weaknesses, case study as a research strategy is considered suitable for the next stage of the research process after the finalisation of the Delphi study. The existing literature (Yin 1994, Stake 1995, Baxter & Jack 2008) names properties that lead to the application of case study research, which also apply to this research project:

- “How” and “why” questions need to be answered, like “How is open access competition in long-distance passenger rail influenced by the 34 identified factors and why is that so?”.
- The collection of contextual conditions is of high importance for the observation of influencing factors, since they are formed and shaped by the environment.
- The observed phenomenon is embedded in a complex environment and boundaries between the phenomenon and the context are not always clear.
- Multiple sources of evidence need to be mixed to observe open access competition and its influencing factors since no single source of quantitative data sets exists. The analysis of only one set of data might also result in misleading conclusions since many different views on the phenomenon observed exist.

This chapter gives a detailed overview of the process of case study research as well as the findings in the form of a case report and a discussion of the outcome.

6.1. Setting the case study process

As described in section 4.2.2., Rosenberg & Yates (2007) state that one drawback of the application of case study research is that its methodological flexibility may lead to uncertainty regarding suitable procedural steps to ensure methodological rigour. Therefore this thesis is based on the framework of case study research proposed by Rosenberg & Yates. The following flow chart gives an overview of the research process, followed by an in-depth description:

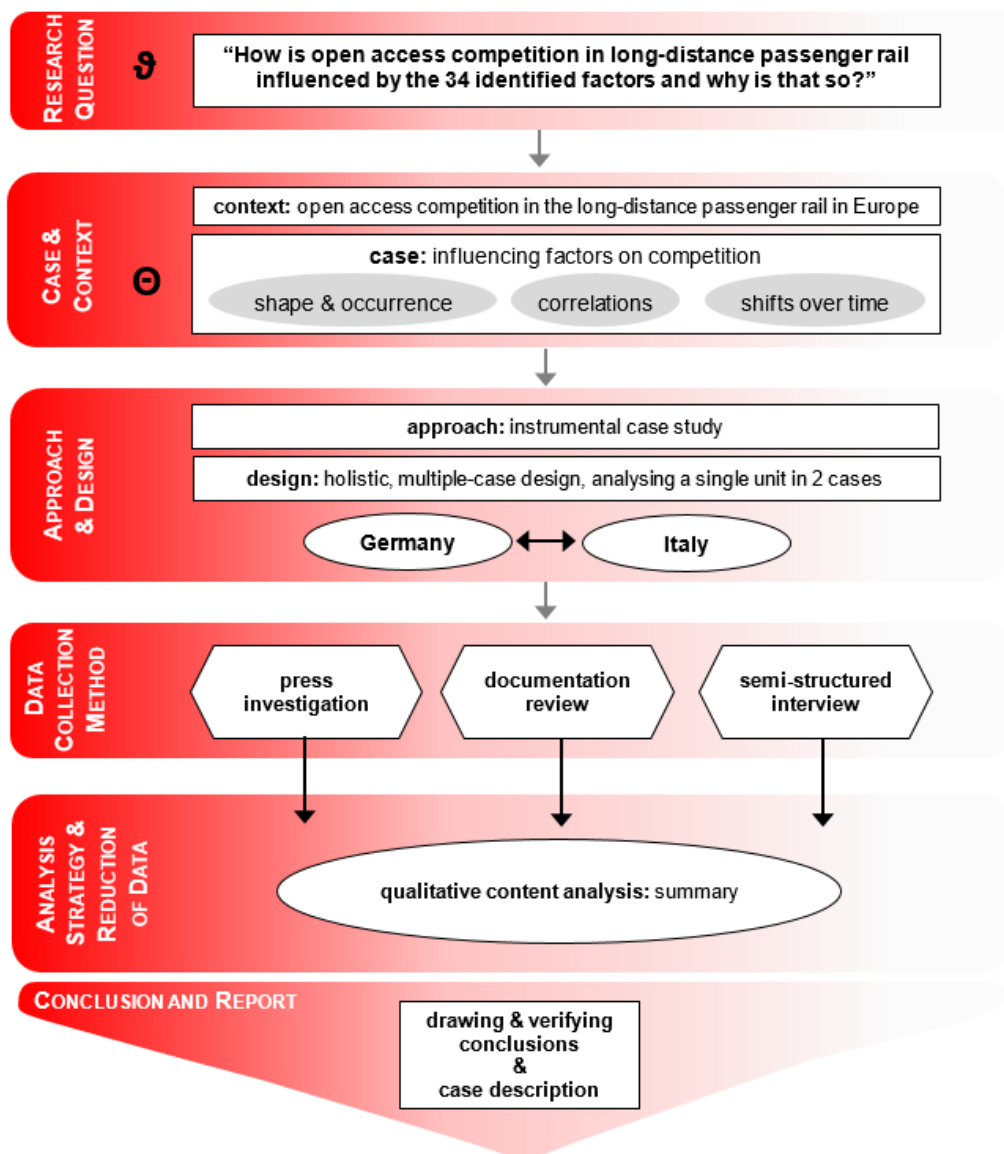


Illustration 17: Process of the case study research of this thesis, based on Rosenberg & Yates (2007)

The main research question for this case study can be posed as follows:

ϑ_1 = *“How is open access competition in long-distance passenger rail influenced by the 34 identified factors and why is that so?”*

The aim of this case study is to provide insights and specific, practical examples of how factors influence open access competition in two countries, based on the findings of the Delphi study. It aims to draw a picture of the phenomenon in the market and give further evidence on correlation between influencing factors and a shift of influencing factors over time. Therefore, the issue question is to be complemented by:

ϑ_2 = *“How do the influencing factors correlate to each other?”*

ϑ_3 = *“Can a shift of influencing factors be observed over time?”*

The definition of the case and the context of the phenomenon plays a major role in the next step: The case study is set in the context of open access competition in European long-distance passenger rail, influenced by the current political setting and current practice. The context is rather complex, since the overall European legal framework is transferred differently into national law, different types of railway networks and population structures and different willingness to pay apply (Laperrouza & Finger 2009, Kirchner 2011). The case itself can be defined as follows:

Θ = *“Influencing factors on open access competition in long-distance passenger rail transport in practice”*

Two sub-units exist:

Θ_1 = “Open access competition in the German long-distance passenger rail market”

Θ_2 = “Open access competition in the Italian long-distance passenger rail market”

The boundaries are set in the following table:

	Θ_1 = Germany	Θ_2 = Italy
Observed competitors	Locomove/Flixbus, HKX/Flixbus, InterConnex, MSM, derschnellzug.de	Arenaways, DB/ÖBB, NTV
Incumbent	DB Fv	TI
IM	DB Netz	RFI
Focus time frame	2012-2018	2009-2018
Time frame of data collection	01/2017 – 08/2018	06/2017 – 08/2018

Table 25: Definition of case boundaries (author’s own diagram)

Competition for the market (PSO, tendering, franchising) in long-distance passenger rail, as well as competition in regional and freight rail are not considered here. Even though intermodal competition plays a role in this analysis, it is only considered as one part of the framework and will not be analysed in-depth.

The research approach and the design set the framework for the case study data collection. This case study takes the form of an instrumental case study.

The case is studied to understand the factors influencing open access competition. It is designed as a holistic, multiple-case study, analysing the factors influencing competition in two sub-cases: Germany and Italy (Yin 1994).

A holistic design is chosen since the global nature of influencing factors is to be observed and the examples from Germany and Italy are to add to the general understanding. A multiple-case design is especially valuable when more than one case is relevant for the investigation. In this case study the sub-cases serve

a specific purpose, following a replication logic. This case study is not designed to achieve statistical generalisation. It aims for a slight degree of theoretical generalisation, underlined by practical examples (Titscher et al. 2000).

Based on the research approach and design, the data collection method needs to be set. In this case study, the press investigation forms the first step in data collection. Relevant press articles from railway print magazines (e.g. "Railway Gazette International", "European Railway Review") were gathered and organised regarding market and competitors. Relevant online-articles from German, Italian and international newspapers (e.g. "Süddeutsche Zeitung", "Handelsblatt", "La Repubblica", "The Guardian") were saved as PDF documents. Additionally, press releases from railway companies, ministries, institutions and associations were downloaded. All documents were organised according to their subject, e.g. the competitors, the political institution, the incumbent. Since many press articles incorporated the discussion of reports, studies and official documentation, the collection took place parallel to the press data collection. Most institutions and companies publish the relevant documents online in PDF form. The documents were downloaded and organised according to their origin. After some initial insights of the press and documentation research, semi-structured interviews with experts were scheduled. For the German and the Italian sub-case, three interviews each were conducted. Since the collection of practical examples of influencing factors is the main goal of the case study, experts from the railway industry were chosen who had several years of working experience in the industry with direct, work-related knowledge about competition in the market. The interviewees work or worked for competitors, in political institutions or as consultants. The interviews took place in person, via telephone or Skype, mostly taking 60 minutes. Prior to the

interview, the interviewee received an information sheet on the research project and an overview of the interview questions (Appendix 6, Appendix 7). To give the interviews a solid structure, a data collecting form was used to ask the questions and fill in the data (Appendix 8). After the interviewees' approval, the interviews were recorded and notes were taken during the interview. After the interviews, the content of the interviews was entered in an interview-protocol based on the notes and records, and sent to all interviewees. The interviewees had the chance to give feedback which was then implemented (Appendix 9).

The next step forms the selection of the data analysis strategy and the reduction and processing of data. "[C]ase studies are not an undertaking that one can embark on in a carefree manner and one is not liberated from all precise methodological procedures" say Titscher et al. (2000, p. 45). A clear data analysis framework is required to deal with the large amount of rich data and prevent the researcher from getting lost (Yin 1994). For this case study, to capture vital part of the acquired data, a type of content analysis was employed for the collected data. "Content analysis is the longest established method of text analysis among the set of empirical methods of social investigation" (Titscher et al. 2000, p. 55). Different definitions and procedures of context analysis exist, some being narrow, some more comprehensive. In original terms, content analysis "referred only to those methods that concentrate on directly and clearly quantifiable aspects of text content" (Tischer et al. 2000, p. 55). However, the concept of qualitative content analysis draws more on the structure and meaning of the analysed texts or materials (Mayring 2010). Mayring has developed three distinct analytical procedures of qualitative content analysis. This case study builds on the framework of summary content analysis. The underlying premise of summary content analysis is that the

abstraction levels of summary are predefined. Due to the gradual generalisation, the content becomes more abstract with each step (Mayring 2010). Each sub-case undergoes a separate summary content analysis. In the first step, the analysis units are predefined according to the research questions ϑ_1 , ϑ_2 and ϑ_3 , including the 34 influencing factors. Therefore a matrix was developed with clusters of the observed competitors and the main institutions e.g. regulators and ministries:

	Influencing factors	Competitor 1	Competitor 2	Competitor 3	Institution 1	Institution 2	Institution 3	...
ϑ_1	<i>Law in the books</i>	...	...	...	...	...	...	...
	<i>Law in action</i>	...	...	...	...	...	...	...

ϑ_2	<i>Correlation</i>	...	...	...	...	...	...	...
ϑ_3	<i>Shift</i>	...	...	...	...	...	...	...

Table 26: Design of the case study's research matrix (author's own diagram)

In the next step, the core messages from the sources were filled into the matrix in form of brief keywords and sentences; each source adds to the existing content. Special attention was paid to practical examples that demonstrate the influencing factors, the correlations and shifts. If necessary, new columns were added during the research process to cover the case as comprehensively as possible. In case of the interviews, notes of the core messages were entered in the matrix and later once again complemented with further information from the recordings. In the next step, the content was further condensed and refined in the data collection forms. In case of the interviews, the data collection forms also served as interview protocols. Writing up the case study was the next step and a further condensation of information took place. The result of the fourth step was the description of the essential information of the individual sub-case. The final step brought the two sub-cases together and the information was further reduced to be discussed on a more general level in the general

framework of this thesis. The process is shown in the following process flow model:

Step		Germany			Italy		
		press analysis	documen- tation analysis	semi- structured Interview	press analysis	documen- tation analysis	semi- structured Interview
1.	pre-definition of analysis unit	X		X	X	X	X
2a.	extraction of core messages from sources in matrix	X	X		X	X	
2b.	making notes of core messages in interviews, again revised with recorded interview			X			X
3.	first reduction of content into data collection form / interview protocol	X	X	X	X	X	X
4.	second reduction of content into case study	X			X		
5.	third reduction of content into discussion on general level	X					

Table 27: Process flow model of the case study (author's own diagram)

Finally, the conclusions needed to be drawn and the case study report needed to be written. This step is closely related to the summary content analysis and both stages merge and complement each other. Writing up the case and sub-case reports can be considered as a step in the data processing flow. To answer the pre-defined research questions, the report successively discusses the findings for each question. The most extensive part ϑ_1 is discussed in steps and each influencing factor, which is relevant for the case, is mentioned. This is necessary for the synthesis with the Delphi findings in the next section.

6.2. A small-scale approach to challenge a strong incumbent: the German case

The German railway market is one of the biggest in Europe. In the early 1990's, Germany was one of the pioneers of rail market liberalisation, opening the

market for open access competition in 1994 (Schwilling & Bunge 2014).

However, in the meantime only a few competitors have entered the market, mostly offering niche services. So far, no competitor challenged the incumbent on its main routes (Tomes et al. 2016). The following section presents the German case, revealing how open access competition developed over time and interacts with incumbent, politics, authorities and other players. Firstly, a description of the case context is given, introducing the case setting. In the main part, the factors influencing open access competition are described, as well as their correlation between each other and their shift over time. Finally, the findings are discussed and a conclusion is drawn.

6.2.1. Setting the German case in context

In context of the German Railway Reforms, full open access was permitted from 1994 onwards for every licenced long-distance passenger RU on the entire network, without limitations. Together with the separation of IM DB Netz and the incumbent DB Fv, this formed the basis for the existence of open access competition. In the following years, the necessary institutions and bodies were established to monitor and control the rail market. In Europe, Germany is part of the group of advanced liberalised countries, the general de jure and de facto framework conditions for open access apply (Kirchner 2011). But only a few entrants offer services and the dominant incumbent controls the market. The key market players observed in this case are described below:

The incumbent was founded as DB Reise & Touristik AG in 1999, resulting from the second step of the Railway Reform. It was hived off from the long-distance sub-unit of DB AG to separate rail infrastructure from train operations. Part of DB Holding, DB Fv focuses only on providing long-distance passenger rail and

a small number of coach services, operating more than 260 ICE trains, 250 locomotives and 1,400 IC/EC coaches. DB Fv's ICE and IC/EC route map is in Appendix 10. With its dominant position in the market, it holds a market share of 99%. However, the company suffered from the liberalisation of the coach market which resulted in the market entry of many new coach providers (DB 2016c, BNetzA 2017c, DB 2018b).

Company profile DB Fv 2017	
CEO	Birgit Bohle
Daily trains	>1,050
Employees	>15,000
Transported passengers	142 million
Passenger km	40,500 million
Revenue	4,368 million EUR
EBIT	381 million EUR

Table 28: Company profile of DB Fv (DB 2018a, DB 2018b)

The first competitor, InterConnex, was founded in 2001 as a brand of Connex (later Transdev GmbH). At the time, Connex was a subsidiary of the French transportation provider CGEA (later Veolia), which used to be the biggest competitor of DB in the regional transport and was already an established player in that market. After DB Fv had discontinued the unprofitable “InterRegio” traffic, InterConnex seized the opportunity to provide parts of these services, offering services at a low-price level. InterConnex operated between 2002 and 2014 on the lines Warnemünde-Leipzig (2002-2014), (Liberec)-Dresden-Stralsund-(Binz) (2002-2006), and (Neuss)-Köln-Rostock (2003), with one to two trains daily. Its last CEO, who also managed the market withdrawal, was Christian Schreyer. InterConnex transported up to 400,000 passengers a year without reaching lasting economic success. InterConnex operated mostly with Bombardier multiple-unit diesel trains (“DMUs”) owned by the holding company as well as locomotives and coaches. After 2012, InterConnex began to struggle due to the liberalisation of the coach market which attracted many of

InterConnex's customers, leading to fierce price competition and decreasing willingness to pay. This situation was further worsened by the increased prices for infrastructure. This finally resulted in the termination of services in 2014 (Seguret 2009, ZDF 2014, Schlesiger 2014c, Netzwerk Bahnen 2016).

Locomore rail GmbH & Co. KG was founded in 2007 and was the first private open access competitor in Germany. Locomore was founded and previously headed by Derek Ladewig, who had worked as a specialist for transportation and railways in the Bundestag. The company's mission was to provide a new mobility concept which was environmentally friendly, affordable for everyone and engaged people in conversation. Locomore also was the main initiator of HKX. After leaving HKX, Locomore prepared its own market launch in 2016, with one daily train pair between Stuttgart and Berlin. Locomore's route map is in Appendix 11. In the first 100 days of operations, Locomore transported 70,000 passengers but filed for insolvency in May 2017. Locomore was the first open access competitor that was financed by crowdfunding. After rejection by banks and investors, the company initiated a crowdfunding campaign to allocate money for the first months of operation. Hector Rail was responsible for the traction and provided train drivers. Locomore rented the rolling stock from SRI Rail Invest GmbH (Schlesiger 2015, Völklein 2016, Locomore 2017a, Locomore 2017e, Locomore 2017f). In August 2017, six months after its start, Locomore went bankrupt and stopped operations for some months. It was bought by coach provider FlixBus and LEO. While LEO runs operations, FlixBus distributes the tickets and improves profitability of the services with its high distribution power. In March 2018 the trains were rebranded as FlixBus, under which a further expansion is planned (FlixBus 2018a, Locomore 2018).

Hamburg-Köln-Express was founded in 2009 as a joint venture of Rail Development Corporation (“RDC”) Deutschland, Locomore and a British-Canadian investor. With Ladewig leaving HKX after differences of opinion regarding the company’s strategy, HKX was included in the holding structure of RDC, alongside RDC Autozug Sylt GmbH. RDC is owned by the American railway investor Henry Posner III. The company’s mission was to offer affordable rail transport and it addressed many customers that did not travel by rail beforehand. HKX’s last CEO was Carsten Carstensen. The company had ca. 25 employees and provided one daily train pair between Cologne and Hamburg. HKX’s route map is in Appendix 11. In the first year of operations, HKX transported 350,000 passengers, but the company struggled to be profitable. In the beginning, HKX rented rolling stock from several companies (e.g. SNCB and Nord-Ostsee-Bahn) and it finally switched to RIC coaches provided by BahnTouristikExpress in September 2015. The service provider for traction was Nord-Ostsee-Bahn up to December 2015, then BahnTouristikExpress (Preuß 2013, Schlesiger 2014b, HKX 2016, HKX 2017b, RDC 2017). In October 2017, HKX stopped operations for unknown reasons, only operating trains over Christmas in cooperation with FlixBus (Handelsblatt 2017b). From March 2018 onwards, FlixBus started HKX’s operations once again under its brand FlixBus together with HKX’s old partner BahnTouristikExpress (FlixBus 2018c).

The last open access competitor that entered the market was FlixBus in March 2018. FlixBus is a brand of the holding FlixBus, which runs the long-distance coach company FlixBus, offering coach services in Germany and Europe since 2013. FlixBus transported over 100 million passengers, mainly by coach, since its market entry and offers more than 250,000 daily connections

in 28 countries. As described above, FlixTrain offers the lines previously run by Locomore and HKX, slowly increasing the frequency of connections. The company's route map is in Appendix 11 (FlixBus 2018d, Spiegel 2018).

In 2012, the Cologne-based company MSM Group announced it would start operations on the Cologne-Hannover-Berlin/Hamburg line in autumn 2012. The company provided charter and party trains and planned to challenge DB Fv on one of its main lines. MSM planned to rent coaches abroad and employ a service provider for the operations to keep investment low. The CEO and founder, Niko Maedge, planned to reach operating profitability within two to three years. Originally, MSM planned up to three daily train pairs with up to 14 coaches between Cologne and Hannover, where the train was to be split with one section going to Hamburg and the other to Berlin. After discussion of available paths with DB Netz, attractive train paths could not be found for three train pairs and Maedge planned to start with one daily train pair. However, the services were never launched (Kirnich 2012, Welt 2012, Wüpper 2013, MSM 2017).

In 2014, *derschnellzug.de* GmbH was founded by Johannes Zimmer, a former dispatcher and train driver. *Derschnellzug.de* planned to operate services on the lines Stuttgart-Dresden, Stuttgart-Hamburg and Stuttgart-Aachen, the route maps are in Appendix 12. The start was originally planned for April 2015 but was postponed several times. The company aimed to provide comfortable through rail travel to destinations for which DB Fv no longer catered, e.g. to/from Heilbronn. *Derschnellzug.de* never entered the market since the necessary paths could not be found, the rolling stock provider needed the IC-coaches for its own operations, and the investor withdrew the commitment of 1.25 million EUR (Stimme 2015, *derschnellzug.de* 2016, Xing 2017).

6.2.2. Characterisation of individual factors influencing the German case

This section outlines the influencing factors in Germany and how they shaped open access competition, giving examples from all observed market players. To give an overview, the following illustration summarises the analysed data and shows the strength of each identified influencing factor:

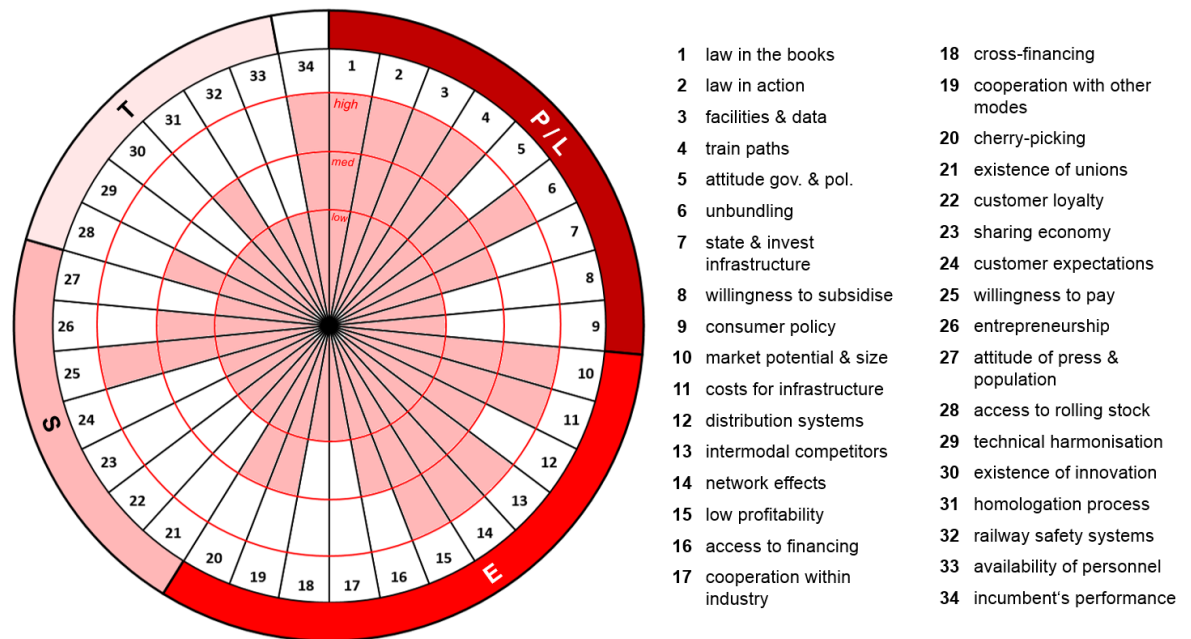


Illustration 18: Overview of influencing factors in the German case (author's own diagram)

Table 29 below lists the key findings for all influencing factors. The factors identified as important for the case will be discussed in more detail in the following section.

	No	Influencing factor	Strength	Key findings
Political & legal	1	Law in the books	High	• The market is liberalised since 1994 and competitors can access without legal barriers
	2	Law in action	High	• Law in action is working well to discipline DB Fv
	3	Access to facilities and data	High	• Access is given to competitors, however the handling of issues with the IM needs a high degree of persistence
	4	Attractive train paths	High	• Good access is generally given • But due to the high utilisation of the attractive paths, it is complex and negotiation with the IM is necessary
	5	Facilitation and attitude of government and politicians	Medium	• No strong attitude towards competition is given • No political attempts have been made to increase the market share of competitors • Clear focus on the improvement of DB Fv's quality

	6	Unbundling	High	<ul style="list-style-type: none"> • Cooperation between IM and competitors is fair • Full separation might promote competition, however only a breaking-up of DB Fv would trigger a high number of market entries
	7	State of and investment in infrastructure	Medium	<ul style="list-style-type: none"> • Safety of infrastructure is taken seriously • However, relatively little investment in infrastructure exists in European comparison
	8	Willingness or ability to subsidise operations	Low	<ul style="list-style-type: none"> • DB Fv receives no subsidies • No willingness to pay subsidies for long-distance passenger rail is given
	9	Consumer policy	Low	<ul style="list-style-type: none"> • All legal requirements are implemented • A level playing field is given for all RUs
Economic	10	Market potential and market size	High	<ul style="list-style-type: none"> • The market potential is considered high • However, with a strong incumbent, relative low willingness to pay and strong intermodal competition, profitability is not reached easily
	11	Costs for infrastructure	High	<ul style="list-style-type: none"> • The RACs in Germany are the highest in the EU • RACs are monitored by BNetzA, some cases of discrimination existed but have been eliminated
	12	Access to distribution systems	Medium	<ul style="list-style-type: none"> • No general access to DB's distributions system is given, competitors need to build an own system • New digital ticketing solutions and distribution partnerships make it easier for entrants than in the past
	13	Presence of intermodal competitors	High	<ul style="list-style-type: none"> • Cars holds ~80% of modal split as biggest competitor • The market opening in 2013 led to an increase in long-distance coach transport and decrease of prices and customers' willingness to pay
	14	Existence of network effects for incumbents	High	<ul style="list-style-type: none"> • The network is finely branched and polycentric • DB Fv has a high degree of network effects due to its holistic distribution system • Competitors cannot access DB Fv's network effects and need to create an own network
	15	Low profitability	High	<ul style="list-style-type: none"> • DB Fv operates its network profitably • However, 2/3 of all RUs cannot cover costs with profits from their core business, especially due to high RACs and low ticket prices
	16	Access to financing	Medium	<ul style="list-style-type: none"> • Access is given, but few institutional financiers exist, mostly focussing on regional transport • Only few private investors exist, mainly having a connection to the rail industry
	17	Existence of cooperation or competition within the industry	Low	<ul style="list-style-type: none"> • DB Fv holds cooperation with other incumbents, which prevented their market entry in the past • Competitors cooperate with other RUs too, but it has no major effect on the business cases
	18	Cross-financing of RUs and lack of transparency	Low	<ul style="list-style-type: none"> • Accounting system of DB Fv and other DB subsidies are separated • Law in action prevents cross-subsidising
	19	Existence of cooperation with other transport modes	Medium	<ul style="list-style-type: none"> • It has not been a major influence until the cooperation between Locomore and Flixbus • Capital and distribution power of Flixbus made operations of Locomore under a new brand possible
	20	Possibility for cherry-picking	Medium	<ul style="list-style-type: none"> • Cherry-picking is allowed if subsidised regional transport is not cannibalised • Many cherry lines exist with high market potential
Social	21	Existence of unions	Low	<ul style="list-style-type: none"> • Unions have a high effect on DB Fv • Union have no effect on small open access RUs
	22	Customer loyalty	Low	<ul style="list-style-type: none"> • No significant customer loyalty for either DB Fv nor open access RUs exists, due to high price sensitivity
	23	Sharing economy	Low	<ul style="list-style-type: none"> • Sharing industry is growing in Germany • Up to now, no significant effect on competition

	24	Adjustment to customer expectation	Low	<ul style="list-style-type: none"> • DB Fv serves a great variety of customer groups • Customers value low prices higher than product differentiation
	25	Customers' willingness to pay	High	<ul style="list-style-type: none"> • Decreasing price level of mobility from 2014 onwards, due to increased intermodal competition • Competitors mostly use low-price strategies
	26	Entrepreneurship	Medium	<ul style="list-style-type: none"> • Market entry and the first years of operation require strong entrepreneurs • Mostly, entrepreneurs were connection to rail beforehand
	27	Attitude of press and population	Low	<ul style="list-style-type: none"> • Press and population have a positive attitude • However, no competitive advantage is generated
Technical	28	Access to rolling stock	Medium	<ul style="list-style-type: none"> • Access to new rolling stock is given • Market for second-hand rolling stock (trains and coaches) is difficult
	29	Lack of technical harmonisation	Low	<ul style="list-style-type: none"> • Harmonisation is necessary for international RUs and has no effect on national competition
	30	Existence of innovation	Low	<ul style="list-style-type: none"> • Different types of innovation exist within RUs • Innovation is not necessary to succeed
	31	Homologation process	Medium	<ul style="list-style-type: none"> • Process has been slow and complicated in the past and led to delayed market entry • In recent years the situation improved
	32	Railway safety systems	Low	<ul style="list-style-type: none"> • Is considered as bureaucratic, time consuming and complex • A level playing field exists
	33	Availability of necessary personnel	Low	<ul style="list-style-type: none"> • Unemployment rate is very low in Germany • Up to now, necessary personnel is available but might be critical in the future
Other	34	Incumbent's performance	High	<ul style="list-style-type: none"> • Some smaller cases of discrimination between IM and RUs existed in the past • Size and dense network of DB Fv leaves little space for large-scale market entry of new RUs • General quality of DB Fv is good, however customers are not always satisfied and loyalty is not very high

Table 29: Key findings of the German case (author's own diagram)

6.2.2.1. Law in the books and law in action

Law in the books is a pre-condition for the existence of open access competition in Germany. The Railway Reforms were initiated in 1989 to transform Bundesbahn and Reichsbahn from two political authorities into one business enterprise, to conduct debt relief, to restructure investment in infrastructure and regional transport and to react to the new political framework. This also incorporated the EU's demand for the introduction of competition (91/440/EEC). The reform resulted in changes to 130 laws and the implementation of seven new laws (Deutscher Bundestag 2008, Schwilling & Bunge 2014, Doll 2014a). Despite Germany's status of advanced liberalisation in Europe, in the following

years some legal proceedings challenged the implementation of 91/440/EEC into German law: especially regarding DB's holding structure and avoidance of cross-financing (Bund 2011, Monopolkommission 2011). In 2013, the ECJ decided that regulation regarding separation between infrastructure and operation was being implemented satisfactorily, and in 2016 that the control framework for accountancy of infrastructure and operations needed to be improved in regulation (Spiegel online 2013, Zeit online 2013a, Zeit online 2013b, Sanchez-Bordona 2016). The following paragraphs give a brief overview of the main changes of law in the books. These changes will be discussed below.

After several complaints about the delays and complexity of homologation, the regulation concerning homologation was improved: in 2012 serial approval of rolling stock was allowed (7. Verordnung zur Änderung eisenbahnrechtlicher Vorschriften); in 2015 a "rail TÜV⁶" was established, allowing selected private inspection bodies to support the Federal Railway Authority ("EBA") in the process (9. Gesetz zur Änderung eisenbahnrechtlicher Vorschriften) (EBA 2013a, Doll 2014b, BMVI 2014a). In 2012, after lengthy discussions, the government decided to liberalise the long-distance coach market from 01.01.2013 onwards, by adapting the "Personenbeförderungsgesetz". This resulted in additional intermodal competition for RUs (Bundesministerium für Verkehr, Bau und Stadtentwicklung 2012, Stern 2012). To increase competition in the railway sector, the "Eisenbahnregulierungsgesetz" ("ERegG") came into force in 2016, implementing Directive 2012/34/EC in German law. It introduced ex ante approval of infrastructure fees by BNetzA, provided incentives for increased efficiency of infrastructure, empowered BNetzA and was supposed to

⁶ "Technischer Überwachungsverein", meaning Association for Technical Inspection

lead to increased transparency. ECJ noted that Germany violated directive 2012/34/EC since ERegG came into action one year late. ERegG is subject to criticism from several parties. The Monopoly Commission, for example, sees an excessive degree of legal uncertainty and states that a 1:1 implementation of EU law resulted in a step backwards in some areas (Monopolkommission 2015, Deutscher Bundesrat 2016, BMVI 2016b, Wüpper 2016).

Overall, the German market is liberalised and competitors can operate on the network with limited direct barriers. However, regarding the degree of market liberalisation, critics name German law in the books a “hybrid-liberalisation”, since competition is possible but not proactively promoted. A need for further development of regulation in the coming years is seen, but experts expect no drastic changes because the legal development ever since the Railway Reforms has been relatively stable and a gradual development has taken place (Kirchner 2011, Participant B 2017, Participant C 2017).

When law comes into action, it is essential that law is put into practice, which is the case in Germany. The institutions are set up and function satisfactorily (Kirchner 2011, Participant B 2017). Due to the Railway Reforms, DB AG was founded on 01.01.1994, being fully state-owned. The Transport Ministry (“BMVI”) is only supposed to intervene in strategic decisions, to avoid the status of a “self-service shop” as it used to be before the reforms. In 1999, the reforms resulted in a splitting of DB in five AGs under the umbrella of a holding structure. The reforms also led to a separation of infrastructure and operations which is considered a success by the BMVI, especially since it resulted in a non-discriminatory access to rail infrastructure and a traceable increase in profitability (Schwilling & Bunge 2014). However, DB’s holding structure makes monitoring by regulatory authorities necessary: the institutions BNetzA, EBA

and Monopolkommission have been successfully established (Participant A 2017, Participant B 2017).

Some examples show the successful and fast implementation of law in the books: in 2013, legal opening for the long-distance coach market was directly implemented, led to a direct issuing of necessary concessions and resulted in the fast market entry of several coach providers (Bundesamt für Güterverkehr 2015). In 2016, the regulation 2016/545/EU on the process of paths framework agreements symbolised a change in paradigm and led to the termination of paths framework agreements by DB Netz from 01.12.2016 onwards. A process for future framework agreements in Germany has not yet been set up (DB Netz 2018b). Also in 2016, the ERegG led to the foundation of a ruling chamber, investigating rail network access conditions and infrastructure prices ex ante. For the 2017/2018 timetable, DB Netz revised the path pricing system fundamentally according to ERegG's guidelines (DB Netz 2016b, BNetzA 2017a).

Law in action is working well to discipline the incumbent. However, critics say that the law is not implemented and applied proactively towards competitors and therefore does not actively support them. The Monopoly Commission is seen as the only active promoter of increased open access competition from an institutional side (Monopolkommission 2013 & 2015, Participant A 2017, Participant C 2017). Moreover, the regulatory framework in Germany is characterised by a wide span of interpretation which makes it weaker regarding implementation (Monopolkommission 2015).

6.2.2.2. Access to facilities and data as well as attractive train paths

Access to facilities and data in Germany is considered satisfactory and no major issues exist (BNetzA 2017c, Participant A 2017, Participant B 2017). A survey of BNetzA shows that RUs consider access to facilities as good: on a scale from 1-5, access to stations was rated 2.1, maintenance facilities and formation facilities was rated 2.4, access to storage sidings was rated 2.8. The trend of recent years shows a relatively stable development (BNetzA 2017c). In 2011, EC investigated DB Energie's traction pricing system after a complaint from a competitor. After legal proceedings, DB announced in 2014 that it was abolishing the 5% discount system for big rail providers, which benefited mostly its subsidiaries (ECJ 2013, DB 2015a). Subsequently, competitors sued DB Energie in 2015 for 13.5 million EUR of compensation (Juve 2015). Highly frequented stations and hubs on the network are considered as overcrowded and difficult to access for competitors, e.g. Hamburg Hbf. and Berlin Spandau (Polke-Majewski 2015, EBA 2016). Critics state that some facilities also suffer from poor management, which affects all market participants: HKX had problems with the availability of sidings at Frankfurt Hbf (Participant B 2017). Locomore had difficulties with display and notice of information in stations. In addition, shunting and the quality of cleaning in Stuttgart were unsatisfying for Locomore (Participant C 2017). Regarding available data, sales figures and details to ODs are still restricted by DB Fv and not accessible for competitors. However, DB established an open-data platform providing e.g. timetables, detailed infrastructure information, mobile network information and enabling competitors to access necessary data more quickly (DB 2017a). All in all, access to facilities and data is "not decisive for the outcome of the war, but can cost a lot of strength", it is not the access which is difficult for competitors, but

the continuous handling of issues which need a high degree of persistence (Participant C 2017).

In Germany, the access to and availability of attractive train paths builds on a good system which is relatively free of discrimination (Participant A 2017, Participant B 2017, Participant C 2017, BNetzA 2017c). A survey by BNetzA showed that the general access to paths is considered as good in the industry: on a scale between 1-5, access to paths on an occasional basis is rated 2.2, access to regular timetable paths is rated 2.2 (BNetzA 2017c). In 2015, 12,500 path conflicts existed, in 19 cases a legal decision procedure was necessary to reach a settlement (DB 2016b).

However, one difficulty is the system's lack of transparency: competitors do not receive an overview of attractive available slots (Participant B 2017).

Additionally, the network is busy and well utilised, especially in urban centres (Participant B 2017). In recent years, a slight increase in path kilometres took place on the network, up to 1,072 million in 2017 (DB 2018a). Since the network is highly utilised, a shortage of paths exists (Participant C 2017). Overburdened and congested lines need to be disclosed by DB Netz on a regular basis. EBA and BNetzA observe and monitor those limitation and capacity bottlenecks, and aim to provide transparency for competitors. In 2015, 15 lines were defined as overburdened (Polke-Majewski 2015, BNetzA 2017b). A further difficulty is that the network is a mixed network, different forms of railway services are provided at the same time with different speeds and stopping patterns. This makes the planning of relatively fast long-distance lines more difficult (Participant B 2017). Also, due to the high utilisation of the network, a newcomer is structurally disadvantaged, since the attractive train paths are already blocked by running operators. A lack of opportunity to achieve long-term paths agreements of over

five years makes it even more difficult to secure financing and enter the market with new rolling stock (Monopolkommission 2015, Participant C 2017).

In the past, framework contract periods greatly shaped the applications for attractive train paths, which has been widely criticised (e.g. Monopolkommission 2011, Warnecke 2014, Participant C 2017). Every five years, RUs applied for paths which were guaranteed for five years, originally initiated to provide competitors with paths security. However, the system was considered as inflexible and seen as a means to hinder competition with a too small lead time to set up operations and buy rolling stock (Monopolkommission 2011, Warnecke 2014). This led to a termination of the system in 2016 (DB Netz 2018b). Currently, paths can only be blocked one year in advance, and a new process is not yet established (Participant B 2017). The following examples show how competitors applied for paths and dealt with paths availability:

When InterConnex started operations, it originally planned to offer more lines of the old DB “InterRegio”-network. However, after negotiations with DB Netz, InterConnex withdrew the request for four daily train pairs between Düsseldorf-Heidelberg, since the paths offered included long waiting times and were unattractive (Eurailpress 2002). In general, HKX described the cooperation with DB Netz as good, but some conflicts have occurred (Preuß 2013): before HKX started operations, it thought about applying for paths framework agreements. This was risky since under this timeframe, it would have needed to start operations within 1.5 years’ time or would have suffered high cancellation penalties (Participant C 2017). Between 2007 and 2010 Locomore tried to negotiate a long-term paths contract for HKX for nationwide paths, but it failed and market entry was smaller than originally planned (Warnecke 2014). On the

Cologne-Frankfurt line, difficulties occurred with finding attractive train paths due to overcrowding. A meeting between HKX, DB Netz and a regional RU was able to solve some problems, but some slots remained critical which finally led to the termination of the line (HKX 2015, Eurailpress 2015). MSM planned to offer three daily train pairs on the line Cologne-Berlin/Hamburg via Hanover. DB Netz, however, could not find attractive train paths on this highly-used route. No solution minimising travel time and optimising rolling stock utilisation could be found. However, DB Netz states that it invested more than 1,000 working hours to check MSM's request (Welt 2012, Wüpper 2013). Derschnellzug.de also had problems to find attractive train paths: it planned to use partly private infrastructure (Grötzingen-Heilbronn), but this infrastructure was not certified for long-distance passenger transportation (Stimme 2015, derschnellzug.de 2015). After the experience with HKX between 2007 and 2010, Locomore successfully applied for a framework paths agreement and secured its paths for a period between 2016 and 2020 (Schlesiger 2015, Participant B 2017).

Generally, good access to paths exists in Germany, but due to high utilisation, it is rather complex and tough negotiation with DB Netz is necessary (Participant C 2017). HKX, Locomore and InterConnex had a high degree of experience in applying for paths, which made them more successful than other competitors in the first place, also regarding path framework contracts (Participant C 2017). All in all, examples from the market show that the access to attractive train paths has a significant influence on competition, also since it was an entry barrier that some RUs did not manage to address. It is difficult to say if a full vertical separation would result in improved conditions for open access competition: on the one hand, cases of discrimination could be prevented, more transparency and an easier access to attractive paths during peak times would be given. On

the other hand, due to its size, DB Fv would still be the dominant customer with a high market power. Due to the mixed system and the current infrastructure bottlenecks, paths conflicts and congestions could not be excluded, which is the main problem in the German case.

6.2.2.3. Facilitation and attitude of government and politicians

Examples from other countries show that a positive attitude of the government and politicians towards competition enhances market liberalisation. However, no clear focus of government and politicians on rail and especially on competition in long-distance passenger rail can be observed, they did not actively try to increase the market share. Although the centre-right government wanted to create a rail network with fair access conditions for all operators, it put emphasis on continuity in long-distance passenger rail within the last decade, with a focus on quality and service improvement of the incumbent (Bundesregierung 2005, 2013, Monopolkommission 2015, Participant A 2017). An example of this passivity was the market withdrawal of InterConnex in 2014: CEO Schreyer wrote an open letter to the Transport Minister and asked for support shortly before the end of operations, but never received an answer (ZDF 2014, Smith 2015). Despite the passivity, no negative actions from political or governmental side against competition can be observed, either. To promote competition, a “big bang” would be needed regarding regulation. But this is not expected and no lobby for such a change exists (SPD 2016, Participant C 2017).

6.2.2.4. Unbundling

In Germany, unbundling in the form of vertical as well as horizontal separation exists to some degree: rail infrastructure and operations are vertically separated

and operated by different companies. Regional, long-distance and freight transport is also horizontally separated. However, the holding company DB incorporates all companies under its umbrella, with Chinese walls set in place to prevent discriminatory behaviour (Schwilling & Bunge 2014). Government and BMVI pleaded in favour of the holding structure for years, believing that competition is possible. They want to work on a further improvement of the system instead of full separation (Bund 2011, Zeit online 2013). The Monopoly Commission is the only official body that attacks the existing holding structure, stating that competition is only possible with full separation (Monopolkommission 2009, Doll 2013, Monopolkommission 2015). The EC disapproves of an integrated holding structure. However, after substantial lobbying by DB, the ECJ dismissed the case in 2013 and guaranteed the continued existence of the holding structure. Subsequently, several discussions and legal proceedings took place between the EC and Germany with terms to cross-subsidisation and an untransparent accounting system made possible by the holding structure (Bund 2011, Spiegel online 2013, Focus 2016).

Existing open access competition shows that the cooperation between the new entrants and the IM is fair (Preuß 2013, BNetzA 2016). Participant A (2017) states that in an ideal world, RU and IM would be separated and promote competition, but the current holding structure of DB results in no serious discrimination against competitors and enables the existence of open access providers. Full unbundling of DB Fv and DB Netz is a means to promote open access competition further, but it would not be enough: real liberalisation would require the breaking-up of DB Fv into several parts that compete against each other (Participant B 2017, Participant C 2017).

6.2.2.5. State of and investment in infrastructure

The state of and investment in infrastructure is taken seriously in Germany, especially regarding safety. However, despite having the longest rail network in Europe, Germany invests relatively little money in rail infrastructure compared to other European countries: a study shows that in 2015, only 56 EUR per inhabitant were invested in the rail network, while Sweden invested 177 EUR and Austria 192 EUR (Allianz pro Schiene 2016a). This trend could also be observed in the previous years which led to underinvestment. The government traditionally prioritised investments in roads (Zeit online 2014). An analysis of the Plan for Federal Traffic Routes confirms the prioritisation of road over rail: between 1991 and 2000 103 billion EUR were invested, 51.6% in road and 42.3% in rail. Between 2001 and 2015 149 billion EUR were invested, 52.1% in roads and 42.9% in rail. The plan provides a significantly increased budget of 264 billion EUR between 2016 and 2030 of which 49.4% will be invested in roads and 41.3% in rail. Electrification and an improvement of capacity is a particular bottleneck which is to be improved in the coming years. The figures show a steady investment in rail, but the extension of the road network receives more funds (Verkehrsministerium Baden Württemberg 2003, BMVI 2016a). A survey of BNetzA showed that the conservation state of the network is considered as satisfactory (3.0 on a scale of 1-5), as are the development conditions (3.0) (BNetzA 2017c). But delays and disruptions due to technical failures in the network occur, for both incumbent and competitors (Participant B 2017). The enhanced investment in rail infrastructure has a positive effect on the entire network for all players. But negative effects also occur due to an increase in construction work: InterConnex, for example, suffered a massive

reduction in sales during construction work and line closures (Participant A 2017, Participant B 2017).

All in all, an intact network is considered a basic condition for competition and has the same influence on the competitor as it does on the incumbent.

Competition is only possible when enough capacity exists, as the experience of InterConnex, HKX, MSM and derschnellzug.de reveals that path allocation, especially in big transport hubs, is difficult in Germany (Participant A 2017, Participant B 2017).

6.2.2.6. Market potential and market size

Market potential and market size of long-distance passenger rail in Germany is relatively high, a positive market environment for rail exists. However, it varies considerably between regions and travel days. In 2016, the modal split of rail passenger transport was 8.6%, with a total amount of 40 billion passenger-km (BNetzA 2017c, Eurostat 2019b). The rail market is fully dependent on the economic situation of the national economy, which has been stable in the past decade. In 2016, DB Fv registered a passenger record with over 139 million transported passengers, despite the intermodal competition, which increased to 142 million in 2017. The sales figures (in billion EUR) in the long-distance passenger rail market in recent years are 2013: 4.0, 2014: 4.0, 2015: 3.9, 2016: 4.2. and 2017: 4.3 (DB 2017b, DB 2018a). Due to the low market share of competitors of under 1%, the sales figures are mainly generated by DB Fv. The average length of passenger journeys was 284 km in 2016 (BNetzA 2017c).

Often the market size and estimated market potential of lines lead to the idea of market entry (Participant A 2017): the higher the estimated market potential, the lower the risk for failed market entry will be and the more attractive market entry

becomes. Competitors usually enter on the line with the highest estimated potential (Participant C 2017). When InterConnex started operations, it filled a gap that DB had left. From DB's point of view, not enough market potential was given to cover the costs (Monopolkommission 2009, Kuhr 2014, Participant A 2017). After market entry, InterConnex transported around 200,000 passengers/year, up to 2012 InterConnex transported around 400,000 passengers/year (Handelsblatt 2005, Fröhlich 2012, Schlesiger 2014c). HKX entered on the Cologne-Hamburg route since it saw market potential, while DB Fv did not serve the line with a high priority on quality (Participant A 2017). In the first year, HKX transported 350,000 passengers (Preuß 2013, HKX 2013). However, with the increased intermodal competition, it reduced its daily connections to the weekends and holidays since the market potential was higher on those days (Schlesiger 2014b, HKX 2014a). When Locomore entered the Stuttgart-Berlin route, it also believed in sufficient market potential and market size. To run profitably, an occupancy rate of 50% needed to be achieved, with 1,000 tickets sold each day. In the first 100 days of operation, 70,000 passengers were transported, with 1,000 or more passengers per day on Fridays and Sundays (Zeit online 2017, Locomore 2017d, Locomore 2017e). FlixTrain plans to transport more than 500,000 passengers in its first 10 months of operations and is very optimistic about an occupancy rate of 70% (Spiegel 2018).

Market size and market potential play a big role in open access competition, since "only when people want to travel does competition make sense" (Participant B 2017). The market potential is considered high. Despite the intermodal competition, DB Fv registers passenger records, it addresses a wide variety of customers. Competitors feel the effects of intermodal competitors

more strongly, since they target a similar customer group as the coaches, mainly the low-budget travellers. Due to their nature, coaches are more flexible and can test and adapt more quickly to market potential than RUs (Participant A 2017). A major negative influence on open access competition is DB Fv's high market penetration, which leaves little potential unexploited (BNetzA 2016). However, when the incumbent is already running a high frequency of trains on a route with high market potential, the risk of expulsion is not as big as when the competitors enters a route which is not served by the incumbent and the incumbent decides to re-enter this route (Participant C 2017).

6.2.2.7. Costs for infrastructure

The costs for infrastructure are a big cost driver in every RU's business case, especially in Germany: compared to other EU countries, Germany has the highest costs for infrastructure, followed by countries like Belgium and France, where charges for dedicated high-speed lines are also included (EC 2016c). This is the case since DB Netz charges direct costs for the train operation, as well as a share of total costs (Ramsey Pricing) and additional elements (e.g. noise protection). In Germany, an average of 25% of all costs of RUs are infrastructure costs. Of these costs, 88% are for paths, 8% for stations and 4% for other facilities (BNetzA 2016, DB Netz 2017b).

DB Netz was the first IM in Europe to introduce a train paths pricing system in 1994. The system was changed into a module-based system in 2001, charging different prices for long-distance, freight and regional transport. The prices consist of three components: a usage-based fee, performance related fees, and other components. Each RU can pre-calculate the prices on DB Netz's homepage (DB Netz 2018a). In 2016, the average price per path km was 4.57

EUR, but long-distance passenger RU paid an average of 6.33 EUR (BNetzA 2017c). With each stop at a station, the RU needs to pay a station fee to DB Station & Service. An average figure of 5.29 EUR is charged, but this varies greatly between rural areas and cities (BNetzA 2017c). The high fees result in the fact that in some parts of the network, it is not possible to provide profitable passenger rail transport. For DB Fv it is possible to achieve a positive business case due to surpluses from other parts of the network (BNetzA 2016).

Examples from open access competitors show that the infrastructure costs play a role for their profitability and that some cases of discrimination existed in the past: when InterConnex left the market in 2014, it blamed the high costs for infrastructure as well as ruinous competition from coaches. For one route, it paid 1,700 EUR which resulted in a cost level of 11 EUR per customer, bearing in mind that InterConnex ran on cheaper, secondary lines (ZDF 2014, Participant A 2017). After HKX announced its market entry, DB Station & Service changed the pricing scheme in 2010. Originally, trains below 180 m were charged at a discounted level, in the new system only trains below 170 m were granted the discount. With HKX's trains being 178 m long, this led to a cost increase of 62.9% for HKX and 3.3% for DB Fv. HKX initiated a lawsuit against DB and won and DB Station & Service had to re-calculate the station prices (Schlesiger 2012, BNetzA 2015). When expanding the line to Frankfurt in 2015, HKX did not use the fast rail paths between Frankfurt and Cologne and ran on cheaper and slower paths to save costs (Participant A 2017).

The new ERegG from 2016 leads to two main changes in the pricing of infrastructure, which affects competition: DB Netz's pricing system needs to be approved ex ante by BNetzA. This guarantees greater transparency and fairer

pricing for competitors. Additionally, prices for regional paths are not to increase by more than 1.8% each year. This may lead to an extra financial burden for long-distance passenger RUs, since freight rail is also to be protected (Doll 2016b, Allianz pro Schiene 2016b, Handelsblatt 2016b). The ERegG resulted in a new path pricing system which DB Netz introduced in December 2017 (DB Netz 2016a). Even though the Transport Minister saw no risk for open access competition through the ERegG, several parties complained about this aspect (Handelsblatt 2016b, Allianz pro Schiene 2016b). DB Netz plans to increase the infrastructure fees by between 2.0 and 2.8% per annum until 2020, despite steadily increased profits. However, a new and cheaper pricing category was also introduced, which enables RUs to run services which do not connect the main metropolises at a reduced price level (DB Netz 2016c, DB Netz 2017a, DB Netz 2018c).

The high RACs have a negative influence on open access competition, this factor might not be the “killer” of competition, but it harms the passenger rail sector in general (Participant A 2017, Participant B 2017, Participant C 2017). Examples show that most competitors use cheaper, slower paths (Participant A). It also reveals that the higher the prices for infrastructure, the less likely competition becomes (Participant B 2017).

6.2.2.8. Access to distribution systems

Free access to distribution systems does not exist in Germany: the market for rail ticketing is dominated by the incumbents' sales subsidiary DB Vertrieb. It provides a variety of sales channels with a high coverage rate, in rural and urban areas: sales offices in stations, ticket machines, online sales, mobile ticketing, travel agencies, hotline and on board the trains (DB Vertrieb 2018).

DB's online and mobile information and ticketing system is highly accepted by users and has over a million clicks every day. By now, more than 40% of DB passenger transport tickets are sold online or via mobile ticketing (Heuzeroth 2010, DB 2018a).

Despite several requests, DB did not open its distribution system to open access competitors in general (Doll 2014c, Monopolkommission 2015). When InterConnex started operations in 2002, DB refused to sell its tickets and did not show InterConnex's timetable information in its national timetable system. InterConnex filed a lawsuit against DB and won: timetable information of all competitors had to be added to DB's information media (Handelsblatt 2003, Participant A 2017). HKX was interested in entering DB's distribution channels and was rejected. In 2015, it rebranded into a regional transport provider and renegotiated with DB. In 2015, it entered a ticketing cooperation, with a cross-acceptance of specific tickets. However, the cooperation ended in summer 2016 due to missed objectives and problems with the reservation included on HKX's trains. The sales cooperation with DB did not result in the significantly higher profits HKX expected (Süddeutsche Zeitung 2016, Participant A 2017, Participant B 2017). Within five years, FlixBus sold coach tickets to more than 100 million passengers over its distribution platform. From August 2017 onwards, it also sold Locomore tickets, around 70,000 in the first four months, which is considered a success. FlixBus states that customers ask for intermodal tickets and also use a combination of rail and coach. Between March and December 2018, it plans to sell 500,000 train tickets (Spiegel 2017, FAZ 2017, FlixBus 2018b, Spiegel 2018).

Critics state that DB used its strong market position to discriminate against competitors in recent years, especially regarding regional transport competitors: the Federal Cartel Office opened a lawsuit against DB in 2014. It resulted in a proposal from DB to adapt the system, enabling regional RUs to sell DB Fv's tickets at a balanced sales provision. Consequently, the lawsuit was closed (Monopolkommission 2015, NEE-Bahnen 2015, DB 2015a). In the past it was almost impossible to sell tickets of open access competitors at DB stations: it was difficult and expensive to rent a sales office inside the stations and most rental contracts prohibited the shops, e.g. kiosks, from selling tickets. This changed with the implementation of the ERegG in 2016 (Monopolkommission 2015, Deutscher Bundesrat 2016).

The access to distribution systems is important for open access providers, but the importance has declined in recent years. This is due to new technological possibilities via online and mobile ticketing platforms and independent ticketing providers (e.g. Trainline, Go Euro). The existing examples show that alternative distribution channels can be established relatively easily. DB states that online channels and mobile solutions are the future in ticket distribution (Heuzeroth 2010, DB 2016b). The importance of access to DB's distribution system is also dependent on the OD: point-to-point tickets depend less on the incumbents' distribution. The more interchanges customers needed to reach their destination, the more unlikely it became that customers chose the competitor due to the variety of separate tickets (Participant A 2017). Examples show the access to DB's distribution system would be an advantage for open access competitors and would most likely result in higher passenger figures (Doll 2014d, Participant A 2017, Participant B 2017, Participant C 2017). The opening of the distribution monopoly of DB is not planned, however, it is

expected that the EU will force a change or an opening soon (Monopolkommission 2015, Participant C 2017). In addition, the example of FlixBus reveals how effective and successful a cooperation with big distribution partners and intermodal competitors can be, through avoiding the previously existing entry barriers.

6.2.2.9. Presence of intermodal competitors

The presence of intermodal competition in Germany plays a big role for RUs. The main intermodal competitor is motorised private transport, it holds 79.9% of the modal split. It is followed by air (5.3%) and coach/bus transport (6.8%) (Umweltbundesamt 2018). In 2017, 46 million cars are registered, this means 0.55 cars for each inhabitant, which is high in international comparison (Kraftfahrt-Bundesamt 2018). 24 million passengers used inner-German flights in 2017 (Statistisches Bundesamt 2018a). 23 million passengers used coaches in 2017 on more than 300 lines, this is 16% of long-distance rail's total amount (FlixBus 2018d, Statistisches Bundesamt 2018b).

Competition between airlines and railways can be observed for several years in Germany, especially on distances around 300-500 km. DB adapted its pricing system and introduced yield management to be more competitive against airlines (Heuermann & Delfmann 2009). The market entry of low-cost airlines further reinforced air-rail competition since it influenced rail ticket pricing (DB 2016a, Participant A 2017). The entry of Germanwings on the Hamburg–Cologne/Düsseldorf route influenced HKX's planned timetable and business plan (Schwenn 2014). The entry of low-cost airlines, e.g. on the Frankfurt-Berlin route, make business for open access providers like Locomore more difficult (Participant C 2017).

Coach providers have several competitive advantages over long-distance rail: production costs for coaches are lower, the flexibility in route planning is higher, no fixed infrastructure costs exist, and rolling stock is cheaper and faster to access (Schlesiger 2014c, Monopolkommission 2015). While the coach market expanded rapidly, prices have fallen dramatically since 2013: an average regular fare costs ca. 9 cents/km while special offers costs less than 4 cents/km (Grimaldi et al. 2017). Thus, the existence of coach competition puts high pressure on the open access providers, regarding numbers of passengers and ticket prices (BNetzA 2016, Participant B 2017, Participant C 2017): when InterConnex exited the market in 2014, CEO Schreyer stated that the main reason was coaches offering cheaper prices. On an economic level InterConnex could no longer compete (ZDF 2014, Schlesiger 2014c, Participant A 2017). HKX has similar problems, due to the high number of coaches between Cologne and Hamburg, HKX had to compete with the low prices and a decreasing number of passengers. HKX reduced the number of connections to run only at weekends with higher demand (Döring 2014, Schlesiger 2014b). The effects on HKX were not only primary but also secondary, since DB Fv also started to adapt its strategy toward the new coach-competition and changed its pricing structure by offering more discounted tickets and special prices (Participant A 2017). Slowly but surely, market consolidation on the coach market can be observed, leading to increased prices: after five years of operations, one dominant company, FlixBus, holds a market share of over 90% (Schwenn 2016, Doll 2017). There is a strong lobby which sees the competition between long-distance rail and coaches as unfair due to the absence of charges for road infrastructure (Spiegel online 2015, Participant C 2017). A toll fee is expected to be introduced for coaches in the coming years (Handelsblatt

2017a). However, intermodal competition can also be an opportunity for open access providers: Locomore was taken over by FlixBus and LEO and started operations again in August 2017, after its insolvency in May. The first months of operations show that Locomore could be saved by the bus company, as well as the operations on HKX's lines (Handelsblatt 2017b).

The examples show that intermodal competition influences open access competition in Germany. The fast and effective market entry of coaches played a particularly big role in recent years, influencing the overall price of mobility and was especially attractive to price-sensitive customers (Participant A 2017, Participant C 2017). This resulted in the market withdrawal of InterConnex and HKX. DB Fv was also forced to react and lowered its prices. All in all, new competitors are able to deal with competition from motorised private transport, its modal split has been relatively constant in recent years and it is the main competitor (Participant B 2017). It was the market entry of airlines and especially coaches that had a major impact for the existence of competitors, especially regarding their profitability, and might have frightened other prospective operators (Schlesiger 2014c, Monopolkommission 2015). But it is also an opportunity as FlixBus in cooperation with LEO shows in the case of Locomore and HKX.

6.2.2.10. Existence of network effects

Long-distance passenger rail in Germany is considered as a fixed, interlinked system and a finely branched network: the more changes passengers have to make to reach their destinations, the more likely *network effects* are. The incumbent operates on the entire network with a relatively high overall frequency which provides it with network effects (Monopolkommission 2013,

Participant A 2017). DB Fv's network effects result from DB's distribution system, which is closed to competitors, as well as its customer loyalty tools, such as the "Bahncard". "Bahncard" offers a discount system in stages, over five million DB customers possess such a card (DB 2018a).

The incumbent's network effects affect HKX and Locomore directly. Both operators' tickets were generally not sold by DB's distribution system which forced customers to buy several tickets for their journey if they needed to change trains en route (Preuß 2013, Locomore 2017a). It can be observed that HKX-customers had fewer changes than average rail customers, since they mostly travelled point-to-point (Participant A 2017). DB Fv's network effects led to further risks for open access operators: they theoretically enable DB Fv to fight tough price wars against competitors on some lines, cross-financing the losses with network benefits from other lines (Participant B 2017). This has not happened in the past, but this theoretical option may discourage possible investors and reduces the likelihood of accessing financing (Participant A 2017). By building a new network, open access competitors can theoretically also profit from network effects. The case of Locomore and FlixTrain shows that by including the company in FlixBus's distribution platform, an independent network was created. FlixBus states that customers combine both transportation modes to reach more destinations (Spiegel 2017).

In recent years, a slight change regarding the power of network effects can be observed: due to technological possibilities, people, especially younger generations, plan their trips differently and compare prices via search engines. Increased price-sensitivity also leads to a higher acceptance of inconvenience and complexity, also regarding tickets. This might lead to the scenario where network effects play a lesser role in the future (Participant A 2017). Overall, DB

Fv has substantial network effects, even if these are difficult to quantify (Monopolkommission 2013). DB Fv's network effects influence open access competitors, but they are not "deal-breakers". However, they lower profitability and make existence in the long run more difficult (Participant C 2017). They are also a market entry barrier since they reduce the entrants' profitability and might deter investors (Participant A 2017, Participant B 2017). The examples also show that access to other networks can be an opportunity for open access providers.

6.2.2.11. Generally low profitability

Generally low profitability in the long-distance passenger rail market can be observed in Germany. By targeting price-sensitive customers, competitors suffer high cost pressure to be profitable. The main cost drivers for every RU are path access charges, energy costs, station costs, rolling stock charges, personnel and overhead costs (Everis 2010). A study by BNetzA shows that only a third of all RUs in Germany, mostly big RUs, could cover their costs by profits from the core businesses in 2015. DB Fv operates its network profitably, some of its lines earn solid profits, others need to be cross-subsidised by these profits. BNetzA observes a declining return on sales rate ever since the market entry of coaches in 2013 and estimates an average return on sales rate of 4.4% in 2016, which is especially influenced by DB Fv's high market share of 99%. The average revenue rate was 10.2 EUR Cent per passenger-km (DB 2016c, BNetzA 2017c).

Examples from the market show that due to the low-price level and the high cost level, profitability is rarely achieved by open access operators: during its whole period of operations, InterConnex struggled for profitability and barely

reached break-even (Doll 2014c, Participant A 2017). Shortly before market exit, InterConnex paid high infrastructure costs at a low average ticket price, which led to substantial losses (Schlesiger 2014c, ZDF 2014). This resulted in its market exit (Doll 2014c). HKX also struggled with profitability ever since the start of operations. Originally, HKX planned to reach break-even within two to four years, which was not possible. In 2013 it made a loss of up to 4 million EUR (Döring 2014, Breitingner 2016a). After five months of operations, Locomore filed for insolvency in May 2017. The number of passengers and the average ticket price were not enough to cover the operating costs of 10 million EUR per year. Originally, Locomore planned to make the business profitable within three months and planned a positive EBITA of 44,000 EUR in the first year (Rail Business 2015, Locomore 2017e). In the first 100 days, it transported 70,000 passengers, with average operational costs of 25,000 EUR for a one-way trip between Stuttgart and Berlin (Locomore 2017f, Böll 2017).

The examples show how difficult it is to earn money with open access competition: the high cost structure and the low rate of return remain a great challenge and have a highly negative influence on competition (Participant A 2017, Böll 2017). RUs cannot compete with other industries regarding profitability, “you do not run trains for high returns” (Participant B 2017). Consequently, “the generally low profitability of the industry often led to bloody noses when talking to possible investors” (Participant A 2017). It is expected that higher profitability would lead to easier financing and more competition in the market (Participant B 2017). Examples shows that the operators were mostly not motivated by profitability, but had a great degree of idealism and passion for rail (Participant B 2017, Participant C 2017).

6.2.2.12. Access to financing

Access to financing in the German railway industry is provided for all railway companies. Investment in the rail market is relatively attractive due to its dense network and its central location in Europe. However, a difference between types of transport and ownership of companies can be observed. DB is fully state-owned and therefore backed up by government funds. DB is rated Aa1 at Moody's and AA- at S&P global ratings, which allows it to access capital easily and on good conditions (Monopolkommission 2015, DB 2018a).

For private open access competitors, access to financing is more difficult. The rail investor Henry Posner III. was HKX's main investor. By 2013, 16 million EUR had already been invested in the company. With a passion for the railway industry, Posner actively shaped HKX's strategy and had a long-term-interest in HKX. He describes himself as a "patient investor" (Kirnich 2013, Schlesiger 2014d, NDR 2016). Locomore had substantial problems to obtain financing from banks and institutional investors (Neuhaus 2016). It decided to focus on private investors and started a crowdfunding campaign: more than 700,000 EUR was collected before the start of operations (Locomore 2017b, Participant C 2017). ROSCO SRI also invested in the refurbishment of coaches (Scherer 2016, Participant C 2017). Derschnellzug.de stated that it had found an anonymous main investor who planned to invest 1.25 million EUR. However, due to the uncertainty of rolling stock and paths' availability, the investor withdrew and market entry was cancelled (derschnellzug.de 2016).

Experience shows that investors are interested in supporting open access competition in Germany at first. However, when they investigate the market further, they withdraw their finance. This is due to low profitability, potential

danger of discrimination by the incumbent in a vertically integrated holding structure, and its high market power, and the long-term character of the investment, especially if new rolling stock is acquired (Participant A 2017, Participant C 2017). Another obstacle is that few institutional financiers exist, with most of them being “spoiled” by regional transport: long-term contracts exist which provide more security with steady payment of subsidies (Participant C 2017). Consequently, the acquiring of financing is possible, but it remains a tricky task for open access competitors and it requires creativity. Financing plays a major role for market entry and the lack of willing investors clearly complicates competition and prevents market entry (Monopolkommission 2015, Participant C 2017, Participant B 2017).

6.2.2.13. Cooperation with other transport modes

Cooperation with other transport modes can also take different forms in Germany: most common are cooperation with airlines, coach providers, car and bike sharing systems. DB is trying to build an intermodal mobility network, also cooperating with different intermodal partners (DB 2018a). For example, DB cooperates with ca. 60 airlines to bring airline customers to airports, providing “Rail&Fly” tickets (DB 2018c). After its start of operations, HKX planned to cooperate with coach providers after market liberalisation to expand its network, but such a cooperation never took place, except for the short ticketing cooperation with FlixBus (Preuß 2013, Handelsblatt 2017b). The cooperation between LEO and FlixBus proved to be more beneficial for open access competition: with LEO providing the railway experience and being the operator and FlixBus providing the market experience and the distribution platform. This cooperation saved Locomore after its insolvency and attracted more customers than before (Handelsblatt 2017b, Locomore 2018).

Participant A (2017) states that cooperation with other transport modes only makes sense if an individual network could be created in addition to the existing network. For most competitors, like HKX in its beginnings, cooperation with intermodal players provided little benefits and was associated with much time-consuming work (Participant B 2017). However, the case of FlixBus shows that an effect exists and that under the right conditions, it can be the factor which leads to success.

6.2.2.14. Possibility for cherry-picking

The possibility for cherry-picking in Germany exists if subsidised regional transport is not cannibalised (Schwilling & Bunge 2013). From a commercial viewpoint, cherry-picking is attractive for operators since several highly frequented and profitable lines exist, e.g. between Frankfurt-Berlin, Berlin-Hamburg, Munich-Hamburg, Stuttgart-Frankfurt and Cologne-Frankfurt. The question is where cherry-picking begins and what is considered as a “cherry” (Participant A 2017). Cherry-picking can exist to different degrees: some competitors run a high frequency service and hold high market shares, others only run a limited number of trains per day on “cherry-lines” (Participant B 2017, Participant C 2017). Planned and existing offers already focus on such “cherry-lines”: Locomore ran between Stuttgart-Frankfurt-Berlin, MSM planned to run between Cologne-Frankfurt-Berlin and Cologne-Frankfurt-Hamburg and HKX operated the Cologne-Hamburg line. However, up to now, no competitor does real cherry-picking: InterConnex only ran on secondary lines and HKX and Locomore provided a small number of daily trains without a high market share (Participant B 2017). Overall, open access competition would not be possible in a market like Germany without cherry-picking. The conditions for cherry-picking

exist which enabled some competitors to start (Participant A 2017, Participant B 2017). It also gives them the prospect of upscaling their services in the future. However, cherry-picking mostly implies a problem of capacity since the destinations are often characterised by a high frequency of connections (Participant C 2017).

6.2.2.15. Customers' willingness to pay

Most German rail passengers, especially in leisure travel, are price-sensitive and have a relatively low willingness to pay (DB 2015b, Participant A 2017, Participant C 2017, DB 2018b). BNetzA observes a decreasing price level of mobility from 2014 onwards, after the liberalisation of the coach market. It also finds that ticket prices are a crucial use factor for rail (BNetzA 2017c). DB Fv has an image of being rather expensive, open access competitors use the customers' low willingness to pay as a competitive advantage (Participant A 2017): InterConnex offered prices 50% below the level of DB Fv's standard price (Monopolkommission 2009). HKX and Locomore used the same pricing level, expecting to attract more rail passengers due to their low prices. FlixTrain's prices may also be found in the same pricing range. Like DB Fv, all RUs varied or vary prices depending on the expected occupancy (Przybilla 2012, Schlesiger 2015, Breiting 2016b). Add-ons like upgrades to business class or an unoccupied seat next to the customer's booked seat as seen at HKX proved as difficult to sell (Participant A 2017). Especially before the liberalisation of the coach market, the low-price strategy worked well for open access competitors (Participant A 2017). However, with the market entry of low-cost coach providers in 2013/2014, customers' willingness to pay was further reduced. Participant C (2017) states that "price sensitivity kills customer loyalty" and observes that if another provider offers a cheaper price, a high percentage

of customers will switch. The reduced willingness to pay also influenced DB Fv, which did not increase fares in 2014 and 2015, despite increased cost pressure (DB 2016c). It lowered fares and increased the number of discounted tickets. This made it even harder for open access competitors to compete against the incumbent and the coach operators (Participant A 2017). The customer groups with a higher willingness to pay, often business travellers, set expectations which in most cases only the incumbent could fulfil: for example, they require high flexibility which most open access providers cannot offer due to low frequency and low network coverage. HKX and Locomore also ran on slower paths and could not provide the same travel time as DB Fv can (Handelsblatt 2016a). This leads to the fact that DB Fv covers a wider group with very different willingness to pay and thus has a competitive advantage over the low-cost competitors (Participant B 2017).

Since willingness to pay directly affects the number of passengers and the earnings per ticket, it plays a major role for open access competition (Participant A 2017, Participant B 2017). Before the market entry of coaches, the low willingness to pay was a competitive advantage for open access providers over the relatively expensive incumbent. Since the emergence of cheap intermodal coach competitors and a price reduction in the incumbent's tickets, the customers' low willingness to pay makes it difficult for competitors to stay successful in the market. However, since the consolidation of the coach market and the rise in energy prices, willingness to pay is slowly increasing (DB 2018b).

6.2.2.16. Entrepreneurship

The German case shows that entrepreneurship and the persistence of some investors and entrepreneurs plays a big role in the existence of open access competition. “You have to be crazy in order to offer open access competition,” states Participant A (2017). To enter the market and stay in the market, it is necessary that the managers have a clear vision and are persistent and driven because it is a stony path to success (Participant A 2017, Participant C 2017). A central player in German open access competition is Derek Ladewig, who founded Locomore in 2007. Previously, he worked in mobility and transportation, inter alia for local public transport and the Bundestag. He also initiated HKX together with the investor, Posner, in 2009. He is determined to compete in the market, has a passion for railways and is prepared to take high risks (Neuhaus 2016, Locomore 2017a, Locomore 2017c). The American investor and entrepreneur Henry Posner III is CEO of RDC and started his business in the 1970s in freight rail. HKX is one of his German subsidiaries, and his company also runs a shuttle to the island of Sylt. Posner has an emotional connection to rail transport and is a patient investor. Despite the difficult economic situation of HKX, he stayed in the market for a long time, and was determined to make his investments successful (Schlesiger 2014a, NDR 2016). The two entrepreneurs who planned to enter the market with MSM and *derschnellzug.de*, Niko Maedge and Johannes Zimmer, also have a background in rail and enthusiasm for the product (Wüpper 2013, Maxwill 2015, Xing 2017). It becomes apparent that the entrepreneurs and investors involved mostly have a background in rail, are often strong advocates for rail transport products and show a fascination for rail. This is necessary since the industry is complex and an understanding of railways is necessary to enter the market (Participant B

2017). The entrepreneurs are to some degree idealists who were prepared to take great risks in an otherwise risk-averse market (Participant B 2017, Participant C 2017). Therefore this factor influences open access competition in Germany.

6.2.2.17. Access to rolling stock

The procurement and leasing of long-distance rolling stock in Germany is considered difficult. This has several reasons: firstly, no real market for second-hand coaches and trainsets exists. Secondly, leasing of trainsets and coaches is equally hard due to non-availability of suitable vehicles (Participant A 2017, Participant B 2017, HKX 2013). Thirdly, the procurement of first-hand rolling stock is possible in theory, but heavily dependent on financing (Participant A 2017, Participant C 2017). The procurement and leasing of locomotives is not considered problematical, as the market for locomotives has been liberalised for 15 years (Participant B 2017, Participant C 2017). For years, former DB CEO Mehdorn followed a restrictive rolling stock sales strategy which led to a lack of suitable second-hand vehicles on the market (Breitinger 2016a, Participant C 2017). Today, DB's strategy has changed, but due to DB Fv's own shortage of rolling stock, only a limited number of vehicles are being sold (Busse & Kuhr 2013, DB 2017c).

Despite the difficulties, all open access providers used and use second-hand rolling stock (Participant A 2017): in 2002, InterConnex started by using second-hand DMUs equipped for regional transport from a Transdev subsidiary. For later expansion, it bought 25 second-hand coaches, originally owned by DB (Participant A 2017). In 2009, HKX bought old ÖBB-coaches that were originally procured by the Reichsbahn in the 1970s. Originally, HKX planned to start

operations in 2010, but the coaches needed technical alterations and comprehensive refurbishment, which, among other factors, lead to a delay in market entry (HKX 2014b, Schlesiger 2014d, Participant A 2017). HKX decided to lease second-hand coaches from several partners like Nord-Ostsee-Bahn and BahnTouristikExpress (HKX 2015). Derschnellzug.de also planned to rent coaches, however, due to the leasing company's need to use the coaches for its own services, no agreement could be achieved (derschnellzug.de 2016). In 2016, Locomore leased its coaches from SRI investment corporation. SRI bought the old DB-coaches in the Netherlands which were fully refurbished in Romania. Due to delays, it had to rent some non-refurbished coaches to run the services after market entry (Briginshaw 2016, Breitingner 2016a). In comparison to the open access competitors, DB Fv procures new rolling stock, which ties up great amounts of capital (40.8 million EUR for ICE 4 trains, 17 million EUR for Intercity trains) (Handelsblatt 2013, Focus 2016, Doll 2016a). Locomore considered buying new rolling stock from Siemens, but the plan failed due to insufficient financing (Participant C 2017).

Overall, the access to rolling stock has a high influence on the existence of competition (Participant A 2017, Participant B 2017), it is even considered as the main influencing factor by Participant C (2017). The history of open access competitors shows that the search for suitable rolling stock took a long time and was difficult. The prices for procuring new and second-hand rolling stock were considered as particularly frightening for investors (Participant A 2017). A chance for new competitors could therefore occur if current operators in Germany or central Europe leave the market and sell the rolling stock at moderate prices (Participant A 2017).

6.2.2.18. Homologation process

In theory, a homologation decision or vehicle authorisation must be made by the EBA within four months of the submission of all required documents (EBA 2016). In practice, however, the vehicle authorisation in Germany is considered as one of the most complicated in Europe. It is often described as slow with too little staff to examine and process application and rules that are too strict. Also, no satisfying communication existed between the EBA and RUs in the past. The status was even considered as a “homologation crisis”, since it posed problems for market entry and was considered a serious bottleneck for incumbent and competitors (Monopolkommission 2011, Siedenbiedel 2013, Doll 2014b, Participant A 2017). After several complaints, the regulation was improved: in 2012 serial approval of rolling stock was allowed; in 2013 a memorandum of understanding was signed which allowed selected private inspection bodies to support the EBA which allowed it to focus on the core parts; in 2015 the “rail TÜV”, came into action (EBA 2013b, Doll 2014b, BMVI 2014b). In 2009, HKX bought second-hand rolling stock from ÖBB and planned to start operations in 2010. However, since the technical changes were too comprehensive and problems with the partner occurred, an attempt to homologate the coaches during this time failed (Participant A 2017, Participant B 2017). In 2014, the modernised coaches were finally homologated within the new “rail TÜV” process and HKX was satisfied with the cooperation of the EBA (Schlesiger 2014d, HKX 2014b, Participant C 2017).

The vehicle authorisation has improved significantly since 2012 (Participant A 2017, Participant B 2017). However, the “homologation crisis” had long-term consequences and still frightens investors (Participant A 2017). It is not the

process itself that is considered critical for market entry, but the effort associated with homologation/authorisation and the preparation for it (Participant B 2017). It only plays an indirect role in Germany and it poses equal challenges to both incumbent and competitors (Participant C 2017).

6.2.2.19. Incumbent's performance

Due to its size and market power, the performance of the incumbent plays a big role in Germany. DB Fv was only founded in 1994, but it has a longer history: when Reichsbahn and Bundesbahn were merged in 1994, their assets, image and staff were taken over, with some of them still working for the company (Schwilling & Bunge 2013). DB Fv is a large company which serves the existing market with more than 99% market share, operating a dense network with a high frequency of trains (Monopolkommission 2015). In 2017, DB Fv transported 142 million passengers and obtained a total of 40 billion passenger kilometres (DB 2018a). This makes it difficult for competitors to enter the market on a large scale. InterConnex's CEO Schreyer says that profitable operations were not possible on other lines of the network, since DB's network was too dense (Smith 2015). Some consider DB Fv as "too big to compete with", since the sheer size of the company deters investors, regardless of actual discrimination (Participant C 2017). In 2015, DB Fv further announced expansion into rural areas by connecting more cities and offering a higher frequency. Thus, it plans to operate 160 million train kilometres in 2030 on 135 million train kilometres today (DB Fv 2016). DB Fv has a strong market position and is among the leading RUs in Europe. The company adapts relatively well to changes: regarding intermodal competition it adapted its pricing system to be more competitive against air transport, and it further adapted its pricing level and special offers to compete with coaches (Heuermann & Delfmann 2009,

Participant B 2017). It also covers a relatively wide portfolio of customers which is a competitive advantage over open access providers since they mostly attract price-sensitive customers (DB 2016b, Participant B 2017). Still, DB Fv has a slightly negative image for being late and overpriced, which is not the case for competitors (Przybilla 2012, Maxwill 2015, Zimmermann 2016). This results in relatively low customer loyalty and a possible switching of customers to competitors (Participant A 2017, Participant B 2017).

Despite DB Fv's size, the history shows no significant discrimination of DB Fv against competitors (Participant A 2017): when InterConnex entered the market in 2002, DB refused to include the competitor in the timetable information system. After a court decision, it was forced to do so and implemented InterConnex's connections (Handelsblatt 2003, Participant A 2017). In 2012, when HKX entered the market, DB Fv decided to set refurbished IC-coaches on the Hamburg-Rhine/Ruhr-Stuttgart line to provide better quality and to differentiate itself from the competitor (Wäschenbach 2012, Rünker 2012). In 2015, when HKX expended its lines to Frankfurt, more discounted DB Fv tickets were available on the internet (Pieren 2015). But when InterConnex, HKX and Locomore started operations, no price war could be observed, as had been the case in the Czech Republic and Austria (Participant A 2017, Participant C 2017). Participant C (2017) states that as long as competitors in the market are on a small scale, little is done against them. The case of coach competitors, however, shows that as soon as competition endangers DB Fv, it is able to react to competitive threats.

As shown above, at the level of DB holding, more incidents and law suits appeared: e.g. the increased station prices of DB Station & Service on the

Hamburg-Cologne line when HKX entered the market, the traction pricing discount system of DB Energy, and the unbalanced distribution conditions between DB Vertrieb and private regional RUs. All in all, it becomes apparent that DB Fv as part of DB holding has the power to discriminate against competitors, but has rarely used it in the past and is considered a fair market player (Participant A 2017, Participant B 2017). However, the sheer potential to discriminate against entrants has an effect on competition, e.g. by deterring potential investors (Participant A 2017, Participant C 2017). The image of being unpunctual, providing bad quality and being too expensive helped competitors in the past to gain more customers since the customers' willingness to switch was high (Participant A 2017, Participant B 2017). The biggest influence on open access competition is the size and the strong market penetration which DB Fv possesses: this makes it hard for competitors to find free attractive train paths and profitable lines (Participant C 2017).

6.2.3. Characterising the correlation of factors influencing the German case

In the German case, the most significant correlation of influencing factors regarding open access competition is “intermodal competition” with “customers' willingness to pay” and “low profitability in the industry”. With the liberalisation of the coach market, fierce competition and the resulting, extensive offer of low-price tickets, the customers' overall willingness to pay for mobility services fell drastically. This forced incumbent and competitors to reduce their prices and lowered their profitability with the consequence that InterConnex left the market, Locomore went bankrupt, and HKX is run by FlixBus.

Another strong correlation applies between “availability of financing” and “availability of rolling stock”, in connection with “availability of attractive train paths”. The guaranteed access to available train paths over a longer period is in most cases the pre-condition to attract investors and obtain access to the necessary financing in Germany. Without the existence of sufficient funds, no rolling stock can be bought since leasing of rolling stock is not easily possible.

The influencing factors “law in the books”, “law in action” and “incumbent’s performance” are also connected. After the Bahnreform in 1994, the applicable law in the books was implemented relatively quickly and the necessary institutions were established to prevent discrimination against market competitors. This led to the situation that DB Fv and DB holding in general caused no major discrimination against competitors as seen in other countries. The few cases were processed by institutions and taken to court.

The relatively high “costs for infrastructure” in Germany are also connected to the “low profitability in the industry”. This leads to a high cost basis, which the operators have to consider in economic terms. Consequently, the economic risk of entering the market is higher.

6.2.4. Characterising the shift of factors influencing the German case

The most significant shift in influencing factors is “intermodal competition”. Before coach market liberalisation in 2013, apart from cars, intermodal competition only had a modest influence on open access competition. With the entry of several new competitors that introduced services on many lines nationwide, the factor influenced open access competition negatively. The case of InterConnex and HKX proves this, it even had an influence on the profitability of the incumbent. The takeover of Locomore and HKX demonstrates the market

power of the coach competitors and also opens possibilities for future competitors to cooperate with these market players.

With the introduction of coach competition, “customers’ willingness to pay” also changed. Within a few years, average ticket prices fell, especially for the small competitors which needed to compete with the coach competitors directly. This factor had a slightly positive influence before the liberalisation of the coach market, since the competitors offered cheaper prices than the incumbent and could therefore attract price-sensitive customers. With the market opening, the price-sensitive customers used coach services and the open access competitors struggled with profitability to meet the customers’ price expectations. Therefore, this factor influenced open access competitors negatively.

“Homologation” also changed over the years and the influence of this factor on open access competition improved. In the past, it was difficult and time-consuming to homologate new or refurbished rolling stock. With the new law in the books and in action, the homologation process sped up and it is now easier for competitors to homologate rolling stock. Therefore, the influencing factor shifted from the negative side to neutral and seems not to be a major entry barrier.

The factor “access to distribution system” also changed over recent years. DB Vertrieb still does not allow any operator in the long-distance passenger rail to enter its distribution system. However, technological possibilities and the wide spread of smartphones made it easier for competitors to create their own distribution system. The advantage of those new distribution channels is that they are often cheaper than the system which the incumbent provides. The

case of FlixBus also shows the impact a partnership or a merger with a company which has a functioning distribution system can have. Therefore this influencing factor shifted from negative to slightly positive.

6.3. Competition between equal and unequal players: the Italian case

The Italian case is of high interest, since big changes took place in the last 15 years, especially with the opening of the high-speed lines. With the separation of infrastructure and operations in 2000, the starting point for market liberalisation was set and open access competition has been allowed since 2003 for purely commercial services. At the beginning, companies trying to establish niche services entered the market. In 2012 the first European high-speed rail competitor started operations (Bergantino 2015). The following section presents the Italian case, revealing how open access competition developed over time and which interactions exist with the incumbent, politicians, authorities and other players. Firstly, a description of the case context is given to introduce the case. In the main part, the influencing factors on Italian competition are described, as well as their mutual correlation and their shift over time.

6.3.1. Setting the Italian case in context

While implementing EU regulations into national law, full open access was permitted from 2003 onwards for all licenced long-distance passenger rail operators, but only for purely commercial services such as on the high-speed network. This formed the basis for the existence of open access competition in Italy, together with the separation of IM RFI and the incumbent TI in 2000. However, it took several years to establish the necessary institutions and bodies to monitor and control the rail market. With the market entry of NTV, a shift

within the country took place and conditions for competitors were improved. The key market players in the Italian case are described below:

The incumbent Trenitalia S.p.A was founded in 2000 with the implementation of the EU regulation into national law, together with the separation of rail infrastructure and operations. TI is part of FSI holding and focuses on providing regional, long-distance passenger and freight rail. It operates more than 150 electric trains in the long-distance passenger sector, as well as more than 1,000 locomotives and 5,000 coaches in overall passenger rail use (FSI 2018b). In conventional long-distance rail, TI has a market share of almost 100%, however it lost a market share of around 35% in the high-speed sector after the entry of NTV (Desmaris 2016, FSI 2017a, NTV 2018b).

Company profile TI 2017	
CEO	Orazio Iacono
Daily trains	387*
Employees	> 27,000
Passenger km	16,303 million**
Revenue	2,506 million EUR**
EBIT	224 million EUR**

* only high-speed and subsidised intercity connections

** only for long-distance passenger connections

Table 30: Company profile of TI (FSI 2018a, FSI 2018b)

In December 2009, a cooperation between DB Fv and ÖBB Pv started operations on the Munich-Verona/Milan/Venice route, offering up to five daily train pairs. Previously, the line was run by a cooperation between DB/ÖBB and TI. After December 2009, the Italian company LeNord acted as service operator on Italian territory. The rolling stock consisted of ÖBB Pv's railjet coaches (Doll & Tauber 2010, Warnecke & Götz 2012).

TI's first national competitor, Arenaways, was founded in 2006 by Guiseppe Arena, a former employee of TI. The company started by offering tourist charter trains and freight business. Later, it was the first company to enter the long-

distance passenger rail market in competition to TI (Bayer 2013). Arenaways operated two daily train pairs on the Turin-Milan line between November 2010 and July 2011, when the company declared bankruptcy (Speciale 2011, Warnecke & Götz 2012). While an overall estimated 32,000 people travel daily between Turin and Milan, Arenaways transported an average of 50-60 passengers (Speciale 2011). Arenaways operated with locomotives and new coaches which involved investment of 50 million EUR (Warnecke & Götz 2012).

NTV was founded in 2006 by four influential Italian industrialists (Bayer 2013). In 2012, it started high-speed operations on the Rome-Milan, Rome-Turin and Rome-Venice lines with several daily train pairs (Warnecke 2014). NTV gradually expanded its business and increased the number of daily connections and lines (Bergantino 2015). NTV is expected to have a market share of 35% of the overall high-speed market (NTV 2018b). In 2015, NTV reached break-even for the first time, in the first two years NTV had made losses of 156 million EUR (Day 2014, Giuricin 2016). In 2017, NTV transported 12.8 million passengers with an EBITDA of 156 million EUR (NTV 2018a).

6.3.2. Characterisation of individual factors influencing the Italian case

This section outlines the influencing factors in Italy and how they shaped open access competition since 2003, giving many examples from all market players observed. To give an overview, the following illustration summarises the analysed data and shows the strength of each identified influencing factor:

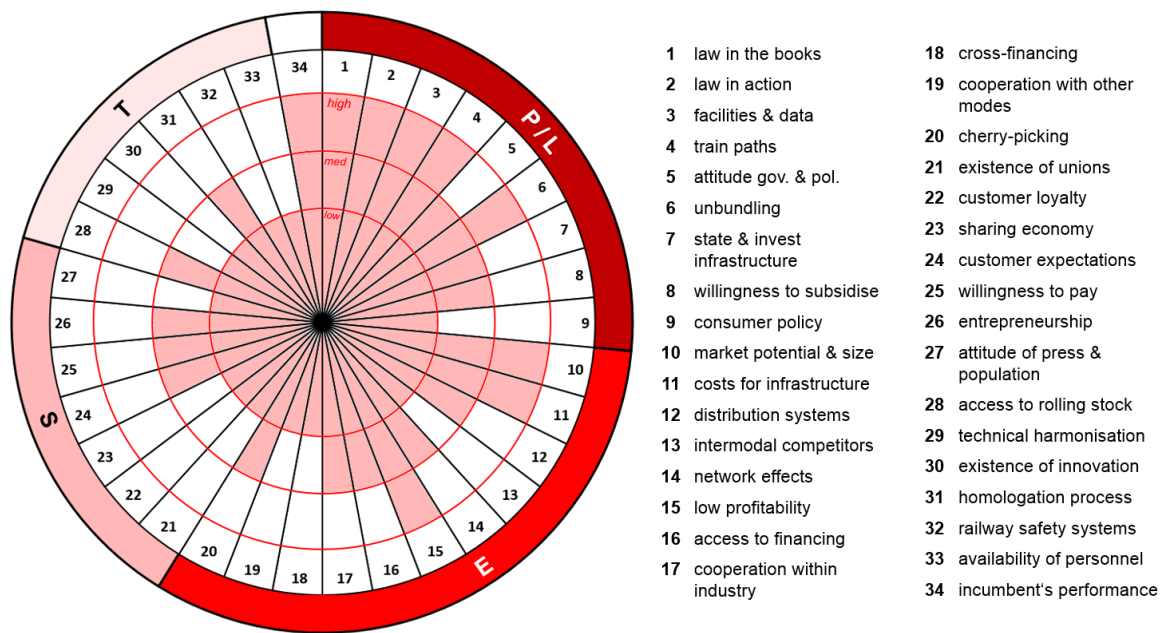


Illustration 19: Overview of influencing factors in the Italian case (author's own diagram)

Table 31 below lists the key findings for all influencing factors. The factors identified as important for the case will be discussed in more detail in the following section.

	No	Influencing factor	Strength	Key findings
Political & legal	1	Existing EU and national law in the books	High	<ul style="list-style-type: none"> Open access arrangements exist since 2003 Competitors can access without legal barriers when subsidised lines are not cannibalised
	2	Existing law in action	High	<ul style="list-style-type: none"> Setting-up of independent bodies and institutions took over 10 years, which made discrimination possible With independent regulator in place since 2012, great improvements took place for competitors
	3	Access to facilities as well as data	High	<ul style="list-style-type: none"> Gaps in regulation made discrimination possible Improvement of access to facilities over time, especially with implementation of the Autorità di Regolazione dei Trasporti ("ART")
	4	Access to and availability of attractive train paths	High	<ul style="list-style-type: none"> Cases of discrimination existed in the past, especially with regards to denial of cabotage Today, the high-speed network is easily accessed, access to the conventional network is more difficult
	5	Facilitation and attitude of government and politicians	Medium	<ul style="list-style-type: none"> Attitude towards competition was ambivalent and mostly pessimistic However, lobbying is possible with the right network and helps especially the national competitors
	6	Unbundling	High	<ul style="list-style-type: none"> With the necessary institutions not yet in place, the incumbent discriminated against competitors Improvements since the ART is fully set up
	7	State of and investment in infrastructure	Medium	<ul style="list-style-type: none"> The investment is below average in EU comparison However, large sums were invested into the new high-speed infrastructure, which triggered NTV's market entry

	8	Willingness or ability to subsidise operations in the country	Medium	<ul style="list-style-type: none"> • 40% of TI's revenues come from subsidised services • Competition on the subsidised network is only possible in niches • On the high-speed network, subsidies have no influence
	9	Consumer policy	Low	<ul style="list-style-type: none"> • All legal requirements are implemented • A level playing field for all RUs is given
Economic	10	Market potential and market size	High	<ul style="list-style-type: none"> • High variations exist due to Italy's polycentric structure • TI dominates the market, but additional potential exists on the high-speed network • Only little potential exists on the conventional network
	11	Costs for infrastructure	High	<ul style="list-style-type: none"> • RACs are in a medium range in the EU • RACs on the high-speed network were reduced by over 35% which benefited incumbent and competitor
	12	Access to distribution systems	Medium	<ul style="list-style-type: none"> • No general access to TI's distribution system is given • To succeed, the setting up of a new distribution system is necessary to sell tickets, if TI refuses to cooperate
	13	Presence of intermodal competitors	Low	<ul style="list-style-type: none"> • Cars are the biggest intermodal competitor in Italy, followed by air and coach transport • High-speed competition led to a switch from car and plane to train • Coach market liberalisation in 2014 had only little effect
	14	Existence of network effects for incumbents	Medium	<ul style="list-style-type: none"> • Network effects greatly vary: no significant effects in high-speed rail, higher effects in conventional rail • NTV generates network effects by adding bus connections, DB/ÖBB by partnering with TI
	15	Generally low profitability of the industry	High	<ul style="list-style-type: none"> • Difficult to earn profits, for TI and competitors likewise • The strength of the factor is related to the financial resources of the competitor: NTV was saved due to an internal restructuring of debts, Arenaways went bankrupt
	16	Access to financing	Medium	<ul style="list-style-type: none"> • As a state-owned company, the access to financing is relatively easy for the incumbent • For entrants it is difficult to acquire financing, it is only possible with strong entrepreneurs
	17	Existence of cooperation or coopetition within the industry	Medium	<ul style="list-style-type: none"> • Cooperation within the industry plays a role, but it depends on the individual case how big the influence is • DB/ÖBB's is dependent on the cooperation with TI
	18	Cross-financing of RUs in the market and a lack of transparency	Low	<ul style="list-style-type: none"> • The accounting systems of RFI and TI are separated, and the cross-subsidising of public funds is prohibited • Cross-subsidising cannot be entirely ruled out, but no ruinous price war took place in the past
	19	Existence of cooperation with other transport modes	Low	<ul style="list-style-type: none"> • TI and competitors cooperate with intermodal partners • The factor is expected to improve the business case, however no great influence can be observed
	20	Possibility for cherry-picking in the market	Medium	<ul style="list-style-type: none"> • Cherry-picking is allowed on the high-speed network • It is difficult on the PSO network as the case of the forbidden intermediate stops of Arenaways shows • It highly influences the profitability of the competitors and competitors mainly entered cherry lines
Social	21	Existence of (strong) unions	Low	<ul style="list-style-type: none"> • Italy has more trade unionists than any other EU country • Due to the high number of strikes in Italy, unions have an influence on long-distance passenger rail • Equal conditions apply and no discrimination takes place
	22	Customer loyalty	Low	<ul style="list-style-type: none"> • Customer loyalty is relatively low in Italy, which is a chance for competition • TI as well as competitors provide loyalty programs
	23	Sharing economy	Low	<ul style="list-style-type: none"> • The sharing economy is developing fast in Italy • However, especially in high-speed rail it has no influence now but might change in the future

	24	Adjustment to customer expectation	Medium	<ul style="list-style-type: none"> • Adjustments to customer expectations plays a role, however premium prices cannot be charged • The adjustment of TI to changed customer expectations had a great influence on NTV and its profitability
	25	Customers' willingness to pay	Medium	<ul style="list-style-type: none"> • Customers' willingness to pay is not especially high, but customer groups with higher willingness to pay exist • NTV's strategy to offer premium quality for higher prices failed and resulted in lower overall prices
	26	Entrepreneurship	Medium	<ul style="list-style-type: none"> • Entrepreneurship plays an important role, especially before and during market entry • Entrepreneurs often have an emotional connection to rail and are prepared to take high risks
	27	Attitude of press and population toward competition	Low	<ul style="list-style-type: none"> • The population wishes for diversification and improvement of quality, therefore an open and positive attitude towards competition exists • However, the influence on competition remains low
Technical	28	Access to rolling stock	Medium	<ul style="list-style-type: none"> • Access to new rolling stock was given to all competitors with the necessary financial resources • Access to second-hand rolling stock is hardly given
	29	Lack of technical harmonisation within the EU	Low	<ul style="list-style-type: none"> • Lacking harmonisation mainly influences cross-border competition and had no big influence in the past
	30	Existence of innovation	Low	<ul style="list-style-type: none"> • Innovation, e.g. in service and ticketing can make a difference, but has no big influence
	31	Homologation process	Medium	<ul style="list-style-type: none"> • Italian National Railway Safety Agency ("ANSF") awards homologations and the process is considered complex • Recent improvements took place due to clearer guidelines and less uncertainties
	32	Railway safety systems	Low	<ul style="list-style-type: none"> • The safety system is based on EU requirements, ANSF is responsible for national railway safety • It is considered complex and complicated, however no difference between competitor and incumbent exists
	33	Availability of necessary personnel	Low	<ul style="list-style-type: none"> • Due to the currently high unemployment rate of young people, necessary personnel is given
Other	34	Incumbent's performance	High	<ul style="list-style-type: none"> • TI has the power to discriminate against competitors and did so in the past, causing the bankruptcy of Arenaways • After NTV's announcement to enter the market, TI changed to a modern and attractive transport provider

Table 31: Key findings of the Italian case (author's own diagram)

6.3.2.1. Law in the books and law in action

Initially, the Railway Reforms in Italy started at a slow pace in the 1980s and it took many years to create law in the books that promoted open access competition. In 1998, however, a big step was taken with the vertical legal separation of the IM RFI and the RU TI, united under FSI holding, thereby satisfying the EU demand for market opening, starting with Directive 91/440/EEC. In 2000, the development gained speed which resulted in law 388/2000. With this law, Italian law in the books went further than the EU

requirements. Decreto Legislativo n. 188/2003, implementing Directive 2001/12/CE, 2001/13/CE and 2001/14/CE into Italian law, strengthened liberalisation further. “According to the degree, any authorised rail company can have access to the national RFI rail network and operate both open-access or contracted services” (Beria & Grimaldi 2017, p. 144 f.). International open access passenger services, including cabotage, are fully permitted since 2012 (Bayer 2013, OECD 2013, Desmaris 2016, Beria & Grimaldi 2017).

Despite the liberal law in the books, the government retained regulatory responsibility for railway companies. The Italian regulatory body was an office of the Ministry of Infrastructure and Transport (“MIT”), fulfilling Directive 14/2001. In 2012, an independent regulator, the ART, was set up by article 36 of Law 27/2012, modifying Law 2001/2011. This was an important step since the authority was entrusted with the tasks of regulating rail’s infrastructure access conditions, imposing sanctions, carrying out investigations and audits, and defining the scope and obligations of PSOs and contract designs (OECD 2013).

Regarding competition, the independence and strength of authorities and institutions plays a big role. Therefore this factor has a strong influence on open access competition (Participant F 2017). Despite being one of the pioneers providing legal possibilities for open access, the European directives were implemented slowly and with delays: despite showing an average delay of implementation into national law in European comparison, Italy and France show the highest number of infringements for non-conformity and incorrect application. This has resulted in negative consequences for competitors so far (OECD 2013, EC 2014b). What remains difficult is the incompleteness of the current regulatory framework with clear advantages for the incumbent TI,

especially the lack of clear identification of PSO, which makes it difficult for competitors to enter (OECD 2013, Participant D 2017). The case of Arenaways shows that when institutions and authorities are not designed strongly enough in law, they cannot protect competition (Participant F 2017).

The formal liberalisation and the adaptation of European directives in law in action in Italy took a long time and was delayed compared to other European countries. The law in the books showed some gaps which made it possible for FSI to discriminate against operators, especially in the first years of competition (OECD 2013, Participant E 2017). One reason for that was that an office at the MIT, the Italian Railway Service Regulatory Office (“URSF”), had the role of independent regulator, but lacked de facto independence and power. Decisions were often made consensually and in a less competition-oriented way. Even if the ART was set up legally in 2012, it only started operating in January 2014 and took over the main tasks of URSF (ART 2014, Participant D 2017, Desmaris & Croccolo 2018). Faiola (2013b) stated that “[p]art of the problem [...] is that Italy opened its train market well before establishing a fully independent transit regulator – something that only happened this summer”. The lacking strength of the independent regulator caused discrimination against competitors. Based on false and misleading statements of RFI and TI, URSF forbade cabotage on the Milan-Turin line by Arenaways. It also forbade cabotage by DB/ÖBB on the Italian network for some time. This resulted in economic difficulties for both competitors, and Arenaways went bankrupt. Italy’s Competition and Market Guarantee Authority (“Agcom”) investigated the case and found RFI and TI guilty of discrimination against Arenaways. This shows that Agcom has great power to intervene in case of complaints, which also happened after the market entry of NTV (Doll & Taber 2010, Chiandoni 2012,

Beria et al. 2012). The issuing of Arenaways' and NTV's licences was also delayed which complicated the competitors' timelines (Bayer 2013).

Gaps in the existing law in the books make it difficult for law in action to act, since procedures and official statements are not always clear. For example, capacity management is not regulated and TI can actively use this gap to delay competition as examples described below will show. "The Italian experience shows that the implementation of vertical separation requires considerable political will for it to be effective and start generating any benefits" (OECD 2013, p. 28). However, law in action has come a long way since the start of market liberalisation and many improvements took place in recent years, especially after the market entry of the first competitors (Participant D 2017). For Arenaways, it was too early to enter the market, law in action was not ready for competition (Participant E 2017). However, with NTV running for several years now, law in action has become better, stronger and more effective. This shows the importance of a rapid and comprehensive implementation of law in the books.

6.3.2.2. Access to facilities and data as well as attractive train paths

Access to facilities and necessary data exists in Italy, and is also monitored by the ART. However, access to stations cannot fully be controlled. Especially in the early days before the setting up of ART, FSI used the existing gaps in the regulation to discriminate against competitors: in the early period of operations, DB/ÖBB was not allowed to stop at Milan and Bologna central stations. The usage of storage facilities was also unclear for a long time. After the start of the company's operations, facilities like energy, clearing, etc. were optimised and the quality of the service improved over the years (Doll & Tauber 2010,

Participant D 2017). Like DB/ÖBB, NTV was not allowed to stop in some central stations, such as Rome or Milan, and had to stop at secondary stations that made the service less attractive. This resulted in financial losses, since especially commuters and business travellers did not use the services due to the journey taking longer. In addition, access to NTV's customer centre in Rome Ostiense was blocked by a wall, two weeks before the start of operations, built by a FSI subsidiary with the reason to provide safety. When NTV wanted to start operations on the Milan-Rimini-Ancona line, NTV could not stop in Rimini station, since the station was not suited to this type of train. RFI refused to adapt the station, NTV wanted to adapt the platform itself but this was not allowed. Consequently, the start was delayed (Faiola 2013a, Day 2014, Participant D 2017, Participant F 2017). The examples show that access to facilities, especially stations, was difficult in the past and influenced open access competition negatively. Additional difficulties existed in the early days of competition, since gaps in the law existed which left leeway for FSI and resulted in uncertainties in the business relations between competitors and FSI. Since then and with practice in dealing with competition, the situation improved (Participant D 2017, Participant E 2017, Participant F 2017). Regarding data, no significant problem for open access competitors exists; however, no open access to all data is provided and, if provided, the information is mainly in Italian.

In Italy, access to and availability of attractive train paths exists and today is relatively free of discrimination. The process is based on an agreement with RFI and RFI accommodates paths with each company individually. Especially on the unmixed high-speed infrastructure, where most of the competition takes place, capacity exists for incumbent and competitor (RFI 2016, Participant E

2017). In conventional long-distance passenger rail, attractive train paths cannot be accessed as easily, since regional and subsidised long-distance passenger rail lines are highly frequented at attractive times. A drawback of the Italian system is that it is not transparent and no general overview of vacant train slots exists (RFI 2016). What has been beneficial for competitors in the past is that it is possible to sign framework agreements with the IM to secure train paths for a longer period. The general length of the framework agreements is five years, but in special cases it can be longer or shorter (RFI 2016). NTV negotiated a long-term framework agreement with RFI to provide security for the business plan and for its investors (Participant C 2017).

The following examples show that especially in the first years of competition, discrimination-free access to attractive train paths did not always exist: one example is provided by dealings with DB/ÖBB, as described above. The company applied for fast train paths with ideal connections into the Italian network, which was rejected by RFI since TI wanted to use the paths, but never did. The paths that DB/ÖBB were granted, missed the connections into the network by some minutes at each stop. For some months, no intermediate stops were allowed on the line, since TI claimed that subsidised regional transport was harmed. A complaint to the EC in Brussels finally resolved the matter and intermediate stops were possible (Doll & Tauber 2010, Warnecke & Götz 2012, Participant D 2017). Another example of discrimination affected Arenaways, which finally resulted in law suits: Arenaways' application for paths was delayed for a total of 18 months by RFI, resulting in delayed market entry. The company also received slow paths, it is possible to run the OD in 1:35 hour, but it took Arenaways 2 hours. RFI was fined 100,000 EUR by Agcom. URSF also banned Arenaways from having intermediate stops on the line, because

operations would harm the subsidised traffic of TI on the line. TI was fined 200,000 EUR by Agcom since it gave false and misleading information to URSF (Chiandoni 2012, Warnecke & Götz 2012, EC 2012, Boitani & Ramella 2012). Before the start of NTV's operations, the infrastructure usage conditions changed at the beginning of 2011, so that NTV received its safety certificates in August instead of November, as originally agreed (Warnecke & Götz 2012). At the beginning of its history, it was also difficult for NTV to negotiate attractive train paths, especially in combination with attractive stations. RFI stated that this was due to overcrowding. After an investigation by Agcom in 2013, RFI pledged to make it easier for NTV to negotiate attractive time slots (Faiola 2013b, Bergantino et al. 2015).

Overall, it can be said that good access to attractive train paths exists now, but it was not so easy in the first years of competition, despite the possibility of negotiating long-term framework agreements (Participant D 2017, Participant F 2017). It is a factor influencing open access competition and a risk especially for new, inexperienced competitors, since the process is complicated and time-consuming (Participant E 2017). For Arenaways, the difficulty in accessing attractive train paths was the main factor in its insolvency.

6.3.2.3. Facilitation and attitude of government and politicians

The attitude of government and Italian politicians towards competition has been ambivalent and mostly pessimistic. However, no universal attitude or opinion exists (Day 2014, Participant D 2017, Participant E 2017). With the implementation of the Railway Packages which was necessary back in the 2000s, the government chose a conservative approach and implemented a minimum standard, leaving gaps. Since TI was part of FSI and therefore

government owned, it was favoured (Participant D 2017, Participant E 2017). In the early days of competition, NTV in particular publicly complained about the scepticism and lack of support from the Italian government. The scepticism was also caused by the participation of SNCF in NTV. Since then, the economic situation and the government have changed and politicians are more open towards competition (Bayer 2013, Participant D 2017). What was helpful for NTV was the executives' good networking with politicians: they used this factor to raise objections when NTV felt disadvantaged. This made the reduction of high-speed infrastructure fees possible. It was not possible for Arenaways which did not have such a prominent position and a high level political network (Participant F 2017). All in all, the attitude of government and politicians towards competition has no significant influence, but it can play an important role in individual cases and situations, as shown by NTV (Participant F 2017). However, Italian companies like NTV are more protected than competitors from other countries (Participant E 2017).

6.3.2.4. Unbundling

In Italy, unbundling exists in the form of vertical separation to some degree: rail infrastructure and operations are vertically separated and operated by different companies, united under one holding. Chinese walls are in place to prevent discriminatory behaviour. Compared to Germany, no horizontal separation exists since TI offers long-distance, regional passenger and freight trains (OECD 2013). As the examples show, competition was discriminated against in the past due to the organisational closeness of RFI and TI, especially when the ART was not fully in place (Faiola 2013b). In early days, the situation for RFI and TI was new and no clear separation existed, e.g. in terms of path priority.

This has improved over time, too (Participant D 2017). Some years ago, the Italian government considered the full privatisation of TI. In the process of unbundling, however, problems occurred, especially with the mixing of asset ownership and future access to funds. Currently, the discussion of full privatisation has been put off, but the government is still considering the privatisation of the profitable high-speed network (Participant E 2017). This factor clearly influenced open access competition negatively in the past, the best example is Arenaways, which went bankrupt as a direct consequence of discrimination. Currently, especially due to setting up the ART, the situation has improved significantly for competitors (Participant D 2017, Participant F 2017).

6.3.2.5. State of and investment in infrastructure

Between 2008 and 2015, Italy invested an average of 87 EUR per inhabitant in the rail infrastructure, with peaks in 2009 (104 EUR) and 2011 (112 EUR), which puts Italy below average in a European comparison (Allianz pro Schiene 2016a). EC ranks the overall quality of railway infrastructure 15th of 26, slightly below the European average (EC 2017e). Analysing the Italian investment in infrastructure between 2004 and 2014, it becomes apparent that in most years, Italy invests more into rail than in road infrastructure. But for the whole period, 71 billion EUR were invested in rail and 81 billion EUR were invested in road infrastructure (OECD 2017). Back in the 1990s, the Italian government decided to invest over 50 billion EUR into rail infrastructure, especially in the high-speed sector. The first high-speed lines were launched in 1992 between Rome and Florence, the “new generation” high-speed lines were launched after 2005, e.g. Rome-Naples and Milan-Bologna. Milan-Turin and Bologna-Florence were completed in 2009 and since 2010, the backbone of the Italian high-speed rail

network has operated. Additional lines are planned (Cascetta & Coppola 2014, Desmaris 2016, Beria et al. 2016b, Participant E 2017).

For open access competition, the fast and attractive infrastructure between main metropolises allows entrants access to a big market. Since the traffic is “unmixed”, no slow regional and freight transport blocks capacity and reduces speed (Participant D 2017). NTV entered the market by using the new high-speed network, building its concept around fast connections and customers in the big urban centres. This factor had a major influence on NTV. The increased speed and capacity might even have been a precondition for NTV to be successful. For Arenaways and DB/ÖBB, the state of and investment in infrastructure did not play a submental role (Participant D 2017, Participant E 2017, Participant F 2017). The planned investments in the conventional rail network in the next few years, however, might benefit additional competitors (Participant E 2017).

6.3.2.6. Willingness or ability to subsidise operations

The Italian state is willing to subsidise long-distance passenger rail. With an overall revenue of 5,139 million EUR in 2017, almost 40% of TI's revenues are subsidies (FSI 2018b). This clearly shows that a general willingness and ability to subsidise operations exists, despite the difficult economic situation in Italy. Currently, the subsidised Intercity network of TI includes around 108 daily trains, reaches more than 200 cities and carries ca. 12 million travellers each year. From 2017 until 2026, a new service contract had been awarded to TI, involving an investment of 300 million EUR into modernisation and new rolling stock. TI will receive around 350 million EUR in subsidies per annum to operate the Intercity network. The new contract has a stronger quality focus than the old

one and TI is supposed to increase passenger figures (FSI 2017c, Participant E 2017, Barrow 2017). The willingness and ability to pay subsidies influence competition differently: due to the high frequency of trains and possibility to offer cheap tickets due to subsidies, it is almost impossible for new RUs to challenge TI on the Intercity network, especially since RFI can forbid it due to cannibalisation, as seen in the past (Participant E 2017). Arenaways tried to compete with subsidised traffic and failed (Participant F 2017). After struggling in the past, DB/ÖBB found its niche. The high-speed network, however, receives no subsidies and therefore, NTV officially has no disadvantage against TI with cross-financing being formally prohibited (Beria et al. 2012, Participant D 2017). Therefore it can be stated that the payment of subsidies has no major influence on open access competition in the high-speed sector, but it clearly prevents competition in the Intercity sector (Participant D 2017, Participant E 2017, Participant F 2017).

6.3.2.7. Market potential and market size

The market potential for long-distance passenger rail in Italy is high and a positive market environment exists, especially in the high-speed sector. Still, there is a variation between different regions in Italy, especially due to its polycentric structure with big metropolises. The modal split for rail, at 6.1%, was relatively low in European comparison, a total amount of 51,120 million passenger-kms was undertaken by rail (EC 2016b, Participant D 2017, EC 2017f, Eurostat 2019b). Despite the weak economic situation in Italy, a shift from other transport modes towards rail could be observed, especially in the high-speed sector after NTV entered the market (Desmaris 2016).

The Italian market is clearly dominated by the incumbent. In conventional long-distance passenger rail, it holds almost 100% of the market share, with its only competitor being DB/ÖBB. In the high-speed sector, TI holds around 65% while NTV holds around 35%. However, while TI lost market share when NTV entered the market, it did not lose passenger-km, since the overall demand increased (Desmaris 2016, Beria & Grimaldi 2017, NTV 2018b). In 2017, TI had 16,303 million passenger-km in long-distance passenger rail, with a total revenue of 2,506 million EUR and an EBIT of 224 million EUR (FSI 2018b).

Arenaways wanted to focus on providing better quality on the Turin-Milan line, by addressing the most densely populated and richest regions in Italy. An average of 32,000 people commuted overall each day between the two cities, a distance of 150 km and many were not satisfied with TI's service during this time. Despite the vast suburban commuter market, only 50-60 passengers used Arenaways daily, despite a capacity of 400. This was due to the prohibition of cabotage, which highly affected the business case (Speciale 2011). The economic situation of NTV is more successful and the market penetration has been fast: in 2012 NTV transported 2.1 million passengers in eight months of operations. In 2017, NTV transported a total of 12.8 million passengers at a load factor of 77.4%. This led to a total revenue of 415 million EUR (Bergantino et al. 2015, Beria & Grimaldi 2017, NTV 2018c). However, due to the high investments and the high operating costs, NTV had negative operating results for the years between 2010 and 2015, which the company turned into a positive net income in the following years (ART 2017).

For the Italian open access competition, the market size seems to be one of the core influencing factors. NTV was convinced of the new potential due to the

new infrastructure which connected rich markets, DB/ÖBB was convinced of the tourist potential (Participant D 2017, Participant E 2017). Participant F (2017) states that “either you go for a rich OD or you don’t consider entering the market”. NTV managed to do this, DB/ÖBB found its niche and since Arenaways failed to address the right market, it had to exit.

6.3.2.8. Costs for infrastructure

Compared to other EU countries, the average cost of infrastructure in Italy is in the medium range, behind Germany, Belgium and France. The fees for freight and passenger transport charges are at an equal level (EC 2016c). Since 2001, RFI is the licenced national IM, the fees are approved by the ART. In December 2015, the ART defined criteria and guidelines for a new access charge system of RFI, which led to the access charge now being based on relevant and efficient costs. The new system ensures greater flexibility for the IM, it is modularly based on the service, geography, capacity and typology of the network, and includes variable components (Bergantino 2016). The access charges are calculated using an algorithm, consisting of a two-part formula: a) a fixed track access charge for each section/node of the train path, and b) a variable usage charge which depends on the number of km and minutes of occupancy of the nodes. The fixed track access charge is dependent on network categories, like “supplementary network section”, “mainline network section” and “node” and is defined for each line individually. The fixed track access charge for high-speed/high capacity (“HS/HC”) lines is 0 EUR, only variable costs occur (RFI 2017b). “Over the previous decade, the access charges for HSR in Italy averaged EUR 13.4 per train/km against EUR 3.4 train/km for conventional trains” (Desmaris 2016, p. 16). Each RU can pre-calculate the prices on RFI’s homepage (RFI 2018). NTV complained about the

defined criteria. It claims that fixed costs cannot be considered as direct and therefore, according to EU law, cannot be included (Bergantino 2016).

Examples from competitors show that costs for infrastructure play a role in their profitability. When NTV struggled with profitability and had a massive crisis in 2014/2015, the management used its political contacts and lobbied for lower infrastructure charges on high-speed lines. Initially, the average costs were fixed at 12.81 EUR/km. This was first reduced by 15% and finally in 2014 the access charge was further reduced by an additional 20% to 8.2 EUR/km. This led to savings of 10 million EUR for NTV and 22 million EUR for TI (Cambini & Perrotti 2015, Giuricin 2016, Bergantino 2016). In the next years, an increase in access charges is planned, which might especially harm DB/ÖBB. The company is taking legal action against RFI since it is convinced that this is unfair and would lead falling profitability (Participant D 2017). The example of NTV and DB/ÖBB shows that costs for infrastructure can be a strong factor influencing open access competition. The factor is not only an entry barrier, but also an influence during operations. In NTV's case, it influenced profitability to a high degree. However, the influence is always dependent on the line (Participant D 2017, Participant E 2017, Participant F 2017).

6.3.2.9. Access to distribution systems

In rail ticket distribution, the Italian market is dominated by the incumbent's sales system which provides a variety of sales channels with a high coverage rate in rural and urban areas: TI's tickets can be purchased from 300 ticket offices and more than 1,900 ticket machines, TI also has call centers and cooperates with travel agencies. Besides the traditional ways, TI also offers online and mobile tickets. In 2016, more than 40% of all tickets were purchased

via online or mobile channels (Trenitalia 2016). TI's distribution system is not open for competitors, but DB/ÖBB have a ticketing cooperation with TI (Participant D 2017). Arenaways could not enter TI's distribution system and offered its tickets online, via ticket machines, on board the trains and at special sales points. NTV has no access to TI's distribution system and set up its own distribution system. Tickets can be bought at stations in ticket offices, lounges and from vending machines (NTV 2017a). Tickets can also be bought via NTV's call centre, online and by using NTV's app (NTV 2018e).

The example shows that all competitors managed to set up individual distribution systems. However, difficulties occurred: while running joint trains together with TI, DB/ÖBB and TI had a ticketing cooperation, and the ticket for these services were therefore sold via TI's distribution system. When DB/ÖBB became a competitor, TI no longer sold the company's tickets which resulted in economic difficulties. After negotiations between both companies, TI started to sell the trains again from August 2011 onwards (DB ML AG 2011, Participant D 2017). NTV states that RFI discriminated against NTV by strictly limiting its floor space for ticket machines in Venice and Bologna. While TI had ticket machines in prominent points in the stations, this was not possible for NTV in the early days (Participant E 2017).

The existence of a well-functioning distribution system is essential for competitors to start. Some years ago, without the advanced technology digitalisation brought about, the situation was different and new entrants were far more dependent on access to TI's distribution system, as DB/ÖBB's example proves. Access to TI's distribution system would still improve open access competitors' positions, but NTV shows that a new distribution platform can be built which finds acceptance with customers. This, however, creates

extra initial costs for RUs, which not every company can cover (Participant D 2017, Participant E 2017).

6.3.2.10. Existence of network effects

The generation of network effects is a means to fill the trains and thus make them more profitable for the operators. Due to its interlinked network and its wide but closed distribution network, TI benefits from network effects like most incumbents (Participant E 2017, Participant F 2017). However, due to the high number of big metropolis, a big market for point-to-point connections exists (Participant D 2017). When DB/ÖBB was not integrated into TI's distribution system and had no convenient connections into TI's network, the business case was negative. It was necessary for DB/ÖBB to be part of TI's system and to profit from network effects. This brought about a new cooperation with TI (Participant D 2017). For Arenaways, the point-to-point connections were not profitable and no integration in TI's system existed. This contributed to Arenaways' low customer numbers. NTV also did not profit from TI's network effects, but it found ways to deal with the problem: firstly, NTV connects major metropolis with a big point-to-point market, where low network effects are generated. Additional, NTV set up Italobus to create its own network by feeding the lines with rural customers (NTV 2017c, Participant E 2017). Also, as in Florence, NTV offers integrated tickets with local public transport which allows customers to use local buses (Participant F 2017). The examples show two different pictures: the niche provider DB/ÖBB is dependent on TI's network effects and therefore chose to cooperate with TI, otherwise profitable operations would not be possible. NTV started to build its own network, where needed, but focuses on the servicing of strong point-to-point connections where network

effects are not crucial (Participant D 2017, Participant E 2017). However, the integration into the regional network might be beneficial for NTV (Participant F 2017). All in all, the influence of network effects on open access competition has a minimal to strong effect, depending on the planned offering of the competitor.

6.3.2.11. Generally low profitability

The generally low profitability in the industry also influences the Italian market. While TI receives subsidies for conventional long-distance transport, it operates its high-speed network at its own risk. TI is therefore obliged to run services profitably. During the whole period of operations, DB/ÖBB struggled with profitability, it was not possible to operate on a profitable level while TI did not sell tickets for the trains. However, since the operator is owned by incumbents, it had a financial backup during these years (Participant D 2017). The example of Arenaways also shows how hard it is to achieve profitability: the company struggled from the first day of operations. It never reached profitability and went bankrupt within a few months of operations at the end of July 2011. One reason for that was the ban on cabotage between Milan and Turin and consequently not enough passengers, while the cost structure remained the same (Speciale 2011, Warnecke & Götz 2012). Even NTV with its solvent shareholders struggled with low profitability, especially at the start. In the first two years' losses of 156 million EUR were made. In 2014, an additional 62 million EUR losses were made (Day 2014, NTV 2015). When entering the market, NTV aimed for a cost leadership approach, but no significant cost leadership could be achieved apart from labour costs, smaller trains and a less complex company structure. Furthermore, NTV could not implement its differentiation strategy by offering a premium product with better quality at higher prices,

consequently, the expected yields could not be achieved (Beria & Grimaldi 2017). This led NTV into a difficult economic situation: in 2015, NTV had debts of 681 million EUR. Those were rescheduled, including an equity increase of 60 million EUR. Consequently, NTV reached break-even for the first time and the EBITDA was positive with 57 million EUR, the EBITDA also increased in 2017 to 156 million EUR. The reduction of infrastructure fees also played a major role in NTV's profitability. However, NTV defines the low profitability of the Italian market as its main risk and focuses on the most profitable routes which results in a similar offer to TI (NTV 2015, Milano today 2015, Giuricin 2016, NTV 2018a, Beria & Grimaldi 2017, Participant E 2017). After 2015, due to the competitive pressure, TI reports a fall in economic performance of the high-speed rail services due to a reduction in yield (FSI 2017b).

The examples show how hard it is to earn profits in the Italian railway industry and that low profitability influences competition. However, depending on the financial resources of the RU, the influence varies: due to a shortage of funds, Arenaways went bankrupt while NTV with strong and solvent investors managed an internal restructuring (Participant D 2017, Participant E 2017). Still, the high cost structure, especially for rolling stock in case of NTV, and the low rate of return is a challenge to all competitors. This also acts as an entry barrier for new competitors (Participant F 2017).

6.3.2.12. Access to financing

Since TI is state-owned, access to financing is relatively easy. The same applies to the competitor DB/ÖBB, which can access financial support within its state-owned holding companies (Participant D 2017). The case is different for private providers: for NTV's market entry, more than one billion EUR were

necessary and later invested. After coming up with the idea of entering the high-speed rail market, the founders of NTV started early to acquire the necessary capital. In 2008, NTV already had a financial agreement of approximately 700 million EUR. Some capital came directly from the founders, at market entry Montezemolo and Punzo held 35% of NTV's shares. 20% of shares were held by Intesa Sanpaolo, a bank which joined in as a shareholder at the beginning. An additional 20% were held by SNCF, the French incumbent, which provided further reliability for additional investors. The remaining shares were owned by Assicurazioni Generali (15%), Bombassei (5%), Serganoli (5%) and Sciarrone (1.5%) (Bayer 2013, Chiandoni 2015, NTV 2017a). The example shows how important it was for NTV that prominent businesspersons with good connections to the financial sector started the company (Participant E 2017). In its internal crisis, NTV underwent a debt restructuring and an additional 60 million EUR of equity capital were injected in 2015. In June 2017 another restructuring took place, where the shareholders entered and others left (NTV 2017a). This led to the following ownership structure: founding members hold 39% of shares, 19.7% is held by Intesa Sanpaolo S.p.A, 15% by Allegro S.A.R.L., 13.2% by PII1 S.A.R.L, 6% by MAIS S.p.A., 5% by Nuova Fourb S.R.L. and finally 2.1% by PARTIND S.R.L (NTV 2017b). In 2018, the American infrastructure investor Global Infrastructure Partners III purchased the entire share capital of NTV for 1.9 billion EUR (NTV 2018d, Arosio 2018). After setting up his successful rail freight company, Arena sold it to DB in 2004. Arena also acquired additional funds of up to 50 million EUR, especially for the procurement of rolling stock (Warnecke & Götz 2012, Boitani & Ramella 2012).

The examples show that for the existing competitors, it was possible to access financing. However, this might not be representative for all possible new

entrants since in the Italian market it is relatively easy to find investors, but once the investors are found the bureaucratic barriers are relatively high (Participant D 2017).

6.3.2.13. Cooperation and coopetition within the industry

TI is part of a cooperation network with other railway companies from neighbouring countries like ÖBB, SBB and DB. In most cases, TI is and was responsible for running trains on Italian territory. This prevented other foreign incumbents from operating in competition to TI. However, the example of DB/ÖBB shows that this can change: when the cooperation between DB/ÖBB was terminated, this contract could no longer protect Italian territory and DB/ÖBB decided to enter the market with LeNord. However, to some degree, the companies depend on cooperation and after some years of renegotiation, TI is selling DB/ÖBB's tickets and has synchronised its timetable (Participant D 2017). Without cooperation with TI, DB/ÖBB's trains were not visible to Italian customers; this changed after the renewal of the partnership and TI even does marketing for these trains on board its trains (Participant F 2017). NTV is in a different situation: when starting the company, NTV was in partnership with SNCF which bought 20% of the company's shares. However, despite the capital, NTV did not take much advantage of a possible cooperation with SNCF. In 2015, SNCF did not agree to a recapitalisation and as a consequence drastically reduced its shareholding and later exited (Giuricin 2016, Participant E 2017). The examples show that cooperation within the industry plays a role and can make a difference by providing more revenue or reducing costs. Due to low profitability, cooperation might be necessary to some degree to remain in the market (Participant D 2017, Participant E 2017).

6.3.2.14. Possibility for cherry-picking

Due to the geographic structure in Italy, cherry-picking and some clear “cherry-lines” exist, connecting big cities and economic and tourist hubs. The development of high-speed lines further enhances this advantage.

Consequently, the high-speed network is run commercially by TI and does not receive subsidies. Cherry-picking is allowed in Italy, if subsidised long-distance or regional transport is not cannibalised. However, cherry-picking is not only dependent on the line, it also depends on the choice of paths and the time of slots (Participant F 2017). Examples of cherry-lines in Italy are Rome-Milan which is one of the busiest lines in Europe, but also Turin-Milan which connects the richest and most densely populated regions in Italy (Speciale 2011, Bergantino et al. 2015). Cherry-picking can exist in different degrees: some competitors run with high frequency and hold high market shares, others only run a limited number of trains per day on “cherry-lines” (Participant B 2017, Participant C 2017). The examples of NTV and Arenaways provide evidence: NTV entered the most profitable lines in Italy with a high frequency and accomplished a high market share. Arenaways entered on a cherry-line with a limited number of trains and tried to establish a basis for further business (Speciale 2011, Bergantino et al. 2015). However, TI prevented cherry-picking and Arenaways could not exploit the whole potential of this line (Participant F 2017). Despite being fined, TI tried a similar strategy as NTV a few years later by not allowing access to strategically important stations. The possibility of cherry-picking is an important precondition to operate open access competition in Italy. The example of NTV shows that the successful operating of cherry-lines can make a difference and is the reason why NTV is still in business (Participant D 2017, Participant E 2017).

6.3.2.15. Adjustment to customer expectation

The adjustment to customer expectation plays an important role in the strategy of open access competitors: at the beginning of the 2000s, TI was in a bad condition and customer satisfaction was low. Competitors saw this as a chance to win customers by adapting to their expectations (Doll & Tauber 2010, Participant D 2017, Participant E 2017). Arenaways ordered new and modern rolling stock and wanted to offer a superior service and higher reliability than TI. NTV used a similar strategy, also ordering rolling stock at premium quality with leather seats, monitors, cinema cars, and a business sector. Moreover, NTV planned to offer a yield-based and simple pricing and ticketing system. On timetables and ODs, NTV also adapted to customer wishes and expectations (Faiola 2013b, Cascetta & Coppola 2015, NTV 2017a). But TI did not stand still and started a restructuring and re-branding: new rolling stock was bought, the frequency of trains was increased, the sales system was updated, average prices were reduced, delays and cancellations were cut (Cascetta & Coppola 2015, Participant D 2017, Participant E 2017, Beria & Grimaldi 2017). Thus TI managed to become attractive, and maintain and increase its customer base, despite competition. For Arenaways and NTV, the improved service was a means not only to attract TI's customers, but also to charge a premium price. With TI becoming a modern and attractive RU, this premium could not be charged and both companies could not reach their estimated yields (Participant E 2017). The examples show that an adjustment to customer expectation plays a major role in Italy, both for competitors and for the incumbent. TI's quick and successful adaptation blocked NTV's product differentiation strategy and triggered an adaptation of ticket prices (Participant D 2017, Participant E 2017, Participant F 2017).

6.3.2.16. Customers' willingness to pay

Due to the poor economic situation in Italy, the general willingness to pay is not overly high, but different customer groups exist: especially between the big metropolis, business travellers are prepared to pay high prices for fast city to city connections (Participant D 2017, Participant E 2017). Between 2009 and 2011, the pricing level of long-distance rail tickets increased slightly. This also shows that the existence of the small operators DB/ÖBB and Arenaways made no difference to the customers' willingness to pay (Cascetta & Coppola 2015). The situation changed after 2011 with the entry of NTV: a two-year decrease of 34% between 2011 and 2013 could be observed. To gain a high percentage of market share, both NTV and TI introduced a new pricing scheme almost in parallel in 2012 with three levels of fares, relating to different types of flexibility (Cascetta & Coppola 2015, Participant D 2017). However, no clear evidence of predatory pricing behaviour by TI can be observed. But the pricing strategies of NTV and TI to attract more customers, seem to be related (Bergantino et al. 2015, Participant E 2017). Since the passenger figures of both TI and NTV increased in the years after market entry, the strategy proved to be successful (NTV 2018a).

While no drastic change in customers' willingness to pay can be observed in the Italian market, this factor still influences open access competition. It shows that it is important to have good yield management system and the right pricing strategy for different customer groups (Participant D 2017, Participant E 2017, Participant F 2017). It is interesting that no competitor entered the market with a low-cost approach. Liberalisation of the coach market also had no fundamental effect on the customers' willingness to pay on the competitive routes (Participant E 2017).

6.3.2.17. Entrepreneurship

Entrepreneurship plays an important role for the existence of open access competition in Italy, especially at the initiation and planning stages. The examples of NTV and Arenaways prove this. NTV was founded by former Ferrari president Luca Cordero di Montezemolo, the owner of leather-manufacturer Tod's, Diego Della Vale, and the businessman Gianni Punzo, who liked the idea of running high-speed trains. The founders were strong and successful entrepreneurs with a valuable network within the industry and high ambitions. This enabled access to financing initially for the procurement of rolling stock (Bayer 2013, Faiola 2013b, Participant E 2017). The NTV founders have a beneficial political and business network which allowed them to make "noise" in case of irregularities which helped NTV to improve profitability and stay in business (Participant F 2017). Arenaways was founded by Guiseppe Arena who is known as the pioneer of private rail in Italy. Arena used to work for TI, but he left the company in 1992 to found his own rail company. After offering tourist charter trains and setting up a successful freight rail business which he sold to DB, he planned to enter the long-distance passenger rail market. Compared to NTV, Arena's access to financing was lower, but he had substantial experience in the railway industry (Bayer 2013, Participant D 2017). In case of NTV and Arenaways, a fascination and an emotional connection to rail existed, Arena and the NTV founders wanted to offer a product with better quality than TI. Arena had gained valuable experience in the industry while the NTV founders entered the market with support from experts, among others SNCF (Bayer 2013). In both cases, the entrepreneurs were prepared to take high risks.

6.3.2.18. Access to rolling stock

The general situation for leasing and procuring of long-distance rolling stock in Italy is as difficult as in the rest of Europe. Despite the difficulties, all observed open access providers managed to obtain rolling stock (Participant D 2017, Participant E 2017). DB/ÖBB's operations were run with given second-hand rolling stock on a conventional level (Participant E 2017). Arenaways leased locomotives and bought two new trainsets from Astra Vagoane Calatori in Romania at a total cost of 50 million EUR. The rolling stock ran for approximately eight months before the company became insolvent. In 2017, some of the coaches were auctioned (Railway Gazette 2010a, Warnecke & Götz 2012, SAERP 2013, Vuotto 2017, Participant E 2017). In November 2007, NTV ordered 25 new high-speed AGVs from Alstom, one of the most advanced trains on the market at that time with premium interior design. The costs for the trains were around 600 million EUR. By April 2013, all trainsets were delivered. In 2015, NTV ordered additional trains from Alstom, at an investment of 250 million EUR. This allows NTV to further increase its network and frequency (Warnecke & Götz 2012, Beria & Grimaldi 2017, NTV 2017a). TI has been buying new rolling stock and also updating its fleet in recent years. Since 2000, TI has extensively refurbished old trains and bought new rolling stock. In the long-distance passenger sector, it runs with AGV ETR 1000 trains (Frecciarossa 1000, bought for ca. 31 million EUR per train), ETR 500 (Frecciarossa), ETR 600 (Frecciargento), ETR 470 (Frecciabianca), as well as locomotives and coaches on slower long-distance trains with longer travel time (Railway Gazette 2010b, Beria et al. 2012, Bergantino et al. 2015, FSI 2018b).

The access to rolling stock is an important influencing factor on open access competition, as it can be a clear barrier to entry (Participant F 2017). The

example of NTV shows that access to rolling stock for new entrants can be relatively easy if the necessary amount of money is available (Participant D 2017, Participant E 2017).

6.3.2.19. Homologation process

Homologation in Italy is known to be a long and complex process which binds the time and resources of open access competitors (Participant D 2017, Participant E 2017). The Italian National Railway Safety Agency (“ANSF”) is in charge of the authorisation and validation of homologations (ANSF 2018). Decreto ANSF n.1/2016 points out the preconditions for homologation, implementing EU law (ANSF 2017). DB/ÖBB experienced the difficulties of homologation in Italy and had problems with the homologation process for its locomotives. It took a long time and homologation is still only valid for speeds up to 200 km/h. Especially at the beginning of operations, decisions and requests from the authority appeared random and without clear guidelines (Participant D 2017). Arenaways originally planned its start of operations in September 2010, but due to delays in the homologation process of the new rolling stock, the start had to be delayed. NTV’s first homologation process was also delayed due to the absence of possibilities to do test runs on RFI’s tracks, Montezemolo accused FSI of delaying the process to damage NTV (Cillis 2010). All in all, competitors received their homologations. Over the years, the system has improved due to clearer guidelines and less uncertainties than in the past. But the factor influences open access competition by adding costs and possibly prolonging the timeline (Participant D 2017, Participant E 2017). This is especially the case when buying second-hand rolling stock (Participant F 2017).

6.3.2.20. Incumbent's performance

Even though the incumbent TI was officially founded in 2000, the company is far older. In 1905 FSI was founded as a state-owned railway company that provided infrastructure and operated trains. It grew exponentially in the following years and played an important role for the development of the country and during wars (FSI 2018c). However, at the beginning of the 2000s, TI was in a bad condition: the rolling stock was run-down, trains were often delayed or cancelled, innovation was lacking, customer service was unsatisfactory and consequently TI's image in Italy was bad (Doll & Tauber 2010, Participant D 2017). This, combined with the new possibilities provided by market liberalisation led, competitors to enter the market.

In the past, TI had two strategies to defend itself against competition: it started by delaying and discriminating against its competitors as described above (prohibiting intermediate stops, no access to central stations, no possibility to establish sales points in stations, delaying of path requests etc.). Then it fully transformed its company strategy and adapted to customer wishes (Participant D 2017, Participant E 2017): new rolling stock was bought and introduced in the market, re-branding of services took place, frequency of trains was increased, a new sales system was set up, average fares were reduced, a new frequent traveller programme was launched, delays and train cancellations were reduced and higher reliability was achieved (Faiola 2013a, Participant D 2017, Participant E 2017, Beria & Grimaldi 2017). This led to a much improved image of TI, especially in the high-speed sector (Participant F 2017). In 2017, TI has a market share of 65% in high-speed rail and >99% in the remaining long-distance passenger rail market (Desmaris 2016, NTV 2018b). The company operated 16,303 million passenger-km in long-distance passenger rail (FSI

2018b). TI's punctuality with a delay of <15 minutes was 97.9% in 2017, it reports 94.4% customer satisfaction (FSI 2018a). Arenaways' and NTV's strategy was to attack a weak incumbent and to seize a huge market of unsatisfied and disappointed customers who were willing to pay more for superior quality. TI's enormous transformation robbed NTV of its potential product differentiation and consequently, the expected higher prices could not be charged which led to economic difficulties for NTV (Beria & Grimaldi 2017, Participant E 2017). It turned out that TI had the better feeling for the market and therefore the better adaptation to customer wants, with plans to invest and improve quality in the coming years (Bogo 2016, Participant F 2017).

Bearing all this in mind, it becomes apparent that TI, as part of FSI, has the power to discriminate against competitors and has used its power in the past. The company was to largely responsible for the insolvency of Arenaways and also for the economic difficulties of DB/ÖBB. Due to its internal change, it grew from a weak incumbent to a professional and modern company which is a serious competitor for new entrants (Chiandoni 2012, Participant E 2017, Participant D 2017, Participant F 2017). All in all, competition has boosted quality and lowered prices at TI, but also provided choice, which is a huge benefit for Italian customers (Faiola 2013b).

6.3.3. Characterising the correlation of factors influencing the Italian case

The most significant and influential correlation between factors may be found between "law in the books", "law in action", "unbundling" and "the incumbent's performance". Despite a de jure opening of the market, for years the institutional landscape was too weak to prevent discrimination by the IM and the incumbent.

This situation caused the early insolvency of Arenaways. The lawsuit against TI and RFI resembled a turning point and the setting up of the ART clearly improved the situation for existing and future competitors.

Another correlation exists between the “adjustment to customer expectation”, “market size” and “low profitability of the industry”. While Arenaways failed with its customer-oriented strategy, TI and NTV gained a high increase in passenger figures in recent years in the high-speed sector, leading NTV to break even in 2015. However, the increased profitability for NTV and TI did not occur due to increased ticket prices and yields, but due to an increase in passengers and passenger-kms.

A correlation between the “costs of infrastructure” and the “low profitability of the industry” can also be shown in the Italian case regarding NTV. When the company struggled for profitability, the cost of high-speed infrastructure was reduced and, together with an internal debt restructuring, led to an improvement of the economic situation of NTV.

The negative example of Arenaways and partly of DB/ÖBB shows the correlation between “access to attractive train paths” and “low profitability in the industry”. Due to the inferior paths with no intermediate stops, Arenaways went bankrupt within a few months. At the same time, DB/ÖBB struggled economically due to similar conditions. Now, with better paths, connections into the Italian network and intermediate stops, the situation changed for DB/ÖBB.

The availability of “rolling stock” in Italy is clearly dependent on the “access to financing”. Arenaways and NTV could buy suitable and high-quality first-hand rolling stock from a small and a large rolling stock provider. A precondition for this was the existence of investors and loans.

The examples provided show the most significant correlation, as in the German case, however more correlation and connections exist. Successful long-distance passenger rail relies on a functioning network of different influencing factors.

6.3.4. Characterising the shift of factors influencing the Italian case

The clearest and most important shift in terms of open access competition is the improvement of “law in action” and with it “unbundling”. In the early days of open access competition, competitors had to suffer discrimination, especially regarding path availability and access to stations. The lawsuit against TI and RFI triggered a chain of improvements: the initial uncertainty of handling competition and competitors was replaced by routine and more professional handling. Existing gaps in regulation are not exploited by RFI and TI as severely as before. The setting up of the ART led to an independent handling of uncertainties and disputes and gave clearer guidelines. All this led to considerably improved conditions for competition.

The digital revolution and new distributional possibilities also changed the influencing factor “access to distribution system”. New technological solutions and a higher percentage of online and mobile ticketing made it possible for NTV to set up its own distribution system with a high coverage rate, as well as classical distribution channels in railway stations. Therefore this influencing factor weakened over time.

The “incumbent’s performance” changed a great deal over time and also led to a shift of influence. Before the market entry of NTV, TI was a weak incumbent with relatively low customer satisfaction. This influenced open access competition positively. Nevertheless, especially in the early days of competition,

TI engaged in discrimination against competitors. In a few years' time, TI managed to change its strategy and adapt to customer wishes by providing better quality and more reliable products, it is a strong market player, which influences open access competition negatively. On the other hand, discrimination by TI was reduced and it is a fairer competitor now, which influences open access competition positively.

The factor "costs for infrastructure" also changed over the years, especially regarding the high-speed lines. Before open access competition existed in the market, the average cost for a path-km was 12.81 EUR/km, it fell in recent years by more than 35%. Therefore its influence is less negative than before, since it promoted open access competition and helped NTV.

With the liberalisation of the coach market in 2007, the shift of the factor "intermodal competition" began. The speed of change is not as fast as in Germany and neither is the strength of influence, but competitive pressure from coaches is nevertheless increasing, especially for conventional rail services. More and more companies are entering the market and more lines are being operated. This makes it more difficult for new open access operators to enter the conventional long-distance passenger rail market in Italy.

6.4. Discussion of the case study findings

When comparing the German and the Italian case, it becomes apparent that many similarities exist: e.g. the time of liberalisation in the books, the basic degree of unbundling and the problems with homologation processes. Yet, some differences exist too: e.g. the degree of intermodal competition, the speed of implementation of law in action and the willingness to pay subsidies. In the

following section, the two cases will be compared and discussed, to gain knowledge from the similarities and differences shown.

The history of open access competition in Germany is characterised by an early liberalisation of the market in the books in 1994, combined with a relatively fast and wide-ranging implementation in action which led to strong institutions. The degree of unbundling, combining the independent IM and the RU under one holding company, shows few cases of discrimination against competitors, with a close monitoring and sanctioning of misconduct by the respective institution, e.g. in setting station or energy prices. Since the early days of liberalisation, government and politicians have not actively promoted further open access competition and were more interested in optimising the status quo, and the monopoly commission remains the only institution which takes a more critical line. The first competitor, InterConnex, entered the market in 2001. HKX followed in 2012 and Locomore in 2015, both operated by FlixMobility since 2017/2018. Two more private competitors announced market entry but failed to enter. Access to necessary facilities and attractive train paths is provided and seen as fair, but the dominant position of the incumbent DB Fv makes it difficult to find attractive gaps in the network and potential has not yet been utilised. Also, DB Fv has substantial network effects, caused by the size and range of the network. Consequently, while receiving no subsidies at all, DB Fv set up a dense network of trains in the whole of Germany, making no drastic product differentiation between conventional lines and high-speed lines. Therefore, DB Fv can serve a high proportion of the existing market. While cherry-picking is possible, it still needs a good strategic fit to find sufficient market potential and be able to compete with the strong incumbent. With the liberalisation of the coach market and the entry of many coach providers on various lines, offering

cheap tickets, customers' willingness to pay has decreased. The low willingness to pay resulted in an overall reduction in ticket prices in Germany, also affecting the profitability of the incumbent and the open access providers HKX, Locomore and InterConnex. This effect is further reinforced by the relatively high costs for infrastructure. Access to funds to finance the costly market entry and starting period, which is necessary to establish the new rail products, is difficult in Germany. This also results in the difficulty of accessing new rolling stock, due to its high costs. A large market for second-hand passenger transport rolling stock does not yet exist in Germany, which results in competitors buying and refurbishing rolling stock abroad. The absence of technical harmonisation did not play a big role in this case. While the homologation process was lengthy and complicated in the past, it has improved over recent years and is manageable for open access providers. As with the recruiting and training of necessary personnell, the existence of unions has not yet been an obstacle. What proved to be difficult is that the open access providers, except for HKX for a brief period, have no access to DB Fv's distribution system and therefore need to establish their own systems. After the acquisition of Locomore and HKX by LEO and FlixMobility, the situation for the company became easier and more customers used Locomore. The open access providers in Germany and most of their investors were connected to the railway industry prior to market entry. All entrepreneurs were prepared to take a high risk and remained persistent during the difficulties of setting up operations and running in the market. The German case clearly shows that fair open access competition is possible and that market potential exists, especially when the open access providers can win costumers from other modes of transportation. Nevertheless, DB Fv is a strong incumbent with a high market coverage, which might deter possible investors. It

requires a good strategic fit to attract customers other than by providing discount prices.

The Italian history of open access competition begins with the liberalisation of the market in the books in 2003. The first competitors to enter the market were DB/ÖBB in 2009, followed by Arenaways in 2010 and NTV in 2012. The first two competitors show that the implementation of law into action took a long time and left scope for discrimination. The degree of unbundling and combining the independent IM and the RU under one holding company, proved to be problematic for the early competitors, due to cases of discrimination, e.g. the granting of intermediate stops on lines, the access to attractive train paths, access to stations, and permission to sell tickets in stations. Proper institutions were not yet set up and closely related to the ministry and the incumbent. However, since the early days of liberalisation, the implementation of law into action has improved a great deal, also with the setting up of the ART, and the number of cases of discrimination is reduced. For a long time, the government and politicians have not been active in promoting further open access competition, but, with the market entry of NTV in 2012 they actively supported open access competition in some cases, e.g. regarding infrastructure costs. In Italy, especially investment in the high-speed network opened new possibilities for competition and attracted NTV to enter the market. Access to necessary facilities and attractive train paths exists and is seen as fair, but cases of discrimination against competitors existed in the past, e.g. by the denial of intermediate stops, the slow process of gaining access to stations or the denial of attractive stations in city centres due to the absence of capacity. The Italian network is divided into two clusters: the conventional network where the incumbent provides subsidised trains, and the high-speed network where TI

runs at its own commercial risk. Open access is allowed on the high-speed network and capacity for paths and stations exists. Cherry-picking is possible and an important precondition for competition. In the conventional network, however, the PSO-services of TI are run in a dense network, so the entry of competitors would be difficult. TI is the domineering RU in Italy and managed to drastically change its strategy, especially in the high-speed sector, after NTV announced its market entry. It improved rolling stock quality, punctuality and service, thereby adapting to customer expectations and making NTV's planned competitive advantage in offering superior services and quality insufficient. Not many customers were ready to pay premium prices for luxury services. But head-to-head competition takes place in the high-speed sector, providing big advantages for customers and shifting then from other transport modes to rail. Especially the major advantages of the high-speed sector regarding time and comfort made high-speed rail invulnerable to the market liberalisation of coach services. Due to head-to-head competition, ticket prices in Italy fell, attracting more customers. Despite the high number of customers, this resulted in difficulties of profitability for the companies. A lack of profitability was also the reason for the insolvency of Arenaways, caused by the ban on intermediate stops. Infrastructure costs in Italy are not very high compared to other countries, except for high-speed lines. But over time and after complaints by NTV, the price was reduced significantly. The examples of Arenaways and NTV show that access to financing exists in Italy, but it is closely linked to the existence of strong entrepreneurs with good networks within the industry and mostly with experience in the railway industry. This also made accessing of new rolling stock possible, while no big second-hand passenger transport rolling stock market exists in Italy. While the homologation process was lengthy and

complicated in the past, it has improved over recent years and is manageable for open access providers. The recruiting and training of necessary personnel has not yet been an obstacle, but the existence of unions led to tough negotiations and strikes for NTV. The lack of access to TI's distribution system was difficult for the smaller open access providers, but since NTV managed to set up its own distribution system, it managed to avoid negative effects. All in all, the Italian case shows that successful open access competition is possible and that a large market exists, especially when the open access providers can attract customers from other modes of transportation. Italy has come a long way since market liberalisation and managed to set up a sound institutional system, learning from past mistakes. However, the incumbent is still a tough competitor, especially after its 180°-turnaround before 2012.

When comparing the German and the Italian case, some similarities become apparent: in both cases, the dependency on the incumbents' distribution systems varies between small and big players in the country in question. Arenaways, InterConnex, partly DB/ÖBB and HKX and Locomore in pre-acquisition times had problems to reach all potential customers with their distribution systems and could not exploit the advantages of network effects. When DB/ÖBB were included in TI's distribution system and when Locomore was distributed by the powerful system of FlixMobility, the economic situation of both competitors changed. The situation is different for NTV, it made a bigger market entry and managed to set up its own professional distribution system, also including local distribution centres. Its approach was big enough to address most possible customers. Due to the focus on point-to-point connections, the inclusion into TI's network seems to be of lesser importance. In Italy and Germany, competitors which cannot get access to the incumbents' distribution

system need to either find a successful and big distribution partner or build a big enough distribution platform which is expensive. Similarities also occur regarding the incumbents' performance: DB Fv and TI are both strong competitors in the market, running a solid and dense network for years, having lots of experience and access to government funds. Both companies managed to change and adapt better to customer wishes in the past years, TI in a faster and more radical manner. This provides less scope for competitors' attacks, if customers are satisfied with the incumbents in the first place. Both cases also show that adjustment to customer expectation is necessary, but no big market for luxury segments and premium offers exist. Customers in both countries can be attracted by low prices and show a relatively low willingness to pay for premium offers. This makes low-cost products very attractive. It also leads to the next similarity, the struggle of all open access competitors in both countries to become profitable. Locomore and Arenaways went bankrupt after only a couple of months, InterConnex withdrew from the market due to economic difficulties and NTV struggled hard in the first three years of operations. This shows that it is not easy in both countries to make profits by providing open access competition and that it takes time in the market before profits can be made. Regarding homologation, both cases show similarities too. The long and bureaucratic processes were a source of delays and a risk for open access providers. In both cases, this changed over recent years and the newest rolling stock homologations of NTV and Locomore show that it has become easier. The fact that access to paths is not transparent is similar in both cases. Open access competitors cannot know in advance, how likely they are to obtain attractive train paths and where possible slots may be found. This is a burden for open access providers in both countries.

After looking at the similarities, some interesting differences may also be found between the two cases: what becomes apparent in the first place is the differing speed of implementation of law into action. Germany was quicker and more thorough in putting law into action, e.g. by setting up strong institutions more quickly. This took longer in Italy and led to more discrimination in the early days of competition. While both countries use the same scheme of unbundling, the holding structure led to bigger problems in Italy than in Germany, e.g. regarding intermediate stops or access to stations. Different rolling stock strategies were used by competitors from both countries: while German competitors used second-hand rolling stock and had problems with the technology or availability at the start, the Italian competitors mainly deploy new rolling stock. Also different is the active role that politicians played in the support of NTV in Italy: no German politicians or government actively intervened in the open access rail competition. What also differs is the investment in rail infrastructure: over the last decade, Italy set up an unmixed high-speed network which is ideal for the existence of open access competition. This was one of the main factors that attracted NTV. This situation cannot be compared to the German network. The structure of the railway market also differs between the German and the Italian case: while similar conditions apply to the whole German network, different conditions apply to the Italian conventional and high-speed network. While it is relatively easy to enter the high-speed network and conditions for open access competition are good, entry into the conventional network is not easy. Also, it shows that network effects in Italy do not play such a big role as in Germany, due to its polycentric structure. Some lines in Italy connect big centres in a short time, leading to more point-to-point travellers than in Germany. This is beneficial for NTV since it does not rely on the incumbent's network. Another major

difference is the reaction of the rail market to the liberalisation of the coach market: in the German case, open access competitors as well as the incumbent suffered economically from the market entry of coach providers. Consequently, the customers' willingness to pay declined and had an effect on the companies' profitability. This was not the case in Italy: while conventional passenger rail was affected a little, it had almost no effect on the high-speed sector, regarding passenger figures and prices.

The discussion and comparison of both cases reveals that the general set of influencing factors which formed the basis for this case study could be applied to both cases and revealed many similarities and differences. This shows that some factors seem to be an underlying basis of the railway industry in total and European standards (e.g. homologation, law in the books, access to distribution systems) while others seem to be country-specific and rely on the market, the market players and national governments. All in all, the two cases show that successful open access competition is possible, but it is not easy and many influencing factors need to be considered and obstacles solved.

6.5. Conclusion of the case study findings

The previous discussion clearly shows that the set of factors from the Delphi study occurs in both cases and gives a good indication of influence on open access competition. It can be concluded that factors of a political/legal and economic nature have the greatest influence on open access competition, both in Italy and Germany. Access to attractive train paths and facilities and market potential and size are the main influencing factors, all having a positive influence on the existence of competition. Intermodal competitors, especially coach providers, have a very high influence in the German case and less

influence in the Italian case. Low profitability of the industry and costs for infrastructure have a strongly negative effect on open access competition in both cases. The existence of law in the books and even more the implementation of law in action played an important role for the existence of open access competition in both cases. The weakest influencing factors, which played a minor role in the existence of open access competition in both cases, are consumer policy, railway safety, the sharing economy, customer loyalty, attitudes of the press and population towards competition, and the existence of innovation. The influence of the absence of technical harmonisation also proved surprisingly weak.

The greatest shift of influencing factors over time affected the homologation process due to the improvements, the existence of intermodal competitors due to the liberalisation of the coach market, the incumbents' performance due to the gradual (Germany) or disruptive adaptation to customer wishes (Italy) and also regarding fairness (Italy), and the access to distribution systems due to the new technological possibilities. Especially in Italy, law in action shifted a great deal since the proper implementation of independent and strong institutions started parallel to the entry of first competitors. The infrastructure prices for high-speed lines also show a shift due to the reduction. In Germany, a shift of customers' willingness to pay is observed and due to the cheaper ticket options provided by coach companies, customers were not willing to pay the normal rail fares and rail had to adapt. Another shift can be observed regarding the existence of cooperation with other transport modes, shown by the cases of Locomore, HKX and FlixMobility.

The strongest interrelations between the factors are clearly political/legal factors, which form a basis for other factors: law in the books and law in action lay the foundation for liberalisation and access to attractive train paths, facilities, the functioning of unbundling within a holding structure and the incumbents' performances. The time gap in the implementation of law into action in Italy shows this well, in comparison to the German case. Further interrelations can be found regarding the low profitability in the industry, which is clearly connected to customers' low willingness to pay and their expectations, to the high costs for infrastructure and the high costs of rolling stock (especially if rolling stock is bought new) as well as the access to distribution systems and the high costs of setting up a functioning distribution system if a sufficient distribution partner is absent.

7. Chapter 7: Discussion

After the in-depth presentation of the research outcome of the literature research, Delphi study and case study, this chapter assembles all findings and analyses and discusses them from an overall perspective. In so doing, the research findings are once again validated and triangulated. This results in an overall picture, from which the core findings are drawn and on which the recommendations for politicians and companies are made (see chapter 8). Firstly, issues of validity, reliability and generalisability are discussed. Then, strength and type of influencing factors are re-evaluated, filled into a scheme, and discussed. Finally, the correlation and shift of factors is discussed.

7.1. Discussion of issues of validity, reliability and generalisability

“The first concern of most qualitative researchers is with the factual accuracy of their account”, states Maxwell (1992, p. 285). A great effort was therefore directed towards achieving descriptive validity in this thesis: all filled-out questionnaires were mapped, the analysed written sources of the case study were copied and saved, and the interviews were recorded and filled into a data collection form, which was verified by the interviewees. To guarantee interpretive validity, coding was used in the free-text-fields of the Delphi study and the number of mentions of factors and issues by the participants was decisive for the interpretation of findings. For the case study, a qualitative content analysis was used to guarantee the validity of the concentration and interpretation of the rich data. To achieve evaluative validity, Mitroff & Turoff’s philosophical research approach of “Inquiring Systems” was used for this research. The combination of Singerian and Lockean IS guarantees that the evaluation of data takes into consideration that the knowledge of the

participants is dependent on their situation and their experience and must be scrutinised against their backgrounds. It further considers that input prepresents the personal opinion of participants and that the validity is always challenged by the degree of consensus.

The concept of reliability is mainly applicable to quantitative research and therefore, reliability in this research context is equalled with consistency of data. To ensure consistency of data for this thesis, a triangulation of different types and sources of data was used. The Delphi study draws on a group of 30 experts, which were recruited according to pre-defined criteria. The case study used a variety of qualitative and quantitative data from different official sources as well as expert interviews. The comparison of the Delphi findings and the case study findings show that the framework of influencing factors could be confirmed (see section 7.2.).

Generalisation “plays a different role in qualitative research than it does in quantitative and experimental research” (Maxwell 1992, p. 293). This thesis is not designed for systematic generalisation, the findings can only be generalised to a certain degree. Since the research scope is limited to open access competition in the EU, the findings can only be generalised on EU level and only give an indication of influencing factors in the long-distance passenger rail industry. The described EU regulation defines the number and the strength of influencing factors, as shown in 7.3. The combination of research methodology in this thesis shows that a generalisation on EU level is possible. The Delphi findings mainly focus on five countries, however, the literature review and the case study show that the developed framework of influencing factors proved to be valid on general EU level. What is expected to vary to some degree is the exact ranking of factors and their type, as shown in 7.2. As in most case study

research, these case study findings are only generalisable to a small degree. Within the framework of this thesis, the observed cases served as a deep dive which filled the developed list of influencing factors with practical examples. Some examples might give an indication of general cause-and-effect relationships. However, an overall generalisation is not possible.

7.2. Discussion of influencing factors

To merge all findings and discuss them holistically, this section starts by bringing the data from the different research parts together in one table. The basis is set by the Delphi framework with the influencing factors collected and rated. The findings from the German and the Italian case show conformity or deviation and further indications from other countries are also taken into consideration. Since it is difficult to quantify the variances, symbols are used whereas “=” means conformance, “▼” negative deviation, and “▲” positive deviation from the Delphi framework. Regarding the type of influence, “++” stands for strongly positive, “+” for positive, “-” for negative and “--” for strongly negative influence.

	Chapt. 5.2	Chapt. 5.2	Chapt. 6.2.	Chapt. 6.3	Chapt. 2.2. / 3.
Influencing factor	Delphi type	Delphi rating	Rating German case	Rating Italian case	Rating others
(4) Access to and availability of attractive train paths	++	1	=	=	=
(10) Market potential and market size of the OD, the line or the network	++	2	=	=	=
(13) Presence of intermodal competitors	--	3	=	▼	▼
(15) Generally low profitability of the industry	--		=	▼	=
(11) Costs for infrastructure	-		=	=	=
(28) Access to rolling stock	+	4	=	▼	=
(3) Access to facilities as well as data	+	5	=	=	=
(31) Homologation process	--	6	▼	▼	▼
(29) Lack of technical harmonisation within the EU	--	7	▼	▼	▼
(5) Facilitation and attitude of government and politicians	+	8	▼	=	=
(25) Customers' willingness to pay	+	9	▲	=	▲
(26) Entrepreneurship	++	10	▲	▲	▲
(12) Access to distribution systems	+	11	▲	▲	▲
(2) Existing law in action	+	12	=	▲	▲
(6) Unbundling	++	13	=	▲	=
(16) Access to financing	+		=	=	=
(20) Possibility for cherry-picking in the market	++	14	=	▲	=
(7) State of and investment in infrastructure	+	15	=	▲	=
(18) Cross-financing of RUs in the market and a lack of transparency	--	16	▼	=	=
(14) Existence of network effects for incumbents	--	17	▲	▼	=
(21) Existence of (strong) unions	--	18	▼	▼	▼
(1) Existing EU and national law in the books	+	19	▲	▲	▲
(24) Adjustment to customer expectation	++	20	=	=	=
(33) Availability of necessary personnel	+		=	=	=
(34) Incumbent's performance	+	21	▲	▲	▲
(30) Existence of innovation	++		=	=	=
(17) Existence of cooperation or competition within the industry	++	22	=	=	=
(27) Attitude of press and population towards competition	++	23	=	=	=
(22) Customer loyalty	-		=	=	=
(8) Willingness or ability to subsidise operations in the country	+	24	▼	▲	▲
(19) Existence of cooperation with other transport modes	++	25	▲	▲	▲
(23) Sharing economy	--	26	=	=	=
(32) Railway safety systems	-	27	=	=	=
(9) Consumer policy	-	28	=	=	=

Table 32: Holistic examination of influencing factors (author's own diagram)

In the following, the influencing factors are discussed, focussing on the conformity and deviation between the Delphi rating and the case findings:

Access to and availability of attractive train paths is the strongest influencing factor and therefore the most important, which all cases confirm. The Italian case in particular reveals how important attractive train paths are and that the absence of this factor leaves the competitors with no chance to survive.

Sometimes, as in Germany, Austria and the Czech Republic, it is a struggle to get attractive slots on the most frequented lines due to absence of capacity and high capacity utilisation by the incumbents. Also, transparency regarding free capacity in the network is mostly absent. However, access to attractive train paths generally exists in the countries investigated, which influences competition positively, forming the basis for current and future services.

Market potential and market size clearly are important pre-conditions for the existence of competition and therefore play an important role. This can be observed in the Delphi study and all cases. The examples of NTV, RegioJet, LEO, WESTbahn, and Locomore in particular show that most competitors enter on cherry-lines, where high market potential exists which demonstrates the high, positive rating. Also, the shift from intermodal competitors to rail and the increasing rail passenger figures in the countries observed form a positive basis for competition.

The presence of intermodal competitors has high influence on open access competition. Motorised private transport is the biggest competitor preventing people from using public transport. It is therefore considered highly negative by the Delphi panel. Coach competitors in particular have influenced competition negatively in recent years. However, the observed cases show that the degree of influence varies strongly between countries: while the liberalisation of coach transportation has affected competitors in Germany and Austria strongly, it has

no significant effect on the high-speed services of NTV. However, in Germany and the Czech Republic, cooperation between both transport modes also proved beneficial for competition, in the cases of RegioJet, Locomore and HKX. This thesis shows that intermodal competition generally is a threat to open access providers, but to be successful, RUs need to think about new ways of cooperation to skim the market potential of more people shifting from cars to public transport. The analysis also shows that due to the differing cost structure (e.g. rolling stock, infrastructure fees), and higher flexibility of operations, no level playing field between coaches, cars and rail exists.

Open access competitors in the market show that the *generally low profitability* of long-distance passenger rail. Small RUs like Locomore and Arenaways prove this, but also bigger providers like NTV and LEO struggle for profitability. Therefore this factor has a strongly negative influence on competition, since it also hinders potential competitors from entering the market. While conformity exists between the Delphi rating and most cases, the Italian case shows a deviation: the examples of NTV show that profitable operation is possible. It usually takes some years' time to reach break-even, this requires enough funds to survive the first few years. However, the analysis also shows that big incumbents also rely on state subsidies or investments to operate trains at high-quality level, especially in regions with lower market potential.

Costs for infrastructure is closely connected to the previous factor. With an average of 25-30% of total costs, this influences competition strongly and negatively. While a general conformity between the Delphi rating and the cases exists on the strength of the factor, differences between the countries under investigation occur: prices in the Czech Republic are lower than in Germany and access charges for the Italian high-speed network have been reduced over

recent years. The example of NTV proves how positive the effect of reduced infrastructure costs can be, both for the incumbent and customers. This factor also presents a competitive disadvantage to intermodal competitors, e.g. coaches.

Access to rolling stock is a basic condition to operate services and therefore has a high influence on competition, mostly a positive one. Conformity exists between the Delphi rating and the cases, however in the Italian case the influence of rolling stock is slightly lower than in the other cases. In the countries under investigation, access to new rolling stock is possible without problems, as soon as sufficient funds exist. Big manufacturers are willing to sell to all RUs. A problem is that the market for second-hand rolling stock is limited in most countries, which is an entry barrier for those operators that cannot afford new rolling stock in the first stage, like HKX, Locomore and RegioJet. In the existing literature, access to rolling stock is mostly described more negatively than appears to be the case, but the access to financing plays a big role.

Access to facilities and data is closely related to access to paths. It therefore plays an important role and is rated as positive, conformity exists between the Delphi rating and the cases. With a further implementation of law into action and with more experience and increased professionalism of incumbents and authorities, less discrimination occurs with regard to facilities as the Italian and German cases show. Access to data, especially commercial or ticketing data, is still not provided in most countries but seems not to be a deal-breaker for competitors. Since this influencing factor is so closely connected to path access, it should be considered as one factor for future studies.

The homologation process and the lack of technical harmonisation within the EU are of medium importance, both are rated highly negative. However, a deviation exists between the case study findings, the analysis of the other countries and the Delphi findings. The high rating of the Delphi panel could not be confirmed. On the one hand, this is due to the great improvement of the homologation process in all countries under investigation. On the other hand, the absence of technical harmonisation plays mainly a role for international services, where open access competition remains rare. RUs like Locomore, HKX and RegioJet show that import and refurbishment of second-hand rolling stock in Europe is possible. Overall, the two factors play a role of medium importance for competition, still providing some complexity for rolling stock procurement and market entry. The planned improvements with regards to vehicle authorisation in the 4th Railway Package can further improve the situation.

The facilitation and attitude of government and politicians towards competition plays a role for competition and is positive. A positive attitude towards competition can be seen in all countries which forms the basis for competition. Most countries reveal no negative intervention by government and politicians; however, the positive attitude scarcely results in proactive support for competitors, as seen in the example of NTV in Italy. This is also due to the fact that incumbents are still state-owned and serve the countries' purposes. The German case shows a slight deviation, since no noteworthy intervention could be observed, and the influence of this factors is therefore slightly lower.

Customers' willingness to pay has a strong influence on competition, especially since it is connected so closely to market potential. In Germany and other cases like the Czech Republic or Austria, the importance of this factor is even higher

than indicated in the Delphi rating. Overall, this factor is perceived as a positive influence. In Italy and Sweden, customers are shifting from other transport modes, e.g. car and air to rail, and are willing to pay an adequate price, especially in the profitable business sector. However, the German example shows that when customers are price-sensitive and the RU's strategy is to offer low-price tickets, the RUs are highly vulnerable to intermodal competition, especially coaches. Therefore, it can also have a negative influence as the examples of InterConnex and HKX show.

Entrepreneurship is a factor which becomes apparent only at second glance. It is rated medium important and plays a highly positive role for competitors. The observed cases show a deviation from the Delphi rating: the examples of Locomore, HKX, RegioJet and WESTbahn show how important a strong and determined entrepreneur is to overcome entry barriers in the first place. NTV's example shows how important the entrepreneurs' networks are to access financing and to do lobbying, something that Arenaways could not achieve. A strong entrepreneur seems to compensate for the role of the state backing up the incumbent. Also, most entrepreneurs behind competitors have experience in, or an emotional connection to rail transportation, which makes them more passionate towards the product.

Access to distribution systems plays an important role and has a positive influence on competition. With regards to this factor, a clear deviation exists: the case study shows that it is even more important than the expert panel's rating and digitalisation made it easier for competitors to distribute tickets. However, while more and more tickets are sold online, some stationary distribution is still important for customers, which competitors like NTV, LEO, MTR and

WESTbahn implemented in their distribution strategy. It also shows that setting up a new distribution system is costly and cannot be afforded by all new entrants. The particular examples of DB/ÖBB in Italy and Locomore and HKX in Germany show how important a big distribution partner can be for profitability. Overall, much more potential exists regarding partnerships with distribution platforms, incumbents, intermodal players, and competitors.

Existing law in action and in the books plays an important role for open access competition. While the Delphi rating places this factors in the middle range and the lower middle range, the case study indicates that the importance is greater than rated by the Delphi panel. The insolvency of Arenaways compared to the success of NTV in Italy gives a clear indication: a sound implementation of regulations, combined with strong and independent authorities promote competition. However, the two influencing factors might not be perceived as so important by the industry, since they are the pre-condition for many other factors and trigger competition indirectly, as described in detail in section 7.3.

Unbundling has a strongly positive influence on competition and is of medium importance. Conformity exists except for the Italian case. The Italian example reveals in particular how important a clear and monitored separation between IM and RU is, regarding Arenaways' insolvency and the market entry of NTV. Experience from the Czech Republic supports this. Separation in combination with a strong and independent authority promotes competition greatly. It also influences the incumbents' performance and prevents discrimination, also encouraging more RUs to enter the market.

The *access to financing* plays a role for competition and is rated as positive. Despite the existing conformity between the Delphi rating and the case study

findings, the access to financing varies between countries and competitors, as the examples show: while it was possible for NTV to access funds in Italy and LEO in the Czech Republic, it proved to be more difficult for Locomore, HKX and other potential entrants in Germany. Locomore finally used a crowdfunding approach to gain funds, which failed due to the relatively small amount of money for the railway industry. The analysis also shows that no level playing field exists between incumbents and competitors, since incumbents can mostly access government funds at good conditions.

The *possibility for cherry-picking* proves to be of medium-high influence and is highly positive for competitors. In the Italian case, this factor shows a deviation: the possibility for cherry-picking proved to be of higher importance as in other countries. Most providers like NTV, LEO, RegioJet and FlixBus make use of cherry-lines and compete with the incumbents on their most profitable lines. Since those lines are mostly not subsidised by the state, competition cannot be hindered. It also shows that this factor is closely connected to market potential, since the high passenger figures lower the risk for market entry.

The state of, and investment in infrastructure has a medium and positive influence on competition. Again, this factor shows a great variation between countries: while high investment in high-speed infrastructure played a significant role in the market entry of NTV and helped WESTbahn. It is only of medium influence in other countries like Germany and the Czech Republic, where the infrastructure is intact. Therefore, especially the Italian case shows a positive deviation from the Delphi rating and is considered as more important for Italian competition. The importance of this factor is increased when bigger market

potential can be accessed by incumbent and competitors due to improved infrastructure conditions.

Cross-financing of RUs and a lack of transparency is a highly negative influence and has medium strength, due also to strict regulation. The examples show that in some countries, it seems to play no role, e.g. in Germany. Therefore, a deviation between the Delphi rating and the German case exists. In other countries, cross-financing, especially of PSO-money supports incumbents in price wars, e.g. in the Czech Republic and in Austria. Therefore, it can be a danger for competitors and strong regulatory authorities are important.

The existence of network effects for incumbents affects competitors negatively and has a medium influence. The examples show that how strong the influence of network effects is, always depends on the individual services. Therefore, a deviation between the Delphi and the case study findings exists: in Germany, the network effects of FlixBus help the rail products of Locomore and later FlixBus to weaken the influence of the incumbents' network effects. In Italy, the city-to-city connections of NTV are not fundamentally dependent on network effects. For other smaller competitors, e.g. HKX or Arenaways, it was a major negative influence.

The *existence of unions* was rated as medium important and negative by the Delphi panel. The investigation of the German and Italian cases and examples from other countries, however, showed a deviation: the importance of unions seems to have only a low influence on competition. While unions played no role at all in the German case, and played a small role in the Italian case, the influence was manageable and a level playing field with the incumbent exists.

When considering Austria, Sweden and the Czech Republic, no significant interference with competition can be observed.

Adjustment to customer expectation has a medium and positive influence on competition. This is indicated by the Delphi panel and the case study and conformity exists. It is interesting that some competitors perceived it differently before market entry: NTV and LEO planned a product differentiation strategy by offering better quality and small-sized premium areas, Locomore tried to attract customers by offering e.g. social seating. The examples show, however, that a basic quality and good prices seem to attract the customers more and no large premium could be charged by offering these extras. In the end, the companies were forced to adapt to this expectation.

The *availability of necessary personnel* is a medium influence, rated as mainly positive. The examples in all countries under investigation show that the necessary personnel exist, and a conformity is given between Delphi rating and case study findings. However, in some cases, e.g. train drivers, it becomes more difficult to find appropriate personnel than it was in the past. This is especially the case in countries with a low unemployment rate, e.g. in Germany. It is likely that this factor might change into a stronger, negative factor in the next decade due to demographic change and the growing shortage of skilled workers available in this field.

The *incumbent's performance* is rated as medium-low important and positive for open access competition. This factor shows a great deviation between the Delphi rating and the case study findings: in the observed cases, some degree of discrimination took place, especially in Italy, which was of high importance for the open access competitors. Further, the incumbent's performance is very

influential: a good performance and a high market coverage leave little market potential for open access providers. This is one reason to explain the low market share of competition in Germany.

The *existence of innovation* is rated as very positive, but the factor's influence is not yet very great. Conformity exists between the Delphi and the case study findings. Examples show that competitors make use of IT innovations, especially in the field of distribution, where the greatest positive effect can be seen. Product innovations are used by some competitors, but they have no significant effect on the number of customers, e.g. InterConnex's childcare programme or Locomore's social seating. It will be interesting to observe these factors in the next few years, due to the great potential that lies especially in digitalisation.

The existence of *cooperation or coopetition within the railway industry* is rated as weak, but very positive. This is confirmed by the case study findings, too. Some cooperation between open access operators can be observed, e.g. HKX with regional transport providers, DB-ÖBB with TI or RegioJet's attempt to cooperate with DB Fv on the Berlin-Prague line. Most of them were profitable for the competitor, but this factor has not been a great game-changer in the past. Especially on international lines, incumbents often have cooperation agreements with other incumbents and jointly run those lines. For them, this minimises the risk for open access competition by neighbouring incumbents and might block market potential for private open access providers on international lines.

Despite a variety of *customer loyalty* programmes of most competitors and incumbents, customer loyalty and the *attitude of press and population towards*

competition only have a weak and negative influence. Despite having a positive attitude towards competition, customers in the railway industry do not seem to be very loyal if they are provided with different options, and low prices can incentivise them to switch between companies. This can be observed in all countries under investigation and in the Delphi rating. Despite the negative rating of customer loyalty, this factor can also be beneficial for competitors, since it implies that customers are not loyal to the incumbents either.

Willingness or ability to subsidise operations varies greatly between the countries under investigation. In Germany, no willingness to subsidise long-distance passenger rail exist and therefore positive conditions and freedom are provided for competitors. In Italy, a high degree of the non-high-speed long-distance network is still subsidised, which makes it almost impossible for competitors to compete on these lines. The Austrian and Czech examples confirm this. Still, the unwillingness to subsidise profitable lines provides competitors with a fair chance to compete against the incumbents. The factor is therefore considered as slightly positive, but rather weak in total comparison.

The existence of *cooperation with other transport modes* is rated as a low but very positive influence on competition. However, compared to the Delphi rating, the cases of Locomore, WESTbahn and RegioJet indicate that the influence is much greater than perceived by the panel: a cooperation with FlixBus and LEO saved the insolvent Locomore and the sound coach network of StudentAgency enabled RegioJet to start operations in the first place. For others, small partnerships e.g. with regional providers like HKX, did not improve the business case significantly. In future, competitors should closely consider

intermodal partners to optimise the business, also with regard to distribution and network effects.

The sharing economy, railway safety systems and consumer policy have no great influence on competition. While the provision of rail safety and consumer policy is a basis to operate in the market, no significant effect on competition can be identified. The sharing economy is rated as weak but very negative by the Delphi panel, but evidence from Germany and Italy shows that the sharing economy is still too weak to harm competition.

Bearing all this in mind, these findings result in the following Force Field Analysis. The Force Field Analysis was originally developed by Kurt Lewin in 1963 as a tool to show driving and restraining forces which result in some form of state of equilibrium in a social context. Lewin describes how a person or a group finds itself in a state of tension, which is dependent on the number of driving and restraining forces (Döring & Glasl 2008). This model is transferred into the context of this research project, revealing the negative and positive influencing factors on open access competition in the form of arrows. The strength of factors is shown by the length of the arrow. The darker coloured arrows show a more positive/more negative influence. The overall sum of forces describes the balance of the system.

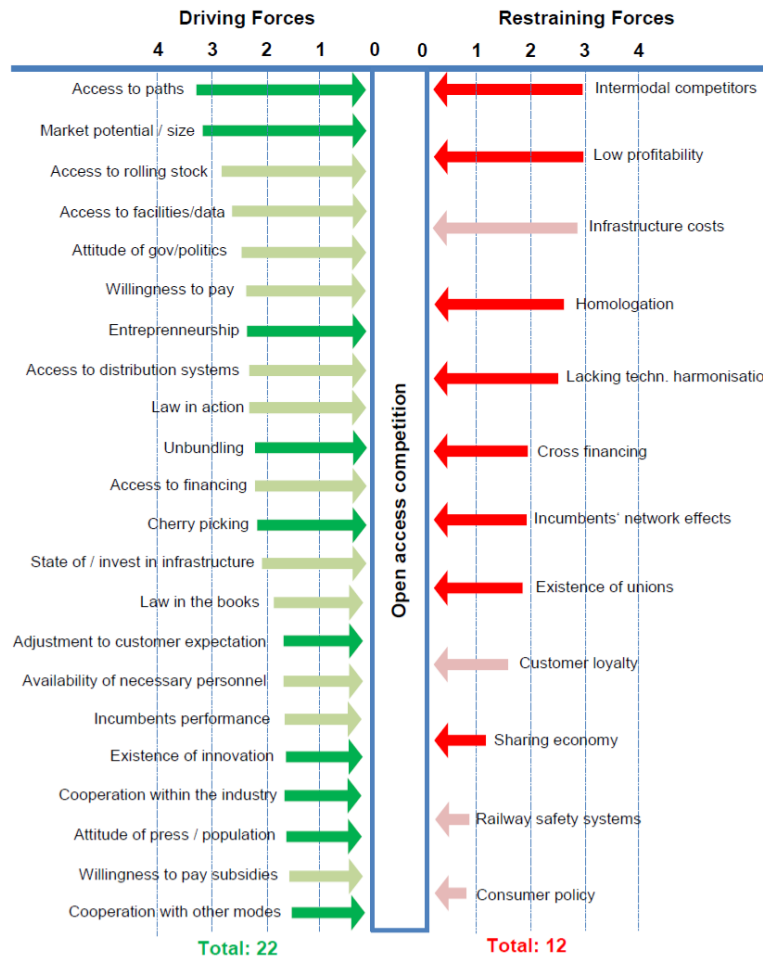


Illustration 20: Force Field Analysis of influencing factors (adapted from Döring & Glasl 2008)

The Force Field Analysis reveals that the positive, driving factors outnumber the negative, restraining factors that influence competition. This indicates that the overall setting of open access competition in the countries under investigation is positive. Two-thirds of identified factors also encourage competition while one third still holds back competition. However, the analysis needs to be considered under the premise that mean values on a European level are used. This means that in the different country cases, the force field might look slightly different. For example, in the German case the existence of unions is not as negative as shown above. In the Italian case, the existence of intermodal competitors would not be rated as strong. The state of and investment in infrastructure in the high-speed sector would also be more positive and stronger.

Overall, the discussion of the influencing factors draws a positive picture of the conditions for open access competition, also showing some need for improvement. It once again becomes apparent that differences occur between the European countries and that the factors need to be considered individually, depending on the country of operation.

7.3. Discussion of correlations of influencing factors

As described in chapter 2, the network industry is a complex industry with many natural interdependencies, caused by the reliance on the infrastructure, specialised technology and the need for basic regulation to avoid discrimination. Consequently, most factors identified somehow relate to each other and form a network of influencing factors. While the findings from the Delphi study only allowed indications about the correlation of factors, the in-depth analysis of the case study made the existing correlations more apparent. Overall, the network can be divided into three parts or sub-networks: the first degree of interrelation is of a political and legal nature, it forms the basis for open access competition by providing the underlying legitimization of its existence. The second degree of interrelation is the market-sided conditions for open access competition, it forms the economic basis to survive profitably in the market. The third degree of interrelation can be considered as optimisation measures which are not a pre-condition for the existence of open access competition, but add to the profitability and success of the RUs. The following diagram gives an overview of the correlation of factors, thereby focusing on the most prominent ones. The factors marked in red act as nodes in the network since many factors are correlated to them. The factors marked in light grey find themselves on the outer edge of the network with less important correlations.

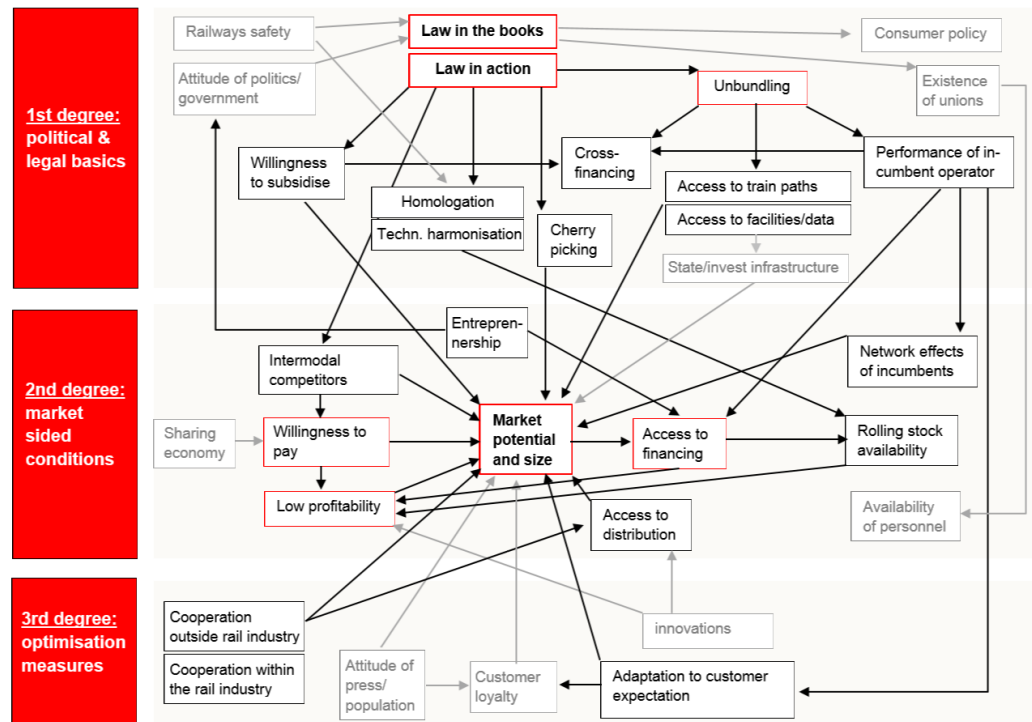


Illustration 21: Overview of correlations between influencing factors (author's own diagram)

This diagram allows a good overview of the nodes in the system which are of high relevance for the development of the other influencing factors, proving the theoretical basis outlined in chapter 2. The existence of law in the books and the implementation of law into action form the basis for open access competition in the first place. The two factors influence several other factors directly and strongly, e.g. unbundling, intermodal competition, homologation, technical harmonisation, willingness to subsidise, and cherry-picking. Some of these are rated as strong influencing factors in the Delphi study and reveal a massive influence in the case study, too. They can therefore be described as the motor or catalyst of open access competition. The Italian case shows this impressively: when the law in the books was properly implemented and gaps in the regulations were closed, other factors like unbundling, access to train paths, and the performance of the incumbent were improved, thereby triggering the successful market entry of NTV, when Arenaways failed a few years earlier. Unbundling, which is directly influenced by law in the books and law in action, functions as a node itself by directly affecting cross-financing, access to train

paths and facilities and the performance of the incumbent. The incumbent's performance, which is again influenced by unbundling, also influences several other factors, including market-related conditions. The German case proves how difficult it can be for a competitor to enter the market, where a fair but strong incumbent dominates.

The second sub-network are market-sided conditions, a node form market potential and market size: the factor is directly connected to access to distribution systems, access to financing, customers' willingness to pay, low profitability and access to train paths/facilities, the incumbents' performance and other factors. Some of these factors are also rated as strong in the Delphi study. The findings from the case study also show that once the legal/political preconditions exist, the market decides upon the success of an RU: Locomore went bankrupt due to insufficient financial resources, customers' low willingness to pay and not enough passengers due to an inefficient distribution system. After the takeover by LEO and FlixBus, those factors were influenced positively and market potential could be skimmed more efficiently. The Czech example, with two competitors in the market, also shows that once a big enough market and number of regular passengers exist, competitors can co-exist. The example of WESTbahn in Austria and MTR Express in Sweden also proves that. The political precondition that cherry-picking is allowed plays a big role. The three smaller nodes, customers' willingness to pay, low profitability and access to financing also have a strong interrelation with market potential and market size. Experience from Germany shows that intermodal competition can influence willingness to pay directly, resulting in low profitability of RUs. Arenaways and the early Locomore reveal that access to financing and insufficient financial resources in the start-up situation are strongly influenced by

the incumbents' performance, entrepreneurship and the availability of rolling stock and its prices, which in turn influences profitability.

The third degree of optimisation measures reveals no additional nodes in the system, but adds to the above-named nodes, as shown in the case study. In the two analysed cases as in the other countries under investigation, innovations, customer loyalty, the attitude of press and population as well as cooperation and adaptation to customer expectation are supporting factors that trigger others and work for the optimisation of a running system. For example, the experience from FlixMobility, Locomore and HKX in Germany indicates how beneficial partnerships outside the railway industry can be and that some potential might not yet be exhausted.

The hypothesis of a network of interrelated factors influencing open access competition can therefore be confirmed. All factors cannot be analysed in a stand-alone perspective and decisions made by politicians, incumbents and open access providers need to incorporate the other influencing factors that relate to the factor under investigation. The diagram developed can provide a good guideline for that.

The diagram also provides an explanation for the question of why the most liberalised countries, e.g. Germany, show so little competition. The first sub-network, the pre-conditions from the political and legal basics, mostly exist, such as separation of IM and RU, strong authorities that monitor this, no subsidies for the incumbent, with the possibility of further cherry-picking.

However, some factors have a direct and negative influence on the second sub-network, the market-related conditions: access to train paths generally exists, but due to the dense network of the incumbent and regional and cargo RUs on

the lines, it is more difficult to find free attractive slots that provide enough market potential than in Italian high-speed rail, for example. The incumbent's strong market position also influences competitors' market potential and market size, despite a large market for mobility in Germany. The incumbent's strong position makes access to financing for competitors more difficult, which again affects the accessibility of rolling stock. The example shows that it is not only the individual influencing factors which make competition difficult in countries, but the dependency on one another and the series of effects.

7.4. Discussion of shift of influencing factors

Over the last decade, some shifts of influencing factors took place all over Europe. Again, the shifts vary between countries and reveal different directions and strength. The indications given in the Delphi study could be confirmed in practice. Below, the most apparent and interesting shifts of factors are discussed:

The access to distribution systems has changed over recent years, but the shift took place on different levels, as described in section 7.2.: digitalisation has changed distribution in the entire transportation industry. Mobile and online ticketing make RUs more independent from stationary distribution points and reduce complexity and costs. Therefore a basic ticket distribution can be guaranteed with limited financial resources, by offering a website, apps and a call centre as seen by all open access competitors currently in the market. This can be considered as a great, positive shift towards competition. Nevertheless, the incumbents' network effects, prominence and wide recognition in the population and the preference of some customers to buy the tickets in stationary offices or on ticket machines influence the open access RUs' success

to a great degree, as Locomore and HKX prove. In some cases the market potential cannot be skimmed efficiently and conventional distribution systems still play a role. NTV, LEO, MTR and RegioJet solved this problem by building their own distribution structure with new technology, ticket machines and sales offices, which led to additional fixed and variable costs. WESTbahn sells tickets in “Trafiken” (kiosks) all over Austria. Locomore accessed the wide distribution system of FlixBus after the takeover. DB/ÖBB managed to enter TI’s distribution system. Overall, it can be said that access to a distribution system became easier in recent years, the ground was prepared by digitalisation. However, to access the entire market potential, powerful distribution partners or a high investment in stationary distribution infrastructure are necessary. However, their importance has decreased and is likely to decline with advancing digitalisation.

With the liberalisation of coach transportation in some European countries, the influence of *intermodal competitors* on long-distance rail has shifted greatly. The German case in particular proves this: within a short period of time, numerous new coach competitors entered the market and offered services on a variety of new lines, offering tickets at a low price. This also attracted rail customers and had a direct influence on the price level and the incumbent’s and open access competitors’ profitability. A similar development can be found in Austria and to some extent in Sweden. In the Italian case, the influence of coach providers on competition has not increased as strongly as in other countries. Another aspect of intermodal competitors, which appeared in recent years, is the possibility of profitable partnerships: RegioJet in the Czech Republic used to be a mere subsidiary of the coach company Student Agency and LEO cooperates with FlixBus in Germany to run Locomore. Intermodal competition not only

moved to a greater extent to open access competition, but also became a potential partner for competitors. The future will show how RUs use this potential to move more passengers to public transport, which would be beneficial for the whole system.

Another shift can be observed regarding the *homologation process* which has improved over the last decade, as can be seen in the Italian and German cases. In the past, it used to be a big bottleneck, deterring investors and RUs alike. Today, handling in the institutions has become more professional and fairer, and also takes less time. Therefore its negative influence on competition has decreased. When considering the other countries under investigation, it is shown that the recent homologation of rolling stock has not been a problem: WESTbahn in Austria recently homologated new Stadler KISS trains without any delays and complications, examples from Sweden support this thesis. Homologation is still a precondition to offer safe and well-functioning rail transport, but it cannot be considered a major entry barrier nowadays.

Implemented law in action also shows a shift over the last decade, especially in some countries. While Germany and Sweden were considered as advanced countries regarding liberalisation by the LIB-Index in 2011, the Czech Republic, Austria and Italy lagged behind. This, however, has changed in recent years. The implementation of law in the book into action has made the handling of competition in those countries more professional. The early competitors, e.g. Arenaways, DB/ÖBB, InterConnex and RegioJet, were forced to deal with discrimination of the IMs and the incumbents. Due to the implementation of independent and strong authorities, the rights of open access RUs are enforced, protecting them from major cases of discrimination in most fields.

Some further steps need to be taken, but the work of recent years is paying off, making open access competition more likely in Europe.

Low profitability has been an influencing factor for the industry for decades. The obligation to provide public transport for the population combined with the high costs were one reason why railways were state-owned for a long time. With improvements in technology and within the organisational structure, profitability has increased. Still, the case remains critical, as the insolvencies of Arenaways and Locomore and the bad economic situation of most other open access RUs show. This factor became more negative in the last few years, due to the market entry of low-cost coach services, the increase of operating costs, especially infrastructure costs, and rolling stock costs. The intensity of competition and the reduction triggered in ticket prices influence the incumbents' and competitors' profitability. The positive consequence is that incumbents need to change and become more efficient to be competitive in the future. Still, it remains a danger for open access competitors and needs to be closely monitored by politicians, since it has the potential to steal the basis of open access competition's existence.

Overall, it can be said that some major steps towards a liberalised market have been taken in the recent years and entry barriers have been reduced. However, some open issues exist which need to be addressed in the next few years to promote open access competition. The negative trends, e.g. low profitability, need to be closely investigated and countermeasures need to be developed on a transport system level.

8. Chapter 8: Conclusion

This chapter draws conclusions from the thesis. Firstly, the core findings are stated. Then, recommendations for politicians and companies are given while referencing the core findings. Finally, some suggestions for further research are made, also taking questions into consideration which have not been answered in this thesis.

8.1. Core findings

Competition in the European long-distance passenger rail is an interesting phenomenon to investigate: feared by incumbents, longed for by unsatisfied customers, treated with ambivalence by politicians, and followed with interest by press and researchers. This thesis aimed to give a detailed picture of open access competition in the market and its journey over the last years: it identified 34 factors influencing competition, their mutual correlations in form of a tight network and their partial shift over time. To answer the research questions, a PESTLE-analysis was used to provide structure and guidelines, a Delphi study was applied to construct the theoretical framework and a final case study filled the framework with practical examples.

What becomes clear is that the introduction of open access competition into the long-distance passenger rail industry proved to be extremely difficult. Up to now, open access competition has not been able to assert itself: in Germany, Austria and in Sweden, no significant market share could be achieved by competitors and in most member states, open access competition does not exist yet. In the Czech Republic and in Italy, moderate market shares could be attained, but only on individual lines and not on the entire network. But what made the introduction of open access competition so difficult? The first reason

is that the introduction of the legal environment took a long time: law in the books needed to be introduced into action and the necessary institutions and authorities needed to be established. The insolvency of Arenaways in Italy is a good example of what happens in case this is not yet given. The entry into a market, which is not yet regulated and monitored properly, proved to be very risky and often unsuccessful. This clearly prevented potential competitors from entering the market. Another reason is the difficult economic situation of the first RUs. HKX and InterConnex as well as Locomore in Germany did not break even and had to leave the market. It can be stated that open access competitors need to have a long breath to be successful, as the cases of RegioJet in Czech Republic and NTV in Italy show. This, combined with high investments and economic risks, might further prevent companies from market entry. Further, this thesis shows that a number of influencing factors need to be present in order to achieve the right competitive environment, as section 7.3. shows. If this is not given, market entry is not possible as the cases of MSM and derschnellzug.de in Germany show. Still, the companies operating in the market show that the introduction of open access competition has been successful to some degree: it took a long time and a series of setbacks but the Delphi study and the case study show that a development took place over time and successful open access competition is possible.

However, competitive markets could only be introduced into some areas of the industry: open access providers operate especially on profitable ODs, which connect big cities or metropolitan areas. This is the case in Italy, Czech Republic and Germany. Particularly if the train connection is faster or as fast as intermodal competitors, open access is successful. Then, also market shares from other transport modes can be acquired. This leads to a big market

potential, which could attract further open access competitors in the future.

Especially the Czech example shows that in a country, where the incumbent operator provides low quality, open access providers offering good quality and innovative services, have a better chance to succeed and to be profitable in the long run. What this thesis also shows is that competition on secondary routes and in more regional areas could not yet be introduced successfully. Some examples exist, like InterConnex, but generally the existence of PSO, the higher degree of intermodal competitors (especially car and coach services) and the smaller market volume prevent the existence of open access competition on those lines.

Still, the current examples of open access competition show that the long journey was worth the efforts, and that the introduction of open access competition is beneficial on many levels: a demand for open access providers exists. The examples from Sweden, Czech Republic and Italy show that competition led to more choice for customers, higher quality of long-distance passenger rail in general and reduced prices. Further, the new competitive situation also forces the incumbents to provide better quality, as the example of TI shows. As a consequence, the modal share of rail increased on the ODs with head-to-head competition, which has a positive influence on the environment. This is a core element for the EU's strategy to reduce future transport emissions. Further, competition leads to a higher efficiency in the market since incumbent operators as well as competitors need to reduce costs in order to provide competitive prices. While the positive aspects outweigh the negative ones, some drawbacks of open access competition exist: on the one hand, the complexity of the system is increased. An overcrowding of infrastructure of profitable ODs can lead to congestions, if the existing infrastructure is not built

for a high frequency of trains. The example on the line Prague-Ostrava shows this. Also, the train paths allocation is more complex than without open access competition. On the other hand, the overall profitability of the rail industry is expected to decrease due to open access competition. This might lead to the reduction of all unprofitable ODs, especially in the regional areas. In the worst case, it could lead to the exit of further open access providers, as in the case of InterConnex.

Having in mind that open access competition has an overall positive effect on the railway industry, what are the underlying drivers that affect competition and that help to establish a competitive market? This thesis identifies and discusses 34 influencing factors from political/legal, economic, social, technical and other backgrounds, as shown in section 7.2. When present, they mainly influence open access competition positively. The Delphi study as well as the case study show that two underlying factors exist, that affect all other factors and therefore determine the success of open access competitors in a country: firstly, an appropriate legal framework needs to be set up, with strong and independent institutions set in place. Secondly, a beneficial market environment needs to exist, with high market potential and accessible financing. For the countries analysed in this thesis, the political/legal framework has been improved over the last twenty years and a good starting position is given. Therefore, the market side becomes more important: if an open access provider is ready to provide good quality at a reasonable price, the development of open access competition can be sped up in the future. However, the experts in the Delphi study do not expect a drastic increase in the next decade.

Coming to an end, this leaves one important question to be answered: how can open access competition best be introduced? As described above, the basic condition for successful open access competition is the sound implementation of law in the books into action. In doing so, no gaps should be left for interpretation that allow the incumbent to discriminate against competitors. All institutions which guarantee this need to be set in place as soon as possible. Also, the right market needs to be addressed to establish successful open access competition. Especially ODs with high market potential and with relatively fast infrastructure are best suited to enter a market. It is important that the IMs are prepared to make those attractive slots available and that not only the incumbent can offer fast connection at the right time. A successful path allocation system needs to be set up. The level of RACs needs to be considered as well: some ODs in Europe, e.g. some highspeed connections, can scarcely be run profitably. With the opening of the overall European market for open access competition, especially those lines could be attractive for competitors. Therefore, a reduction of RACs might be necessary to establish successful competition. Further, a level playing field between intermodal competitors is necessary for successful competition. If transport emissions are to be reduced, especially on those lines where car and coaches have similar travel times, a similar cost structure must exist in order to shift passengers from car and coaches to rail.

The research on open access competition proved to be very interesting, throughout the whole process of this thesis. A holistic picture of open access competition in the EU could be drawn, which can benefit the development of competition in the next years. Especially the EU-wide market opening in 2020

will be a crucial date for the future of open access competition, which will be observed closely by politicians, companies, customers and researchers alike.

8.2. Recommendations

Based on the findings of this thesis, the following recommendations can be made, divided into different levels: European politics, national politics, open access providers, and incumbents.

Politics at the European level. Both the Delphi study and the case study reveal that open access competition proves beneficial, if set up correctly. Therefore the EU's expectations can be fulfilled by promoting open access competition. During work on this thesis, the EC decided to make domestic open access competition mandatory, which is a step in the right direction. A recommendation is that the EU must continue to monitor the liberalisation process closely and further observe violations of law as well as taking enforcement actions when appropriate. The Italian case shows that the simple implementation of EU law in the books is not a solution which promotes open access competition. It is therefore necessary that existing law in the books and future law in the books need to be holistically implemented as part of a network of influencing factors, without leaving leeway for interpretation. The progress made regarding homologation shows that the EU has taken the right steps and needs to continue with the idea of a one-stop shop in the future to further reduce the negative influence from this factor. Technical harmonisation between the countries must also be observed closely and a higher process speed might be necessary to reduce the negative influence and provide the basis for additional international open access competition.

Politics at the national level. Despite the EU's decision to make domestic open access mandatory by 2020, liberalisation can also be promoted at the national level more quickly. It is recommended that the EU countries examine the situation and proceed to allow open access competition partly or entirely. This speeding up bears risks as well and needs to be considered closely, also taking other transport modes into consideration. If this step is taken, it is of great importance to establish and guarantee the independence and necessary strength of the respective authority, since this proved to be the core issue in the Italian and German cases. The case study also reveals and the Delphi study indicates that PSO needs to be reconsidered as well. In Germany, no PSO in long-distance passenger rail exists, in Italy the high frequency of PSO-services on some lines leaves little room for profitable open access competition. It is therefore recommended to closely examine the necessity to pay subsidies on highly frequented secondary lines, to open new possibilities for open access providers. Furthermore, the Italian case proves the influence of amended costs for infrastructure: the reduced track access fees in Italy on the high-speed lines led to a stabilisation of NTV's economic situation, it was beneficial for the incumbent TI and due to the increase in train-km not harmful for the IM. Also, national governments tend to lose track of cross-financing, especially of PSO-money to guarantee equal conditions for incumbents and competitors.

Open access competitors. The outcome of the thesis shows that the optimal absorption of market potential is the key to successful open access competition, once the legal framework exists. This requires different steps from providers: before market entry, an analysis of the currently existing market potential and an estimate of possible future customers need to be performed. The overall increase in rail customers in the Italian high-speed network indicates this. This

forms the basis for economic success. It further shows the necessity of a successful distribution strategy: the increase of customers for Locomore after the integration into FlixBus's distribution system is impressive. This once again indicates that a strong distribution partner or a well-functioning distribution system is a precondition to realise the existing market potential. A further finding is that product differentiation strategies that addressed especially the higher-priced segments, by offering premium quality, did not work out for most open access competitors. The setting up of low-price strategy on the other side worked out well for some open access providers, like RegioJet, FlixBus, and WESTbahn. This strategy is therefore recommended, since it attracts more customers not only from the incumbent, but also from other modes of transportation. Overall, it is recommended that the open access providers have a close look at the existing network of factors influencing their individual case: this can help to show additional risks or chances that are not obvious at first glance.

Incumbents. The findings of the study reveal that the existence of open access competition does not have to be a disadvantage for incumbents, if they can provide a comparable service. Within a few years' time, TI managed to improve the quality of its services and its efficiency to a great degree, resulting in an increase of customers in the high-speed sector despite fierce competition. Thus when competitors, especially large competitors, plan to enter the market of the incumbent, the company needs to reconsider its positioning, internal structure and strategy to adapt to customer expectation. This makes the migration of customers to the competitor less likely. An increase of efficiency also prepares the incumbent for a potential price war after market entry. A further recommendation for incumbents is the consideration of partnerships with open

access providers or intermodal competitors like coach providers, with the goal of achieving a shift of customers to rail, and to keep those customers within the system. This can also serve as a competitive advantage over positive intramodal competitors.

8.3. Suggestions for further research

The research goals of this thesis were fulfilled completely and the topic of open access competition was reviewed comprehensively. The following section will give some brief suggestions for further research, drawing on the findings of this thesis.

The scope of the case study is limited to Germany and Italy, additional case studies of existing competition in the Czech Republic, Austria and Sweden are recommended. This would lead to a broader set of qualitative data and the identified influencing factors could further be challenged from additional country perspectives. The analysis could further be extended to a specific investigation of international long-distance passenger services, to challenge the influencing factors by having two or more European countries under consideration. While the influencing factors identified by the Delphi study form a framework, the case study reveals developments until the middle of 2018. To identify future developments, it is recommended to conduct a similar study in a few years' time, especially regarding the opening of the market for open access competition in all member states in 2020, and a shift of factors and new factors occurring. With the further development of competition and the generation of new, quantitative data, the outcome of this thesis should once again be challenged, taking this quantitative data into consideration. Moreover, it would be helpful for understanding the global passenger rail industry if the identified

influencing factors could also apply to other countries. Therefore a new Delphi study with an extended panel is recommended. This thesis shows that the development of customers' willingness to pay has a major influence on open access competition, and also on the profitability of incumbents. It would be helpful for the passenger rail industry to investigate these influencing factors more closely, especially taking the intermodal competitors such as coach providers and airlines into consideration. With PSO closing markets in which open access competition could be beneficial for customers and regions, the system of PSO needs to be reconsidered once again, answering the question if PSO on profitable lines is a strong means to prevent open access competition and what needs to be done to achieve a viable balance. This thesis gives an indication regarding the linkages of influencing factors and proposes a precondition chain. It would be helpful to do further research in this field to gain more knowledge on that part. If done properly, this could serve as a "check-list" for the politics, companies, and researchers to classify the degree of liberalisation and likeliness of successful open access competition. Finally, this thesis once again shows how interlinked the long-distance passenger rail market is with other transportation modes, especially the coach industry. It would be of great interest to analyse long-distance coaches on a European level to show past developments and give an outlook for future developments. This would also benefit the passenger rail industry since important considerations can be drawn from this concerning future strategic positioning. Also, both the Italian and German cases indicate that a combination of coaches and rail can be beneficial for rail operators, coach operators and the customers. It would be interesting to develop an approach towards an ideal combination of

coach and rail networks to optimise customer usage, maybe also including air transport.

I. Appendices

Appendix 1: Delphi information sheet

Research Project on “Open access competition in passenger rail”

Information Sheet

Dear participant,

Thank you very much for taking part in this Delphi study to investigate factors influencing open access competition in the long-distance passenger rail market. You have been chosen to participate in this study due to your knowledge in and first-hand experience of open access competition in the European long-distance passenger rail market.

What are you supposed to do?


- You will participate in a Delphi study in approx. 3 rounds over a timeline of approx. 6 months.
- You will be sent approx. 3 individual PDF questionnaires by email that can be answered electronically in approx. 20 minutes each.
- The Delphi process seeks to find consensus amongst experts on the researched topics. The findings of each questionnaire will serve as the basis for each subsequent round of inquiry.

Your rights:

- You may decide to stop being a part of this study at any time with no reason given. Your personal information will be deleted immediately. If you wish, your input given within the last 2 weeks will be deleted as well.
- You have the right to omit or refuse to answer or respond to any question.
- You have the right to have your questions about the next steps, procedure, etc. answered, unless answering the questions would interfere with the study's outcome. Please feel free to contact me at any time; my contact information can be found at the top of this page.
- Throughout the research process, you will remain anonymous. I may use direct quotes from the Delphi process, but these comments will not be linked to your name. I will keep your personal information strictly confidential.

Your risks and benefits from participating in the study:

- There are no known risks for you as a participant in this study.
- You can challenge your own knowledge and expertise with high-level experts from the industry while remaining anonymous.
- After finalisation of the study, you will be granted access to the outcome and receive a report summarising the work and my conclusions.



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Appendix 2: 1st Delphi questionnaire

1st Questionnaire: "Open access competition in passenger rail"

Research questions:

- How is competition practised in the long-distance passenger rail industry?
- Which factors influence open access competition, positively or negatively?
- Is there a correlation between these factors and do they shift over time?



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Set-up of the research process:

The foundation of the research project is this Delphi study with 25-30 experts from the railway industry. The Delphi study will consist of approx. 3 rounds of PDF-questionnaires. The outcome of the first questionnaire will then result in the subsequent questionnaire.

Set-up of this questionnaire:

This questionnaire is divided into three parts: the first part will ask questions about your working background in order to group you. In the second part, you will be asked about your general opinion on competition. In the third and most important part, you will be invited to name factors influencing competition.

Definition of terms and wording:

This Delphi study investigates intra modal competition in the railway industry, it specialises on long-distance open access competition of day trains in the EU. All questions are aimed at this type of competition. In order to guarantee similar understanding of the terms to all participants, they are briefly defined in the following:

- **Long-distance passenger rail transport:** regularly scheduled Intercity or Eurocity trains (e.g. ICE, IC, EC, RJ, SC, TGV etc.) which transport passengers with a one-way trip length of minimum 50 km by having a relatively limited stopping pattern. Most long-distance services provide additional features like different service classes, on-board catering, entertainment, etc.
- **Open access competition or competition in the market:** passenger rail operators compete on the tracks, not for the tracks. The operators compete in the market on the same routes for the same customers. The operators run the services on those lines under their commercial responsibility and do not hold public service contracts or franchises.
- **Intramodal competition:** competition between two or more railway companies.
- **Influence factors on competition:** circumstances or aspects that have an impact on or consequences for competition and encourage it in a positive way or hinder or weakens it in a negative way. The influence factors can be of political/legal, economic, social, technical or environmental nature. Influence factors could be e. g. entry barriers that prevent competition, legal changes that enable competition, underlying determinants of the industry, preferences of the customers, etc.

Part 1 – Working background & personal information

1. What is your current job position?

2. For how long have you been working in the transport/railway industry?

- ☐ < 5 years
☐ 5-10 years
☐ 10-15 years
☐ > 15 years

3. In which role have you experienced competition? *Note: you can tick one or more boxes*

- ☐ Incumbent railway company
☐ New competitor
☐ Research / consulting
☐ Politics / political institution / association

4. In which countries have you experienced competition? *Note: you can tick one or more boxes*

- ☐ Germany
☐ Sweden
☐ Czech Republic
☐ Italy
☐ Austria
☐ EU in general

Part 2 – Perspective on competition

5. How does competition shape the long-distance passenger rail market? What has changed due to competition?

6. What is the core effect of open access competition for the passenger rail market?

7. From EU perspective, competition is a way to increase efficiency of railway undertakings and to modernise them, make them more responsive to customer demand and decrease overall transport emission. From your perspective, is open access competition the right tool to reach these goals? Why?

8. How would the number of competitors in the European rail market change in the next 10 years? From your opinion, will there be an increase or decrease in competitors compared to today?

9. How would you describe your personal attitude towards open access competition?

Part 3 – Identification of influence factors

10. From your personal experience, please name factors that influence open access competition.

Note: those influence factors can either be positive and promote competition or negative which hinders or weakens competition, please name both types. Also consider influence factors from all fields (political/legal, economic, social, technical and environmental)

		Influence:	
		positive	negative
1.		<input type="checkbox"/>	<input type="checkbox"/>
2.		<input type="checkbox"/>	<input type="checkbox"/>
3.		<input type="checkbox"/>	<input type="checkbox"/>
4.		<input type="checkbox"/>	<input type="checkbox"/>
5.		<input type="checkbox"/>	<input type="checkbox"/>
6.		<input type="checkbox"/>	<input type="checkbox"/>
7.		<input type="checkbox"/>	<input type="checkbox"/>
8.		<input type="checkbox"/>	<input type="checkbox"/>
9.		<input type="checkbox"/>	<input type="checkbox"/>
10.		<input type="checkbox"/>	<input type="checkbox"/>
11.		<input type="checkbox"/>	<input type="checkbox"/>
12.		<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>

Further:

Thank you very much for your participation.

I will now evaluate and interpret the results of this questionnaire and come back to you with the following questionnaire of the second round in approx. 6-8 weeks' time. If you have any questions in the meantime, do not hesitate to contact me.

Appendix 3: 2nd Delphi questionnaire

2nd Questionnaire: "Competition in the long-distance passenger rail"

Dear participant,

Thank you very much for your participation and for filling out a first questionnaire. I have evaluated all forms and on the basis of your joint input, I have built this second questionnaire.



Set-up of this questionnaire

This questionnaire is divided into 3 parts: the first part investigates the perspective on competition and incorporates your feedback from the first questionnaire. In the second part, you will rate the influence factors indicated in the first questionnaire. The third part relates to the shift of influence factors and linkages among them.

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Definition of terms and wording

The Delphi study investigates intra modal competition in the railway industry, it specialises in long-distance open access competition of day trains in the EU. All questions are aimed at this type of competition. In order to guarantee similar understanding of the terms to all participants, they are briefly defined in the following:

- **Long-distance passenger rail transport:** regularly scheduled Intercity or Eurocity trains (e.g. ICE, IC, EC, RJ, SC, TGV etc.) which transport passengers with a one-way trip length of minimum 50 km by having a relatively limited stopping pattern. Most long-distance services provide additional features like different service classes, on-board catering, entertainment, etc.
- **Open access competition or competition in the market:** passenger rail operators compete on the tracks, not for the tracks. The operators compete in the market on the same routes for the same customers. The operators run the services on those lines under their commercial responsibility and do not hold public service contracts or franchises.
- **Intra modal competition:** competition between two or more railway companies.
- **Influence factors on competition:** circumstances or aspects that have an impact on or consequences for competition and encourage it in a positive way or hinder or weakens it in a negative way. The influence factors can be of political/legal, economic, social, technical or environmental nature. Influence factors could be e.g. entry barriers that prevent competition, legal changes that enable competition, underlying determinants of the industry, preferences of the customers, etc.

Part 1 – Perspective on competition

The evaluation of the first questionnaire resulted in the following statements concerning competition. The statements in bold are the central messages, the subordinated statements are further specifications. Please read through all statements and rate them on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree.

- | | 1 | 2 | 3 | 4 | 5 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. Open access competition has an overall positive effect on long-distance passenger rail, especially for customers. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1.1. The positive effect for customers is a higher customer focus with better prices, better quality, higher frequency of trains, better services and more innovation. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1.2. The positive effect for the incumbent is a development to higher efficiency and quality. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 1.3. The positive effect for the industry is the gaining of new customers. It also has negative effects such as a lower overall profitability and a higher complexity of the system. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

If you do not agree, please comment:

- | | 1 | 2 | 3 | 4 | 5 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 2. All in all, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a higher customer focus and decrease emission by attracting more customers. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2.1. Incumbent operators change much faster and adapt much quicker to the market. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2.2. More customers use long-distance passenger rail. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2.3. However, the success depends on infrastructure capacity, if open access is implemented sufficiently and if ODs (origin-destinations) or lines can be produced profitably. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2.4. A tendering/franchising-system could possibly fulfil the goals better. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

If you do not agree, please comment:

- | | 1 | 2 | 3 | 4 | 5 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 3. The number of competitors and the degree of competition will increase only slightly. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3.1. The consolidation and merger of companies is expected. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

If you do not agree, please comment:

Part 2 – Rating of influence factors

4. In the last questionnaire you named factors that influence open access competition. Please rate these factors according to how important they are respectively how strong their positive or negative impact on competition is just now in 2016. Please consider your personal experience.

	Influence factor	very strong negative influence -4	-3	-2	-1	0	+1	+2	very strong positive influence +3	+4
Political / Legal	1 Existing EU and national law in the books (e.g. regarding number and complexity of regulation, transparency, operational rules, independence and strength of regulator)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	2 Existing law in action (e.g. regarding transparency, operational rules, independence and strength of regulator)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	3 Access to facilities (stations, maintenance depots, sales offices in stations, etc.) as well as data (e.g. sales information)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	4 Access to and availability of attractive train paths	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	5 General facilitation of and attitude of government and politicians towards competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	6 Unbundling (separation between infrastructure of operations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	7 State of and investment in infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	8 Willingness or ability to subsidise operations in the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	9 Consumer policy (e.g. customer protection, passenger rights)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic	10 Market potential and market size of the OD (origin-destination), the line or the network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	11 Costs for infrastructure (paths, stations, traction, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	12 Access to distribution systems (sales offices in stations, online sales systems, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	13 Presence of intermodal competitors (car/bus/plane), enabled by economic privileges for other transport modes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	14 Existence of network effects for incumbents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	15 Generally low profitability of the industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	16 Access to financing (e.g. for rolling stock)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	17 Existence of cooperation or cooptation within the industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	18 Cross financing of railway undertakings in the market and a lack of transparency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	19 Existence of cooperation with other transport modes (e.g. bus)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social	20 Possibility for cherry picking in the market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	21 Existence of (strong) unions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	22 Customer loyalty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	23 Sharing economy (e.g. rideshare, car sharing)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	24 Adjustment to customer's expectation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	25 Customer's willingness to pay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	26 Entrepreneurship (capacity/willingness to develop a new business)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technical	27 Attitude of press and population towards competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	28 Access to rolling stock (1 st & 2 nd hand as well as leasing)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	29 Lack of technical harmonisation within the EU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	30 Existence of innovation (of rolling stock, sales systems, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	31 Homologation process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	32 Railway safety systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	33 Availability of necessary personnel (e.g. train drivers)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other 34 Incumbent's performance (reputation, service quality, efficiency)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Part 3 – Linkages between and shift of influence factors

5. Have a look at the list of influence factors in part 2. From your point of view, which influence factors are linked to each other and mutually dependent? *E.g. no. x and no. y*

	and	
	and	
	and	
	and	
	and	

Additional comment:

6. Have you experienced a shift of influence factors in the last years? If yes, which factors show the strongest shift?

Thank you very much for your participation, again.

I will now evaluate and interpret the results of this questionnaire and come back to you with a following questionnaire in approx. 8 weeks' time. If you have any questions in the meantime, do not hesitate to contact me.

Appendix 4: 3rd Delphi questionnaire

3rd Questionnaire: "Competition in long-distance passenger rail"

Dear participant,

Thank you very much for your participation and for filling out the first & second questionnaire. I have evaluated all forms and build this third questionnaire on basis of your joint input.

Set-up of this questionnaire:

This questionnaire is divided into 3 parts: the first part investigates the perspective on competition and those statements that could not reach consensus in the last round are rated once again. In the second part, you are asked to reconsider the rating of the influence factors since no consensus could be reached in the second round. The third part rates the statements on shift of influence factors and the linkages among them.



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Definition of terms and wording:

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- Open access competition or competition in the market: passenger rail operators compete on the tracks, not for the tracks. The operators compete in the market on the same routes for the same customers. The operators run the services on those lines under their commercial responsibility and do not hold public service contracts or franchises.
- Intra modal competition: competition between two or more railway companies.
- Influence factors on competition: circumstances or aspects that have an impact on or consequences for competition and encourage it in a positive way or hinder or weakens it in a negative way. The influence factors can be of political/legal, economic, social, technical or environmental nature. Influence factors could be e. g. entry barriers that prevent competition, legal changes that enable competition, underlying determinants of the industry, preferences of the customers, etc.

Part 1 – Perspective on competition

Consensus could be reached on most statements in the last questionnaire. Please reconsider these statements and rate them on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree. The red arrow (▼) marks the group's mean, the grey bar (■) marks the standard deviation. In case you do not agree, please state why.

2. All in all, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a high customer focus and decrease emission by attracting more customers. 1 2 3 4 5
- 2.4. A tendering/franchising-system could possibly fulfil the goals better...
- new!* 2.5. ... however this strongly depends on the characteristics of individual lines (e.g. market size, degree of intermodal competition, etc.)
- new!* 2.6. ... and on the availability of funds to finance such a system.

3. The number of competitors and the degree of competition will increase only slightly in the next 10 years. 1 2 3 4 5
- 3.1. The consolidation and merger of companies is expected...

- new!* 3.2. ...however only a very limited number of companies exist which could merge.

Part 2 – Influence factors

4. In the previous questionnaire, the influence factors were rated on a scale between -4 and +4 according to their strength and type – no consensus could be reached. Please reconsider your rating on the strength of influence factors on this slightly adapted scale. Also mark whether they are positive (and enhance competition) or/and negative (and hinder competition) – you can now tick off both options and if you do so, please comment below to which countries you are referring. Find below the sorted list including the group's mean (▼) and the standard deviation (■). Again, please consider your personal experience based on the current situation just now in 2016 in your country/countries.

No	Influence factor	Strength of influence	Type of influence	
		no infl | weak | strong 0 1 2 3 4	pos	neg
4	Access to and availability of attractive train paths		<input type="checkbox"/>	<input type="checkbox"/>
10	Market potential and market size of the OD (origin-destination), the line or the network		<input type="checkbox"/>	<input type="checkbox"/>
13	Presence of intermodal competitors (car/bus/plane), enabled by economic privileges for other transport modes		<input type="checkbox"/>	<input type="checkbox"/>
28	Access to rolling stock (1st & 2nd hand as well as leasing)		<input type="checkbox"/>	<input type="checkbox"/>
29	Lack of technical harmonisation within the EU		<input type="checkbox"/>	<input type="checkbox"/>
15	Generally low profitability of the industry		<input type="checkbox"/>	<input type="checkbox"/>

No	Influence factor	Strength of influence					Type of influence				
		no infl	weak	strong	0	1	2	3	4	pos	neg
31	Homologation process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Access to facilities (stations, maintenance depots, sales offices in stations, etc.) as well as data (e.g. sales information)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Costs for infrastructure (paths, stations, traction, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Access to distribution systems (sales offices in stations, online sales systems, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Possibility for cherry picking in the market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Entrepreneurship (capacity/willingness to develop a new business)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Existing law in action (e.g. regarding transparency, operational rules, independence and strength of regulator)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Unbundling (separation between infrastructure and operations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	General facilitation of and attitude of government and politicians towards competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Existing EU and national law in the books (e.g. regarding number and complexity of regulation, transparency, operational rules, independence and strength of regulator)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Existence of (strong) unions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Access to financing (e.g. for rolling stock)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	State of and investment in infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Customer's willingness to pay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Existence of network effects for incumbents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Cross financing of railway undertakings in the market and a lack of transparency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Incumbent's performance (reputation, service quality, efficiency)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Sharing economy (e.g. rideshare, car sharing)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Attitude of press and population towards competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Customer loyalty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	Existence of innovation (of rolling stock, sales systems, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Willingness or ability to subsidise operations in the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Adjustment to customer's expectation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Availability of necessary personnel (e.g. train drivers)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Existence of cooperation or competition within the industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Existence of cooperation with other transport modes (e.g. bus)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	Railway safety systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Consumer policy (e.g. customer protection, passenger rights)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional comments & explanations:

Part 3 – Linkages between and shift of influence factors

The evaluation of the second questionnaire resulted in the following statements. The statements in **bold** are the central messages, the subordinated statements are further specifications. Please read through all statements and rate them on a scale between 1 and 5, where 1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree. If you do not agree or have further comments, please clarify in the textboxes.

- 5. Influence factors are strongly interconnected and determine one another. It is difficult to analyse them from a standalone perspective.** 1 2 3 4 5
☐ ☐ ☐ ☐ ☐
- 5.1. Law in the books (1) and law in action (2) show the highest frequency of links to other influence factors. ☐ ☐ ☐ ☐ ☐
- 5.2. The following factors show the strongest connection:
- 5.2.1.: Law in the books (1) & law in action (2) ☐ ☐ ☐ ☐ ☐
- 5.2.2.: Access to facilities and data (3) & access to distribution systems (12) ☐ ☐ ☐ ☐ ☐
- 5.2.3.: Low profitability in the industry (15) & customers' willingness to pay (25) ☐ ☐ ☐ ☐ ☐
- 5.2.4.: Law in the books (1) & lack of technical harmonisation (29) ☐ ☐ ☐ ☐ ☐
- 5.2.5.: Law in action (2) & access to and availability of attractive train paths (4) ☐ ☐ ☐ ☐ ☐
- 5.2.6.: Law in action (2) & facilitation/attitude of politicians towards competition (5) ☐ ☐ ☐ ☐ ☐
- 5.2.7.: Law in action (2) & cross financing and lack of transparency (18) ☐ ☐ ☐ ☐ ☐
- 5.2.8.: Facilitation/attitude of politicians towards competition (5) & attitude of press and population towards competition (27) ☐ ☐ ☐ ☐ ☐
- 5.2.9.: Costs for infrastructure (11) & low profitability in the industry (15) ☐ ☐ ☐ ☐ ☐
- 5.2.10.: Low profitability in the industry (15) & access to financing (16) ☐ ☐ ☐ ☐ ☐

- 6. In the last years, a shift of individual influence factors could be observed – the shifts vary between countries.** 1 2 3 4 5
☐ ☐ ☐ ☐ ☐
- 6.1. In general, the following factors show the strongest shifts:
- 6.1.1.: Presence of intermodal competitors, e.g. bus, car, plane (13) ☐ ☐ ☐ ☐ ☐
- 6.1.2.: Access to distribution systems (12) ☐ ☐ ☐ ☐ ☐
- 6.1.3.: Low profitability of the industry (15) ☐ ☐ ☐ ☐ ☐
- 6.1.4.: Law in action (2) ☐ ☐ ☐ ☐ ☐

Thank you very much for your participation!

Appendix 5: Delphi Report




Delphi Report

Factors influencing open access competition in the European long-distance passenger rail transport

LISA FEUERSTEIN, PLYMOUTH UNIVERSITY


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1. Introduction

- For this Delphi study the following **research aims** were set:
 - to gain knowledge on the experts' perception of open access competition in the European long-distance passenger rail transport;
 - to identify positive and negative factors influencing open access competition;
 - to assess the strength of influence factors;
 - to explore the possible correlation of influence factors among each other;
 - and to explore the possible shift of influence factors over time.
- The study took place between **March and September 2016**.
- The **panel** (n=30) was selected from the **researcher's network, experts' recommendations** and **relevant publications**. All panel members were recruited based on pre-defined compulsory and desirable criteria.
- This report presents the **findings after the 3rd and final Delphi round**.

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2. Summary

- Open access competition has an overall positive effect on long-distance passenger rail. It is perceived as a tool which promotes increased efficiency, modernises passenger rail, establishes a higher customer focus, and decreases overall transport emissions.
- Only a slight increase in the degree of competition within 10 years' time can be expected.
- A total amount of 34 influence factors were identified, whereas economic and political/legal factors have the highest influence on open access competition.
- The factors rated the five strongest in terms of the mean include: access to and availability of attractive train paths, market potential and market size, presence of intermodal competitors, low profitability of the industry, and costs for infrastructure.
- Homologation and lacking technical harmonisation have the highest negative, market potential and unbundling the highest positive rating.
- Strength and type of influence factors vary between countries, confirming the market is still fragmented.
- The panel agrees that the influence factors are strongly interconnected and difficult to analyse from a standalone perspective – however no clear network of interconnections could be identified in this study.
- The study indicates an overall shift of influence factors, however this point does not reach consensus. Further analysis is required to fulfil this research aim.

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3. Methodology

- Literature and desktop research resulted in the design and wording of the questions. All questionnaires were pre-tested by 3 experts.
- 3 rounds of fill-in PDF-questionnaires were sent out. 5 categories of questions were asked: on the experts' professional details, their perception of competition, the strength and type of influence factors, on linkages between and shift of factors over time.
- The 1st questionnaire consisted of open-ended questions which were analysed and aggregated into statements and a list of influence factors.
- The 2nd questionnaire rated the statements (5-point Likert Scale), the influence factors (scale of -4 to +4), and posed open-ended questions on the linkages between and shift of the identified factors. The rated statements were analysed with regards to consensus (≥75% agreement/disagreement = verification/falsification). The factors were analysed regarding their strength and type and also tested for consensus (≥75% of identical rating = verification). The linkages between and shift of factors were analysed and aggregated into statements.
- The 3rd questionnaire rated the statements, which did not reach consensus again (5-point Likert Scale). All influence factors were re-rated using an altered scale (0 to 4) and the possibility to mark an influence factors positive and negative. The statements on linkages between and shift of factors were rated (5-point Likert Scale) and analysed with regards to consensus (≥75% of agreement/disagreement = verification/falsification).
- After the finalisation of the 3rd round no further adaption to consensus could be expected and the Delphi study was terminated.

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4. Delphi Panel

- The panel included 30 experts from the railway industry. Its composition is very satisfying, with a high return rate throughout the whole study.
- All panel members have:
 - first-hand experience in competition in Germany, Italy, Czech Republic, Austria, Sweden and/or the EU in general;
 - worked for either a railway company, in research/consulting, and/or in politics or for a political association;
 - and an interest in the topic of competition.
- 67% of all participants had ≥ 10 years of working experience in the industry.
- 33% of the participants hold or held CEO or board member positions.

1st Delphi round

Return rate: 83%, n=25

Working background*:

- incumbent: 68%
- competitor: 44%
- research/consulting: 44%
- politics/associations: 36%

Country background*:

- Germany: 52%
- Austria: 28%
- Czech Republic: 24%
- Italy: 40%
- Sweden: 28%
- EU in general: 44%

2nd Delphi round

Return rate: 100%, n=25

Working background*:

- incumbent: 68%
- competitor: 44%
- research/consulting: 44%
- politics/associations: 36%

Country background*:

- Germany: 52%
- Austria: 28%
- Czech Republic: 24%
- Italy: 40%
- Sweden: 28%
- EU in general: 44%

3rd Delphi round

Return rate: 92%, n=23

Working background*:

- incumbent: 65%
- competitor: 44%
- research/consulting: 44%
- politics/associations: 35%

Country background*:

- Germany: 48%
- Austria: 30%
- Czech Republic: 26%
- Italy: 39%
- Sweden: 30%
- EU in general: 44%

*) experts clustered themselves in the 1st questionnaire, one expert can qualify for multiple clusters when they gained experience in multiple countries or multiple companies/institutions

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5. Results: Perception of competition (1/2)

Statement / sub-statement*	% agree	% disagree	mean	median	variance	st. dev.
1. Open access competition has an overall positive effect on long-distance passenger rail, especially for customers.	80.00	12.00	1.72	1	1.08	1.04
1.1. The positive effect for customers is a higher customer focus with better prices, better quality, higher frequency of trains, better services and more innovation.	88.00	8.00	1.68	1	0.78	0.88
1.2. The positive effect for the incumbent is a development to higher efficiency and quality.	96.00	4.00	1.68	2	0.46	0.68
1.3. The positive effect for the industry is the gaining of new customers. It also has negative effects such as a lower overall profitability and a higher complexity of the system.	76.00	16.00	2.12	2	1.23	1.11
2. All in all, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a higher customer focus and decrease emissions by attracting more customers.	84.00	4.00	1.76	2	0.66	0.81
2.1. Incumbent operators change much faster and adapt much quicker to the market.	88.00	4.00	1.88	2	0.51	0.71
2.2. More customers use long-distance passenger rail.	88.00	4.00	1.72	2	0.84	0.92
2.3. However, the success depends on infrastructure capacity, if open access is implemented sufficiently and if ODs (origin-destinations) or lines can be produced profitably.	76.00	8.00	2.08	2	0.95	0.98
2.4. A tendering/franchising-system could possibly fulfil the goals better...	45.45	27.27	2.77	3	1.08	1.04

*) rated on a 5-point Likert Scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

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5. Results: Perception of competition (2/2)

Statement / sub-statement*	% agree	% disagree	mean	median	variance	st. dev.
2.5. ... however this strongly depends on the characteristics of the individual lines (e.g. market size, degree of intermodal competition, etc.)	65.22	21.74	2.48	2	1.64	1.28
2.6. ... and on the availability of funds to finance such a system.	43.48	30.43	2.70	3	1.69	1.30
3. The number of competitors and the degree of competition will increase only slightly.	100.00	0.00	1.67	2	0.22	0.47
3.1. The consolidation and merger of companies is expected...	59.09	9.09	2.45	2	0.79	0.89
3.2. ... however only a very limited number of companies exist which could merge.	69.57	21.74	2.30	2	1.34	1.16

- The study shows that open access competition has a positive effect on long-distance passenger rail, especially for customers.
- As envisaged by the EU, open access is one of the tools to achieve increased efficiency in the market, modernise passenger rail, establish a higher customer focus and decrease emissions by attracting more customers. The panel does not agree on the question if a tendering/franchising-system would be the better option to reach the goals.
- The panel clearly expects the number of competitors and the degree of competition to increase only slightly.

*) rated on a 5-point Likert Scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

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5. Results: Influence factors (1/6)



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5. Results: Influence factors (2/6)

Influence factors*	cluster**	mean	median	var- lance	st. dev.	% neg	% pos
Access to and availability of attractive train paths	P/L	3.27	3	0.38	0.62	21.74	78.26
Market potential and market size of the origin-destination, the line or the network	E	3.18	3	0.42	0.65	4.76	95.24
Presence of intermodal competitors (car/bus/plane)	E	2.86	3	0.75	0.87	77.27	22.73
Generally low profitability of the industry	E	2.86	3	0.66	0.81	90.91	9.09
Costs for infrastructure (paths, stations, traction, etc.)	E	2.86	3	0.48	0.69	72.73	27.27
Access to rolling stock (1 st and 2 nd hand as well as leasing)	T	2.82	3	0.60	0.78	28.57	71.43
Access to facilities (stations, maintenance depots, etc.) as well as data (e.g. sales data)	P/L	2.68	3	0.49	0.70	28.57	71.43
Homologation process	T	2.64	3	0.69	0.83	95.24	4.76
Lack of technical harmonisation within the EU	T	2.59	2.5	1.15	1.07	100.00	0.00
General facilitation of & attitude of government and politicians towards competition	P/L	2.50	2.5	0.98	0.99	26.09	73.91
Customers' willingness to pay	S	2.45	2	0.70	0.84	30.00	70.00
Entrepreneurship	S	2.43	3	0.91	0.95	11.11	88.89
Access to distribution systems (sales offices, online sales systems)	E	2.41	2.5	1.15	1.07	25.00	75.00

*) rated on a scale from 0=no influence to 4=very strong influence, **) type of influence: P/L=political/legal, E=economic, S=social, T=technical

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5. Results: Influence factors (3/6)

Influence factors*	cluster**	mean	median	var- lance	st. dev.	% neg	% pos
Existing law in action (e.g. regarding transparency, independence of regulator)	P/L	2.36	2	1.05	1.02	36.36	63.64
Unbundling (separation between infrastructure and operations)	P/L	2.27	2.5	1.56	1.25	0.00	100.00
Access to financing (for e.g. rolling stock)	E	2.27	2	0.74	0.86	25.00	75.00
Possibility for cherry picking in the market	E	2.23	2	1.27	1.13	20.00	80.00
State of and investment in infrastructure	P/L	2.18	2	0.88	0.94	33.33	66.67
Cross financing of railway undertakings in the market and a lack of transparency	E	1.91	2	1.54	1.24	94.44	5.56
Existence of network effects for incumbents	E	1.90	2	0.75	0.87	80.00	20.00
Existence of (strong) unions	S	1.86	2	0.48	0.69	80.00	20.00
Existing EU and national law in the books	P/L	1.81	2	0.73	0.85	40.91	59.09
Adjustment to customers' expectations	S	1.73	2	0.93	0.96	10.00	90.00
Availability of necessary personnel (e.g. train drivers)	T	1.73	1.5	1.20	1.09	44.44	55.56
Incumbent's performance (e.g. reputation, service quality, efficiency)	other	1.68	2	0.94	0.97	42.11	57.89
Existence of innovation (e.g. rolling stock, sales systems)	T	1.68	1	1.40	1.18	5.88	94.12

*) rated on a scale from 0=no influence to 4=very strong influence, **) type of influence: P/L=political/legal, E=economic, S=social, T=technical

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5. Results: Influence factors (4/6)

Influence factors*	cluster**	mean	median	var- lance	st. dev.	% neg	% pos
Existence of cooperation or competition within the industry	E	1.67	1	1.84	1.36	23.53	76.47
Attitude of press and population towards competition	S	1.64	2	0.60	0.77	21.74	78.26
Customer loyalty	S	1.64	2	1.05	1.02	52.63	47.37
Willingness or ability to subsidise operations in the country	P/L	1.59	1.5	1.15	1.07	31.58	68.42
Existence of cooperation with other transport modes (e.g. bus)	E	1.52	1	0.82	0.91	11.11	88.89
Sharing economy (e.g. rideshare, car sharing)	S	1.14	1	0.94	0.97	83.33	16.67
Railway safety systems	T	0.86	1	0.60	0.77	58.82	41.18
Consumer policy (e.g. customer protection, passenger rights)	P/L	0.82	1	0.79	0.89	61.11	38.89

- **Economic factors have the highest influence on open access competition, followed by political and legal factors.**
- The factors with the **highest variation in expert opinion** are the existence of cooperation/cooperation within the industry, unbundling and cross financing of railway undertakings.
- **Homologation and lacking techn. harmonisation** had the highest negative, market potential and unbundling the highest positive rating.
- **No consensus could be reached on the exact rating of the influence factors**, however mean, variance and standard deviation lead to a satisfying outcome which can be further analysed in the next steps.

*) rated on a scale from 0=no influence to 4=very strong influence, **) type of influence: P/L=political/legal, E=economic, S=social, T=technical

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5. Results: Influence factors (5/6)

Top 5 influence factors according to the experts' country of experience[§]

No.	Germany	Italy	Austria	Sweden	Czech Republic	EU
1	market potential	low profitability	low profitability	train paths availability	train paths availability	low profitability
2	train paths availability	train paths availability	train paths availability,	market potential,	market potential,	train paths availability,
3	low profitability	market potential	techn. harmonisation	access to rolling stock	infrastructure costs	market potential
4		intermodal competition,		distribution system	willingness to pay	
5	intermodal competition,	techn. harmonisation,	homologation,	entrepreneurship	intermodal competition,	access to rolling stock,
	infrastructure costs	homologation,	infrastructure costs		low profitability,	infrastructure costs
		infrastructure costs			homologation, financing	

- The analysis shows that a **small number of influence factors**, e.g. train paths availability, low profitability and market potential, can be found in the **top 5 of most country clusters**.
- However, **no identical country rating exists**. This indicates that the EU-market is still fragmented with regards to liberalisation – as often pointed out in relevant literature.
- Further **in-depth analysis of the individual countries is necessary** to supplement the findings with examples.

[§]) experts clustered themselves in the 1st questionnaire, one expert can qualify for multiple clusters when they gained experience in multiple countries.

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5. Results: Influence factors (6/6)

Top 5 influence factors according to the experts' working background^{*}

No.	Incumbent	Competitor	Politics / Associations	Research / Consulting
1	train paths availability	train paths availability,	train paths availability,	market potential
2	market potential	infrastructure costs	market potential	intermodal competition
3	low profitability	market potential	low profitability,	train paths availability,
4	infrastructure costs	access to facilities	infrastructure costs	rolling stock
5	intermodal competition	low profitability	access to facilities	low profitability,
				law in action

- The analysis also shows that a **small number of influence factors** were rated into the top 5 by most experts from **all working backgrounds**.
- In terms of type and rating of influence factors, the experts from **"Research/Consulting"** show the **greatest deviation** from the other clusters.
- The **strongest similarities** show the clusters **"Incumbent"** and **"Politics/Associations"**, also since many experts from the cluster **"Politics/Associations"** worked/work for **"Incumbents"** as well.

^{*}) experts clustered themselves in the 1st questionnaire, one expert can qualify for multiple clusters when they gained working experience in different companies/institutions.

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5. Results: Linkages between influence factors (1/2)

Statement / sub-statement [*]	% agree	% disagree	mean	median	variance	st. dev.
5. Influence factors are strongly interconnected and determine one another. It is difficult to analyse them from a standalone perspective.	83.33	0.00	1.94	2	0.39	0.62
5.1. Law in the books and law in action show the highest frequency of links to other influence factors.	59.09	13.64	2.41	2	0.79	0.89
5.2. The following factors show the strongest connection:						
5.2.1. Law in the books & law in action	59.09	13.64	2.55	2	0.79	0.89
5.2.2. Access to facilities and data & access to distribution systems	59.09	22.73	2.45	2	1.61	1.27
5.2.3. Low profitability in the industry & customers' willingness to pay	72.73	13.64	2.18	2	1.15	1.07
5.2.4. Law in the books & lack of technical harmonisation	45.45	13.64	2.64	3	0.87	0.93
5.2.5. Law in action & access to and availability of attractive train paths	68.18	13.64	2.32	2	1.04	1.02
5.2.6. Law in action & facilitation/attitude of politicians towards competition	59.09	18.18	2.41	2	0.97	0.98
5.2.7. Law in action & cross financing and lack of transparency	59.09	9.09	2.32	2	0.76	0.87
5.2.8. Facilitation/attitude of politicians towards competition & attitude of press and population towards competition	54.55	22.73	2.64	2	0.78	0.88

^{*}) rated on a 5-point Likert Scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

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5. Results: Linkages between influence factors (2/2)

Statement / sub-statement*	% agree	% disagree	mean	median	variance	st. dev.
5.2.9. Costs for infrastructure & low profitability in the industry	72.73	9.09	2.18	2	0.97	0.98
5.2.10 Low profitability in the industry & access to financing	50.00	27.27	2.68	2.5	1.22	1.10

- The panel agrees that the influence factors are strongly interconnected and difficult to analyse from a standalone perspective.
- However, **no clear network of linked factors becomes apparent**. All other statements could not reach consensus and show a **widely dispersed spectrum** with a relatively high degree of "3=neutral" ratings.
- On account of the wide spread of the panel's opinion, **no consensus could be expected in an additional Delphi round**. An in-depth investigation of country and case examples might lead to more accurate findings.

*) rated on a 5-point Likert Scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

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5. Results: Shift of influence factors

Statement / sub-statement*	% agree	% disagree	mean	median	variance	st. dev.
6. In the last years, a shift of individual influence factors could be observed – the shifts vary between countries.	70.59	11.76	2.24	2	0.77	0.88
6.1. In general, the following factors show the strongest shifts:						
6.1.1. Presence of intermodal competitors, e.g. bus, car, plane	77.27	9.09	2.00	2	0.82	0.90
6.1.2. Access to distribution systems	52.17	39.13	2.70	2	1.86	1.37
6.1.3. Low profitability of the industry	45.45	31.82	2.82	3	1.15	1.07
6.1.4. Law in action	59.09	18.18	2.55	2	0.70	0.84

- The panel agrees that a shift in intermodal competition can be observed.
- The study indicates an overall shift of influence factors, however it cannot be proven: most statements could not reach consensus and show a **widely dispersed spectrum**, also with a relatively high degree of "3=neutral" ratings.
- As specified on the previous chart, **no consensus can be expected in an additional Delphi round**, therefore an analysis of case example is suggested.

*) rated on a 5-point Likert Scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

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6. Additional Comments

- Since a Delphi study always reflects the personal experience and opinion of the panel, **further triangulation is suggested** in order to validate the findings.
- Therefore, **country case studies** are planned in the next step in order to **find proof of the Delphi results** and give examples in **several countries** where open access competition is in place (e.g. Italy, Germany, Czech Republic).
- In these case studies, the **questions which could not be answered in the Delphi study** are once **again posed** and will be answered in a **country-specific context**.

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January 2017

**RESEARCH
WITH
PLYMOUTH
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Dear Sir or Madam,

Thank you for your participation in this Delphi study, I am very grateful for your help.

If you want to give feedback, need further insight into the study's methodology or findings, or have any questions, please do not hesitate to contact me.

Kind regards,
Lisa Feuerstein

LISA FEUERSTEIN, PLYMOUTH UNIVERSITY

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Appendix 6: Case study information sheet

Research Project on “Long-Distance Passenger Rail Competition”

Information Sheet

Dear participant,

Thank you very much for taking part in this case study research to investigate factors influencing open access competition in the long-distance passenger rail transport. You have been chosen to participate in this study due to your knowledge in and first-hand experience of open-access competition in the European long-distance passenger rail transport.

What are you supposed to do?


- You will be interviewed about your experience of open access competition in the long-distance passenger rail.
- The interview will be semi-structured.
- It will be either in person or via telephone.
- The interview will take about 30-60 min. of your time.

Your rights:

- You may decide to stop being a part of this study at any time with no reason given. Your personal information will be deleted immediately.
- You have the right to omit or refuse to answer or respond to any question.
- You have the right to have your questions about the next steps, procedure, etc. answered, unless answering the questions would interfere with the study's outcome. Please feel free to contact me at any time; my contact information can be found at the top of this page.
- Throughout the research process, you will remain anonymous. I may use direct quotes from the interview, but these comments will not be linked to your name. I will keep your personal information strictly confidential.

Your risks and benefits from participating in the study:

- There are no known risks for you as a participant in this study.
- After the transcription of the interview, you will receive an interview protocol and have the chance to comment on this to prevent misunderstandings.
- After the finalisation of the study, you may get access to the study's findings.



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Appendix 7: Overview over interview questions

Draft Questions: semi-structured interviews

Professional background of experts:

- For how long have you been working in the industry?
- In which European country/countries did you gain experience on open access competition?
- In which type of company did you gain experience on open access competition (incumbent operator / competitor / research & consulting / politics & political association & authority)?



Questions on influence factors on open access competition:

Please have a look at the factors influencing open access competition in the long-distance passenger rail transport in Europe. These factors have been identified by experts from the industry in my Delphi study between March and September 2016:

Cluster	No.	Influence factors
Political & legal	1	Existing EU and national law in the books (e.g. regarding number and complexity of regulation, transparency, operational rules, independences and strength of regulator)
	2	Existing law in action (e.g. regarding frequency, operational rules, independence and strength of regulator)
	3	Access to facilities (stations, maintenance depots, sales offices in stations, etc.) as well as data (e.g. sales information)
	4	Access to and availability of attractive train paths
	5	General facilitation of and attitude of government and politicians towards competition
	6	Unbundling (separation between infrastructure and operations)
	7	State of and investment in infrastructure
	8	Willingness or ability to subsidise operations in the country
	9	Consumer policy (e.g. customer protection, passenger rights)
Economic	10	Market potential and market size of the OD (origin-destination), the line or the network
	11	Costs for infrastructure (paths, stations, traction, etc.)
	12	Access to distribution systems (sales offices in stations, online sales systems, etc.)
	13	Presence of intermodal competitors (car/bus/plane), enabled by economic privileges for other transport modes
	14	Existence of network effects for incumbents
	15	Generally low profitability of the industry
	16	Access to financing (e.g. for rolling stock)
	17	Existence of cooperation or cooptation within the industry
	18	Cross financing of railway undertakings in the market and a lack of transparency
	19	Existence of cooperation with other transport modes (e.g. Bus)
Social	20	Possibility for cherry picking in the market
	21	Existence of (strong) unions
	22	Customer loyalty
	23	Sharing economy (e.g. rideshare, car sharing)
	24	Adjustment to customer's expectation

Technical	25	Customer's willingness to pay
	26	Entrepreneurship (capacity/willingness to develop a new business)
	27	Attitude of press and population toward competition
	28	Access to rolling stock (1 st and 2 nd hand as well as leasing)
	29	Lack of technical harmonisation within the EU
	30	Existence of innovation (of rolling stock, sales system, etc.)
	31	Homologation process
	32	Railway safety systems
	33	Availability of necessary personnel (e.g. train drivers)
	34	Incumbent's performance (reputation, service quality, efficiency)
Other		

- Have you experienced one or more of these influence factors? If you, please give examples.
- From your point of view, which type of influence factors affected your company/working field the most (political & legal / economic / social / technical)?
- Which influence factors determine and cause one another? Please give examples.
- Do you observe a shift of influence factors over time? If yes, please give examples.

Appendix 8: Data collection form for interviews

Data Collection Form xx			
G1	data collection = interview	time of collection:	
		characterisation of participant:	
G1	cluster	influence factor	
		Participant X	
	PIL	Law in books	
		Law in action	
		Access to facilities & as well as data	
		Access to and availability of attractive train paths	
		Attitude of government and politicians towards competition	
		Unbundling	
		State of and investment in infrastructure	
		Willingness or ability to subsidise operations	
		Consumer policy	
		E	Market potential and market size
			Costs for infrastructure
			Access to distribution systems
			Presence of intermodal competitors
Existence of network effects for incumbents			
S	T	Generally low profitability of the industry	
		Access to financing	
		Cooperation/cooperation within the industry	
		Cross financing	
		Cooperation with other transport modes	
	S	Possibility for cherry picking in the market	
		Existence of (strong) unions	
		Customer loyalty	
		Sharing economy	
		Adjustment to customer's expectation	
T	Customer's willingness to pay		
	Entrepreneurship		
	Attitude of press and population toward competition		
	Access to rolling stock		
	Lack of technical harmonisation within the EU		
T	Existence of innovation		
	Homologation process		
	Railway safety systems		

	Availability of necessary personnel	
	Other	
	Incumbent's performance	
	Additional findings	
	Findings:	
G1	Findings:	
	Findings:	

Appendix 9: Approved interview data collection forms (Participant A to F)

Data Collection Form A			
Θ₁	Data collection = interview		Time of collection = 10.02.2017
			Characterisation of participant: <ul style="list-style-type: none"> more than 20 years of working experience in the passenger rail industry, mainly in Germany CEO and board positions at different railway companies (competitors and incumbent) as well as political associations
Θ₁	Cluster	Influencing factor	Participant A
	P/L	Law in books	<ul style="list-style-type: none"> Laws are the basis for theoretical existence of competition Can function as a threat of possible competition for incumbent
		Law in action	<ul style="list-style-type: none"> In action, law is working mostly to discipline the incumbent since DB Fv has such big influence and market power and a quasi-monopoly Monopoly Commission is the only active promoter for more open access competition from the legal side
		Access to facilities and data	<ul style="list-style-type: none"> Access for competitors is generally considered satisfying till good and is no major issues exist
		Access to and availability of attractive train paths	<ul style="list-style-type: none"> Access for competitors is generally considered satisfying till good with no major issues In the past, "path framework contracts" were a means to secure paths for competitors (HKX and InterConnex) for several years – as long as the competitor understood the system and knew when and how to apply
		Attitude of government and politicians towards competition	<ul style="list-style-type: none"> Open access has a limited number of advocates in German government and the political landscape The currently provided network or system might be too big to engage politicians to change it The difference in regional passenger rail is that politicians are actively involved since they feel responsible for the regional traffic strategy – and also subsidies are paid
		Unbundling	<ul style="list-style-type: none"> In an ideal world, DB Fv and DB Netz would be separated If unbundling is successful, this is strongly dependent on the law in action The current holding structure of DB AG results in no big discrimination of competitors However, the "signal" of an integrated holding – no matter how good the Chinese walls work – is a market entry barrier or an insecurity for e.g. investors
		State of and investment in infrastructure	<ul style="list-style-type: none"> A network in good conditions is the basis for competition German network has an investment backlog and in the next years, major construction works will take place to solve the problems This harms all operators, including competitors <ul style="list-style-type: none"> For InterConnex, line closures due to construction work lead to reduction in sales The too old signalling/security facilities lead to high maintenance costs and therefore increase the price for infrastructure
		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> Higher investments/subsidies in infrastructure would benefit the entire industry, competitors included
		Consumer policy	<ul style="list-style-type: none"> Not relevant, the same conditions apply to everyone
	E	Market potential and market size	<ul style="list-style-type: none"> A very important point: often the obvious potential lead to the idea and finally market entry

			<ul style="list-style-type: none"> ○ InterConnex: DB withdraw from InterRegion-Network and InterConnex filled the gap since they saw a market potential ○ HKX: DB Fv did not serve the line between Hamburg and Cologne sufficiently and no proper air-competition existed, therefore market potential was seen in • The aspect becomes trickier now, since the bus competition is more dynamic than the rail competition and connects more destinations directly
		Costs for infrastructure	<ul style="list-style-type: none"> • In Germany, infrastructure costs increase the prices to non-profitability in the long-distance passenger market • This leads to a market entry of competitors mainly on niche markets where prices for infrastructure are lower <ul style="list-style-type: none"> ○ HKX did not use high speed rail paths between Frankfurt and Cologne ○ InterConnex also used secondary lines • "This factor might not be the "killer" of the competition but it harms the passenger rail sectors in general"
		Access to distribution systems	<ul style="list-style-type: none"> • Inclusion in passenger information and in the listing of connections is very important <ul style="list-style-type: none"> ○ InterConnex filed a suit against DB in order to be listed in their systems – they won • Even when the listing is given now for every competitor, access to distribution is still important – the "buy now"-button makes a difference for customers <ul style="list-style-type: none"> ○ HKX changed from a long-distance provider to a regional provider in order to be sold over DB's distribution channels – however it did not work out due to problems with reservation, an investment was necessary which HKX did not want to take • This is also dependent on the OD, since an OD with more interchanges is more unlikely to attract customers when different tickets are required – point-to-point tickets depend less on the incumbents' distribution system • In the starting years of long-distance bus competition, the price comparison platforms directed especially price-sensitive customers to HKX' booking page, since HKX was listed there • Still, a shift can be observed: online and mobile sales become more important and make it easier to sell tickets. In the beginning, mostly young people used it – now a wider share of population gets used to it
		Presence of intermodal competitors	<ul style="list-style-type: none"> • It was introduced by the politicians partly to discipline DB Fv on long-distance passenger transport • Bus transport has a high influence on open access competition <ul style="list-style-type: none"> ○ InterConnex: bus competition was the fatal blow for InterConnex, it came really fast with many connections and to very cheap prices, they finally had to terminate the market ○ HKX: bus has an effect on HKX' profitability, however it is indirect. Since DB Fv adapted their prices to compete with bus providers, HKX suffers from the low price-level of DB Fv • The existence of bus competition led, together with the low-cost-airlines, to a decreasing price

			of mobility which forces long-distance rail provider to offer cheap price in order to be competitive
		Existence of network effects for incumbents	<ul style="list-style-type: none"> Long-distance passenger rail in Germany is considered as a fixed, interlinked system: the more inter-changes a passenger needs to make to get to their destination, the more likely network effects are <ul style="list-style-type: none"> HKX has more point-to-point travellers will lesser inter-changes A difference between generations can be observed, younger people “design” their trips with apps and different ticket providers, enabled by technology. More and more people adapt, too This is also depending on price sensibility: business travellers and higher priced segments are more likely to stay in the network than leisure and low-price segments
		Generally low profitability of the industry	<ul style="list-style-type: none"> It is difficult to earn money with open-access competition <ul style="list-style-type: none"> InterConnex: the transport did not earn much money but is contributed positively to the brand image “The generally low profitability of the industry often led to bloody noses when talking to possible investors – they might like the idea of open access competition at first but when they do research, they back out” A high fixed costs structure exists in the industry, especially due to high infrastructure fees High exit costs: bought rolling stock is often too specialised and cannot be used elsewhere and consequently cannot being sold easily
		Access to financing	<ul style="list-style-type: none"> Experience shows that investors are interested in doing open access in Germany because it is allowed by law and scare. However, when they make further investigation, they deny financing This is due to: low profitability, potential danger of discrimination by incumbent in a vertically integrated holding structure, high market power of DB Fv, often irreversible costs of rolling stock, long-term-character of the investment
		Cooperation/coopetition within the industry	<ul style="list-style-type: none"> The existing structure of international cooperations between incumbents makes it nearly impossible for open access competitor to provide international services: the network is too dense when two incumbents already cooperate
		Cross-financing	<ul style="list-style-type: none"> Not an issue in Germany
		Cooperation with other transport modes	<ul style="list-style-type: none"> Cooperation with other modes, e.g. buses, would only make sense if an individual network could be created. This is not the case in Germany and failed, e.g. for HKX.
		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> In general, it can be beneficial for incumbents but it is always dependent on what the “cherry” is – this can be seen from different points of view, e.g. Gera in case of InterConnex Highly dependent on market structure and market size
	S	Existence of (strong) unions	<ul style="list-style-type: none"> Not an issue in Germany
		Customer loyalty	<ul style="list-style-type: none"> Competitors observe a high customer loyalty in general They collect “fans” quickly and form online communities, like in case of HKX and InterConnex Customer of competitors seem to have a higher tolerance for problems and delays “Customer loyalty to competitors is often triggered only by the existence of the new

			providers which symbolise an alternative to the incumbents"
		Sharing economy	<ul style="list-style-type: none"> This is a revolution for transportation, and further enabled by the internet and apps Currently mainly used by younger generation
		Adjustment to customer expectation	<ul style="list-style-type: none"> One would believe that this has a high effect <ul style="list-style-type: none"> HKX offered special organic food and drinks InterConnex offered child-care for children that travelled alone on weekends However, no big effect: the battle is won on the price-side
		Customers' willingness to pay	<ul style="list-style-type: none"> Currently, a relatively low willingness to pay for mobility, this has decreased in the last years Add-ons (like e.g. Business Tickets in HKX) are difficult to sell Competitors use the low willingness to pay as an advantage over incumbents: <ul style="list-style-type: none"> This worked well for HKX and InterConnex during the time when DB Fv was considered as expensive – today this is not working anymore DB Fv sold "Sparpreise" up to 3 days before the start of journey. Consequently, the last 3 days before departure, customers changed from DB Fv to HKX since it was cheaper. Since DB Fv now sells "Sparpreise" until the start of journey as a consequence to the cheap bus prices, it becomes more difficult for HKX
		Entrepreneurship	<ul style="list-style-type: none"> "You have to be crazy in order to offer open access competition" It is very important for an open access competitor in Germany to have a persistent and driven entrepreneur as CEO, since it is a stony path Since the industry is complex, an understanding for rail is necessary (e.g. paths framework agreements)
		Attitude of press and population toward competition	<ul style="list-style-type: none"> For competitors this is extremely important and mostly very positive: due to the novelty and mostly non-existence of competition, customers like to chose Positive attitude of press and population leads to higher customer loyalty <ul style="list-style-type: none"> DB has a highly negative image in Stuttgart since the project "Stuttgart 21" - this is expected to bring more customers to Locomore. Their market potential increases due to the positive attitude of people towards the competitor
	T	Access to rolling stock	<ul style="list-style-type: none"> Access to rolling stock is still extremely tricky in Germany First hand rolling stock mostly is too expensive and only few investors would finance it – very little leasing companies exist Second hand rolling stock is also difficult to buy due to the technical specification and missing technical harmonisation in the EU Most competitors use second hand rolling stock <ul style="list-style-type: none"> InterConnex even used rolling stock from regional transport and the customers were very satisfied HKX also partly used regional transport rolling stock since they had no reserve in the beginning

			<ul style="list-style-type: none"> ○ The older coaches HKX used lead to a lower reliability and a higher degree of maintenance • Requirements on type and number of rolling stock can change during process of ordering/refurbishment <ul style="list-style-type: none"> ○ HKX bought old ÖBB-coaches which were refurbished and homologated and now are not being used since the situation changed • “Rolling stock generally is an “Investorenschreck”” • A chance could occur if first competitors leave the market and try to sell rolling stock, this could lead to market entry in other countries and on other lines
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> • This is an important point, mostly due to rolling stock access • Up to now, no clear improvements can be seen up to now
		Existence of innovation	<ul style="list-style-type: none"> • Technical innovation rarely plays a role • Market innovation can be a chance for competitors, e.g. InterConnex’ idea to offer “child care” on the line between Berlin and Leipzig
		Homologation process	<ul style="list-style-type: none"> • After a “homologation crisis” a few years ago, the situation has improved significantly <ul style="list-style-type: none"> ○ During this time, HKX also tried to homologate ÖBB-coaches and had trouble doing so • The “homologation crisis” however had long-term consequences and still frightens investors
		Railway safety systems	<ul style="list-style-type: none"> • No effect on the German market
		Availability of necessary personnel	<ul style="list-style-type: none"> • No significant problems which cannot be solved • Possible future problems with the availability of train drivers
	Other	Incumbent’s performance	<ul style="list-style-type: none"> • Generally, no significant discrimination by DB Fv • No price war between DB Fv and competitor can be observed • However, the decrease of DB Fv prices since the introduction of long-distance bus services harmed HKX • DB Fv’s sometimes bad image leads to a switch of customers to competitors
	Additional findings		<ul style="list-style-type: none"> • “In general, the economic factors are the most relevant for a competitor – all other problems can be solved by fighting” • “HKX is like a mouse between two elephants: DB Fv and FlixBus”
Θ ₂	Findings		<ul style="list-style-type: none"> • Access to financing – secured access to paths – law in the books and discrimination potential by vertical integration – high costs for rolling stock • Law in the books – law in action – incumbent’s performance – politicians’ attitude towards competition • Low profitability – intermodal competition – high costs for infrastructure
Θ ₃	Findings		<ul style="list-style-type: none"> • Clear shift in intermodal competition since opening of the long-distance bus market • Customers’ willingness to pay also decrease over the years • Homologation process improved • The appearance and disappearance of “bus-price-competition-pages” which improved distribution of tickets • Shift with regards to access to distribution systems: not as important anymore due to easily booking online and via apps

Data Collection Form B			
Θ_1	Data collection = interview		Time of collection = 16.02.2017
			Characterisation of participant: <ul style="list-style-type: none"> • More than 20 years of working experience in the railway industry, mostly with focus on Germany • Background in research and consulting as well as civil service in political institutions
Θ_1	P/L	Cluster	Influencing factor
			Participant B
			<ul style="list-style-type: none"> • Law forms the underlying basis for competition • Legal conditions for open access competition are given in Germany since 1994 • Regulation needs to be developed further in the next years but will most likely not change drastically
			<ul style="list-style-type: none"> • Law in the books is lived in Germany • The holding-structure of DB makes a monitoring of political institutions and authorities necessary
			<ul style="list-style-type: none"> • Good access is generally given in Germany • In highly frequented stations or hubs bottlenecks occur <ul style="list-style-type: none"> ◦ HKX had trouble to get sidings at Frankfurt Hbf ◦ RDC hat problems with the infrastructure and paths on the route to Sylt
			<ul style="list-style-type: none"> • General access to paths is satisfying, however in big transport hubs (e.g. Frankfurt/Hamburg) allocation of attractive paths can be tricky • The German network is a “mixed network”, different forms of railway service are provided at the same time with different speeds and stopping pattern • Currently, paths can be blocked one year in advance • In the past, “path framework contracts” could be closed in order to secure paths and achieve planning security <ul style="list-style-type: none"> ◦ Competitors, e.g. HKX/Locomore used this tool • Open access competitors need planning security with regards to paths, e.g. to attract investors
			<ul style="list-style-type: none"> • The attitude of politicians towards open access competition is ambivalent – no homogeneous opinion exists <ul style="list-style-type: none"> ◦ SPD-delegate at “Bundestag” is closely connected to the unions whereas the unions are mostly dominated by DB Fv employees • Different interests can also be found between “Bund” and “Länder”, since the regional governments are mostly interested in their subsidised regional transport
			<ul style="list-style-type: none"> • “The stricter infrastructure and services in unbundled, the less regulation and monitoring of the market is needed” • Full unbundling would promote open access competition in Germany • However, it is seen as ambivalent: a weighing off between efficiency of the total passenger rail market and the wish to introduce more competition needs to take place
			<ul style="list-style-type: none"> • The network forms the basis for competition and therefore has a high influence • Competition is only possible when enough capacity is given

			<ul style="list-style-type: none"> ○ Repeatedly, difficulties in path allocation for competitors especially in transport hubs occur • An upgrading of infrastructure in transport hubs could lead to more open access competition and would make the entire rail transport more attractive • The present status quo of the network often leads to disruptions and consequently delays • However, construction work, if it is organised without considering running services of incumbent and competitor, can lead to commercial losses and a decrease of attractiveness
		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> • Only plays a role in theoretical considerations and discussions: <ul style="list-style-type: none"> ○ “Deutschlandtakt” as a means to offer a full-coverage network, also serving regions with low demand, whereas the state pays subsidies and tenders the lines ○ This would lead to more competition, however competition for the market not in the market • However, currently not pursued aggressively and not widely supported by politicians
		Consumer policy	<ul style="list-style-type: none"> • Plays no significant role, also because same conditions apply for all participants
	E	Market potential and market size	<ul style="list-style-type: none"> • Plays a big role since “only where people want to travel, competition makes sense” <ul style="list-style-type: none"> ○ Market entry in most European countries show the focus on lines with strong demand
		Costs for infrastructure	<ul style="list-style-type: none"> • The higher the price for infrastructure, the less likely is competition • However, infrastructure is only a part of the total costs in Germany, round about 20% • If costs would be, e.g. halved, no massive wave of new competitors would enter the market, since the effect would be too weak
		Access to distribution systems	<ul style="list-style-type: none"> • In the past, access to distribution systems in Germany was much more important than today – IT and internet enabled other ways of distribution • Today it is essential that the “brand” of the competitor is known <ul style="list-style-type: none"> ○ HKX had a distribution partnership with DB but no significant increase of sales resulted from that • Access to DB Fv’s distribution system in Germany is an advantage, but it has to be considered at which costs
		Presence of intermodal competitors	<ul style="list-style-type: none"> • Intermodal competition influences the price level of mobility in the industry • However intermodal bus and air competition in Germany does not kill intra modal competition: car transportation is the main intermodal competitor <ul style="list-style-type: none"> ○ InterConnex claims to be a victim of intermodal competition with long-distance busses, however their services were even unprofitable before the liberalisation
		Existence of network effects for incumbents	<ul style="list-style-type: none"> • DB Fv’s network effects hinders competition, it is a strong entry barrier <ul style="list-style-type: none"> ○ e.g. the “Bahncard” as a customer loyalty tool: customers “buy” a network with Bahncard 100 or Bahncard 50 – why should they change to a competitor’s network?

			<ul style="list-style-type: none"> • Network effects also theoretically enable DB Fv to fight price wars against competitors
		Generally low profitability of the industry	<ul style="list-style-type: none"> • Railway industry cannot compete with other industries regarding profitability • “You do not run trains for high returns” <ul style="list-style-type: none"> ◦ HKX and Locomore have “railway enthusiasts” as managers/investors, therefore we can speak of another type of competition, which has an “idealistic” goal besides high profits • More profitability in the industry would result in easier access to financing and more competition
		Access to financing	<ul style="list-style-type: none"> • Plays a big role for market entry <ul style="list-style-type: none"> ◦ Various companies who planned to access the market failed due to missing financing, they were asked by the investors to provide securities • High ex ante investment sums are needed which makes it even harder to get financing
		Cooperation/cooperation within the industry	<ul style="list-style-type: none"> • Cooperation within the rail industry can make a difference: <ul style="list-style-type: none"> ◦ E.g. regional pre- and onwards carriage ◦ Loyalty caused by cooperation between DB Fv and other European incumbents, e.g. SNCF can prevent entry from the other incumbent
		Cross-financing	<ul style="list-style-type: none"> • Regional transport provider get subsidies in order to cover the expenses – they provide open access at marginal cost level with existing rolling stock (e.g. HEX)
		Cooperation with other transport modes	<ul style="list-style-type: none"> • Can be an advantage but is often associated with a lot of work and has no significant effect on competition
		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> • Necessary to get competition going in the beginning • Currently no real cherry-picking is practiced in the German market: <ul style="list-style-type: none"> ◦ InterConnex ran on secondary lines ◦ HKX and Locomore run on “cherry lines” but provide too little daily connections
	S	Existence of (strong) unions	<ul style="list-style-type: none"> • Political influence of unions is relatively high in Germany (e.g. SPD in Bundestag) • However, if new rail companies are found, unions normally have little influence
		Customer loyalty	<ul style="list-style-type: none"> • Customer loyalty at DB Fv is relatively low
		Sharing economy	<ul style="list-style-type: none"> • Currently no big influence on open access competition, however this can change in the next years • UBER for example has more influence on regional transportation
		Adjustment to customer expectation	<ul style="list-style-type: none"> • Customers’ expectations in Germany are very heterogeneous • “The passenger rail provider that can bundle the most customer expectations will be most successful” <ul style="list-style-type: none"> ◦ DB Fv satisfies a great variety of customer expectations ◦ HKX partly failed due to a focus on a too narrow field of customers, namely the price sensitive leisure customers
		Customers’ willingness to pay	<ul style="list-style-type: none"> • Plays a big role for competition • In order to be successful in Germany, a wide variety of different willingness to pay needs to be covered • Willingness to pay is also influence by intermodal competition • However the Germans’ willingness to pay does not and will not change significantly in the next

			years since it is also influence by economic circumstance
		Entrepreneurship	<ul style="list-style-type: none"> • “Open access competition is mostly done by idealists with passion for railways” • Competitors often bring own money into the company (e.g. HKX & Locomore, also Westbahn & NTV)
		Attitude of press and population toward competition	<ul style="list-style-type: none"> • The attitude of press and population towards competition is generally positive • Only individual interest groups are/were suspicious • However, this has little influence on competition
	T	Access to rolling stock	<ul style="list-style-type: none"> • In Germany, no market for second hand rolling stock and leasing of rolling stock exists • It is easier to buy and rent locos than coaches <ul style="list-style-type: none"> ◦ HKX and Locomore had trouble to obtain coaches
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> • The missing harmonisation is an entry barrier for incumbent competitors • It has a weaker influence on domestic German competition
		Existence of innovation	<ul style="list-style-type: none"> • Innovations can have positive and negative influence: <ul style="list-style-type: none"> ◦ The internet and the related technical changes had a very positive influence on competition since it e.g. allows easier ticket distribution ◦ ETCS can mean additional effort and costs for competitors
		Homologation process	<ul style="list-style-type: none"> • Not the process of homologation is hindering competition but the effort which is associated with homologation <ul style="list-style-type: none"> ◦ HKX bought coaches abroad which used to run in Germany but those could not be homologated without alterations
		Railway safety systems	<ul style="list-style-type: none"> • Hinders no competition since equal conditions apply to all railway undertakings • For smaller competitors: <ul style="list-style-type: none"> ◦ Technical features which might need to be updated are most costly ◦ Safety management systems can also provide challenges
		Availability of necessary personnel	<ul style="list-style-type: none"> • Companies in Germany complain about the non-availability of train personnel • However, all companies found needed staff, incl. HKX and Locomore • The number of employed train drivers has increased in the last years in Germany
	Other	Incumbent's performance	<ul style="list-style-type: none"> • DB Fv has a strong market position in Germany and even in Europe and adapts well to changes <ul style="list-style-type: none"> ◦ Updated their pricing system according to market changes ◦ Covers a wide portfolio of customers which is a clear competitive advantage • However, DB Fv sometimes has a negative image among customers which leads to a low customer loyalty
	Additional findings		<ul style="list-style-type: none"> • Existing competitors provide competition on another level: slower paths, less frequency of connections, older rolling stock • Political and legal influence factors form competition and influence it most (e.g. organisation of the market, investment in infrastructure)
	Findings		<ul style="list-style-type: none"> • Availability of paths – rolling stock – financing – possibility for cherry-picking – profitability → all leads to the conception of a business model
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		<ul style="list-style-type: none"> Incumbents performance (strong market position) – cooperation with other state incumbents Low profitability – infrastructure costs
Θ_3	Findings	<ul style="list-style-type: none"> Market environment has changed only slightly – no leaps can be observed <ul style="list-style-type: none"> DB Fv slightly improved in image and adapted to market conditions, undermining their position as strong market player Intermodal competition changed due to the opening of the bus market, however no significant shift can be observed due to the still remaining strong position of cars Access to distribution systems became easier due to internet and technical innovations

Data Collection Form C			
Θ_1	Data collection = interview		Time of collection = 28.02.2017
			Characterisation of participant: <ul style="list-style-type: none"> over 15 years of working experience in the mobility and railway industry working experience in politics and for competitors senior management positions
Θ_1	Cluster	Influencing factor	Participant C
		Law in books	<ul style="list-style-type: none"> Right from the beginning, German law in the books symbolises a “hybrid-liberalisation” Law and regulation providing long-term planning security would be of high importance for competitors, but are currently absent
		Law in action	<ul style="list-style-type: none"> German law in the books is not implemented and lived in a proactive way towards competition On one occasion, in the third path framework agreement period, the cancellation fee for paths had been reduced drastically which was beneficial for competitors Recent change in paradigm: process of paths framework agreement has been abolished by EU and are therefore not any longer possible in Germany – unclear how the process will work in the future
	P/L	Access to facilities & data	<ul style="list-style-type: none"> This influence factor is “not decisive for the outcome of war, but costs a lot of strength” Access is basically seen as possible, but it is a “handling” issue: it costs a lot of work and persistence Some facilities suffer from bad management, however this affects all players <ul style="list-style-type: none"> DB Station and Services needed to hang out Locomore’s information on the stations and at the info points and this was often incorrect The display of the train order is not working correctly in some stations, like Hanau Locomore has difficulties with shunting and the quality of cleaning in Stuttgart
		Access to and availability of attractive train paths	<ul style="list-style-type: none"> General access to paths is given, however it is rather complex and decisiveness in negotiations is necessary <ul style="list-style-type: none"> Locomore and HKX understand the system and have a high degree of filigree experience The German network is highly utilised and a de facto shortage of paths exists

			<ul style="list-style-type: none"> ○ The newcomer on the German network is always structurally disadvantaged, since attractive paths are already blocked by running competitors ○ In order to break this up, an asymmetric regulation is necessary, e.g. through "Vorratstrassen" or "Angebotstrassen" like in freight rail – this is currently not wanted by DB Netz ○ Locomore tried to get paths for HKX via "urgent proceedings" at BNetzA, however it was denied since it is not clearly defined in the existing law • Paths framework agreements as an instrument was not usable for competitors <ul style="list-style-type: none"> ○ Before HKX started, they planned to apply for path framework agreements and in 1.5 years' time they would have had started or pay a high cancellation penalty – which was very risky ○ Further could the needed long-term security not be given by paths framework agreements, since it only runs for 5 years which is too short for most investors. This is different in Italy and Austria and enabled competition with new rolling stock financed by investors in these countries. • It is currently unclear how the new system without paths framework agreements will work – up to now no clear shaping is known
		Attitude of government and politicians towards competition	<ul style="list-style-type: none"> • Open access competition is seen as a "transport ministry specific topic" and has no wide lobby • In order to promote competition, a "big bang" with regards to regulation is needed – currently, this cannot be expected and no lobby for such a change exists
		Unbundling	<ul style="list-style-type: none"> • Full unbundling would be possible for competition, but it is not enough: a real liberalisation would need a breaking up of DB Fv into several parts that compete against each other – which is not wanted by the current government and politicians
		State of and investment in infrastructure	<ul style="list-style-type: none"> • Irrelevant for competition
		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> • It plays a role in interregional transport: a clearly organised framework would lead to new possibilities for competition in regions without cherry-picking potential, subsidised by regionalisation funds
		Consumer policy	<ul style="list-style-type: none"> • It plays a role, but is not significant – it is a "handling topic" which costs capacity but has to be done • Consumer policy is unfair with regards to intermodal competition
	E	Market potential and market size	<ul style="list-style-type: none"> • The higher the market potential of a destination, the lower the risk for market entry • Competition starts where the highest market potential is, then timetable have to be examined and finally the rotation planning has to be done • When the incumbent is already running a high frequency of trains on a route with high market potential, the risk of expulsion is not as big as when the competitor enters a route which is not served by the incumbent and the incumbent decides to re-enter this route again.
		Costs for infrastructure	<ul style="list-style-type: none"> • The high costs for infrastructure play a big negative role for open access competition
		Access to distribution systems	<ul style="list-style-type: none"> • Alternative distribution channels can be established relatively easy due to technological possibilities and the internet

			<ul style="list-style-type: none"> • A refused access to distribution systems has a negative effect on competitors <ul style="list-style-type: none"> ◦ At least 20-25% more tickets could be sold if Locomore would be included in DB's distribution system ◦ Due to high costs, the setting up of individual ticket shops in stations is too expensive for a limited number of trains • The opening up of the distribution system is currently not planned in Germany, however it is expected that EU will force an opening quite soon and competitors will continue to campaign for it
		Presence of intermodal competitors	<ul style="list-style-type: none"> • It has an influence on open access rail competition, especially due to the decreased prices for long-distance passenger transportation <ul style="list-style-type: none"> ◦ Market entry of busses changed situation for open access competitor ◦ Market entry of low-cost-airlines, like Ryanair on the route Frankfurt-Berlin, makes profitable operations more difficult • This is also enabled due to the unfairness of infrastructure costs, e.g. compared to busses
		Existence of network effects for incumbents	<ul style="list-style-type: none"> • This is no "knock-out-criteria" for competition, however the incumbent's network motivates customers to stay within the system
		Generally low profitability of the industry	<ul style="list-style-type: none"> • The industry is not known to be very profitable • However, it is always dependant on how the business case is conceptualised • When setting up open access competition in Germany, companies are not motivated by profitability but also need a great degree of idealism
		Access to financing	<ul style="list-style-type: none"> • Financing for open access competition and especially rolling stock is very hard to obtain in Germany • Very few institutional financiers exist, most of them are "spoiled" by regional transport: long-term contracts are given which provide more security with steady payment of subsidies • Finding financing is a tricky task for competitors: <ul style="list-style-type: none"> ◦ For HKX, Henry Posner was found, who had specific ideas how to do competition and provide services ◦ For Locomore, crowdfunding was established and SRI invested in rolling stock ◦ In case of WESTbahn and NTV, the French incumbent was participated with as many company shares as necessary to provide security for investors and banks
		Cooperation/coopetition within the industry	<ul style="list-style-type: none"> • Cooperation can be a means to optimise the business
		Cross-financing	<ul style="list-style-type: none"> • Due to the missing regulatory framework which implies full liberalisation, it is still non-transparent how the infrastructure funds are used within DB AG - a possible coverage of ICE 4 financing by infrastructure funds cannot be fully excluded
		Cooperation with other transport modes	<ul style="list-style-type: none"> • This influence factor does not save any business plan, but helps to optimise the business
		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> • Open access competition would not be possible in the market if no cherry-picking exists • It is always a question where cherry-picking begins – also with regards to the scale of the offer • Cherry-picking mostly implies a problem of capacity since the destinations for cherry-picking are often characterised by high frequency of connections
	S	Existence of (strong) unions	<ul style="list-style-type: none"> • Neutral

		Customer loyalty	<ul style="list-style-type: none"> A customer's loyalty in Germany is not given, if the price of another competitor is cheaper
		Sharing economy	<ul style="list-style-type: none"> Sharing economy has an influence on competition, mainly because it supports the trend to increase the usage of public transportation, which also benefits open access competitors
		Adjustment to customer expectation	<ul style="list-style-type: none"> It is important to be successful Traveling in Germany is too standardised – little possibility is given to travel individualised or personalised
		Customers' willingness to pay	<ul style="list-style-type: none"> German customers are very price sensitive Price sensitivity kills customer loyalty: if another provider offers a cheaper price, a high degree of customers will switch
		Entrepreneurship	<ul style="list-style-type: none"> As a competitor, in order to be successful in the long-distance passenger rail, you have to have a clear vision and be extremely steady to it To get what you need, when entering the market and when staying in the market, it is important to be very persistent
		Attitude of press and population toward competition	<ul style="list-style-type: none"> The positive attitude of press benefits the competitors <ul style="list-style-type: none"> Marketing budget can be saved due to the good presence in press and media Press and population is highly interested in competitors in the German market, this is also due to the general monopoly in the long-distance passenger rail transport
	T	Access to rolling stock	<ul style="list-style-type: none"> This is the main influence factor on open access competition Access to rolling stock is closely related to financing, since ex ante investment in rolling stock is high and the amortisation period is very long <ul style="list-style-type: none"> Locomotion considered the buying of new rolling stock from Siemens but the finding of investment was too difficult It is very hard to find hand rolling stock for rent in Germany and Europe: no leasing companies like in freight rail and little offer of good second hand rolling stock exist When Hartmut Mehdorn was CEO at DB AG, a very restrictive rolling stock strategy was in place, this led to a lack of suitable rolling stock in Germany: <ul style="list-style-type: none"> A high degree of outgoing but still operable coaches were scrapped Another part of the rolling stock was sold to destinations far away The rolling stock which was sold in central Europe was highly restricted and its usage was closely controlled The access to locomotives is not considered as a problem, the locomotive-market in Germany was liberalised 15 years ago when Siemens decided to offer flexible and short-term leasing <ul style="list-style-type: none"> Since big parts of the freight wagons were financed with private capital and therefore easily accessible, the liberalisation of the locomotive market triggered the liberalisation of freight rail
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> Irrelevant: if you want to run a concept with locomotives and coaches, technical harmonisation does not play an immense role Locomotives are relatively easy accessible in Germany and coaches are to some degree already standardised within Europe

		Existence of innovation	<ul style="list-style-type: none"> It plays no essential role in the market entry process, it is possible to enter the market with old, conventional rolling stock However, it is an influence on commercial success: if you are not innovative with your product/offer, it is harder to achieve commercial success
		Homologation process	<ul style="list-style-type: none"> It plays a derivative role The process and interaction with the authorities is tricky and complex, but solutions can be found <ul style="list-style-type: none"> In case of HKX's second hand rolling stock, a solution could be found and homologation was granted
		Railway safety systems	<ul style="list-style-type: none"> Irrelevant, since the same conditions apply for all market players
		Availability of necessary personnel	<ul style="list-style-type: none"> Generally, no problem: necessary personnel is available However, due to the status of full employment in Germany, it is generally harder to get personnel than it was a few years ago
	Other	Incumbent's performance	<ul style="list-style-type: none"> The incumbent in Germany is too big to compete with The size of the incumbent discourages competitors and investors – regardless of actual discrimination As long as all competitors of DB Fv in the market are "alibi-competitors", little will be done against them <ul style="list-style-type: none"> The case of bus competitors shows that as soon as competition endangers DB Fv, they react to competitive threats
	Additional findings		<ul style="list-style-type: none"> The finding of rolling stock is the main influence factors, combined with the finding of paths and financing Legal and economic influence factors play the most important role, being closely intertwined
Θ ₂	Findings		<ul style="list-style-type: none"> Law in the books (and its interpretation) – law in action – access to attractive paths (with long-term security) – financing Financing – rolling stock
Θ ₃	Findings		<ul style="list-style-type: none"> Access to distribution systems: technology and internet made it easier to establish alternative distribution channels Intermodal competition: liberalisation of the long-distance bus market led to a decrease of monopolistic returns and also to a decrease of profitability for the long-distance passenger rail industry

Data Collection Form D

Θ ₂	Data collection = interview		Time of collection = 03.09.2017
			Characterisation of participant: <ul style="list-style-type: none"> More than 15 years of working experience in the rail industry, with a focus on the Italian and German market Participant D holds/held high management positions and has experience with both competitors and incumbents
Θ ₁	Cluster	Influencing factor	Participant D
	P/L	Law in books	<ul style="list-style-type: none"> Up to 2009, Italy worked on the implementation of EU law, this was the initiation of competition in the country

			<ul style="list-style-type: none"> • Law in the books, however, still provided competitive advantages for the incumbent over a long period • The legal situation was not very clear and uncertainties occurred in the beginning
		Law in action	<ul style="list-style-type: none"> • Law in action is broadly diversified: statements and decisions are not always clear and explicit • In the beginning, one office in the Transport Ministry was the whole authority. Decisions were made consensual and less competition oriented • Law in action came a long way since the early days, an improvement becomes apparent
		Access to facilities & data	<ul style="list-style-type: none"> • This factor has an influence on competition and the access to facilities today is better than in the early days of competition <ul style="list-style-type: none"> ◦ The usage of storage facilities was unclear for a long time for NTV and DB/ÖBB ◦ Facilities like energy, cleaning, etc. were optimised after the start of operations by DB/ÖBB and changed during the years ◦ Access to major stations (e.g. in Rome or Milan) were denied by RFI to NTV and DB/ÖBB
		Access to and availability of attractive train paths	<ul style="list-style-type: none"> • Especially in the early times, access to attractive train paths was scarcely given <ul style="list-style-type: none"> ◦ When DB/ÖBB applied for paths prior to their market entry in 2009. RFI denied the attractive train paths since TI wanted to use them. They were offered slower train paths that did not fit with connecting trains of TI. TI, however, never used them and DB/ÖBB had to run behind a "ghost train" ◦ Originally, DB/ÖBB wanted to run until Milan, but the paths were unattractive and slow and the train station in Milan was outside of the city ◦ A official order has been issued to DB/ÖBB not to serve intermediate stops on the Italian territory, due to expected cannibalisation of subsidised lines – in the end the order has never been executed.
		Attitude of government and politicians towards competition	<ul style="list-style-type: none"> • In the beginning, the attitude was rather protectionist: Italy implemented EU law at a minimum standard • When NTV started, there was a lot of scepticism and no support from government • However, due to the change in government and the changed economic situation in Italy, the conditions have changed and government and politicians are more open towards competition now
		Unbundling	<ul style="list-style-type: none"> • Unbundling had an influence, especially in the early times: for RFI, the situation was new and no clear separation to TI existed <ul style="list-style-type: none"> ◦ e.g. in terms to paths, no clear guidelines for prioritisation existed, so TI was often prioritised • Today, a stronger separation exists and Chinese Walls are intact which work efficiently
		State of and investment in infrastructure	<ul style="list-style-type: none"> • This factor has a high influence on open access competition in Italy • A lot was invested in the Italian infrastructure and an investment programme was set up before the market entry of competition • The fast and attractive infrastructure between the main metropolises (Rome-Milan) allows competition and provides access to a big market • Due to dedicated high-speed lines, the traffic is "unmixed" – no slow regional or cargo transportation is running on those lines

		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> The influence of this factor in Italy is rather low In the early times, the authorities feared a cannibalisation of the subsidised lines, therefore cabotage was forbidden in parts (Arenaways, DB-ÖBB) <ul style="list-style-type: none"> DB-ÖBB feared that it would influence their traffic but it turned out to be no big influence It also seems to have no influence on NTV since they only run high speed transport which is also not subsidised in any way
		Consumer policy	<ul style="list-style-type: none"> This factor has low influence – the same conditions apply for all market participants
	E	Market potential and market size	<ul style="list-style-type: none"> Market potential has a high positive influence on competition in Italy Italy is not polycentric like e.g. Germany, big centres with millions of inhabitants exist, which are connected with one another via high-speed infrastructure (e.g. Milan, Rome) <ul style="list-style-type: none"> Together with the infrastructure, market potential was the core influencing factor that brought NTV to a market entry DB-ÖBB were convinced of the touristic potential in the north-Italian part and therefore also set up the traffic due to this reason
		Costs for infrastructure	<ul style="list-style-type: none"> Infrastructure costs is a strong influencing factor in Italy It is also a leverage government takes: the prices for path km in the high speed network have been decreased from 14 EUR in the beginning to 6,50 EUR now In the past and today, the cost for other infrastructure was and is relatively low. However, the government plans a high decrease in 2018 <ul style="list-style-type: none"> DB-ÖBB is taking legal actions against RFI since they are convinced that this is unfair
		Access to distribution systems	<ul style="list-style-type: none"> Access to distribution systems was and still is a main factor for the start of operations in Italy 5-6 years ago when digitalisation was not as strong as it is today, it was an obligation to have a sales office in the stations in order to fill the trains with customers Digitalisation changed this up to today, however in big hubs, a sales office is still required <ul style="list-style-type: none"> TI knows about its power in this field TI did not sell DB-ÖBB for some time and it was a fight to get back in TI's sales system. Only inside TI's distribution system, DB-ÖBB could run profitably NTV was not distributed from the beginning onwards and had to establish their own sales offices NTV offers sales offices in form of ticket machines and staff that help customers use those ticket machines
		Presence of intermodal competitors	<ul style="list-style-type: none"> This factor has low influence on high-speed competition: <ul style="list-style-type: none"> Compared to air competition, NTV has advantages since airports are often located outside of cities and NTV is fast due to the fast infrastructure Compared to buses, NTV is a lot faster In long distance passenger rail it was not relevant at market entry of DB-ÖBB. The overall pressure is not very high, since bus companies already reduced services on some lines

		Existence of network effects for incumbents	<ul style="list-style-type: none"> • Competition in Italy is possible without network effects, since a number of big cities exist on direct lines • In long-distance passenger rail, feeding is more necessary and possible, DB-ÖBB profit a lot from customers that come from or change to TI's network • TI and DB-ÖBB work on the harmonisation of their timetables in order to guarantee good interchange possibilities for the customers
		Generally low profitability of the industry	<ul style="list-style-type: none"> • Low profitability influences competition in Italy <ul style="list-style-type: none"> ◦ After the market entry, TI and NTV entered a price war which led to a drastic decrease of ticket prices ◦ The banks that are shareholder of NTV want to withdraw step by step from the business due to the low profitability
		Access to financing	<ul style="list-style-type: none"> • It is relatively easy to find investors in Italy, however once an investor is found the bureaucratic barriers are relatively high <ul style="list-style-type: none"> ◦ It was rather easy for NTV to access financing since the main shareholders have been financially sound ◦ For DB-ÖBB it was also relatively easy to access financing since the holding companies provided financing
		Cooperation/cooperation within the industry	<ul style="list-style-type: none"> • This influencing factor plays a big role in Italy • The generally low profitability forces competitors and incumbent to cooperate <ul style="list-style-type: none"> ◦ DB-ÖBB, for example, have a formal cooperation agreement with TI, which is important for DB-ÖBB's success
		Cross-financing	<ul style="list-style-type: none"> • Very low influence
		Cooperation with other transport modes	<ul style="list-style-type: none"> • Low influence on competition
		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> • Cherry-picking is a big influence factor due to the metropolitan areas • In the past, competition on cherry lines was prevented, e.g. by non-availability of infrastructure where TI provided subsidised transport <ul style="list-style-type: none"> ◦ When NTV applied for paths, access to strategically important stations was denied
	S	Existence of (strong) unions	<ul style="list-style-type: none"> • Unions have an influence on competition since they are a cost driver <ul style="list-style-type: none"> ◦ Unions frequently demand that two locomotive drivers are needed on one locomotive as it is common in freight services. This threat would make operations significantly more expensive for DB-ÖBB to run the trains
		Customer loyalty	<ul style="list-style-type: none"> • The influence of customer loyalty on competition is relatively low in Italy • Customers are not very loyal in Italy, they consider which offer is more attractive and convenient for them <ul style="list-style-type: none"> ◦ NTV and TI both have customer loyalty programmes
		Sharing economy	<ul style="list-style-type: none"> • The influence on competition is low • Carpooling companies like BlaBlaCar are no real competitor to long-distance and especially high-speed rail
		Adjustment to customer expectation	<ul style="list-style-type: none"> • This factor plays a role in Italian competition: <ul style="list-style-type: none"> ◦ In the last 8 years since NTV announced to enter the market, TI adapted to customer wishes: it bought new rolling stock for the high speed sector, it adapted the offer between Rome and Milan, etc.

			<ul style="list-style-type: none"> ○ NTV regularly adapts the network and the ODs to customers wishes ○ DB-ÖBB also modified its lines to customers wishes and offers end-to-end tickets together with TI
		Customers' willingness to pay	<ul style="list-style-type: none"> • Willingness to pay has an influence on competition, especially since the economic crisis from 2010 onwards • A detailed yield-management is a pre-condition for success in Italian long-distance passenger transport • The low willingness to pay caused the price war between NTV and TI, the connection Rome-Milan was sold for 9 EUR at some times
		Entrepreneurship	<ul style="list-style-type: none"> • This has a high influence on competition in Italy and is a precondition for market entry: Arenaways and NTV had and have strong entrepreneurs, which started the company • When the market entry is successful, perseverance is also necessary in order to survive in the market
		Attitude of press and population toward competition	<ul style="list-style-type: none"> • Population and press generally promoted competition in Italy • Population wishes for diversification and for an improvement in quality <ul style="list-style-type: none"> ○ In studies, DB-ÖBB regularly obtain good results with regards to service and comfort
	T	Access to rolling stock	<ul style="list-style-type: none"> • This is not an Italian topic, it is a European problem • Access to rolling stock in Italy is possible, however very dependent on the capital strength of the company <ul style="list-style-type: none"> ○ In the case of DB-ÖBB, ÖBB had a surplus of coaches which could run on the Italian network
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> • Technical harmonisation has high influence on competition in Italy <ul style="list-style-type: none"> ○ DB-ÖBB's locomotive had no homologation for Italy for a long time. Now, the homologation is existent however only up to 200 km/h • Italy has its own type of ETCS for the high-speed lines • Entering the Italian market costs a lot of time and resources due to the barriers of lacking technical harmonisation
		Existence of innovation	<ul style="list-style-type: none"> • Innovation makes a difference in Italy, it is, however, no major influence factor on competition <ul style="list-style-type: none"> ○ NTV set up a new distribution system: it does not offer sales centres but ticketing machines centres where staff helps the customers to buy tickets at the machines ○ NTV also provides an entertainment and wifi on board of the trains in a very early stage
		Homologation process	<ul style="list-style-type: none"> • The homologation process has a high influence on the time and resources of competitors • In the early times of competition, a lot of uncertainties existed and the process was not very clear – this has improved • Requests and decisions felt random without clear guidelines <ul style="list-style-type: none"> ○ Next to DB-ÖBB, also NTV had problems with the homologation process
		Railway safety systems	<ul style="list-style-type: none"> • Even if the conditions are equal for all operators, it is a complex influence factor • A special Italian version of ETCS exists named SCMT

			<ul style="list-style-type: none"> Train driver can only run in Italy when they are employed by an Italian rail operator
		Availability of necessary personnel	<ul style="list-style-type: none"> The availability of necessary personnel is given in Italy and has no influence on open access competition The necessary training for personnel in operations is difficult, also since high barriers for the change between companies exists
	Other	Incumbent's performance	<ul style="list-style-type: none"> For TI, two strategies could be observed which changed after some time: At first, TI tried to prevent competition where possible (e.g. paths, stations) and to create barriers for possible competitors Due to competitive pressure, TI then initiated a comprehensive internal change which resulted in a massive increase in quality (e.g. new sales system, new rolling stock, new customers orientation)
	Additional findings		
Θ_2	Findings		<ul style="list-style-type: none"> Unbundling: the relationship between RFI and TI changed a lot over the last years. RFI's decisions were taken randomly and individually in the past and are more structured and independent from TI now Distribution system: customers are used to digital sales channels and machines and no longer require personal sales offices Law in action: the regulatory agencies are now established and independent and used to be non-existent in the beginning → however there is work to do
Θ_3	Findings		<ul style="list-style-type: none"> Access to financing is closely connect to availability of rolling stock The customers' low willingness to pay is related to the low profitability in the industry The homologation is connected to availability of rolling stock

Data Collection Form E			
Θ_2	Data collection = interview		Time of collection = 19.09.2017
			Characterisation of participant: <ul style="list-style-type: none"> More than 10 years of working experience in the transportation industry, with a focus on the Italian market Participant E has experience in consulting and research
Θ_1	Cluster	Influencing factor	Participant E
	P/L	Law in books	<ul style="list-style-type: none"> The Italian law in the books is relatively old. If it would have been implemented after 2012 it would look different Open access is possible for more than 10 years, the legal framework was introduced in 2003 A new regulation was introduced which obliged rail companies to be in a situation, where they can tow their own trains in case they get stuck on the infrastructure and block other trains. This was considered anticompetitive and modified.
		Law in action	<ul style="list-style-type: none"> The separation between infrastructure and operations, which is set in the law, exists, not from an ownership perspective but two mayor companies are set up under one public holding (FSI): Trenitalia (hereinafter "TI") is running trains and RFI is in charge of the infrastructure

			<ul style="list-style-type: none"> It took a long time to implement law into action, and also for companies to enter the market <ul style="list-style-type: none"> For Arenaways, it was too soon to enter the market, the basics for competition were not fully implemented at that time However, there are many gaps within the legal framework, this makes it harder for competition since procedures were and are sometimes not clear <ul style="list-style-type: none"> TI actively used especially at the beginning the existing gaps in order to delay competition Capacity management is not regulated: when enough capacity exists, competition is easily possible. However, when capacity is exhausted, competition is in danger → there is a future risk TI tried to block Italo in the first years with the “gaps” in the law. For example, it said that Rimini station was not suitable for the trains and NTV could not stop
		Access to facilities & data	<ul style="list-style-type: none"> General access to stations is provided with some gaps in the regulation. Therefore, access to stations cannot fully be controlled <ul style="list-style-type: none"> In the first years, NTV was only permitted to use some secondary stations. This, however, has changed over the years TI has its own maintenance and this is not accessible by NTV, it also has its own maintenance facilities The stations in Italy are managed by RFI Commercial spaces is by Centostazioni (formerly partially privatised and recently rebought by FSI 100%) and Grandistazioni (privatised). The two companies are in charge of mid-large and large stations in Italy. The rest is not commercially exploited (or it is by RFI)
		Access to and availability of attractive train paths	<ul style="list-style-type: none"> It is rather complicated in Italy to get train paths, this can be difficult and a risk for new companies The process is based on agreements with RFI, RFI accommodates paths with each company according to a catalogue Access to attractive train paths has not been a real problem in the past, since enough capacity is existing. This could change in the future when not enough capacity is given
		Attitude of government and politicians towards competition	<ul style="list-style-type: none"> The attitude of government and politicians is generally diversified and not “one” universal attitude exists In the beginning, politicians were not aware of the positive and negative consequences which their decisions on competition had The government has a general interest to favour TI, they are protective since it is governmental owned With regards to competition, Italian companies, e.g. NTV, are more protected than other competitors from other countries, e.g. DB/ÖBB
		Unbundling	<ul style="list-style-type: none"> Some years ago, the government wanted to sell/privatise TI, however unbundling resulted to be a problem: the mix of asset ownership and the access to credits were tricky, therefore the holding structure and the state ownership remained Currently, full unbundling is not a topic which is actively discussed

			<ul style="list-style-type: none"> The government, however, thinks about the privatisation of operation (only train operator) on the profitable high-speed network
		State of and investment in infrastructure	<ul style="list-style-type: none"> In the 90th, the government decided to invest a great sum into the high-speed network The high-speed network and the resulting increase in capacity is one of the preconditions for competition in Italy The main competitor, NTV, is offering no niche product since the capacity to start with a big scale approach existed
		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> 104 long-distance daily trains are subsidised in Italy, TI has a contract which ran for 15 years and the payment volume was 200 Mio. EUR This contract has recently been renewed and TI gets 350 Mio EUR per year, for 10 years for about the same amount of trains Especially long running IC trains and night trains with low fares, many stops and slow travel times need subsidies. Often, they run in between regional transport. Therefore, they cannot be run on a commercial level and are not TI's core business Those subsidised trains make niche services for competitors impossible since it is not profitable to compete with TI's subsidised trains as well as the also subsidised regional trains
		Consumer policy	<ul style="list-style-type: none"> Not relevant
	E	Market potential and market size	<ul style="list-style-type: none"> Market potential in Italy has a strong influence on open access competition <ul style="list-style-type: none"> NTV chose one of the richest markets to enter, which is also a main line of the Italian network After running some trains on less profitable lines, NTV abandoned those services due to cost optimisation
		Costs for infrastructure	<ul style="list-style-type: none"> Infrastructure costs have an influence on open access competition <ul style="list-style-type: none"> When the costs for high-speed paths was decreased from 15 EUR to an average of 8.50 EUR, the business case of NTV was improved and the so gained economic stability helped NTV The access fees to conventional lines are also rather cheap with about 3 EUR per path/km
		Access to distribution systems	<ul style="list-style-type: none"> The access to distribution system has an influence on open access competition, especially due to the resulting costs when a new distribution system needs to be set up TI has no obligation to share its sales system with competitors <ul style="list-style-type: none"> NTV created a parallel sales system, including search engines, ticketing machines, web page, commercial agreements with other operators (tourist operators, GDSs), etc. The costs for establishing a parallel distribution system are bearable for big competitors, like NTV, but not possible for small ones <ul style="list-style-type: none"> This also was a problem for Arenaways
		Presence of intermodal competitors	<ul style="list-style-type: none"> The presence of intermodal competitors clearly influences the long-distance passenger rail. However, it always depends on the routes <ul style="list-style-type: none"> E.g. on the route Milan-Bari, air is the better choice compared to rail, on the route Milan-Rome, air connections were almost cancelled since rail is the better choice

			<ul style="list-style-type: none"> The quality of the transport provider's product as well as the travel time make the difference for the customers On the Italian market, all modes are present, including low cost airlines like Easyjet, coaches, carsharing Long-distance coaches are more and more present in Italy, yet, they have not a high influence right now but their influence might increase Coaches might have a small price effect on the rail lines where prices are high, like Milan-Padua. This would lower entry-prices for low willingness-to-pay users
		Existence of network effects for incumbents	<ul style="list-style-type: none"> TI definitely has network effects NTV never put much power into integrating into a rail network <ul style="list-style-type: none"> NTV never integrated into SNCFs TGV network, despite SNCF being a shareholder in the business, this would have been beneficial NTV initiated self-run coaches as "feeder" and tries to set up an own network and in order to gain network effects
		Generally low profitability of the industry	<ul style="list-style-type: none"> This factor should normally be of high influence but might not be of such <ul style="list-style-type: none"> NTV ignored the high economic risk when it entered the market and were very optimistic. It clearly overestimated the willingness-to-pay (→ the obtainable yields). However, with time NTV adapted its strategy and business plans In general, profitability in Italy is not as low as one would expect and competition can be successful
		Access to financing	<ul style="list-style-type: none"> When companies and/or entrepreneurs have good business connections to banks or investors, access to financing is easy <ul style="list-style-type: none"> The president of NTV held very good connections to investors and also banks, they provided the necessary money
		Cooperation/cooperation within the industry	<ul style="list-style-type: none"> TI holds cooperation with different rail companies, e.g. SNCF, DB, SBB, ÖBB Italo holds no rail cooperation, also not with SNCF. This however could have had a positive effect
		Cross-financing	<ul style="list-style-type: none"> Cross-financing has formally no influence on open access competition Generally, no money from infrastructure and regional transport can be transferred to TI However, TI gets indirect cross-financing since it receives 350 Mio. EUR of subsidies for the slower long-distance network. Also access to credit could be easier due to its dimension (too big to fail).
		Cooperation with other transport modes	<ul style="list-style-type: none"> Cooperation with other modes are used in Italy, e.g. in form of feeders <ul style="list-style-type: none"> Operators have contracts with local coach companies which bring people from the rural areas to the metropolitan areas where they switch to trains NTV has further partnerships with hotels, sea ferries and some urban transport networks FSI owns Busitalia and Busitalia Fast (bus & coach companies)

		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> • TI complains that NTV does cherry-picking on the high-speed network, however this could not been shown and proven yet • It can be said that open access competition in Italy could not have been realised at such a large scale when a running on the main “cherry lines” would not have been allowed
	S	Existence of (strong) unions	<ul style="list-style-type: none"> • TI has a “national” contract with the Italian unions. Since until NTV Ferrovie dello Stato was the only national rail company, the “national” contract is actually “FSI”’s contract, if a newcomer defines a new contract with unions as NTV did. • NTV negotiated its own contract with the Italian unions • It is necessary to integrate the unions and do contracts with them in order to do competition in Italy at such scale
		Customer loyalty	<ul style="list-style-type: none"> • Italian customers are not particularly loyal and therefore this factor has no big influence on competition • It can be said that the Italian customers had no “love” for TI and therefore it was relatively easy for NTV to attract TI’s customers
		Sharing economy	<ul style="list-style-type: none"> • BlaBlaCar is operating in the Italian market and competition exists, however it has now big influence on open access competition in Italy due to small modal share
		Adjustment to customer expectation	<ul style="list-style-type: none"> • An adjustment to customers’ wishes is an important factor in Italy <ul style="list-style-type: none"> ◦ NTV started with the hypothesis, that it would have a huge comfort and quality advantage over TI, however TI adapted very quickly to customers’ wishes ◦ As a consequence, NTV could not realise the yield that they originally planned to gain
		Customers’ willingness to pay	<ul style="list-style-type: none"> • The willingness to pay in Italy has not changed a great deal with the start of open access competition • The Italians’ willingness to pay is not particularly low, especially on the high-speed lines a lot of business travellers use the trains which have a high willingness to pay • Still, NTV offered lower prices than TI to attract customers • Some offers of both TI and NTV are very low • Price variability across classes & flexibility rules is very high
		Entrepreneurship	<ul style="list-style-type: none"> • This factor plays an important role for open access competition <ul style="list-style-type: none"> ◦ In case of NTV, some entrepreneurs liked the ideal to run trains on the Italian network and they also had the right contacts to investors, so they set up a business and started operations
		Attitude of press and population toward competition	<ul style="list-style-type: none"> • Press and population have no particular favour or ill-favour for one company or the other • The population did not “love” TI, also people do not have a negative image of NTV which is good for the company
	T	Access to rolling stock	<ul style="list-style-type: none"> • Access to rolling stock is a general problem in the industry all over Europe • The exception of Italy is that you have a big amount of money available to invest in new rolling stock <ul style="list-style-type: none"> ◦ NTV had the money and bought 25 new trainsets + 12 new trainsets

			<ul style="list-style-type: none"> ○ Arenaways bought 2 second-hand train sets from Czech Republic
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> • This factor is not crucial for open access competition as most of traffic is domestic, however it has an influence on the cost structure <ul style="list-style-type: none"> ○ NTV had the money to buy new rolling stock that fully fit into the Italian network
		Existence of innovation	<ul style="list-style-type: none"> • Existence of innovation is currently no major influencing factor and will not be in the future
		Homologation process	<ul style="list-style-type: none"> • Homologation in Italy is a long and complicated process which costs a lot of money <ul style="list-style-type: none"> ○ The examples of NTV show that it is possible, when you have the necessary resources and time
		Railway safety systems	<ul style="list-style-type: none"> • This factor has no influence on competition
		Availability of necessary personnel	<ul style="list-style-type: none"> • Availability of personnel plays a role for competition • A high upfront investment is required since people need to be trained and paid for months before the start of operations • It is not a major problem to recruit necessary personnel, it is the training that is the critical path
	Other	Incumbent's performance	<ul style="list-style-type: none"> • TI had a strategy to delay competition by using the existing gaps in regulation • In the beginning of competition, discrimination of TI against competitors was frequent, however over time it had become less and less • The reputation of TI is now generally good. The quality of high-speed trains changed a lot since TI initiated the change of strategy
Additional findings			<ul style="list-style-type: none"> •
ϑ_2	Findings		<ul style="list-style-type: none"> • The incumbent's performance changed a great deal, since TI improved rolling stock, punctuality, pricing system, etc. after the competitor announced to enter the market • Intermodal competition grew stronger, since after the liberalisation more coaches entered the market • Access charges changed, especially in on high-speed lines they decreased • Investment in infrastructure changed (however it is not continuous)
ϑ_3	Findings		<ul style="list-style-type: none"> • The access to rolling stock is highly dependent on the access to financing • The availability of necessary personnel is also dependent on the access to financing • The availability of attractive train paths is dependent on the profitability of the industry • The customers' willingness to pay is dependent on the market potential • Adjustment to customers' experiences is dependent on the profitability of the industry

Data Collection Form F			
Θ_2	Data collection = interview		Time of collection = 29.09.2017
			Characterisation of participant: <ul style="list-style-type: none"> • Many years of working experience in the rail industry, with a focus on Italy • Participant F is working in the field of research and consulting
	Cluster	Influencing factor	Participant F

9 ₁	P/L	Law in books	<ul style="list-style-type: none"> Especially the independency and strength of authorities and institutions play an important role. Therefore, this influence factor has a high importance for open access competition <ul style="list-style-type: none"> The case of Arenaways shows that when authorities and institutions are not made strong enough, they cannot protect competition
		Law in action	<ul style="list-style-type: none"> Infrastructure fees in Italy are generally set base on regulation <ul style="list-style-type: none"> Intense lobbying by NTV lead to a decrease of infrastructure fees
		Access to facilities & data	<ul style="list-style-type: none"> This influence factor is of high importance and had delayed start of operations in the past: <ul style="list-style-type: none"> On the line Milano – Rimini – Ancona, NTV could not stop on Rimini Station, since the station was not fit for the train. RFI refused to adapt the station. NTV wanted to adapt the platform by themselves, but was not allowed. As a consequence, the start was delayed and due to commercial reasons was only run for a limited time by NTV
		Access to and availability of attractive train paths	<ul style="list-style-type: none"> Access to attractive paths is of significant importance: <ul style="list-style-type: none"> The main stations Milan and Rome were already “full” and no path capacity for NTV’s trains was given. Therefore, access to those important stations was denied in the beginning Now, the situation changed and NTV has access
		Attitude of government and politicians towards competition	<ul style="list-style-type: none"> The visibility of NTV’s top executives is very high and they have a good network in the politics – NTV could make a lot of “noise” <ul style="list-style-type: none"> NTV used this influence in order to decrease the fee for high-speed lines For Arenaways, this was not possible since the political connection was not there and it could not make much “noise”
		Unbundling	<ul style="list-style-type: none"> Unbundling has been a problem in the past, especially the case between RFI/Trenitalia and Arenaways proofs this
		State of and investment in infrastructure	<ul style="list-style-type: none"> Participant F is uncertain about this factor: <ul style="list-style-type: none"> On the high-speed sector the updated infrastructure has the positive effect of additional capacity which incumbent as well as competitors can use For Arenaways it was of no real influence, however a generally low capacity exists in the normal regional and intercity network The question is, if NTV would have entered the market without the existing high-speed network
		Willingness or ability to subsidise operations	<ul style="list-style-type: none"> This influence factor has relatively high influence: <ul style="list-style-type: none"> Arenaways was competing with TI’s subsidised lines and did not succeed DB ÖBB also see that it is tricky to compete with TI SNCF provides a line between Milan and France and does not have cabotage in order to not compete with national lines
		Consumer policy	<ul style="list-style-type: none"> Consumer policy did play a role in the past: <ul style="list-style-type: none"> Between Torino and Milan, commuter trains are very full and commuters often have no seats The association of commuters complained about this TI started to ask commuters to book seats

E			<ul style="list-style-type: none"> ○ Interesting is, that Italo does not offer the type of connections which are attractive for commuters – it seems to avoid big masses of commuters
		Market potential and market size	<ul style="list-style-type: none"> • “Either you go for a rich OD or you don’t consider entering the market” • An adequate market size is the precondition for open access competition • NTV does not offer international connections since they are convinced that the market is too small
		Costs for infrastructure	<ul style="list-style-type: none"> • This factor influences open access competition, and it mostly is an entry barrier • However, it always depends on the line: on some lines – mostly high-speed lines - the costs are very high, on other lines they are rather low and fair
		Access to distribution systems	<ul style="list-style-type: none"> • TI has ticketing machines at prominent points in station - they are very visible. NTV wanted to have machines in the same places but it was not possible in the beginning. Now, the situation changed and ticketing machines are in place at key points • No ticketing platform exists, which allows all operators to sell tickets to increase Network effects
		Presence of intermodal competitors	<ul style="list-style-type: none"> • In most cases, it is the other way around and open access competition influences intermodal competitors: airlines abandon lines and rail take over air customers • The core advantage is that rail starts its lines directly in city centres, this beats air because airports are often located outside of cities • Coaches are no competition to high-speed rail but can be for long-distance passenger rail
		Existence of network effects for incumbents	<ul style="list-style-type: none"> • This factor influences open access competition in Italy, it is a means to fill the trains at its optimum • In Florence, NTV offered an integrated ticket with local public transport: with an NTV rail ticket one hour of bus travel in Florence was included • NTV and TI both set up their own bus network in order to generate additional network effects • TI’s timetable is matched to its regional connections, when using NTV, customers often have to wait in order to be connected to the regional network – this is a disadvantage
		Generally low profitability of the industry	<ul style="list-style-type: none"> • This influence factor is an entry barrier for open access competitors, especially in combination with path access fees
		Access to financing	
		Cooperation/cooperation within the industry	<ul style="list-style-type: none"> • The example of DB Fv/ÖBB Pv shows that this factor has an influence: when DB/ÖBB set up the trains and were not cooperating with TI, the trains were hidden from the public. After the cooperation started, however, TI began advertising the DB/ÖBB trains on board of its trains
		Cross-financing	<ul style="list-style-type: none"> • Since separate accounts exist within FSI and a strong, independent institution is set up, this factor has no influence on open access competition
		Cooperation with other transport modes	<ul style="list-style-type: none"> • This influences open access competition, the coach network that TI and NTV established show that • NTV and also TI offers a courier-service to carry luggage which can be bought with the NTV ticket
		Possibility for cherry-picking in the market	<ul style="list-style-type: none"> • Cherry-picking is not only dependant on the line, it is also dependant on the choice of paths and the time slots:

			<ul style="list-style-type: none"> ○ Arenaways ran on cherry lines, however its time slots were not ideal and not many customers changed from TI ○ NTV on the other hand has a very similar offer to TI, they run only minutes apart
	S	Existence of (strong) unions	<ul style="list-style-type: none"> • The factor generally has no significant influence on open access competition • Railway unions are generally strong • However, not all of NTV's staff has railway tariff contracts: the "stewards" belong to another tariff group
		Customer loyalty	<ul style="list-style-type: none"> • Customer loyalty has no effect on open access competition
		Sharing economy	<ul style="list-style-type: none"> • Carsharing exists in all of Italy's big cities • Despite NTV offering carsharing on top to their high-speed trains, no significant influence on open access competition can be found
		Adjustment to customer expectation	<ul style="list-style-type: none"> • Adaption to customers' wishes is necessary: <ul style="list-style-type: none"> ○ NTV wanted to operate luxury trains, however they adapted to satisfy a wider market ○ TI also adapted and does finetuning: in the beginning, they offered a premium class with meeting rooms on Frecciarossa trains. Since they seem to be used rarely, the customers from the other classes also can access the meeting rooms
		Customers' willingness to pay	<ul style="list-style-type: none"> • It is important to find the right pricing strategy for customers • It proved not to be profitable, if only luxury high-speed rail is provided, no money can be made • There is a wide segment of price-sensitive customers, therefore TI and also NTV changed their strategy and offer cheaper tickets to fill the trains
		Entrepreneurship	<ul style="list-style-type: none"> • Especially the political network and the possibility to make "noise" in case of irregularities is a benefit which NTV had and which helped the to improve profitability and stay in the business
		Attitude of press and population toward competition	<ul style="list-style-type: none"> • This factor has no real influence on the Italian market • Press and population in Italy are generally neutral • The customer group of commuters however played a special role, they wanted to enforce that commuters could use all trains
	T	Access to rolling stock	<ul style="list-style-type: none"> • Access to rolling stock is a barrier to entry for new open access operators • Arenaways leased its rolling stock from abroad
		Lack of technical harmonisation within the EU	<ul style="list-style-type: none"> • This influence factor has an influence, since it makes the acquisition of rolling stock even more difficult
		Existence of innovation	<ul style="list-style-type: none"> • Innovations have generally low influence on open access competition • One innovation that would have a higher influence would be the setting up of a sales system which is independent of any sales infrastructure
		Homologation process	<ul style="list-style-type: none"> • Homologation has a negative influence on open access competition, it makes it more difficult to buy rolling stock, especially second-hand rolling stock
		Railway safety systems	<ul style="list-style-type: none"> • SNCF runs services between Milan and France, however the TGV cannot use the high-speed line since it has no approval for the railway safety system
		Availability of necessary personnel	<ul style="list-style-type: none"> • In freight transport, the recruiting of train drivers is critical: in the first years, the freight competitors acquired personnel from TI. In the following

			<p>years, the association of freight open access operators complained that TI acquired trained train drivers from them</p> <ul style="list-style-type: none"> • In Italy, companies exist that train train drivers and provides schools for training
	Other	Incumbent's performance	<ul style="list-style-type: none"> • TI made it really hard for competitors in a fair way: <ul style="list-style-type: none"> ◦ TI got the better feeling for the market and therefore better adapted to customers wants ◦ TI improved its image a great deal. There is a differentiation between regional and high-speed, but now TI is known to provide good quality high-speed rail
	Additional findings		<ul style="list-style-type: none"> • Marketing plays an important role: NTV made an impression by using clever marketing strategies: <ul style="list-style-type: none"> ◦ NTV let people chose the name for the trains ◦ Before the start of operations, NTV filled billboards with advertisement ◦ NTV regularly posts advertisement in papers ◦ Also TI started posting advertisement recently, making Frecciarossa a real brand
§₂	Findings		<ul style="list-style-type: none"> • Law in action and law in the books • Access to facilities • Access to attractive train paths
§₃	Findings		<ul style="list-style-type: none"> • Rolling stock availability – homologation process – lacking technical harmonisation • Infrastructure fees – market size – low profitability • Law in action – law in the books


Appendix 10: DB Fv's ICE and IC/EC route map 2018

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Sources:

DB (2018e). *ICE-Netz 2018*. [online] Available at: https://www.bahn.de/p/view/mdb/bahnintern/fahrplan_und_buchung/reiseauskunftsmedien/fahrplanmedien-download/mdb_263334_ice liniennetz_v2_2018.pdf [Updated 12/2017, accessed 12/5/2018].

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Appendix 11: Locomore's and HKX's route map and FlixTrain's route map 2018

The illustrations have been removed due to Copyright restrictions

Adapted from: FlixTrain (2018). *Unser FlixTrain Streckennetz*. [online] Available at: <https://www.flixtrain.de/> [Accessed 12/5/2018].

Source: FlixTrain (2018). *Unser FlixTrain Streckennetz*. [online] Available at: <https://www.flixtrain.de/> [Accessed 12/5/2018].

Appendix 12: Derschnellzug.de's planned route map

The illustration has been removed due to Copyright restrictions

Source:

Derschnellzug.de (2018). *Fahrpläne*. [online] Available at: <http://www.derschnellzug.de/fahrplan.html> [Accessed 12/5/2018].

Appendix 13: NTV's route map 2018

The illustration has been removed due to Copyright restrictions

Source: Italo Spa (2018). *Il nostro network*. [online] Available at: <https://italospa.italotreno.it/network/il-nostro-network.html> [Accessed 12/5/2018].

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III. Publications and conference presentations

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